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# An Assessment of Shaanxi's Competitive Advantages

**Development Research Center**

**The State Council**

**People's Republic of China**

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# Executive Summary

This report is focused mainly on assessment of Shaanxi's competitive advantage in global market based on an analysis of two-region Chinese CGE Model. A detailed analysis of changing of RCA from 1992-2001 has been done in part III of this report. Analysis of four scenarios has also been done in part IV to study the impact of sector specific subsides, taxes and wages on environment and employment issues, and it is concluded in the last part that "The elimination of distortionary taxes and subsidies would shtengthen the export competitiveness of Shaanxi" and also "When carbon tax introduced, Shaanxi would experience smaller loss relative to the rest of China, because it has lower share of industry and is less intensive".

The structure of the whole report has provided useful systematic data, information and analysis related to this assessment.

Part I of this report presented an overview of economic and social development of Shaanxi province. A detailed information of GDP, structure of GDP, import and export of this province from 1995-2001. Analysis of various indicators of Shaanxi province and their comparison with Western region and China is given in table 1 of this part and concluded that:

1. Shaanxi province has a solid foundation and growth potential to take the lead in Western regional development initiative;
2. It has relative sound infrastructure, transport and communication networks.
3. It has established a solid foundation for development.
4. The advantage of resource endowment will also provide an important basis for its further economic development.

The major issue of current industrial structure is low rate of capacity utilization, this may require further in depth analysis.

The second part of this report gives analysis of structure of manufacturing sector of Shaanxi province in 2001 and its changes from 1992-2001, changes of locational quotient are also given. The structure of export trade of Shaanxi province in 2001 is analyzed in detail based upon the Customer Data. Industrial sectors are classified into four categories: resource intensive, labor intensive, capital intensive and also technology intensive, this will provide a basis of understanding the comparative

advantage of Shaanxi province in general. Analysis of industrial and export structure related to those at country level is also done in the last section of part II.

Part III presents the changes of industrial comparative advantage in Shaanxi province through RCA, detail value of RCA of various industrial sectors of this province in 1992, 1996 and 2001 are given in table 4 and in figure 5 of this part. Eight conclusions are derived through analysis of above informations. Only four of them are briefed below. Please refer the others to the main text.

1. About half of the industrial output is concentrated on the five manufacturing sectors, electric and telecommunication equipment, transport and communication equipment, electric machinery and equipment, chemical raw material and chemical products and pharmaceutical industry.
2. 63% of the export is concentrated on five sectors, coal, textile, metal products, general machinery products, and telecommunication equipment.
3. There is no tangible relationship between the industrial and export trade sector.
4. There are big changes of comparative advantages in past ten years of Shaanxi province. The comparative advantage of resource intensive sector seems to be increasing, the labor intensive sector is deueasing, while the technology intensive and capital intensive sector are increasing in early years and kept stable in later period.

Part IV of this paper is competitive advantage analysis based on two region Chinese CGE model.

The two-region Chinese CGE model employed in this paper is an extension of the single region Chinese CGE model that had been used in China's WTO accession study. Two regions – Shaanxi province and rest of China are specified, each with a demand and production structure, and interregional trade in commodities and services. The operation, application and its result have been briefed in the beginning of this executive summary, sectoral effect of scenario 2, 3 and 4 described in % change with scenario is presented in table 11-13 of part IV.

In brief, four parts of this paper and the annex have provided many useful data, information and analysis to give an essential assessment of Shaanxi's competitive advantage for a good reference. Due to shortage of data, the competitive advantage

and its relevant factors given in UNIDO Industrial Development Report 2003 cannot be fully followed. But this report has achieved the result to certain extent.

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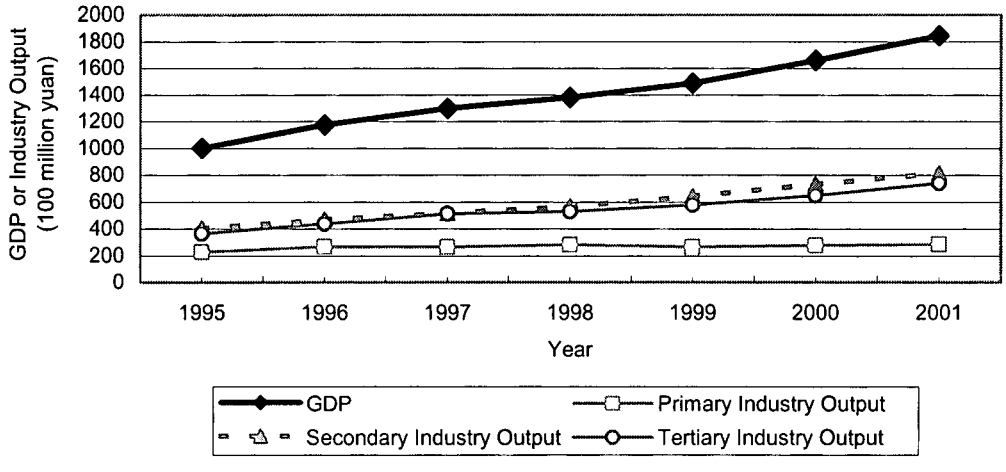
# An Assessment of Shaanxi's Competitive Advantages

## I. Economic and social development in Shaanxi Province

### 1. The current situation in the economic and social development in Shaanxi

For over two decades since the reform and openness, great achievements have been made in the economic and social development in Shaanxi Province. The national economy has fast grown at an annual speed of 9% since the Ninth Five Year Plan was implemented. In 2001, the GDP of the province reached RMB184.427 billion, of which the primary industry valued at RMB28.724 billion; the secondary industry was RMB81.634 billion and the tertiary industry RMB74.069 billion. The proportions of the primary, secondary and tertiary industries changed from 22.7:40.6:36.7 in 1995 to 15.6:44.3:40.1, with the tertiary industry 6.6 percentage point higher than the national average. An accumulative total investment of RMB269 billion was accomplished in the Ninth Five Year Plan period. With the large-scale investment in fixed assets, a major step has been made forward in the construction of infrastructures, including 550 kilometers of newly constructed railways and 393 kilometers of high-grade highways.

Figure1 : GDP and Primary, Secondary and Tertiary Industry Output of Shaanxi Province(1995 ~ 2001)

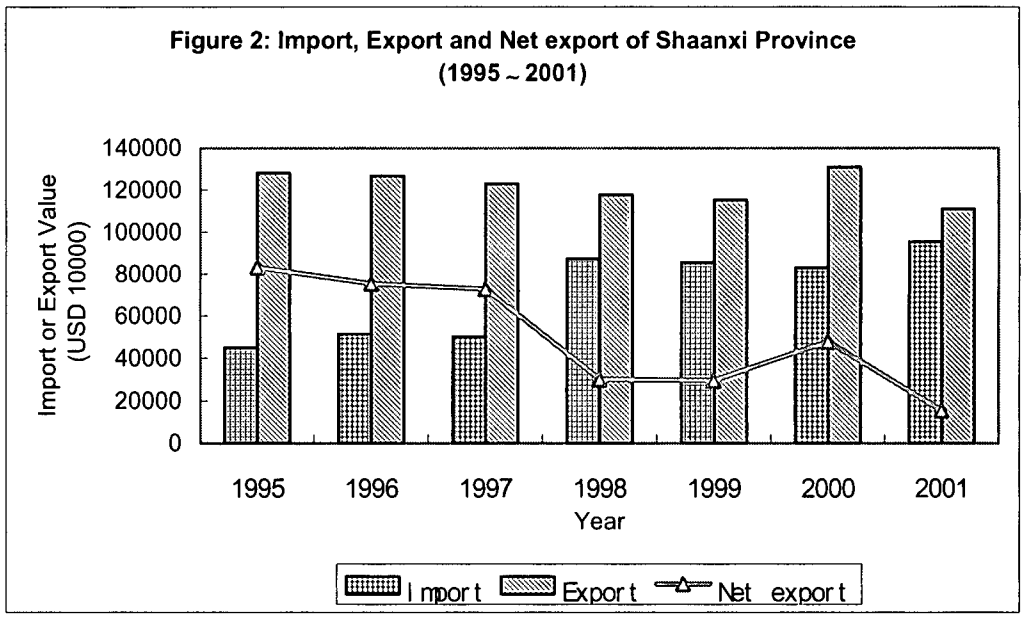



Solid progress has been made in the adjustment of industrial structures. A strong momentum has been seen in the development of the industries with local characteristics, such as high technology, tourism and fruits. Remarkable achievements have been made in the enterprise restructuring. A large number of private hi-tech enterprises have emerged, and the share of non-public sectors in the total GDP has increased to 31.3%. In 2001, the per capita GDP of the province was RMB5,024

equaling 66.6% of the national average and the figure at the end of the Eighth Five Year Plan period was 58.6%. The per capita net income of farmers reached RMB1,470 and the per capita disposable income of urban residents reached RMB5,124, increased by RMB557 and RMB2,171 respectively over the year 1995. A social security system has been initially established.

The total import and export volume of the province amounted to US$2.064 billion in 2001, of which import valued at US$954 million and the export US$1.11 billion. The trade dependent ratio was 9.27%. In recent years, the province has kept its annual export at the level around US$1.2 billion (the export in 2000 exceeded US$1.3 billion) while its import has seen gradual increase. While there have been no remarkable changes in the total volume of export, the export composition has seen major difference with the private enterprises gradually became the major part of its export, it is expected that the export of private enterprises will hopefully surpass that of foreign-invested firms by the end of 2002.

**Figure 2: Import, Export and Net export of Shaanxi Province (1995 ~ 2001)**




By the end of 2000, the province had approved 3,291 foreign investment projects with actual use of foreign capital of US$4.694 billion, of which 3,186 were foreign direct investment projects with actual use of US$3.063 billion; 175 were foreign loan projects with actual use of foreign capital of US$1.631 billion. Since the Ninth Five Year Plan was implemented, the foreign direct investments in Shaanxi Province have presented such features as expanded scale, widened sources, diversified modes multiplied investors and rationalized investment orientations. The foreign investment

has extended from general processing industry and real estate to basic industry and infrastructures, and has turned gradually from short-term trial projects to large and medium long-term projects, which are closely related to the development of the national economy and society. The investment orientations have tended to be consistent with the industrial policies. Foreign investment has played decisive role in the development of basic industry and improvement in infrastructures and has further promoted the economic development in Shaanxi Province.

## 2. The Position of Shaanxi in the Western Region Development Initiative

Shaanxi is a major node of connection of Central and Western parts of China, and may be a possible important node od networked economy (transportation and communication network) in coming future. The province is located at the western part of China's eastern and central regions and at the eastern part of China's western regions. It has the advantage as a connecting link between the east and the west and between the north and the south. Judging from its location features and economic position, the province should be regarded as the "first step" in the Western development.

1) Shaanxi Province has a solid foundation and growth potentials for taking the lead in the Western development

**Table 1. Comparison of Some Indices of Shaanxi Province, Western Region and China**

| | Indices | Shaanxi | Western region | China | Rank in Western region | Rank in China |
|---|---|---|---|---|---|---|
| 1 | GDP (100 million) (2001) | 1844 | 18248 | 95933 | 4 | 20 |
| 2 | Per Capita GDP (RMB) | 5024 | 5007 | 7543 | 8 | 27 |
| 3 | GDP Growth Rate (%) (1996~2001) | 9.17 | | 10.19 | 4 | 17 |
| 4 | Ratio of Shaanxi or the West industry value-added in China (%) (1999) | 1.60 | 11.68 | 100.00 | 7 | 26 |
| 5 | Per Capita Disposable Income of Urban Households (RMB) (2001) | 5483.7 | 6171.8 | 6859.6 | 10 | 25 |
| 6 | Per Capita Annual Net Income (RMB) (2001) | 1490.8 | 1692.8 | 2366.4 | 10 | 29 |
| 7 | Average Wage of Staff and Workers (RMB) (2001) | 9120 | 10679 | 10870 | 9 | 19 |
| 8 | Index of Industry Structure Change (1990-1999) | 28.53 | 27.1 | | 3 | 7 |
| 9 | Index of Industry Structure Specialization (1999) | 14.12 | 23.2 | | 11 | 25 |

| | Indices | Shaanxi | Western region | China | Rank in Western region | Rank in China |
|---|---|---|---|---|---|---|
| 10 | General Index of Industry Structure transition Capacity (1990-1999) | 1.38 | | 1.00 | 1 | 4 |
| 11 | Degree of Marketization | | | | 4 | 22 |
| 12 | Total Value of Imports and Export (USD 100 million ) (2001) | 20.6 | 168.4 | 5097.7 | 2 | 19 |
| 13 | Actually Used FDI (USD 100 million) (2001) | 3.5 | 19.2 | 468.8 | 2 | 18 |
| 14 | Ratio of Staff have College and above-College Degree in total employees (%) (2001) | 8.3 | 5.4 | 6.0 | | |
| 15 | Ratio of Scientific and Technical Personnel in total employees (%) | 3.3 | 25.6 | 100 | 3 | 14 |
| 16 | General Score of Scientific Advancement | | | | 1 | 12 |

Note: Index Explanation and Data Resource

Indicator 8--Index of Industry Structure Change –S is calculated by follow expression:

$$S = \frac{\sum_i |s_i(t) - s_i(t-5)|}{2}$$

$s_i(t)$ is the ratio of industry value-added of I sector in whole industry sector in t year. S is equal to half of absolute value of sum of each industry sector ratio change in past 5 years. If S is equal to 100%, it means the total industry structure change. If S is 50%, it means half of industry sector value-added change.

Indicator 9--Index of Industry Structure Specialization—H is calculated by follow expression:

$$H = 100 \times \left( 1 + \frac{\sum_i s_{i*} \ln s_i}{h_{\max}} \right)$$

$s_i$ is same as above expression, $h_{\max}$ is the nature logarithm of each sector value。 If each sector ratio is same, H is equal to 0. If there have only one sector, H will be 100. H is between 0 and 100. The much larger is H, the much degree is industry specialization.

Indicator 10--The calculation method of General Index of Industry Structure transition Capacity mainly follows the way used by Wei Wei etc. (See "The analysis of regional comparative advantage of China", PP267, China Plan Press,1992).

Indicator 11--It mainly from the data of "Report or regional Marketization of China,1997,1998,1999" (Fan Gang, 2001. Apr.)

Indicator 16--It mainly from the general evaluation result of Scientific Advancement of whole nation by Ministry of Science and Technology of China.

Other Data are calculated by the information from "China Statistical Yearbook".

The data in the above table shows the general situation of Shaanxi Province and its position in the western regions and in the country as a whole, in terms of economic size, growth rate, development level, standard of living of households, economic structure, the process of marketization, the degree of economic openness, human

resources and capability of technical innovation. Thus the distinct features can be seen in the following aspects: First, while the economic size and the growth rate are at the forefront, the living standard of the people is relatively low in the western region. Second, while the capability of industrial transformation is strong, the level of industrial specialization is low. Third, the degree of marketization and openness is low, but still at the forefront in the western regions. Fourth, there are abundant education and human resources and solid foundation of science and technology. Judging from the advantages in terms of the geographical location, transportation and other infrastructures, Shaanxi Province has a solid foundation and growth potentials for taking the lead in the Western development and also is the leading force in the development particularly in the Northwestern regions.

