Application of the Dynamic CGE Model in Chinese Indirect Tax Reform

Xuemei Shen
College of Economics Ritsumeikan University, Japan

Kazuo Inaba
College of Economics Ritsumeikan University, Japan
Contents

• 1. Introduction: Background and goal
• 2. Growth Accounting for Chinese Economy
  • 2.1 Solow residual
  • 2.2 Measurement of Chinese economy productivity
• 3. Construct SAM for China
  • 3.1 How SAM is defined in System of National Accounts (SNA)
  • 3.2 China’s System of National Accounts (CSNA)
• 4. SAM based CGE model
  • 4.1 Entire economy
  • 4.2 From Statistic model to dynamic model
  • 4.3 Simulation case
• 5. Simulation Result
  • 5.1 Influence on macroeconomics in the statistic model
  • 5.2 Influence on macroeconomics in the dynamic model
• 6. Conclusion
1. Introduction:

**Background**

- **Recent Indirect Tax system reform in china**
  
  **i. 1994 Tax Sharing Reform:**
  - **GNP type Value Added Tax (VAT):** 45% in total tax revenue (1994)
  - **Business tax (BT-impose on service sectors):** 13% in total tax revenue (1994)
  - **Enterprise Income Tax:** 14% in total tax revenue (1994)
    - Indirect tax vs. direct tax ⇒ Imbalanced tax system
  
  **ii. GNP type VAT:** from 2009 shifted to consumption type VAT
  
  **iii. Business Tax (BT):** from 2016 replace with VAT
1. Introduction:

Background II

- **Recent Indirect Tax system reform in China**
  
i. **1994 Tax Sharing Reform:**
   - *GNP type Value Added Tax (VAT):* 31% in total tax revenue (2016)
   - *Business tax (BT-impose on service sectors):* 9% in total tax revenue (2016)
   - *Enterprise Income Tax:* 20% in total tax revenue (2016)
   - Indirect tax vs. direct tax ⇒ **Imbalanced tax system**
  
  ii. **GNP type VAT:** from 2009 shifted to consumption type VAT
  
  iii. **BT (business tax):** from 2016 replace with VAT
1. Introduction:

**Background**

- **Review**
  


- **Static CGE model**

  - **Result**
    
    - → Relieve the tax burden
    
    - → Domestic production increase
    
    - → Household welfare improved
    
    - → Government tax revenue decrease
But the real economy is under dynamic movement

- Not only tax reform → influence to the macro-economy

→ economy growth also crowding out the tax reform
1. **Introduction:**

**Goal of this paper**

1. **Growth Accounting**
   - Solow residual
   - Measurement of Chinese economy productivity

2. **Build SAM for China (2012)**
   - China’s Input-Output table (2012)
   - China’s Social National Accounts (CSNA)

3. **Construct Dynamic CGE model based on the SAM**
   - VAT reform (2016) how to influence on—
     - Chinese macro economy
     - Indirect tax & direct tax revenue *(economic growth how to crowd out the tax reform)*
   - In the statistic model vs. In the dynamic model
2. Growth Accounting

Solow Residual

- **The restriction of dynamic CGE model**
  - The model based on single period data are obtained from an economy
  - Parameters are calibrated for this base year I-O table
  - growth → exogenous

- **Cobb-Douglas production function**

\[
Y_t = A_t K_t^\alpha L_t^{1-\alpha}
\]

\[
\log(Y_t) = \log(A_t) + \alpha \log(K_t) + (1 - \alpha) \log(L_t)
\]

- **Solow Residual (TFP)**

\[
\frac{\partial \log(A_t)}{t} = \frac{\partial \log(Y_t)}{t} - \alpha \frac{\partial \log(K_t)}{t} + (1 - \alpha) \frac{\partial \log(K_t)}{t}
\]

- Value added: \( Y_t \)
- TFP (a function of productivity): \( A_t \)
- Physical capital: \( K_t \)
- Labor: \( L_t \)
## 2. Growth Accounting

