Market Reform and Income Distribution in China: A CGE–Microsimulation Approach

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Abstract

Through 30 years of significant reform in the commodity markets and the relatively slow liberalization on the factor market, income disparity has been a serious problem affecting China's economy. Policies for inclusive growth—economic growth with fair income distribution—are desirable and urgently required for China. This study uses a computable general equilibrium–microsimulation approach (CGE–MSA), which benefits from both the powerful analysis of the comprehensive economic activities of the CGE model and the heterogeneity among microsimulated households, to analyze the effects of macroeconomic policies on income disparity under different assumptions about the factor market in China. The database for this study includes the macro social accounting matrix of China and a Chinese household income survey from 2002. We conclude that (1) both industrial and trade policies have a greater impact on income growth under a segmented factor market (SFM) than under an integrated factor market (IFM), (2) rural and immigrant households would benefit more than urban households from industrial and trade policies, and (3) an SFM is not favorable for the poor.

JEL classification: C68, D31, D58, O53

Keywords: Factor Market Integration, Income Disparity, CGE-Microsimulation Approach, China

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1. Introduction

Since reform and the opening up of the country from 1978 onward, China has experienced steady economic growth, and the people's welfare has improved. According to the perspective of general equilibrium theory, which focuses on market-oriented optimal behavior of institutions and market equilibrium, China's economic system before 1978 was centrally planned to optimize the behavior of institutions and create equilibrium in the segmented marketplace. The great reform in 1978, named Gradual Reform, was initially implemented to transform the behavior of farmers under a command economy to that under a market economy; however, it transformed the command-oriented approach to the commodity market. Reform in the factor market lagged behind, however, resulting in a high degree of factor market segmentation in China, which might have been responsible for the severe income disparity during the rapid economic growth.

Income disparity between China's urban and rural areas is very high compared with that around the world due to its institutional arrangement—called household registration system (HRS)—combined with the traditional structural differences between urban and rural areas. Figure 1 shows that the income ratio between urban and rural residents (U/R) was cyclical from 1990 to 2011 and increased along with economic growth. U/R was less than 2.2 in 1990, before surging to 2.85 in 1994 during the period of high inflation in China. Under tight macroeconomic policies, U/R dropped to 2.45 in 1997, but rapidly rose again to 3.25 after the Asian financial crisis. This was followed by small, steady increases from China's admission to the World Trade Organization (WTO) in 2002 until 2009. With increasing fiscal support from the government for agriculture and the rural areas, China's U/R decreased to 3.1 in 2011, a trend that is expected to continue in the near future.

Severe income disparities between the provinces and industries are also important indicators of economic dysfunction in China. According to research by the Inequality Project at the University of Texas, interprovincial and intraprovincial income disparity increased from 1987 to 2006, based solely on industrial wage data in the formal sectors.[1] Before 2005, the interprovincial Theil index was greater than the intraprovincial Theil index, implying that the income disparity between provinces contributed more toward the national income disparity than disparity between industries did. Since China has a large land area, uneven income distribution among regions is acceptable. However, after 2005, the intraprovincial Theil index exceeded the interprovincial Theil index. Since the former measures income disparity between industries within each province, its surpassing the latter implies that income disparity between industries contributes more toward the national income disparity than disparity between provinces does. The reason for this reversal should be of concern.

Income disparity is always generated by two sources. One is the quantity of household

[1] Detailed information on this research and database is found at http://utip.gov.utexas.edu/data.html.

endowments such as capital, labor, human capital, and land. The other is the accessible price of household endowments, which are affected by the performance of factor markets. In a perfectly competitive factor market with full factor mobility, an endowment must be equally priced. In contrast, an endowment would be available at different prices in a segmented factor market (SFM) with factor immobility. Labor and capital are the most common household endowments in China. For example, in 2011, the share of income from labor and capital was 76% and 93% for urban and rural households, respectively, while the remainder comprised transfers from the government and relatives. Therefore, the functions of both the labor and capital markets could significantly influence income disparity.

The labor market experienced a significant transformation after 1978. On the one hand, people from rural areas could be employed by urban sectors. On the other hand, urban residents could change their jobs across sectors, although there was a somewhat high transaction cost. Zhou (2004) shows that interindustrial labor mobility increased between 1978 and 1988, and it continued in agriculture until 1993. In the meantime, interindustrial labor mobility in manufacturing, social services, construction, and the government began declining, especially since 1993, when interindustrial labor mobility in all four industries declined. Therefore, there has been an increasing degree of segmentation in China's labor market since 1993.

Mobility in the capital market is similar to that in the labor market. It is assumed that if the variation of capital return increases across sectors or regions, then there is a greater degree of segmentation across sectors or regions in the capital markets. Zhang and Tan (2005) show that segmentation declined from 1978 to 1992 and then rapidly reversed after 1993. The evolution of sector polarization indicates that capital became more immobile across sectors, while the reduction of regional polarization after 1996 shows that it became more mobile across regions. Therefore, there has been an increasing degree of segmentation across sectors in the capital market since 1994.

We draw two significant trends from the above analysis: income disparity across industries contributes more toward the national income disparity than does that across provinces, while both labor and capital become more immobile across industries. It is intuitive that factor immobility across industries might be correlated with increasing income disparity between industries. In this study, we examine the policy effects on income disparity under different degrees of factor mobility across sectors.

