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Abstract

The aim of this paper is to analyse the general equilibrium effects of tariff changes in a multiregional model that has inter-government strategic interactions, where central and regional governments react to policies of one another by implementing counter strategies to maximise their own welfare. The motivation for this paper arises from observing inter-provincial and provincial-central government competitive money creation behaviour in China and in the former Soviet Union.

Keywords

China, Soviet Union, strategic interactions, multi-region modelling.

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General Equilibrium Modelling Within an Inter-Regional Game Theoretic Framework: Impact of Trade Liberalisation on a Multi-Region Economy

I. Introduction

In CGE models, regional governments (states or provinces) are assumed to accept passively the regional effects of trade liberalization. However, this assumption might not hold in countries that have a federal system form of government or in countries where the central government is weak. The aim of this paper is to analyse the general equilibrium effects of tariff changes in a multiregional model that has inter-government strategic interactions, where central and regional governments react to the policies of one another by implementing counter strategies to maximise their own welfare. The motivation for this paper arises from observing inter-provincial and provincial-central government behaviour in China and in the former Soviet Union.[1] In these two countries, a weakened central government had on occasions lost control of the money creation process and local governments had been able to gain real resources for their regions by influencing credit creation within their regions through their de facto control over local banks. With constant aggregate output, if only the central or a local government is able to exploit the use of seignorge, it will be able to run a larger real (as distinct from nominal) budget deficit and be able to obtain the use of more real resources. But if every local government is able to do likewise, the result is inflation. If one party does not engage in this practice, there is no guarantee that the others would not do so. There is, thus, a prisoner's dilemma. Central and local governments, therefore, have to make a conscious choice between the possibility of having more real resources at their region's disposal and likely higher rates of inflation in the face of their mutual competitive money creation (Liew 1994).

The competitive money making behaviour described above continued for sometime after the breakup of the Soviet Union, when there was as monetary but not a political union. The competitive money during that time demonstrates the difficulty of having a monetary union in the absence of a political union and serves as a warning to potential problems for monetary integration in the European Union.

Strategic interactions between domestic governments in competitive money creation affect real resource flows between regions. Only by incorporating these interactions can the impact of national policies or exogenous national and international shocks on the regional level be accurately assessed in these countries. For example, an exogenous change in trade tariffs affects domestic regional GDPs and prices, which could elicit policy responses from regional and central governments. Regions that are adversely affected by a tariff reduction, for example those that have a high concentration of import competing industries, may increase regional demand in an effort to compensate for the reduction in their regional GDPs. If a country

faces a balance of payments constraint, its regions are limited in their ability to vary their regional GDPs. What this means in effect is that the balance of payments constraint determine the national GDP and strategic interactions between the regions in response to the tariff reduction determine its distribution across the regions. But even if there is no balance of payments constraint, inflation caused by regional expansion in demand could limit the desire of regional governments to expand regional demand. Regional governments may trade off a lower GDP for a lower rate of inflation.

The aim of this paper is to specify a model of inter-government strategic interactions based on a game-theoretic framework and demonstrates its operations using a hypothetical data base that describes the Chinese economy in aggregate. The data is based on five industries (Agriculture, Light Manufacturing, Heavy Industry, Service and Government) and two regions (Advanced, Backward). The objective is to demonstrate that central and regional governments are not passive actors but react to economic events, and that such reactions can be modelled empirically.

II. Approaches to regional modelling

There are three basic approaches adopted by researchers to regional modelling: bottom-up, top-down, and hybrid of bottom-up and top-down. A bottom-up regional model is a fully interdependent system. The behaviour of region specific agents are specified and regional level policies and other exogenous shocks can affect national performance. Two examples of this approach are described in Liew (1984) and Meagher and Parmenter (1993).

In the top-down approach, regional agents may be identified but their individual behaviour is not explicitly modelled. Regional results are obtained from the disaggregation of national results. There is no feedback from the regions to the national level and, therefore, regional developments cannot affect national performance. Examples of this type of approach can be found in Leontief, Morgan, Polenske, Simpson and Tower (1965) and in chapter 6 of Dixon, Parmenter, Sutton and Vincent (1982).

