Front. Econ. China 2010, 5(1): 96–113
DOI 10.1007/s11459-010-0005-4

RESEARCH ARTICLE

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A CGE Analysis of Oil Price Change

Abstract As Chinese economy system has been depended more on the import of petroleum with the development of China, the change in the price of international oil have caused concern among economists and policy makers. This paper is to present a financial Computable General Equilibrium (CGE) model of the Chinese economy which integrates real economy and financial sectors, and to apply it to quantitatively evaluate the impacts on Chinese economy caused by international oil price changes. And the model endogenously determines the exchange rate, covering fixed, partially flexible, and completely flexile exchange rate system to consider the effect of foreign oil price changes from the point of view of macro and industrial aspects. Finally, this paper presents concluding remarks.

Keywords oil price, CGE model, economic system, policy simulation

JEL Classification C68, F33, G14

1 Introduction

In recent years, China's economy grows at an astonishing rate. However, in the process of rapid growth, some potential issues are showing up. Both excessive growth of investment on fixed asset and a sharp rising of prices of oil, food and other raw material are becoming a constraint on economic development in China. As a result of the broader issues involved and the complexity of the economic structure, It is very necessary to construct a systematical model, combined with different exchange-rate systems, to quantitatively evaluate the impacts of oil price changes on the China's economy.

Translated and revised from *Shuliang Jingji Jishu Jingji Yanjiu* 数量经济技术经济研究 (Journal of Quantitative & Technical Economics), 2009, (4): 45–56, 69

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After July 21, 2005, a more market-oriented and managed floating exchange rate system was implemented in China. Currently, RMB exchange rate is reference to a basket of currencies rather than pegging to the U.S. dollar and a more flexible RMB exchange rate system is forming. As a result that pegging RMB to a basket of currencies is based on the weight of foreign trade-oriented, the scope of RMB exchange rate fluctuation directly relates to net exports and indirectly relates to the adjustment of industrial structure, and further affects the Chinese economic system.

During the period of reform of the RMB exchange rate system, the international oil price has been kept in a rising trend and the index of oil price continued to run in a high level. There is no doubt that the importance of oil on the economy is self-evident, for example, the Oil Crisis in 1970s, and the Gulf War in 1980s, they had a major impact on the world economic system. Meanwhile oil shock led to fluctuations of oil prices by influencing oil supply and further affecting the output of oil-related industries. Finally, oil shock affected the operation of the physical economy. Usually, oil shock in economic analysis is described as a typical case of supply shocks, that means oil shock led to the change of interest rate, exchange rate and monetary policies, etc., and further spread rapidly to the physical sectors so as to have a significant impacts on the real price level of output and real economic variables. Since the dependence on imported oil will gradually increase in future, the impact of international oil price change on Chinese economy is increasingly concerned.

According to the IMF outlook on the world economy: when the crude oil price rises by $5, the economic growth in industrialized countries should fell 0.2%. According to the forecast of the Organization for Economic Cooperation and Development (OECD), if oil price rises by $10 a barrel, real GDP of industrial countries will fell 0.25%, and inflation rises by 0.5%. Obviously, oil price change has more significant impacts on the developed countries. If this occurs in China, what are the impacts on China's economy? How to quantitatively evaluate the impacts of oil price change on the Chinese economy? Especially, it is practically significant to consider the effect of foreign oil price changes in terms of macro and industrial aspects and to present relative implications of policies for the Chinese economy.

Empirical studies on this area have broadly followed two different techniques: macro-econometric and (on behalf of the real level) CGE model. The advantage of macro-econometric model is that they can take into account macro-economic behavioral relationships and are suitable for analyzing short-term to medium-term effects of economic policy. However, the macro-econometric models are high aggregated, they are not able to capture sector effects and inter-industrial linkage. While the real CGE models are disaggregated, they are largely based on micro behavioral relation, in which the agents make decisions to optimize their respective utility or profit functions. Real CGE models are suitable to analyze long-term effects of economic policies brought about by the changes in economic intensions and relative prices. Thus, the real CGE models are not suitable for analyzing short- to medium-term effects of economic policy. In order to overcome the shortcomings above-mentioned, the paper extends real computable general equilibrium model to incorporate financial markets and macroeconomic variables, and applies it to make a quantitative evaluation of economic changes in terms of not only from the short-, medium-and long-term, but also from the industrial sector and macroeconomic levels.

