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ABSTRACT

We note the absence of prior literature on analytical structures to be used for China and other economies with extensive SOEs when evaluating behavioural responses of SOEs to trade policy and other changes. This is despite both the large empirical literature discussing the productivity effects of Chinese SOE enterprise reform, and wider policy discussion of the potential impacts of various reform initiatives. We present two simple analytical formulations of SOE behaviour in response to trade policy change with the aim of investigating how traditional competitive models of enterprise behaviour can mislead when used in policy debate. One formulation centres on SOE managerial control. In this enterprise managers are politically appointed, expect any non performing loans to be recapitalized by state banks andhence capital is centrally allocated by credit rationing. The managers are assured to maximize the size of the enterprise rather than profits since this yields maximal networking benefits to managers. This implies labour is priced at its average rather than its marginal product, and with a competitive non-manufacturing (agricultural) industry free trade is not optimal policy. The other assumes worker control of SOEs and that workers satisfice in their supply of effort to the enterprise given both fixed wage rates and enterprise employment and otherwise shirk or pursue second jobs. In this formulation the enterprise meets their budget constraint and covers costs. With leisure in the preferences of enterprise members, their leisure consumption will be implied by the satisfying behaviour of the enterprise and will be non optimal. In both model variants, implications for trade policy are different from those of a standard competitive model, and computations using models calibrated to 2003 Chinese data suggest the differences can be large.

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1 Introduction

It seems widely agreed in the literature both that the institutional structure of China's economy remains significantly different from that of the OECD economies, and that to analyze policy issues in China using simple western style neoclassical models based on household utility and firm profit maximizing behaviour can be potentially misleading. Nowhere is this more the case than in the trade policy area where simple competitive structures are now widely used to analyze a range of Chinese trade policy issues including the implications of WTO accession and China's regional trade agreements (see Ianchovichina and Martin (2004)). This is despite China's industrial sector continuing to heavily feature state or communally owned enterprises (national, provincial, municipal government, publicly funded research institutes, and other). Previous literature on Chinese SOEs has been mainly econometric; assessing performance, profitability and labour hiring (examples are Bigsten, Liu, and Zhang (2002), Cull and Xu (2003), and Liu (2002)). None to our knowledge has been analytic.

Here we present two different analytical structures which we use to analyze the behavioural response of communally owned enterprises in China to trade policy changes using numerical simulation methods. The ways that we model behavioural responses imply departures from Pareto optimality relative to competitive structures, and so free trade is not best policy if no changes are made to enterprise structure. Since our analysis also applies to other economies with SOEs, we also emphasize the analytical gap in existing literature so far as model based analyses of the behavioural response of SOEs to such policy changes, as trade liberalization is concerned. In the first of these, we assume that enterprises are managed by political appointees and that the state banking system will receive funds from the central bank to cover any non-performing loans through a recapitalization. Capital is thus centrally allocated via credit rationing, and with (effectively) no servicing costs of debt the cost of capital to management is zero. Enterprises are assumed to be entirely under managerial control, and we assume management hires labour in a competitive labour market paying the going wage. If politically appointed enterprise managers are motivated by the returns they receive from networking both with other managers and more broadly within the political structure, they will seek to maximize the size of the enterprise subject to the constraint of covering labour costs rather than profits, since larger size confers more personal network benefits on management. This, in turn, means that enterprises hire labour up to the point that the wage they pay equals the average rather than the marginal value product of labour. Typically, too much labour will be hired (relative to a Pareto optimal outcome) in free trade and a tariff will worsen things. While a simplified analytical treatment, the key for our purposes is that in such an economy with state owned enterprises in the industrial sector and competitive enterprises elsewhere (in agriculture), labour is misallocated by freely functioning product and labour markets, and free trade need not to be the best policy.

We first show this for a case where the manufacturing sector has a single SOE and the economy is a price taker (removing monopoly power for the SOE), and then extend this to a more complex case where SOEs and competitive firms co-exist within the same sector. We use data for China for 2003 to

calibrate both models. We are also able to make calculations of the cost to China of free trade in such a world and assess the welfare implications of Chinese trade policy changes in the SOE models relative to a comparable competitive model.

We then present a second formulation of SOE behaviour in which we assume that the workforce, rather than management, collectively determines output. If the enterprise budget construct is not met the enterprise will close and workers will lose their jobs. We assume that both employment and wage guarantees apply for workers, who engage in satisficing behaviour in terms of their supply of effort in meeting the enterprise budget constraint. Once enough effort is expended to generate output to meet this constraint, labour shirks or engages in moonlighting (second jobs). Capital is again assumed to be centrally allocated at no cost to the enterprise. Here the analytical point is that from the enterprise budget constraint, the effort level of workers is determined. This implies that if preferences for workers are defined over both goods and leisure, the marginal utility of leisure will not equal the marginal productivity of additional effort in SOE production. Again, a departure from Pareto optimality occurs relative to a traditional competitive structure. We also apply this formulation to 2003 Chinese data showing that free trade is again not best policy, and also extend the model to the case where both private firms and an SOE produce manufactuing output.

Both of these formulations are only crude abstractions from the more complex and diverse world of communally owned production units which characterize the contemporary Chinese economy. Attempts to combine these two formulations face the difficulty that only one objective function for the enterprise can easily be accommodated. Also, state-owned enterprise reform in China has proceeded in recent years in ways that imply that neither of these two simple formulations is entirely satisfactory. But given the seeming absence of prior analytical literature on the behavioural response of SOEs to trade policy change, and the implication we stress that in both model variants free trade is no longer best policy, we believe that our analyses are of wider interest given that numerical results from competitive models are now extensively cited in trade policy debute in China.

Many other potential formalizations of SOEs can probably be constructed, and we do not claim that ours are in any way definitive. However, the ones we present are simple and transparent and lead to different policy implications from the traditional competitive case. These formulations thus provide an initial base for further work, rather than definitive analyses of how Chinese SOEs actually respond to policy change in practice. Numerical simulation work on economies such as China needs to take into account more specificity of economic structure than currently appears in the literature, since simple application of conventional neoclassical models to Chinese policy reform (such as trade liberalization) can mislead.

2 The State-Owned Enterprise Sector in China

The state-owned enterprise sector in China, while declining somewhat in significance in recent years, is large, pervasive and embodies complex and interlocking forms of ownership and corporate control. Bill Gates at a recent World Economic Forum Conference in Davos (Gates 2005) suggested that China has created a new form of capitalism with heightened dynamism, meritocratic management, and superior labour force organization. However, we tend to view China as perhaps closer to a new form of socialism or communism rather than a new form of capitalism. In this new form, central direction through planning has been removed but production units in the urban manufacturing sector remain largely communal with many diverse organizational forms in their ownership and management structure. [1] Competition between communally owned units both can be and typically is aggressive, but many of these entities make losses, and the banking system has been used until recently as the mechanism for recapitalizing loss making SOEs and servicing large non-performing loans. [2] Most of these enterprises also involve politically appointed management who, in turn, seem to operate so as to maximize enterprise size for personal network (Guanxi) benefits rather than for profits. Also, individual economic behaviour in China is much more heavily reflective of group (family, village, town, county, district, province, country) interest over individual interest than is true of OECD economies.