### DATA Source for growth accounting

#### Nominal Data
- China I-O Table
- 30 sector

#### Real Data
- CIP (The China Industrial Productivity) database by RIETI (Research Institute of Economy, Trade and Industry, JP)
- EU KLEMS Project
- 37 sector

### Regression

$$\frac{\partial \log(A_t)}{\partial \log(Y_t)} = \frac{\partial \log(Y_t)}{t} - \alpha \frac{\partial \log(K_t)}{t} + (1 - \alpha) \frac{\partial \log(K_t)}{t}$$

**Estimate:** $Y_t = A_t K_t^\alpha L_t^{1-\alpha}$

### Solow Residual (TFP)

$$\log(A_t) = \lambda_t \log(e) + \log(A'_t)$$

**Estimate:** $Y_t = A_t e^{\lambda t} K_t^\alpha L_t^{1-\alpha}$

<table>
<thead>
<tr>
<th>Nominal Data</th>
<th>Real Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ China I-O Table</td>
<td>✓ CIP (The China Industrial Productivity) database by RIETI (Research Institute of Economy, Trade and Industry, JP)</td>
</tr>
<tr>
<td>✓ 30 sector</td>
<td>✓ EU KLEMS Project</td>
</tr>
<tr>
<td>✓ 37 sector</td>
<td>✓ 37 sector</td>
</tr>
</tbody>
</table>

- Y: Gross Value added
- K: Surplus + Depreciation
- L: Compensation for employees + Indirect Taxes (less, subsidies)
$\ln Y = \ln A + \lambda t \ln e + \alpha \ln K + \beta \ln L$
2. Growth Accounting

Capital vs. Labor growth rate vs. Working Hour

Graph showing the comparison between capital growth rate, labor growth rate, and working hour growth rate over the years from 1981 to 2009. The graph includes a legend indicating the lines representing working hours/month (right axis), employee growth rate, working hour growth rate, and capital stock growth rate.
2. Growth Accounting

Measurement of Chinese productivity by nominal data
2. Growth Accounting

Measurement of Chinese productivity by nominal data

2007

2012

TFP

Capital

Labor

K

L

A

AGRI MIN PETRO METAL NONMETAL FOODTAB TEXT WEARING TIMBER PAPER REFINPETRO CHEM NONMINEPRO PROCMETAL METALPRO MACHIN TRNEQ ELEMAC ELEEQ MEASUR OTHMANU UTILITY CONST TRANS RETAIL ACCOMM FIN EDU SER PUBSER Total
2. Growth Accounting

Measurement of Chinese productivity by real data
2. Growth Accounting

Measurement of Chinese productivity by real data
2. Growth Accounting

\[
\exp(\ln A) \exp \lambda
\]

A\_real

A\_nominal

after 10 years

\exp \lambda
\( Y = AK^\alpha L^\beta \)

\[ 0.6 \times x^{0.3} \times y^{0.7} \]

\( Y = Ae^{\lambda t} K^\alpha L^\beta \)

\[ 0.8 \times 2.7^t \times x^{0.3} \]

\[ 0.8 \times 2.7^{(t \times (-0.6))} \times x^{0.3} \]
China’s National Accounts System

- **National Income Accounts system in China**
  
  
  ii. Second stage (1985 to 1992): coexistence of MPS and SNA
  
  iii. Third stage (1993 to present): adoption of SNA

  - keep the of MPS-based national income system in this era

- China’s National Accounts (CSNA2002)
  - CSNA 2002 attempted to coincidence with the 1993SAN
China’s System of National Accounts (CSNA2002)

- **China’s System of National Accounts 2002 (CSNA2002):**
  - Based on the 1993 SNA
  - Non-profit institutions (NPI): serving households sector
    - In 1993 SNA: classified to one of economic sector,
    - In CSNA2002: financed by government
  - Tariff
    - In 1993 SNA: the tariff is contained in the *production tax*
    - In Chinese Input-Output table: the production tax not include the tariff, so separate the tariff from the imports