Given its objectives, this paper is to present a Chinese Financial CGE (Computable General Equilibrium) model which integrates real and financial sectors, and to apply it to quantitatively evaluate the impacts on Chinese economy caused by international oil price changes. And the model endogenously determines the exchange rate, covering fixed, partially flexible, and completely flexile exchange rate system to consider the effects of foreign oil price changes in terms of macro and industrial aspects. Finally, results are summarized as three implications of related policies for the Chinese economy.

Section 2 provides an analytical framework and data of the financial CGE model. Section 3 is devoted to simulations, while Section 4 summarizes the results and extracts the policy implications.

In addition, the main characteristics of this study include: (1) In the model, private investment is determined endogenously depending on the interest rate and the return to capital. (2) Saving no longer finances investment directly. Instead households allocate their savings and wealth into physical and financial assets given relevant assets returns. Firms also make decisions over borrowings, based on relevant interest rates. (3) The financial CGE models can capture not only the long-term effect of the changes in relative prices brought about by economic policies but also the short-term effect on economic activities through the change in asset prices and total demand. (4) The inclusion of financial markets also allows the model to determine the absolute price level and interest rates. Accordingly, a currency perspective of the inflation analysis makes it possible. While the research on CGE model which integrates real and financial sectors in China is far from being full, the paper attempts to make an explored study.

2 Framework and Characteristics of the Model

2.1 Basic Framework of the Model

The model is generally based on the neoclassical CGE model (Devarajan et al., 1982), but extends the statistic model to incorporate the accumulation of capital stock and factors supplies. Additionally, the model framework also refers to Esaki (2002), Hertel (1997). The model includes the following blocks: production block, trade block, income distribution block, the consumer block, the balance of supply and demand of factors, and recursive dynamic block. The main framework and characteristics of the model are briefly described as the following.

2.1.1 Production Blocks

Production processes are described by a multi-layer nested CES production function which assumes that all of the sectors have constant returns to scale. Firstly，the model determines total final output by the CES function, assuming substitutability between inter-mediated inputs and value-added, both of which are aggregated as composite inputs. Secondly, the model determines the demand of inter-mediated inputs by the CES function. Concerning value-added, the model determines value-added by the CES aggregated function, assuming substitutability between labor and capital inputs. Labor input is an aggregation of non-formal and formal employment based on the CES function.

2.1.2 Trade Block

In the model, producers are profit-maximizers who decide whether to sell on the domestic market or to export, Imperfect transformability between domestic output for exports and domestic sales. Imperfect transformability between domestic output for exports and domestic sales is captured by a CET (Constant Elasticity of Transformation) function in which the composite commodities that is applied to domestic sales and exported commodities. Producers also decide whether to sell on the domestic market or to export on the basis of relative price, and determine the optimal mix between exports and domestic sales.

2.1.3 Income Distribution Block

National income derived from the process of production and trade is assigned to three major institutions: firms, households and government. The income distribution includes initial income distribution and redistribution. In the initial distribution, the various factors of production earn its incomes which based on endowments in the production process. In this case, income of the private sector consists of labor and capital income. In the income redistribution, distribution of factor incomes to the institutions is given by constant coefficients. The firms' income which comes from capital, minus tax payments and transfers to households equals firm savings. The government of the model earns its revenues from income and sales taxes, such as personal income tax, production and sales tax, and tariffs and duties, and spends it on consumption and transfers to firms and households. Government savings is the difference between its revenues and spending. Subsidies are taken as negative income for the government in the model.

2.1.4 Consumer Demand Block

Utility functions of Cobb-Douglas type are adopted for the consumption of households and the government, who consume the composite commodities by constant coefficients. Household consumption, government consumption, investment and the demand for intermediate goods constituted an aggregate demand for composite commodities. Government imposes tariffs on imported goods and duties on exports (or subsidies), in which the tariffs rate or subsidy rate is treated as exogenous variables.