To overcome economic dysfunction, the Chinese government established ambitious goals and implemented many reforms based on home and overseas experience. Inclusive growth is a recent strategy proposed by former President Jintao Hu in 2010; he stated that inclusive growth entailed spreading the benefits of economic globalization and development among all countries, regions, and people, as well as realizing balanced economic and social progress through sustainable development. Actually, inclusive growth was first suggested in a report by the Asian Development Bank in 2007, wherein it referred to the pace and pattern of growth, that is, a high, sustainable growth record, as well as poverty reduction (ADB, 2007).

Since it was introduced in 2007, dozens of economists have commented on inclusive growth. Ali and Zhuang (2007) believe that inclusive growth means growth with equal access to opportunities; it focuses on both creating opportunities and making the opportunities universally accessible. Growth is inclusive when it allows all members of society to participate in and benefit from the growth process on an equal basis, regardless of individual circumstances. From a policy perspective, Zhuang (2008) contends that inclusive growth implies high and sustainable growth to create and expand economic opportunities as well as equal access to these opportunities to ensure that all members of society can participate in and benefit from the growth process. Ianchovichina and Lundstrom (2009) conclude that the inclusive growth approach adopts a long-term perspective by focusing on productive employment rather than direct income redistribution to increase incomes for the excluded groups. Thus, inclusive growth can be summarized as the integration of factor markets and equal income distribution.

Before evaluating China's practice of inclusive growth, we should clearly understand the following issues: what is the impact of reform in the factor market on income inequality and growth? What is the impact of economic policy on income inequality and growth in an SFM and in an integrated factor market (IFM)? How does the factor market influence the effects of economic policy on income inequality and growth?

Besides China, many developing countries and international institutions have focused on the practices and policies of inclusive growth. A macro-micro analysis is used to understand issues related to inclusive growth, such as the relationship between macro (growth) and micro (poverty and its distribution) variables (Bourguignon et al., 2010). A computable general equilibrium-microsimulation approach (CGE-MSA), which benefits from both the economy-wide effects of a macro analysis using the CGE model and the heterogeneity of a micro analysis using microsimulation, has been widely used for macro-micro analysis. Therefore, such analysis provides a useful framework to study how the factor market influences the policy effects on income inequality and growth, and the CGE-MSA makes this objective feasible.

This study uses CGE-MSA to simulate the impact of different economic policies on income inequality and growth under different assumptions about the factor market in order to explore the effect of the factor market on policies for inclusive growth in China. Section 2 reviews the research on the methodologies and applications of advanced models of income distribution and growth. Section 3 describes the structure of CGE-MSA and the different scenarios of the factor markets. Section 4 defines and adjusts the data used for the CGE-MSA. Section 5 analyzes the effects of different policies under SFMs or IFMs. Section 6 concludes.

2. Literature Review

The empirical studies conducted thus far primarily focus on the measurements, causes, and consequences of income disparity (see Yang, 1999; Li and Zhao, 1999; Xu and Zou,

2000; Gustafsson and Li, 2002; Chang, 2002; Wang and Fan, 2004; Wan, 2007; Sicular et al., 2007) and offer supportive assumptions for the policy and external shock simulations.

The simulated research can be classified into three groups according to the adopted methodologies. The first studies the policy effect on income disparity at the macro level, which affects the economy as a whole. Many similar studies have analyzed the impact of China's accession to the WTO on income distribution using CGE analysis (Yang and Huang, 1997; Wang and Zhai, 1998; Zhai and Li, 2000; Wang et al., 2005). There is also research that focuses on the impact of growth patterns on income distribution in China (He and Kuijs, 2007). In addition, there is research that investigates the impact of the fiscal dimension of China's government transfers and preferential tax policies on regional income disparity and poverty reduction (Wang et al., 2010), as well as that which examines the impact of rural income support policies on rural income inequality (Heerink et al., 2006). The second group studies the policy implications at the micro level and considers the differences between the behavior of households and firms. Zhang and Wan (2008) analyze the impact of the income tax system on household income distribution in China based on a microsimulation model. The third group studies the macro policy effect on micro behavior and attempts to incorporate both the economy-wide effects and heterogeneous micro-behaviors. Chen and Ravallion (2004) study the welfare impacts of China's accession to the WTO at the household level using a CGE-microsimulation approach. Although these three groups have their merits in terms of policy simulation, they also have shortcomings. For example, the first group cannot capture the change in household income because it assumes a representative household in their macro models. The second group cannot consider the economy-wide effect of policies at the micro level, and the third group provides a comprehensive approach based on those of the other groups, however, it has several specific weaknesses. For example, Chen and Ravallion (2004) do not adopt a true macro-micro approach due to the disequilibrium in the commodity market. Yan et al. (2011) conduct policy simulations based on a CGE integrated multi-household (CGE-IMH) model, which adequately considers both micro heterogeneity and the macro economy. However, they assume that the factor market is integrated and do not consider the reality of factor immobility across industries.

Empirical studies on the impact of factor markets on income distribution in China suggest that integration-oriented reform in the factor market positively affects income disparity. Based on a household survey in northern China in the 1930s, Benjamin and Brandt (1997) show that the integration of factor markets reduced inequality in rural areas. Several studies argue that an SFM has significantly contributed to the recent urban–rural disparity (Cai and Yang, 2000; Li, 2003) and regional disparity (Cai et al., 2001; Lin and Liu, 2003; Wan et al., 2005), as rural area residents did not have opportunities equal to those of urban residents because of unfair institutions. Furthermore, in a paper published in the *American Economic Review*, Song et al. (2011) concluded that the disequilibrium in China's economy is primarily due to a segmented capital market.