In the hybrid top-down, bottom-up approach, the behaviour of some region-specific agents are specified. For others, regional results are obtained from regional disaggregation of national results. There are, therefore, limited regional-national interactions and regional developments are restricted in their impacts on national performance. Higgs, Parmenter and Rimmer (1988) is an example of this approach.

The model to be presented in this paper is of a hybrid top-down, bottom-up variety. But unlike other hybrid type models, in this model, the behaviour of none of the industries at the

regional level is modelled specifically. Regional-national interactions in this model are restricted to strategic interactions over money creation between the central and local governments. In general, except for results on regional absorption and some output results, regional results are obtained from a regional disaggregation of national results, and it is not possible for regional level policies to affect national performance. The novel aspect of the model is the use of game theory to model central and local governments' strategic interactions.

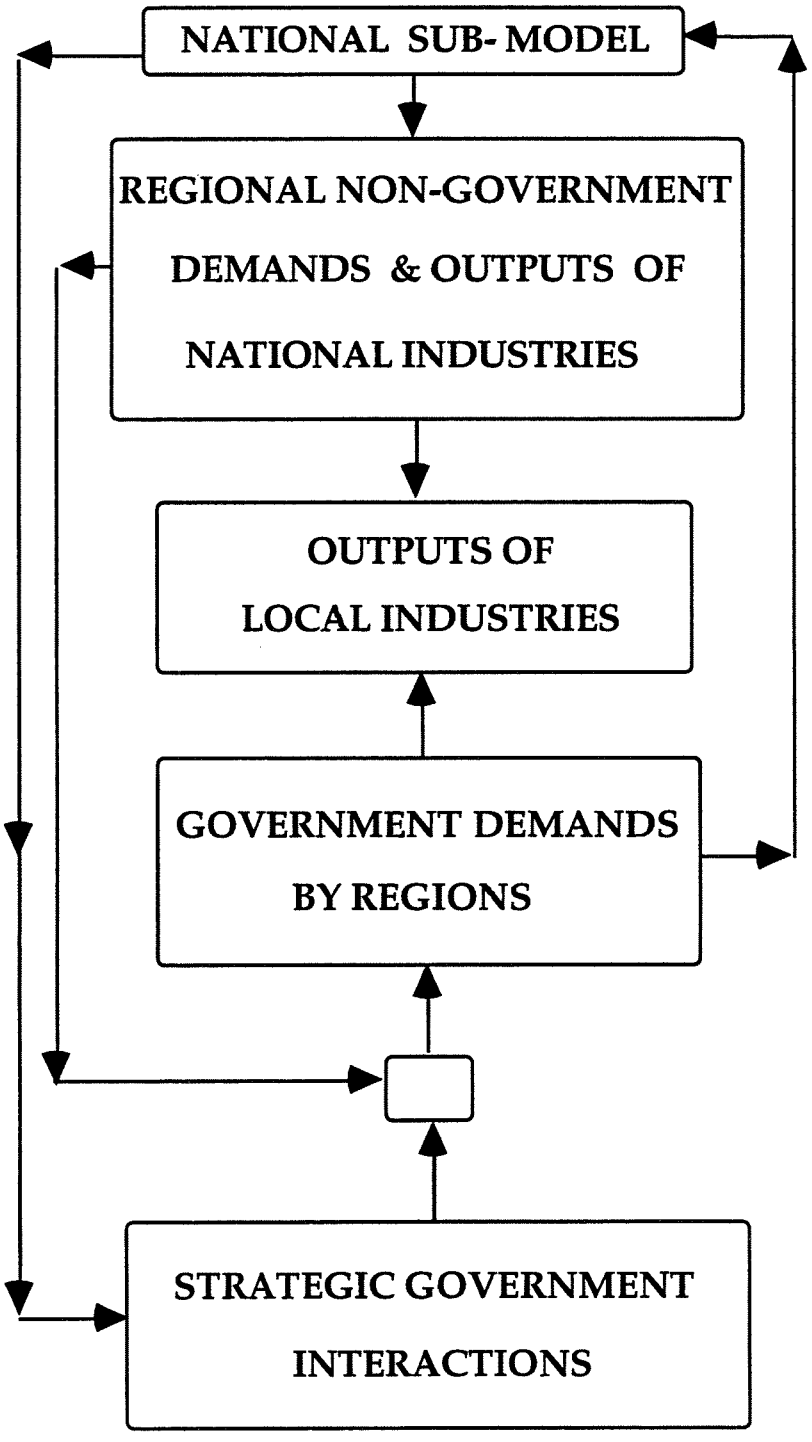
A schematic representation of the model is presented in figure 1. The model makes a distinction between local and national industries. Only outputs of national industries are traded across regions. There is no inter-regional trade of outputs of local industries. Regional non-government demands and regional outputs of national industry are disaggregations of national results obtained from the national sub-model. Given GDP, which is derived in the national sub-model, and regional non-government demands, strategic interactions between local and central governments determine their real and nominal expenditures and, thus, different government demands in different regions. These are fed into the national sub-model to derive national results. Total regional final demands and intermediate demands for goods of local industries determine outputs of local industries. Intermediate demand for goods of local industries come from both local and national industries. Product, value-added, and profit taxes are derived from regional demands and outputs. They affect supply and demand in the national sub-model, and together with local and central governments' expenditures, produce sets of budgetary accounts for each of the local and central governments.

