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CHINA'S INCOME TAX REFORM AND ITS IMPACTS

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Abstract

Personal income tax is a very small portion of China's total tax revenue, yet enterprises pay more than 90 percent of the country's taxes. This paper proposes a reform of personal income tax and suggests that shifting some of the tax burden from producers to consumers. Increase employee's wage payment by a certain amount. To keep the enterprises in the same financial situation, the government should reduce the corporation's direct taxes or value-added tax by the same amount. Increase the personal income tax rate and keep household at the same real income level as before the tax reform.

Using a newly designed recursive dynamic computable general equilibrium model (CGE) that differentiates seven productive sector by ownership and 22 labour groups by age and gender benchmarked to a year 2000 Social Accounting Matrix (SAM) of China, this paper quantitatively evaluates the differences between taxing consumers and producers. The simulation results show that the proposed reform may significantly improve real economic growth. Meanwhile, the new tax system may improve the income equality of the society, household savings, investment and government tax revenue without sacrificing society's standard of living.

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The draft is still very preliminary. Please do not quote without consent from the authors.

I. Introduction

Since 1979, the Chinese government has adopted a series of tax reforms to coincide with the transition towards a market-oriented economy. The current tax system is a significant move away from the former centralised system, but many problems persist. To provide feasible tax reform policies, quantitative analysis is definitely necessary.

This paper proposes a reform of personal income tax. Using a newly designed recursive dynamic computable general equilibrium model (CGE) that differentiates seven productive sector by ownership and 22 labour groups by age and gender benchmarked to a year 2000 Social Accounting Matrix (SAM) of China, this paper quantitatively evaluates the differences between taxing consumers and producers. Simulation results indicate that shifting some of the tax burden from producers to consumers will improve economic growth, household savings, investment and government tax revenue without sacrificing society's standard of living.

Section II compares China's income tax system with those in other countries. Differences between taxing consumers and producers are discussed in Section III. Section IV suggests how China's income taxation system should be reformed. Section V describes the basic structures of our CGE model, while Section VI discusses simulation results. Conclusions are presented in Section VII.

II. China's Income Tax System Compared to Other Countries

China's total tax revenue relative to Gross National Product (GNP) fell from 34 percent under a centrally planned economy to approximately 16 percent in recent years. This ratio is 21.6, 30.2, 21.4, 25.4, 23.1 and 23.2 percent in the US, UK, Japan, France, Italy and Germany respectively. In developing countries like Brazil, Korea, Malaysia, Mexico and Thailand, the ratio ranges from 16.4 to 19.8 percent for these countries with average ratio of 16.4 percent. Given this data, China's ratio appears quite normal.[1]

It is worthwhile noting that more than 80 percent of Chinese residents live in rural areas yet the agricultural tax generates only 5 percent of the total tax revenue. This would imply that most of China's tax revenue comes from urban residents. In 1994, there were approximately 146 million urban residents employed with an average per capita tax burden of 3500 yuan annually. Given that average urban income

[1] All figures are taken from "International Statistical Yearbook", 1995.

was 4538 yuan, the urban tax burden is over 75 percent.[2] Although this is a heavy burden, most of the Chinese are not concerned since most of this is levied on enterprises.

Personal income tax is a small portion of China's total tax revenue. There are approximately 20 million taxable enterprises in China compared to 650 million eligible taxpayers, yet enterprises pay more than 90 percent of the country's taxes. China's recent tax structure is given in Table 1. Most taxes, such as value-added, business, city construction, enterprise income and consumption tax, are levied on enterprises. Personal income tax was only 2.2 percent of total tax revenue in 1995 and 1.53 percent in 1994. Before that, the figure was negligible.

Table 1 Financial Structure of China Tax Revenue

(100 million yuan)

	1993		1994		1995	
	Tax	%	Tax	%	Tax	%
Consumption tax	279	8.34	324	7.99	429	8.35
Value added tax	863	25.81	1811	43.33	2157	41.98
Business tax	833	24.91	616	14.74	780	15.18
Construction tax	125	3.74	154	3.68	192	3.74
Enterprise income tax	409	12.30	566	13.54	674	13.12
Personal income tax	NA	NA	64	1.53	114	2.22
Tariff	230	6.88	245	5.86	266	5.18
Agricultural tax	124	3.71	161	3.85	191	3.72
Other	456	13.64	229	5.48	335	6.52
Total	3344	100	4180	100	5138	100

Source: Hong Ma and Shangqin Sun, "Economic Situation and Prospect of China", 1993, 1994, 1995.

