Modeling Synthesis in Application to Endogenized Trade Policy in China

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ABSTRACT   This paper formulates single and multi-sector-based models as a modeling system and protracts their evolutional paths in a manner that implements modeling synthesis in political demand side pursuant to orthodox model of international trade theory and anatomy of institutional economics, where it is emphasized that implication of disparity in both cross-sectional capacity of benefit expression and cross-country governance to implement trade policy on agent's behavioral performance affecting policy. And the model endogenizing trade policy is inferred to deal with constraints of both negotiated and non- negotiated equilibrium through CES and VES model, and endogenity of independent variables in the functions for both political supply and demand side is ensured with modeling synthesis. Furthermore, a few of policy implications for improvements of mechanism implementing trade policy are offered according to ensuing economic implications in the models.

KEYWORD   Trade Policy   Econometric Model   Political Economy Approach

I Introduction

During the last quarter of the 20th century, main change in trade policy practice has just been gradual substitution of new trade policy with new protectionism for traditional one. This transition has helped the further formulation of the mechanism of the endogenization of trade policy, which results in a subtle change in the structure of the economic interests that has been the focus of trade policy. And there has been growing influence of individuals' preference or their agents' on the policy-making of international trade. Meanwhile, worldwide vertical specialization among manufacturers has become more and more deeper and wider, which has resulted in the popular global manufacture and distribution around world. The protection of the traditional import competing sectors remains but there have been more and more powerful outsourcing firms with diversified interests. And the flexibility of the adjustment of input-output combination has been remarkably improved with the wide application of high-tech like information technology and the constant improvement of factor structure. As a result, more and more firms have been involved in so called fragmented world, which continues to expand over time.

International specialization involved by China's firms has taken on a net style. Conflict of interest induced by one single trade policy, between import and import competing sectors and between export and domestic selling, has been emerging. With the shaping and development of an open economy, there will be more and more tradables and trade-substituting sectors. Consequently, influence of trade policy, originally affect only a pair of sectors' interests, will produce the similar effect within a single firm. Therefore, following external sectors, some firms are also subjected to indirect influence from trade policy, and the opportunity cost of import substitution and the share of tradables in these firms' value chain will determine the size of this indirect influence. So,

interest-diversification has expanded from internal sectors to foreign trade-related sectors. Exogenous trade policy without considerations of trading sectors' interest or partial endogenous trade policy only with considerations of one single industry will face severe challenge.

II   Literature Review

As a normal theory, trade policy is an important field and branch of international trade theory and together with trade models, they composed the integrated system of international trade theory（Corden，1984）. As trade neutralization is considered the terminals for trade policy reform, research on trade policy issues has been focusing on trade protection, in which policy alternatives on tariff and other inventions has been subjected to extensive influence from lobby and political factors. Therefore, the application of public choice theory is related to the observatory process of international trade field (Caves, 1976). Economists' ensuing research, particular the deliberate observation on trade policy in USA, initiate the adoption of political economy approach on the research of political decision-making process in trade policy and thus has created a new vision for research on international trade theory (Baldwin, 1982). Since then, economists has established the so-called small country model with two sectors and a general equilibrium and factor-specific to sector, according to which two sectors use part of their economic resource to support or oppose certain trade protection by lobbying. Consequently, there comes the tariff and other measures to protect domestic sectors ,which is determined endogenously by political process with exploitation of domestic resource（Findlay & Wellisz, 1982）.   Obviously , the resource mentioned above consists of   two parts of expense: the cost of non optimal intervention deviated from free trade and the cost of lobbying activities.

Actually, economist's discussion on the nature of policy-making process has triggered the debate on the endogeneity of trade policy as early as 1960s. At that time, some economists believed that policy makers should play the role of policy mediators and responsible for the coordination between groups of opposing interests so as to increase the possibility of governments' remaining in office (Olson,1965 Brock & Magee, 1978); some other scholars argued that government had plenty of room to avoid the influence from those interest groups and had to give more consideration to public interests and act to social constraints（Nordlinger, 1981）. Actually, most economists after that adopted the former point of view, which reflected that historically at the time endogenous trade policy was not applicable.