CGE–MSA is conducted worldwide in policy analysis in terms of five types of issues

related to inclusive growth. The first relates to the impact of trade policies on income distribution (Cororaton, 2003; Vos and De Jong, 2003; Chen and Ravallion, 2004; Annabi et al., 2005; Chitiga et al., 2007; Herault, 2007 and 2010; Rutherford and Tarr, 2008; Chitiga et al., 2010). The second type of issue concerns the impact of fiscal policies on income distribution (Cockburn, 2001; Ahmed et al., 2008; Peichl, 2008; Savard, 2010). The third focuses on the impact of industrial policies on income distribution (Boccanfuso and Savard, 2008; Labandeira et al., 2009; Arndt et al., 2010; Boccanfuso and Savard, 2010; Yan et al., 2011). The fourth type of issue concerns the impact of factor market reform on income distribution (Arntz et al., 2008; Chitiga and Mabugu, 2008; Boeters and Feil, 2009; Ortega Diaz, 2009), while the final type of issue relates to the impact of environmental policies on income distribution (Buddelmeyer et al., 2009).

Summing up, we know that the factor market is important for income distribution and that CGE-MSA is used to simulate the impact of policies related to the factor market on income disparity. However, reforming the factor market is not a smooth process; therefore, policymakers' fears of undesirable effects require further scenario analysis before policies are implemented.

3. Model

A CGE-MSA household model with detailed household information is essential for issues such as income distribution or heterogeneous households. The three popular CGE–MSAs are the CGE-IMH, CGE microsimulation sequential (CGE-MSS), and CGE top-down/bottom-up (CGE-TD/BU) approaches. The CGE-IMH approach incorporates all households included in a household survey into the CGE model after achieving consistency between the national accounts for the CGE model and the micro data from a household survey (Decaluwé et al., 1999). This indicates that household behavior of the labor supply and commodity purchases in the household model are consistent with the assumptions in the CGE model. The CGE-MSS approach is superior to the CGE model when the household model assumes a linkage between the CGE and household models (Bourguignon et al., 2005). This means that the household behavior of the labor supply is discrete and affected by household characteristics such as education, gender, and location. In this approach, the factor market, especially the labor market, is in equilibrium, but the commodity market is not market clearing because of the lack of feedback of household consumption. The CGE-TD/BU approach is an extension of CGE-MSS due to its consideration of the feedback effect from the household to the CGE model (under the premise that the change in household behavior due to the effect of the CGE model will significantly impact the macro economy). It is therefore important to address the feedback effect (Savard, 2010). This approach is also an extension of CGE-IMH, wherein there is a change in household behavior of the labor supply from restricted to discrete choices, and in which other factors also impact the labor supply decisions of households. Figure 2 demonstrates the framework for the CGE-IMH approach.

This study compares the above three CGE–MSAs in terms of behavior and equilibrium in the factor and commodity markets, data consistency, and speed of solving the problem.

3.1. Behavior and Equilibrium in Factor Markets

Although labor and capital are the fundamental factors that provide households with stable income flows, this study only discusses the labor market for three reasons. First, labor is the primary factor of households in developing countries, especially in China. Second, the interest rate in China is fixed by the government, not the capital market; therefore, it is improper to analyze the capital market in the general equilibrium model. Third, there is a lack of data about capital holdings at the micro level.

The labor market is widely analyzed in the literature regarding the application of CGE–MSAs. In the CGE-IMH model, labor supply behavior is fixed; households do not decide between working and not working, but they do decide the amount of time they should work in response to the change in wages determined by the labor market. This model assumes that the labor market will return to equilibrium after external shocks or macro policies due to wage flexibility; thus, there is no unemployment in the labor market. In the CGE-MSS and CGE-TD/BU models, labor supply behavior is discrete; households choose whether to work or not, and their choices are either made at random or depend on individual household characteristics. These models assume that the labor market is not market clearing under certain shocks or macro policies, and that there will be workers who cannot find employment.

3.2. Behavior and Equilibrium in Commodity Markets

Equilibrium in the commodity markets is the essential feature of general equilibrium theory. In both the CGE-IMH and CGE-TD/BU models, the household commodity demand is equal to the commodity supply by the firm, although this equilibrium in the latter model is always referred to as the feedback from households to the CGE model. In the CGE-MSS model, the commodity markets are not in equilibrium since the model only considers the transmission from CGE to households in the labor market and neglects the feedback to the CGE model in the commodity markets.

3.3. Data Consistency

A CGE-IMH model must compile a detailed social accounting matrix (SAM) that includes all households in the micro database. Therefore, it is necessary to balance the macro and micro data. But in the CGE-MSS and CGE-TD/BU models, one does not have to adjust the micro and macro data, because the CGE and household models are relatively separate. The advantage of these two models is that they do not have to balance the data, which is a time consuming task. However, this is also their weakness, as there are errors in the

simulations resulting from data inconsistency.

3.4. Solution Speed

The solution speed depends on the variables and equations in the model. The CGE-IMH model takes a long time to solve due to the enormous number of variables and equations related to each household in the micro database. The CGE-MSS model is solved in the shortest time since there are only a few representative households in the CGE model, and the second step in the household model is a type of statistical regression that does not need much time to solve. The time required by the CGE-TD/BU model falls between the time needed by the CGE-IMH and CGE MSS models, because the CGE-TD/BU model includes a loop between the CGE and household models.

