
THE STUDY OF THE RAW MATERIALS INDUSTRY DEVELOPMENT IN
CHINA BY USING A COMBINED APPROACH OF QUALITATIVE &
QUANTITATIVE METHODS*

Qifan Wang
Xiaobo Zhang

School of Management, Fudan University,
Shanghai, 200433, China

ABSTRACT

China's economy had got its newest growth during the "No. 6 Five Year Plan" period, however, the problem of unbalanced production structure in China's economy system turned to be more obvious and serious, reflected by the fact that the base economic production, defined as energy production, transportation and raw materials production faced a bigger lag in satisfying the social demand. Raw materials industry, including ferrous metal industry, nonferrous metal industry, chemical industry, building materials industry and forest industry showed even more serious tightness in meeting the demand. The paper tackles with such a complicated economy system by combining the qualitative method and quantitative methods. We believe that such a combined approach is effective in dealing with problems associated with a planned, but more and more market oriented economy, such as the economy system of China.

I. Development and Problems in China's Raw and Semifinished Materials Industries

I-1. Growth during "No. 6 Five Year Plan"

China's raw and semifinished materials industries, defined as ferrous metal industry, nonferrous metal industry, chemical industry, building materials industry and forest industry, has got a new development during the "No.6 Five Year Plan" period (1981-1985). Steel output increased from 35.6 million ton in 1981 to 46.79 million ton in 1985. During the same period, concrete output increased from 84.45 mil. ton. The output of synthetic rethin, which is a main material for plastic production, increased from 9.16 mil. ton to 12.34 mil. ton, and wood output increased from 42.49 mil. cub. meters to 53.14 mil. cub. meters.

*First draft written in 1988, revised in 1991.



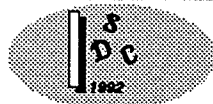
However, such a development could not cover up a big problem, that is, the development of raw and semifinished materials industries laged greatly behind the development of the whole economy. Following is a list of the annual growth rates of different economic and production sectors of China in 1981-1985 period.

SECTORS	GROWTH RATE
Social Total Output	11.0%
Agriculture*	11.7%
Commerce	11.4%
Building	10.7%
Transportation	9.2%
Industry	10.8%
Ferrous Metal Industry	6.36%
Nonferrous Metal Industry	9.06%
Chemical Industry	10.44%
Forest Industry	4.8%
Building Materials Industry	12.4%
Electricity Industry	7.68%
Coal Industry	5.62%
Oil Industry	5.1%
Machine Building Industry	14.8%
Textile and Other Industries	8.6%

* Including rural industries

We can see from the above figures that during the No. 6 Five Year Plan period, Agriculture (including rural industries), Commerce and processing industries grew ahead of the whole economy in a great phase, while the keystone production sector to the processing industry, such as transportation, raw and semifinished materials industries, grew obviously behind the whole economy. If we define the Transcendence Parameter of a production sector as the average annual growth rate of the production sector divided by the average annual growth rate of the whole industry then minus 1, then the positive figure reflects "beyond development", the negative figure reflects "behind development". We have the below figures:

Ferrous Metal Industry	-0.41
Nonferrous Metal Industry	-0.16
Chemistry Industry	-0.03
Forest Industry	-0.56
Building Machine Industry	0.15
Machine Building Industry	0.37



The parameter of Ferrous Metal Industry "-0.41" forms a clearcut contrast with parameter of Machine Building Industry "0.37".

Problems also existed in investment structure. If we divide industry into three sectors of raw and semifinished industries, energy industries and processing industries, we see that the investment rate of raw and semifinished industries (defined as the investment of these industries divided by the investment of total industry) shows a declining tendency. If we go further into the raw and semifinished materials industries, we can find that the investment rate of metallurgical industries went down most sharply.

A result derived from such a production structure was that the increase of demand for raw and semifinished materials surpassed the increase of the production. During the five years, the consumption of steel products, aluminium materials, wood and synthetic resin increased by 190%, 158%, 145% and 179% respectively, while the production of those materials only rose by 138%, 133%, 125% and 135% respectively.

Under such a condition, the exceeded demand for raw and semifinished materials could only be met through import. During the five years, the import for steel products, aluminium materials, wood, concrete and synthetic resin rose up by 5.41, 10.6, 6.65, 3.1 and 3.69 respectively.

I-2. Meanings behind the Problems

By further analyzing the above problems, we find three factors are fundamental causes of these problems:

- 1). Over investment of capital made economy "overhot", and lead social demand excessive expanding, furthermore, the unbalanced investment structure accelerated the structural contradiction of the demand and supply for the raw and semifinished materials.
- 2). Raw and semifinished materials industries themselves had the problem of poor quality and insufficient variety in products supply. On the other hand there was a overstock of the products.
- 3). The rapid development of the rural processing industries, which are generally indicated by low technology and high materials consumption, in a certain grade made the materials demand and supply contradiction more serious.



Then, questions are: are these problems merely temporary phenomena? or of some structural and inevitable senses?, if later is the case, what can we do to such problems?

Many studies have shown that the demand for basic production sectors from China's production system and consumption system has undergone a structural changes, and such changes have rigidity. Therefore, there would be a long term and large amount of demand for raw and semifinished materials as the economy ever grows.

Considering the way to solve the problems, we may have three macrochoices:

1). Speed the growth of raw and semifinished materials industries, realize the selfsufficient of material supply.

2). Since in world wide the raw and semifinished materials industries has been thought as "sunset industries", China should not develop raw and semifinished materials industries in a great effort, rather, should put more emphasis on some new processing industries. The materials desired for consumption could be covered through import.

3). China, as a big socialist developing country, the domestic supply of materials should not overly relied on import. China should still stand on her own feet in materials production, and on the other hand try to develop some high-tech, high added value processing industries, enhance the export ability of those products and use foriegn exchanges got from these products exports to import some portion of raw and semifinished materials to supplement domestic supply.

Which choice is most suitable to China? We may answer this question in later chapters.

II. Introduction to Research Approach and Model Structure

The problems and choices we discussed in previous section in nature reflects a question that what way of production structure reformation that China should take, a question that how China should develop her processing industries and basic industries. To answer this question, a systematic study is needed. Let's first look at what kind of research approach will be appropriate.



II-1. Research Approach in General

Experiences have told us that in answering the question like the one now we are facing, a qualitative analysis is far more than enough, however, because of the complications of the studying object, a fully quantified method may not answer the question well, too.

Therefore, the approach we are taking is to combine quantitative analysis and qualitative analysis. The study is composed of 4 parts. The first part is human brain justification (1), which connects the 4th part and the 2nd part. This part is of qualitative nature, which designs the production structure(2) and justify such designs based on qualitative and quantitative results from the 3rd and 4th part. The 2nd part transform the 1st part's qualitative analysis into production structure mode and inputs the mode into 3rd part. The 3rd structure and 4th part simulates the demand and supply of raw and semifinished materials and the result to back to 1st part for justification.

II-2. Model Structure

System Dynamics Demand and Supply Model is functioned to simulate the demand and supply situation of raw and semifinished materials in future 15 years under the given production structure.

Because the demand for raw and semifinished materials involve all the production sectors of the economy, and each section has a different intensity of demand to the materials, the model considers Agriculture, Commerce, Construction, Transportation and Industry top five sectors and further divide Industry sector into ferrous metal, Nonferrous metal, Coal, Oil, Electricity, Machine Building, Chemical, Building Materials, Forest and Textile and other 10 subsectors. Steel Products, Aluminium Materials, Concrets, Synthetic resin and Wood are selected as deputies of raw and semifinished materials.

System dynamics Investment Model involves the same production sectors as the Demand and Supply Model. This model produces the investment structure under given industry structure.

III. Production Structure Reform and Raw and Semifinished Materials Industries Development



As we have said in the first section, the raw and semifinished materials industries in fact is related to the production structure reform in China. Before we are involved into China's production structure reform, we would first look at the ways that some countries have gone through.

III-1. Development of Production Sectors in Some Selected Countries

Below are some data which show the raw and semifinished materials production output growth rates and industrial production growth rate in some countries when the GNP per capita in these countries reached about US\$1000.

Japan: GNP per capita US\$ 1035 in 1965

Average Annual Growth Rate	1956-1965
Industry	13.65%
Steel Products Output	15.90%
Aluminium Output	19.90%
Plastic Output	32.00%

West Germany: GNP per capita US\$ 1015 in 1958

Average Annual Growth Rate	1956-1960
Industry	5.7%
Steel Products Output	6.8%
Aluminium Output	5.7%
Plastic Output	18.5%

South Korea: GNP per capita US\$ 950 in 1977

Average Annual Growth Rate	1976-1980
Industry	15.9%
Steel Products Output	23.5%
Plastic Output	27.6%
Concrete Output	9.1%

Above data shows a clearcut fact that when GNP per capita in those selected countries reached \$1000, the production of raw and semifinished materials all had an obvious leading growth in industry.

China's goal is to reach GNP per capita of \$1000 in year 2000, comparing to other countries, in the left years of this century. Raw and semifinished materials industries



would not be "Sunset Industries" to China, rather these industries should at least keep synchronized development with industry.

III-2. Industry Structure Reform and Raw and Semifinished Materials Industries Development in China

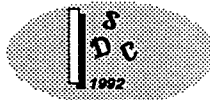
The objective of the industry structure is to reach a equilibrium state of social total demand and total supply. In dynamic studying the industry structure reform and Raw and Semifinished Materials Industries development, we should take two aspects into account, one is the growth situation of the total economy, the other is the Raw and Semifinished Materials Consumption.

a) Keep steady growth of the economy for the benefit of industry structure reform.

According to the original national plan of China, China's economy development would be divided into two phase from year 1981 to 2000. The first decade (1981-1990) be the reforming year phase, the second decade (1991-2000) be the growth phase, average annual growth rate be "reach 4% try 5%" in the "No.6 five Year Plan" period. In actual practice, the average annual growth rate of Social Total Output was 12%. The shortage of raw and semifinished materials supply was closely related to this high growth rate. We expect three modes of Social Total Output development. The first mode suggests the annual growth in 1985-2000 period as 11%, roughly the same growth rate as No. 6 Five Year Plan period. The second mode supposes the annual growth rate in 1985-1990 period as 7.5%, 1991-2000 period as 6%, the third mode suggests the annual growth rate in 1985-1990 as 7.5%, 1991-2000 as 4.6%.

Simulations show that if the future development goes in the first mode, and the industry structure keeps in the first mode, and the industry structure keeps unchanged, then in the year of 2000, steel products supply shortage would be 6000-7000 mil. tons, aluminium supply shortage would be over 13 mil. tons, synthetic resin supply would have a shortage of 67 mil. tons, wood shortage would be 100 mil. cub. meters.

Such big shortages in materials supply would certainly unbearable to China's economy. In order to create a favorable environment for industry structure reform, we suggest the second mode be an appropriate way or China's economy growth in the years remained in 20th century, and we suggest that in future 10 or more than 10 years,



ferrous and nonferrous metallurgical industries should try to keep a synchronized growth with the total industry, Chemical Industry and Building Materials Industry should have big phase leading growth than total industry.

b). Raw and semifinished materials consumption structure adjustment

Let's first look at the following data:

Consumption Structure of some Main Raw and Semifinished Materials in 1985

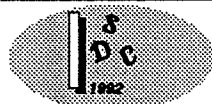
	Steel Products	Aluminium Material	Wood
Total	100%	100%	100%
Industry	6.9%	1.0%	7.04%
Energy Industry	17.8%	17%	71.66%
Raw & Semi Industry	75.3%	82%	21.3%
Process Industry (Machine)	68.6%	72.6%	14%

And further let's check a set of data of machinery industry.

Consumption Structure of Steel Products and Aluminium Materials for Machinery Industry

	Prod. (\$) Stl. Prts.	Consum. Alu. Matr.	Consum
Mach. Build.	100%	100%	100%
Metal Proc.	10.4%	19.1%	28.4%
Conv. Mach.	40.8%	53.1%	27.7%
Building			
Tran. Equip.	15.8%	19.2%	9.4%
Manufact.			
Elec. Equip.	16.2%	6.5%	24.5%
Electronic. &	3.7%	0.9%	3.1%
Commu. Equip.			

From the figures above we see that most of the steel products and aluminium materials were consumed by the processing industries or Machine Building Industry, we can find that the metal processing industry, conventional machine Building industry and transportation equipment manufacturing industry consumed



most of the materials, while electric equipment industry and electronic communication equipment industry only consumed a small part of the materials.

Aimed at steel products consumption we design some policies for the future 10 or more years.

Policy 1. Social Total Output annual growth rate as 12%, industry structure keep unchanged.

Policy 2: Social Total Output annual growth rate as Mode 2 in last paragraph.

Policy 3: Keep conditions of policy 2, and steel products consumption density (consumption/output) of construction industry decreases by 15% from 1985 to 2000.

Policy 4: Keep conditions of Policy 3, at the same time, the output portion of electronic industry increases by 10%, portion of conventional machine building industry decreases by 10%, output portion of electric equipments industry increases by 5%. In sum, steel consumption density of Machine Building Industry decreased by 37% from 1985 to 2000.

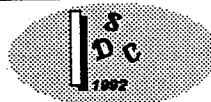
Then, we could see the results of above listed policies. Results show that, if we could realized the conditions requested by policy 4, by the year of 2000, we could possibly save 450 mil. tons of steel products consumption, the domestic steel products satisfaction rate could reach about 80%.

IV. Policy Recommendation

Based on the discussion above we are now able to put forward a series of policies for the future.

1. Under the existing situations unbalanced industry structure, big lag in raw material industrial production and lack of fund, the so called economy "overhot" is harmfully intensifying the contradictions of the supply and demand for the raw materials. Therefore, the annual growth rate for total national economy should be constrained properly. Then a favorable condition for realization of transcending or synchronizing development of raw material industry and for adjustment of industry structure will appear.

2. China should pay attention to playing the role of self-raised fund in local region in the future, and try the best to guide it to invest in the high demand sectors such as raw material industry, energy industry, transportation etc.



3. The adjustment of industry structures should be favorable for accelerating the development of processing industries. Attention should be paid to developing some high-tech, high added value processing industries. Some constraints should be put on the departments of low-tech, high consumption in energy. Electronic industry should be encouraged to develop.

4. The development of rural processing industries should be guided by correct policies. Some regulations and law should be made out to constrain rural processing industries of high material and energy consumption and low-tech. Government may encourage rural industrial enterprises to cooperate with middle or big enterprises in order to have a coordinate and stable development in whole national economy.

5. China should still stand on self-reliance in material production, the domestic supply of materials should not overly rely on import and on the other hand enhance the export ability of high-tech and high added products, and use the foreign exchanges from the exports to import certain portion of raw and semifinished materials to supplement domestic supply.

IV. Conclusion

The paper tackles with such a complicated economy system by combining the qualitative method and quantitative method. The authors believe that such a combined approach is effective in dealing with problem associated with a planned, but more and more market oriented economy, such as the economy system of China.

References:

1. Statistics Almanac of China, 1981-1986.
2. Wang, Qifan. et al. 1987. Economic structure Changes and Impacts on Chinese Economy.
3. Wang, Qifan. et al. 1985. Proceedings of the 1987 International Conference of S.D. Stimulations and Obstructions to the Economic Growth of China.
4. Zhang, Bo, 1986, Proceedings of the 1985 International Conference of S.D., Analysis to the "Sunset-saying" of Conventional Materials Industries, Shanghai Economics pp. 13-16, No.1, 1986.
5. Statistical Materials of International Economy and Society 1985, China Finance and Economy Press, Beijing.