However measured, collectively owned and controlled enterprises in China's industrial sector is substantial, even through the precise mix of public and private ownership is hard to ascertain because of the complexity of organizational form. An example of this complexity is provided by Lenovo, who recently received substantial media attention for their buy out of IBM's PC Business. Lenovo is a quoted company listed on the Hong Kong and New York exchanges which has grown quickly since its establishment in 1984. However, 43 % of Lenovo's stock (a controlling interest) is held by Legend Holdings who in turn are under the control of the Chinese Academy of Natural Sciences through a 65 % holding. Thus, Lenovo is effectively a communally controlled entity even through seemingly widely discussed in the media as a private company.

Fan and Wang (2004) and Tan, Wang and Zhang (2005) (both quoted by Liu (2005)) estimate that that of 1134 listed companies in China in 2001, 61.4 % are under local government control, 12.6 % are under central government control, 3.4 % are collectivelly controlled, and 12.8 % are privately controlled, with 5.2 % unaccounted for. The privately controlled component is up from 3 % in 1993, but still represents a significant minority of publically listed companies. Data on ownership forms for both listed and non-listed enterprises are reported in a variety of forms in the China Statistical Yearbooks, and are also quoted by Broadman (2001). In his data, in 1999 SOEs and collective enterprises accounted for 63 % of gross value added of all enterprises and SOEs and collective enterprises accounted for 70 % of 1999 industrial sector employment.

This communally owned and managed structure while complex in its detail is clearly central to

[1] See Broadman (2001).

[2] See Bonin and Huang (2002) who suggest that perhaps 60 % of loans to the banking sector are nonperforming, in contract to official estimates in the 25 % range.

any evaluation of trade policy changes in China since the behavioural response of production units of this form will differ from that of competitive private firms as typically modelled in current numerical analyses of Chinese trade policy changes. Previous numerical modelling literature on China either adopts simple competitive assumptions as in Ianchovichina and Martin (2004), or variants of monopolistically competitive models. Modelling capturing explicit representations of SOEs behaviour is absent. As we note above, analytical literature on SOE behaviour seems not to be available and this is the gap we attempt to partially fill.

3 Models Capturing the Behavioural Response by Chinese SOEs to Trade Policy Change

Any analytical structure used to represent the behavioural response of SOEs in China to policy or other shocks (such as prices changes) will inevitably only provide an abstraction from a more complex reality. The point emphasized here is that the behavioural response of such enterprises to policy change is likely to depart from that of the competitive privately owned firm which provides the center piece of Western neo-classical economic analysis, and analytical frameworks for the analysis of SOE behaviour are not well developed in literature.

Here we consider two alternative formulations of SOE behavioural response to trade policy change. In the first, SOEs are assumed to be under managerial control with managers politically appointed. We assume that capital is effectively centrally allocated by rationed credit via the banking system, and that all losses from non-performing loans made to state-owned enterprises are covered through a recapitalization mechanism via the state owned banking system. As such, capital is effectively free to management but access to it is constrained via credit rationing. We then assume that enterprise managers seek to maximize personal gain from networking and political connections (Guanxi). A simple representation of this is to assume that enterprise managers seek to maximize enterprise size rather than profits. The implication is that if managers hire labour in a competitive labour market (a strong and simplifying assumption in the Chinese case) and pay labour its going wage, they will hire labour up to the point that the product price equals the average value product of labour, rather than the marginal value product as in the competitive case.

In such a world, free trade will typically not be best policy since there is a departure from the conditions for Pareto efficiency. Average product pricing of labour by SOEs will typically imply that the SOE sector is too large relative to Pareto efficiency, and protection of this sector via trade barriers can be Pareto improving. With a more complex formulation capturing co-existence of SOEs and private firms in the manufacturing sector, if private firms provide marginal production conditions for Pareto efficiency will be satisfied at the margin but inframarginal production will be inefficiently provided by SOEs that are individually too large.

Our second formulation, in contrast, assumes that the work force rather than management collectively controls the enterprise. Workers in SOEs are assumed to have job and wage guarantees (the so called Iron Rice Bowl system), and collectively determine output in response to product prices set on world markets (plus or minus ad valorem trade interventions). Capital is again assumed centrally allocated by credit rationing, and to be at zero cost to the enterprise with losses again covered via recapitalization through the banking system. In this case, workers collectively engage in satisficing behaviour, supplying effort to produce enough output to meet their enterprise budget constraint, but otherwise engage in shirking or moonlighting (taking second jobs). Here, with the firm budget constraint effectively determining output a fall in a product price (such as with the removal of protection) will increase output rather than reduce it as in the competitive case. Moreover, effort levels of workers are determined from the enterprise

production function and the enterprise budget constraint due to the satisfycing bahaviour of workers. This implies that if leisure enters preferences for these workers the marginal valuation of leisure (reduced effort) will not equal the marginal value of extra effort in production in SOEs. Again, a departure from Pareto optimality not present in a competitive model will occur and free trade again will not provide best policy.

Our purpose in using these two simple formulations is to highlight both the differences in behaviour relative to the conventional competitive firm case and the relative lack of analytical literature in this area on which to draw in assessing behavioural response in China to trade policy change given the large presence of SOEs. Also, the implication is that in the absence of enterprise reform, free trade will typically not provide the appropriate trade policy stance.

3.1 Managerial Control Models

We consider two version of models incorporating SOE managerial enterprise control: a simple model in which we assume there is only a single state-owned enterprise in the manufacturing sector and a more complex variant in which both SOEs and competitive firms co-exist in the manufacturing sector. In both cases, we assume there are two sectors in the economy, an agricultural sector with private competitive enterprises and a manufacturing sector with either only a single SOE or a single SOEs along with a series of atomistic competitive firms.

We consider a small open economy case with two goods (agriculture and manufacturing) both consumption and produced. The world prices for the 2 goods (agriculture and manufacturing) are P_A^0 and P_M^0. Domestic prices are then given by world prices plus (or minus) the effect of ad valorem border measures (either import tariffs or export subsidies), i.e.

$$P_A = (1 + r_A)P_A^0 \qquad and \qquad P_M = (1 + r_M)P_M^0 \tag{1}$$

where P_A and P_M are domestic prices of the agricultural and manufacturing products, and r_A and r_M are agricultural and manufacturing import tariffs or export subsidies ($r_A > 0$ and $r_M > 0$ indicate tariffs, and $r_A < 0$ and $r_M < 0$ indicate export subsidies).

In the agricultural sector we assume a decreasing returns to scale production function

$$Y_A = \phi_A L_A^{\alpha_A} \tag{2}$$

where Y_A is agricultural output, L_A is labour used in agriculture, ϕ_A is a units term (scalar parameter), and $\alpha_A < 1$ is the production exponent. We assume that in this sector labour is paid its marginal product, i.e. the wage rate is

$$W_A = P_A \frac{\partial Y_A}{\partial L_A} = P_A \phi_A \alpha_A L_A^{\alpha_A - 1} \tag{3}$$

and agricultural rent is $R_A = P_A Y_A - W_A L_A$.

In the manufacturing sector the production function is

$$Y_M = \phi_M L_M^{\alpha_M} \tag{4}$$

where Y_M is manufacturing output, L_M is labour used in manufacturing, ϕ_M is a units term (scalar parameter), and $\alpha_M < 1$ is the production exponent.

The use of capital by the enterprise is captured simply in the fixed factor implied in the decreasing returns production function. Capital is assumed to be allocating via centralized credit allocation through the banking system, but recipients of loans (and hence capital) expect that any servicing costs of the loan will be covered by central recapitalization of the banking system, and they can allow the loans to remain as non-performing. We assume managers of the enterprise are politically appointed and are concerned with the size of their personal network rather than profits. Thus networking benefits are assumed to be collinear the size of the enterprise they manage. Thus, in this simple model with a single SOE, labour is paid its average value product since managers maximize enterprise size measured by output Y subject to the enterprise budget constraint.