The number of variables exceeds the number of equations in the model. By specifying a non-zero value to an exogenous variable, the model can solve for the impact of this on the set of endogenous variables. Thus, the model can be used to simulate the regional impacts of government policy and other exogenous shocks on the economy. The major role played by inter-governments' interactions is to distribute domestic absorption impacts of exogenous shocks across the regions. In other words, they explain how the "cake" is shared among the regions.

III. Model Specifications

The model is linear with variables expressed in percentage-change form. In this paper, the terms, local governments and regional governments are used interchangeably. Most equations in the model will be familiar to many readers. They are generic equations found in almost all general equilibrium models (Dixon, Parmenter, Powell and Wilcoxen 1992; Liew 1996, Siriwardana 1991, 1995, 1997, 1998), and will only be discussed briefly.[2] Others are specific to this model. These will be discussed in greater detail. Equations belonging to the latter group are those that explain inter-government strategic interactions.

Figure 1: A multiregional model with inter-government strategic interactions



The first part of the model explains central-local governments' strategic interactions. Given GDP, these interactions determine aggregate domestic absorption and how it is divided up to different regions, and the balance of trade.

Assume that there are R+1 governments, 1 central and R local governments. Their reactions to any exogenous shock are dependent on their utility functions, which for each of them has the form:

$$U^r = -\pi_Q^{\alpha(r)} / (q_f^r)^{\sigma(r)}, \alpha > 1, \sigma > 0, \tag{1}$$

where π_Q is domestic absorption price index; $\forall r \neq R+1$, q_f^r is total real absorption, excluding central government demand, in region r; $\forall r = R+1$, it is central government demand; and $\alpha(r)$ and $\sigma(r)$ are parameters.

This utility function satisfies the usual concavity assumptions:

$$\partial U^r / \partial \pi_Q < 0, \partial^2 U^r / \partial \pi_Q^2 < 0; \partial U^r / \partial q_f^r > 0, \partial^2 U^r / \partial q_f^{r2} < 0$$

The variables of this utility function are all in percentage-change form. Although the detailed specification of this utility function is different from those used in models of international macroeconomic coordination and interactions, for example Hamada (1976) and Mckibbin and Sachs (1991), the idea of a trade-off between the two variables in the function is common in all the utility functions. Instead of real domestic absorption as a variable, the other utility functions have stocks of foreign exchange or real output.

Domestic expenditure (excluding expenditure by central government) in region r ($\forall r \neq R+1$) and central government expenditure (r=R+1) is defined as

$$P_Q Q_f^r = M_f^r H^r, \tag{2}$$

where P_Q, Q_f^r, M_f^r, H^r are domestic absorption price index, real domestic absorption (excluding central government demand, $\forall r \neq R+1$) and real central government demand (r=R+1), money supply subject to the influence of government r, and expenditure velocity. Q_f^r can be interpreted as real domestic demand subject to the influence of government r. Government r is able to play an influencing role because of its ability to vary the money supply to accommodate the spending required. Equation (2) is based on the simple assumption that nominal spending is proportional to nominal money holdings. This form of expenditure function has been used in some international monetary economic models, for example, the models of Dornbusch (1973) and Dornbusch and Mussa (1975).