Table 2 Share of taxes in total tax revenue (%)

	1	2	3	4	5	6	7	8
Rumania	2.50	NA	NA	0.57	NA	80.07	2.89	13.97
Hungry	25.95	NA	NA	36.77	6.82	20.16	6.96	3.36
Korea	26.36	13.97	12.39	51.16	16.80	1.33	1.05	3.30
Singapore	50.66	NA	NA	201.3	7.57	2.59	14.55	4.50
India	17.01	6.62	9.47	57.69	22.34	NA	1.59	0.66
Indonesia	81.22	2.30	74.26	11.50	5.04	NA	1.59	0.66
Philippine	22.35	10.52	12.01	45.20	26.00	0.00	4.03	2.52
Thailand	21.45	10.87	10.58	52.69	22.64	NA	2.49	0.73
Turkey	56.85	45.19	11.27	27.24	9.47	NA	1.96	4.48
Brazil	14.22	0.73	5.72	47.33	3.32	28.04	1.62	5.47
Chile	18.34	9.74	8.60	53.59	8.23	10.30	3.91	5.63
Egypt	25.21	NA	NA	18.64	27.37	19.16	1.75	7.87
Average	29.40	10.92	16.98	26.94	30.29	9.03	2.40	3.23

Note: Column 1: Total income tax; Column 2: Personal income tax; Column 3: Enterprise income tax; Column 4: Indirect tax;

[2] Data source: "Chinese Statistical Yearbook", 1995.

Column 5: Tariff and import tax; Column 6: Social security tax; Column 7: Property tax; Column 8: Others. The last line shows the average tax rate calculated from data of 93 developing countries.
Source: IMF, "State Financial Yearbook", Vol.9, 1995.

Table 2 gives the tax structure in developing countries. Usually, personal and corporate income taxes have been called "direct" taxes and all other tax is called "indirect". Personal income taxes vary significantly across countries. In Turkey, personal income tax is 45.19 percent of total tax revenue, while Rumania and Brazil's figures are significantly lower. The average share in 93 developing countries is 10.92 percent.

Table 3 Share of personal income tax

	Year	% of GNP	% of tax revenue
U.S.A	1978-1982	9.55	48.51
Canada	1977-1981	6.42	41.22
Australia	1978-1982	13.35	55.19
Japan	1977-1981	4.12	36.72
France	1978-1982	4.89	13.07
Germany	1977-1981	4.28	16.00
Italy	1977-1981	7.80	24.91
U.K	1978-1982	10.90	35.40
Average		8.12	29.04

Source: IMF, "State Financial Yearbook", Vol.9, 1985.
Note: The averages come from data calculation for 27 industrial countries. The second column presents data collecting period.

Table 3 shows the shares of personal tax in developed countries. Australia's is above 50 percent with both the US and Canada above 40 percent. France and Germany are well below average yet they are still over 13 percent. The average for twenty-seven developed countries is approximately 29 percent. China's personal income tax share is very low compared with both the developed and developing countries.

Beware that China's definition of wages is different from most countries. Wages normally imply nominal, before-tax income internationally whereas in China, it means after-tax income. Chinese employees do not distinguish nominal income from real income since they do not need to pay income tax. These anomalies suggest that the gap between the income of Chinese workers and their Western counterparts may not be as large as the data implies.

III. The Differences between Taxing Producers and Consumers

Ceteris paribus, reducing the tax burden for producer's means increasing the burden for consumers.

How would this policy affect the economy?

Imagine an economy with two sectors (for example, industry and agriculture), two products (X_1 and X_2) with prices P_1 and P_2 respectively. Then the utility-maximising problem is

Max u (X_1, X_2)

St. $P_1X_1 + P_2X_2 = Y$

where Y is total output. In Figure 1, EF stands for the budget line with slope $-P_1/P_2$. Indifference curve H_0G_0 is tangent to the budget line at point A.

Suppose the government levies a tax on each unit of X_1 at rate t. Total tax revenue would be tX_1.

The taxation changes the relative price between the two goods and the new budget line would be

$Y = (P_1 + t)X_1 + P_2X_2$

with a slope of $-(P_1 + t)/P_2$.