Imperfect substitutability between imports and domestic output sold domestically is adopted an Armington function. The composite commodities are used by all domestic demanders. Imperfect substitutability between imports and domestic output sold domestically is captured by a CES aggregated function in which the composite commodity that is supplied domestically is produce by domestic and imported commodities, and in the model, consumers are cost-minimizer who decide whether to buy on the domestic market or to import.

2.1.5 Market Equilibrium

Balance blocks include commodity markets, labor market, capital market, the balance of payments, the balance of international trade, government budget, and bank credit. The model specifically allows labor factor mobility among sectors. In the simulations, labors are allowed to freely migrate in inter-sectors, if the labor returns in one activity is lower than those in other activities. The degree of factor mobility is determined in the model by the different marginal opportunities across sectors and the elasticity of the substitution. Capitals are also allowed to optimize the allocation in inter-sectors, if the capital returns in one industry is lower than those in other industries. The degree of factor mobility is determined in the model by the different marginal returns across sectors and the elasticity of the substitution.

2.1.6 Dynamic Recursive Block

The model here is a dynamic recursive model. That is to say, the model is solved year by year dynamically by using extrapolated values on such exogenous variables and parameters as supply of formal labor, supply of non-formal labor, real investment, total factor productivity, scale factors of exports, and capital stocks. Total capital stocks are obtained by accumulating total real investment, and then allocated to industries in proportion to their rates of return. Dynamic characteristics in the model are reflected as the following: (1) the number of production factors, such as the labor and capital stock, increases year by year. (2) TFP and technological progress lead the efficiency of production to height and (3) population growth.

2.1.7 Characteristics and Model Data

In the model, the dynamic financial CGE model contains 16 activities and industries, and two factors of production. The paper extends real computable general equilibrium model to incorporate financial markets and macroeconomic variables, and applies it to quantitatively evaluate the economic impacts of policy changes. In addition, the main characteristics of this study include: (1) In the model, private investment is determined endogenously depending on the interest rate and the return to capital. (2) Saving no longer finances investment directly. Instead households allocate their savings and wealth into physical and financial assets given relevant assets returns. Firms also make decisions over borrowings, based on relevant interest rates. (3) The financial CGE models can capture not only the long-term effect of the changes in relative prices brought about by economic policies but also the short-term effect on economic activities through the change in asset prices and total demand. (4) The inclusion of financial markets also allows the model to determine the absolute price level and interest rates. Accordingly, a currency perspective of the inflation analysis makes it possible.

2.2 Construction of a Financial SAM: Data Requirements of CGE Model

2.2.1 Framework of Financial SAM

The paper constructs a financial SAM which provides a great deal of information about the structure of the Chinese economy. The SAM provides a schematic portrayal of the circular flow of income in the Chinese economy from 16 activities and commodities, to factors of production, to institutions, and back to activities and commodities again. Meanwhile, the labor factor is further classified into unskilled and skilled labor. The paper extends real SAM to incorporate financial markets and assets, in which includes 7 types of assets: money, bank deposits and foreign assets, etc. The institutions are further classified into the central banks and commercial banks.

This paper constructs a financial CGE model in which data based on I-O tables (2002) and capital-flow related data, first of all to construct the financial SAM matrix in 2002 (Social Accounting Matrix, SAM). Its basic structure is shown in Table 1 (real SAM) and Table 2 (financial SAM):

The structure of social accounting matrix which provides a great deal of information about China's economy in 2002 is described briefly in Table 1 (real SAM) and Table 2 (financial SAM). Real SAM is divided into nine accounts: Accounts 1 and 2, respectively, account for goods and activities. Factors in next categories account for labor and capital. Acount5, 6 and 7, respectively, accounts for enterprises, households and government. Account 9 represents the rest of world. In economic accounting, all data must meet the following economic relations, namely:

(1) the value-added + intermediate inputs =domestic production.

(2) total production + imports = domestic supply.

(3) intermediate demand + export + private consumption for rural and urban residents+government consumption+fixed assets+inventory = domestic demand.

(4) total supply = total demand.

In addition, constructs the Financial SAM in which the following economic relations in SAM can be consistent with the basic structure of CGE models:

(1) depreciation of fixed assets + operating surplus + wages = value-added.

(2) operating surplus + depreciation of fixed assets = rent.

(3) net of Production tax = indirect taxes.