III Change in Policy Climate: rationale for endogenization of trade policy in China

3．1   Agent's Objective function: From a firm dimension perspective.

The relatively centralized economic agents' impact on an economy's trade policy and its aftermath motivates the application of *agent* as an analytical tool and object in researching on international trade theory and policy with the wide adoption of political economy approach (Mayer, 1984). China's foreign trade system and trade policy reform gradually qualified the external sector as the economic agent and formulated the objective function defined by transitional economy.

3.1.1   objective function specific to export Agent

Since its reform and opening-up, China has experienced significant change in export structure, which stretches from single labor-intensive products to a diversified structure including labor, capital and medium-technology intensive products like steel, chemicals and machinery. And general trade affected by trade policy in import stage concentrates on natural resources, capital

products and IT products. Due to the transition and nowadays' situation of China's foreign trade, both classical and new classical international trade models are applicable in depicting its trade activities.

H-O-based Objective Function specific to Exporters Besides its advantage in labor, a strong desire for foreign trade has forced China's authority to take measures to promote those exporting sector to improve industrial standard, the quality of factors and productivity and stimulate technical progress. Consequently, this sector's productivity as a whole remains higher than others and formulates a long-term competitiveness in export. This experience validates the common lesson from the development of export expansion in developing economies. In terms of input structure, Heckscher-Ohlin Model could define the objective function specific to this sector.

R-V based objective function specific to exporters With the deepening of the on-going reform, enterprises gradually become the dominant motivation to keep high productivity in export sector. Since 1990s, many famous local firms have kept growing rapidly and have entered into world market. These firms' consumption of factors increase the immobility of factors, and together with the large country case and firms' desire to expand in overseas market, make it very difficult for these firms to transfer market share. So rigidity of change in the means of achieving profit requires the adoption of Ricardo-Viner Model in defining its objective function.

Modeling Synthesis for objective function specific to export Economists use H-O and Ricardo-Viner Models to define two kinds of objective functions specific to two kinds of exporters respectively. This paper attempts to modify them and constructs one single mathematic description that can be extensively applied to any of the above sectoral objective function specific to one kind of exporters, and offers a wider researching and developing prospect for ensuing model utilization. Formulization of the model here still follows the presumption of perfect competition.

$$Y_i = S_L wL + S_k rK + \sum_{i=1}^{n} (p_i^* - p_i)m_i + \Psi \tag{1}$$

$$\Psi = \sum_{i=1}^{n} f(x) \qquad x \in (0, \infty) \tag{2}$$

$$f(x) = \begin{cases} > 0, & F_s < F_d \\ = 0, & F_s = F_d \\ < 0, & F_s > F_d \end{cases} \tag{3}$$

where Y_i = sector's aggregate income; S_L and S_k = labor and capital share used in their own sectors, respectively；

w and r = wage ratio and profit ratio, respectively; L and K = aggregated labor and capital;

p_i and p_i^* = price in domestic and world market respectively； m_i = net export of the sector;

F_s and F_d = factor supply and demand, respectively.

Disturbance term, Ψ, is the change in product claim right including residual and fixed claim

right level induced by mobility of factors. $F_S = F_d$ is a special case in which quasi-rent totally disappears because of balance between factor supply and demand. Although essentially, change in product claim right level is determined by the nature of a factor, perfect factor mobility will be satisfied by gape between supply and demand in factor market. Generally speaking, in international market, factor mobility is weaker and the final formulation of a perfect factor market is slower than that in domestic market. In a market with more perfect mobility, buying factor will result in equalization of factor price and return to factor and in this case, the fixed claim right is relatively stable, meanwhile firm's residual claim right is not easily to be adjusted in short term with factor market change and cost in utilization of factor. Excluding disturbance term in the formula above could ensure the mobility of a factor not only exclusively determines change in quasi-rent but also is accurate to define the critical points in balance sheet in the case of factor market being the primary reference.