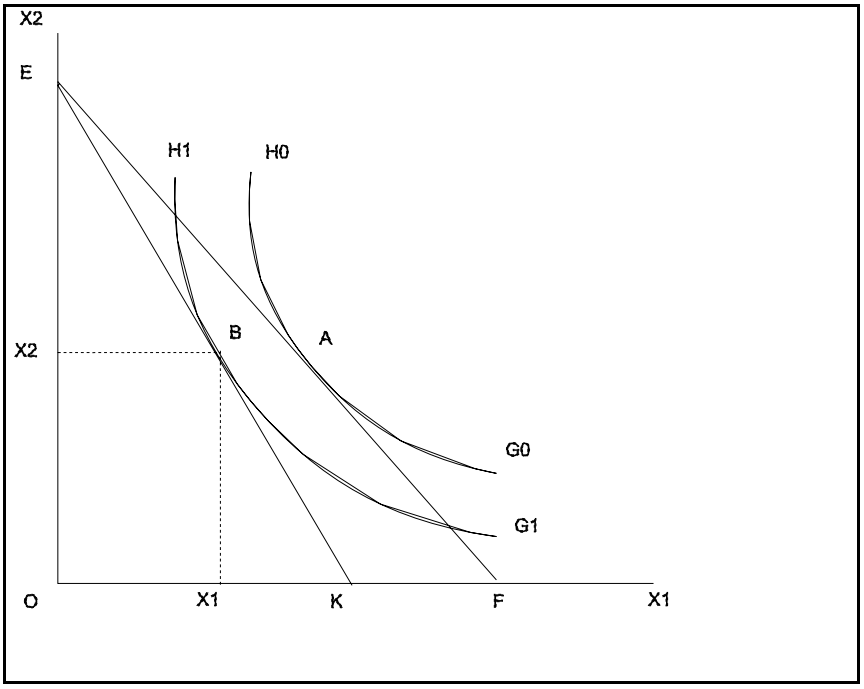

Figure 1

The budget line pivots from EF to EK in Figure 1 and the new tangency occurs at point B. Assume that the amounts being consumed are X_1^* and X_2^*. This means that tax revenue is equal to tX_1^*.

Suppose the government decides to changes its policy and tax income while still keeping the same amount of tax revenue, tX_1^*. The new budget line would be

$$Y - tX_1^* = P_1X_1^* + P_2X_2^*$$

with a slope of $-P_1/P_2$. This new budget line is presented as E_1F_1 in Figure 2.

Note that the budget line retains the same slope as the original scenario but has been shifted down parallel from EF.

Figure 2 shows how the budget line (in the presence of an income tax), will cross the indifference curve at two points, B and C. According to the property of convex indifference curves, we can achieve a higher level of utility on any point between the segment of BC. As pointed out by H. Varian, society can achieve a higher utility level from an income tax than from a commodity tax even if both generate the same level of tax revenue (Varian, 1984).

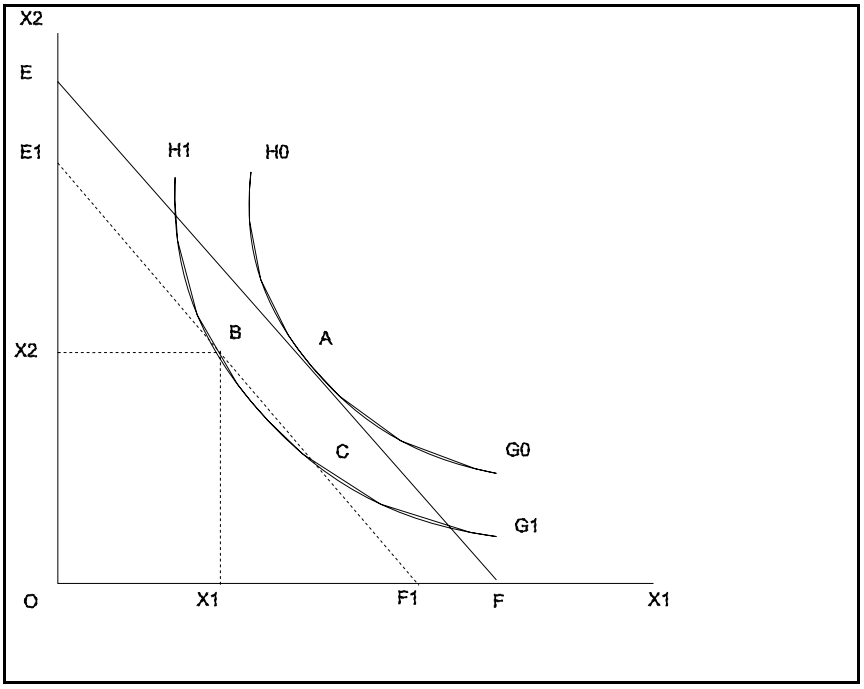

Figure 2

IV. Basic Idea of Income Tax Reform

Static models make it almost impossible to increase government tax revenue without an increased tax burden on consumers and producers. However, dynamic models suggest that one should first increase the amount of output, then it is much easier to allocate the tax burden. It is imperative to increase output when discussing the feasibility of reform policies.

Consider the following proposal for reforming personal income tax.

(1) Increase each employee's wage a certain amount.

(2) To keep the enterprises in the same financial situation, the government should reduce the corporation's tax burden by the same amount.

(3) Increase the personal income tax rate and keep household at the same living standard.

It seems like a numerical game: a given amount of money circulates from enterprise to worker and to the government; nobody's financial position is changed but the results are significant.

(1) Income taxes are preferred to commodity taxes. A lower tax burden for enterprises will improve efficiency, productivity, competitiveness and finally, social welfare.

(2) The average worker will not see a difference; the wage increase will offset the personal income tax due. Realistically, because wage incomes are different for all workers, we can assume that personal wage income follows a normal distribution. If we introduce a progressive income tax scheme, then it is possible to raise government tax revenue while reducing inequity in income distribution.

(3) Higher wages mean more people are eligible to pay tax (i.e. more people will be above the minimum wage level for income tax). This will significantly increase the tax base.