Using equation (2), the percentage-change form of the GDP identity can be written as

$$\Delta BT / NGDP + \sum_{r}^{R+1} S_Y^r m_f^r = \pi_Y + y, \tag{3}$$

where BT is balance of trade, NGDP is nominal GDP in the base year, S_Y^r is the ratio of total domestic expenditure subject to the influence of government r to nominal GDP, y is real GDP, and π_Y is the GDP deflator. Balance of trade is not in percentage-change form because it can either be positive or negative.

By assuming a constant expenditure velocity, real domestic demand subject to the influence of region r can be defined as

$$q_f^r = m_f^r - \pi_Q, \tag{4}$$

where π_Q is the domestic expenditure deflator.

Summing over r, equation (2) can be expressed as

$$\sum_{r}^{R+1} S_Q^r m_f^r = \sum_{r}^{R+1} S_Q^r q_f^r + \pi_Q, \tag{5}$$

where S_Q^r is the share of domestic expenditure subject to the influence of government r. The first term on the right-hand-side is total real domestic absorption, q. Formally,

$$q = \sum_{r}^{R+1} S_Q^r q_f^r \tag{6}$$

Take the total differential of (2) to obtain

$$dq_f^r = dm_f^r - d\pi_Q \tag{7}$$

By using equation (5), this becomes

$$dq_f^r = dm_f^r - S_Q^r dm_f^r \tag{8}$$

Therefore, from (5) and (8)

$$d\pi_Q / dq_f^r = (d\pi_Q / dm_f^r)(dm_f^r / dq_f^r) = S_Q^r / (1 - S_Q^r) = \beta^r \tag{9}$$

Equation (9) calculates the marginal rate of transformation between the domestic absorption price index and domestic absorption subject to the influence of government r. The larger the share of influence, as measured by the parameter S_Q^r, the larger the marginal rate of transformation. In other words, the larger the degree of influence, the larger the trade-off between real absorption and inflation.

From equation (1), the marginal rate of substitution is derived as

$$MRS = \sigma(r)\pi / \alpha(r)q_f^r \tag{10}$$

It is positive, meaning that a higher rate of growth in real absorption must be compensated by a higher rate of inflation to maintain utility at a given level. The utility function shows that the larger the value of σ, the larger is the increase in utility from an increase in absorption, and the larger the value of α, the larger is the decrease in utility from an increase in inflation. This means that the rise in inflation has to be larger for an increase in absorption to fix the level of utility than would be for a lower ratio of $\sigma(r)/\alpha(r)$. Hence, the larger the ratio the larger the MRS.

Assuming non-cooperation between governments, each government will equate their MRS with their MRT. Thus, from equations (9) and (10),

$$q_f^r = \lambda^r \pi_Q / \beta^r, \tag{11}$$

where

$$\lambda^r = \sigma(r)/\alpha(r) \tag{12}$$

The parameter λ measures the impact of growth in real absorption and inflation on the utility of the regional and central governments. The numerator of the right-hand-side expression of (12) is the utility elasticity with respect to growth in real absorption, while the denominator is the utility elasticity with respect to inflation. The larger is the value of this parameter, the greater is the impact of real absorption than inflation on utility. Equation (10) indicates that the larger is λ, the higher is the increase in inflation required for an increase in real absorption if utility were to remain constant. If that parameter is increased, the marginal rate of substitution can remain constant only if the ratio of growth in real absorption and inflation is increased. According to (11), with a given MRT, the larger is the value of λ, the larger is the change in real absorption for a given inflation rate. As expected, the larger the MRT between

inflation and real absorption, the smaller is the growth in real absorption for a given inflation rate. As expected, real absorption is positively correlated with inflation.