Considering the above comparative analyses, we contend that CGE-IMH and CGE-TD/BU are both suitable for China under different research purposes, and that CGE-MSS is not as suitable as these two models because it does not reach equilibrium in the commodity markets. Furthermore, since data inconsistency is more important in the macro–micro framework than the role of discrete behavior in labor supply, and the computation time is not critical, it is advisable to choose the CGE-IMH model.

The CGE used here is based on the standard CGE model by Lofgren et al. (2002). Its production functions are nested, while total production is generated by a Leontief function between value added and intermediates at the top level nest. The value added is determined by a constant elasticity of substitution (CES) function among three factors. Intermediate demand by sector is modeled as a Leontief function. There is no home-made commodity, and all commodities are sold through the market. Factor demands are determined by the enterprise's cost-minimizing behavior. The closure choices in the factor market are as follows: (1) the supply of each factor is fixed; (2) the relative wage and rent across sectors are fixed; and (3) the average wage and rent are endogenously determined by market forces.

The nominal consumer price index is considered the numeraire. All other prices are variable, except the world price. The price of commodity imports is equal to the world price multiplied by the exchange rate plus the respective commodity tariff. The price of commodity exports is equal to the world price multiplied by the exchange rate minus the respective commodity tariff. The domestic price is equal to the producer price plus an indirect tax.

The produced output is the aggregate output sold in the domestic market or exported to foreign markets. The imperfect transformation of the aggregate good into exports and domestic goods is given by a constant elasticity of transformation (CET) function. Producers attempt to maximize their profit from sales, given the constraint in the transformation. The elasticity of export demand is assumed to be finite because China is a large country. The price received by producers is given in the domestic currency. In the domestic market, the commodity is bought by households and the government, and is also used for investment and intermediate inputs. Domestic prices are changeable and equilibrate the demand and supply

of each commodity. The domestic market also contains imported commodities. These are combined in a CES function—alternatively called an Armington function—to form a composite commodity for each commodity. The international supply of imports is assumed to be infinitely elastic at the given world prices. The Armington specifications allow two-way trades as well as some degree of independence in domestic prices (Chitiga et al., 2007).

Institutions consist of households, enterprises, the government, and the rest of the world. Households receive their income from wages based on the labor they provide, from rent based on the capital they lend, and from transfer payments received from the government, enterprises, and the rest of the world. On the other hand, households spend their income by consuming commodities, saving, paying direct taxes, and making transfers to other institutions. Consumption demand is specified as a linear expenditure system (LES), which is commonly used in CGE models and is derived by maximizing a Stone–Geary utility function. The calibration of subsistence consumption is performed on the income elasticities and Frisch parameters after adjusting the elasticities to ensure that they satisfy an Engel aggregation in the LES demand system (Dervis et al., 1982). All households are assumed to have the same utility function and Frisch parameter, but different income elasticities are assumed between urban, rural, and immigrant households. Enterprises receive income from capital and transfers from other institutions. They pay dividends to their shareholders (e.g., households who invest in the enterprise), pay direct taxes to the government, save, and transfer income to other institutions. However, they do not consume commodities.

The model comprises 18,035 households derived from Chinese Household Income Project (CHIP), which is a randomly derived sample from a national representative survey, in 2002. The expenditure and income data for each household are extracted and linked to the macroeconomic data. Instead of only a few representative households, all the households surveyed are scaled up to the national population. This micro data now form part of the SAM and are directly used to calibrate parameters, such as the share parameters in the LES system, and to solve the CGE model. We can then trace the individual impact of policies on each household due to their different sources of income and patterns of expenditure. Incomes and expenditures are compared before and after the simulation to check the changes in income distributions following the initial policy simulation.

The government imposes taxes on institutions, commodities, and various activities. These taxes are given at fixed ad valorem rates. Direct taxes apply to enterprises and most households. The government spends its income on commodities and transfers to other institutions. All transfers to households are fixed. The choices of government closure are as follows: (1) the government demand and direct tax scaling factors are fixed, (2) the change in the domestic institution tax share is fixed, and (3) government savings and government consumption share of absorption are endogenous. When the government cuts taxes for agribusiness sectors or commodities, there are consequences in terms of government revenue. The government’s response to this is obviously very important. Based on the government closure, public savings must be adjusted to balance the government account.

The choice of closure in the savings–investment balance is the neoclassical type, in which the change in marginal propensity to save and saving rate scaling factor are fixed, while investment scaling factor for fixed capital formation and investment share of absorption are endogenous. The choice of closure in current accounts in the rest of the world is a fixed exchange rate, while foreign saving is endogenous.

3.5. Alternative Settings of the Factor Market

Alternative factor market closures reflect different mechanisms for equilibrating supply and demand in factor markets. In an IFM closure, the quantity of each factor is fixed at the observed level. An economy-wide wage variable may freely vary to ensure that the total demand from all industries equals the supply. Each industry pays an industry-specific wage, that is, the product of the economy-wide wage and an industry-specific wage (distortion) term. Since the requirements for labor quality vary by industry, it is acceptable to assume a fixed, industry-specific wage. Meanwhile, if the relative wages in certain industries differ from the industry-specific wage, the factor market would flow from industries with relatively low wages to those with relatively high wages. Therefore, an IFM closure is determined so that the average wage is an endogenous variable, while the industry-specific wage is an exogenous variable.

In an SFM closure, each industry is forced to hire the observed, base year quantity, that is, the factor is industry specific. The average wage is an exogenous variable, while the industry-specific wage is an endogenous variable. Therefore, in an SFM closure, the factor market is immobile across industries.