(4) Increasing the nominal wage will generate consumer optimism and improve consumption behaviour. It will encourage the worker to save and invest.

(5) The definition of a Chinese worker's personal income will change from after tax to before tax. This will bring the Chinese accounting system in line with the rest of the world. Information will be easier to interpret and compare.

V. Computable General Equilibrium Model for Income Tax Reform

5.1 The Advantage of CGE Models

There has been a great deal of academic interest in analyzing and evaluating tax reform policies

quantitatively. John Whalley (1985) and many others have advanced significantly the study of tax systems in recent years.

Employing CGE model to analyze the impact of tax reform has the following advantages: First, it has theoretical consistency. The CGE model can be considered as incorporating particular specifications of production and demand functions in the well-known Arrow-Debreu general equilibrium framework. Prices and quantities in CGE models are determined endogenously in simulating the results of an external shock or a policy change. An economy-wide consistency check can be performed by means of Walras' Law. Second, CGE models impose interaction consistency. A CGE model usually builds on a closed accounting system such as a social accounting matrix (SAM), which details all the basic identities for the modeled economy. CGE models are used to reflect many markets (such as product markets and factor markets), many institutes (such as firms, household, and governments) and their interactions. Third, CGE models can be used to analyze the economic structure changes that are very important to change welfare of varies groups of households. Since any policy change has its welfare consequences, properly measuring changes in welfare is important for policy evaluation. A multi-sector, multi-household apparatus in CGE models is justified because it generates such measures.

5.2 Basic Structure of the CGE Model for Tax Reform in China

Building on a long tradition of multisector CGE models used in analyzing trade and public policies (Dahl, Devarajan and Wijnbergen, 1986; de Melo and Tarr 1992; Beghin and others 1994; Garbaccio 1994; Wang and Zhai 1998), our model is recursive dynamic and has the following features.[3] It differentiates ownership by productive sectors, divides labor inputs into 22 groups, and has a built-in module on population dynamics and labor supply. The particular version model used in this analysis is developed by Fan Zhai as an extension of our earlier work on China's pension reform (Wang, Yan et al. 2001) based on a newly estimated Chinese Social Accounting Matrix of 2000. It has seven production sectors, 2 representative households, and is specified and solved in levels.[4]

Firms' ownership structure and production

[3] A survey of the application of the CGE model in taxation and public policy can be seen in Pereia and Shoven 1988. A survey of the application of the CGE model in developing countries is found in Robinson 1992. A survey of recent developments regarding CGE model application in on trade policy is given by Garbaccio and Plummer 1997.

[4] The model is implemented using the General Algebraic Modeling System (GAMS; Brooke, Kendrick, and Meeraus, 1988). Due to space limitation, only a description of the major characteristics of the model is presented. A detailed algebraic specification is available from the authors upon request.

There are seven sectors in this model, namely, agriculture, township and village enterprises (TVEs), rural informal sector, state and collective enterprises[5], the government and public institutions, other urban formal sector[6] and urban informal sector. We assume that one represent firm exists in each of the productive sectors, which produces only one product. Production uses primary factors and other products (both domestic and imported) as variable inputs in a cost-minimizing way, and is characterized by a multilevel nesting of constant elasticity of substitution (CES) functions. At the first level, firms are assumed to use a composite of primary factors, i.e., value-added and an aggregate intermediate input according to a CES cost function. Technology in all sectors is assumed to exhibit constant returns to scale. At the second level, the division of intermediate demand is assumed to follow a Leontief specification; therefore, there is no substitution among intermediate inputs.

Agricultural land as a sector-specific factor is used only in agricultural production, physical capital is mobile between sectors. Labor force is distinguished by its location, i.e. urban and rural. Labor force is regional specific: the rural sectors use rural labor force only and urban sectors use urban labor only. But within urban area and within rural area, labor force is fully mobile across sectors. The transfer of labor force from rural to urban is implemented through exogenous population migration.

Domestic and import demand

Agents are assumed to consider products from domestic supply and imports as imperfect substitutes (the Armington assumption). The two representative households (one in urban and another in rural areas) are assumed to maximize a Stone-Geary utility function over 3 composite (Armington) goods (Agricaltural goods, Non-agricultural goods and public goods) subject to their budget constraints, which leads to the Extended Linear Expenditure System. Household savings are treated as a demand for future consumption goods with zero subsistence quantity (Howe 1975). A household-specific, aggregate consumer price index is specified as the price of savings. It represents the opportunity cost of giving up current consumption in exchange for future consumption (Wang and Kinsey 1994). Other final demands, including public spending and investment demand, are based on constant share functions that fix their structure in real terms. The intermediate inputs for the firms, household consumption, and other final

[5] The Chinese economy is a mixed economy under transition where the state sector plays a declining role in production and employment, and the non-state sector is expanding rapidly. The multi-ownership structure of the economy is expected to persist for some time. However, China's pre-'95 tax system covers only state-owned enterprises. Thus, an analysis of tax system reform in such an economy requires a model that differentiates production and employment by ownership types.