Since capital is effectively unpriced, this implies that

$$P_M Y_M = W_M L_M + R_M \tag{5}$$

where R_M is the (given) surplus to be transfered to the state by the SOE. This, in turn, implies that labour receives its average value product plus its share of required surplus rather than its marginal product. This implies that conditions for Pareto efficiency are violated, and as a result in such a model free trade will typically not be best policy.

On the demand side of the model, domestic consumption of agricultural and manufacturing output reflect utility maximizing behaviour by a single representative household, which for convenience we assume to be of Cobb-Douglas form, i.e.

$$U = X_A^{\theta_A} X_M^{\theta_M}, \qquad \theta_A + \theta_M = 1 \tag{6}$$

where X_A and X_M are consumption of agricultural and manufacturing, and θ_A and θ_M are Cobb-Douglas exponents.

Household income is given by

$$I = P_A Y_A + P_M Y_M + r_A P_A^0 Z_A + r_M P_M^0 Z_M + P_A^0 Z_A^0 + P_M^0 Z_M^0 \tag{7}$$

where $Z_A = X_A - Y_A$ and $Z_M = X_M - Y_M$ are the net trade in each product (positive indicating imports and negative indicating exports) and we assume any surplus accruing to the state is recycled to consumers as lumpsum transfers.

The household budget constraint implies that

$$I = P_A X_A + P_M X_M \tag{8}$$

From the household budget constraint there will be balanced trade in equilibrium. If preferences are Cobb-Douglas, domestic consumption of the two goods is given by

$$X_A = \frac{\theta_A I}{P_A} \qquad \textit{and} \qquad X_M = \frac{\theta_M I}{P_M}. \tag{9}$$

Equilibrium conditions for this structure are that then there is full employment of labour

$$L_A + L_M = L \tag{10}$$

and wage rates are equalized across the two sectors

$$W_A = W_M. \tag{11}$$

In a more complex version of this model we assume that there both SOEs and private firms operate in the manufacturing sector. Labour is assumed mobile between agriculture and manufacturing and private firms will provide the marginal source of supply of output, but SOEs will hire labour up to the point that the wage paid equals the enterprise average value product. We thus assume both an SOE and competitive firms now operate in the manufacturing sector, and designate domestic prices for each to allow for trade interventions to be firm specific. We again consider two sectors, agriculture with private competitive enterprises and manufacturing, now with both SOEs and private groups. For simplicity we consider only one SOE.

We again set the world prices as P_A^0, P_S^0 and P_P^0. Domestic prices are again assumed to be given by world prices plus (or minus) the effect of ad vlorem border measures (either import tariffs or export subsidies), i.e.

$$P_A = (1 + r_A)P_A^0 \qquad and \qquad P_S = (1 + r_S)P_S^0 \qquad and \qquad P_P = (1 + r_P)P_P^0 \tag{12}$$

where P_A, P_S and P_P are domestic prices of the agricultural and manufacturing SOEs and private groups product, r_A, r_S and r_P are agricultural and manufacturing import tariffs and export subsidies ($r_A > 0$, $r_S > 0$ and $r_P > 0$ indicate import tariffs, and $r_A < 0$, $r_S < 0$ and $r_P < 0$ indicate export subsidies).

In the agriculture sector the production function, wage rates, and agricultural rents are the same as in the simple model, see (2) and (3).

In the manufacturing sector the production function for both SOEs and the private firms is

$$Y_m = \phi_m L_m^{\alpha_m} \qquad for \;\; m = S, P \tag{13}$$

where Y_m is manufacturing output, L_m is labour used in manufacturing, ϕ_m is a units term (scalar parameter), and $\alpha_m < 1$ is the production exponent. Capital is thus treated as a fixed factor in the private firms.

In the SOE, labour is paid its average value product plus its share of any required surplus and capital is unpriced, and so

$$P_S Y_S = W_S L_S + R_S \tag{14}$$

where R_S is the (given) surplus paid to the government by the SOEs.

For the private firms in the manufacturing sector we assume that labour is paid its marginal product, i.e. the wage rate is

$$W_P = P_P \frac{\partial Y_P}{\partial L_P} = \alpha_P P_P \phi_P L_P^{\alpha_P - 1} \tag{15}$$

and rent is $R_P = P_P Y_P - W_P L_P$.

Domestic consumption of agricultural and manufacturing output again reflects utility maximizing behaviour, which for convenience we assume to be Cobb-Douglas, i.e.

$$U = X_A^{\theta_A} X_S^{\theta_S} X_P^{\theta_P}, \qquad \theta_A + \theta_S + \theta_P = 1 \tag{16}$$

where X_A and X_m are consumption of agricultural and manufacturing products, and θ_A and θ_m are Cobb-Douglas exponents for $m = S, P$.

Income is now given by

$$I = P_A Y_A + P_S Y_S + P_P Y_P + r_A P_A^0 Z_A + r_S P_S^0 Z_S + r_P P_P^0 Z_P + P_A^0 Z_A^0 + P_S^0 Z_S^0 + P_P^0 Z_P^0 \tag{17}$$

where $Z_A = X_A - Y_A$, $Z_S = X_S - Y_S$ and $Z_P = X_P - Y_P$ are net trades (positive indicates imports and negative indicates exports) in each product.

The household budget constraint is

$$I = P_A X_A + P_S X_S + P_P X_P \tag{18}$$

and domestic consumption of the three goods are given by

$$X_A = \frac{\theta_A I}{P_A} \qquad and \qquad X_S = \frac{\theta_S I}{P_S} \qquad and \qquad X_P = \frac{\theta_P I}{P_P}. \tag{19}$$

The equilibrium conditions are again that there is full employment of labour

$$L_A + L_S + L_P = L \tag{20}$$

and wage rates are equalized across the two sectors

$$W_A = W_S = W_P. \tag{21}$$

Since labour in the SOE group of firms in the manufacturing sector receives its average value product plus its share of any transferred surplus, rather than its marginal product, an equilibrium will again not satisfy conditions for Pareto optimality and free trade again need not be best policy. But now the departure from Pareto optimality involving marginal supply to the market is absent, and the allocation issue is between SOEs and private firms within manafactoring, with the SOEs too large relative to Pareto optimality.

3.2 Worker Control Models

We next consider two versions of models incorporating worker control rather than managerial control of SOEs. In the basic worker control model SOE behaviour reflects joint decision making on output by the members of each enterprise. We assume both the membership of the enterprise and the enterprise wage rate are fixed and that enterprise members must jointly meet the enterprise budget constraint. If they fail to cover costs by selling output, the enterprise is bankrupt and workers lose their jobs. Enterprise

members thus collectively satisfice and meet the enterprise budget constraint by setting an effort level which yields the required output. They then either shirk or expend additional effort on second jobs. In the simple version of this model we consider only a single state-owned enterprise in the manufacturing sector and two sectors; agriculture with private competitive enterprises and manufacturing with only a single SOE. As with the managerial control model, we then consider an extension with both SOEs and private firms in manufacturing.

For this model domestic prices are again given from world prices by (1). In the agricultural sector the production function is as described in the simple managerial control model (see (2) and (3)). In the simple version of the model with only SOEs in manufacturing, the labour input in the agriculture sector is assumed fixed, so output is always same. In SOEs, the labour input available in terms of the number of manufacturing employees is also fixed, but their effort level is endogenous and hence output is endogenous.In the more complex model with mobile labour in the private sector which spend both manufacturing and agriculture, labour used in agriculture may vary.

