

Simulation Analysis of Orientations of Macroeconomic Policies' Impact on Industrial Economy

- Based on Dynamic CGE Model

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Abstract: There are three different orientations of the macroeconomic policies, namely, factor-expansion, prudent-continuation as well as structural-adjustment. The paper uses the dynamic CGE model to simulate the effects of the three different orientations on the economy, and arrives at the following conclusions: while the factor-expansion policies can lead to growth rate of economic output, they also result in the further imbalance in the industrial structure and the “crowding-out effect” on the private investment. In addition, such growth is unsustainable in the long run- the growth of the industrial economy will decline rapidly to a lower level after reaching a certain high level. The prudent-continuation policies refer to the continuation of the current policies that sustain the current trends of the industrial economy, and such policies reduce the growth of the industrial economy to a lower level in the long run. The structural-adjustment policies reduce the economic outputs at the current stage; however, it can bring a gradual improvement of industrial structure and a balance of the supply and demand. In the long run, the optimized structure will improve the total factor productivity (TFP) and the production-possibility frontier, and thereby realizes a long-term stable and rapid growth of the industrial economy. Four policy recommendations were proposed based on the simulation of the models, including taking the structural adjustment as the fundamental orientation of macroeconomic policies, lowering the “floor level” of economic growth with macro regulation, giving play to the fundamental role of market mechanism in structural adjustment and increasing the role of TFP in the growth of the industrial economy.

Keywords: dynamic CGE model, factor-expansion policies, prudent-continuation policies, structural-adjustment policies

JEL Classification: E10, E27, O11

1. Introduction

China has experienced several rounds of rapid industrial growth since the reform

and opening-up, and has established an internationally competitive, modern industrial system with a complete range of products at various levels. China's economic aggregate ranks second in the world after the United States, and its industrial economic aggregate has surpassed that of the U.S. and ranks first in the world. However, as China gradually enters the first half of the later stage of industrialization (Chen, 2012), its industrial economy is facing greater downward pressure because of changes in internal and external conditions. On the issue of the continuing decline of the growth of the industrial economy, most scholars believe that due to changes in labor, resources, environment and other factors, China's industrial economy can no longer sustain its the rapid growth; it will **reach** a new stage of development (Research Group on Industrial Operation, Institute of Industrial Economics of CASS, 2011; Liu, 2011; Jiang, 2012; etc.). The decrease in the growth rate of potential output is the root cause of the declined growth of the industrial economy (Liu, 2012; Liu, 2013; etc.). Adding to the downward pressure is the fact that the industrial economy is in a downward interval of the economic cycle (Lang, 2012; Kong, 2012; etc.). In face of the pressure of the continuous decline of the industrial economic growth, China is faced with a dilemma in the formulation of policies: if the country identifies "growth stabilization" as a priority and continues to implement factor-expansion policies, it will face the pressure of further exacerbation of the structural imbalance; if the country identifies "structural adjustment" as a priority and implement structural-adjustment policies to eliminate backward production capacity with no economic stimulus policies, the government would be worried that the growth of the industrial economy might decline to a level lower than that can be accepted. Under such circumstances, the paper carries out simulations of the results of the different orientations of macroeconomic policies and quantitative analysis of the effects of different orientations on the economic aggregate, structure and other indicators to provide a useful reference for the formulation of national policies.

2. Model Specification and Data Source

There are several categories of models used to evaluate policies: the econometric models, the input-output models, as well as the computable general equilibrium (CGE) models and dynamic CGE models. Compared to the econometric models and the input-output models, the CGE models can not only illustrate the efforts and the effects of the policies clearly, but also demonstrate the mechanism of function to explain how the policies work. In addition to the above features, the dynamic CGE model can simulate the long- and short-term effect of the policies, and serves as a powerful tool for the analysis and evaluation of fiscal and monetary policies. The theories on the CGE model was improved and developed during the 1960s. After that, Scarf (Scarf, 1967a, 1967b, 1973) made an outstanding contribution to the promotion of the practical application of the model. In the early 1970s, Shoven and Whalley, both of whom were the students of Scarf, became important scholars in the field of the application of CGE model. Since then, CGE model has been widely used in areas such as finance, taxation, resources, environment

and international trade. The Institute of Quantitative & Technical Economics of CASS (QTCASS), cooperating with the Dutch Central Planning Bureau from 1997 to 2000, developed China multi-sectors dynamic CGE models. As a member of QTCASS, Li (2000) developed a China 40-sectors dynamic CGE model. Based on this model, this paper expands the scope of the model to cover 42 industries, and evaluates and forecasts the policies aimed to adjust the economic structure and stabilize growth.