4. Data

Data in the CGE–MSA model is a detailed SAM, which consists of income and expenditure data from a household survey and data from a national SAM. This section describes the compilation of the national SAM, the balance of household data, and the reconciliation between household data and the national account.

4.1. Compilation of the National SAM

In the national SAM (Table 1), there are eight institutions within the matrix. Since the household survey was conducted in 2002, this study compiles the national SAM from 2002. The 2002 database for the national SAM includes an input-output table, the Finance Yearbook of China, the Tax Yearbook of China, and the cash flow statement of China. The items (12), (14), (16), (18), (32), (62), and (81) are derived from an input-output table with 122 sectors; (26), (63), and (64) come from the Finance Yearbook; (38), (83), (53), (45), (46), and (68) are computed from the cash flow statement; (61) is from the Tax Yearbook; and (17),

(21), (43), (74), (75), (76), and (78) are treated as balance items. Table 2 is the final national SAM.

4.2. Balance of Household Data

The CHIP survey comprised almost 18,000 households in 2002 and several variables. This study focuses on the educational level, income, and expenditure variables. We classify the households into either unskilled or skilled, depending on the educational level of the heads of each household. The number of people within each household is treated as a weighted value.

The income items of urban households are as follows: (1) wage and subsidy, (2) other income from work, (3) net income from private businessmen or self-employed, and (4) property income and transfer income. The consumption expenditure items of urban households include the following: (1) food; (2) clothing; (3) home equipment, facilities, and services; (4) health and medical expenditures; (5) transportation and communication; (6) entertainment, education, and cultural services; (7) housing and related items; and (8) miscellaneous goods and services such as expenditures on building and buying houses, transfers, property, and related debits and credits.

The income items of rural households include wages, gross income from household operations, and other household income, which includes (1) income from collective welfare funds, (2) other monetary income from the various levels of government or collectives, (3) income brought back or remitted by household members who lived and worked outside the household, (4) gifts from relatives and friends, (5) income from renting or contracting out land, (6) income from renting out other assets, (7) income from interest and dividends, and (8) other income. The expenditure items of rural households include the following: (1) staple food, (2) non-staple food, (3) other food expenditures, (4) clothing, (5) transportation and communication, (6) consumption goods for daily use, (7) durable goods, (8) medical care, (9) education, (10) housing, (11) purchasing fixed capital for production, (12) depreciation of productive fixed capital, (13) interest, (14) taxes and fees, and (15) others.

The income items of immigrant households include the following: (1) income from employment, (2) income from family production, (3) income from assets, (4) cash gifts, and (5) others. The expenditure items of immigrant households include the following: (1) staple food; (2) non-staple food; (3) alcohol; (4) cigarettes; (5) clothes; (6) household equipment, facilities, and services; (7) health and medical; (8) transportation and communication; (9) local entertainment, education, and cultural activities; (10) housing; (11) gifts, including cash; (12) charges for certificates; (13) miscellaneous; and (14) home remittances.

Based on the above variables, this study divides household income into five categories on the basis of income from labor, income from capital, income transferred from enterprise, income transferred from government, and income transferred from abroad. Household expenditures are divided into the consumption of eight commodities, government income tax,

and savings. In the CHIP database, household income is not always equal to household expenditure. We treat this discrepancy as a change in savings. Therefore, similar to the assumption in the national SAM that treats savings as a balance item, we treat savings in the micro data as a balance item while fixing the other variables as constants.

4.3. Conciliation between Household Data and the National Account

After obtaining the national SAM and household financial data, we must still balance the income and expenditure items between these two databases. There are two ways to balance the macro and micro data. One is to fix the macro data and adjust the micro data to the macro data. The other is to fix the micro data and adjust the macro data to the micro data (Robilliard and Robinson, 2003). Since the CHIP data is a representative sample of all Chinese households, we choose the first method to balance the data and use cross entropy for the adjustments.

Following Golan et al. (1996), the estimation procedure of cross entropy is

$$\min \sum_{n=1}^{N}\sum_{i=1}^{I} p_{n,i} \ln(\frac{p_{n,i}}{q_{n,i}}) \quad (1).$$

Subject to moment consistency constraints,

$$\sum_{n=1}^{N} p_{n,i} = 1 \quad (2),$$

$$\sum_{i=1}^{I} p_{n,i} x_i = y_n \quad (3),$$

where y_n is the share of household n's total income or expenditure of all households included in the micro data, x_i is the share of item i's total income or expenditure of all household items included in the macro data, $q_{n,i}$ is prior survey probabilities that result in a vector of observed characteristics for each household, and $p_{n,i}$ is the objective weight that we attempt to estimate.

5. Empirical Analysis

5.1. Settings of Alternative Scenarios

To analyze the impact of policies on income distribution and growth under alternative factor markets, this study simulates two policies under both IFM and SFM. The first is an industrial policy that cuts 50% of the value-added tax for all industries. The Chinese

government has reformed the value-added tax in some provinces since 2004 to the benefit of many industries. The second is a trade policy that cuts 50% of the tariffs on imported goods. Since China's entry into the WTO, the tariffs on most commodities have been reduced. Therefore, there are four scenario settings:

S1: value-added tax is cut by 50% (Industrial Policy) under IFM
S2: tariff on imported goods is cut by 50% (Trade Policy) under IFM
S3: value-added tax is cut by 50% (Industrial Policy) under SFM
S4: tariff on imported goods is cut by 50% (Trade Policy) under SFM

Considering the economic indicators for the change in income inequality and economic growth under each scenario, this study uses indexes of the rate changes for the Gini coefficient (CRGC) and average income (CRAI).