Together, equations number (3) to (6), and (11) make up the central-local (provincial) governments' interactions part of the model. Together, they make up a total of 3+2r (1+r+1+1+r) equations. Two variables in the above list of equations, real GDP and the domestic absorption price index are explained in the other part of the model. Real GDP is modeled on the supply side and the absorption price index is the weighted sum of the prices of consumption and private investment goods, and the good provided by the government.

The second part of the model contains equations that explain the national part of the model, excluding government demand. Regional results of the model, other than those derived from strategic interactions, are obtained from a disaggregation of national results obtained from this part of the model.

Each industry is assumed to produce only one good or commodity; thus, industry j produces good (commodity) j. Producers are assumed to be price takers at the margin. Although some producers are expected to fulfil certain state planning quotas at below market prices, all above plan output is sold at market prices. As Sicular (1988) has shown, such a system of plan deliveries and plan sales at below market prices acts in the same way as lump-sum taxes and subsidies, and therefore does not affect the marginal decisions of economic agents. Producers are assumed to choose inputs to minimize costs subject to nested Leontief-CES, constant returns to scale production functions. There is no substitution between material inputs of different commodity categories, and between material and primary inputs. Substitution is possible between domestic and imported inputs, and between different types of primary inputs. However, there is no possibility of substitution between same domestic commodity categories from different domestic regions.

Investment demand by industry is exogenous. It is assumed that net investment is not immediately translated into expanded stocks of capital. Capital stocks are industry specific and are assumed fixed in the model. Households' demands across commodities are dependent on real wage income and consumption subsidies, and prices. Each industry and each household chooses combinations of imported and domestic goods of the same commodity category to minimize their total costs of a given commodity for intermediate use, investment, and consumption. The degree of substitutability between domestic and foreign goods depends on Armington elasticities (Armington 1970). Export demand equations are normally assumed to be downward sloping. but by making the shift variable endogenous both export prices and quantities can be made exogenous.

Given the rental price of land and capital, and the price of labor, industries choose combinations of land, capital, and labor to minimize the total costs of primary factors. Land and capital are assumed to be industry specific. There is only one type of labor, and it is mobile across industries and regions.

Basic prices of domestic and imported goods are specified on the assumption of zero pure profits. The tariff and export tax variables in the model are "one plus tariff rate" and "one plus export tax rate" variables. In most general equilibrium models, the absolute price level is not explained; either the exchange rate or the nominal wage rate is used as the numeraire and made exogenous. In this model, the exchange rate, balance of trade and real aggregate domestic absorption can all be endogenous. The general price level and money supply are determined via strategic interactions between governments over competitive money creation.

The difference between basic and purchases' prices are product and value-added taxes. They are levied on purchasers' and not on sellers' prices. Both taxes are sometimes levied on the one commodity. When this happens, it means that the tax rate on consumption is higher than the tax rate for industrial use. One tax variable is used to represent both of these taxes in this model. However, tax rates are differentiated by the use of the commodities.

The third part of the model consists of a series of equations on regional disaggregation of national outputs and demands. The procedure adopted to disaggregate industry output to obtain industry output by region follows that of Leontief, et. al. (1965) and Dixon, et. al. (1982). It involves the division of industries into national and local industries. Commodities produced by national industries are transported and sold across domestic regions. Local industries, on the other hand, produce commodities that are mainly sold only within the local regions that the industries are located. In this model, there are 3 national and 2 local industries.

The contribution from region r to the supply of the good from national industry j for intermediate use is explained by total intermediate demand for good j and the share of region r in the total output of national industry j. Domestic output of local industries in a given region is supplied only to national and local industries located in the given region. Thus, given that intermediate input-output ratios are constant in this model because of nested Leontief-CES production functions, output of local industry i for intermediate use in region r is explained by outputs of local and national industries in region r weighted by shares of individual local and national industries in the sales of local industry i for intermediate demand. Intermediate demand by region is not specified because it is not required to explain other parts of the model.

Demand for an investment good in a given region is disaggregated from total investment demand for that good on the basis of the region's share in gross domestic product. Total investment demand of the good supplied by national industry n in region r is explained by national demand of investment good n and the share of region r in the total output of good n. Investment demand for goods produced by local industries in region r are mainly satisfied by goods produced in region r.