For the manufacturing SOE sector we write the production function as

$$Y_M = \phi_M[\lambda L_M]^{\alpha_M} \tag{22}$$

where λ denotes the endogenously determined level of effort and L_M is the membership size of the enterprise. λ is effectively determined by the enterprise budget constraint since workers supply effort which satisfies the enterprise budget constraint. These activities are modelled simply as resulting in leisure consumption for SOE members and are represented by the term $(1-\lambda)L_M$. This budget constraint for the SOE in the manufacturing sector can be written as

$$P_M Y_M = W_M L_M + R_M \tag{23}$$

where R_M is again the required surplus of the enterprise transferred to the state.

On the demand side of the model, domestic consumption of agricultural and manufacturing product again reflect utility maximizing behaviour, but the model involves separately specifying the demand side behaviour of workers employed in the agricultural sector and in the SOE in manufacturing.

Income of workers employed in agricultural and manufacturing workers are

$$I_A = P_A Y_A + \gamma_A[r_A P_A^0 Z_A + r_M P_M^0 Z_M + P_A^0 Z_A^0 + P_M^0 Z_M^0] \tag{24}$$

$$I_M = P_M Y_M + \gamma_M[r_A P_A^0 Z_A + r_M P_M^0 Z_M + P_A^0 Z_A^0 + P_M^0 Z_M^0] \tag{25}$$

where γ_A and γ_M refer to the shares of the tariff revenue distributed by government to workers in agricultural and manufacturing sectors with $\gamma_A + \gamma_M = 1$. Z_A and Z_M are again the net trades in each product (positive indicates imports and negative exports).

Preferences for workers in the agricultural sector are defined only over agricultural and manufacturing goods, and leisure does not appear. We use this simplifying treatment since a departure from Pareto optimality involving leisure consumption would only occur in the manufacturing sector we were to specify

leisure consumption by both types of agents. These preferences are Cobb-Douglas

$$U_A = X_{AA}^{\theta_{AA}} X_{AM}^{\theta_{AM}}, \qquad \theta_{AA} + \theta_{AM} = 1 \tag{26}$$

The household budget constraint is

$$P_A X_{AA} + P_M X_{AM} = I_A. \tag{27}$$

Consumption of the two agricultural and manufacturing workers is

$$X_{AA} = \frac{\theta_{AA} I_A}{P_A} \qquad and \qquad X_{AM} = \frac{\theta_{AM} I_A}{P_M}. \tag{28}$$

For the consumers receiving income from working in the manufacturing sector SOE, their utility is now defined over 3 goods, consumption of agricultural and manufacturing goods and leisure, given by $(1-\lambda)L_M$. In the Cobb Douglas case this is

$$U_M = X_{MA}^{\theta_{MA}} X_{MM}^{\theta_{MM}} \left[(1-\lambda)L_M\right]^{\theta'_{MM}}, \qquad \theta_{MA} + \theta_{MM} + \theta'_{MM} = 1 \tag{29}$$

The household budget constraint is

$$P_A X_{MA} + P_M X_{MM} = I_M. \tag{30}$$

Consumption of the 2 agricultural and manufacturing goods by manufacturing workers is

$$X_{MA} = \frac{\theta_{MA}}{\theta_{MA} + \theta_{MM}} \frac{I_M}{P_A} \qquad and \qquad X_{MM} = \frac{\theta_{MM}}{\theta_{MA} + \theta_{MM}} \frac{I_M}{P_M}. \tag{31}$$

The net trades are

$$Z_A = X_{AA} + X_{MA} - Y_A \qquad and \qquad Z_M = X_{AM} + X_{MM} - Y_M. \tag{32}$$

With this formulation, the marginal utility of leisure will not necessarily equal the marginal value of additional effort in production, since the requirement is that the enterprise members meet their budget constraint or face loss of their jobs. This means that satisficing bahaviour (in the sense of Simon) occurs at enterprise level and determines leisure consumption of enterprise workers. Thus

$$\lambda \phi_M [\lambda L_M]^{\alpha_M - 1} \neq \theta'_{MM} X_A^{\theta_A} X_M^{\theta_M} \left[(1-\lambda)L_M\right]^{\theta'_{MM}-1} \tag{33}$$

and this provides is an additional departure from Pareto Optimality besides those conventionally associated with trade interventions (such as a tariff at the border) in a competitive model and will imply consumption of leisure inconsistent with Pareto optimality. Production will also be affected by a tariff and a changed value of λ. The additional distortion of leisure consumption relative to Pareto optimality implies that free trade again need not be the best policy since in free trade (33) will apply. A trade intervention will affect consumption and production, but may also improve matters in terms of the leisure distortion.

A equilibrium for this model is characterized by an equilibrium value of λ, and the wage rate. Given λ, the output of the SOE, and both household budget constraints are then determined. Agricultural

output is determined by domestic prices and the agricultural production function given L_A. Consumption by each household type can be determined and international trade is given by the difference between production and consumption of each good. Trade balance follows directly from the budget constraint. λ can be changed by trade policy interventions since domestic prices will change. If reduction in a tariff lowers domestic prices and raises output of manufacturing from the budget constraint (23),this is opposite to the behaviour in a traditional competitive model in which a lowered tariff reduces output in the protected sector. Because of the satisficing behaviour of enterprise members in terms of effort supply, the marginal utility of leisure will not necessarily equal the marginal value of extra effort in manufacturing production. The marginal valuation of leisure by workers in manufacturing on the one hand and the additional potential output from increased effort on the other will not be the same. This is a departure from Pareto optimality on the consumption and product sides which exists along with conventional distortions of trade. Free trade again need no longer be best policy because of the presence of the additional leisure distortion.

In a more complex form of the worker control model, we can again consider two sectors, agriculture but with both private competitive enterprises and private firms in manufacturing. Domestic prices are again given from world prices by (12). The agricultural sector is the same.

For the manufacturing SOE, the production function is again

$$Y_S = \phi_S[\lambda L_S]^{\alpha_S} \tag{34}$$

where λ denotes the endogenously determined level of effort, and L_S is the membership of enterprises. Labour is paid its average value product and its share of any required surplus and capital is unpriced, hence (14) holds.

For the private sector in manufacturing the production functions is

$$Y_P = \phi_P L_P^{\alpha_P} \tag{35}$$

and labour is paid its marginal product, i.e. the wage rate is given by (15).

Income of workers employed in agricultural and manufacturing workers are

$$I_A = P_A Y_A + \gamma_A[r_A P_A^0 Z_A + r_S P_S^0 Z_S + r_P P_P^0 Z_P + P_A^0 Z_A^0 + P_S^0 Z_S^0 + P_P^0 Z_P^0] \tag{36}$$

$$I_S = P_S Y_S + \gamma_S[r_A P_A^0 Z_A + r_S P_S^0 Z_S + r_P P_P^0 Z_P + P_A^0 Z_A^0 + P_S^0 Z_S^0 + P_P^0 Z_P^0] \tag{37}$$

$$I_P = P_P Y_P + \gamma_P[r_A P_A^0 Z_A + r_S P_S^0 Z_S + r_P P_P^0 Z_P + P_A^0 Z_A^0 + P_S^0 Z_S^0 + P_P^0 Z_P^0] \tag{38}$$

where γ_A, γ_S and γ_P refer to the shares of the tariff revenue distributed by government to workers in agricultural and manufacturing sectors with $\gamma_A + \gamma_S + \gamma_P = 1$. Z_A, Z_S and Z_P are again the net trades in each product (positive indicates imports and negative exports).

