Chioms: An Input-Output Modeling System Dynamics

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General Features

- Dynamic forecasting model 1997-2025
- Current Prices
- Guided by MUDAN (national model)
- 29 of 31 provinces (Tibet and Hainan omitted)
- 33 industries
General Features Continued

- Prices are exogenous from MUDAN
- Bilateral Inter-provincial exports and imports by sector
- Four categories of final demand: households, government, fixed investment, inventory change
- Four categories of value added: depreciation, wages, taxes, surplus
General Features continued

- Consistent data base with provincial accounts (old) for 1997
- Nearly * consistent with reported foreign exports and imports from yearbook

* Except for Beijing and Fujian
Central equation

\[(1) \ q = Aq + f + e - m\]

where
q is a vector (all vectors are of length 33) of domestic regional production,
A is a matrix of direct input-output coefficients
f, e and m are defined below.
Domestic Final Demand

\[(2) f = hhc + g + v + vc\]

where

- \(hhc\) is a vector of household consumption
- \(g\) is vector of government consumption
- \(v\) is a vector of investment and
- \(vc\) is a vector of inventory change.
Exports

\[(3) e = fe + \sum_{j=1}^{nprov} B_{i,j}\]

Where

fe is foreign exports

B is a matrix of inter provincial exports
Imports

\[ (4) m = f_m + \sum_{i=1}^{nprov} B_{i,j} \]

Where

- \( f_m \) is foreign imports
- \( B \) is a matrix of inter provincial exports
Household Consumption

- Total estimated on a provincial per capita basis
- MUDAN national per capita
- Provincial Income: wages plus a portion of profits
- The portion of profits is the determined is the same for all provinces and determined by the national portion
- Based upon data from 1995-2002
(5) $\ln hhpc = a_0 + a_1 \ln nathhcpc + a_2 \ln provinc$

Where

- $\ln hhpc$ is the log of provincial per capita consumption;
- $\ln nathhcpc$ is the log of national per capita consumption;
- $\ln provinc$ is log of sum of provincial wages and portion of provincial surplus;
- the coefficient on $\ln nathhcpc$ is constrained to be approximately .5.
Investment

- Log function of national investment, provincial GDP
- Coefficient on national investment constrained to .3
Inventory Change

Simple equation in which inventory change represents the closure amount from the actual stock of inventories to a desired level
Government

Growth rate is estimated relative to that of the national government growth.
Employment/productivity

Exogenous productivity trends from MUDAN applied as movers to provincial 1997 levels
Wages

Wage rates exogenously obtained from MUDAN applied to provincial employment to yield wages by sector
Depreciation

Function of the estimated capital stock (total)
Taxes

- Provincial tax rates to move (as levels) as the national tax rate of the corresponding national sector
- Tax rates are then multiplied by output to obtain levels of provincial taxes
**Surplus**

- Computed as a residual
- Output less intermediate inputs, wages, taxes and depreciation
- Surplus rates determined as surplus/output
Imports

- Most complicated portion of the model
- Two parts: foreign and domestic
- Computed as a share of domestic demand
  \[ \frac{\text{imports}}{(\text{output} + \text{imports} - \text{exports})} \]
- Sum of the two parts constrained
  \[ 0 < \text{sum} < 1. \]
- Foreign Share moves like that of national imports
Domestic Imports - share

- Domestic share a function relative profitability of the product in the province
- and the perceived distance of other provincial suppliers
- Thus as the profit rate (surplus/output) rises the domestic import share falls and
- As the perceived distance from other provinces falls the domestic share increases
- Share elasticities are currently arbitrary
**Domestic Imports – Perceived Distance**

△ Share depends on the percentage *change* in the perceived distance

△ Leaving aside sector subscripts the perceived distance, \( pd \), is defined as follows where \( S \) is the share matrix corresponding to \( B \) and \( D \) is a matrix of distances between provinces \( i \) and \( j \) (measured in hours).

\[
(6) \quad pd = \sum_{i=1}^{nprov} S_{i,j} \ast D_{i,j}
\]
Changes to Distance

- Exogenous factors such as new or faster highways, railways, canals, new airport facilities, etc
- Endogenous factors include extremely rapid growth relative to history and the national economy
*Imports Concluded*

- Foreign and domestic import share are combined and domestic output and total imports are computed.
- Imports are then separated into foreign and domestic.
- Domestic imports are then used to compute the B matrices of the domestic export functions.
Exports

- Domestic Exports computed from domestic imports of other provinces and S matrices
- Foreign exports begin with the 1997 share by province of total foreign exports
- Total foreign exports move exactly as national (MUDAN) exports
- Provinces share of foreign exports changes as its relative (to other provinces) profitability changes
Three Experiments

- Subsidize apparel industry in Sichuan—how much does it cost per job and how many jobs are generated with taxes increased in Guangdong
- Alter national government expenditure to include infrastructure development in western provinces to reduce travel time
- Change tax structure by taxing rich coastal provinces and lower taxes in the west (combined with infrastructure development)
# Sichuan’s Share of Imports of other Province’s Apparel Imports

<table>
<thead>
<tr>
<th>Province</th>
<th>Apparel Subsidy - compensating tax changes GDG</th>
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<tbody>
<tr>
<td></td>
<td>2004</td>
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<tr>
<td>Sichuan</td>
<td></td>
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<tr>
<td>Tax rate</td>
<td>0.04</td>
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<td></td>
<td></td>
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<tr>
<td>4 Shanxi</td>
<td>0.0006</td>
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<tr>
<td>5 IMAR</td>
<td>0.0011</td>
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<tr>
<td>22 Chongqing</td>
<td>0.0156</td>
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<td>19 Guangdong</td>
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<td>29 Qinghai</td>
<td>0.0022</td>
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<td>30 Ningxia</td>
<td>0.0022</td>
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<tr>
<td>Chioms</td>
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Cost per job in Sichuan
Apparel subsidies in US$

![Graph showing the cost per job in Sichuan from 2005 to 2025. The graph indicates a steady increase in costs over the years.](Image)
Jobs vs Tax loss

![Graph showing the comparison between jobs and tax loss, with data points for years 2005 to 2025 and values on the y-axis ranging from 12 to 27773. The graph includes two lines, one for diffemp and another for taxdifschap, indicating the trend over time.]
# Change in Distance in Hours

<table>
<thead>
<tr>
<th></th>
<th>Beijing</th>
<th>Chongqing</th>
<th>Sichuan</th>
<th>Guizhou</th>
<th>Yunnan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sichuan</td>
<td>-2.85</td>
<td>-2.85</td>
<td>0</td>
<td>-6.3</td>
<td>-5.7</td>
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<td>Guizhou</td>
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<td>-3.45</td>
<td>-6.3</td>
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<tr>
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<td>-2.85</td>
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<td>-5.7</td>
<td>-6.3</td>
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Percent Changes in total GDP

Percent Change

<table>
<thead>
<tr>
<th>Year</th>
<th>Change</th>
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<tbody>
<tr>
<td>2000</td>
<td>0.75</td>
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<tr>
<td>2005</td>
<td>0.38</td>
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<tr>
<td>2010</td>
<td>-0.00</td>
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<tr>
<td>2015</td>
<td></td>
</tr>
<tr>
<td>2020</td>
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<tr>
<td>2025</td>
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