[6] These include private enterprises, joint stock companies, and foreign joint venture companies.

demands constitute the total demand for the same Armington composite of domestic products and imported goods from the rest of the world.

Income and Government policy instruments

Production generates income, which is distributed to four major institutions, namely, enterprises (corporations), households, the government, and extra-budget public sectors. Corporate earnings equal a share of gross operating surplus, i.e., sum of capital remuneration across all sectors, minus corporate income taxes. A part of net company income is allocated to households as distributed profits based on fixed shares, which are the assumed shares of capital ownership by households. Another part of net company income is allocated to extra-budget public sectors as fee. Retained earnings, i.e., corporate savings for new investment and capital depreciation replacement, equals after-tax company income minus the distributed profits and fee.

Household income consists of labor earnings and the returns from land and capital the household owns. Additionally, households pay taxes, receive tax benefits, transfers from the government, and remittances from the rest of the world. Household disposable income equals the sum of household income from different sources less various taxes.

The government derives revenues from direct corporate and household income taxes, import tariffs, and various types of indirect taxes. Subsidies and export tax rebates enter as negative receipts. Two types of indirect taxes are included in the model. The value-added tax, which is the most important part of indirect tax in China after 1994 tax reform, is treated as a tax levied on production factors; its revenues equal total sector value-added multiplied by a tax rate. The other indirect tax is treated as a production tax levied on sectoral outputs.

All tax rates are taken as parameters in the model. However, they can be endogenized to meet government fiscal targets, in which case an adjustment parameter associated with each type of taxes become endogenous. It shifts in or out to achieve government budget balance. Otherwise, the tax schedules are exogenous and the adjustment factors remain at their initial value of one. An adjustment factor on government transfers, similar to the adjustment factors on other taxes, provides another fiscal instrument to achieve a specified budget target.

The extra-budget public sector collects fees from enterprises and households. Their income is allocated to consumption and saving. The spending by extra-budget public sectors and government constitutes public consumption, one type of the final demands.

Intra-period equilibrium and macroeconomic closure

Equilibrium is defined as a set of prices and quantities for goods and factors such that (a) demand equals supply for all goods and factors; (b) each industry earns zero profit; and (c) gross investment equals aggregate savings, which is the sum of domestic savings plus foreign capital inflows.

There are three major macroeconomic balances in the model: (a) the government budget, (b) aggregate savings and investment, and (c) the balance of payments. In the benchmark equilibrium all these three accounting balances hold. The behavioral aspect of macro closure in CGE model involves choosing a mechanism by which macroeconomic balances are brought back into equilibrium when exogenous shocks disrupt the benchmark during an experiment. Thus, a macroeconomic scenario is imposed on the CGE model, and then the sectoral implications of the assumed macroeconomic behavior can be traced out (Devarajan, Lewis, and Robinson 1990).

Given China's small trade share in the world, a small-country assumption is used for imports, i.e. we assume that the local consumption of imports does not affect the border price of imports. Exports are demanded by the rest of the world according to constant-elasticity demand curves, the price elasticity of which are high but less than infinite (Pomfret 1997). An exchange rate is specified to convert world prices into domestic prices. Either this exchange rate or the balance of payment can be fixed while the other is allowed to adjust, providing alternative closure rules.

Since the purpose of this paper is to estimate the impact of tax reform, we keep the domestic savings and investment gap constant in all the simulations conducted. This is achieved by keeping the balance of payments and real government spending fixed as share of real GDP. In such a way, macroeconomic rigidity is imposed on the model. By a macroeconomic identity, this closure implies that a constant sum of domestic savings and taxes in real terms is needed to finance both real investment and real government expenditures. Thus, any changes in real GDP are induced by changes in real absorption, i.e., household consumption plus other final demand, thus making it easy to compare the efficiency impacts of different simulations.

Inter-period linkage and recursive dynamics

The intra-period equilibrium is solved recursively from 2000 to 2050. Between each two periods, dynamic growth in the model originates from three sources: rate and demographic structure of labor force growth, accumulation of physical capital stocks, and improvement of total factor productivity. Capital stock in each simulation period equals last period's capital stock plus gross investment minus

depreciation. All net investments in the previous period are assumed to become new production capital in the next period. Accumulation patterns for capital stock depend upon the depreciation rate and gross investment rate, which is set exogenously as a percentage of GDP. However, household and corporate savings, government surplus (deficit), and foreign capital inflow (foreign savings) are assumed to be perfect substitutes and collectively constitute the sources of gross investment.

The equilibrium data set of the model at base year is constructed around a Chinese social accounting matrix for Tax reform estimated for 2000. It includes 7 production sectors and 2 representative households.[7] It provides a consistent framework for organizing the relevant flow-of-value statistics for China's economy to satisfy the requirements of a benchmark data set for CGE modeling, as outlined in Whalley (1985).