3.1.2 An Objective Function for import agent

Import agent represents consumer's interests in the sector including the consumption of final and semifinished products. With trade intervention, import agent's objective function will have to consider many price variables. So it will adopt the indirect utility function instead of barter format of utility function as indirect utility function contains many price variables as exogenous variables which are different in prices between domestic and international markets and the function also contains the product difference stemming from product's heterogeneity and developing countries' resistance in purchase power for import by controlling foreign exchange, inconvertibility of their currencies as well as currency converting channels. It can be written as

$$
\begin{aligned}
\underset{x_d, x_f}{MAX} \ U_i^* &= U_i^* \left[x_d \left(p_d, p_f, I \right), x_f \left(p_d, p_f, I, r \right) \right] \\
&= U_i^* \left(p_d, p_{f,} I, r \right)
\end{aligned}
\tag{4}
$$

that satisfys ： $$ p_d x_d + p_f x_f + r = I \tag{5} $$

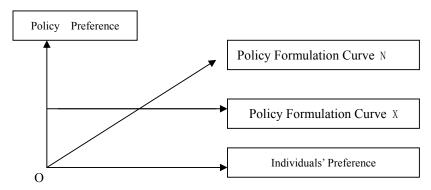where U_i^* = the sum of direct utility; x_d and x_f = domestically-made product and import

product, respectively; p_d and p_f = domestic product price and import product price(CIF),

respectively; r= resistance in converting local currency to foreign currency

3. 2 Nature of Endogenous Trade Policy: Examination from the perspective of Governmental Policy

3. 2. 1 transformation of Policy Formulation Curve

Transformation of trade policy-making mechanism and the completion of its endogeneity is a natural outcome of the development of an open economy in China as an economy in transition. Under planned economy, China's trade policy-making sought for sole public economic objectives, which is orthogonal to individual's objectives curve defined by firm theory. So in the period of planned economy and the early stage of the transitional economy in China, trade policy-making and implementation was isolated from other public economic policies to ensure the success of a particular reform strategy. Mathematical fundamentals of exogeneity of trade policy in China is as the following table:

Table 1　Policy Formulation Curve

　　Where curve X, orthogonal to vertical axis, indexes exogeneity of both the process and outcome of trade policy-making, in other words, trade policy-making is not subjected to influence from individuals' preference. In contrast, curve N indicates that it is obviously subjected to influence from individuals' preference, whose direction and velocity is determined by the robustness of individuals' preference which was an outcome endogenously determined by government's aim to struggle for settlement resort.

3.2.2 Comparison of Policy Focus

　　Based on an economy's export structure and existing comparative advantages of trading partners, the government's focus on trade barriers and its changes often are the prelude to the adjustment of its trade policy. We select the annual estimates on trade barriers from two countries, China and USA, and found that trade barriers and their extent defined by a country not only cover its export sectors with comparative advantage but also incarnate the dynamics of its comparative advantage. In contrast with China, USA has paid more attention to trade barriers on investment and anti-competition practice and has began to observe market access of e-commerce of its trading partners since 1999. And China is still closely observing its trading partners' trade barriers specific to import in manufacturing product. It is as follows:

Table 2 The Focusing Area of Trade Barriers of In China and US

China

Tariff	Import Restrictions	Customs Clearance	Domestic Tax and Fees	Technical Barriers	Government expenditure	Export Subsidy	Intellectual Property	Export Resitrctions
Inspection and Quarantine	Trade in Service	Trade Alms	Other Barriers					

■　■　■　□　■　■　■　■　□　■　■　□　■

　■　　■　　■　　■　　■　　■　　□　　□　　□　　■

Import Policy	Technical Barriers	Government expenditure	Export Subsidy	Intellectual Property	Service Barriers	Investment Barriers	Anti-competition Convention	E-Commerce	Other Barriers

USA

Where ■ and □ indicate two countries' different and same items for trade barriers respectively.

IV Examination on Endogenous Mechanism of Trade Policy Ⅰ: Agent's Behavior's influence on policy