A region's households' demand for goods is derived from a disaggregation of national households' demand and depends on the region's share of total wage income and consumption subsidies. There is only one type of labor and it is mobile across industries and regions.

Regional employment is derived on the assumption that labor-output ratios in similar industries move together. This is to be expected in the long-run given inter-regional capital mobility in the long-run and the assumption of a uniform movement of wages across regions (Dixon, et. al.1982: 266).

Total domestic demand influenced by individual governments must equal the sum of its components. Thus, total domestic demand influenced by regional government r must equal the sum of industry investments and households' demand in region r and demand by regional government r. Domestic demand under the influence of the central government is just central government demand, and demand by regional government r is solved as a residual. The share of each region in total export from each industry is assumed constant. Thus, regional industry exports move together with national industry exports.

The demand for goods by various governments has to be allocated to different regions. Government demand for good sj (good j from source s) in region r is made up of demand by the local government r and central government for good sj. A distinction is made between demand by government r for good sj and government demand for good sj in region r. The former identifies government r as the government demanding good sj. The latter does not. For the latter, government demand includes both demand by government r and central government (R+1). In this model, the share of total central government demand spent in a given region is exogenous.

For each industry, it is assumed that regional outputs move uniformly together with national outputs. Since there is zero substitution between primary and material inputs, gross domestic product is determined by the weighted sum of industry outputs and gross regional products are determined by the weighted sums of regional outputs of national industries and the outputs of local industries.

IV. Simulation Results

In most CGE simulations on tariff liberalization, either the balance of trade or domestic absorption is fixed. In this model, however, they are both endogenous, even though there is no explicit modeling of savings. Strategic interactions between central and regional governments in this model will determine regional demands and total domestic absorption. GDP is explained by the supply side of the model and the balance of trade is solved as a residual. Unlike most other CGE models, the exchange rate is endogenous in this model. The normal method of setting the exchange rate endogenous is by having an equation that links the exchange rate to the money supply. Money supply is then set exogenously to explain the exchange rate. In this model, not only is the exchange rate endogenous, the money supply is endogenous as well. Strategic interactions between the regional and central governments determine the domestic money supply and the exchange rate.

Variations in regional economic performance based on analyses of trade liberalization using multiregional models of the top-down variety are usually explained by differences across regions of industrial composition and inter-regional multiplier effects. By taking into account strategic interactions between governments over competitive money creation, the model provides an additional important explanation for variations in regional economic performance in response to a policy of trade liberalization.

The model has three governments (central and 2 regional governments) and five industries, each producing one commodity. There are three national and two local industries. A total of 77 variables are exogenous in this model. The model is solved using GEMPACK (Codsi and Pearson 1988).

Table 1 presents results from simulating the model of a 10 per cent increase in "one plus the tariff" rate, using a hypothetical data base, which is shown in the appendix. All export demand elasticities are set to 20.0, except for commodity 2, where the value 2.0 is used. Armington elasticities are set at 2.0 for all commodities, and elasticities of substitution for primary inputs are all set to 0.5. In the simulation, Industry 2 is classified as an export industry, Industry 1 and 3 are import competing industries and Industry 4 and 5 are non-traded industries. Four sets of results, each pertaining to a given value of lamda are presented. Industry 1 is agriculture, 2 is light manufacturing, 3 is heavy industry, and 4 and 5 are services. Region 1 is the more advanced region with a larger concentration of light and heavy industries, while Region 2's economy is biased towards agriculture.