Since China is a large country, in addition to the investigation at the national level, this study analyzes the impact of policies at both the urban and rural levels (urban, rural, and immigrant households) and the regional level (eight regions).

5.2. Results of the Four Scenarios

Figure 3 shows CRGC and CRAI under the four scenarios at the national level. Under S1, CRGC and CRAI are positive at 0.314% and 0.513%, respectively. This implies that income distribution is more restrictive relative to economic growth when the value-added tax is cut by 50% (Industrial Policy) under IFM. Under S2, CRGC and CRAI are positive at 0.027% and 0.513%, respectively. Since CRGC under S2 is smaller than that under S1, while CRAI remains constant, we conclude that trade policy is better than industrial policy under IFM. Under S3, CRGC and CRAI are positive at 0.932% and 0.761%, respectively. Under S4, CRGC is −0.078%, while CRAI is 0.978%, which is in line with inclusive growth. Both industrial and trade policies have a greater impact on income growth under SFM than under IFM. Moreover, industrial policy has a greater negative effect on income inequality under SFM, while trade policy has a smaller effect on income inequality under IFM.

Figure 4 shows CRGC and CRAI under the four scenarios at the urban and rural levels. Under S1, CRGC and CRAI in urban households are positive, while CRGC in rural and immigrant households are negative. Furthermore, there is little change in income in these households, implying that industrial policy positively influences income disparity in rural and immigrant households under IFM. However, industrial policy has a significantly negative impact on income inequality in urban households. Under S2, CRAI in all three types of households is positive, while CRGC shows little change. Under S3, all indexes are positive, except CRAI in urban households. Under S4, income disparity declines with increasing income. We conclude that rural and immigrant households would benefit more from industrial and trade policies than would urban households, and trade policy supports inclusive

growth for urban, rural, and immigrant households under SFM.

Table 3 shows CRGC and CRAI under the four scenarios at the regional level. Under S1 and S3, almost all CRGC and CRAI measures are positive. Under S2, CRGC is negative in nearly half the regions, while CRAI is positive in all regions. Under S4, CRGC in all regions is negative, while CRAI in all regions is positive. We conclude that (1) the impact of industrial policy on income growth under IFM is smaller than that under SFM, (2) the negative impact of industrial policy on income inequality under IFM is smaller than that under SFM, and (3) both impacts of trade policy on income inequality and growth under IFM are generally smaller than those under SFM. This study uses data from 2002, when the Chinese government prioritized economic efficiency with due consideration to fairness and did not implement thorough reform of the factor markets. The scenario results suggest that comprehensive reform would not favor economic efficiency or fairness, thus supporting the Chinese government's gradual reform style.

If we classify households according to income levels, we gather that they conform to traditional expectations: poor households will benefit more than rich households under IFM, while rich households will benefit more than poor households under SFM. Under S1, the top 50% of household average incomes increase by 0.48%, while the bottom 50% increases by 0.122%. Under S3, the top 50% increases by 0.56%, while the bottom 50% increases by 8.2%. Therefore, it is not good for households with low incomes to have an SFM.

6. Concluding Remarks

Through 30 years of significant reform in the commodity markets and the relatively slow liberalization in the factor market, income disparity has been a serious problem affecting China's rapid economic growth. Inclusive growth–economic growth with fair income distribution–is desirable and urgently required for China. This study uses a CGE–MSA, which benefits from both the powerful analysis of the comprehensive economic activities of the CGE model and the heterogeneity among microsimulated households, to analyze the effects of macroeconomic policies on income disparity under different assumptions about the factor market in China. The database for this study includes the macro SAM of China and a Chinese household income survey in 2002. We conclude that (1) both industrial and trade policies have a greater impact on income growth under an SFM than under an IFM, (2) rural and immigrant households would benefit more than urban households from industrial and trade policies, and (3) an SFM is not favorable for the poor. Because of data limitations, although an SFM is not favorable for the poor, our conclusions that a thorough reform of the factor market would not favor inclusive growth might be valid only for 2002. To analyze factor market reforms along with economic growth, we should conduct our simulations based on additional years such as 2007 or 2012.