Japan-China Input-Output table(2007) by the Ministry of Economy Trade and Industry of Japan to separate the tariff from the import.
3. Construct SAM for China

Standard Macro SAM

<table>
<thead>
<tr>
<th>Commodity and Services</th>
<th>Production Accounts</th>
<th>Expenditure</th>
<th>Capital Accounts</th>
<th>Non-financial Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities</td>
<td>Tariff</td>
<td>Domestic Final Consumption</td>
<td>Income</td>
<td>Tax Distribution</td>
</tr>
<tr>
<td>Subsidies</td>
<td>Domestic Final Consumption</td>
<td>Income</td>
<td>Tax Distribution</td>
<td>Current Transfer</td>
</tr>
<tr>
<td>Final Consumption</td>
<td>Domestic Final Consumption</td>
<td>Income</td>
<td>Tax Distribution</td>
<td>Current Transfer</td>
</tr>
<tr>
<td>Domestic Capital Expenditure</td>
<td>Domestic Capital Expenditure</td>
<td>Income</td>
<td>Tax Distribution</td>
<td>Current Transfer</td>
</tr>
</tbody>
</table>

ⅰ. the supply and use of goods and services

ⅱ. production

ⅲ. the distribution of income

ⅳ. the use of income

ⅴ. the capital transactions

Source: refer 1993SNA (Schematic presentation of a SAM, 1993SNA, pp.470) compiled by author
## Detailed SAM Table

| 100million Yuan | AGRI | MN | FOOD | MANFCT | MACHN | COMM | UTILITY | CONST | FIR | SERVS | CAP | LAB | DEP | HOH | GOV | INV | IDT | TRF | EXT |
|-----------------|------|----|------|--------|-------|------|---------|-------|-----|-------|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|
| AGRI            | 12321| 25 | 31841| 15207  | 150   | 2601 | 6       | 1888  | 514 | 697   |     |     |     |      |     |     |     |     |
| MN              | 6    | 7160| 221  | 57519  | 525   | 4    | 10984   | 870   | 27  | 136   |     |     |     |      |     |     |     |     |
| FOOD            | 9412 | 234 | 20021| 3414   | 1035  | 1822 | 186      | 1131  | 1227| 2248  |     |     |     |      |     |     |     |     |
| MANFCT          | 9176 | 7213| 3845  | 215056 | 68712 | 1884 | 2405     | 77683 | 14960| 15914 |     |     |     |      |     |     |     |     |
| MACHN           | 763  | 3353| 362   | 15803  | 105892| 1299 | 3791     | 12693 | 13310| 4322  |     |     |     |      |     |     |     |     |
| COMM            | 1398 | 954 | 4555  | 13158  | 39975 | 708  | 5544     | 8291  | 5033 |       |     |     |     |      |     |     |     |     |
| UTILITY         | 893  | 3131| 786   | 16828  | 3291  | 1083 | 16764    | 3226  | 1215| 1270  |     |     |     |      |     |     |     |     |
| CONST           | 1093 | 1422| 2891  | 12694  | 7087  | 3198 | 957      | 17375 | 6177 | 4640  |     |     |     |      |     |     |     |     |
| FIR             | 1741 | 3452| 2415  | 17284  | 13473 | 13982| 3184     | 18172 | 37956| 7642  |     |     |     |      |     |     |     |     |
| SERVS           | 262  | 401 | 324   | 2234   | 1764  | 873  | 518      | 2256  | 3042 | 3934  |     |     |     |      |     |     |     |     |
| CAP             | 6899 |    | 5877  | 52638  | 15127 | 3274 | 428      | 5032  | 13719| 35193 |     |     |     |      |     |     |     |     |
| LAB             | 10438|    | 6418  | 15177  | 33492 | 29058| 47796    |       |     |       |     |     |     |      |     |     |     |     |
| DEP             | 2257 | 2741| 2168  | 13996  | 22709 |     | 6366     |       |     |       |     |     |     |      |     |     |     |     |
| HOH             | 12738|    | 264134| 71682  |       |     |         |       |     |       |     |     |     |      |     |     |     |     |
| GOV             |       |    | 35818 | 73606  | 2784  |     |         |       |     |       |     |     |     |      |     |     |     |     |
| INV             | 239746|   | 28119 | Saving |     |     |         |       |     |       |     |     |     |      |     |     |     |     |
| IDT             | -2896|    | 6172  | 6237   | 18426 | 7570 | 1716     | 2007  | 5862 | 11668 |     |     |     |      |     |     |     |     |
| TRF             | 10   | 42  | 337   | 1295   | 888   | 147  | 42       | 52    |     |       |     |     |     |      |     |     |     |     |
| EXT             | 5108 | 24855| 3044  | 28394  | 47342 | 21   | 3348     | 4160  | 1830 |       |     |     |     |      |     |     |     |     |