Preferences for workers in the agricultural sector are defined only over agricultural and manufacturing goods, and leisure does not appear. We use this simplifying treatment since a departure from Pareto optimality involving leisure consumption would only occur in the manufacturing sector we were to specify

leisure consumption by both types of agents. These preferences are Cobb-Douglas

$$U_A = X_{AA}^{\theta_{AA}} X_{AS}^{\theta_{AS}} X_{AP}^{\theta_{AP}}, \qquad \theta_{AA} + \theta_{AS} + \theta_{AP} = 1 \tag{39}$$

The household budget constraint is

$$P_A X_{AA} + P_S X_{AS} + P_P X_{AP} = I_A. \tag{40}$$

Consumption of the two agricultural and manufacturing workers is given by

$$X_{AA} = \frac{\theta_{AA} I_A}{P_A} \qquad and \qquad X_{AS} = \frac{\theta_{AS} I_A}{P_S} \qquad and \qquad X_{AP} = \frac{\theta_{AP} I_A}{P_P}. \tag{41}$$

For the consumers receiving income from working in the manufacturing SOEs sector, their utility is now defined over 3 goods, consumption of agricultural and manufacturing goods and leisure, given by $(1-\lambda)L_S$. In the Cobb Douglas case this is

$$U_S = X_{SA}^{\theta_{SA}} X_{SS}^{\theta_{SS}} \left[(1-\lambda)L_S\right]^{\theta'_{SS}} X_{SP}^{\theta_{SP}}, \qquad \theta_{SA} + \theta_{SS} + \theta'_{SS} + \theta_{SP} = 1 \tag{42}$$

The household budget constraint is

$$P_A X_{SA} + P_S X_{SS} + P_P X_{SP} = I_S. \tag{43}$$

Consumption of the 3 agricultural and manufacturing goods by manufacturing workers is

$$X_{SA} = \frac{\theta_{SA}}{\theta_{SA} + \theta_{SS} + \theta_{SP}} \frac{I_S}{P_A} \quad and \quad X_{SS} = \frac{\theta_{SS}}{\theta_{SA} + \theta_{SS} + \theta_{SP}} \frac{I_S}{P_S} \quad and \quad X_{SP} = \frac{\theta_{SP}}{\theta_{SA} + \theta_{SS} + \theta_{SP}} \frac{I_S}{P_P}. \tag{44}$$

For the consumers receiving income from working in the manufacturing private firms sector, their utility is now defined over 3 goods. In the Cobb Douglas case this is

$$U_P = X_{PA}^{\theta_{PA}} X_{PS}^{\theta_{PS}} X_{PP}^{\theta_{PP}}, \qquad \theta_{PA} + \theta_{PS} + \theta_{PP} = 1 \tag{45}$$

The household budget constraint is

$$P_A X_{PA} + P_S X_{PS} + P_P X_{PP} = I_P. \tag{46}$$

Consumption of the 3 agricultural and manufacturing goods by manufacturing workers is

$$X_{PA} = \frac{I_P}{P_A} \qquad and \qquad X_{PS} = \frac{I_P}{P_S} \qquad and \qquad X_{PP} = \frac{I_P}{P_P}. \tag{47}$$

The net trades are

$$Z_A = X_{AA} + X_{MA} - Y_A \qquad and \qquad Z_M = X_{AM} + X_{MM} - Y_M. \tag{48}$$

We can extend our treatment of the demand side of the economy by specifying preferences for workers in both private firms and in the agricultural sector defined only manufacturing and agricultural goods. The demand side structure is thus similar to that of the simple model.

The extended model departs from the simple model in having an endogenously determined wage $W_A = W_P$ such that labour markets in the private manufacturing and agricaulture sector in combination clear, i.e.

$$L_A + L_P = L - L_S \tag{49}$$

where $L - L_S$ is the non SOE labour endowment of the economy.

A equilibrium is again given by a value of λ and equilibrium embodies maximization of utility subject to household budget constraints with implied trade balance. The departure from Pareto optimality remains that for workers in each SOE the marginal value of additional effort in production differs the marginal value of extra leisure. The added feature of the more complex model is that marginal supply of manufacturing output to the market will come from competitive firms and so departures from Pareto optimality now occur with intra marginal SOE production and the associated distortion of leisure consumption by workers in the SOE.

4 Numerical Analysis of SOE Responses to Trade Liberalization in China

We have used the two formulations set out above to conduct numerical analyses which explore possible economy wide responses to trade liberalization in China in observationally equivalent models and contrast the results to those generated by comparable simple competitive structures. We calibrate both model forms to a 2003 benchmark equilibrium data set capturing the presence of Chinese SOEs, and use similar data in calibrating a competitive model for comparison purposes.

We draw on data from the Chinese National Bureau of Statistics (NBS) (2004) (from the China Statistical Yearbook) for our calibrations. In the simple versions of both models, we treat the entire managerial sector as a simple SOE. For the more complex model forms we group the manufacturing sector in China across sectors of registration as reported in the China Statistical Yearbook and allocate each to the two manufacturing sub sectors appearing in the model of SOEs and private firms. Sectors of registration according to the statistical yearbook are as Manufacturing 1 = State-Owned Industry, Manufacturing 2 = Collective-Owned Industry, Manufacturing 3 = Co-operative Enterprises, Manufacturing 4 = Joint Ownership Enterprises, Manufacturing 5 = Limited Liability Co-operations, Manufacturing 6 = Share Holding Enterprises, Manufacturing 7 = Private Enterprises, Manufacturing 8 = Other Enterprises, Manufacturing 9 = Enterprises with Funds from Hong Kong, Macao, and Taiwan, and Manufacturing 10 = Foreign Funded Enterprises. We treat the first 5 as the SOE subsector, and the latter 5 as the competitive subsector in manufacturing.

From the NBS data (Table 1) the 2003 gross output of the agriculture sector (farming, forestry, animal husbandry and fishery), P_AY_A, is 2969.180 billion RMB, and the value of labour input, W_AL_A, is 2614.101 billion RMB. The value of net trade (imports) in agriculture, Z_A, is 3143.310 billion RMB. The gross industrial output, P_MY_M, is 14227.122 billion RMB, and the value of labour input, W_ML_M, is 7297.69072 billion RMB. The value of net trade (exports) in manufacturing, Z_M, is - 5252.79722 billion RMB.

We define physical units for agricultural and manufacturing products to be related to these value observations following the Harberger and Shoven and Whalley units convention that in the initial benchmark equilibrium data world prices, $P_A = P_M = 1$ and wage rates $W_A = W_M = 1$. There is no information that we can use from base data to yield λ through calibration, and so we assume $\lambda = 0.75$ in manufacturing in the base data and then perform sensitivity analysis around this value.