(4) labor income=wages + workers income paid from overseas−remuneration received from foreigners.

(5) capital income = depreciation of fixed assets + foreign transfer to Chinese enterprises – remittances of investment return.

AS the equation system of model includes quite a huge mount of equations and data, we make use of GAMS to solve the CGE model. The equation system, which is a mathematical statement of the CGE model. First, equations defining the price system are presented. Second, the production and value-added equations are formed respectively. Next are equations that describe the mapping of value added into institutional income. A circular flow is then completed by equations showing the balance between supply and demand for goods by the various actors. Finally, there are a number of “system constraints” that the model economy must satisfy. These include both market clearing conditions and the choice of macro “closure” for the model.

Table 1 Schematic Real Social Accounting Matrix

	Activities on production	Commodities	Labor	Capital	Enterprises	Households	Government	Saving/ investment	Foreign sector	Total
Activities on production		Sales								Total sales
Commodities	Inputs					Private consumption	Government consumption	Private investment	Exports	Total demand
Labor	Labor income								Labor income from foreign countries	Labor income
Capital	Capital rent								Investment revenue from foreign countries	Capital income
Enterprises	Earned surplus			Capital income			Subsidy from government			Corporate total income
Households			Salary		Transferring payment		Transferring payment		Foreign transfer	Total household income
Government	Indirect taxes				Corporate taxes	Income taxes			Grants	Government income
Saving/ investment					Corporate savings	Household savings	Government savings		Foreign exchange savings	Total savings
Foreign sector		imports	Foreigners labor income	Investment income collects	profit repatriation	Capital transfer	Transfer payment from Chinese government		Foreign exchange outflow	Foreign exchange outflow
Total	Production cost	Total supply	Total expenditure	Total expenditure	Household expenditure	Firms expenditure	Government expenditure	Investment expenditure	Foreign expenditure	

Table 2 A Schematic Financial Social Accounting Matrix

		Current account	Capital account						Change in asset							Total
			HH	FF	GOV	CB	SBC	ROW	KG	KF	EQT	MON	DLN	FLN	FA	
Current account		Real SAM							IG	IP						Total investment
Capital account	HH	SH											ΔBDH			
	FF	YC									ΔEQT		ΔBDF	△BFF		
	GOV	SG											ΔBDG	△BFG		Total change in assets
	CB	CA														
	SBV											ΔCU	ΔRES			
	ROW	CA													ΔTFA	
Change in liabilities	KG				ΔKG											IG
	KF			ΔKF												IP
	EQT		ΔEQTH					ΔEQTR								ΔEQT
	MON		ΔCUH	ΔCUF												ΔCU
	DLN		ΔDH	ΔDF		ΔYB	ΔSBL									ΔBD
	FLN							ΔBF								ΔBF
	FA		ΔFAH			ΔFFR										ΔTFA
	Total	Total saving	Change in labilities						IG	IP	ΔTotal equility	ΔCU	ΔBD	ΔBF	ΔTFA	

Note: HH: households; FP: firms；GOV: government; CB: commercial banks; SBC: state bank of China；ROW: rest of the world; KG, KF: public and private capital; EQT: equities; MON: cash; DLN: domestic loans; FLN: foreign loans; FA: foreign assets; SH: household savings, YC: firms' retained profits; SG: government savings; YB: bank income; CA: current account deficits; CUH, CUF: money held by households and firms; CU: total money demand; DF, DH: firms' and households' deposits; FAH: households' foreign assets; FFR: foreign reserves; SBL: rediscount loans; RES: required reserves; BDF, BDG: commercial banks' loans to firms and government; BFP, BFG: foreign loans to firms and government, EQT: total equity contribution.

3 Simulation Analysis

For purposes of our analysis, this paper is to present a Chinese financial CGE (Computable General Equilibrium) model which integrates real and financial sectors, and to apply it to quantitatively evaluate the impacts on Chinese economy caused by international oil price changes. And the model endogenously determines the exchange rate, covering fixed, partially flexible, and completely flexile exchange rate system to consider the effects of foreign oil price changes from the point of view of macro and industrial aspects. Meanwhile, we examine the effects of fiscal policies coping with rising oil price. Finally, results are summarized as three implications of related policies for the Chinese economy.