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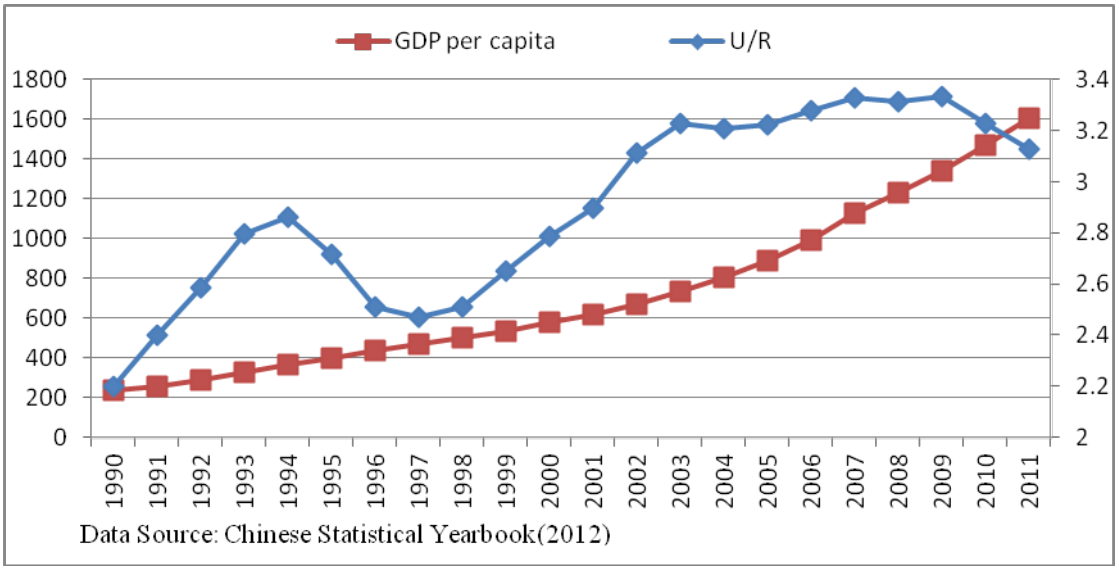
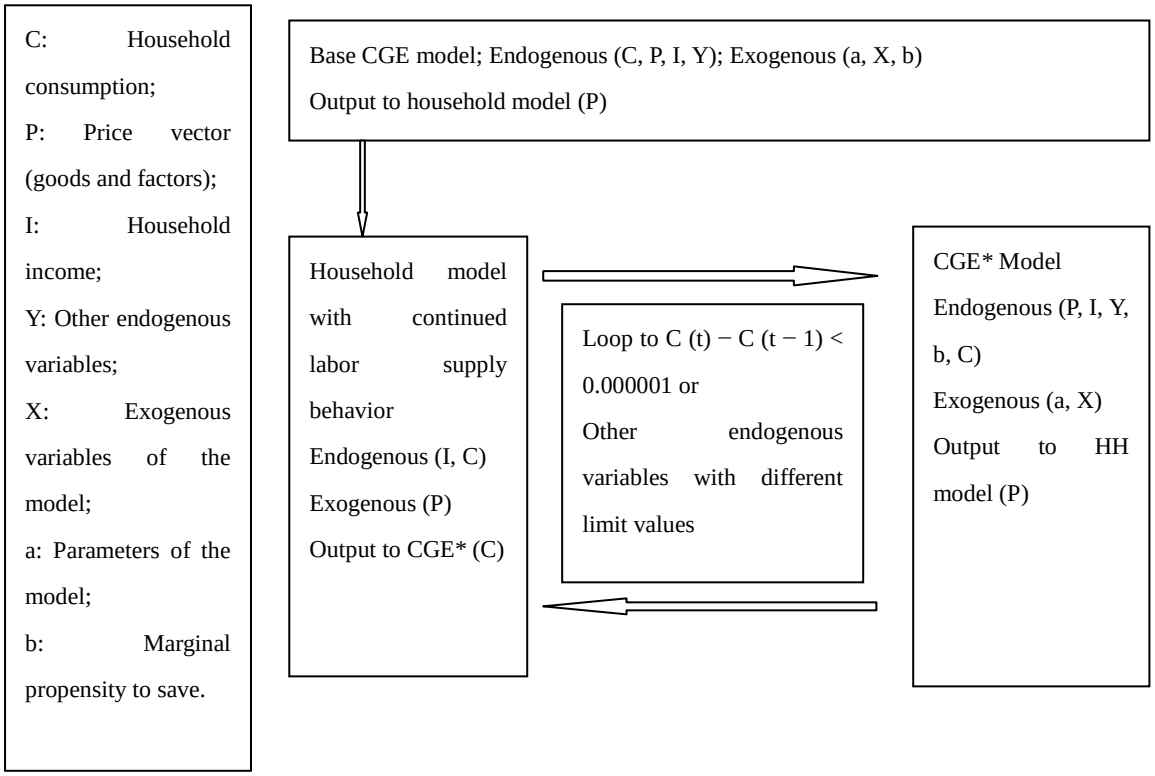
Figure 1 Economic Growth and Ratio of Urban to Rural Income



(Source) China Statistical Yearbook (2012)

Figure 2 The Framework of CGE Integrated Multi-household Approach



(Source) Authors

Table 1 The Framework of China's National SAM

	Commodity	Industry	Factor	Household	Enterprise	Government	Investment and saving	Rest of the world	Total
Commodity		(12)		(14)		(16)	(17)	(18)	(19)
Industry	(21)					(26)			(29)
Factor		(32)						(38)	(39)
Household			(43)		(45)	(46)		(48)	(49)
Enterprise			(53)						(59)
Government	(61)	(62)		(64)	(65)			(68)	(69)
Investment and saving				(74)	(75)	(76)		(78)	(79)
Rest of the world	(81)		(83)			(86)			(89)
Total	(91)	(92)	(93)	(94)	(95)	(96)	(97)	(98)	

(Source) Authors

Table 2 China's National SAM in 2002 (in billion yuan)

	Commodity	Industry	Factor	Household	Enterprise	Government	Investment and saving	Rest of the world	Total
Commodity		19,157		5,257		1,912	4,907	3,033	34,266
Industry	31,341					194			31,535
Factor		10,437						69	10,507
Household			6,268		1,735	110		108	8,221
Enterprise			4,047						4,047
Government	202	1,941		121	381			1	2,646
Investment and saving				2,843	1,932	428		−296	4,907
Rest of the world	2,723		193			1			2,917
Total	34,266	31,535	10,509	8,221	4,047	2,646	4,907	2,915	