4. 1 Agent's Potential Policy Demand

Trade policy as a product of political market consists of both its demand and supply sides, which is similar to ordinary markets. Political demand is represented and is realized by agent's voting. Similar to the transformation of potential demand into realistic demand in commodity market, transferring of agent's objective function into his real voting behavior is determined by many factors. If using any econometric method to express it, exogenous variables have to be set properly, and the model should describe the relationship between exogenous variables and agent's voting behavior in mathematic term. And it is as follows:

$$A_i = F\left[f(m_{iI}, m_{iO}, E_x), MAX\ \sigma_i\right] \qquad\qquad \sigma_i \in \left(U^*_i, Y_i\right) \qquad\qquad (6)$$

where A_i =sect agent's real voting behavior：m_{iI} = inputting factor mobility of the sector—;

m_{iO}— market transfer mobility of the sector；E_i =interest expressing ability of the sector。

$$f(m_{iI}, m_{io}, E_i) = \begin{cases} > 0, for \\ = 0, abstaining \\ < 0, against \end{cases} \qquad\qquad (7)$$

Influence of inputting factor mobility on agent's voting behavior has been the focus of political economy approach to trade policy (Either, 1982). And the feasibility of the transferring of sectoral market share has been a new factor that affects agent's real voting behavior. This feasibility is determined by a firm's market share, opportunity cost of trade frictions and the range of its global distributing net. Trade practice in China shows that the firms have a lower share of the export to the suiting country's market enjoy a high possibility in transferring their sales to other markets through their distributing net. And the firms who have a higher opportunity cost coping with trade frictions are more likely to abandon their defense, which usually results in the renunciation of their agents.

In the progress of using political economy approach for trade policy analysis, economists extensively explored lobbying activities in USA and other countries, where representative democracy regime is popular, and attention has been paid to the real effect of grass-root movement on individuals ' interest expression. However, in an economic structure with strong asymmetry of information, power, ability to lobby, difference in sectoral ability to express their interests will be very significant. As a result,

$$E_i = T_R / T_e \qquad i = 1,2,\cdots\cdots n \qquad\qquad (8)$$

Where E_i =sectoral ability in interest expressing—i ; T_R =real protection before negotiation；

T_e = balanced protection level after negotiation---。 Here we use the difference in the expressing

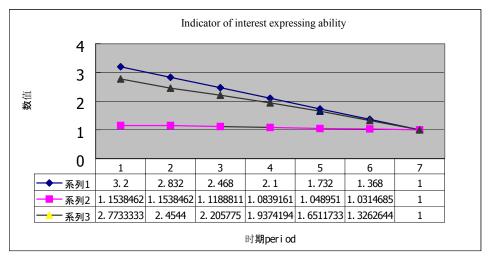ability between the auto industry and economical crop industry in China as an example. See
following

Figure 2 indicator of interest expressing ability

时期period	1	2	3	4	5	6	7
系列1	3.2	2.832	2.468	2.1	1.732	1.368	1
系列2	1.1538462	1.1538462	1.1188811	1.0839161	1.048951	1.0314685	1
系列3	2.7733333	2.4544	2.205775	1.9374194	1.6511733	1.3262644	1

Source： 1.US-China Business Council: Copy of US-China Bilateral Market Access
Agreement as Released by USTR on March 14, 2000;   2. PROTOCOL ON THE
ACCESSION OF THE PEOPLE'S REPUBLIC OF CHINA

Figure 2 shows the difference in interest expressing ability of the two typical sectors,
automobiles and economical crop in China, is magnitude.

4.2 Incorporation of Agent's Policy Demand into Endogenous Trade Policy
4.2.1 The Single-Sector Interest Model
When trade policy is only relevant to a single sector or even if the case is multi-sector but it
is not put into consideration by policy-maker, the process of policy-making can be expressed as
the following process of partial derivation of agent's objective function, *vice verse* （See following
analysis:

模型I: $$P = \frac{\partial f(A_T, A_{S,})}{\partial A_i} \qquad\qquad i = (T, S) \in A \qquad (9)$$

Under exogenous trade policy: $i \notin A$ $i \in G$

A=agent (also the representative of sector interest in China's foreign trade and its policy

practice) A_T =import or export sector； A_s = import competition sector or sector sales export to

domestic market。

4.2.2 The Multi-Sector Interest Model
When trade policy is relevant to several sectors and all sectors are fully considered by

policy-makers, the single-sector model could be extended to a multi-sector one. Thus, the process of policy-making could be expressed as the following making of the total differential coefficient of agent's objective function:

模型 II: $\quad P = \sum_{i=1}^{n} \frac{\partial f(A_1, A_2, \cdots\cdots A_n)}{\partial A_i} \qquad\qquad i = 1,2, \cdots\cdots n \in A \qquad (10)$

Where sector I represents tradables and substituting sector and two or more indirectly related sectors, whose agent could take three kinds of positions. Beside assent and dissentient, some sectors that are indirectly related could take renunciation as a position towards curtain policy because they feel that outcome from negotiated equilibrium in both external and internal market would offset the negative effect of the substituting sectors in the country's trade partners on them.