We use literature sources for both import tariffs and export subsidy rates for China's agricultural and manufacturing trade. The export subsidy for manufacturing reflects tax preferences for exports given to foreign owned enterprises. The average tariff rate on imports (agricultural good) is $r_A = 16.8\%$ (from Yu (2004) and BBCE (2004)), and the average export subsidy (subsidy rate on the manufacturing good) is $r_M = -15.0\%$ (from CHINANEWS (2003 and 2004)). These two compound in their effects on relative domestic prices relative to world prices. [3]

[3]From these literatures sources, the average import tariff rate on agricultural goods is 16.8 %, and the average export

These data sources thus yield a benchmark data set that we are able to use in calibrating our 2 models in both their simple and more complex forms. The resulting model parameter values are set out in Tables 2 and 3. In calibration, for the managerial control model first order conditions imply no value directly for the exponent in the production function. For the worker control model, calibration is unable to use first order conditions to yield share parameters on leisure in preferences for workers in manufacturing enterprises. These we set equal to 0.25 and then also perform sensitivity analysis around this setting. For the simple model variants we group the 5 SOE sectors and 5 private firms into 2 composite sectors. For the more complex model variants, we use 5 separate sector SOEs and 5 private competitive sectors.

subsidy rate on agricultural goods is 8.5 %. The average import tariff rate on manufacturing goods is 10.3 %, and the average export subsidy rate on manufacturing goods is 15.0 %.

Table 1. Base Case 2003 Chinese Data[1] Used in Calibrating Alternative Formulations for Managerial and Worker Control SOE Models

1.1. Simple and Complex Managerial Control SOE Models

	World Prices	Import Tariffs[2] Export Subsides	Wage Rate	Value of Output (Billion RMB)	Value of Labour Input (Billion RMB)	Value of Net Trade (Billion RMB)
Simple Model						
Agriculture	$P_A = 1$	$r_A = 16.8\%$	$W_A = 1$	$Q_A = 2969.180$	$K_A = 2614.100662$	$B_A = 3143.310256$
Manufacturing	$P_M = 1$	$r_M = -15.0\%$	$W_M = 1$	$Q_M = 14227.122$	$K_M = 7297.690729$	$B_M = -5252.792719$
More Complex Variant						
Agriculture	$P_A = 1$	$r_A = 16.8\%$	$W_A = 1$	$Q_A = 2969.180$	$K_A = 2614.100662$	$B_A = 3143.310256$
SOEs	$P_S = 1$	$r_S = -15.0\%$	$W_S = 1$	$Q_S = 5872.134$	$K_S = 3012.065114$	$B_S = -2168.049360$
Private Firms	$P_P = 1$	$r_P = -15.0\%$	$W_P = 1$	$Q_P = 8354.988$	$K_P = 4285.625615$	$B_P = -3084.743361$

1.2. Simple and Complex Worker Control SOE Models

	World Prices	Import Tariffs[2] Export Subsides	Wage Rate	Value of Output (Billion RMB)	Value of Labour Input (Billion RMB)	Value of Net Trade (Billion RMB)	Labour Shrinking Parameter
Simple Model							
Agriculture	$P_A = 1$	$r_A = 16.8\%$	$W_A = 1.00$	$Q_A = 2969.180$	$K_A = 2614.100662$	$B_A = 3143.310256$	$\lambda_A = 1.00$
Manufacturing	$P_M = 1$	$r_M = -15.0\%$	$W_M = 0.75$	$Q_M = 14227.122$	$K_M = 7297.690729$	$B_M = -5252.792719$	$\lambda_M = 0.75$
More Complex Variant							
Agriculture	$P_A = 1$	$r_A = 16.8\%$	$W_A = 1.00$	$Q_A = 2969.180$	$K_A = 2614.100662$	$B_A = 3143.310256$	$\lambda_A = 1.00$
SOEs	$P_S = 1$	$r_S = -15.0\%$	$W_S = 0.75$	$Q_S = 5872.134$	$K_S = 3012.065114$	$B_S = -2168.049360$	$\lambda_S = 0.75$
Private Firms	$P_P = 1$	$r_P = -15.0\%$	$W_P = 1.00$	$Q_P = 8354.988$	$K_P = 4285.625615$	$B_P = -3084.743361$	$\lambda_P = 1.00$

1. Sources: National Bureau of Statistics (NBS) of China (2004), Yu (2004) and BBCE (2004), and CHINANEWS (2003 and 2004).

2. See discussion of these values in the text.

Table 2. Calibrated Model Parameters for Simple and More Complex Managerial Control SOE Models

	Scalar Parameter Production Side	Power Parameter Production Side	Scalar Parameter Utility Side	Rent (Billion RMB)	Total Labour
Simple Model					$L = 9911.791391$
Agriculture	$\phi_A = 2.491973$	$\alpha_A = 0.880412$	$\theta_A = 0.404843$		
Manufacturing	$\phi_M = 21.198691$	$\alpha_M = 0.750000$	$\theta_M = 0.595157$	$R_M = 6929.431271$	
More Complex Variant					$L = 9911.791391$
Agriculture	$\phi_A = 2.491973$	$\alpha_A = 0.880412$	$\theta_A = 0.404843$		
SOEs	$\phi_S = 16.991384$	$\alpha_S = 0.750000$	$\theta_S = 0.245646$	$R_S = 2860.068886$	
Private Firms	$\phi_P = 134.745314$	$\alpha_P = 0.512942$	$\theta_P = 0.349511$		

Table 3. Calibrated Model Parameters for Simple and More Complex Worker Control SOE Model Variants

	Scalar Parameter Production Side	Power Parameter Production Side	Share Parameter Utility Side			Rent (Billion RMB)	Total Labour
Simple Model ($\theta'_{MM} = 0.25$)							$L = 12344.354967$
Agriculture	$\phi_A = 2.491973$	$\alpha_A = 0.880412$	$\theta_{AA} = 0.404843$		$\theta_{AA} = 0.595157$		
Manufacturing	$\phi_M = 21.198691$	$\alpha_M = 0.750000$	$\theta_{MA} = 0.303632$		$\theta_{MM} = 0.446368$	$R_M = 6929.431271$	
More Complex Variant ($\theta'_{SS} = 0.20$)							$L = 10915.813096$
Agriculture	$\phi_A = 2.491973$	$\alpha_A = 0.880412$	$\theta_{AA} = 0.404843$	$\theta_{AS} = 0.245646$	$\theta_{AP} = 0.349511$		
SOEs	$\phi_S = 16.991384$	$\alpha_S = 0.750000$	$\theta_{SA} = 0.323874$	$\theta_{SS} = 0.196517$	$\theta_{SP} = 0.279608$	$R_S = 2860.068886$	
Private Firms	$\phi_P = 134.745314$	$\alpha_P = 0.512942$	$\theta_{PA} = 0.404843$	$\theta_{PS} = 0.245646$	$\theta_{SP} = 0.349511$		

We have performed numerical simulation analyses for various forms of trade liberalization in China using both SOE model formulations set out above, and also using their simple and more complex forms. Using the model parameterizations generated by calibration we can then parametrically vary the import tariff and export subsidy rates and assess the economy wide behavioural response. This allows us to assess the welfare implications of alternative trade policy changes in China capturing SOE behavioural response using the two models formulations. We can also compare the results we generate to a comparable competitive case by also calibrating a simple competitive model with decreasing returns to scale production and sector specific rents using the same data sets for each SOE model. In each experiment we perform we first calibrate the relevant model to the 2003 benchmark data set out in Table 1, and then vary both import tariff and export subsidy rates and compute the relevant new equilibria. We make welfare comparisons across equilibria using Hicksian equivalent variations expressed as a % of GDP.

Table 4 reports the welfare impacts of moving to free trade in five different model formulations all calibrated to the same base case data. These are the simple and more complex managerial control models, the simple and more complex worker control models described above, and a simple competitive model. The differences in model results are striking. Moving to free trade in a simple competitive model implies a welfare gains of 3.4 % of income, but in a simple managerial control model a welfare loss of 22.7 % and a sharply smaller welfare loss of 4.1 % in the complex managerial control model. The simple and complex worker control model implies a welfare loss of 9 % and the more complex worker control mald a welfare gain, but this is larger than in the competitive model. These results thus suggest that the analytical formulation used to represent SOE behaviour when analyzing responses to trade liberalization in China can make a large difference.