(Source) Authors

Figure 3 CRGC and CRAI under Four Scenarios at the National Level

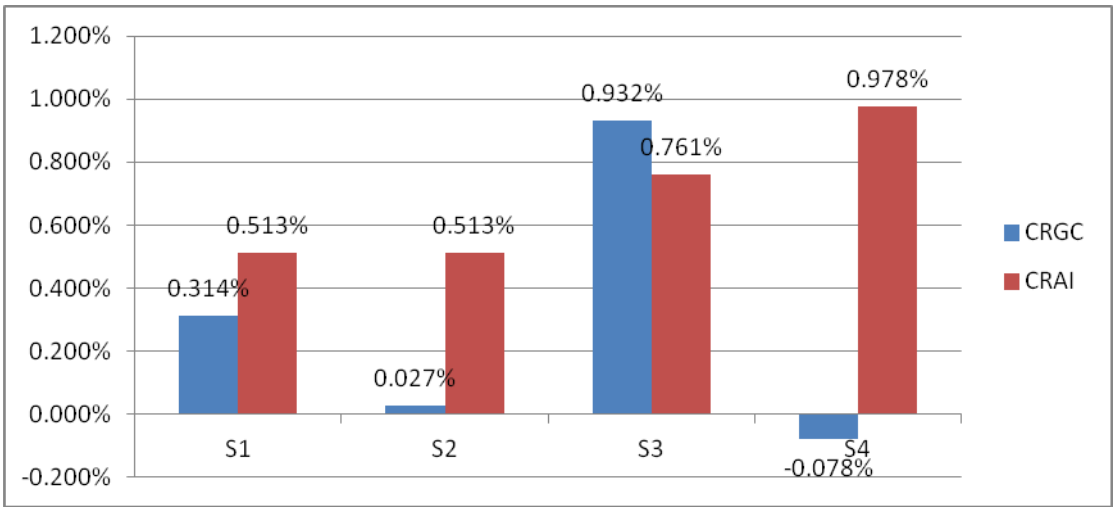


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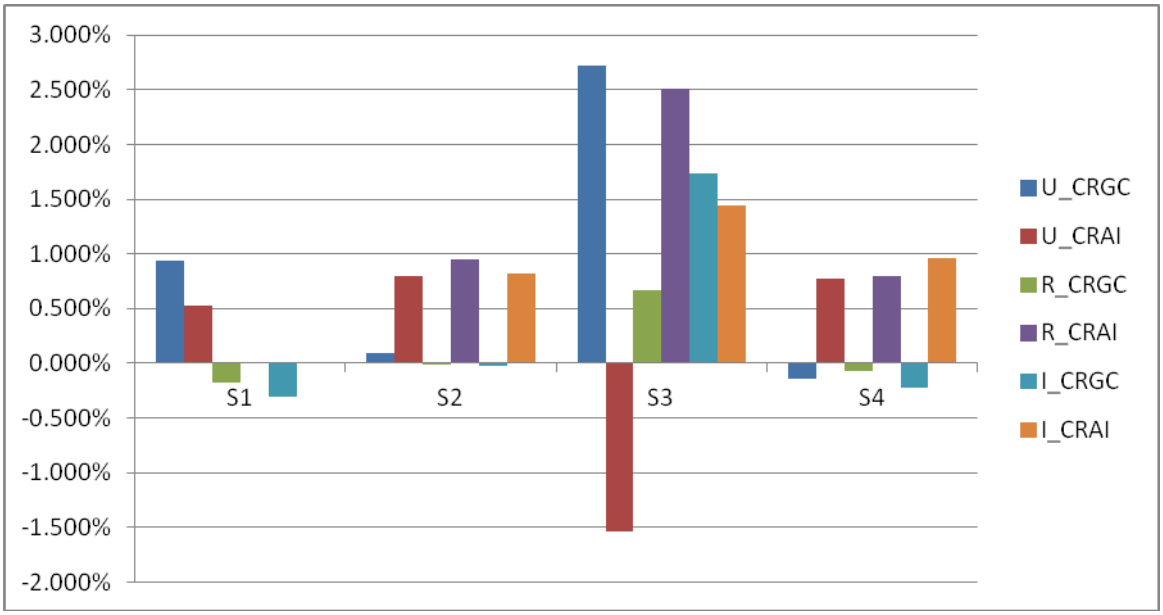
Figure 4 CRGC and CRAI under Four Scenarios at the Urban and Rural Levels



(Source) Authors

Table 3 CRGC and CRAI under Four Scenarios at the Regional Level

Scenarios	**S1**		**S2**		**S3**		**S4**	
Regions	CRGC	CRAI	CRGC	CRAI	CRGC	CRAI	CRGC	CRAI
Northeast China	0.124%	0.000%	**−0.076%**	**0.515%**	0.834%	0.359%	**−0.082%**	**0.958%**
Capital Region	1.150%	1.134%	0.440%	1.134%	1.359%	−1.190%	**−0.073%**	**0.595%**
North China	−0.118%	0.000%	**−0.005%**	**0.926%**	0.924%	2.390%	**−0.096%**	**0.930%**
Central coast	0.271%	0.365%	**−0.116%**	**0.730%**	1.789%	0.704%	**−0.117%**	**0.704%**
Southeast China	0.250%	0.000%	0.013%	0.637%	1.028%	0.621%	**−0.076%**	**0.621%**
Central China	0.526%	0.568%	0.075%	0.568%	1.196%	0.505%	**−0.090%**	**0.884%**
Northwest China	0.040%	0.885%	**−0.044%**	**0.885%**	0.967%	1.246%	**−0.108%**	**1.068%**
Southwest China	0.268%	0.592%	0.010%	0.592%	0.851%	0.641%	**−0.077%**	**1.026%**

(Source) Authors