Table 1: Impact of a 10 per cent tariff reduction

Lamda	0.5	1.0	3.0	5.0
GDP	-0.013	-0.014	-0.015	-0.016
Domestic Absorption	-0.003	-0.005	-0.009	-0.011
Employment	0.203	0.202	0.200	0.199
Change in Bal. of Trade x100	72.600	72.700	73.200	73.400
Foreign Currency Exports	4.299	4.300	4.301	4.301
Foreign Currency Imports	2.887	2.885	2.881	2.880
Exchange Rate	8.335	8.336	8.338	8.340
GDP Deflator	0.009	0.007	0.004	0.003
Domestic Absorption Deflator	-0.003	-0.002	-0.002	-0.001
CPI	0.578	0.578	0.579	0.579
Government Money Supply:				
Central	-0.006	-0.008	-0.012	-0.014
Region 1	-0.005	-0.006	-0.009	-0.011
Region 2	-0.006	-0.007	-0.011	-0.013
Government Influenced Demand:				
Central	-0.003	-0.005	-0.011	-0.013
Region 1	-0.002	-0.004	-0.008	-0.009
Region 2	-0.003	-0.005	-0.010	-0.012
Gross Domestic Product:				
Region 1	0.044	0.043	0.042	0.041
Region 2	-0.080	-0.080	-0.082	-0.082
Wage Incomes:				
Region 1	0.405	0.405	0.405	0.404
Region 2	0.615	0.615	0.614	0.614
Industry Outputs:				
Industry 1	-0.027	-0.028	-0.028	-0.028
Industry 2	1.868	1.868	1.868	1.868
Industry 3	-0.574	-0.574	-0.575	-0.575
Industry 4	-0.534	-0.535	-0.537	-0.538
Industry 5	-9.628	-9.637	-9.657	-9.667

*Unless stated, only monetary variables are nominal variables, all others are real. All projections are in percentage changes except the balance of trade. The change in the balance of trade is in million yuan valued at base period prices.

The discussion will focus on the set of results for lamda=5. A reduction in tariff causes an increase in both exports and imports. Imports rise, because imported goods are substituted for domestic goods and exports rise, because a reduction in tariffs on imported inputs make exports more competitive. The depreciation of the exchange rate improves the competitiveness of exports. The size of it is, however, not sufficiently large to compensate fully for the fall in tariffs, which explains why there is a rise in imports despite depreciation of the exchange rate. The larger increase in exports compared to the increase in imports leads to an improvement in the balance of trade of 73.4 million yuan at base period prices.

An interesting result is the fall in real domestic absorption. The fall in real absorption is caused by the restrictive monetary policy pursued by the central and regional governments. Prices fall in response to the reduction in tariffs. The fall in prices led the governments to reduce their money supplies, which caused real absorption in the regions to fall. Because the ten per cent reduction in tariffs overrides the 8.3 depreciation in the exchange rate, there is a fall in the domestic absorption deflator. There is a rise in the consumer price index because more than half of household demand is accounted for by good 2, which is the export good. Since good 2 is the export good, the exchange rate effect on the price of that good dominates the tariff effect.

Although the balance of trade improves with a reduction in tariffs, the improvement is insufficient to compensate for the fall in domestic real absorption. Consequently, there is a small fall in GDP. The fall in GDP is, however, not uniform across the country. Region 2 experiences a fall in its GDP but Region 1 experiences a rise. The explanation for this is in the difference in industry structure of the two regions. More than half of the GDP of Region 2 is accounted for by import industries. In contrast, the share of import industries in the GDP of Region 1 is less than half. The industry structure of Region 1 is dominated by the export industry. It occupies about 44 per cent of the region's value added and explains the positive GDP growth in Region 1.

Overall, the country's GDP fall by 0.016 per cent, but employment increases by 0.2 per cent. Aggregation is the cause of this counterintuitive result. Output and employment in Industry 2 have increased because of the tariff reduction. Since its share of total employment in the economy is 39 per cent, the increase in employment in this industry overshadows the fall in employment in other sectors. Industry 5 has a fall in output and employment in the order of about 9.7 per cent. Although it is a service sector and is more labor-intensive than Industry 2, its share of employment is only 8 per cent. The increase in employment and a fixed real wage imply a rise in real labor income and household consumption. Real labor incomes increase in both regions. Region 2 has a larger increase in real labor income than Region 1 because,

compared to Region 1, a smaller share of its labor is employed in the three industries that experience the largest fall in output.

A fall in tariff rates decreases import prices and causes a fall in the price deflator for domestic absorption. The central government has the largest marginal rate of transformation between real absorption and inflation. It, therefore, experiences the largest fall in absorption. The demand that regional government 2 has influence is next, followed by the demand that regional government 1 has influence. The fall in domestic absorption is smaller than the fall in money supply, which causes the exchange rate to depreciate.