3.1 The Impacts of Oil Price Fluctuation on the Chinese Economy

Oil price will affect the imports and the domestic prices of oil-related industries, but also affect the income of government, enterprises and individual, and further relate to the transfer of inter- institutions. As shown in Table 3.

Using the model which endogenously determines the exchange rate, covering fixed, partially flexible, and completely flexile exchange rate system to simulate the effects of foreign oil price increases or declines by 10% on the Chinese economy:

(1) From the point of view of macro-economic aspect (as shown in Table 3): the simulation shows positive effects of the decline in oil price, which brings about higher GDP in an effective cost-cutting manner. The economy-wide increase in real GDP is equal to 1.0% (fixed exchange rate), 0.8% (partially flexible exchange rate), 0.2% (completely flexible exchange rate). And this also bears out the favorable effects on social welfare by increasing the real household consumption, which respectively increased by 1.7% (fixed rate), 1.8% (partially flexible exchange rate), 2.1% (completely flexible exchange rate). As shown in Table 3, that the decline in oil price has a depressing effect on inflation level(household consumption deflator decline), and the balance of payments is improved(capital inflow), and the employment rate in formal and informal sectors begin to rise (as shown in Table 3).

In contrast, the simulation indicates a negative effect of the rise of oil price, which bring out the economy-wide decrease in real GDP is equal to –0.9%(fixed exchange rate), –0.7%（partially flexible exchange rate）and –0.2%(completely flexible exchange rate). In case that the international oil price increases significantly, there is an obviously depressing effect on the demand of each industry for energy, and the drop in demand has an obviously adverse effects on the real consumption and investment. The decrease in real consumption and

Table 3 The Impacts of Oil Price Fluctuation on China's Macro-economy (%)

	Exchange rate system	Decreased by 10% Fixed exchange rate	Decreased by 10% Partially flexible	Decreased by 10% Completely flexile	Increase by 10% Fixed exchange rate	Increase by 10% Partially flexible	Increase by 10% Completely flexile
GDP	Real GDP	1.0	0.8	0.2	–0.9	–0.7	–0.2
C	Real consumption	1.7	1.8	2.1	–1.6	–1.7	–2.0
PGDP	Deflator: GDP	0.5	0.4	–0.1	–0.5	–0.4	0.1
PC	Private consumption	–0.2	–0.5	–1.8	0.1	0.5	1.8
FW	Capital inflow	–3.7	–1.9	4.1	3.5	2.1	–3.4
LF	Formal employment	1.3	1.0	0.2	–1.2	–1.0	–0.1
LI	Non-formal employment	1.7	1.2	–0.2	–1.6	–1.2	0.2
FM	Currency supply	1.6	0.1	0.1	–1.5	–0.1	–0.2
ER	Exchange Rate [2]	0.0	–2.0	–5.1	0.0	2.0	5.5

Source:CGE model simulation results.
Note: partially flexible exchange rate refers to fixed exchange rate for baseline, then to plus or minus 2% on the base of baseline.

investment is much larger than the drop of real GDP, which implies that the rising oil price contributes to bear out a more efficient usage for energy. However, the impacts on economy-wide are negative, and the aggregate price level will also be affected to a certain extent.

(2) Table 4 presents the effects of oil price change on industries: As the industrial cost is inter-dependent with demand structure, the scenarios of the decline of oil price indicate obviously positive effects on almost all industries. The decline in oil price effectively cut the cost in almost all industries, especially those that specialize in consuming more energy (i.e., crude petroleum and natural gas, oil refining industry, and the transport). Due to lower production cost associated with the cost paid by the producer, production price for most products decline(as shown in Table 5), this bring about an increase in output mainly via the increase in consumption demand spurred by the decrease in price (as shown in Table 5). On the other hand, the increase in demand results in positive effects

[2] Direct Quotation.

on the national income and saving. This effectively favors the growth of industrial outputs, obviously supports demand-dependent sectors(i.e., agriculture, food processing, commercial and other services) and such highly investment-dependent sectors as construction industry. Thus, in the case of completely flexible exchange rate, the exchange rate appreciates to help to promote imports and restrain exports, and to cause negative effects on agriculture and other industries.