4.2.3 An Evidence

Full incarnation of individuals' preference in trade policy model is the critical criteria to identify the endogeneity of trade policy, which has to rely on a particular governing structure to realize its voting decision. For example, in antidumping procedure, although administrative verdict taken in China can mediate different sector's interests, it cannot achieve the full balance of sectoral interests. And some countries, typically the USA, adopt collective choice as a means of public decision-making. So the governing structure is a committee mechanism. And the members of the committee can represent the economic preferences of the import, import competing and other indirectly related sectors by voting for or against one policy or renunciation. This can be illustrated by the geometric probability of affirmative anti-dumping cases in both China and USA

table 2 geometric probability of affirmative anti-dumping cases in both China and USA

counntry	time	number of cases that passes the first or final arbitrage	number of affirmative dumping cases	number of negative dumping cases
China	1997.3—2003.6	18	15	3
the U.S.	1998.1—2003.6	143	114	29

source: Proclamation of the Ministry of Foreign Trade and Economic Cooperation of People's Republic of China; USTTC, news release.

Geometric probability model $\quad P_c = \int_0^n F(X)dx / \int_0^n Xdx \quad$ c = (China, US) $\quad$;

$F(X) = aX + C \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad (11)$

using the statistics above and by regression we have:

$$p_{China} = \int_0^{18} (0.9494X - 2.352)\,dx / \int_0^{18} X\,dx \approx 0.6879$$

$$P_{US} = \int_0^{143} (0.8967X - 18.72)\,dx / \int_0^{143} X\,dx = 0.6348$$

The outcome above shows that import competing sectors' real interest has been the dominant factor in the verdict of antidumping cases in China and import sectors' interest hasn't been fairly expressed so far for various reasons. In contrast with China, import sectors' interest significantly influences the verdict in USA, which reduces the geometric probability of affirmative cases and it is lower than that of China.

V Examination on Endogenous Mechanism of Trade Policy Ⅱ: Endogenization of Policy Target.

5. 1　Model of Endogenized Trade Policy.

5.1.1 Unilateral Case and Popularization of Exogenous Trade Policy: Introduction of CES Function under Non-negotiated Equilibrium

From the rising of mercantilism to the enacting of provisional protocol of GATT, early trade policy showed the long history of unilateralism, when individual preference A could be fairly compatible with government considerations for external economy in affecting the process of policy-making. However, this also brought difficulties in the shaping of a totally endogenized trade policy, as the clarifying of the protective level Φ_i had not been strictly constraint by the pressure of counterparts' protection.

$$\Phi_i = f(A_i, G_i) = a\left[\delta A_i^{-\lambda} + (1-\delta)\ G_i^{-\lambda}\right]^{-1/\lambda} \tag{12}$$

where $\qquad A_i = F\left[f(m_{iI}, m_{iO}, E_i),\ \mathrm{MAX}\ \sigma_i\right] \qquad\qquad G_i = MAX\ E_X$

$$\tag{13}$$

式中：E_X = external economic consideration for trade protection on product X；a =discount ratio of foreign negotiation；δ = the share of effect of individual preference；$1-\delta$ = the share of effect of external economic consideration.

$$\sigma = \frac{1}{1+\lambda} \geq -1$$

Models above explain the behavior pattern in which western countries took a foreign exchange policy for dumping to promote expansion in export and heightened tariff barriers to block the surge of import without common trade discipline, which resulted in hyper-protection and average tariff rate in western countries was as high as 40% after WWⅡ. Considerations for various domestic interests promoted the rising of Φ almost without restraint. In 1980s when China was in its early stage of opening-up, practice of unilaterally made policy caused the average tariff including that on agriculture products to reach as high as 43%.