5.3 Baseline Calibration

To calibrate a baseline, we introduce an economy-wide Hicks-neutral TFP variable into the model. It is solved endogenously in the calibration to match a pre-specified path of real GDP growth. The growth rate of real GDP is set to decline linearly from 7.5 percent in 2000 to about 3 percent in 2050.

Table 4c presents the baseline calibration results under the assumptions specified in table 4a and 4b. This calibrated benchmark serves as a basis of comparison for counterfactual simulation analysis presented later. All the endogenously solved macroeconomic and demographic variables seem to fall into reasonable range. TFP - as a residual and an adjusting mechanism in the model to match the pre-specified real GDP growth rate and the gross investment rate - decline gradually from 2.35 percent a year in 2010 to 1.01 percent in 2050, which seems consistent with recent estimations of TFP growth in China.

[7] The base year data set and key parameters used in the model are available from authors upon request.

Table 4a Baseline calibration: assumptions on macro economic variables

Category	Assumptions
Macroeconomic variables	- Real GDP is exogenous in the baseline - TFP growth rate is endogenous - Gross investment rate declines from 36.9 percent of GDP in 2000 to 30 percent of GDP in 2050 - Trade balance gradually declines to 0 in 2020.
Demographic parameters	- See table 4b
Government fiscal closure	- Government consumption, transfers and saving (excluding saving/deficits for pension) are exogenous - Corporate tax rate is endogenous to achieve government budget balance - All other tax rates are fixed at base year level.

Table 4b Baseline calibration: assumptions on demographic parameters

	Urban			Rural			Rural-Urban Migration
	Life Expectancy-male	Life Expectancy-female	total fertility rate	Life Expectancy-male	Life Expectancy-female	total fertility rate	(Mn people)
2000	70.98	76.3	1.39	68.79	73.33	2.10	7.08
2010	72.98	78.63	1.60	71.42	76.44	2.24	7.67
2020	74.23	79.52	1.58	72.85	78.32	2.22	10.04
2030	75.13	80.38	1.58	74.25	79.78	2.21	12.25
2040	76	81.22	1.57	75.42	80.65	2.20	7.57
2050	76.86	82.05	1.57	76.29	81.49	2.20	6.24

Source: China Population Information and Research Center.

Table 4c. Baseline calibration - results

Year	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Annual growth rate (%) – 5 year average										
GDP	7.18	6.73	6.29	5.86	5.43	4.98	4.54	4.09	3.64	3.18
Labor	1.45	0.87	0.39	0.01	-0.23	-0.25	-0.34	-0.53	-0.59	-0.51
Capital	9.23	8.06	7.24	6.51	5.83	5.19	4.62	4.09	3.60	3.13
TFP	2.23	2.35	2.22	2.03	1.83	1.61	1.46	1.34	1.19	1.01

VI. Simulation results

Three sets of policy simulations are conducted. Simulation set 1 reduces cooperate tax which equal to 2.5, 5, 7.5 and 10 percent of base year wagebill respectively and shift them into household income tax accordingly. What we did is add household's wage income by the same amount as the reduced cooperate tax and in the meantime increase household income tax rate (determined endogenously) to increase income tax payment by the same amount. Simulation set 2 focuses on transfer tax burden from value-added tax to household tax, also at four different levels of base year wagebill. Simulation set 3 further examines the financial impact of tax reform if the shift of tax burden from the enterprises to households is the combination of transferring both cooperate tax and value added tax to household income tax.

Real GDP and economic growth rates during 2000-2020 resulting from the baseline calibration and the three sets of policy simulation at 5 percent of base year wagebill are presented in Table 5 for comparison.

Table 5 Impact on Real GDP and Economic Growth Rate (10 Billion RMB)

Year		2000	2001	2002	2003	2004	2005	2010	2015	2020
Base	Real GDP	903.48	969.95	1040.48	1115.15	1194.14	1277.65	1769.10	2400.37	3191.63
	Growth rate		0.0736	0.0727	0.0718	0.0708	0.0699	0.0655	0.0612	0.0569
Cut cooperate tax	Real GDP	904.92	976.59	1052.21	1131.81	1215.58	1303.70	1815.45	2460.77	3259.93
	Growth rate		0.0792	0.0774	0.0756	0.0740	0.0725	0.0660	0.0607	0.0560
Cut value-added tax	Real GDP	906.42	976.66	1050.97	1129.24	1211.72	1298.58	1804.74	2445.94	3242.34
	Growth rate		0.0775	0.0761	0.0745	0.0730	0.0717	0.0658	0.0607	0.0562
Cut combination of taxes	Real GDP	905.71	976.67	1051.64	1130.58	1213.71	1301.21	1810.19	2453.48	3251.30
	Growth rate		0.0783	0.0768	0.0751	0.0735	0.0721	0.0659	0.0607	0.0561

It is very clear that the real GDP increase almost 0.7 percent from 969.95 to 976.59 (10 billion RMB) in 2001, next year of the proposed tax reform. The economic growth rate increases almost 0.56 percent. The results prove that shifting tax burden from producer to consumer is benefit to economic growth. The positive effect on GDP growth is very significant during the first 5 years, however, the effect will diminishing with time.