2.1 Model Specification

The model is neo-classical in spirit, i.e., it assumes market clearing in commodity/labor market and the full mobility in the factor market. There are four behavioral agents in the model- household, producer, government and foreign country, as well as two factors of production-labor and capital. The model assumes that all of the foreign producers and consumers are homogeneous, and that households are composed of a large number of homogeneous domestic consumers. For the purpose of the research, there are three orientations of types of macroeconomic policies: the factor-expansion orientation, the prudent-continuation orientation and the structural-adjustment orientation. The paper also assumes that the policy objectives are achieved **through** government subsidies or tax reductions, which affect the business cost directly, and thereby influence the production decisions.

(1) The production module. The production process is described by two nested production functions. The first layer is the combination of capital and labor, and the second layer is the combination of the first layer and intermediate inputs. The production technology of the intermediate inputs in the second layer is set to be the Leontief technology. Under the premise of the cost-minimizing production of business, the demand for intermediate inputs is determined by the exogenous input-output coefficient.

(2) The consumption module. The household consumption is represented by a linear consumption function, and can be converted to the final consumer demand through a conversion matrix. The consumption function is the result of maximization of the current utility of the consumers. The optimal behaviors of the residents and producers are the core of the CGE model, and this is how the seven modules are derived. In addition to consumer consumption, there are also producer consumption and government consumption in the consumption module,. The consumption of the producers is assumed to be the total of consumption of all sectors, which are exogenously determined. The government consumption is represented by the total government expenditure and the fixed shares of spending of different sectors. Government subsidies to producers consist of export rebates and targeted subsidies, and are represented by multiplying total output/exports with corresponding rates of subsidies. In order to distinguish between the nominal GDP and the real GDP, the real GDP in the model is the sum of the final consumption, investment demand and net exports of each sector.

(3) The price model. The products consist of domestic products and foreign products, and the total price depends on the proportion of the both. The model uses the Armington assumption to reflect the feature of imperfect substitutability of domestically-produced products and imported products. The value-added price is obtained by deducting the indirect tax and the price of the composite commodities used as the intermediate inputs and adding the subsidies. The capital price is the weighted average of capital prices in each sector, and the weight is the proportion of the actual capital of each sector. The consumer price is the weighted average of the prices of the composite commodities used as the intermediate inputs in each sector and the weight is the proportion of such composite commodities. The price reference system is the exogenously given GDP (gross domestic product) deflator, set to be 1 for the base year.

(4) The capital accumulation and investment module. The investment module consists of fixed asset investment and business inventories. The nominal fixed asset investment is calculated by subtracting the nominal inventory growth and the total budget deficit from the total nominal investment; the depreciation of fixed assets is the weighted average of the depreciation rates of each sector based on their proportions; the change of inventories of different sectors is calculated by multiplying the outputs by exogenous inventory growth coefficient.

(5) The income module. The national income distribution includes primary distribution and redistribution. In the primary distribution, the national income is broken down into the three parts of government income, capital income, and labor income. By providing a safe environment and public facilities for the production behavior, the government earns the right to levy taxes, and thereby obtains tax income; the capital owners earn capital income in exchange for the right to use capital; and the workers obtain labor income by providing labor. The redistribution adjusts the government income, capital income and labor income, and the growth of income in one sector means the decrease of the income in another.

(6) The trade module. The model uses the Armington assumption that domestic and imported products are imperfect substitutes, and so are the similar products imported from different countries. It uses a CES function to aggregate the domestic and imported products to form a composite good for the final demand. The import demand function is deduced from the first order condition of the cost-minimizing CES function. The changes of the relative prices in the domestic and foreign markets lead to the changes of the ratios of the imported products in the domestic sales. The elasticity of substitution of the price is used to measure the degree of substitution between domestic and imported products. A similar approach is applied to the imported products.

(7) The equalization module. This paper involves the clearing of three factor markets and three macro equilibrium constraints. The clearing of three factor markets

includes the clearing of the commodity market, the labor market and the capital market. The commodity market clearing means that the total supplies of composite goods in various sectors are equal to the total domestic demand of various sectors. Such condition of clearing is identical equation, because the commodity market regulates the imbalance of supply and demand through inventories. The labor market clearing is a strong assumption, which requires that the total sum of labor force in all sectors is equal to the sum of exogenously given labor force. The equilibrium setting of the capital market is the same as the labor market. The three macro equilibrium constraints are government budget, trade as well as savings and investment. The principle of neoclassical closure assumes that the investment is savings-driven; therefore, the constraint of “savings equal investment” is set. The constraint of identically equal government revenue and expenditures is set by endogenizing the savings surpluses of the government. The constraint of balance of domestic and foreign trade is set by endogenizing the domestic trade surplus and the foreign exchange reserve.