The 22.7% loss when moving to free trade in the simple managerial control model is especially striking. This is a reflection of a number of features. First a loss occurs when moving to free trade since with average product pricing of labour the marginal product of labour in manufacturing is below the wage. Relative to Pareto optimality the SOE is too large, trade interventions correct for this departure from Pareto optimality and removing them thus implies a welfare loss. Secondly, in the data we use manufacturing accounts for nearly 80% of activity in the economy. We ignore services in our benchmark data, and our data are consistent with the widely used figure that 60% of China's GDP is in manufacturing. Thirdly, the size of the loss moving to free trade depends critically on both the size of the gap between average and marginal product, and their slopes. This gap is large in the base case, and the slope of both marginal and average product functions shallow.

The 4.1% loss in the worker control case when moving to free trade reflects a smaller size for the SOE sector relative to the whole of manufacturing, and the feature that marginal source of supply now comes from competitive firms and it is the intra marginal SOE production that is now provided by an enterprise that is too large.

Table 5 reports on sensitivity analyses in the simple and complex SOE models varying α_M (the production function exponent) around the control case value of 0.75. these variations make little difference

to results.

Table 6 reports results by model type involving the separate elimination of import tariffs (on agriculture) and export subsidies (on manufacturing). Removing each produces results that are smaller than movements to free trade, but the signs are the same as these two as elements compound with each other in their trade effects. As in Table 4, there are large differences in results across models.

Table 4. Impacts of Trade Liberalization in Managerial Control SOE, Worker Control SOE, and Competitive Models

	Hicksian Equivalent Variations of Welfare Change Relative to Base Case as % of Base Case Income in Moving to Free Trade
Simple Managerial Control SOE Model	- 22.7266 %
Complex Managerial Control SOE Model	- 4.1381 %
Simple Worker Control SOE Model	- 9.2977 %
Complex Worker Control SOE Model	12.5506 %
Competitive Model	3.4560 %

Table 5. Sensitivity Analyses of Trade Liberalization Impacts in Managerial and Worker Control SOE Models

	Hicksian Eqivalent Varations of Welfare Change Relative to Base Case as % of Base Case Income in Moving to Free Trade			
	Simple Managerial Control SOE Model	Complex Managerial Control SOE Model	Simple Worker Control SOE Model	Complex Worker Control SOE Model
$\alpha = 0.70$	- 22.8080 %	- 4.1850 %	- 8.8539 %	12.7262 %
$\alpha = 0.75$	- 22.7266 %	- 4.1381 %	- 9.2977 %	12.5506 %
$\alpha = 0.80$	- 22.6420 %	- 4.0918 %	- 9.6983 %	12.3919 %

Table 6. Impacts of Separate Trade Policy Instrument Removal in Managerial Control SOE, Worker Control SOE, and Competitive Models (Hicksian EVs as % of Base Case Income When Moving to Free Trade)

6.1. Elimination of Import Tariff on Agricultural Imports

	Hicksian Eqivalent Varations of Welfare Change Relative to Base Case as % of Base Case Income in Moving to Free Trade
Simple Managerial Control SOE Model	- 14.0029 %
Complex Managerial Control SOE Model	- 6.5716 %
Simple Worker Control SOE Model	- 8.4655 %
Complex Worker Control SOE Model	6.5037 %
Competitive Model	- 4.2198 %

6.2. Elimination of Export Subsidy on Manufacturing Exports

	Hicksian Eqivalent Varations of Welfare Change Relative to Base Case as % of Base Case Income in Moving to Free Trade
Simple Managerial Control SOE Model	- 19.5777 %
Complex Managerial Control SOE Model	- 7.4557 %
Simple Worker Control SOE Model	- 0.7591 %
Complex Worker Control SOE Model	5.0255 %
Competitive Model	- 1.9449 %

Table 7 reports results of changes in trade policies which go beyond free trade, either by having a reduction in rather than a removal of import tariffs and export subsidies, or in having greater than 100 % reductions. In the competitive model, a 100 % reduction in tariffs and export subsidies maximizes the welfare gain, implying that in this model free trade is the best policy. In the simple and more complex managerial control models welfare losses increase continuously and beyond a 100 % reduction. This suggests that in these model variants, increases in the level of trade protection rather than moves towards free trade are welfare preferred. In the worker control models, free trade is again best policy.

Table 8 reports optimal policy interventions in the simple and more complex managerial control SOE models for alternative value of α_M, and also for the worker control model. As noted above, for the worker control model free trade is the best policy, whereas in the managerial control models increases in existing levels of protection as in the base case data are welfare preferred.

Table 7. Impacts of Trade Policy Change Beyond Free Trade in Model Types
(Hicksian EVs as % of Base Case Income for Alternative % Joint Reductions)
(in Both Import Tariffs on Agricultural Imports and Export Subsidies on manufacturing Exports)

% Joint Reduction in both Import Tariffs and Export Subsidies	Simple Managerial Control SOE Model	Complex Managerial Control SOE Model	Simple Worker Control SOE Model	Complex Worker Control SOE Model	Competitive Model
0	0.0000 %	0.0000 %	0.0000 %	0.0000 %	0.0000 %
10	- 5.9595 %	- 0.7184 %	- 0.5743 %	1.1549 %	0.7226 %
20	- 9.2311 %	- 1.2472 %	- 1.2698 %	2.3279 %	1.3549 %
30	- 11.7650 %	- 1.6720 %	- 2.0648 %	3.5226 %	1.8969 %
40	- 13.8877 %	- 2.0391 %	- 2.9422 %	4.7413 %	2.3500 %
50	- 15.7363 %	- 2.3774 %	- 3.8878 %	5.9849 %	2.7171 %
60	- 17.3854 %	- 2.7063 %	- 4.8902 %	7.2533 %	3.0025 %
70	- 18.8815 %	- 3.0390 %	- 5.9398 %	8.5456 %	3.2120 %
80	- 20.2562 %	- 3.3849 %	- 7.0285 %	9.8604 %	3.3525 %
90	- 21.5322 %	- 3.7500 %	- 8.1498 %	11.1960 %	3.4313 %
100	- 22.7266 %	- 4.1381 %	- 9.2977 %	12.5506 %	3.4560 %
110	- 23.8526 %	- 4.5505 %	- 10.4675 %	13.9225 %	3.4336 %
120	- 24.9207 %	- 4.9871 %	- 11.6549 %	15.3106 %	3.3705 %
130	- 25.9396 %	- 5.4464 %	- 12.8563 %	16.7146 %	3.2720 %
140	- 26.9162 %	- 5.9256 %	- 14.0686 %	18.1347 %	3.1422 %
150	- 27.8566 %	- 6.4218 %	- 15.2889 %	19.5722 %	2.9842 %
160	- 28.7659 %	- 6.9317 %	- 16.5148 %	21.0288 %	2.8000 %
170	- 29.6483 %	- 7.4523 %	- 17.7442 %	22.5072 %	2.5908 %
180	- 30.5078 %	- 7.9816 %	- 18.9751 %	24.0103 %	2.3572 %
190	- 31.3476 %	- 8.5178 %	- 20.2058 %	25.5414 %	2.0990 %
200	- 32.1707 %	- 9.0603 %	- 21.4346 %	27.1043 %	1.8159 %

