



Estimating the Inter-Regional Trade Based on 2002 IO Tables

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1. Introduction

- Inter-Regional trade is needed for multi-regional model
- Inter-Regional trade is also indispensable for some regional trade analysis and so on.



2. Data Base

- 30 regions IO tables in 1997 and 2002
42 sectors (1 primary industry, 24 secondary industry, 17 tertiary industry)
includes all provinces in mainland of China except Tibet
- Inter-regional trade through the railway for 8 commodities in 2002



2002 IO table of Beijing

	Agriculture	.....	Pubadmin	consume, capital formation	export to ROMC	export to Row	import from ROMC	import from ROW	total
Agri	740435	.....	0	.....	24893	270303	825100	122693	2465569
Coalmin	13965	.....	46279	.....	86548	0	616667	1006	575360
CrudeOil	0	.....	0	.....	0	0	1257642	0	0
MetalOreMin	0	.....	0	.....	4478	21	142495	230756	18783
NonMetalOreMin	388	.....	965	.....	0	30249	226431	17630	15394
FoodTobacco	32172	.....	0	.....	1132881	181044	1702123	31314	2761603
Textile	4937	.....	849	.....	386245	190139	575244	100640	559217
.....	.....	.....	.....	.....	1075062	286627	50998	0	5342430
Pubadmin	85	.....	3159	.....	140	0	3905	0	2423506
totalinput	1457023	.....	1276428	.....	32119535	8182706	34093690	8199308	108605286
depreciate	69755	.....	260303						
wage	611595	.....	868439						
adjtax	4856	.....	17017						
profit	322340	.....	1320						
valueadded	1008546	.....	1147078						
total	2465569	.....	2423506						

2002 IO table of Shanxi Province

	Agriculture	.....	Pubadmin	consume, capital formation	Total Export	.....	Total Import	.....	total
Agri	883274	.....	0	.....	76632	.....	825100	.....	3729428
Coalmin	1221	.....	0	.....	3132255	.....	616667	.....	5180081
CrudeOil	50	.....	0	.....	0	.....	1257642	.....	0
MetalOreMin	0	.....	0	.....	5715	.....	142495	.....	440594
NonMetalOreMin	7	.....	2130	.....	0	.....	226431	.....	362531
FoodTobacco	33727	.....	0	.....	23571	.....	1702123	.....	1372029
Textile	248	.....	0	.....	38504	.....	575244	.....	403855
.....
Pubadmin	0	.....	0	.....	0	.....	0	.....	1685600
totalinput	1522828	.....	663884	.....	6520177	.....	7377178	.....	49227936
depreciate	1472629	.....	888019						
wage	36079	.....	18473						
adjtax	98345	.....	101976						
profit	599547	.....	13248						
valueadded	2206600	.....	1021716						
total	3729428	.....	1685600						

2002 IO table of Shandong Province

	Agriculture	Pubadmin	consume, capital formation	Net export	total
Agri	883274	0	825100	3729428
Coalmin	1221	0	616667	5180081
CrudeOil	50	0	1257642	0
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Inter-regional trade through the railway for 8 commodities in 2002

- Grain
- Coal
- coke
- Petroleum
- metal ore
- Nonmetal ore
- Nonmetal Mineral Products (cement,glass,etc)
- Ferrous and nonferrous Metals (steel)

Inter-Regional trade of grain through railway

	Anhui	Beijing	Fujian	Gansu	Shaanxi	.....	Zhejiang	Chongqing	total
Anhui	0	7153	0	1808	49	.....	32393	1303	42705
Beijing	5939	0	0	989	25	.....	5350	678	12981
Fujian	0	0	0	0	0	.....	0	0	0
Gansu	2743	2819	0	0	31	.....	12168	616	18377
Guangdong	42	1	0	51	3	.....	0	74	171
...
Shaanxi	9898	10587	0	4638	0	.....	49673	1557	76352
Shanghai	0	0	0	0	0	.....	0	0	0
Sichuan	0	0	0	0	0	.....	0	0	0
Tianjin	0	0	0	42385	1904	.....	0	45519	89809
Xinjiang	682	392	0	633	7	.....	290	238	2242
Yunnan	210	42	0	289	9	.....	0	650	1200
Zhejiang	704	23	0	104	5	.....	0	96	931
Chongqing	0	0	0	0	0	.....	0	0	0
total	20216	21017	0	50897	2033	.....	99874	50731	