2.2 Data Sources and Parameter Estimation

The main data sources in this paper include: First, the social accounting matrix (SAM) and the various statistical yearbook prepared by the author; Second, the literature references; Third, the author’s own estimates. The labor force population in each industry is estimated by proportionally allocating the total registered population into each industry. Most of the depreciation rates come from Xu, Duan and Yang (2010), and the rates of the rest industries are estimated based on the paper of Weng and Wang (2012). The parameter estimation uses the calibration method. There are two ways of the preparation of the SAM: one way is a top-down approach which prepare the macro SAM first, then use it to control the preparation of the micro SAM afterward; the other way is bottom-up approach which gets the micro SAM before the macro SAM. This paper uses the first approach. The SAM data come from the *2007 Input-Output Tables of China*, *2008 China Statistical Yearbook*, and the *2008 Finance Statistics Yearbook*.

Table 1: Social Accounting Matrix

		Expenditure (Unit: RMB Trillion)									
		1. Commodity	2. Activity	3. Factor	4. Resident	5. Firm	6. Government	7. Capital Accumulation	8. Inventory	9. Other Countries in the World	10. Total
Income	1. Commodity		55.28		9.66		3.52	10.54	0.55		79.55
	2. Activity	72.15					0.56			9.55	82.26

3. Factor		23.84								23.84
4. Resident			11.00		6.04	0.54			0.03	17.61
5. Firm			12.83			0.35				13.18
6. Government	0.14	3.15		0.40	0.88		0.57		0.32	5.46
7. Capital Accumulation				7.56	6.27	0.48			-2.64	11.66
8. Inventory							0.55			0.55
9. Other Countries in the World	7.26									7.26
10. Total	79.55	82.26	23.84	17.61	13.18	5.46	11.66	0.55	7.26	

Source: Author's Calculation

3. Impact of Different Orientations of Macroeconomic Policies on Current Industrial Economy

3.1 Three Orientations of Macroeconomic Policies

In the face of the current situation of the industrial economy, China may have three different orientations of macroeconomic policies in the next stage: factor-expansion orientation, prudent-continuation orientation as well as structural-adjustment orientation. First, with the factor-expansion orientation, China will take "growth stabilization" as the primary objective of the policies and introduce major stimulus policies to achieve industrial growth with enhanced investment. To achieve the objective of "growth stabilization", China will have to be able to tolerate structural imbalance and reduced productivity. Second, with the prudent-continuation orientation, China will carry on with the current policies, and place equal weight on the "growth stabilization" and the "structural adjustment". It will not introduce any major "growth stabilization" or "structural adjustment" policies, and will be able to tolerate the decline of the industrial economy to a certain extent. Third, with the structural-adjustment orientation, China will take "structural adjustment" as the primary objective of the policies. It will promote the restructuring of the industrial economy, accelerate the elimination of backward production capacity, and refrains from issuing any stimulus policies that are not conducive to the structural adjustment. The prudent-continuation policies are used as the

benchmark for the evaluation of the economic effects of the factor-expansion and structural-adjustment policies in the CGE model,. There is no special handling of the prudent-continuation policies, but the simulations of the factor-expansion and structural-adjustment policies require adjustment of variables in the models.

The factor-expansion policies concentrate more resources in the production process. From the perspective of industries, the resources are concentrated in industries more susceptible to the infrastructure investment. The CGE models of this paper use industrial subsidies (tax reduction) for the simulation. Different levels of subsidies will be given to different types of industries in accordance with the real effects of the 4 trillion investment plan rolled out during the international financial crisis¹. Specifically, there are two different scenarios: First, the strong policy efforts. the simulation reduces the tax by 20% for six industries of the 42 industries based on the classification of the National Bureau of Statistics,, namely, the construction industry, the arming/forestry/husbandry/fishing industry, the metal smelting and rolling industry, the general/special purpose equipment manufacturing industry, the manufacturing industry of communications equipments, computers and other electronic equipments, as well as the wholesale/retail industry which are more sensitive to the expansionary policies,. The simulation reduces the tax by 10% for 11 heavy industries, namely the coal mining and washing industry, the oil and gas exploration industry, the metal mining industry, mining industry of non-metal ores and other minerals, the petroleum processing, coking and nuclear fuel processing industry, the chemical industry, the manufacturing industry of non-metallic mineral products, the manufacturing industry of metal products, the manufacturing industry of transport and communication facilities, the manufacturing industry of electrical machinery and equipments, as well as the manufacturing industry of instruments, meters, cultural and official machinery. The simulation reduces the tax by 5% for the rest 24 light industries and service industries. Second, the weak policy efforts. The simulation implements a 10% tax reduction for the six industries sensitive to the expansionary policies, and a 5% tax reduction for the rest.