### Notes
- **SAM based CGE model and Scenarios**
- Values in thousands of Yuan.
- **Intermediate inputs** highlighted in red.
4. SAM based CGE model and Scenarios

Structure of the entire economy

\[ Y_j = b_j \prod_h F_{h,j}^{\beta_{h,j}} \]
\[ b_j = A_j e^{\lambda_j t} \]

\[ \sum_j X_{ij} (input) \]

\[ M \text{ (import goods)} \]
\[ D \text{ (domestic goods)} \]
\[ E \text{ (export goods)} \]

 CES\( \alpha = 2 \)

 CES\( \alpha = 2 \)

 \[ T_j^z \text{ (production tax)} \]

 Leontief

 \[ Z \text{ (domestic production)} \]

 \[ X_{ij} \text{ (input)} \]

 CEB-Douglas

 \[ F_{\text{capital}} \]

 \[ F_{\text{labor}} \]

 goods flow

 Financial flow

GAMS /path
From Statistic model to dynamic model

**Labor**

\[ F_{lab,t+1} = (1 + \text{pop})F_{lab,t} \quad \forall \text{lab}, t \quad \text{(1)} \]

**Capital**

\[ KK_{j,t+1} = (1 - \text{dep})KK_{j,t} + \text{II}_{j,t} \quad \forall j, t \quad \text{(2)} \]

\[ F_{\text{cap},t+1} = ror_j KK_{j,t} \quad \forall j, t \quad \text{(3)} \]

\[ KK00_j = F00_{\text{cap},j} / ror00_j \quad \text{(4)} \]

\[ p_t^k \Pi_{jtt} = \frac{p_{\text{cap},j,t+1}^f f^f \hat{F}_{\text{cap},j,t+1}^f \xi}{\sum_i p_{\text{cap},j,t+1}^i f^f \hat{F}_{\text{cap},j,t+1}^i \xi} (S_{it}^{\text{hp}} + S_{it}^{\text{sp}} + \epsilon S_{it} f^f \xi (\text{myopic expectation})) \quad \text{(5)} \]

- \text{variable00} … in the initial
- \text{variable0} … in BAU growth
- \text{variable1} … After some sock

\[ \text{pop} = 1\% \]

\[ \text{ror00} = 6\% \]
4. SAM based CGE model and Scenarios

From Statistic model to dynamic model


⇒ **Ramsey model**
### 4. SAM based CGE model and Scenarios

#### Tax Rate

<table>
<thead>
<tr>
<th>Sector</th>
<th>before tax reform</th>
<th>after tax reform</th>
<th>before tax reform</th>
<th>after tax reform</th>
<th>before tax reform</th>
<th>after tax reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRI</td>
<td>0.115</td>
<td>0.099</td>
<td>METALPRO</td>
<td>0.145</td>
<td>0.145</td>
<td>RETAIL</td>
</tr>
<tr>
<td>MN</td>
<td>0.145</td>
<td>0.145</td>
<td>GENMACHN</td>
<td>0.145</td>
<td>0.145</td>
<td>TRANS</td>
</tr>
<tr>
<td>PETRO</td>
<td>0.145</td>
<td>0.145</td>
<td>SPEMACHN</td>
<td>0.145</td>
<td>0.145</td>
<td>ACCOMM</td>
</tr>
<tr>
<td>METAL</td>
<td>0.145</td>
<td>0.145</td>
<td>TRNEQ</td>
<td>0.145</td>
<td>0.145</td>
<td>TECHSER</td>
</tr>
<tr>
<td>NONMETAL</td>
<td>0.145</td>
<td>0.145</td>
<td>ELEMAC</td>
<td>0.145</td>
<td>0.145</td>
<td>FINANCE</td>
</tr>
<tr>
<td>FOODTAB</td>
<td>0.115</td>
<td>0.115</td>
<td>ELEEQ</td>
<td>0.145</td>
<td>0.145</td>
<td>REALES</td>
</tr>
<tr>
<td>TEXT</td>
<td>0.145</td>
<td>0.145</td>
<td>MEASUR</td>
<td>0.145</td>
<td>0.145</td>
<td>RENT</td>
</tr>
<tr>
<td>WEARING</td>
<td>0.145</td>
<td>0.145</td>
<td>OTHMANU</td>
<td>0.145</td>
<td>0.145</td>
<td>SCISER</td>
</tr>
<tr>
<td>TIMBER</td>
<td>0.145</td>
<td>0.145</td>
<td>WASTE</td>
<td>0.145</td>
<td>0.145</td>
<td>WATMANA</td>
</tr>
<tr>
<td>PAPER</td>
<td>0.145</td>
<td>0.145</td>
<td>REPAIR</td>
<td>0.145</td>
<td>0.099</td>
<td>HOUSSER</td>
</tr>
<tr>
<td>REFINPETRO</td>
<td>0.145</td>
<td>0.145</td>
<td>SUPELEC</td>
<td>0.115</td>
<td>0.099</td>
<td>EDU</td>
</tr>
<tr>
<td>CHEM</td>
<td>0.145</td>
<td>0.145</td>
<td>GAS</td>
<td>0.115</td>
<td>0.099</td>
<td>HEALTH</td>
</tr>
<tr>
<td>NONMINEPRO</td>
<td>0.145</td>
<td>0.145</td>
<td>WATER</td>
<td>0.115</td>
<td>0.099</td>
<td>CULTURE</td>
</tr>
<tr>
<td>PROCMETAL</td>
<td>0.145</td>
<td>0.145</td>
<td>CONST</td>
<td>0.030</td>
<td>0.099</td>
<td>PUBSER</td>
</tr>
<tr>
<td><strong>VAT sector</strong></td>
<td><strong>17% or 13%</strong></td>
<td></td>
<td><strong>BT sector</strong></td>
<td><strong>3 ~ 20%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>6% or 11%</strong></td>
<td></td>
</tr>
</tbody>
</table>
4. SAM based CGE model and Scenarios

Simulation Case

<table>
<thead>
<tr>
<th>Case1</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperfect Consumption type VAT replace Business Tax(BT)</td>
<td>Replace BT sector with Imperfect Consumption type VAT. So whole the sectors can deduct the tax on intermediate inputs and investment for machinery.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption type VAT replace BT</td>
<td>Replace BT sector with perfect Consumption type VAT. So whole the sectors not only can deduct the tax on intermediate inputs and investments.</td>
</tr>
</tbody>
</table>

- In the individual case the production tax rate \( \tau_j^Z = \frac{T_j^Z}{Z_j} \) representative as follow formulations.

  ✓ \( \tau_j^Z \): In the Benchmark(before the tax reform)
  
  • \( \tau_j^Z = \frac{(\text{Imperfect Consumption-type VAT} + \text{Business Tax} + \text{Other IDT})}{Z_j} \)

  ✓ \( \tau_j^Z \): After BT reform
  
  • In the Case 1:
    
    \( \tau_j^Z = \frac{(\text{Imperfect Consumption-type VAT} + \text{Other IDT})}{Z_j} \)
  
  • In the Case 2:
    
    \( \tau_j^Z = \frac{(\text{Consumption-type VAT} + \text{Other IDT})}{Z_j} \)
5. Simulation result

Effect on the macroeconomics in the Static Model

Total tax revenue -14%

Total tax revenue -30%

2012 case1 case2

2012

VAT(VAT+M-E)

VAT

VAT

Individual Income Tax

Company Income Tax

Urban Maintenance and Development Tax

Other Tax Revenue

Tax on Contracts

Land Appreciation Tax
5. Simulation result

Effect on the macroeconomics in the Dynamic Model

- The VAT system reform
  - influence on the production tax rate ($\tau^Z_j$)

### Annual Total tax revenue growth rate, 16%

<table>
<thead>
<tr>
<th>Year</th>
<th>Tz (indirect tax)</th>
<th>Tm (tariff)</th>
<th>Td (direct tax)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td></td>
<td>3.8%</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td>3.8%</td>
<td>2.2%</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Simulation result

**ror00 = 6%**

ror: ratio of return to capital

**pq00 = 1**

pq: production price

**ror**

**pq**
5. Simulation result

Effect on the macroeconomics

- Compare the BAU with case 1
  - The growth of domestic production (Y) is higher in BAU scenario than case 1

![Graph showing comparison between Y_{BAU} and Y_{Case1}](image)
Simulation result

Effect on the macroeconomics

- Compare the BAU with case 2
  - The growth rate of domestic production ($Y$) is higher than BAU scenario in the case 2 but only in short period

![Graph comparing Y_BA and Y_Case 2](image-url)
5. Conclusion

- **Conclusion**
  - Indirect tax reform can increase domestic production only in short period not keeping on.
    - *Indirect tax reform couldn’t recover economy essentially*
  - After the indirect tax reform the government tax revenue not be decrease
    - *government damage can be alleviate by the economic growth*

- **Further Studies**
  - Separate the corporate from the household
  - Analyze more the distortion of the economic growth and the tax reform
References


Thank you for your attention.
K_real
3. SAM based CGE model and Scenarios

Production tax structure

- **VAT**
  
  $= \text{Tax on value added part}$

- **GNP-type VAT**
  
  $= Z_j p_j^q + p_i^{wm} M_i - p_i^{we} E_i \times TR_j^v - p_i^q X_{ij} \times TR_j^v$

- **Business Tax**
  
  $= Z_j^b p_j^q \times TR_j^b$

- **Imperfect Consumption-type VAT (from 2009)**
  
  $= (Z_j p_j^q + p_i^{wm} M_i - p_i^{we} E_i) \times TR_j^v - p_i^q (X_{ij} + Inv_{machine,j}) \times TR_j^v$

- **Consumption-type VAT**
  
  $= (Z_j p_j^q + p_i^{wm} M_i - p_i^{we} E_i) \times TR_j^v - p_i^q (X_{ij} + Inv_{ij}) \times TR_j^v$
5. Simulation result

Effect on the macroeconomics in the Dynamic Model

- The VAT system reform

<table>
<thead>
<tr>
<th>(Billion Yuan)</th>
<th>Tz (indirect tax)</th>
<th>Tm (tariff)</th>
<th>Td (direct tax)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the benchmark</td>
<td>50633.0</td>
<td>2255.1</td>
<td>189360</td>
</tr>
<tr>
<td>After tax reform</td>
<td>52779.3</td>
<td>2339.8</td>
<td>193580</td>
</tr>
<tr>
<td>growth rate</td>
<td>3.8%</td>
<td>3.8%</td>
<td>2.2%</td>
</tr>
</tbody>
</table>

Annual Total tax revenue growth rate, 16%

Annual GDP growth rate, 13%
2. Growth Accounting

Measurement of Chinese productivity

Source: Estimated by author by the CIP database.

Source: China’s Growth and Productivity performance Debate Revisited – Accounting for China’s Sources of Growth with a New Data Set, Harry X. Wu. Institute of Economic Research, Hitotsubashi University, Tokyo. January 2014.