(3) The impacts on prices of industry (such as shown in Table 5): In the case of a fixed exchange rate, the drop in oil prices results in a rising trend of prices in almost all industries. The only explanation for above phenomenon is that the

Table 4 Impacts of Oil Price Change on Industrial Outputs (%)

Real production	Industry	Decreased by 10%			Increase by 10%		
		Fixed exchange rate	Partially flexible	Completely flexible	Fixed exchange rate	Partially flexible	Completely flexible
X1	Grains	0.8	0.4	–0.7	–0.8	–0.4	0.7
X2	Other crops	0.8	0.4	–0.7	–0.8	–0.4	0.7
X3	Other Agriculture	1.0	0.8	0.2	–1.0	–0.8	–0.2
X4	Minerals	0.7	0.6	0.4	–0.7	–0.6	–0.4
X5	Petroleum & gas products	2.8	2.5	1.9	–2.8	–2.5	–1.9
X6	Food processing	0.8	0.4	–0.8	–0.8	–0.4	0.8
X7	Textile, paper and printing	0.4	0.4	0.5	–0.4	–0.4	–0.5
X8	Petroleum refining	2.8	2.6	1.9	–2.8	–2.6	–1.9
X9	Chemicals and nonmetals	1.0	0.7	0.1	–1.0	–0.7	–0.1
X10	Metals, machinery & equipment	0.7	0.5	0.0	–0.7	–0.5	0.0
X11	Other manufacturing	0.8	0.5	–0.4	–0.8	–0.5	0.4
X12	Construction	0.7	1.0	1.9	–0.7	–1.0	–1.9
X13	Transport & warehousing	2.2	2.0	1.5	–2.2	–2.0	–1.5
X14	Finance & insurance	0.9	0.8	0.3	–0.9	–0.8	–0.3
X15	Public and social services	0.3	0.2	0.1	–0.3	–0.2	–0.1
X16	Others	1.0	0.8	0.0	–1.0	–0.8	0.0

Source: CGE model simulation results.

Table 5 The impacts of oil price fluctuation on prices of industry (%)

Price	Industry	Decreased by 10%			Increase by 10%		
		Fixed exchange rate	Partially flexible	Completely flexible	Fixed exchang e rate	partially flexible	Completely flexible
P1	Grains	0.1	0.0	0.0	–0.1	0.0	0.4
P2	Other crops	0.2	0.0	–0.8	–0.2	0.0	0.8
P3	Other Agriculture	0.3	0.1	–0.7	–0.3	–0.1	0.7
P4	Minerals	0.0	–1.1	–4.3	0.0	1.1	4.3
P5	Petroleum & gas products	–10.0	–10.9	–13.4	10.0	10.9	13.4
P6	Food processing	0.2	–0.1	–0.9	–0.2	0.1	0.9
P7	Textile, paper and printing	0.0	–1.1	–4.3	0.0	1.1	4.3
P8	Petroleum refining	–7.5	–7.5	–7.5	7.5	7.5	7.5
P9	Chemicals and nonmetals	0.0	–0.5	–1.8	0.0	0.5	1.8
P10	Metals, machinery & equipment	0.1	–0.5	–2.2	–0.1	0.5	2.2
P11	Other manufacturing	0.1	–0.3	–1.4	–0.1	0.3	1.4
P12	Construction	0.2	–0.1	–0.7	–0.2	0.1	0.7
P13	Transport & warehousing	–1.4	–1.7	–2.4	1.4	1.7	2.4
P14	Finance & insurance	0.6	0.5	–0.3	–0.6	–0.5	0.3
P15	Public and social services	–0.1	–0.1	–0.2	0.1	0.1	0.2
P16	Others	0.3	0.1	–0.7	–0.3	–0.1	0.7

Source: CGE model simulation results.

drop in oil prices bear out a tendency of excessive demand in the Chinese economy (that is, the demand growth is faster than the supply side). In contrast, in the case of completely flexile exchange rate, the drop in oil prices brings about appreciation of the exchange rate, which led to an increase in imports and fall in exports. And the input prices lowered, which bring about the decline in the price in almost all industries in an effective cost-cutting manner.

(4) We apply the model, which endogenously determines the exchange rate, covering fixed, partially flexible, and completely flexile exchange rate system, to examine the impacts of the decline in oil price on macro aspects. From the simulation above, we can summarize the impact as follows: The impacts on economic growth, employment rate and price level would gradually become smaller in terms of different exchange rate system (fixed, partially flexible, and completely flexile exchange rate). In contrary, the impacts on the social welfare (real household consumption) and the balance of payments gradually become larger in terms of fixed, partially flexible, and completely flexile exchange rate system. However, the industry which has a significant impact on all industrial

outputs has a smaller effects on the price level. In short, Compared with fixed exchange rate, completely flexile exchange rate system can play the role of stability for economic growth, employment rate and industrial outputs, while completely flexile exchange rate system becomes a destabilizing factor for the social welfare (real household consumption), the balance of payments and price level.

Otherwise, the simulation results would seem to indicates that the rising oil price have a detrimental effects on Chinese sustainable and stable growth in long term. The extent to which the international oil price rise by 10%, the rate of GDP growth is measured at –0.2% in China (completely flexile exchange rate system). Using the model, we look into the impacts on Chinese economy caused by international oil price changes from the point of view of macro and industrial aspects. In the next section, this paper draws forth the countermeasure in respond to the rising oil price and presents concluding remarks.

3.2 One of Countermeasures Coping with the Rising Oil Prices: An Expansionary Fiscal Policy

We simulate an expansionary fiscal policies scenario in which all 16 sectoral tariff rates and indirect-tax rate are reduced by 10%. The economy-wide effects arising from the CGE model, which integrates real and financial sectors, and simulation of fisccal policies regime are shown in Table 6.

Table 6 The Impacts of Fiscal Policies on Macro-economy (%)

		Tariff rate is reduced by 10%	Indirect-tax is reduced by 10%
	Exchange rate system	Partially flexible exchange rate	Partially flexible exchange rate
GDP	Real GDP	0.2	1.6
C	Real consumption	0.3	2.3
PGDP	Deflator: GDP	0.1	0.6
PC	Private consumption	0.1	0.9
FW	Capital inflow	0.7	5.5
LF	Formal employment	0.3	2.5
LI	Non-Formal employment	0.4	3.1
FM	Currency supply	1.5	12.2
ER	Exchange rate	2.0	2.0

Source: CGE model simulation results.

Note: partially flexible exchange rate refers to fixed exchange rate for baseline, then to plus or minus 2% on the base of baseline.

In the first simulation which tariff rate is reduced by 10%, its negative effect on government income, the aggregate savings and net exports, but it is beneficial for the overall Chinese economy. According to Table 6, we can find that the real GDP increase by 0.2% , and the household and firms income is improved.

This simulation models a scenario in which oil sector indirect-tax are reduced by 10%. The scenario brings about higher domestic output. Since the effective cost-cut manner lowers domestic production price to strengthen its competitiveness in world market and expand the export, and prompt domestic consumption correspondingly. The economy-wide increase in GDP is equal to 1.6%. This increase is mainly driven by a 2.3% growth in domestic consumption demand. Otherwise, the significant cost-cut effect of the decrease in indirect-tax rate has a positive impact on income. Households experience an increase in their incomes, mainly via the increase in wages level. The growth in consumption demand is mainly spurred by the increase in household income. Relatively (speaking), rural households are able to increase consumption slightly more (in relative terms) than urban households. Therefore, the increase in the income of rural households effectively favors consumption growth and, obviously, supports non-agricultural products output.

Correspondingly, the production subsidy also has various important indirect effects. Firstly, on the government account aspect, in order to increase government investment, government has to increase its borrowings. Although the increasing household income and consumption demand allows government to increase its revenue from direct taxes and indirect taxes, the direct and indirect tax which takes for government revenue decline in this simulation, the joint effects are negative. Secondly, on the investment aspect, investment is modeled as expenditure on goods and services in the economy. Thus, it implies that a decline in investment negatively affects the demand for goods and services. Typically industries that supply investment-type goods, such as the construction industry are hardest hit by sharp decreases in investment demand. The drop in demand has an adverse effect on output in all industries, especially those that specialize in investment goods (construction industry, machinery and equipment industry).