The structural-adjustment policies allocate resources by balancing the supply and demand. From the perspective of industries, more resources are concentrated in industries conducive to the industrial restructuring and upgrading. The CGE models of this paper stimulate the policy effects by providing industries with excess capacities with reverse subsidies (tax increases). Specifically, there are two different scenarios: First, the strong policy efforts. The simulation increases the tax by 20% for five industries with serious overcapacity, namely the metal smelting and rolling industry, the manufacturing industry

¹ According to the calculation of the Task Force of the “Analysis and Application of China 2007 Input-Output Table”, the 4-trillion investments has the most significant stimulating effect on the construction industry, the arming/forestry/husbandry/fishing industry, the metal smelting and rolling industry, the general/special purpose equipment manufacturing industry, the manufacturing industry of communications equipments, computers and other electronic equipments, as well as the wholesale/retail industry

of non-metallic mineral products, the petroleum processing, coking and nuclear fuel processing industry, the chemical industry, the papermaking, printing and manufacturing industry of cultural and sports goods. It increases the tax by 10% for nine industries with partial or minor overcapacity, namely the manufacturing industry of transport and communication facilities, the manufacturing industry of electrical machinery and equipments, the manufacturing industry of communications equipments, computers and other electronic equipments, the manufacturing industry of instruments, meters, cultural and official machinery, the coal mining and washing industry, the metal mining and dressing industry, the mining and dressing industry of non-metal ores and other minerals, the food manufacturing and tobacco processing industry, as well as the textile industry. The simulation doesn't increase the tax of industries with no overcapacity. Second, the weak policy efforts. The simulation increases the tax by 10% for the five industries with serious overcapacity, by 5% for industries with partial or minor overcapacity, and by 0% for industries with no overcapacity.

3.2 Impact of Different Orientations of Macroeconomic Policies on Current Industrial Economy

Different orientations of macroeconomic policies have different impacts on the economic aggregate (see Table 2). Factor-expansion policies increase the economic aggregate, and accelerate the growth of GDP and industrial added value. In contrast, while the structural-adjustment policies are conducive to long-term improvement of the TFP and the efficiency of resource allocation, they will reduce the outputs, thereby reducing the growth of GDP and industrial added value in the short term. The factor-expansion policies can lead to increase of imports and exports, but the overall growth of imports is faster than that of exports, indicating that the obvious externality of the policies, i.e. China's economic stimulus policies promote the economic growth of other countries. The factor-expansion policies lead to a 0.38% change of trade deficit in the scenario of weak policy efforts, and a 0.77% change of trade deficit in the scenario of strong policy efforts. The structural-adjustment policies reduces both imports and exports, but the decrease of exports is generally faster than that of imports, indicating that such policies are conducive to the change of an export-reliant path for industrial economic growth, and can make more room for the role of domestic demand in economic growth. The corresponding change of trade deficit is 0.78% in the scenario of weak policy efforts and 1.52% in the scenario of strong policy efforts.

Table 2: Impacts of Various Orientations of Macroeconomic Policies on Economic Aggregate

	Prudent-continuance policies	Factor-expansion policies		Structural-adjustment policies	
		Weak policy efforts	Strong policy efforts	Weak policy efforts	Strong policy efforts

	Value (Trillion)	Value (Trillion)	Rate of change (%)	Value (Trillion)	Rate of change (%)	Value (Trillion)	Rate of change (%)	Value (Trillion)	Rate of change (%)
GDP	25.37	25.53	0.63	25.66	1.14	25.29	-0.32	25.20	-0.68
Industrial added value	10.91	11.10	1.74	11.25	3.12	10.79	-1.10	10.67	-2.20
Imports	7.35	7.50	2.04	7.62	3.67	25.29	-0.32	25.20	-0.68
Exports	9.65	9.81	1.66	9.93	2.90	10.79	-1.10	10.67	-2.20

Source: Author's Calculation

Different orientations of macroeconomic policies will lead to unbalanced growth of outputs in different sectors, and result in changes in the industrial structure (see Table 3). In terms of the proportions of three industries, the factor-expansion policies can lead to the further growth of the proportion of the secondary industry and the decline of the proportion of the third industry. In contrast, the structural-adjustment policies can lead to the decline of the proportion of the secondary industry and the rise of the proportion of the third industry. The factor-expansion policies can lead to the rise of proportion of highly-processed industries, and the structural-adjustment policies can lead to the decline of the proportion of such industries. It is because many industries with excess capacity are highly-processed industries, and the restructuring of these industries will result in the declined proportion of such industries, so the results are largely caused by the change of the scope of the statistics. In terms of the proportion of the high-end service industry, the factor-expansion policies can lead to the decline of proportion of such industries, and the structural-adjustment policies can lead to the rise of the proportion of such industries.