5. 1. 2 Bilateral Case and Formulation of Endogenous Trade Policy: Introduction of CES Function Under Negotiated Equilibrium

Reciprocal trade policy is an important characteristic of current trade policy practice and

constitutes the ultimate constraints on equilibrium level and protection on interests involved achieved through reciprocal negotiations in the development of the mechanism of trade policy formulation. If the main target of the incorporation of constraint on equilibrated negotiation and clarifying endogenous trade policy is to define the relationship between government desire and individual preference and to let this two factors determine the protection level on one sector, Cobble-Douglas Function has to be used to delineate the mathematic interdependence between individual preference A and government objective G. And that is:

$$\Phi = aA^{\alpha}G^{\beta} \qquad 满足\ \alpha + \beta = 1 \quad \text{and} \quad \sigma = 1 \qquad (14)$$

In this model, fixing some variables to curtain value and setting other exogenous variables to determine the protection on the sector could fairly properly simulate the process of trade policy-making.

5. 1. 3 Multi-Sector and Single–Sector models in A Bilateral Case

Major means to promote trade liberalization after WWⅡ is the multilateralization of the achievements brought by bilateral-negotiations through the particular mechanism of MFN in GATT or WTO. In the framework of GATT and WTO, bilateral negotiation often adopts colligated compensation to arrive at a package of agreements for concession on market accession. And in another case, conditions of market accession can be swapped among domestic sectors. Even if there are some constraints of equilibrated negotiation, there is significant difference in the range of constraint. So it is necessary to set both single and multi-sector models.

Model for Multi-Sector: General Equilibrium Approach

In the multi-sector model, although an agreement prescribes a country's aggregated commitments in market accession, the countries can still implement structural protection in particular sectors. Thus, disparity between individual preference and government objectives will be ameliorated and the model in reduced form can ensure two variables to be compatibles. See following formula:

$$\Phi_i = f(A_i, G_i) = a_i A_i^{\alpha} G_i^{\beta} \qquad\qquad i = 1, 2, 3, \cdots\cdots n \qquad (15)$$

that satisfy:
$$\frac{\sum_{i=1}^{n} \Phi_i}{n} \leq \Phi_A \qquad (16)$$

Where Φ_A is the aggregated protection agreed in the negotiation of colligated compensation.

Single-Sector Model: Partial Equilibrium Approach

With fairly stable protection achieved through equilibrated negotiation in the single sector model, individual preference and government considerations have lost the nature of exogenous variables. They have to reestablish their own shares of influence on the formulation of trade policy and the ratio of the shares has to satisfy substitute elasticity. In consideration of the flexibility of results achieved in the final negotiation, the model can allow little fluctuation stemmed from difference between A_i and G_i in different combinations of α and β. It can be written as:

$$\Phi_i = f(\alpha, \ \beta) = a_i A_i^{\alpha} G_i^{\beta} \qquad\qquad （17）$$

VI Policy Implication and Its Practice

Success in modeling synthesis in endogenized trade policy will remarkably extend its implications and will be extensively applied to trade policy-making in China. Since the middle of 1980s, traditional trade system, as an integral part of the whole economic reform, has been experiencing systematic reform to stimulate firms and external sector as a whole to establish an organizational base and architecture in accordance with globalization and international competition, particularly after China's accession to WTO. So far, China has completed its transformation from traditional trade policies to modern ones that are required by a market-oriented economy, and it is expected that China will make the full achievement in trade policy reform defined by economists as a developing country soon （Krueger, 1978）. Meanwhile trade policy implemented in China has been in accordance with targets of macro-economy, social welfare and economic security in the past decades and trade policy-making has showed obvious exogeneity. Endogenous trade policy is in accordance with the current situation in which interests of various tradable sectors is becoming more and more diversified.

The essence of the transferring to endogenous trade policy is to recognize the profound change in interest diversification of trade-related sectors in China and to fully consider the interest balance among various sectors and take the full advantage of firms' comparative advantage in international specialization in China.

It is necessary to readjust the role and function of the government to implement endogenous trade policy in China properly, especially as it is different from traditional trade policy in the implementing process of border measures. As the achievements of academic studies are applied to policy practice, we suggest that consulting agencies and commission-based mechanism be set to ensure the success of collective choice mechanism.

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