In short, the expanded fiscal policies coping with rising oil prices, would effectively favor macro-economic growth and, obviously, supports domestic output in short-term. However, it is worth pointing out that poor investment growth resulting from the fiscal subsidy will have a detrimental effect on the growth of capital stock and GDP growth in the long run for the Chinese economy.

4 Summary and Conclusion

The paper firstly constructs a Financial SAM which provides a great deal of information about the structure of the Chinese economy. And extends real SAM to incorporate financial markets and assets, in which includes 7 types of assets: money, bank deposits and foreign assets, etc. The objective of this study is to present a Chinese Financial CGE (Computable General Equilibrium) model which integrates real and financial sectors, and to apply it to quantitatively evaluate the impacts on Chinese economy caused by international oil price changes. And the model endogenously determines the exchange rate, covering fixed, partially flexible, and completely flexile exchange rate system to consider the effects of foreign oil price changes from the point of view of macro and industrial aspects. Finally, results are summarized as three implications of related policies for the Chinese economy.

(1) We apply the model, which endogenously determines the exchange rate, covering fixed, partially flexible, and completely flexile exchange rate system, to examine the impacts of the decline in oil price on macro aspects. From the simulation above, we can summarize the impact as follows: The impacts on economic growth, employment rate and price level would gradually become smaller in terms of different exchange rate system (fixed, partially flexible, and completely flexile exchange rate). In contrary, the impacts on the social welfare (real household consumption) and the balance of payments gradually become larger in terms of fixed, partially flexible, and completely flexile exchange rate system. However, the industry which has a significant impact on all industrial outputs has a smaller effects on the price level. In short, Compared with fixed exchange rate, completely flexile exchange rate system can play the role of stability for economic growth, employment rate and industrial outputs, while completely flexile exchange rate system becomes a destabilizing factor for the social welfare (real household consumption), the balance of payments and price level.

(2) From the point of view of macro-economic aspect: the simulation shows positive effects of the decline in oil price, which brings about higher GDP in an effective cost-cutting manner. The economy-wide increase in real GDP is equal to 1.0% (fixed exchange rate), 0.8% (partially flexible exchange rate), 0.2% (completely flexile exchange rate). And this also bears out the favorable effects on social welfare by increasing the real household consumption, which respectively increased by 1.7% (fixed rate), 1.8% (partially flexible exchange rate), 2.1% (completely flexile exchange rate). As shown in Table 3, that the decline in oil price has a depressing effect on inflation level (household consumption deflator decline), and the balance of payments is improved (capital inflow), and the employment rate in formal and informal sectors begin to rise (as

shown in Table 3). In contrast, the simulation indicates a negative effect of the rise of oil price, which bring out the economy-wide decrease in real GDP is equal to –0.9% (fixed exchange rate), –0.7%（partially flexible exchange rate）and –0.2%(completely flexible exchange rate). In case that the international oil price increases significantly, there is a depression in demand of each industry for energy, and the drop in demand has an obviously adverse effects on the real consumption and investment. The decrease in real consumption and investment is much larger than the drop of real GDP, which implies that the rising oil price contributes to bear out a more efficient usage for energy. However, the impacts on economy-wide are negative.

(3) The expanded fiscal policies Coping with rising oil prices could effectively favor macro-economic growth and, obviously, supports domestic output in short-term. However, it is noticeable that poor investment growth resulting from the fiscal subsidy will have a detrimental effect on the growth of capital stock and GDP growth in the long run for the Chinese economy.

Meanwhile, it is worth pointing out that these conclusions are derived from the current economical structure. Thus, it becomes a key for China to how to construct a feasible industrial and economic structure supporting its sustainable growth in next decades. In future, I further study on the model framework from the following two aspects:

(1) Disaggregate national level into regional or provincial level.

(2) Further disaggregate household groups, farm enterprises and farm products.

Acknowledgements This research was financially supported by the following Grants-in-Aid: (1) Grants-in-Aid by SZU R/D Fund (No. 801000029). (2) Grants-in-Aid for Scientific Research of Guangdong Province (No. 04GH79012). (3)SRF for ROCS, Ministry of Education (Structural Adjustment in China: A Financial CGE Analysis).(4)Grants-in-Aid by SZU R/D Fund (No. 801000075).

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