Table 3: Impacts of Different Orientations of Macroeconomic Policies on Economic Structure

	Prudent-continuance policies		Factor-expansion policies				Structural-adjustment policies			
			Weak policy efforts		Strong policy efforts		Weak policy efforts		Strong policy efforts	
	Value (trillion)	Proportion (%)	Value (trillion)	Proportion (%)	Value (trillion)	Proportion (%)	Value (trillion)	Proportion (%)	Value (trillion)	Proportion (%)
Primary industry	2.67	10.17	2.68	10.13	2.68	10.08	2.67	10.18	2.66	10.20
Secondary industry	13.72	52.19	14.01	52.94	14.23	53.49	13.55	51.75	13.39	51.31
Tertiary industry	9.89	37.64	9.77	36.93	9.69	36.43	9.97	38.07	10.05	38.50

Highly-processed industry	4.48	17.05	4.59	17.33	4.67	17.57	4.42	16.89	4.37	16.73
High-end service industry	5.42	20.68	5.37	20.31	5.33	20.04	5.47	20.90	5.51	21.11

Source: Author's Calculation

The factor-expansion policies can lead to the further expansion of industries with excess capacity, and have a “crowding out effect” on some industries already have a serious shortage of supply, resulting in a further imbalance in the industrial structure. Among the six industries more sensitive to the factor-expansion policies, there is serious overcapacity in the metal smelting and rolling industry, partial or minor overcapacity in the manufacturing industry of general/special equipments, and the manufacturing industry of communications equipments, computers and other electronic equipments. The factor-expansion policies can lead to the direct surge of the outputs of these industries. The continued implementation of the factor-expansion policies may cover up the problem of overcapacity to a certain extent, but the problem would become prominent as soon as such policies exit. In addition, the factor-expansion policies create a serious “crowding out effect”. Construction and other five industries sensitive to such policies have a high pulling coefficient and can lead to the fast growth of domestic economy. However, the high pulling coefficient also means that these industries have a strong influence on the allocation of resources, and can lead to further concentration of resources in a few industries, leaving industries with inadequate resources more resource-deprived. It will have a serious “crowding out effect” on the sectors essential to the long-term development capacity of the national economy, such as education and R&D sector. The ten industries with the highest output growth under the factor-expansion policies are the construction industry, the manufacturing industry of non-metallic mineral products, the manufacturing industry of general/special equipments, the manufacturing industry of communications equipments, computers and other electronic equipments, the metal smelting and rolling industry, the metal mining and dressing industry, the mining and dressing industry of non-metal ores and other minerals, the manufacturing industry of transport and communication facilities, the manufacturing industry of electrical machinery and equipments, as well as the manufacturing industry of metal products. The top ten industries suffering from the “crowding out effect” are the public administration and social organizations, education/water/environment/public facilities management, health/social security/social welfare, culture/sports/recreation, R&D, postal services, the papermaking, printing and manufacturing industry of cultural and sports goods, the textile industry, as well as accommodation and catering.

The structural-adjustment policies can transfer more capital to industries with

insufficient supply so that the allocation of resources is more in line with market demand. Overcapacity is basically caused by the chaotic pricing mechanism of production factors because of government subsidies. In addition, the allocation of resources in the entire industry is inefficient, the excess capital in a certain industry resulted from inadequate information cannot find an effective mechanism to exit. The problem of overcapacity requires the external forces to break the inefficient market equilibrium, so that the excess resources can exit the industries with overcapacity and re-enter the market for distribution. The simulation of CGE models shows that China's structural-adjustment policies are effective. The capital pulled out from the industries with overcapacity is redistributed by the market-based national income distribution mechanism and are channeled to the under-supplied industries. Under the structural-adjustment policies, the top ten industries with the biggest decrease in outputs are the construction industry, the manufacturing industry of non-metallic mineral products, the metal smelting and rolling industry, the manufacturing industry of general/special equipments, the metal mining and dressing industry, the mining and dressing industry of non-metal ores and other minerals, the manufacturing industry of transport and communication facilities, the manufacturing industry of electrical machinery and equipments, the manufacturing industry of communications equipments, computers and other electronic equipments as well as the manufacturing industry of metal products. The top ten industries with the biggest increase in outputs are public administration and social organizations, education/water/environment/public facilities management, health/social security/social welfare, culture/sports/recreation, R&D, postal services, leasing and commercial services, accommodation and catering, as well as the papermaking, printing and manufacturing industry of cultural and sports goods.