3. Estimation of Inter-regional trade

Initial trade Matrix

	Anhui	Beijing	Gansu	.....	Zhejiang	Chongqing	total Export to ROMC
Anhui	0	7153	1808	...	32393	1303	42656
Beijing	5939	0	989	.....	5350	678	12955
Fujian	0	0	0	.....	0	0	0
Gansu	2743	2819	0	.....	12168	616	18346
Guangdong	42	1	51	.....	0	74	168
...
Xinjiang	682	392	633	.....	290	238	2235
Yunnan	210	42	289	.....	0	650	1191
Zhejiang	704	23	104	.....	0	96	927
Chongqing	0	0	0	.....	0	0	0
total Import from ROMC	10319	10430	3874	.....	50201	3655	

Control number



Step 1: estimating the total export
(import) to ROMC for each sector

2002 IO table of Beijing

	Agriculture	Pubadmin	consume, capital formation	export to ROMC	export to Row	import from ROMC	import from ROW	total
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profit	599547	13248						
valueadded	2206600	1021716						
total	3729428	1685600						

Balance the trade matrix

	total export to ROMC	total Import from ROMC	Import	Export
Beijing	24893	925100	122693	270303
Tianjin	717580	362208	219504	114432
Hebei	4545520	1722937	212264	173939
Shanxi	0	321155	5586	76632
.....
Gansu	136145	130491	17659	72705
Qinghai	17214	71727	415	7961
Ningxia	228199	58697	14325	3114
Xinjiang	1089098	26991	376	114774
total	3965	2145		



Cross-Entropy method

$$\min \left[\sum_i \sum_j a_{i,j} \ln \frac{a_{i,j}}{\bar{a}_{i,j}} \right]$$

$$st. \sum_j a_{j,i} = 1 \text{ and } 0 \leq a_{j,i} \leq 1$$

$$\sum Export^{romc} = \sum Im port^{romc}$$

$$Export^{romc} + Export^{row} \leq Output$$

$$Im port^{romc} + Im port^{row} \leq Demand$$



Step 2: Estimating the Initial Trade Matrix

$$x_k^{AB} = e^{\beta_0 + \varepsilon} \frac{(Q_k^A)^{\beta_1} (C_k^B)^{\beta_2}}{(d^{AB})^{\beta_3}}$$

x_k^{AB} export of commodity k from region A to B

Q_k^A Production of commodity k in region A

C_k^B total demand of commodity k in region B

d^{AB} Distance between A and B



Some results of the gravity models

$$x_{\text{metal ore}}^{AB} = e^{7.753} \frac{(Q^A)^{0.019} (C^B)^{0.025}}{(d^{AB})^{0.967}}$$

$$x_{\text{coke}}^{AB} = e^{2.240} \frac{(Q^A)^{0.481} (c^B)^{0.039}}{(d^{AB})^{0.539}}$$



Calculating the Initial trade matrix for the Industry sector

For every industry sector (except the sectors with trade matrix through railway), choose a gravity model of most similar commodity in the 8 gravity model, and calculate the Initial trade matrix

Calculating the Initial trade matrix for the service sector

	Anhui	Beijing	Gansu	.....	Zhejiang	Chongqing	total Export to ROMC
Anhui	0	7153	1808	.....	32393	1303	42656
Beijing	5939	0	989	.....	5350	678	12955
Fujian	0	0	0	.....	0	0	0
Gansu	2743	2819	0	.....	12168	616	18346
Guangdong	42	1	51	.....	0	74	168
...
Xinjiang	682	392	633	.....	290	238	2235
Yunnan	210	42	289	.....	0	650	1191
Zhejiang	704	23	104	.....	0	96	927
Chongqing	0	0	0	.....	0	0	0
total Import from ROMC	10319	10430	3874	.....	50201	3655	

$$x^{AB} = \text{Export}^A \frac{\text{import}^B}{\sum \text{import}^{\text{region}}}$$



Step 3: Estimating the Final Trade Matrix

$$\min \left[\sum_i \sum_j a_{i,j} \ln \frac{a_{i,j}}{\bar{a}_{i,j}} \right]$$

$$st. \sum_j a_{j,i} = 1 \text{ and } 0 \leq a_{j,i} \leq 1$$

$$\sum_B x^{AB} = \text{Export}^A$$

$$\sum_A x^{AB} = \text{Import}^B$$



Future Work

- Construct the multi-regional model
- Analysis the regional trade dependence
- Sectoral comparative advantage and other analysis based on the trade matrix



Thanks for your attention !