The simulation results of simulation set 2 on GDP and economic growth rate are list at the fifth and sixth row in Table 5 if the value-added tax has been cut the same amount which equal to 5 percent of base year wagebill. Shifting certain amount of value-added tax from producer to consumer has also

positive effect on GDP growth rate, even its effect is not as strong as to shift the cooperate tax.

Because total value of cooperate tax is around 14 percent of total government tax revenue, the room to shift cooperate tax to household income tax is limited. The results of simulation set 3 are shown on seventh and eighth row in Table 5 when the shift of cooperate tax and value-added tax to personal income tax equal to 2.5 percent of wagebill in the base year respectively. The impact on real GDP and economic growth rate is just in the middle between two previous simulations.

The effects of tax reform on aggregate investment are listed in Table 6. It is very beneficial to shift tax burden from producer to consumer because the aggregate investment may significantly increase after tax reform.

Table 6 Impact on Aggregate Investment (10 Billion RMB)

Year	2000	2001	2002	2003	2004	2005	2010	2015	2020
Base	323.00	345.79	371.14	398.17	426.75	457.04	634.88	856.08	1116.48
Cut cooperate tax	351.56	377.30	405.62	435.29	466.36	498.97	685.91	912.04	1174.48
Cut value-added tax	343.90	368.68	396.17	425.01	455.28	487.12	670.96	894.90	1155.25
Cut combination of taxes	347.76	373.02	400.93	430.18	460.86	493.08	678.49	903.53	1164.94

Table 7 presents the government tax revenue after tax reform. Because the tax reform could increase the GDP growth rate, the government tax revenue is also increase when the net income of the consumer who on the average wage level remain the same.

Table 7 Impact on Government Tax Revenue (10 Billion RMB)

Year	2000	2001	2002	2003	2004	2005	2010	2015	2020
Base	133.81	139.23	152.98	161.45	170.18	179.16	230.73	293.68	366.50
Cut cooperate tax	156.89	163.01	177.53	186.63	195.93	205.43	258.97	323.27	397.20
Cut value-added tax	153.52	159.29	173.65	182.48	191.52	200.77	253.03	315.52	386.28
Cut combination of taxes	155.20	161.15	175.59	184.56	193.73	203.11	256.01	319.40	391.75

The impact on aggregate consumption level is shown in Table 8. Because there are only two representative households in our model, we are not able to introduce progressive personal income tax system into the simulation design, the aggregate consumption level may decrease during a short run. The negative impact on aggregate consumption would be mostly eliminated after the progressive personal tax system. However, the aggregate consumption will increase in a long run because of the dramatic increase in investment as shown in table 6.

Table 8 Impact on Aggregate Consumption (10 Billion RMB)

Year	2000	2001	2002	2003	2004	2005	2010	2015	2020
Base	431.44	467.02	503.53	541.90	582.37	624.98	874.56	1198.36	1615.60
Cut cooperate tax	404.24	441.93	480.41	520.91	563.53	608.29	868.30	1200.48	1622.82
Cut value-added tax	413.64	450.92	488.96	529.01	571.17	615.49	873.25	1203.74	1625.67
Cut combination of taxes	408.95	446.44	484.70	524.98	567.38	611.91	870.82	1202.17	1624.33

Table 9 presents the impact of cooperate tax allowing the comparison of various percentage to see which has more stimulus to economic growth. The figures in Table 9 imply that the more the tax burden shifts from producer to consumer the stronger the stimulus to economic growth.

Table 9 Impact of cooperate tax cuts on real GDP (10 Billion RMB)

Year	2000	2001	2002	2003	2004	2005	2010	2015	2020
Base	903.48	969.95	1040.48	1115.15	1194.14	1277.65	1769.10	2400.37	3191.63
Shift 10.0% tax	906.58	984.38	1065.91	1151.13	1240.28	1333.53	1867.18	2527.17	3334.57
Shift 7.5% tax	905.81	980.78	1059.59	1142.24	1228.94	1319.86	1843.64	2497.09	3300.80
Shift 5.0% tax	904.92	976.59	1052.21	1131.81	1215.58	1303.70	1815.45	2460.77	3259.93
Shift 2.5% tax	904.26	973.56	1046.88	1124.25	1205.87	1291.93	1794.65	2433.77	3229.46

Comparing the GDP growth rates under different scenarios, we find that the proposed tax reform will positively and significantly affect the GDP growth. The new tax system will push the GDP growth rates up in the short to medium run.

Our simulation results provides useful insights for the design of China's tax system reform and illustrates how CGE models can be valuable tools for evaluating different tax systems and transition options. Results show that the current tax system is inefficient.