4. Simulated Industrial Economic Growth under Different Policy Scenarios

The third part simulates the impacts of macroeconomic policies on the economic system at the current stage. The long-term impact on economic growth is realized through the changes of the quantities and qualities of different factors of production. This paper assumes that the economic structure parameters stay unchanged. The changes in the industrial economy over the next 10 years are simulated by the change of technical structure (labor-capital ratio) and technology (TFP) under the influence of the policies.

4.1 Trends of Changes of Production Factors

The industrial growth is the result of a concurrent function of many factors, such as labor, capital and TFP, and the concurrent function of various factors results in the rapid growth of the industrial economy. From the perspective of labor, the overall workforce population in China's industrial sector is growing constantly and the number of 2011 has increased by 2 times compared to that of 1979. The labor quality has been greatly improved as well. While the annual growth rate of population of employees is 1.8% from

1982 to 2000, the labor input during the same period after taking into consideration the improving the quality of labor is as high as 3.23%. The difference in the two rates is the contribution of the improvement of the quality of labor, which is more than 44% (YUE Ximing, 2008). From the perspective of capital accumulation, the accumulation of China's industrial capital has been rapid, and the capital stock in the industrial sector increased by nearly 25 times from 1979 to 2011. With the rapid expansion of the scale of the capital comes also the remarkable improvement of the quality of the industrial capital. From the perspective of TFP, the TFP growth in the industrial sector increased first and then declined (see Figure 1).

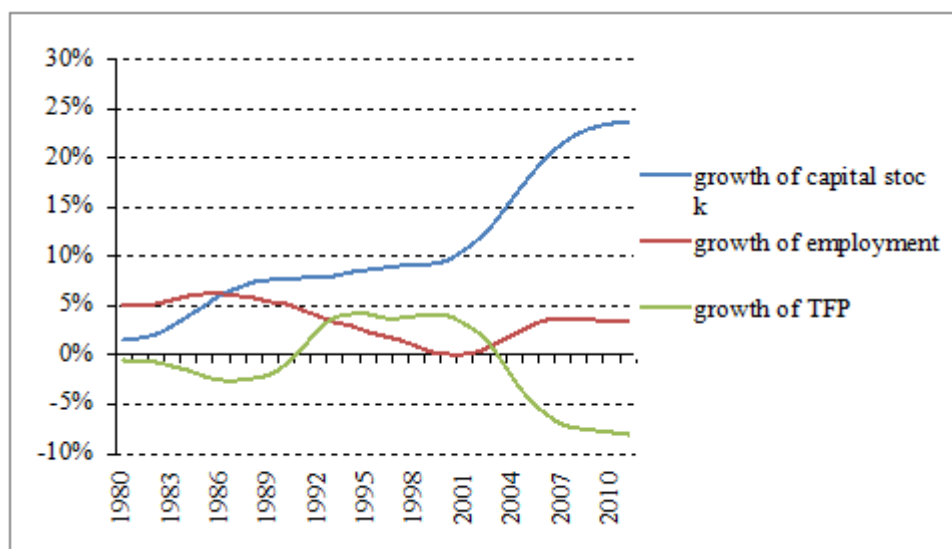


Figure 1: Growth of Capital Stock, Employment and TFP in Industrial Sector

Source: Author's Calculation based on Data of National Bureau of Statistics

4.2 Simulation of Growth of Industrial Output in Next Ten Years

Different orientations of macroeconomic policies can lead to different changes of factors of production, thus affecting the changes of the potential industrial output. The factor-expansion policies mean accelerated investment growth, which can promote the rapid growth of the capital stock and employment. But such extensive growth is not conducive to enhancing the TFP. In contrast, the structural-adjustment policies mean slower investment expansion, resulting in slower growth of capital stock and employment. But the transformation of the economic development mode helps enhance TFP. The simulation of China's economic growth for the next decade will evaluate the changes of factors of economic growth under the three different policy orientations.

First is the growth rate of the capital stock. Under the factor-expansion policies, the capital stock will grow rapidly. Based on the growth of capital stock under the national

economic stimulus policies during the global financial crisis, the paper assumes that the average growth rate of the capital stock at the initial stage of 2009 to 2011 is 24.4%, and decreases by one percentage point each of the following year because of the change of base number and the reduced effect of policies after repeated implementation. Under the prudent-continuation policies, the paper uses exponential smoothing of the current capital stock for the extended prediction of the growth of the capital stock from 2013 to 2023. Under the structural-adjustment policies, the paper uses the average growth rate of the capital stock from 1992 to 2000 as the rate for the period when China enhances its effort of structural adjustment, and the rate will decrease 0.5 percentage points every year after that.