2) Relatively sound infrastructures and transport and telecommunications network linking up all parts of the province

A crisscross highway network has taken shape including 9 state highways and 53 provincial highways centered at XiAn and extended to counties and townships. A sub-main highway system of 3,600 kilometers is now being constructed around the province. This system will create a "one-day traffic circle", connecting not only the 10 prefectures and cities within the province but also the surrounding center cities of Taiyuan, Shijiazhuang, Zhenzhou, Wuhan, Hefei, Chongqing, Chengdu, Yinchuan, Baotou, etc.

The railway construction has seen fast development, and has formed a trunk line framework of 2 vertical lines, 6 horizontal lines and 4 hubs. Within the province, there have been 16 trunks and branches with a traffic mileage of 2,821 kilometers including electrified railways of 2,100 kilometers.

Shaanxi is an important aviation hub in the Northwestern regions. The province has 5 civil airports in XiAn, YanAn, Yulin, Ankang and Hanzhong and has two airlines companies—Northwest and Changan.

The levels of equipment and technology of the telecommunications network has linked up with the world new technologies. A large capacity, high-speed digital transmission network has been built with optical cables as the main means supplemented by digital microwave and satellite communications.

The urban facilities have increasingly improved. In 2000, the province completed 246

major municipal engineering projects concerning urban forestation, gas lines, sewage treatment and garbage disposal. 13 large and medium cities have the daily water supply capacity of 311.5 tons. Presently, the installed capacity of power generation of the whole province is 7.4 million kilowatts. With the construction of the thermal power base in northern Shaanxi, development of the step hydroelectric stations along the Han River in southern Shaanxi and the intensification of the 330-kilovolt main power grids, the power supply can not only meet the needs within the province, but also transmit power to north China and other places.

3) Tremendous economic strength and emerging featured industries have laid solid foundation for development

Since the founding of the People's Republic, particularly through the First Five Year Plan and the construction of the "third line" regions, Shaanxi has basically become an inland industrial base in China featured with an industrial setup with complete categories and a solid foundation, which involve machinery, electronics, textile, pharmaceuticals, energy and foodstuff, etc. The province has 1,880 state holding industrial enterprises with total assets of RMB185.59 billion. 484 of these are large enterprises. 9 enterprises, such as Xifei (XiAn Aeroplane Manufacturing Corporation), Caihong, and Changling, are among the 520 key state enterprises nationwide. Sectors such as machinery, electronics, textile, pharmaceuticals and energy enjoy a leading position in the country. Products such as color TV tubes, plane parts, deluxe buses, high power driven engineering excavators, heavy-duty trucks, axial flow compressors, deflecting cores, program-controlled switchboards, rank top three of the same sectors around the country. In recent years, great efforts have been made by Shaanxi Province to readjust the economic structures and develop them with unique featured. These unique featured industries have emerged rapidly and have seen strong development momentum. The high-tech development belt in Guanzhong area has become a a core area of qualified personnel and a backup base of the province. The belt covers the following: 3 national high-tech development zones in XiAn, Baoji and Yangling; XiAn national economic and technological development area and 2 provincial high-tech development areas in Weinan and Xianyang; 10 scientific parks including Xian Software Park, High-tech Export Industrial Park and University Bio Park. In an effort to realize industrialization and internationalization, the development belt concentrates on developing sophisticated products such as electronics and information,

bioengineering, new materials, new energy, software, highly efficient farm produce. Shaanxi's financial and insurance sector occupies important position in the western regions. Apart from the four large state-owned banks in Shaanxi, some other share-holding banks and foreign banks, such as Communication Bank, Merchants Bank and East Asian Bank, also have their branches in Xian. Plus the central bank sets up its regional branch in Xian, Shaanxi has become a financial center radiating the northwest and west regions and has created necessary conditions for standardized and efficient operations of the capital market.

4) Endowed resource advantage becomes important pillar for Shaanxi's economic development.

The mineral resources in Shaanxi have many varieties and rich reserves. The reserves of coal, crude oil and natural gas are particularly abundant. The demonstrated reserves of coal amount to 270 billion tons with a potential value of RMB8259.4 billion, ranking the third in China. The prospective reserves of oil are 1.1 billion tons and the proven reserves are 760 million tons. The prospective reserves for natural gas are 6,000-8,000 billion cubic meters. Within the 50,000 square kilometers at the central part of Shaan-Gan-Ning Basin, the proven reserves of natural gas reach up to 350 billion cubic meters ranking the second in China. With its present production capacity of 2.2 billion cubic meters per year, accelerated development will be of great significance to the establishment of China's future follow-up energy base.

Shaanxi is one of the areas where the Chinese civilization is mostly concentrated. With its rich humanistic and tourism resource, Shaanxi is regarded as a "natural history museum" and is well-known as the "world of historical relics". From imperial tombs to royal palaces and gardens, from ancient temples to exotic hills and streams, from rare animals to folk customs, all these have created featured tourism resources of Shaanxi. Currently, the province has the capacity of receiving over 1 million tourists a year, showing that tourist industry occupies a very important position in Shaanxi's economic development.

5) The intensity of scientific and educational resources ranks on the top list in China

Shaanxi now has 43 regular tertiary education institutions, 11 military universities and colleges, and 37 civilian-run tertiary education institutes. There are complete branches of learning, 520 authorized master degree units, and 136 authorized doctor degree

units, 25 post-doctoral research mobile stations. The institutions of higher learning have 242,000 postgraduate and junior college students, 18,000 graduate students for master degrees and over 3,300 doctoral students. The number and scale of higher education institutes of Shaanxi rank the fifth in the nation. The comprehensive level of scientific research of tertiary education institutes ranks the fourth in China, so as the general level of technology. The province has over 2,000 scientific research institutes and 79 national and provincial level key laboratories with 850,000 professionals of various specialties. Among the professionals, 170,000 are directly engaged in the research and development of high technologies and 100,000 of them are scientists and engineers ranking the eighth in China.

**3. Present problems**

- Industrial structure

Judging from the internal structure of industry, the structure of industry in Shaanxi is mainly composed of processing industries particularly machinery, electronics, textile and food processing. Some main industrial products propping up the economic growth are restrained by market demand leading to serious under-capacity operations with utility rate of only about 50%. The existing brand-named products that have certain advantage are in small production scale and have not gained competitive advantage. This shows the weak competitiveness of existed industrial sector of this province. We shall not discuss how to improve its competitive in detail, reference to UNIDO Industrial Development Report 2003 will be very useful.

The geographic distribution of industry in Shaanxi is always centered at Xian with Guanzhong as the key area. By the end of 2000, the GDP share of the three major economic areas of Guanzhong, South Shaanxi and North Shaanxi in the whole province is 72.63%, 16.19% and 11.18 respectively. South Shaanxi and North Shaanxi particularly the latter are the resource abundant areas, but over a long period of time, these areas have not been developed soundly. In addition, Guanzhong area has many original problems and reserves inadequate strength for further development. Its economic performance is poor.

- Ownership structure

The main difference between Shaanxi and the eastern coastal region in terms of ownership forms is that the former has higher proportion of state sectors and weaker

non-state sectors. Compared with the rapid development of the non-state economies in the eastern coastal regions, the development of Shaanxi's non-state sectors is slow. For example, in 1999, the industrial output value of state-owned sectors made up 59.42% of the total in Shaanxi while the share of state-owned industries was only 24.1% in the eastern regions. The economic output value of the non-public sectors in Shaanxi shared only 21% of the GDP, over 10% lower than the national average and even 45%, 37% and 6% lower respectively than Fujian, Guangdong and Shanghai. Furthermore, Shaanxi does not have any large non-public model firms that are influential and can play a leading role in developing the non-state economies.

Another distinct feature of Shaanxi's ownership structure is its greater number of military industries and related sectors. The enterprises owned by the ministries and commissions of the central government and stationed in Shaanxi are all large and medium-sized. These enterprises have numerous qualified professionals, apply advanced technologies and are well equipped. It will be of great significance to accelerate the restructuring of these enterprises and make use of their expertise to transform and upgrade the local industries so that Shaanxi can play a leading role in the Western development.

- The structure of financial revenues and expenditures

According to the statistical data over the years, the revenues of Shaanxi increased very fast but the expenditure increased even faster, resulting in the expanded financial insufficiency. The fiscal deficit in 1979 was RMB276 million and increased to RMB1.15 billion in 1987 and further went up to RMB10.012 billion. The expanded fiscal deficit has made it difficult for the government to keep the daily expenditures and even more difficult to invest in the local constructions.

- Household income

In 1994, per capita disposable income of urban residents was RMB2,684, 23.2% lower than the national average, and the per capita net income of farmers was RMB805, 34.1% lower than the national average. In 2001, per capita disposable income urban resident was RMB5,484 and the per capita net income of farmers was RMB1,520, all lower than the national average levels 20.1% and 35.8% respectively.

- Urbanization

The process of urbanization is lagging behind, the urbanization rate was 27.01%, 7.34

percentage lower than the national average. Huge working population is detained on the limited farmland, leading to the difficulties in raising the income of rural population and transferring the surplus agricultural laborers to other sectors. As a result, the development level of tertiary industry is low and the upgrading of the overall economic structure is impeded.

## II. The Present State and Evolution of the Industrial Structure and Trade Structure of Shaanxi Province

### 1. Industrial Structure

In 2001, the GDP of Shaanxi Province reached RMB 184.12 billion accounting for 1.9% of the national total. Out of that, the added value of the primary industry, the secondary industry and the tertiary industry occupied respectively 1.9%, 2.3% and 1.7% of the national level.

In order to accord with the trade structure analysis, we would use the total output to analyze the industrial structure. This might obviously overestimate the position of the downstream industries in the manufacturing industry, but it will not affect the dynamic comparativeness. Here we would disaggregate the manufacturing industry into 31 sectors for analysis and we have excluded those sectors for the production and supply of the public utility such as power, gas, running water and natural gas.

**Table 2: Structure of Shaanxi Manufacture Sector (2001)**

| Sector | Gross Output Value (100 million RMB) | Share (%) A | Share of Same Sector in whole country (%) B | Locational Quotient C=A/B |
|---|---|---|---|---|
| Electronic and telecommunication equipment | 172.5 | 16.65 | 15.24 | 1.09 |
| Transport equipment | 140.1 | 13.53 | 7.79 | 1.74 |
| **Medical and pharmaceutical products** | **69.8** | **6.74** | **3.06** | **2.20** |
| Electric equipment and machinery | 68.0 | 6.57 | 7.05 | 0.93 |
| Raw chemical materials and chemical products | 56.4 | 5.45 | 7.12 | 0.76 |
| Special industrial equipment | 48.9 | 4.72 | 2.61 | 1.81 |
| Coal mining and processing | 47.4 | 4.58 | 1.48 | 3.10 |
| Textile goods | 45.6 | 4.40 | 6.14 | 0.72 |
| General Industrial machinery | 42.5 | 4.10 | 3.96 | 1.04 |
| Food products | 31.1 | 3.00 | 3.94 | 0.76 |

| Sector | Gross Output Value (100 million RMB) | Share (%)A | Share of Same Sector in whole country (%) B | Locational Quotient C=A/B |
|---|---|---|---|---|
| Nonmetal mineral products | 29.8 | 2.88 | 4.18 | 0.69 |
| **Tobacco processing** | **28.3** | **2.74** | **1.11** | **2.47** |
| Petroleum processing and coking | 22.6 | 2.18 | 2.32 | 0.94 |
| Nonferrous metal processing | 22.3 | 2.15 | 2.45 | 0.88 |
| Beverage | 22.3 | 2.15 | 1.69 | 1.27 |
| **Non-ferrous ore mining** | **21.4** | **2.07** | **0.38** | **5.43** |
| Manufacture of food products | 19.9 | 1.92 | 1.69 | 1.14 |
| **Printing and record medium reproduction** | **17.9** | **1.73** | **0.80** | **2.15** |
| Ferrous metal processing | 16.6 | 1.60 | 4.86 | 0.33 |
| Instruments, meters, cultural and office machinery | 14.0 | 1.35 | 1.20 | 1.12 |
| Paper and products | 13.0 | 1.25 | 1.86 | 0.67 |
| Metal products | 11.4 | 1.10 | 3.12 | 0.35 |
| Crude petroleum and natural gas products | 8.5 | 0.82 | 1.06 | 0.78 |
| Wearing apparel | 5.1 | 0.49 | 2.74 | 0.18 |
| Plastic products | 3.7 | 0.36 | 2.45 | 0.15 |
| Chemical fibers | 2.9 | 0.28 | 1.46 | 0.19 |
| Furniture | 2.8 | 0.27 | 0.46 | 0.58 |
| Rubber products | 2.8 | 0.27 | 1.10 | 0.24 |
| Leather, furs, down and related products | 2.1 | 0.20 | 1.64 | 0.12 |
| Products of wood, bamboo, cane, palm, straw, etc | 1.8 | 0.18 | 0.81 | 0.22 |
| Cultural, sporting and athletic and recreation products | 0.7 | 0.07 | 0.72 | 0.09 |
| Similarity coefficient | | | A~B:0.9229 | |

Data Resource: "China Statistical Yearbook"

Please refer to table 2 for the total output value of the manufacturing industry of Shaanxi Province. The output value of the electronic and telecommunication equipment manufacturing industry and the transport and communication equipment manufacturing industry which are two pillar industries in the manufacturing industry both surpassed RMB 10 billion constituting over 10% of the total output value. The output value of pharmaceutical industry, electrical machinery and equipment industry and chemical raw material and chemical products industry also reached over RMB 5 billion accounting for over 5% of the total output value. The total output value of the above-mentioned five sectors almost occupied half of the output value (49%) of the 31 sectors. Taking the country as a whole, the output value of these five sectors also

exceeded 40% of the nation's total and the output value of the rest 26 sectors was less than 60%. This shows that the industrial output structure of Shaanxi Province is similar to that of the country. In fact, the similarity coefficient of the two reached 0.9229. In other words, there is great similarity between the industrial internal sector structure of Shaanxi Province and that of the country. But if we take a notice of the position of the 31 sectors in Shaanxi Provincial industry and compare their position in the corresponding industries of the country, we would find that there is almost no connection between the two (the relevant linear coefficient between the sector share in the provincial industry and the sector location quotient is only 0.2483). This shows that there is nearly no definite relationship in terms of statistics between the importance of a certain sector in Shaanxi Province and the location advantage of the same sector in the country.

Over the past ten years, with the implementation of the national and regional industrial structure adjustment policies, Shaanxi Province has seen obvious changes in its industrial structure. In 1992, the share of textile industry output value reached 11.7% ranking first among the 31 sectors. By 1996, its share was reduced to 7.3% listing the third. Till 2001, its share further dwindled to 4.4% and was ranked at the eighth place (Figure 3). The sectors that witnessed successive reduced shares also include general machinery manufacturing industry, non-metal mineral products industry, tobacco processing industry, food industry, garment and other fiber products manufacturing industry and rubber industry. However, the electronic and telecommunication equipment industry saw a quick rise. Its output share was increased from 10% in 1992 to 14.5% in 1996 and further to 16.7% in 2001. Similarly, the industrial output share of transport and communication equipment industry, the pharmaceutical industry and electrical machinery and equipment industry also increased by a big margin.

**Figure 3: Change of Industry Structure(1992--2001)**

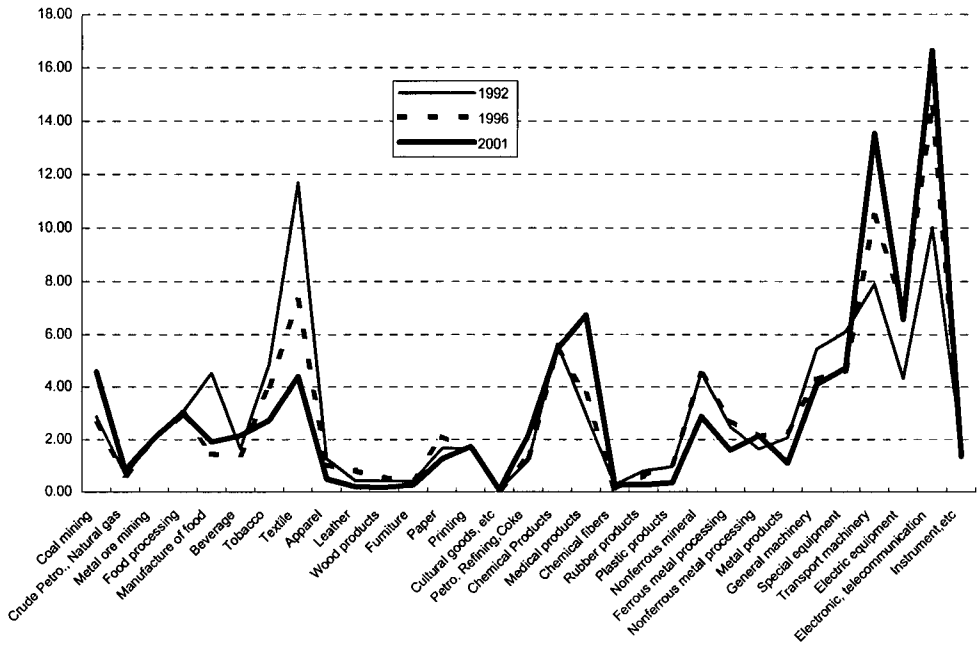
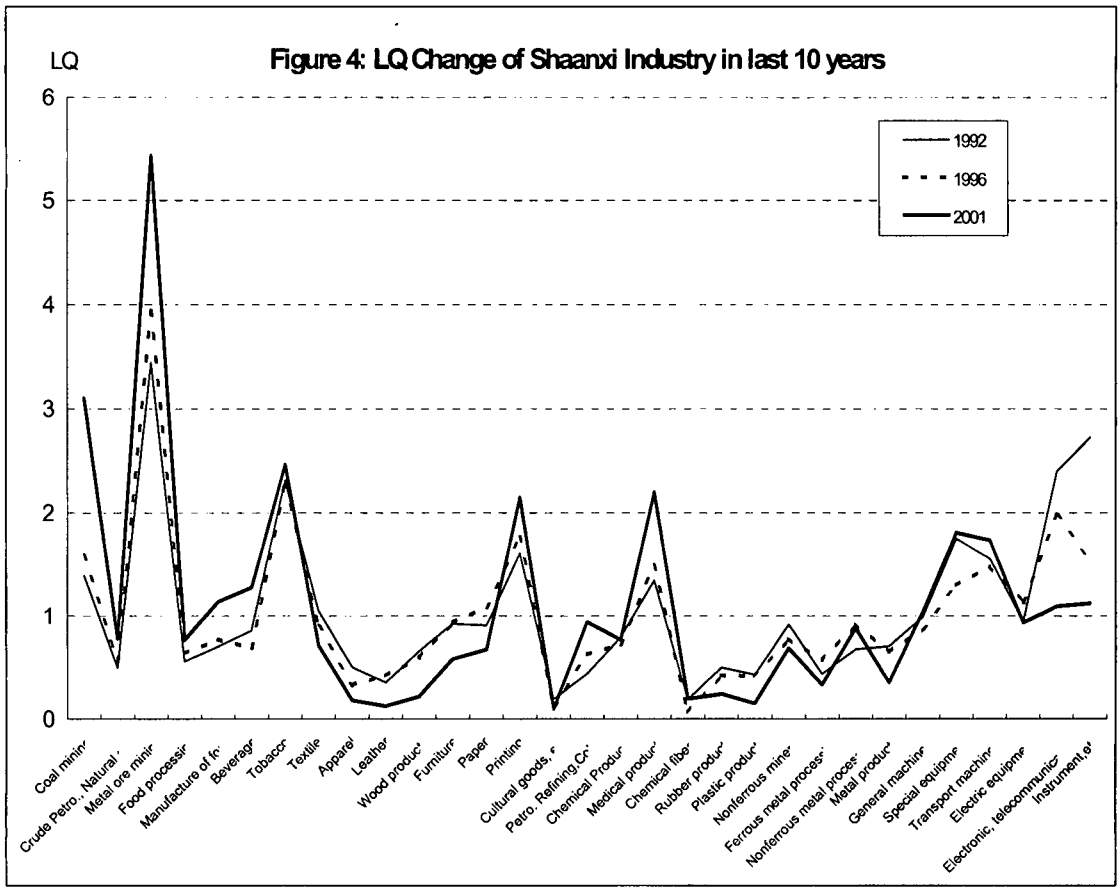



Figure 3 gives a clear illustration of the structural changes of the 31 industrial sectors in Shaanxi Province and their relevant rise and fall development trend. Taking the picture as a whole, the coal industry, the nonferrous metal mining industry and the petroleum natural gas extraction industry which are resource input based have almost kept a constant share. The share occupied by technology-intensive based industries such as the electronics industry, electric appliances and communication equipment manufacturing industry is increasing rapidly whereas most of the rest industrial sectors are facing a declining trend.

What merits attention is that if we observe the location quotient change of the industrial sectors in Shaanxi Province from the angle of the state, we could find the inconsistent change of the industrial sector structure, i.e. the location quotient of those capital input based sectors goes up quickly with an obvious location advantage whereas the location quotient of those technology-intensive based sectors goes down markedly with reduced location advantage. The location quotient of a few other sectors goes up while that of most other sectors goes down. This shows that the development speed of the technology-intensive based sectors in Shaanxi Province is lagging behind that of the whole country.




## 2. Trade Structure

Table 3 lists the export statistical data of the 31 sectors of Shaanxi Province in 2001. The export of coal extractive industry was put at the head of the rank with a total export value of US$ 0.306 billion accounting for 23.8% of the total share. The export value of textile industry, metal manufacturing industry, general machinery manufacturing industry and electronic and telecommunication equipment manufacturing industry also exceeded US$ 0.1 billion. The above-mentioned five sectors had an export value of US$ 0.81 billion constituting 63% of the total export value of the 31 sectors. It indicates that the concentration degree of sector export is higher than that of the sector output.

**Table 3. Export of 31 industry sectors of Shaanxi Province (2001)**

| Sector | Export* (USD 1000) | Share (%) | Export/Output (%) |
|---|---|---|---|
| Coal mining and processing | 306257 | 23.84 | 53.47 |
| Crude petroleum and natural gas products | 0 | 0.00 | 0.00 |
| Non-ferrous or mining | 44590 | 3.47 | 17.23 |
| **Resource intensive Industries** | **350847** | **27.31** | **37.53** |
| Food products | 679 | 0.05 | 0.18 |

| Sector | Export* (USD 1000) | Share (%) | Export/Output (%) |
|---|---|---|---|
| Manufacture of food products | 7719 | 0.60 | 3.21 |
| Beverage | 45692 | 3.56 | 16.96 |
| Tobacco processing | 4516 | 0.35 | 1.32 |
| Textile goods | 169872 | 13.22 | 30.87 |
| Wearing apparel | 32646 | 2.54 | 53.11 |
| Leather, furs, down and related products | 2223 | 0.17 | 8.85 |
| Products of wood, bamboo, etc | 1813 | 0.14 | 8.25 |
| Furniture | 8111 | 0.63 | 24.07 |
| Paper and products | 2402 | 0.19 | 1.54 |
| Printing and record medium reproduction | 207 | 0.02 | 0.10 |
| Cultural, sporting and athletic products | 2793 | 0.22 | 33.03 |
| **Labor intensive industries** | **278673** | **21.69** | **12.11** |
| Petroleum processing and coking | 16902 | 1.32 | 6.20 |
| Raw chemical materials and chemical products | 66826 | 5.20 | 9.81 |
| Medical and pharmaceutical products | 24928 | 1.94 | 2.96 |
| Chemical fibers | 3002 | 0.23 | 8.48 |
| Rubber products | 848 | 0.07 | 2.55 |
| Plastic products | 2057 | 0.16 | 4.55 |
| Non-metallic mineral products | 38585 | 3.00 | 10.71 |
| Ferrous metal processing | 7417 | 0.58 | 3.71 |
| Nonferrous metal processing | 38024 | 2.96 | 14.11 |
| Metal products | 117072 | 9.11 | 85.18 |
| General Industrial machinery | 110907 | 8.63 | 21.62 |
| **Capital intensive industries** | **426568** | **33.20** | **12.58** |
| Special industrial equipment | 13380 | 1.04 | 2.27 |
| Transport equipment | 21012 | 1.64 | 1.24 |
| Electric equipment and machinery | 49608 | 3.86 | 6.04 |
| Electronic and telecommunication equipment | 106685 | 8.30 | 5.12 |
| Instruments, meters, and office machinery | 38088 | 2.96 | 22.57 |
| **Technology Intensive Industries** | **228773** | **17.81** | **4.27** |
| **Total** | **1284861** | **100.00** | **10.71** |

Resource: Custom Data

We have roughly divided the 31 sectors into 4 kinds in terms of the intensive degree of input factors, i.e. resources, labor, capital and technology-intensive. Table 3 shows that the 11 sectors which constitute the capital-intensive products occupy the main position with an export value of US$ 0.43 billion accounting for 1/3 of the total industrial export value. The resource-intensive products such as coal and nonferrous metal are also main products for export in Shaanxi Province with an export share of 27%. But the export of the 12 intensive-intensive sectors does not enjoy advantage with an export share of only 22%. The five technology-intensive sectors have an export value of 18%. If we put them together, we could see that the export value of

the capital-intensive sectors and that of the resource and intensive-intensive sectors equal each other or half to half.

Table 3 also gives a calculation of the export proportion in terms of output of various sectors. Over half of the total products of metal manufacturing industry, coal extractive industry and garment manufacturing industry are for export while over 10% of the products of the 9 sectors such as textile, instruments and meters, office equipment manufacturing industry, etc. are also for export. In other words, the export proportion of resource products has a big ratio of 38% whereas the technology-intensive products has a smaller ratio of only 4%. The ratio of intensive-intensive and resource-intensive products for exports are both about 12%.

In 1992, the textile products of Shaanxi Province for export held an absolute position with a high export value of 57.3% out of the total industrial export value. This share witnessed a rapid decline. By 1996 it was 23.6% and by 2001 was reduced to 13.2% and textile industry became the number two export sector after coal industry. In 1992, the coal export share was 6.4% and by 2001 was rapidly increased to 23.8%. There are other sectors which also saw a steady increase of export share. For instance, the export share of the metal manufacturing industry grew from 5.6% in 1992 to 7.7% in 1996 and further to 9.1% in 2001. The export share of general machinery manufacturing industry grew from 3.8% in 1992 to 7.6% in 1996 and further to 8.6% in 2001. Besides, the electronic and telecommunication equipment manufacturing industry, nonferrous metal mine extractive industry, electric machinery and equipment manufacturing industry also showed a momentum of much increased export share.

All in all, the export share of resource-intensive sectors grew from 6.9% in 1992 to 27.3% in 2001 showing a rapid increase and by a big margin whereas the export share of intensive-intensive sectors was sharply reduced from 63.3% in 1992 to 21.7% in 2001. The export share of capital-intensive and technology-intensive sectors both experienced a first rise and then fall process. The export share of capital-intensive sectors grew from 23.4% in 1992 to 36.3% in 1996 and fell to 33.2% in 2001 while the export share of technology-intensive sectors grew from 6.5% in 1992 to 25.6% in 1996 and fell to 17.8% in 2001.

Another feature related to the trade structure evolution is the decreasing of the concentration degree for export sectors. In other words, more sectors occupy a rather

big share in foreign trade and export. In 1992 there were only 7 sectors with over 2% export share, but in 1996 the number of sectors was increased to 11 in 1996 and further to 13 in 2001.

There is one thing that differs from the change of output structure. Looking at the same sectors across the country, the changing trend of export share in different years of resource-intensive, intensive-intensive, capital-intensive and technology-intensive sectors in Shaanxi Province is completely in accordance with the changing trend of the ratio of their export value amounting to the total export value of the same sectors across the country. For instance, the export ratio of provincial resource-intensive products accounting for the national resource-intensive products grew from 0.5% in 1992 to 1.2% in 1996 and further to 7.9% in 2001. But the export ratio of intensive-intensive, capital-intensive and technology-intensive sectors making up the total export ratio of the same sectors of the country was no more than 1%.

### 3. The Relationship between Industrial Structure and Trade Structure

Over the past 10 years, the industrial structure of Shaanxi Province has changed in accordance with the change of the national industrial structure and the two have become more and more related with each other, i.e. the similar coefficient of industrial is becoming bigger and bigger. For instance, the similar coefficient of Shaanxi Province and that of the country was 0.9090 in 1992 and it rose to 0.9092 and 0.9229 in 1996 and 2001 respectively.

But the trade structure of Shaanxi Province has showed a different change over the past 10 years with some uncertainties for export structure in different years. Besides, the similarity of its export structure was comparatively weak compared to that of the whole country. In 1992, the similar coefficient of the industrial export structure of Shaanxi Province and that of the whole country was 0.6820 and it grew to 0.8415 in 1996, but in 2001 it was only 0.5505.

The industrial structure and trade structure of Shaanxi Province are being affected by different factors. In 1992, the relevant linear coefficient between output structure and export structure was 0.59 in 1992 and in 1996 the two remained the same at medium degree. But in 2001 it fell to 0.31 showing a weak link between the two.

But generally speaking, both the output share and export share for intensive-intensive sectors were decreased whereas the output share and export share for

technology-intensive sectors were increased with different degrees.

## III. The Changes of Industrial Comparative Advantage in Shaanxi Province

A sector's position in export and its changing direction along with the time are both governed by its comparative advantage. We would discuss in the following paragraphs the measurement of the comparative advantage of various industrial sectors of Shaanxi Province and its dynamic changing process.

Revealed comparative advantage index (RCA index) refers to the ratio between the export share of a certain product of a country constituting the export share of the same product of the world and the export of the total products of that country accounting for the total export of the world. It is a most widely used indicator for comparative advantage. Its measurement formula is:

$$RCA_i = \frac{X_i / X}{X_{iw} / X_w}$$

$X_i$ refers to the export of i commodity of a country and X stands for the total export volume of that country; $X_{iw}$ refers to the export of the i commodity of the world and $X_w$ stands for the world total export volume. It is generally understood that the bigger the value is the more remarkable the advantage is. If RCA index is bigger than 2.5, it shows that the products of that country has a strong international competitiveness; if RCA index is smaller than 2.5 but bigger than 1.25, it shows that the products of that country has a comparative international competitiveness; and if RCA index is smaller than 0.8, it shows that the products of that country has a weak international competitiveness.

We could use RCA to measure the comparative advantage of a certain region of China. However, this comparative advantage is within the country, but the same formula could be used. Here Xi refers to the export of i commodity of a certain region and X stands for the total export volume of the region; $X_{iw}$ refers to the export of i commodity of the whole country and $X_w$ stands for the total export volume of the country.

According to that, we have worked out the revealed comparative advantage of various industrial sectors in Shaanxi Province in 2001. Table 4 shows the numerical value

grouped from big to small (it also lists the RCA value of 1996 and 1992).

**Table 4. RCA value of Shaanxi Industries**

| Sector | 1992 | 1996 | 2001 |
|---|---|---|---|
| **Non-ferrous or mining** | **3.35** | **11.05** | **46.54** |
| **Coal mining and processing** | **6.02** | **6.02** | **21.70** |
| **Beverage** | **0.01** | **0.54** | **6.59** |
| **General Industrial machinery** | **2.27** | **3.53** | **3.07** |
| **Medical and pharmaceutical products** | **0.82** | **1.86** | **2.95** |
| Nonferrous metal processing | 2.90 | 1.59 | 2.43 |
| Tobacco processing | 0.15 | 0.02 | 2.35 |
| Metal products | 1.53 | 1.55 | 1.68 |
| Non-metallic mineral products | 0.54 | 1.32 | 1.47 |
| Textile goods | 3.42 | 1.87 | 1.27 |
| Raw chemical materials and chemical products | 1.65 | 1.97 | 1.21 |
| Crude petroleum and natural gas products | 0.07 | 0.48 | 1.10 |
| Transport equipment | 0.55 | 0.30 | 0.74 |
| Special industrial equipment | 0.59 | 0.97 | 0.72 |
| Ferrous metal processing | 1.10 | 1.19 | 0.68 |
| Chemical fibers | 0.65 | 0.82 | 0.65 |
| Instruments, meters, cultural and office | 0.17 | 0.56 | 0.56 |
| Electric equipment and machinery | 0.44 | 1.07 | 0.48 |
| Products of wood, bamboo, cane, palm, straw, etc | 0.08 | 0.20 | 0.46 |
| Electronic and telecommunication equipment | 0.34 | 1.04 | 0.39 |
| Paper and products | 0.10 | 0.42 | 0.38 |
| Wearing apparel | 0.21 | 0.35 | 0.27 |
| Furniture | 0.28 | 0.34 | 0.26 |
| Printing and record medium reproduction | 0.02 | 0.03 | 0.23 |
| Manufacture of food products | 0.27 | 0.37 | 0.21 |
| Food products | 0.03 | 0.27 | 0.19 |
| Plastic products | 0.03 | 0.09 | 0.06 |
| Cultural, sporting and athletic products | 0.04 | 0.10 | 0.05 |
| Leather, furs, down and related products | 0.06 | 0.32 | 0.03 |
| Rubber Plastics | 0.02 | 0.04 | 0.03 |
| Crude petroleum and natural gas products | 0.00 | 0.00 | 0.00 |
| **Resource Intensive industries** | **1.33** | **1.88** | **14.89** |
| **Labor Intensive industries** | **1.16** | **0.76** | **0.59** |
| **Capital Intensive industries** | **1.09** | **1.43** | **1.41** |
| **Technology Intensive industries** | **0.34** | **0.89** | **0.47** |

Table 4 shows that in 2001 five sectors in Shaanxi Province had a very strong comparative advantage which were resource-intensive nonferrous mine extractive industry and coal extractive industry as well as capital-intensive general machinery

manufacturing industry and pharmaceutical manufacturing industry and labour-intensive beverage industry. Another five sectors had comparatively strong advantage including capital-intensive nonferrous metal metallurgy and calendar processing industry, metal manufacturing industry and nonmetal mineral products industry as well as intensive-intensive tobacco processing industry and textile industry. Two sectors had general comparative advantage which were capital-intensive chemical industry and petroleum processing industry. The technology-intensive sectors did not have tangible comparative advantage.

In terms of large kinds of industrial sectors, the revealed comparative advantage index for resource-intensive industries is 14.9 showing a very strong comparative advantage; the revealed comparative advantage index for capital-intensive industries is 1.4 showing a strong comparative advantage; the revealed comparative advantage indexes for intensive-intensive and technology-intensive industries are respectively 0.6 and 0.5 showing no revealed comparative advantage.

Table 4 shows that over the past 10 years the various industrial sectors have witnessed much changes in terms of their comparative advantage in different periods. Out of that, the comparative advantage of resource-intensive sectors had an obvious increase and its RCA was increased from 1.33 in 1992 to 1.88 in 1996 and further to 14.9 in 2001. In contrast, the comparative advantage of intensive-intensive sectors was rapidly lost and its RCA was reduced from 1.16 in 1992 to 0.76 in 1996 and down to only 0.59 in 2001 and became sectors with comparative disadvantage. The comparative advantage of capital-intensive sectors was first increased and later remained stable and its RCA was increased from 1.09 in 1992 to 1.43 in 1996 and by 2001 it remained at 1.41 belonging to sectors with a rather strong competitive advantage. The competitive advantage of technology-intensive sectors was first increased by a big margin from 0.34 in 1992 to 0.89 in 1996 and later was decreased and by 2001 its RCA was only 0.47 belonging to sectors with no competitive advantage.

Over the past 10 years, the regularity of the export structure of various sectors in different periods has not been obvious, but the changing trend of their revealed comparative advantage has been quite stable with certain inheritance. In 1992 and 1996, the relevant RCA linear coefficient of various sectors was 0.75, but those sectors which had 0.95 RCA linear coefficient in 1996 and 2001 are highly integrated.

Now we take the 31 sectors as the horizontal axis and the RCA of various sectors as the vertical axis and various industries are grouped according to their RCA index of 2001. On that basis, we have made three RCA curves respectively indicating 1992, 1996 and 2001 (please refer to table 5. In order to distinguish the different RCA of various sectors, the highest graduation is set at 4 on the vertical axis).

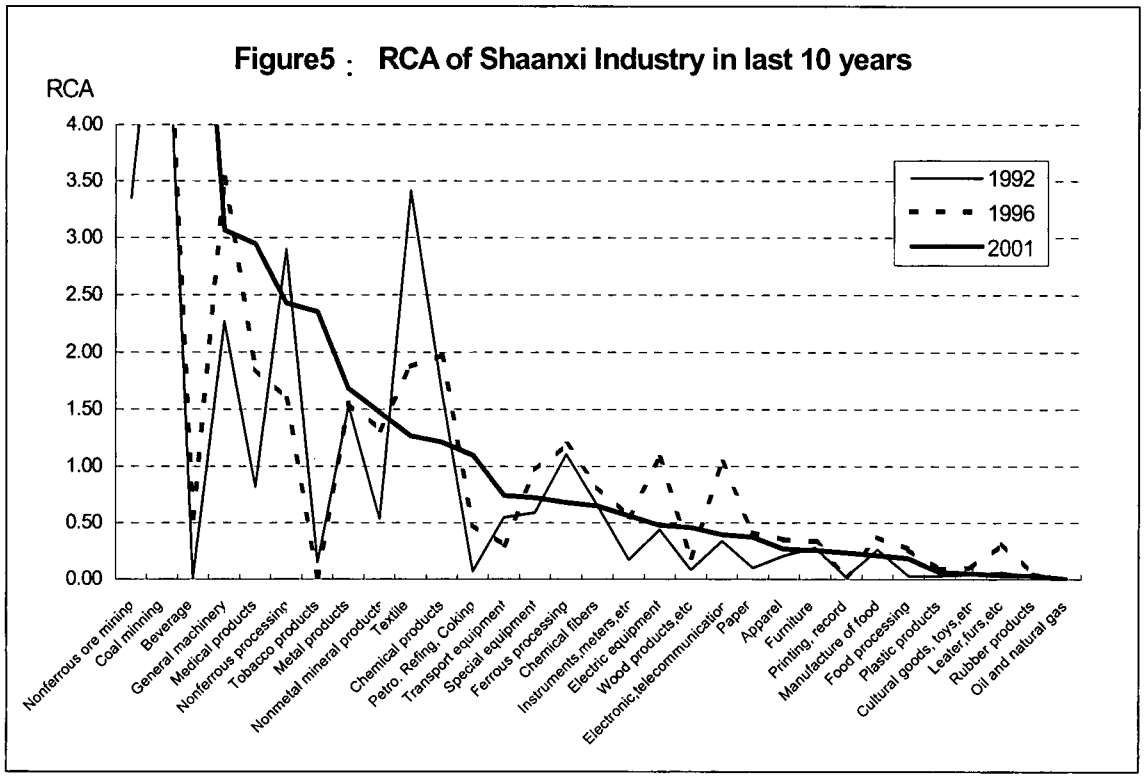



Figure 5 shows that the RCA in different years has the following features:

- In general, those sectors with high RCA have a constant high RCA in different years while those sectors with low RCA have a constant low RCA in different years. The three years' curves are sloped.

- Those sectors with high RCA have shown marked RCA changes whereas those sectors with low RCA have shown little RCA changes.

- Most of the curves of 2001 and 1996 are above that of 1992, which shows that from 1992 to 1996 the comparative advantage of most sectors was increased. But the curve of 2001 and that of 1996 go through each other which shows that during that 5 years the comparative advantage of some sectors was increased and some decreased with irregular changes.

- The left part of figure 5 shows that most of the curve of 2001 in this part is above

that of 1996, which shows those sectors that enjoyed comparative advantage have a more obvious comparative advantage. These sectors are nonferrous metal mine extractive industry, coal extractive industry, beverage manufacturing industry, general machinery manufacturing industry, pharmaceutical industry, nonferrous metal metallurgy and calendar processing industry, metal products manufacturing industry, nonmetal mineral products industry and tobacco processing industry. The right part of figure 5 shows that most part of the 2001 curve in this part is under that of 1996 which shows that those sectors that had disadvantage in 1996 had even more obvious comparative disadvantage. In other words, their comparative advantage had been further worsened. These sectors are mainly intensive-intensive industries such as paper making and paper products industry, garment manufacturing industry, furniture manufacturing industry, printing industry, food processing industry, food manufacturing industry, culture, education and sports products manufacturing industry, leather and eiderdown manufacturing industry as well as rubber products industry, etc.

Through the above analysis, we could come to the following conclusions:

1. The secondary industry which takes industry as the mainstay in Shaanxi Province holds an important position in the economy of the province and it has been rapidly developed in the past few years. However, taking the industry of the country as a whole, its ratio is still below that of the primary and tertiary industries.

2. About half of the industrial output is concentrated on the five sectors of electric and telecommunication equipment manufacturing industry, transport and communication equipment manufacturing industry, pharmaceutical industry, electric machinery and equipment manufacturing industry and chemical raw material and chemical products manufacturing industry. Compared with the whole country, the concentration degree is rather high.

3. Over the past 10 years, the industrial structure evolution has witnessed an obvious trend. The resource-based industries such as coal, nonferrous metal mine and petroleum natural gas extraction have had a constant share; the technology-intensive industries such as electronics, electric appliances, communication equipment manufacturing industry have had their share rapidly increased whereas most of the other sectors have been facing a comparative dwindling trend. But taking the country as a whole, the location advantage of those sectors of Shaanxi Province with resource

input as the main line has been somewhat advanced whereas the location advantage of those sectors with technology-intensive industries as the main line has been sharply reduced.

4. 63% of the industrial export is concentrated on the five sectors of coal, textile, metal products, general machinery products and electronic and telecommunication equipment. The concentration degree of sector export is higher than that of sector output. In other words, the export volume of capital-intensive and resource-intensive products constitute 60% of the total.

5. Over the past 10 years, the export structure regularity in different years is not that obvious. But on the whole, the export share of resource-intensive sectors, mainly the coal industry has been rapidly increased whereas the export share of intensive-intensive sectors, mainly the textile industry has been reduced by a big margin. The export shares of both capital-intensive and technology-intensive sectors have witnessed a first marked rise and then a fall process. At the same time, the concentration degree of export sectors has been degraded and polarization among different sectors is being formed.

6. There is no tangible relationship between the industrial structure and trade structure. But on the whole, both the output share and export share of the intensive-intensive sectors have been decreased whereas the output share and export share of the technology-intensive sectors have been increased.

7. In 2001, five sectors in Shaanxi Province had a very strong comparative advantage which were nonferrous metal extractive industry, coal extractive industry and capital-intensive industries such as general machinery manufacturing industry, pharmaceutical manufacturing industry and beverage industry. Five sectors had strong comparative advantage which were nonferrous metal metallurgy and calendar processing industry, metal products industry, nonmetal mineral products industry, tobacco processing industry and textile industry. In terms of large items of industrial sectors, the resource-intensive industries have a very strong comparative advantage; the capital-intensive industries have a strong comparative advantage; and the intensive-intensive and technology-intensive industries do not have revealed comparative advantage.

8. Over the past 10 years, the comparative advantage of various sectors of Shaanxi

Province have seen rather big changes as time passed by. Out of all the sectors, the comparative advantage of resource-intensive sectors has had a clear increase whereas the comparative advantage of intensive-intensive sectors has been rapidly lost. The comparative advantage of capital-intensive sectors and technology-intensive sectors has witnessed a rise in early years and then a stable development.

# IV Competitive Advantages Analysis based on the Two-region Chinese CGE Model

In this study we develop two region- Shaanxi province and rest of China-CGE model, and use this model to analyze the impact of trade liberalization and SID policy on competitive advantages in Shaanxi province.

## 1. The Shaanxi -Rest of China CGE Model

The two-region Chinese CGE model we employ in this study is an extension of the single region Chinese CGE model that had been used in China's WTO accession study (Development Research Center, 1998; Zhai and Li, 2000). Two regions - Shaanxi province and rest of China - are specified, each with a demand and production structure, and interregional trade in commodities and services. The interregional factor mobility and intergovernmental transfer are also introduced in the model.

Each region in the model has 32 industries, 5 production factors and 2 representative households by urban and rural. Among the factors, labor and capital are used by all sectors, while land is used only by agricultural activities. Labor is disaggregated into three types: agricultural labor, production workers, and professionals.

The model assumes imperfect interregional factor mobility to reflect the policy and institution factors that limit regional factors movement, as well as the location preference of residents. The movement of capital is driven by the relative rental rates across region and the constant elasticity of transformation, and the movement of labor is determined by the relative real income across region and the constant elasticity of transformation. The real income of labor is defined as the wage plus per capita net intergovernmental transfer income.

### (1) Production and Factor Markets

All sectors are assumed to operate under constant returns to scale and cost optimization. Production technology is represented by a nesting of constant elasticity of substitution (CES) functions. At the first level, output results from two composite goods: a composite of primary factors plus energy inputs, i.e., value-added plus the energy bundle, and aggregate non-energy intermediate input. At the second level, the split of non-energy intermediate aggregate into intermediate demand is assumed to follow the Leontief specification, i.e. there is no substitution among non-energy intermediate input. Value-added plus energy component is decomposed into aggregate labor and energy-capital bundle. Aggregate labor is further split into 3 types of labor force. And energy-capital bundles are decomposed into energy and capital-land bundles. Finally, the energy bundle is made up of 3 types of base fuel components, and capital-land is split into capital and land in agricultural sector.

All commodity and factor markets are assumed to clear through prices. Capital and labor forces are fully mobile across sectors. Thus there are a single region-wide equilibrating rental rate for capital and wage rate for each labor type. The agricultural laborers work only in agricultural sectors and production workers work only in non-farm sectors. There is no substitute between agricultural laborer and production worker in production function. In China, although it is increasing reformed, there are still large barriers for rural labor forces to migrate to urban. These barriers include household registration regime, discrimination in employment, education and social security, etc. This segmented labor market is modeled by incorporating partially mobility between agricultural laborer and production worker. We assumed agricultural laborer and production worker could be converted from one to another. A CET function is used here to capture this specification, i.e., this transfer is determined by the relative wage of agricultural labor and production worker, as well as the constant elasticity of transformation.

The model assumes imperfect interregional factor mobility. CET functions are utilized to describe the regional movement of labor and capital. The movement of capital is determined by the relative rental rates and the constant elasticity of transformation, and the movement of labor is determined by the relative real income and the constant elasticity of transformation. The real income of labor is defined as the wage plus per capita net intergovernmental transfer income, deflated by the regional consumer price indices.

**(2) Interregional and Foreign Trade**

The rest of the world supplies imports and demands exports. Given China's small trade share in the world, import prices are exogenous in foreign currency (an infinite price-elasticity). Exports are demanded according to constant-elasticity demand curves, the price-elasticities of which are high but less than infinite.

The model assumes that there is one representative firm in each sector. The firms allocate their output between export and domestic sales to maximize profits, subject to imperfect transformation between the two alternatives. The domestic sales are further split into local sales and interregional exports using a CET function.

Products are assumed to be differentiated by region of origin, i.e. the Armington assumption (Armington, 1969). A two-level nesting CES aggregation function is specified for each Armington composite commodity. At the top level, agents choose an optimal combination of the aggregate domestic good and imports, which is determined by a set of relative prices and the degree of substitutability. At the second level of the nest, aggregate domestic good are split into local good and interregional import from rest of China.

**(3) Income Distribution and Demands**

Factor income is distributed to four major institutions: enterprises, households, the government and extra-budget public sector.

Household income derives from capital, labor and land income. Additionally, households receive distributed enterprise profits, transfers from the government and rest of the world. All kinds of import and export quota rent are also allocated to households. Assume the rural households earn all the land returns. Rural households earn their labor income from both agricultural labors and production workers, while urban households obtain their wages from both production and professional workers. When transformation between agricultural labor and production worker occurs, if some agricultural labors transferred to non-agricultural sector and became production workers, their wage would be allocated to rural households. Vice versa, if production workers transferred to agricultural sector and became agricultural labor, their wages are still distributed to urban and rural households according to the distribution share of production worker's wages.

Capital revenues are distributed among households and enterprises. Enterprise earnings equal a share of gross capital revenue minus corporate income taxes. A part of enterprise earnings is allocated to households as distributed profits based on fixed shares, which are the assumed shares of capital ownership by households. Another part of net company income is allocated to extra-budget public sectors as fee. Retained earnings, i.e. corporate savings for new investment and capital depreciation replacement, equals a residual of after-tax enterprise income minus the distributed profits and fee.

Household disposable income is allocated to goods, services, and savings. Households maximize utility using the extended linear expenditure system (ELES) which is an extension of the Stone-Geary demand system. Saving enters the utility function, which is evaluated using the consumer price index. Social consumption and investment final demand follow a fixed share expenditure function.

Stock change is assumed as a demand for domestic products. The intermediate inputs, household consumption, and other final demands constitute the total demand for the same Armington composite of domestic products and imported goods from the rest of the world.

**(4) Central and Regional Governments, and Extra-budget Public Sector**

An important difference in the model relative to other applied general equilibrium models is the separate treatment of central government and regional governments. The governments collect taxes from the producers, households and foreign sector, transfer money to the household sector, and purchases public goods. There are also transfers between central and regional governments. Central government derives revenues from direct corporate income taxes, import tariffs, and various types of indirect taxes. Regional government derives revenues from direct corporate income and households taxes, as well as various indirect taxes. Subsidies and export tax rebates enter as negative receipts. There are two types of indirect taxes in the model. The value-added tax, which is the most important part of indirect tax in China after 1994 tax reform, is treated as a tax levied on production factors. Its revenues equal total sector value-added multiplied by a tax rate. Three quarters of value-added tax is allocated to central government and the rest is allocated to regional government. The value-added tax is also levied on imports while firms obtain rebates when they

export. The other indirect tax, including various agricultural taxes, and business taxes on construction and services, is treated as a production tax levied on sectoral outputs.

Extra-budget public sectors collect fees from enterprise and households. Their income are allocated to consumption and saving. The consumption of extra-budget public sectors and government spending compose a type of final demand, i.e. the social consumption.

**(5) Macro Closure**

Macro closure determines the manner in which the following three accounts are brought into balance: (i) the government budget; (ii) aggregate savings and investment; and (iii) the balance of payments.

Real government spending and real government saving are exogenous in the model. All tax rates and transfers are fixed, except the VAT, which endogenously adjust to maintain the balance of government budget. The total value of investment expenditure must equals total resources allocated to the investment sector: retained corporate earnings, total household savings, government savings, extra-budget saving and foreign capital flows. In this model, the aggregate investment is the endogenous sum of the separate saving components. This specification corresponds to the "neoclassical" macroeconomic closure in CGE literature.

The value of imports, at world prices, must equal the value of exports at border prices, i.e., inclusive of export taxes and subsidies, plus the sum of net transfers and factor payments and net capital inflows. An exchange rate is specified to convert world prices, e.g., in dollars, into domestic prices. With foreign saving set exogenously, the equilibrium would be achieved through changing the relative price of tradables to nontradables, or the real exchange rate.

**(6) Data**

The model is calibrated to the 1997 two-region Chinese Social Accounting Matrices (SAM) developed from the 1997 national and Shaanxi Input-Output tables. The SAM provides a consistent framework to organize the relevant flow of value statistics to satisfy the requirements of a benchmark data set for CGE modeling. Some key parameters of the model – essentially substitution and income elasticities – were derived from a literature search. All other parameters – mainly shift and share parameters – are calibrated in the base year using the key parameters and the base

data.(see annex tables of SAM for China and Shaanxi)

## 2. Economic Structure, Market Openness in China and Shaanxi

Our CGE model for China is constructed according to two SAMs for the year of 1997. The section outlines the basic features of industrial structure of Chinese economy in 1997 based upon the SAMs.

Table 5 summarizes the sectoral structure and market openness of Chinese economy in the base year. For each of the 34 sectors, the base year data for shares of output, employment, imports, exports, and trade dependence are reported. As may be seen in columns 1 through 4, the data are notably asymmetric among the shares of output, employment, and trade. For example, the agricultural sectors account for 50 percent of China's labor employment but only produce 12 percent of its output and account 3 percent of China's total trade. While textile and apparel industries employ 3.3 percent of China's labor force, but produce 7.7 percent of its total output and account for more than 26 percent of the country's total exports.

Export dependency is high for the apparel, social articles, electronics and instruments sectors as more than 30 percent of their products depend on foreign markets. Textile is also the export-oriented sectors in which almost 20 percent of the output is sold on international markets. The sectors with the largest shares in imports are machinery, electronics and chemicals as they account for more than 10 percent of China's total imports, respectively. The wool, instruments, electronics and special equipment and two raw materials sector (crude oils and ferrous ore mining) have higher market penetration ratio. The electronics and instruments sectors have both high export and import dependency, reflecting the fact that a large percentage of production in this sector represents processing and assembling products from abroad, i.e. processing trade.

The trade balances by industry in column 10 reflect China's comparative advantage. China is a net exporter of labor-intensive manufactures and a net importer of capital-intensive manufactures. The largest share of the trade surplus in China comes from apparel and textile. In agricultural sector, China is net importer of grain, but has trade surplus of other agricultural products.

Table 6 summarizes the economic structure of Shaanxi in the base year. The first four columns report the sectoral composition of output, employment and foreign trade.

Column 5-10 reports the trade dependence of Shaanxi, both foreign and interregional. In comparison with national economy, Shaanxi is more specialized in service sector and export-oriented labor-intensive manufacturing sector. In 1997 the share of agriculture output was 13.7%, which was the highest among the all of the sectors. The share of construction and manufacture of food products ranked second and third, the share was 9.5% and 7.4% respectively. Agriculture is not important in Shaanxi in terms of output and employment relative to the national average, but there is still more than 60 percent of labor force employed in agricultural sector. So provincial labor productivity of agriculture sector is low (as 60% of national average). The labor productivity of secondary industry is half of national average.

We also calculate sectoral RCA based on SAM(see figure 6). In previous part RCA analysis is focused on manufacture sectors, but agriculture sector is also included here. RCA of agriculture in Shaanxi is closed to 2. This means that agriculture has strong comparative advantage.

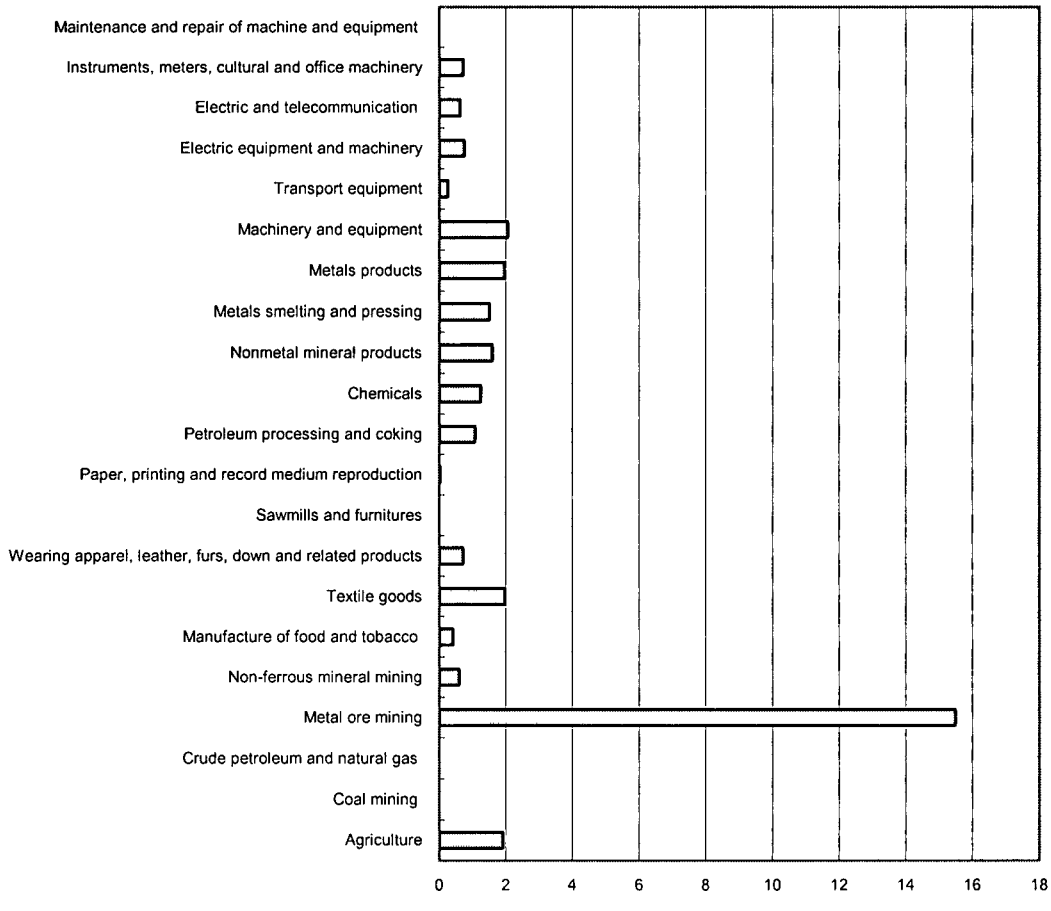



Figure 6. Shaanxi's sectoral RCA based on SAM

Shaanxi is an open economy, 20 percent of its domestic use are import and 25 percent of its products are exported to oversea market. The dependency of Shaanxi's economy on oversea market is higher than that on interregional domestic market. Only 17 percent of its domestic use are from rest of China and 11 percent of its products are sold at the market of rest of China. At industry level, textile, apparel, leather, electronics and electric machinery are important export sectors, they together contribute 64 percent of Shaanxi's exports. Electronics, chemicals and textiles sectors are three largest import sectors, they account for 41 percent of total imports. The electronics, instruments, special equipment and textiles sectors have both high export and import dependency. Shaanxi depends on interregional import for most of energy goods and primary metal, as well as electric machine and electronics. The electric machine and electronics sectors are also the largest sector in terms of interregional exports. Exports to the rest of China are also important for most chemical industries in Shaanxi.

**Table 5 Economic Structure and Market Openness in China, 1997 (%)**

| | Output | Employment | Imports | Exports | Import/ Domestic Use | Export/ Outputs | Net Export (bn. Yuan) |
|---|---|---|---|---|---|---|---|
| Agriculture | 12.3 | 49.9 | 3.1 | 2.6 | 1.6 | 1.8 | 4.5 |
| Coal Mining | 1.1 | 1.6 | 0.1 | 0.6 | 0.4 | 4.2 | 8.6 |
| Crude Oil | 0.8 | 0.3 | 3.6 | 1.5 | 24.8 | 15.3 | -20.6 |
| Metal Mining | 0.6 | 0.3 | 1.6 | 0.1 | 14.6 | 0.9 | -19.3 |
| Quarrying | 0.9 | 1.0 | 0.8 | 0.6 | 5.6 | 5.3 | -0.5 |
| Food | 6.9 | 1.8 | 3.6 | 4.8 | 3.4 | 5.8 | 34.3 |
| Textiles | 4.6 | 2.0 | 6.8 | 11.4 | 10.3 | 20.4 | 104.5 |
| Apparel | 3.0 | 1.3 | 2.5 | 15.0 | 8.1 | 40.9 | 217.6 |
| Sawmill &furniture | 1.1 | 0.5 | 0.9 | 2.1 | 5.7 | 15.3 | 22.8 |
| Social article | 2.8 | 1.2 | 4.0 | 6.5 | 9.9 | 19.3 | 58.4 |
| Petroleum refining | 1.5 | 0.2 | 3.1 | 1.2 | 11.8 | 6.3 | -19.6 |
| Chemical | 7.6 | 2.5 | 16.2 | 9.6 | 13.0 | 10.5 | -43.8 |
| Building material | 4.4 | 2.8 | 0.8 | 2.1 | 1.2 | 3.9 | 23.9 |
| Primary metal | 3.9 | 1.3 | 6.4 | 3.0 | 10.0 | 6.5 | -30.7 |
| Metal products | 2.5 | 0.9 | 2.6 | 4.1 | 7.1 | 13.9 | 36.4 |
| Machinery | 4.2 | 2.2 | 13.7 | 2.9 | 17.9 | 5.7 | -123.9 |
| Transport equipment | 2.9 | 1.0 | 3.7 | 2.0 | 7.7 | 5.6 | -13.4 |
| Electronic machine | 2.8 | 0.8 | 4.0 | 5.5 | 9.7 | 16.5 | 42.2 |
| Electronics | 2.5 | 0.5 | 13.2 | 11.5 | 35.6 | 38.9 | 25.2 |
| Instrument | 0.4 | 0.3 | 2.7 | 2.7 | 47.0 | 54.8 | 12.3 |
| Other manufacturing | 0.8 | 0.8 | 0.4 | 0.9 | 3.1 | 8.8 | 9.6 |
| Electricity | 2.0 | 0.3 | 0.0 | 0.2 | 0.0 | 1.0 | 3.8 |
| Gas & water | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Construction | 8.7 | 6.0 | 0.4 | 0.1 | 0.3 | 0.1 | -2.6 |
| Transport | 2.5 | 3.2 | 0.7 | 2.8 | 1.8 | 9.4 | 38.9 |
| Telecomm | 1.0 | 0.3 | 0.2 | 0.7 | 1.3 | 5.7 | 8.7 |
| Commerce | 5.7 | 7.8 | 0.9 | 0.0 | 1.0 | 0.0 | -11.2 |
| Restaurant | 1.1 | 1.5 | 0.3 | 0.7 | 2.0 | 5.0 | 6.9 |
| Finance | 1.8 | 0.5 | 0.4 | 0.1 | 1.2 | 0.5 | -2.7 |
| Social service | 3.7 | 1.6 | 2.9 | 4.5 | 5.2 | 10.1 | 38.8 |
| Education & health | 3.3 | 3.7 | 0.2 | 0.3 | 0.4 | 0.7 | 1.7 |
| Public administration | 2.2 | 1.8 | 0.2 | 0.0 | 0.5 | 0.1 | -1.5 |
| TOTAL | 100.0 | 100.0 | 100.0 | 100.0 | 6.4 | 8.3 | 409.5 |

Note: Imports/Domestic use and Exports/output are at domestic price. The sectoral share of imports and exports are at world price.
Source: Chinese Social Accounting Matrix, 1997, Development Research Center of the State Council

**Table 6 Economic Structures in Shaanxi, 1997 (%)**

| | Output | Employment | Imports | Exports | Import/ Domestic Use | Export/ Outputs | Net Export (bn. Yuan) | RCA | Inter-regional Import | Inter-regional Export | Inter-regional Import/ Domestic Use | Inter-regional Export/ Outputs | Net Inter-regional Export (bn. Yuan) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture | 13.7 | 61.6 | 6.5 | 5.5 | 0.8 | 1.0 | 0.11 | 2.097 | 1.09 | 1.87 | 1.70 | 2.39 | 0.33 |
| Coal Mining | 1.1 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 0.09 | 1.61 | 2.17 | 24.91 | 0.89 |
| Crude Oil | 0.7 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 0.37 | 0.00 | 10.50 | 0.00 | -0.27 |
| Metal Mining | 3.0 | 0.2 | 3.9 | 1.1 | 2.1 | 0.9 | -0.13 | 13.991 | 0.47 | 5.09 | 4.40 | 29.64 | 2.68 |
| Quarrying | 0.2 | 0.0 | 0.0 | 0.4 | 0.5 | 5.2 | 0.03 | 0.633 | 1.45 | 0.04 | 64.90 | 3.44 | -1.02 |
| Food | 7.4 | 1.0 | 1.0 | 2.2 | 0.2 | 0.7 | 0.13 | 0.441 | 17.88 | 6.02 | 37.31 | 14.13 | -9.26 |
| Textiles | 2.0 | 1.8 | 0.8 | 24.1 | 1.0 | 31.0 | 2.06 | 2.300 | 5.21 | 6.51 | 80.94 | 56.77 | 0.12 |
| Apparel | 0.6 | 0.3 | 0.1 | 11.2 | 0.3 | 48.0 | 0.99 | 0.815 | 7.23 | 0.43 | 86.31 | 12.36 | -4.93 |
| Sawmill &furniture | 0.3 | 0.2 | 0.0 | 0.0 | 0.1 | 0.2 | 0.00 | 0.012 | 1.42 | 0.02 | 48.35 | 1.23 | -1.01 |
| Social article | 1.7 | 0.6 | 2.0 | 0.2 | 1.9 | 0.4 | -0.09 | 0.038 | 4.87 | 0.25 | 37.86 | 2.57 | -3.34 |
| Petroleum refining | 1.6 | 0.1 | 0.1 | 1.4 | 0.1 | 2.2 | 0.11 | 1.149 | 0.79 | 0.64 | 10.67 | 7.18 | -0.19 |
| Chemical | 3.9 | 1.2 | 26.1 | 13.6 | 10.7 | 8.5 | -0.34 | 1.270 | 12.89 | 16.29 | 69.51 | 72.19 | 0.41 |
| Building material | 5.3 | 0.9 | 2.0 | 3.7 | 0.6 | 1.7 | 0.19 | 1.766 | 1.88 | 0.73 | 7.17 | 2.40 | -0.91 |
| Primary metal | 2.1 | 0.7 | 7.1 | 5.1 | 5.7 | 6.1 | 0.03 | 1.532 | 8.28 | 7.98 | 72.22 | 67.12 | -1.21 |
| Metal products | 1.0 | 0.5 | 4.6 | 9.1 | 9.5 | 23.5 | 0.50 | 2.181 | 0.23 | 2.24 | 10.34 | 40.84 | 1.16 |
| Machinery | 2.8 | 1.9 | 24.9 | 7.0 | 13.4 | 6.0 | -0.82 | 2.115 | 6.45 | 12.93 | 62.46 | 79.65 | 3.04 |
| Transport equipment | 2.6 | 1.7 | 6.5 | 0.6 | 3.9 | 0.5 | -0.32 | 0.253 | 3.07 | 12.13 | 50.94 | 79.92 | 4.98 |
| Electricity machine | 4.1 | 0.7 | 3.5 | 4.6 | 1.4 | 2.8 | 0.19 | 0.750 | 2.02 | 8.08 | 13.79 | 34.10 | 3.34 |
| Electronics | 4.1 | 0.3 | 5.1 | 7.9 | 2.1 | 4.8 | 0.39 | 0.728 | 4.12 | 15.47 | 40.14 | 65.66 | 6.21 |
| Instrument | 0.3 | 0.3 | 5.6 | 2.2 | 25.3 | 16.6 | -0.13 | 0.866 | 1.01 | 1.50 | 66.66 | 79.41 | 0.17 |
| Other manufacturing | 0.2 | 0.0 | 0.1 | 0.0 | 1.0 | 0.6 | 0.00 | 0.064 | 0.30 | 0.05 | 24.29 | 4.46 | -0.18 |
| Electricity | 2.3 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 0.03 | 0.14 | 0.27 | 1.06 | 0.06 |
| Gas & water | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 2.13 | 0.00 | 77.58 | 0.00 | -1.53 |
| Construction | 9.5 | 5.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 6.39 | 0.00 | 12.44 | 0.00 | -4.58 |
| Transport | 5.5 | 2.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 0.12 | 0.00 | 0.44 | 0.00 | -0.08 |
| Telecomm | 1.3 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Commerce | 6.2 | 4.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Restaurant | 2.4 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Finance | 1.4 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Social service | 3.0 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 6.16 | 0.00 | 30.27 | 0.00 | -4.42 |
| Education & health | 4.7 | 4.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 4.06 | 0.00 | 15.31 | 0.00 | -2.91 |
| Public administration | 4.7 | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| TOTAL | 100.0 | 100.0 | 100.0 | 100.0 | 1.7 | 2.5 | 2.90 | | 100.00 | 100.00 | 20.56 | 17.46 | -12.47 |

**Table 7 Sectoral Tax/Subsidy Rates for Shaanxi, 1997 (%)**

| | VAT | Other indirect tax | Production subsidy | Tariff | Import VAT | Fee |
|---|---|---|---|---|---|---|
| Agriculture | | 2.75 | -0.02 | 9.32 | | 0.13 |
| Coal Mining | 9.80 | 0.84 | -0.15 | | | 0.08 |
| Crude Oil | 11.77 | 0.42 | -0.15 | | | 0.02 |
| Metal Mining | 4.03 | 0.20 | -0.05 | 0.86 | 5.09 | 2.43 |
| Quarrying | 5.45 | 1.37 | -0.15 | 0.46 | 2.21 | 4.00 |
| Food | 6.34 | 4.67 | -0.95 | 6.88 | 8.29 | 1.98 |
| Textiles | 10.25 | 0.89 | -0.15 | 0.12 | 0.13 | 0.81 |
| Apparel | 6.27 | 0.74 | -0.14 | 0.37 | 0.28 | 4.26 |
| Sawmill &furniture | 7.87 | 0.93 | -0.15 | 6.67 | 4.11 | 3.54 |
| Social article | 6.53 | 0.93 | -0.14 | 3.79 | 4.93 | 3.41 |
| Petroleum refining | 11.03 | 8.14 | -0.06 | 4.15 | 10.09 | 0.06 |
| Chemical | 9.18 | 1.19 | -0.15 | 1.80 | 3.88 | 0.65 |
| Building material | 4.53 | 2.30 | -0.15 | 1.62 | 2.33 | 4.90 |
| Primary metal | 7.78 | 0.64 | -0.15 | 1.27 | 3.67 | 1.96 |
| Metal products | 6.51 | 0.89 | -0.15 | 1.79 | 3.38 | 4.18 |
| Machinery | 7.66 | 0.41 | -0.14 | 2.16 | 4.43 | 0.08 |
| Transport equipment | 6.64 | 1.35 | -0.14 | 1.51 | 6.99 | 0.70 |
| Electronic machine | 6.95 | 0.48 | -0.14 | 2.46 | 3.28 | 1.39 |
| Electronics | 7.79 | 0.90 | -0.15 | 1.51 | 3.33 | 2.28 |
| Instrument | 8.79 | 1.23 | -0.15 | 1.34 | 3.41 | 0.73 |
| Other manufacturing | 5.54 | 1.09 | -0.13 | 1.01 | 0.61 | 4.74 |
| Electricity | 13.66 | 0.30 | -0.15 | | | 0.25 |
| Gas & water | 10.42 | 0.12 | -0.15 | | | 0.10 |
| Construction | | 2.52 | 0.00 | | | 0.08 |
| Transport | | 4.90 | -1.14 | | | 4.31 |
| Telecomm | | 3.67 | 0.00 | | | 0.20 |
| Commerce | 4.80 | 0.57 | -4.09 | | | 0.33 |
| Restaurant | | 3.64 | 0.00 | | | 0.03 |
| Finance | | 21.32 | 0.00 | | | 11.92 |
| Social service | | 2.62 | 0.00 | | | 0.29 |
| Education & health | | 0.31 | 0.00 | | | 0.35 |
| Public administration | | 0.01 | 0.00 | | | 0.06 |
| TOTAL | 6.87 | 2.22 | -0.45 | 2.51 | 4.18 | 1.32 |

The data for trade balance show that the largest share of foreign trade surplus in Shaanxi comes from apparel, textile, leather, electric machine and electronics. The electric machine sector in Shaanxi also has large surplus from interregional trade. Shaanxi is net importer of energy, chemicals and primary metal.

Table 7 reports the sectoral rates of domestic tax and tariff. It shows that the tax rates are quite diversified across sector. For instance, although the nominal rates of VAT are 17% and 13%, the actual sectoral collection rates ranges from 4% to 13%, due to extensive preferential treatment and tax exemptions. Obviously, the current tax system introduces strong distortionary effects across sector.

This SAM-based data analysis provides an overview of the characteristics of economy structure and intersectoral distortion in Shaanxi. It has important implications for the impact of policy adjustments and facilitates the understanding of simulation results reported later in this paper.

## 3. Simulations Design and Results

To investigate the implication of removal of distortionary taxes and subsidies, we consider four scenarios which take different assumptions on the unification of sectoral taxes/subsidies, environment policy and labor market. The first scenario look at the impact of elimination of sector-specific subsidies and taxes, in which we unify import taxes rates across sector, eliminate production subsidies and replace all domestic indirect taxes with a unified VAT. Based on the first scenario, the second scenario further introduces the carbon tax which reduces the carbon emission by 10 percent. Through it we may assess the sectoral competitiveness when environment cost is taken into account. The third scenario considers the impact of employment creation by introducing a fixed shadow wage that is 5 percent lower that market wage, again based on the first scenario. The last scenario combines the second scenario and the third scenario to generate a comprehensive picture from both environment and employment perspectives.

### 1) Unification of intersectorally distortionary taxes/subsidies

In the first scenario, the unification of sectoral taxes/subsidies is implemented in a revenue-neutral fashion: the sectoral rates of taxes/subsidies are replaced by a single VAT rate, which is endogenously adjusted to keep the real expenditure and real saving of government constant. This rule of fiscal closure ensure the fiscal neutrality in macro-economy, so that any changes in consumption and investment do not come result from changes in government expenditure and saving. This makes it easy to assess the impacts of changes in sectoral structure of taxes and subsidies.

Table 8 reports the major aggregate results of the first scenario. They are deviations from the base year values. The results show that both China as whole and its Shaanxi

province would experience GDP and welfare gain from the elimination of distortionary taxes/subsidies. In scenario 1, China's real GDP will increase 0.15 percent compared with base case. The welfare gains represented by Hicksian equivalent variations (EV), is around half of GDP gain, due to the deteriorated terms of trade. The GDP and welfare gains of Shaanxi are larger than that of China, indicating the more serious distortions embodied in Shaanxi's tax/subsidy structure.

**Table 8 Major aggregate effects of Scenario 1 (% change with base year)**

| | China | Shaanxi |
|---|---|---|
| EV (% of GDP) | 0.07 | 0.48 |
| GDP | 0.15 | 0.83 |
| Consumption | -0.73 | -0.32 |
| Investment | 1.43 | 2.09 |
| Exports | 0.07 | 6.05 |
| Imports | 0.00 | 2.84 |
| Real exchange rate | -1.03 | -2.60 |
| Terms of trade | -0.07 | -0.92 |
| Factor price | | |
| Agricultural labor | -2.30 | 0.64 |
| Production worker | -1.44 | 1.26 |
| Skilled labor | 0.10 | 1.34 |
| Land | -3.53 | -0.27 |
| Capital | 5.58 | 6.59 |

Source: simulation results.

Elimination of distortionary taxes/subsidies would result in more investment and less private consumption, because the changes in functional income distribution are in favor of corporate sector than households sector. As shown in table 8, when a unified VAT is utilized to replace current distornationary taxes/subsidies, the rental rate of capital would increase by 5.58 percent in China and 6.59 percent in Shaanxi, but the wage would decline in China and increase by around only 1 percent in Shaanxi.

To fully understand pattern of changes in factor price, it is necessary to examine the sectoral impact. Table 9 lists the changes of producer price, gross output, employment and export by sector in Shaanxi under the first scenario. The changes of sectoral producer prices shows that the net tax burden for agriculture, crude oil, metal mining, commerce, post and tele communication as well as some other service sectors are

lower than other sectors, their prices would increase by 4-8 percent if a unified VAT is utilized. While financial sector, petroleum refining, electricity and building materials bear heavy tax burden, their prices would decline sharply with removal of current sectoral distortion in tax/subsidy. The prices of food, primary metals and electronics would also have relatively large decline when a unified VAT is utilized.

**Table 9 Sectoral effect of Scenario 1, Shaanxi (% change with base year)**

| | After-tax Producer price | Output | Employment | Export | Inter-regional Export | RCA* |
|---|---|---|---|---|---|---|
| Agriculture | 7.8 | -0.8 | -0.5 | -21.9 | 0.1 | -0.094 |
| Coal Mining | 1.2 | 8.8 | 9.2 | | 29.7 | |
| Crude Oil | 4.6 | 2.4 | 3.3 | | | |
| Metal Mining | 3.8 | -6.9 | -6.3 | -11.0 | -11.1 | -2.047 |
| Quarrying | 0.0 | -1.1 | -1.1 | 1.5 | -4.3 | -0.055 |
| Food | -2.6 | 0.7 | 1.2 | 10.1 | -1.4 | -0.020 |
| Textiles | -1.1 | 10.2 | 10.2 | 8.9 | 11.4 | -0.036 |
| Apparel | -0.7 | 4.5 | 5.0 | 2.2 | 6.8 | -0.001 |
| Sawmill &furniture | -2.1 | 5.5 | 5.6 | 5.0 | 8.8 | 0.000 |
| Social articles | 0.3 | 3.2 | 3.7 | -1.0 | 5.2 | -0.001 |
| Petroleum refining | -4.6 | 1.2 | 1.2 | 23.1 | -3.9 | -0.087 |
| Chemical | -1.6 | -3.8 | -3.8 | 7.9 | -5.3 | -0.130 |
| Building material | -3.3 | 4.7 | 4.8 | 11.9 | 13.3 | 0.010 |
| Primary metal | -2.8 | 6.2 | 5.9 | 14.3 | 6.7 | -0.051 |
| Metal products | -2.2 | 7.0 | 7.0 | 11.7 | 6.8 | -0.048 |
| Machinery | 0.5 | -3.1 | -3.1 | -2.5 | -3.2 | -0.163 |
| Transport equipment | 0.8 | -11.3 | -11.2 | -5.1 | -12.2 | -0.033 |
| Electronic machine | -0.9 | 1.0 | 1.2 | 6.1 | -2.3 | -0.055 |
| Electronics | -2.3 | 16.6 | 16.8 | 12.6 | 17.8 | 0.029 |
| Instrument | -0.8 | 13.4 | 13.3 | 3.8 | 17.1 | 0.044 |
| Other manufacturing | 4.5 | 6.0 | 6.6 | -19.5 | 21.3 | 0.002 |
| Electricity | -3.6 | 2.2 | 2.1 | | 18.0 | |
| Gas & water | 2.7 | 21.6 | 21.6 | | | |
| Construction | 2.1 | 1.8 | 1.7 | | | |
| Transport | 0.5 | 0.8 | 0.6 | | | |
| Telecomm | 4.2 | 0.5 | 0.6 | | | |
| Commerce | 6.5 | 0.4 | 0.5 | | | |
| Restaurant | 3.6 | 0.4 | 0.4 | | | |
| Finance | -18.1 | 10.6 | 10.6 | | | |
| Social service | 4.3 | 2.3 | 2.2 | | | |
| Education & health | 10.0 | -5.3 | -5.4 | | | |
| Public administration | 8.8 | 0.0 | 0.0 | | | |

*Change of RCA, not % change.

The changes in sectoral tax burden and prices will result in changes in demand and output. When sectoral distortion of taxes is removed, generally, the output of those sectors with high tax burden would increase, while the output of those sectors with low tax burden will decline. The simulation results in Table 9 shows that output of

agriculture and metal mining will fall by 0.8 percent and 6.9 percent respectively, while financial sector will increase its output by 10 percent. The output of most industrial sectors would increase, except chemicals, machinery and transportation equipment.

The changes of sectoral output are driven by not only the sectoral tax rates, but also the factor cost. Since agricultural sector owns 62 percent of total labor forces in Shaanxi, its contraction would lower the wage of agricultural labor and divert some of them to non-agricultural sectors. This will in turn lower the wage of production worker. So the labor-intensive sectors, even those are not highly taxed, such as textile, apparel and Social articles, would experience expansion of production because of lower labor cost.

In the two-region model, inter-regional trade also plays an important role in determining of the sectoral output. The machinery, transportation equipment, electronics and instrument sectors in Shaanxi are very interregional export-oriented, their exports to rest of China account for more than 70 percent of their total output. Due to the different composition of imports of transportation equipment, its weighted tariff rate in rest of China is as high as 11%, much higher than that in Shaanxi. Given this heavy import protection in rest of China, the unification of tariff rate will significantly lower the its import prices, and induce consumers to substitute imports for domestic products, including the inter-regional imports from Shaanxi. The simulation results reported in table 9 shows that the exports of transportation equipment from Shaanxi to rest of China would decline 12 percent, resulting in the contraction of its output. On the contrary, the demand expansion of electronics and instruments in rest of China drive up its inter-regional imports from Shaanxi and induce a dramatic output increase in Shaanxi.

Most major exporting sectors of Shaanxi, such as textiles, chemical, metal products and electronics, will benefit from the removal of intersectorally distortionary taxes/subsides, due to either the reduction of tax burden in those sectors or the favorable changes in their production costs of factor and intermediate input. This

enhances the export competitiveness of these sectors at international market, resulting that their exports will increase by 8-13 percent under the first scenario. Since the export of textiles, chemicals, metal products and electronics account for 55 percent of total exports of Shaanxi in base year, their rapid exports growth strongly contribute the growth of total exports of Shaanxi. The aggregate results in Table 8 show that total exports of Shaanxi would increase by 6 percent, much stronger than that of the rest of China.

When distortionary taxes/subsidies are removed, the RCAs for most sectors in Shaanxi would decline. This indicates that Shaanxi's current export structure is dependent on the current taxes/subsidies system, at least at a certain extent. Without distortionary tax structure, the sectoral structure of exports of Shaanxi would tend to convergence to that of national average.

**2) Introduction of environment tax and fixed wage**

The scenario 2, 3 and 4 consider the impacts of introduction of environment tax and a lower fixed wage, given that the distortionary taxes/subsidies have been removed already. Table 10 reports the aggregate results of the three scenarios. They are derivations from scenario 1. In scenario 2 and 4, carbon tax is regional–specific to reduce the carbon emission of each region by 10 percent compared with its base year level. We assume that all revenue from carbon tax will be redistributed to households as a lump sum transfer. In scenario 3 and 4, real wage is fixed to be 5 percent lower than that in scenario 1, and total labor supply is endogenous to clear the labor market.

**Table 10 Major aggregate effects of Scenario 2, 3, 4 (% change relative to Scenario 1)**

| | Scenario 2<br>Environment tax | Scenario 3<br>Fixed wage | Scenario 4<br>Envr. tax & Fixed wage |
|---|---|---|---|
| **China** | | | |
| EV (% of GDP) | -0.58 | 1.19 | 1.66 |
| GDP | -0.51 | 1.20 | 1.79 |
| Consumption | 3.84 | -0.40 | 4.44 |
| Investment | -6.94 | 4.12 | -1.03 |
| Exports | 0.92 | 0.97 | 3.22 |
| Imports | 1.08 | 1.16 | 3.80 |
| Real exchange rate | 5.84 | 0.59 | 8.55 |

| | Scenario 2 Environment tax | Scenario 3 Fixed wage | Scenario 4 Envr. tax & Fixed wage |
|---|---|---|---|
| Terms of trade | -0.10 | -0.09 | -0.35 |
| Factor price | | | |
| Agricultural labor | 0.91 | -5.97 | -11.93 |
| Production worker | -0.50 | -5.97 | -11.93 |
| Skilled labor | -2.50 | -5.97 | -11.93 |
| Land | 2.16 | 1.80 | 8.39 |
| Capital | -14.06 | 8.34 | -1.83 |
| Total employment | 0.00 | 2.07 | 4.48 |
| **Shaanxi** | | | |
| EV (% of GDP) | -0.44 | 5.92 | 8.17 |
| GDP | -0.75 | 6.37 | 8.36 |
| Consumption | 4.68 | 2.23 | 9.35 |
| Investment | -7.62 | 13.87 | 10.69 |
| Exports | -3.53 | 6.93 | 7.05 |
| Imports | 0.32 | 8.58 | 13.56 |
| Real exchange rate | 4.71 | 0.43 | 6.57 |
| Terms of trade | 0.54 | -1.43 | -1.56 |
| Interregional trade | 0.42 | -0.80 | -0.35 |
| Factor price | | | |
| Agricultural labor | 0.88 | -6.77 | -11.58 |
| Production worker | -0.35 | -6.77 | -11.58 |
| Skilled labor | -2.80 | -6.78 | -11.58 |
| Land | 2.36 | 15.68 | 26.82 |
| Capital | -13.89 | 13.73 | 4.79 |
| Total employment | 0.00 | 6.50 | 10.07 |

Source: simulation results.

When carbon tax is introduced, the GDP in both China and its Shaanxi province will decline due to lower energy use. It is not strange that the output loss in Shaanxi is slightly smaller that the rest of China, because the share of agriculture and service in its economy is higher that national average. An interesting finding is that the welfare loss of Shaanxi is smaller than GDP loss. This could be explained by the changes in terms of inter-regional trade. When carbon tax is introduced, the energy demand will decline and the producer price of energy good will also decline. Since Shaanxi is a net exporter of energy-intensive, heavy industry products and net importer of less energy-intensive, light industry products in its inter-regional trade, it will experience improved terms of trade under carbon reduction scenario. While the rest of China will suffer deteriorated terms of trade and its welfare loss is larger than GDP.

The rental rate of capital will decline sharply when carbon tax is introduced, because most carbon-intensive sectors are also capital intensive. Lower capital return reduces the retained earning of firms, so the total investment would decline when carbon tax is

introduced. But the household sector would benefit from the transfer of carbon tax revenue. Thus the private consumption would increase by 3.84 percent and 4.68 percent in China and Shaanxi, respectively.

In the third scenario, the total employment is expanded due to lower wage. Since Shaanxi has relatively high labor/capital ratio, the growth effects of lower wage in Shaanxi is larger than that in rest of China. When market wage is reduced by 5 percent, GDP would increase by 1.2 percent for whole China and 6.37 percent for Shaanxi. The total employment in China and Shaanxi would increase by 2.07 percent and 6.5 percent, respectively.

Due to the static feature of this model, the total capital stock is kept constant, but it could mobile across region to maximize its return. The reduction of market wage would induce more employment and change the pattern of factor price. Since Shaanxi is more labor intensive than rest of China, the employment in Shaanxi would increase more and in turn the price of capital would also increase more. Thus more capital would be diverted to Shaanxi, resulting that the GDP growth in Shaanxi is almost same with its employment growth, but in rest of China the GDP growth is much smaller than employment growth.

The sectoral results for Shaanxi from scenario 2, 3 and 4 are reported in table 11, 12 and 13. Generally, when carbon tax is introduced, the energy-intensive sectors would shrink since they will face higher cost of intermediate input, while those sectors with less energy input would expand. Moreover, the sectoral output in Shaanxi would be influenced by the price changes in rest of China, especially for those sectors with high dependence of inter-regional dependence. For instance, the machinery sector in Shaanxi is more energy intensive than that in rest of China. Its producer price would rise when carbon tax is introduced, while the price for same sector in rest of China would fall. This results in sharp decline of machinery exports from Shaanxi to rest of China, and induce a large output reduction in Shaanxi.

In scenario 3 with lower wage, almost all sectors in Shaanxi would expand. In general, the labor-intensive sectors would benefits more from the more labor inputs

and lower wage. It is noteworthy that factor intensities of some sectors in Shaanxi are quite different with that in rest of China. For instance, the apparel sector is relatively capital intensive in Shaanxi. Its price could only decline by 0.4 percent when lower wage is introduced. This results in the output of apparel in Shaanxi would increase 2.1 percent only in scenario 3. Likewise, the machinery sector is much more labor intensive in Shaanxi than that in rest of China. Its price could fall by 2.1 percent when wage decline by 5 percent and its output and exports to rest of China would increase by more than 20 percent.

**4. Conclusion and Policy Implication**

It can be seen from I, II, III of this paper that Shaanxi province had a long history of economic development before the launch of economic reform, its average annual growth rate of GDP from 1952-1980 was 6.9%, which is similar to Liaoning province in the same period, and they are higher than the national average GDP growth rate of 6.2% and Zhejiang (6.4%) and Guangdong (5.6%) province by the same period. Therefore, the major issue faced by Shaanxi province to improve its competitive advantage either in domestic or in international market are of two aspects, one is further opening to the outside world to overcome its locational disadvantage compared to coastal region, one is industrial restructuring and institutional reform to utilize fully its potential of human resource in defense and heavy industrial sector. This cannot be discussed fully in this paper. The analysis done in part IV includes the primary, secondary and tertiary sector of whole provincial economy, which provides an additional detail information and analysis done in part III.

The results of simulation show that the current tax/subsidies structure induces great distortion in Chinese economy. Both China and Shaanxi province would gain in economic efficiency when intersectorally distortionary taxes and subsidies are eliminated. And the GDP and welfare gains of Shaanxi are much larger than that of China, indicating the more serious embodied in Shaanxi's tax/subsidy structure.

The current tax/subsidy structure is in favor of agriculture, mining and some heavy industry sectors. When the intersectoral distortion of taxes/subsidies is removed, the output of those sectors with high protection, such as transportation equipment, metal mining and chemical sector, would be contracted. While most manufacturing sectors, especially for the labor-intensive sectors and export-oriented sectors, would benefit from the removal of distortionary taxes and subsidies, because of the alleviated tax burden on them and the favorable changes in their factor costs.

The elimination of distortionary taxes and subsidies would strength the export competitiveness of Shaanxi. When the distortionary taxes and subsidies are removed, the total exports of Shaanxi would increase by 6 percent, much larger than that of rest of China. The export of those labor-intensive and export-oriented sectors, such as food, textile, primary metal and electronics, would expand significantly. The sectoral structure of exports in Shaanxi would be more consistent to that of China, and more consistent to its comparative advantage.

When carbon tax is introduced, Shaanxi would experience smaller loss relative to the rest of China, because it has lower share of industry and is less carbon-intensive. Theoretically speaking from the result of simulation of this model, a lower fixed wage will be beneficial more for Shaanxi than the rest of China, because it has relatively large endowment of labor force and higher labor/capital ratio. But it is described in the beginning of this part, an incentive system and skilled labor force are also important for the further growth of Shaanxi economy, therefore a compromised solution has to be pursued in reality. When carbon tax is introduced, the energy-intensive sectors would shrink and those sectors with less energy use would expand. While in the scenario with lower fixed wage, almost all sectors would expand in Shaanxi.

Some policy implications could be derived from the above model analysis. Firstly, to reform the current sectoral taxes and subsidies with a unified value-added tax would improve the economy efficiency and promote the economic growth. Secondly, some sectors with high protection would loss from this tax unification reform. Thus,

some complimentary reforms are necessary to facilitate the smooth transition, especially the reform in labor market. Given the huge resource of labor force in China, the policies to facilitate the employment creation would have important implication for Chinese economy. Thirdly, from the regional perspective, the tax unification reform could divert the capital flow from one region to another region. It is possible to be harmful to the economic growth of some regions. Thus to maintain a high saving rate and build a well-functioned financial system would be quite important.

**Table 11 Sectoral effect of scenario 2, Shaanxi (% change with scenario 1)**

| | After-tax Producer price | Output | Employment | Export | Inter-regional Export | RCA* |
|---|---|---|---|---|---|---|
| Agriculture | -0.6 | 1.8 | 1.1 | 1.5 | 9.1 | 0.135 |
| Coal Mining | -0.2 | -6.9 | -7.1 | | 3.4 | |
| Crude Oil | -4.7 | 2.5 | 0.2 | | | |
| Metal Mining | -3.3 | 10.1 | 8.4 | 8.3 | 20.8 | 2.917 |
| Quarrying | 0.9 | -3.8 | -3.6 | -7.2 | -7.4 | 0.019 |
| Food | -1.4 | 4.7 | 3.5 | 4.6 | 7.8 | 0.013 |
| Textiles | -0.2 | -1.4 | -1.2 | 3.0 | -3.0 | -0.021 |
| Apparel | -2.4 | 11.2 | 9.7 | 15.9 | 7.8 | 0.045 |
| Sawmill &furniture | 2.5 | -8.4 | -7.8 | -9.5 | -14.9 | 0.000 |
| Social articles | -1.3 | 0.2 | -0.5 | 3.4 | 3.1 | 0.002 |
| Petroleum refining | 5.1 | -1.5 | -1.6 | -22.8 | 9.5 | 0.130 |
| Chemical | 3.9 | -11.0 | -11.0 | -17.0 | -10.9 | -0.015 |
| Building material | 7.3 | -3.2 | -2.9 | -29.4 | 9.4 | 0.208 |
| Primary metal | 4.8 | 0.3 | 1.8 | -20.1 | 1.7 | 0.162 |
| Metal products | 1.7 | -3.1 | -2.9 | -9.4 | -2.3 | 0.112 |
| Machinery | 1.4 | -13.4 | -13.2 | -10.3 | -14.6 | -0.048 |
| Transport equipment | -0.3 | -3.2 | -3.5 | -0.9 | -3.4 | 0.009 |
| Electronic machine | 0.7 | -2.9 | -3.3 | -5.1 | -1.1 | 0.034 |
| Electronics | -0.8 | -2.1 | -2.6 | 4.8 | -1.9 | 0.001 |
| Instrument | 0.8 | -9.6 | -9.5 | -3.9 | -11.8 | -0.032 |
| Other manufacturing | -7.8 | 7.7 | 6.2 | 27.3 | 27.7 | 0.011 |
| Electricity | 19.7 | 0.0 | 3.8 | | 8.3 | |
| Gas & water | 1.6 | 46.8 | 47.0 | | | |
| Construction | 1.6 | -6.6 | -6.7 | | | |
| Transport | -0.7 | -0.4 | -0.6 | | | |
| Telecomm | -2.1 | -1.0 | -1.5 | | | |
| Commerce | -1.6 | -0.5 | -0.9 | | | |
| Restaurant | -2.1 | 0.5 | 0.5 | | | |
| Finance | -1.0 | 0.4 | 0.3 | | | |
| Social service | 0.8 | -5.3 | -5.2 | | | |
| Education & health | -0.4 | 2.4 | 2.3 | | | |
| Public administration | -0.1 | 0.0 | 0.0 | | | |

*Change of RCA, not % change.

**Table 12 Sectoral effect of Scenario 3, Shaanxi (% change with scenario 1)**

| | After-tax Producer price | Output | Employment | Export | Inter-regional Export | RCA* |
|---|---|---|---|---|---|---|
| Agriculture | -2.0 | 3.9 | 5.6 | 10.5 | -2.9 | -0.105 |
| Coal Mining | -0.9 | 4.0 | 6.0 | | -1.1 | |
| Crude Oil | 5.5 | 2.2 | 6.1 | | | |
| Metal Mining | 3.5 | -3.9 | -0.5 | -8.3 | -13.9 | -1.661 |
| Quarrying | -3.6 | 15.3 | 16.2 | 21.9 | 22.3 | 0.051 |
| Food | -1.1 | 4.0 | 6.5 | 4.3 | 1.1 | -0.021 |
| Textiles | -1.9 | 12.6 | 13.4 | 11.3 | 13.0 | 0.042 |
| Apparel | -0.4 | 2.1 | 4.4 | 3.2 | -0.7 | -0.037 |
| Sawmill &furniture | -0.4 | 8.2 | 9.2 | 9.5 | 4.7 | 0.000 |
| Social articles | -0.3 | 6.3 | 8.7 | 4.8 | 2.6 | -0.001 |
| Petroleum refining | 4.1 | 3.5 | 3.5 | -8.5 | -10.3 | -0.091 |
| Chemical | -1.3 | 12.1 | 12.1 | 8.1 | 12.5 | 0.022 |
| Building material | -0.8 | 9.9 | 10.8 | 6.9 | 8.1 | -0.018 |
| Primary metal | -0.7 | 7.3 | 7.8 | 5.6 | 6.4 | -0.026 |
| Metal products | -0.7 | 5.1 | 6.0 | 4.5 | 5.7 | -0.045 |
| Machinery | -2.2 | 21.9 | 22.2 | 15.2 | 23.4 | 0.137 |
| Transport equipment | -0.1 | 4.5 | 5.5 | 2.2 | 4.0 | -0.007 |
| Electronic machine | 0.4 | 5.7 | 6.9 | 1.5 | 1.8 | -0.026 |
| Electronics | 0.5 | 2.0 | 3.2 | -1.5 | 0.9 | -0.022 |
| Instrument | -2.9 | 18.5 | 18.8 | 15.2 | 21.6 | 0.061 |
| Other manufacturing | 6.4 | -2.7 | -0.6 | -12.1 | -20.7 | -0.009 |
| Electricity | -1.3 | 6.6 | 7.4 | | 12.8 | |
| Gas & water | 0.2 | 12.6 | 13.9 | | | |
| Construction | 0.1 | 13.7 | 15.0 | | | |
| Transport | 1.8 | 5.0 | 6.5 | | | |
| Telecomm | 0.5 | 5.9 | 7.1 | | | |
| Commerce | -1.1 | 6.7 | 7.4 | | | |
| Restaurant | -1.5 | 6.1 | 6.1 | | | |
| Finance | -4.1 | 7.2 | 7.4 | | | |
| Social service | -2.2 | 11.6 | 12.3 | | | |
| Education & health | -4.4 | 6.5 | 6.8 | | | |
| Public administration | -3.7 | 0.0 | 0.1 | | | |

*Change of RCA, not % change.

**Table 13 Sectoral effect of scenario 4, Shaanxi (% change with scenario 1)**

| | After-tax Producer price | Output | Employment | Export | Inter-regional Export | RCA* |
|---|---|---|---|---|---|---|
| Agriculture | -4.9 | 8.2 | 10.2 | 24.8 | 3.0 | -0.053 |
| Coal Mining | -1.3 | -3.2 | -0.3 | | 0.3 | |
| Crude Oil | 3.4 | 6.5 | 10.3 | | | |
| Metal Mining | 1.9 | 2.3 | 6.4 | -6.6 | -3.8 | 0.164 |
| Quarrying | -4.4 | 17.7 | 19.8 | 24.0 | 24.3 | 0.098 |
| Food | -4.0 | 11.4 | 14.3 | 16.6 | 10.5 | -0.016 |
| Textiles | -3.5 | 19.9 | 21.7 | 24.7 | 18.3 | 0.038 |
| Apparel | -3.7 | 18.0 | 20.5 | 27.1 | 8.1 | -0.012 |
| Sawmill &furniture | 2.5 | 0.0 | 2.5 | 0.0 | -12.8 | -0.001 |
| Social articles | -2.0 | 9.3 | 12.5 | 11.6 | 7.5 | 0.001 |
| Petroleum refining | 13.2 | 3.4 | 3.4 | -37.0 | -5.3 | 0.000 |
| Chemical | 2.8 | 4.9 | 4.9 | -9.8 | 5.8 | 0.020 |
| Building material | 7.9 | 10.4 | 12.5 | -28.1 | 25.1 | 0.198 |
| Primary metal | 5.0 | 11.3 | 14.5 | -17.8 | 11.9 | 0.138 |
| Metal products | 1.2 | 3.9 | 5.6 | -5.7 | 6.2 | 0.051 |
| Machinery | -1.5 | 15.0 | 15.9 | 8.8 | 15.7 | 0.151 |
| Transport equipment | -0.2 | 3.2 | 4.6 | 1.5 | 2.4 | -0.001 |
| Electronic machine | 1.8 | 4.6 | 6.2 | -5.0 | 1.5 | -0.004 |
| Electronics | 0.1 | 0.0 | 1.5 | 1.5 | -1.1 | -0.031 |
| Instrument | -3.4 | 15.4 | 16.3 | 17.4 | 17.1 | 0.056 |
| Other manufacturing | 0.9 | 3.5 | 5.4 | 3.0 | -9.3 | -0.003 |
| Electricity | 22.2 | 9.5 | 16.1 | | 30.2 | |
| Gas & water | 2.6 | 83.1 | 86.9 | | | |
| Construction | 2.4 | 11.5 | 13.5 | | | |
| Transport | 2.3 | 6.7 | 9.0 | | | |
| Telecomm | -1.5 | 7.0 | 8.5 | | | |
| Commerce | -3.5 | 9.1 | 9.9 | | | |
| Restaurant | -5.3 | 9.5 | 9.5 | | | |
| Finance | -6.7 | 10.9 | 11.1 | | | |
| Social service | -2.3 | 10.9 | 12.3 | | | |
| Education & health | -6.4 | 12.4 | 13.0 | | | |
| Public administration | -6.0 | 0.0 | 0.2 | | | |

*Change of RCA, not % change.

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# Annex Social Accounting Matrixes (SAM)

## A Macro SAM for Chinese Economy, 1997 (100 million Yuan)

| | | | 1 | 2 | 3 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Factor | | | | | | | | | |
| | | | Commodity | Activity | Capital | Labor | Household | Enterprise | Local Gov. | Central Gov. | Extra-budget | Capital | ROW | Total |
| 1 | Commodity | | | 124,140 | | | 35,779 | | *4,772* | *1,679* | *2,274* | 27,416 | | 196,060 |
| 2 | Activity | | *182,794* | | | | | | | 555 | | | 16,543 | 199,892 |
| | Factor | Capital | | 23,919 | | | | | | | | | | 23,919 |
| 3 | | Labor | | 41,540 | | | | | | | | | | 41,540 |
| 4 | Household | | | | | 41,540 | | *10,641* | 381 | 82 | | | 400 | 53,045 |
| 5 | Enterprise | | | | 22,336 | | | | | | | | 249 | 22,585 |
| 6 | Local Gov. | | | *3,344* | | | 260 | 552 | | 2,857 | | | | 7,012 |
| 7 | Central Gov. | | 827 | *3,199* | | | | 555 | 604 | | | | 40 | 5,224 |
| 8 | Extra-budget | | | *3,750* | | | *1,739* | | | | | | | 5,489 |
| 9 | Capital | | | | | | *15,267* | *10,838* | *1,255* | *16* | *3,215* | | *-3,175* | 27,416 |
| 10 | ROW | | 12,440 | | 1,583 | | | | | 35 | | | | 14,058 |
| | Total | | 196,060 | 199,892 | 23,919 | 41,540 | 53,045 | 22,585 | 7,012 | 5,224 | 5,489 | 27,416 | 14,058 | 596,748 |

## A Macro SAM for Shaanxi Province, 1997 (10000 Yuan)

| | | | 1 | 2 | 3 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Commodity | Activity | Factor | | Household | Enterprise | Local Gov. | Central Gov. | Extra---budget | Capital | ROC | ROW | Total |
| | | | | | Capital | Labor | | | | | | | | | |
| 1 | Commodity | | | 20,647,074 | | | 6,563,552 | | *1,307,468* | *439,456* | *535,376* | 5,461,703 | | | 34,954,629 |
| 2 | Activity | | *26,750,444* | | | | | | | *31,258* | | | *6,279,429* | *853435* | 33,914,566 |
| 3 | Factor | Capital | | 3,295,477 | | | | | | | | | | | 3,295,477 |
| | | Labor | | 8,353,665 | | | | | | | | | | | 8,904,040 |
| 4 | Household | | | | | 8,353,665 | | *452,758* | *81,460* | *16,157* | | | | | 9,380,496 |
| 5 | Enterprise | | | | 3,295,477 | | | | | | | | | | 3,295,477 |
| 6 | Local Gov. | Local Tax | | ***604,141*** | | | 22,107 | *77,376* | | | | | | | -98,693 |
| | | Local Subsidy | | *-97,463* | | | | *-1,230* | | | | | | | 710,456 |
| | | Local fee | | *102,634* | | | | *7,087* | | 600,735 | | | | | 627,772 |
| | Central Gov. | Central Tax | 39,451 | *549,997* | | | | *38,324* | | | | | | | -42,943 |
| 7 | | Central Subsidy | | *-50,905* | | | | | 7,962 | | | | | | 771,203 |
| 8 | Extra-budget | | | *509,947* | | | *261,256* | | | | | | | | 913,715 |
| 9 | Capital | | | | | | *2,057,125* | *2,721,162* | *-81,503* | *-502,777* | *235,827* | | *1,322,320* | *-290,450* | 5,461,703 |
| 10 | ROC | | *7,601,749* | | | | | | | | | | | | 7,601,749 |
| 11 | ROW | | *562,985* | | | | | | | | | | | | 562,985 |
| | Total | | 34,954,629 | 33,914,566 | 3,295,477 | 8,353,665 | 8,904,040 | 3,295,477 | 1,315,387 | 584,828 | 771,203 | 5,461,703 | 7,601,749 | 562,985 | |

## A Macro SAM for Rest of China , 1997 (100 million Yuan)

| | | | 1 | 2 | 3 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Factor | | | | | | | | | | |
| | | | Commodity | Activity | Capital | Labor | Household | Enterprise | Local Gov. | Central Gov. | Extra-budget | Capital | ROC | ROW | Total |
| 1 | Commodity | | | 122,075 | | | 35,123 | | 4,659 | 1,635 | 2,203 | 26,870 | | | 192,565 |
| 2 | Activity | | 178,730 | | | | | | | 552 | | | 760 | 16,458 | 196,500 |
| | Factor | Capital | | 23,601 | | | | | | | | | | | 23,601 |
| 3 | Factor | Labor | | 40,705 | | | | | | | | | | | 40,705 |
| 4 | Household | | | | | 40,705 | | 10,596 | 373 | 80 | | | | 400 | 52,154 |
| 5 | Enterprise | | | | 22,018 | | | | | | | | | 249 | 22,267 |
| 6 | Local Gov. | | | 3,283 | | | 258 | 543 | | 2,797 | | | | | 6,881 |
| 7 | Central Gov. | | 823 | 3,149 | | | | 551 | 603 | | | | | 40 | 5,166 |
| 8 | Extra-budget | | | 3,687 | | | 1,713 | | | | | | | | 5,400 |
| 9 | Capital | | | | | | 15,061 | 10,577 | 1,246 | 67 | 3,197 | | *-132* | *-3,146* | 26,870 |
| 10 | ROC | | 628 | | | | | | | | | | | | 628 |
| 11 | ROW | | 12,383 | | 1,583 | | | | | 35 | | | | | 14,002 |
| | Total | | 192,565 | 196,500 | 23,601 | 40,705 | 52,154 | 22,267 | 6,881 | 5,166 | 5,400 | 26,870 | 628 | 14,002 | |