However, several important limitations need to be mentioned. First, we assume agents adjust their behavior according to information received in the last period. Thus, the existence of a future tax will not affect agents' saving behavior today. Second, the model does not specify explicitly the different behavior rules of the various types of firms in China, but assumes that they all operate to maximize profit. A third limitation is that the model may overestimate the impact of various tax reform policies on macroeconomic

variables because it does not include an explicitly specified financial market. Gross national savings are assumed to become gross investment, implying a perfect capital market, which is far from the reality in China. Fourth, the simulation results may under- or overestimate the real effects of tax policy because the model does not take tax collection costs into account, while the collection cost is one of the major obstacles for implementing a more broad personal income tax system in China. Therefore, the simulation results must be interpreted with caution and may be best understood as indicative rather than conclusive.

VII. Concluding Remarks

This research provides a tool to quantitatively analyze the economic effects of personal income tax reform. We need include more variables and develop more advanced models to implement the theory in practice. Obviously, not all sectors need to adjust their wage payments by the same amount. However, time and resource limitations force us to leave the research work on effects of progressive income taxes on income distribution and economic efficiency for another paper.

The analysis suggests that shifting some of the tax burden from producers to consumers may improve economic growth, household saving, investment and government tax revenue without sacrificing society's standard of living. The tax reform will change the macro-economic structure, including sectoral labor demand and the relative price system. The more the adjustment, the stronger the impact. To improve economic growth while maintaining social stability, tax reforms must be conducted cautiously and consistently with other macroeconomic policies.

References

Beghin, John, Dessus, Sebastien, Roland-Holst, David, and van der Mensbrugghe, Dominique, “Prototype CGE Model for the Trade and the Environment Program-Technical Specification.” OECD Working paper, Center of Organization for Economic Co-operation and Development, Paris, 1994.

Brook, Anthony, David Kendrick, and Alexander Meeraus. 1998. *GAMS a User's Guide*. New York: The Scientific Press.

Dahl, Henrik, Devarajan, Shantayanan, and Wijnbergen, S. van, “Revenue-Neutral Tariff Reform: Theory and Application to Cameroon.” CPD Discussion Paper No. 1986-25, the World Bank, Washington, DC, 1986.

Ding, Xuedong (1994), "New Tax System in China", Economic and Management Publishing House.

Dorfman, Mark C. Dlaus Lorch and Chunlin Zhang. 2000. “Linking Tax and State Enterprise Reform in China.”

Paper presented in the China Development Forum Conference on China Social Security System, August 2000.

Hang, Feng. 1999. “The Situation of Development of China’s Basic Tax Insurance Undertaking.”

Holzmann, Robert. 1988. “Reforming Public Taxes.” OECD, Paris.

Kumar, Anjali, and Yan Wang. 1999. “Tax Fund Management and China’s Financial Market.” In Yin, Lin and Gates, eds., *Social Security Reform: Options for China*. World Scientific, Singapore, p. 153-180.

Leslie, P.H. 1945. “On the Use of Matrix in Certain Population Mathematics.” *Biomatrika* 33:183-212.

Pereira, Alfredo and John Shoven. 1988. “Survey of Dynamic Computational General Equilibrium Models for Tax Policy Evaluation.” *Journal of Policy modeling* 10(3):401-436.

Ma, Hong and Shangqin Sun (1995) "Economic Situation and Prospect of China", China Development Publishing House.

Robinson, S. (1988) "Macroeconomic Structure and Computable General Equilibrium Models", Journal of Policy Modelling, Vol.10(3), 353-375.

Srinivasan, T.N., John Whalley, eds. (1986) "General Equilibrium Trade Policy Modelling." MIT Press, Cambridge, Mass.

Von Gersdorff, H. 1997. “*The Bolivian Tax Reform: Innovative Solutions to Common Problems*.” Working Paper, World Bank, Washington, D.C.

Wang, Yan, Dingqing Xu, Zhi Wang and Fan Zhai “Implicit Pension Debt, Transitional Cost, Options and impact of China’s Pension Reform: A Computable General Equilibrium Analysis.” Policy Research Working Paper 2555, The World Bank, World Bank institute, February 2001.

Wang, Zhi, and Jean Kinsey, 1994 “Consumption and Saving Behavior under Strict and Partial Rationing” *China Economic Review*, 5, 1:83-100.

Wang, Zhi and Fan Zhai, 1998 "Tariff Reduction, Tax Replacement, and Its Implication for Income Distribution in China." *Journal of Comparative Economics* 26(2): 358-87

Whalley, John, *Trade Liberalization among Major World Trading Areas*. MA: The MIT press, 1985.

Varian, H. (1984) "Microeconomic Analysis", W.W. Norton & Company.

Xu, Dianqing (1993) "Price Distortion in the Transition Process: A CGE Analysis of China's Case", Economics of Planning, Vol.26, 161-182.