Second is the growth rate of labor. On the whole, the paper uses the conclusion of the Research Group of Frontier Theories of China Economic Growth, and assumes that the growth rate of labor under the prudent-continuation policies is 0.8% from 2011 to 2015, -0.1% from 2016 to 2020, and -0.5% from 2020 to 2030. The national economic stimulus policies would increase the employment, therefore, the labor growth rate under the factor-expansion policies are 0.2 percentage points higher than above rates. On the contrary, the structural-adjustment policies increase unemployment, and the rates under these policies are 0.2 percentage points lower than above rates.

Third is the TFP. The TFP is analyzed from the two perspectives of industrial restructuring/ system effects of system changes as well as the effects of technological advances based on the estimated results of FAN Gang (2011) and ZHANG Jun (2009). The initial value of the system effects is set to be -2% under the factor-expansion policies, and decreases by 0.2 percentage points annually because of the self-reinforcement of the interest groups that deter the reform; the initial value of the effects of technological advances is the average rate from 1997 to 2007, and decreases by 0.2 percentage points annually. The paper assumes that the system effects remain the same under the prudent-continuation policies, and the value is -0.1%, the average value from 2001 to 2006. The value of the effects of technological advances also stays the same at 2.2%, which is the average value from 1997 to 2007. The paper also assumes that the system effects and the effects of technological advances both rise steadily under the structural-adjustment policies by 0.2 percentage points annually. The dynamic CGE models use the estimated changes of the factors of production as the input value to predict the change of potential output of the industrial economy in the next ten years under the three orientations of policies. (See Figure 2)

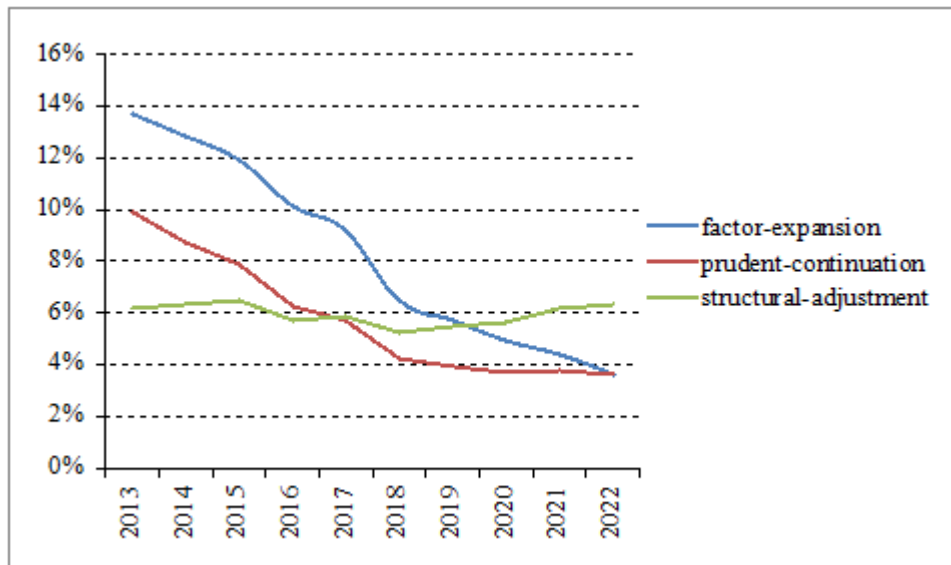


Figure 2: Forecast of Growth of Industrial Economy under Three Scenarios

Source: Author's Calculation

4.3 Comparison of Potential Growth of Industrial Output under Three Orientations of Macroeconomic Policies

The differences of the potential growth of industrial output are significant under different orientations of macroeconomic policies. The factor-expansion policies can stimulate the economy and realize a 14 % growth rate during a short time. But due to the reduced efficiency of asset allocation and the low level of the industrial technology, the industrial economic growth will soon show a downward trend and drop to around 3.6% in 2022 by 1 percentage point per year on average. This process will be accompanied by the loss of a large number of natural and human resources. For a country, such growth (instead of development) will not bring the growth of social wealth, but lead to the negative growth of comprehensive national wealth (LI Haijian, 2008).