Table 8. Optimal Trade Policies in Managerial Control and Worker Control SOE Models
(Hicksian EVs as % of Base Case Income for Alternative % Joint Reductions)
(% reduction in Import Tariffs and Export Subsidies)

8.1. Simple Managerial Control SOE Model

	Optimal Joint Reductions in Import Tariffs and Export Subsidies	Optimal Reduction in Import Tariffs	Optimal Reduction in Export Subsidies
$\alpha_M = 0.70$	- 0.0795 %	- 0.0998 %	- 0.0670 %
$\alpha_M = 0.75$	- 0.7099 %	- 2.3541 %	- 1.0170 %
$\alpha_M = 0.80$	- 3.0408 %	- 6.6764 %	- 2.9350 %

8.2. Complex Managerial Control SOE Model

	Optimal Joint Reductions in Import Tariffs and Export Subsidies	Optimal Reduction in Import Tariffs	Optimal Reduction in Export Subsidies
$\alpha_M = 0.70$	- 10.9169 %	- 38.1336 %	- 15.2859 %
$\alpha_M = 0.75$	- 19.6042 %	- 67.1161 %	- 27.6610 %
$\alpha_M = 0.80$	- 30.2607 %	-102.3328 %	- 41.3000 %

8.3. Simple Worker Control SOE Model

	Optimal Joint Reductions in Import Tariffs and Export Subsidies	Optimal Reduction in Import Tariffs	Optimal Reduction in Export Subsidies
$\alpha_M = 0.70$	- 18.9400 %		39.4000 %
$\alpha_M = 0.75$	- 22.5500 %		32.1300 %
$\alpha_M = 0.80$	- 32.2000 %		24.8300 %

5 Conclusions

In this paper we present analytical formulations of SOE behavioural response to trade policy change which we apply to the Chinese case. Our analyses are motivated both by the significance of communally controlled enterprise structures in economies such as China, and the seeming lack of analytical work in existing literature capturing their behavioural response. At the save time we note that OECD style competitive structures are now widely used in policy evaluation numerical simulation work on China.

We present two alternative formulations of SOE behavioural response to policy change. In the first of these, management controls enterprise behaviour with political appointees whose losses are re-capitalized through the banking system and who are assumed to maximize enterprise size so as to yield the largest potential personal networking benefits to management. In this case labour is paid its average rather than its marginal product and free trade is not best policy. In the second, workers collectively control enterprise behaviour and meet the enterprise budget constraint given employment and wage rates, and otherwise satisfice using surplus labour for moonlighting or second jobs. Again free trade is not best policy.

Model results using 2003 data indicate welfare losses rather than welfare gains from trade liberalization and effects that are potentially very large. We compare model results to those from comparable competitive structures calibrated to the same data set, and results show both differences of sign and large quantitative variants. We conclude that explicit analytical representations of SOE behavioural response is needed when assessing policy change such as trade liberalization in China.

References

[1] Chong-en Bai and Yijiang Wang (1998) *Bureaucratic Control and the Soft Budget Constraint*, Journal of Comparative Economics 26: 41-61.

[2] Arne Bigsten, Xiaoxuan Liu and Jinghai Zheng (2002) *Efficiency, Technical Progress, and Best Practice in Chinese State Enterprises*, China Economic Quarterly 1: 521-540.

[3] BBCE (2004) **Blue Book of China's Economy**, Spring 2004.

[4] John Bonin and Yiping Huang (2002) *Foreign Entry into Chinese Banking: Does WTO Membership Threaten Domestic Banks?* The World Economy 25: 1077-1093.

[5] Harry G. Broadman (2001) *The Business(es) of the Chinese State*, The World Economy 24: 849-875.

[6] Jianbo Chen, Jang Yang, Qiao Yu and Wei Zhang (2002) *Investment Pattern of Non-State Owned Firms in China*, China Economic Quarterly 1: 501-520.

[7] CHINANEWS (2003) *WWW.CHINANEWS.COM.CN*, http://www.chinanews.com.cn/n/2003-09-17/26/347701.html.

[8] CHINANEWS (2003) *WWW.CHINANEWS.COM.CN*, http://202.106.184.148//n/2003-10-14/26/356427.html.

[9] CHINANEWS (2004) *WWW.CHINANEWS.COM.CN*, http://www1.cei.gov.cn/hottopic/doc/zjzt2002011/200401122446.html.

[10] Robert Cull and Lixin Colin Xu (2000) *Bureaucrats, State Banks, and the Efficiency of Credit Allocation: The Experience of Chinese State-Owned Enterprises*, Journal of Comparative Economics 28: 1-31.

[11] Robert Cull and Lixin Colin Xu (2003) *Who Gets Credit? The Behavior Bureaucrats and State Banks in Allocating Credit to Chinese State-Owned Enterprises*, Journal of Development Economics 71: 533-559.

[12] Gang Fan, Wen Hai, Yibiao Jin and Wing Thye Woo (1994) *How Successful has Chinese Enterprise Reform Been? Pitfalls in Opposite Biases and Focus*, Journal of Comparative Economics 18: 410-437.

[13] Madanmohan Ghosh and John Whalley (2000) *State-Owned Enterprises, Shirking and Trade Liberalization*, NBER Working Paper No. 7696, CESifo Working Paper No. 300, University of Western Ontario Working Paper, and University of Warwick Working Paper.

[14] John Gilbert and Thomas Wahl (2002) *Applied General Equilibrium Assessments of Trade Liberalization in China*, The World Economy 25: 697-731.

[15] Thomas W. Hertel and Terrie L. Walmsley (2001) *China's Accession to the WTO: Timing is Everything*, The World Economy 24: 1019-1049.

[16] Elena Ianchovichina and Will martin (2004) *Economic Impacts of China's Accession to the WTO*, Deepak Bhattasali, Shantong Li and Will Martin (Edited) **China and the WTO**, Chapter 13, 211-236.

[17] Young Lee (1997) *Bank Loans, Self-Financing, and Grants in Chinese SOEs: Optimal Policy under Incomplete Information*, Journal of Comparative Economics 24: 140-160.

[18] Guo Li and Lixin Xu (2001) *State-Owned Enterprise, Labour Redundancy, and Job Creation*, China Economic Quarterly 1: 97-110; Forthcoming in Journal of Development Economics.

[19] Deqiang Liu (2002) *Managers in State-Owned Enterprises: Ability, Efforts, and Productive Efficiency - A Case Study of the Iron and Steel Industry in China*, China Economic Quarterly 1: 419-434.

[20] Zhi Wang (2003) *The Impact of China's WTO Accession on Patterns of World Trade*, Journal of Policy Modeling 25, 1-41.

[21] John Whalley (1985) **Trade Liberalization among Major World Trading Areas**, MIT Press.

[22] John Whalley and Xian Xin (2005) *The Growth Performance of China's FDI and Non-FDI Economies*, http://www.ssc.uwo.ca/economics/workshop/epri/XianDec14.pdf.

[23] Yongzheng Yang (2001) *China's Integration into the World Economy: Implications for Developing Countries*, IMF Working Paper No. WP/03/245.

[24] Xiangkang Yin (2001) *A Dynamic Analysis of Overstaff in China's State-Owned Enterprises*, Journal of Development Economics 66: 87-99.

[25] Yongding Yu (2004) *China's Trade Policy*, http://www.apec.org.au/docs/China04YuYongding.pdf.