Industries 1 and 3 experience falls in output. They are import competing industries and a tariff reduction reduces their international competitiveness. The most severely affected industry is the non-traded industry, Industry 5. Its large drop in output is due to its heavy reliance on sales to Industry 3, which shows the largest reduction in output after Industry 5. More than 20 per cent of Industry 5 output goes to Industry 3. Exports from industries 1 and 3 are projected to increase by 2.5 and 3.6 per cent respectively. Industry 2 is the only industry to benefit from the tariff reduction. More than 17 per cent of its sales are exports.

As expected the larger the parameter lambda, the larger is the change in domestic absorption with a change in inflation. However, the impact of lambda on the other variables is marginal. Its impact is mainly on the trade-off between domestic absorption and inflation. Since, there is no reason to believe that the value of lambda varies across the regions, the impact of inter-regional government interactions is dependent on the different industry structures of the regions.

V. Conclusion

A general equilibrium multiregional model with inter-government strategic interactions based on competitive money creation has been specified to analyse the impact of liberalization on a hypothetical economy. The main departure of this model from other multiregional models used to analyse trade issues is its focus on inter-government strategic interactions. The model incorporates the relative preferences of different local and central governments in economic analyses and is particularly useful in analysing transition economies, where the power of the central government has weakened with economic reforms and its conduct of monetary policy is compromised by competitive money creation among local governments. Empirical work on the model presented in this paper suggests that the modeling of inter-government strategic interactions is feasible and potentially could provide additional insights into the regional impacts of trade liberalization.

Appendix: Data

The first table is the national I-O table. The second shows the distribution of value-added of the industries across the regions and the third shows the industry structure of the non-traded industries, Industry 4 and 5, which are region specific.

	Intermediate					Final Demand				Total
	D1	D2	D3	D4	D5	C	I	G	X	
Domestic 1	24	38	6	3	4	53	0	9	12	149
Domestic 2	20	42	30	2	11	90	30	13	50	288
Domestic 3	12	28	35	3	9	18	60	28	18	211
Domestic 4	5	3	5	6	5	30	3	4	0	61
Domestic 5	7	13	10	2	5	10	8	9	0	64
Import 1	1	4	1	1	1	2	0	2	0	12
Import 2	3	7	6	1	3	10	5	3	0	38
Import 3	2	8	9	1	4	1	15	4	0	44
Import 4	0	0	0	0	0	0	0	0	0	0
Import 5	0	0	0	0	0	0	0	0	0	0
Land	15	0	0	0	0					
Capital	8	40	54	5	4					
Labor	58	124	71	40	26					
Capital/Labor	0.14	0.32	0.76	0.13	0.15					
Total	149	288	211	61	64	214	121	72	80	
Value-Added	81	164	125	45	30					445

	REGION 1				REGION 2			
INDUSTRY	Value-Added			Total	Value-Added			Total
	Land	Capital	Labor		Land	Capital	Labor	
D1	4	2.5	14	20.5	11	5.5	44	60.5
D2	0	28	78	106	0	12	46	58
D3	0	34	40	74	0	20	31	51
D4	0	3	21	24	0	2	19	21
D5	0	2.5	13	15.5	0	1.5	13	14.5
TOTAL	4	70	166	240	11	41	153	205

REGION 1	Intermediate					Final Demand				Total
	D1	D2	D3	D4	D5	C	I	RG1	CG	
Domestic 4	2	2	3	4	3	20	2	1.7	0.7	38.4
Domestic 5	3	8	6	1.2	3	6	5	3.2	1.7	37.1
REGION 2	Intermediate					Final Demand				Total
	D1	D2	D3	D4	D5	C	I	RG2	CG	
Domestic 4	3	1	2	2	2	10	1	1.2	0.4	22.6
Domestic 5	4	5	4	0.8	2	4	3	2.8	1.3	26.9

Notes

[1] . An analysis of centre-local government economic relations in China is given in Liew (1997: chs 5 and 6).

[2] . These equations are not listed. Readers can request a copy of these from the authors.

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