The growing asset size resulted from the high rates of investment is the major driving force for the growth of industrial economy. The industrial growth is mainly dependent on the growth of the capital stock, while the system optimization and technological progress have limited contribution to the economic growth. Under the prudent-continuation policies, the industrial growth will maintain the current trend, and slow down by some 0.66 percentage points each year to around 3.6% in 2022. In this process, the industrial growth will also cause greater pressure on resources and the environment, but the results are much better than the factor-expansion policies. Under such macroeconomic policies, the growth of capital stock is still the most important driving force for the industrial growth. Under the structural-adjustment policies, China enhances its policy efforts for "structural adjustment", resulting in a sharp slowdown in the growth of industrial investment and the large-scale elimination of backward

productivity. Under such circumstances, the growth rate of the industrial economy will drop rapidly to 6.2%, but will stay at around 6% in the subsequent 10 years or so. It will be at around 6.4% in 2022. Such policies can realize a steady and rapid growth of the industrial economy in a long-term, and also lead to the gradual optimization of the industrial structure and drastically-reduced resources and environmental pressures. In this case, the role of system optimization and technical progress will be increasingly important, and they will gradually replace capital stock growth to become the primary forces of industrial growth.

5. Policy Recommendations

5.1 Taking Structural-adjustment as the Fundamental Orientation of Macroeconomic Policies

The simulation of the CGE models shows that the structural-adjustment policies are the best choice for China's macro regulatory effort at the current stage. While the factor-expansion policies can enhance the economic output as well as imports and exports, they will lead to the further imbalance in the industrial structure, exacerbate the problem of overcapacity, and creates the "crowding out effect" for social investments. In addition, the sustained implementation of the factor-expansion policies can realize a higher level of industrial growth in the short term, but will cause enormous resource and environmental pressures in the long run. The industrial growth is therefore not sustainable, and might drop rapidly to a lower level in the next decade. The prudent-continuation policies are a continuation of the current policies. The industrial economy will maintain the current trend, and the problems of industrial structural imbalance and excess capacity will remain difficult to resolve. The sustained implementation of the prudent-continuation policies will bring the growth of the industrial economy down to a lower level. The structural-adjustment policies may lead to a drop in the current economic output, but they can gradually improve the industrial structure and balance the supply and demand. In the long run, the enhanced TFP because of structural improvements will promote the change of the driving force of the industrial growth and improve the production-possibility frontier, thus achieving stable and rapid industrial growth.

5.2 Lowering the Floor Level of the Economic Growth with Macro-Regulation

Prime Minister Li Keqiang once proposed that the economic growth should not drop to below the "floor level", reflecting the central government's intention of stabilizing the economic growth. The setting of the "floor level" of the economic growth is of great significance to the maintenance of economic stability. The key is exactly how much should the "floor level" be. Too high a level essentially leads to the orientation of factor-expansion, and put the industrial economy back on the track of extensive growth. The simulation of CGE models shows that the growth rate of the industrial added value will be reduced to about 6% if the central government enhances its effort of structural adjustment. Therefore, the floor level of growth rate can be set to around 6% so as to

promote the smooth implementation of structural adjustment policies and leave large room for structural adjustment policies. If the growth hasn't dropped to below the floor level, China should not introduce large-scale economic stimulus policies, but use market mechanisms to promote elimination of backward production capacity and promote industrial restructuring.

5.3 Giving Play to the Fundamental Role of the Market Mechanism in the Structural Adjustment

China has been implementing the catch-up strategies for a long time, claiming that the market mechanism is not ideal for structural adjustment. In fact, according to the simulation of the CGE models, the market mechanism can also play a good role in the optimal allocation of resources in the structural adjustment. When the resources are rechanneled to the national economic system from industries with excess capacity by reverse subsidies (tax increases), the national economic system can use the market mechanism for the automatic reallocation of resources to industries with shortages. For the government to promote industrial restructuring, the core is to eliminate barriers of the flow of resources between different industries, so that resources can be withdrawn from the industries with excess capacity to the national economic system for redistribution.

5.4 Increasing the Role of TFP in Industrial Growth

China's industrial growth since the Reform and Opening-up is largely attributable to the continuous capitalization of the economic resources. However, the contribution of technological progress to the industrial growth cannot be ignored. In terms of the change trend of the industrial TFP, it grew sharply during the 1990s, and began to decline since 2000. There is a clear trade-off between the growth rate of capital accumulation/its contribution to economic growth and the contribution of technological progress to economic growth represented by TFP (Task Force on China's Economic Growth and Macroeconomic Stability, 2010). The fundamental purpose of the structural-adjustment policies is to enhance TFP and realize intensive economic growth. Judging from the simulations of the CGE models, even if China has maintained a high growth rate of investment, its industrial economy cannot maintain a long-term rapid growth due to the accelerated decline of TFP. By contrast, the restructuring can improve efficiency of resource allocation and the level of industrial technology so as to obtain improved TFP and steady and rapid growth of the industrial economy even in the face of the sharp decline in investment growth. Therefore, the core objective of macro-control policies should be to promote the change of the growth momentum from investment-driven to TFP-driven.

References: