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Trade reform in the short run: China's WTO accession☆

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Abstract

Because trade liberalisation, taken alone, reduces the home prices of foreign goods, there is a substitution away from home-produced goods and a real depreciation. In fixed exchange rate regimes, this requires a domestic deflation, which can be contractionary in the short run. This paper reviews the short-term effects of trade reform and shows that they are expansionary if the reformed economy enjoys an immediate improvement in allocative efficiency and it attracts a sufficient increase in investment from abroad. These offsetting effects are analysed in the case of China using a global comparative static macro model. The results suggest that a short-term contraction could result if capital controls stifle the inflow of foreign investment. On the other hand, ignoring exchange rate retaliation elsewhere in Asia, the results suggest China's trade reforms would be robustly expansionary were it to adopt a floating exchange rate regime. Simulations are also presented which detail the short-term effects of trade reform with alternative fiscal policies. Because the reforms cause the most substantial reductions in protection to China's food-processing sector, they lead to contractions in agricultural output in both the short and long runs. They therefore require substantial structural change, including the relocation of employment from agriculture to manufacturing.

JEL classification: C68; E63; F47

Keywords: Trade liberalisation; Exchange regime; Monetary targets; Capital controls; China

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1. Introduction

China's accession to the WTO was an important event in global economic history and it is fitting that there has been so much quantitative analysis of its implications for trade and growth (Gilbert & Wahl, 2001). The most recent quantitative assessments have offered comparatively sophisticated representations of some peculiar trade policies and Chinese labour market conditions.[1] All these studies have, however, focussed on medium to long run impacts of accession reforms. They have failed to address the issue of "how we get there from here" and, in particular, the dependence of this transition on macroeconomic policies. This paper follows from that by Yang and Tyers (2000) in that it emphasises the short run and the role of the macroeconomic environment, though it departs from that paper in its representation of accession trade policy reforms. Like Ianchovichina and Martin (2002), we make allowance for idiosyncratic trade policies, such as the duty drawbacks on imports used in the manufacture of exported goods. And, as befits a short run analysis, we also allow for labour market rigidity and departures from full employment.[2]

Our point of departure is the recognition that the removal of import barriers can be contractionary in the short run in economies where the target of monetary policy is the exchange rate. This is because trade liberalisation, taken alone, reduces the home prices of foreign goods. Households and firms therefore substitute away from home-produced goods, reducing their prices relative to foreign goods abroad, thus causing a real depreciation. If the nominal exchange rate is the target of monetary policy and the home economy is small by comparison with its trading partners, then a fall in the home price level (a deflation) is required. This must be brought about by a monetary contraction in defence of the exchange rate. To the extent that wages adjust more sluggishly than product prices, the deflation causes the real wage to rise relatively quickly and hence employment growth to slow. Were the real depreciation the only consequence of the trade liberalisation shock its effects would therefore be contractionary.

Trade reforms can, however, have positive effects in the short run. These include allocative efficiency gains that emerge even in the very short run and that raise aggregate productivity. Trade reforms also tend to raise the expected future net return on installed capital, stimulating investment. If the capital account is sufficiently open, a rise in foreign-financed investment might occur which contributes substantially to short run expansion. In essence, then, the issue we address is the robustness of the much anticipated gains from Chinese trade reform in the short run and its dependence on macroeconomic policy settings.

To do this we use a comparative static global macroeconomic model, within which the microeconomic (supply) side is adapted from GTAP,[3] a multi-region comparative static model in real variables with price-taking households and all industries comprising identical competitive firms. Following Yang and Tyers (2000), to this microeconomic base is added

[1] For one line of evolution, see the papers by Ianchovichina and others (Ianchovichina & Martin, 2001, 2002; Ianchovichina, Martin, & Fukase, 2000; Walmsley, Hertel, & Ianchovichina, 2001).

[2] We do not, however, differentiate rural from urban labour and hence we cannot represent explicitly the hukou system of labour market regulation (Sicular & Zhao, 2002).

[3] A detailed description of the original model is provided by Hertel (1997).

independent representations of governments' fiscal regimes, with both direct and indirect taxation, as well as separate assets in each region (currency and bonds) and monetary policies with a range of alternative targets. With this model it is possible to conduct trade liberalisation and other experiments under alternative and explicit assumptions about macroeconomic policy regimes. Section 2 offers a description of the model used. Section 3 then reviews China's trade policies and the changes to which it is committed as part of the accession. Section 4 examines the long run effects of unilateral trade liberalisation, primarily as a basis for the formation of expectations by investors, and Section 5 then considers the effects of the reforms in the short run under a range of alternative macroeconomic policy regimes. A short summary and conclusions are offered in Section 6.

2. The model

The microeconomic side of the model is a modified version of that by Hertel (1997). It offers the following useful properties: (1) a capital goods sector in each region to service investment, (2) explicit savings in each region, combined with open regional capital accounts that permit savings in one region to finance investment in others, (3) multiple trading regions, goods and primary factors, (4) product differentiation by country of origin, (5) empirically based differences in tastes and technology across regions, (6) non-homothetic preferences, and (7) explicit transportation costs and indirect taxes on trade, production and consumption. All individual goods and services entering final and intermediate demand are constant elasticity of substitution (CES) blends of home products and imports. In turn, imports are CES composites of the products of all regions, the contents of which depend on regional trading prices. Savings are pooled globally and investment is then allocated between regions from the global pool. Within regions, investment places demands on the domestic capital goods sector, which is also a CES composite of home-produced goods, services and imports in the manner of government spending.

To expand the model for macroeconomic analysis, the standard code is modified to make regional governments financially independent, thus enabling explicit treatment of fiscal policy. Direct taxes are incorporated at the observed average income tax rates for each region. Marginal tax rates are therefore assumed constant (say at τ). Regional households then receive regional factor income, Y_F, and from this they pay direct tax τY_F. The disposable income that remains is then divided between private consumption and private saving. Government saving, or the government surplus, $S_G = T - G$, is then simply revenue from direct taxes, τY_F, and from the many indirect taxes already incorporated in the microeconomic part of the model,[4] T_I, less government spending, G, which could be exogenous or fixed as a proportion of GDP. Thus, $S_G = T_I + \tau Y_F - G$. The private saving and consumption decision is represented by a reduced form exponential consumption equation with wealth effects included via the dependence of consumption (and hence savings) on the

[4] T_I includes revenue from taxes on production, consumption, factor use and trade, all of which are accounted for in the original GTAP model and database.

interest rate. Each region then contributes its total domestic (private plus government) saving, $S_D = S_P + S_G$, to the global pool from which investment is derived.[5]

For each region, the above relations imply the balance of payments identity, which sets the current account surplus equal to the capital account deficit: $X - M = S_P + S_G - I$.[6] From the pool of global savings, investment is allocated across regions and it places demands on capital goods sectors in each region. In the short run considered, however, investment does not add to the installed capital stock. Also at this length of run, nominal wages are sticky in some regions (the industrialised regions of the US, the EU, Canada and Australia, and those developing countries with heavily regulated labour markets: China and Vietnam) but flexible elsewhere. In the spirit of comparative statics, although price levels do change in response to shocks, agents represented in the model do not expect any continuous inflation and so there is no distinction between the real and nominal interest rates.

In allocating the global savings pool as investment across regions, we have opted for the most flexible approach, implying a high level of global "capital" mobility.[7] Where controls exist on international capital flows we introduce these explicitly. In the absence of capital controls, then, the allocation to region j (net investment in that region) depends positively on the expected long run change in the average rate of return on installed capital, r_j^e, which, in turn, rises when the marginal product of physical capital is expected to increase.[8] This allocation falls when the opportunity cost of financing capital expenditure, the region's real interest rate, r_j, rises. This rate depends, in turn, on a global capital market clearing interest rate, r^w, calculated such that global savings equals global investment: $\sum_j S_j^D = \sum_j I_j(r_j^e, r_j)$. Here, I_j is real gross investment in region j.[9] The region's home interest rate is then $r_j = r^w(1 + \pi_j)$ where π_j is a region-specific interest premium, thought to be driven by risk factors not incorporated in this analysis. The investment demand equation for region j then takes the form:

$$I_j = \delta_j K_j + I_j^N = \delta_j K_j + \beta_j K_j \left(\frac{r_j^e}{r_j}\right)^{\varepsilon_j} = K_j \left[\delta_j + \beta_j \left(\frac{r_j^e}{r_j}\right)^{\varepsilon_j}\right] \tag{1}$$

where K_j is the (exogenous) base year installed capital stock, δ_j is the regional depreciation rate, β_j is a positive constant and ε_j is a positive elasticity. Critically, investment in any region responds positively to changes that are expected to raise the sectoral average of a region's marginal product of physical capital and hence the regional average return on

[5] Private saving is derived as the difference between disposable income ($Y - T$) and consumption expenditure, where real consumption is determined in a Keynesian reduced form equation that takes the form: $C = \gamma r^{\delta}[Y - T]^{\mu}$, where r is the real interest rate.

[6] Note that there is no allowance for inter-regional capital ownership in the starting equilibrium. At the outset, therefore, there are no factor service flows and the current account is the same as the balance of trade.

[7] By which it is meant that households can direct their savings to any region in the world without impediment. Installed physical capital, however, remains immobile even between sectors.

[8] r_j^e is the expected rental rate on physical capital (which, when physical capital is sector specific, varies across sectors and so is averaged), adjusted for depreciation and divided by the price of capital goods to yield a unitless net rate of return.

[9] Before adding to the global pool, savings in each region is deflated using the regional capital goods price index and then converted into US$ at the initial exchange rate. The global investment allocation process then is made in real volume terms.

installed capital.[10] Other things equal, then, improvements in trans-sectoral efficiency, such as might stem from a trade reform, are thought to raise capital returns permanently and hence they raise r_j^e. If such a shock also causes the rate of unemployment to fall this raises total labour use and hence the current return on installed physical capital. When the shock is a trade reform, such employment effects are also considered permanent and so they add positively to the expected future return on installed capital, r_j^e.

Investment decisions are assumed to be made by forward-looking agents with access to a long run version of the model. Thus, the expected change in the (long run) rate of return on installed capital in each region, r_j^e, is exogenous in short run simulations. It is calculated by first simulating the effects of the same shock but under long run closure assumptions. These differ from the short run closure in the following ways: (1) there are no nominal rigidities (no rigidity of nominal wages), (2) larger production and consumption elasticities are used to reflect the additional time for adjustment, (3) physical capital is no longer sector specific; it redistributes across sectors to equalise rates of return, and (4) capital controls are ignored, and (5) in China, irrespective of short run fiscal policy assumptions, in the long run any loss of government revenue associated with tariff changes is assumed to not be made up via direct (income) tax with the result that the fiscal deficit expands; so that the ratios of government revenue and expenditure to GDP are endogenous while the average direct tax rate is exogenous.

Note that the short run comparative static analysis does not require that the global economy be in a steady state. When shocks are imposed, any change in the counterfactual return on installed capital, r_j^e, need not be the same as the corresponding change in the opportunity cost of capital expenditure, r_j. Most often, in the short run shocks change income and savings and therefore expected returns in directions that differ from corresponding short run changes in the global interest rate, particularly considering that physical capital is fixed in quantity and sectoral distribution at this length of run. Even in long run simulations, the global distribution of physical capital at the outset does not equalise rates of return across regions and redistribution through the regional allocation of 1 year's global savings is insufficient to redress such imbalances.

To include asset markets, region-specific money and homogeneous nominal bonds are introduced. Even though there is no inter-regional ownership of installed capital in the initial database regional bonds are traded internationally, making it possible for savers in one region to finance investment in another.[11] Cash in advance constraints cause households to maintain portfolios including both bonds and non-yielding money and the resulting demand for real money balances has the usual reduced form dependence on GDP (transactions demand) and the interest rate. This is equated with the region's real money supply, where purchasing power is measured in terms of its GDP deflator, P^Y. Since all domestic transactions are assumed to use the home region's money, international transactions require currency exchange. For this purpose, a single nominal exchange rate,

[10] This investment relation is similar to Tobin's Q in the sense that the numerator depends on expected future returns and the denominator indicates the current cost of capital replacement.

[11] Since the initial database (GTAP Version 5) incorporates no "net income" or factor service component in its current account, the initial equilibria must do likewise. This implies the assumption that, although there are no inter-regional bond holdings initially, the shocks implemented cause inter-regional exchanges of bonds and hence a non-zero net income flow in future current accounts not represented.

E_j, is defined for each region. A single key region is identified (here the US) relative to whose currency these nominal rates are defined. For the US, then, $E = 1$ and E_j is the number of US dollars per unit of region j's currency. In essence, we are adding to the real model one new equation per region (the LM curve linking the real money supply to GDP and the interest rate) and one new (usually endogenous) variable per region, E_j.[12]

The bilateral rate between region i and region j is then simply the quotient of the two exchange rates with the US, $E_{ij} = E_i/E_j$. Quotients such as this appear in all international transactions. The most straightforward of the international transactions in the original model are trade transactions. There the bilateral exchange rate is simply included in all import price equations, along with *cif/fob* margins and trade taxes. In the case of savings and investment, the global pool of savings is accumulated in US dollars. Investment, once allocated to region j, is converted to that region's currency at the rate E_j (US$ per unit of local currency). The third, and most cryptic, set of international transactions in the original model concerns international transport services. Payments associated with *cif/fob* margins are assumed to be made by the importer in US dollars. The global transport sector then demands inputs from each regional economy and these transactions are converted at the appropriate regional rates.

Without nominal rigidities the model always exhibits money neutrality, both at the regional and global levels. Firms in the model respond to changes in nominal product, input and factor prices but a real producer wage is calculated for labour as the quotient of the nominal wage and the GDP deflator, so that $w = W/P^Y$. Thus, money shocks always maintain constant w when nominal rigidities are absent—as expected, money is then neutral. To make possible some rigidity in the setting of the nominal wage, W, a parameter, $\lambda \in (0, 1)$ is inserted, such that

$$\frac{W}{W_0} = \Lambda \left(\frac{P^C}{P_0^C} \right)^{\lambda} \tag{2}$$

where W_0 is the initial value of the nominal wage, P_0^C is the corresponding initial value of the consumer price index (CPI) and Λ is a slack constant. Whenever Λ is exogenous and set at unity, the nominal wage carries this relationship to the CPI and the labour market will not clear except in the unlikely event that Eq. (2) happens to yield a market clearing real wage. The case where the labour market is fully flexible is represented by setting Λ as an endogenous slack variable and thereby rendering (2) ineffective. At the same time, labour demand is forced to equate with exogenous labour supply to reflect the clearing market.

2.1. The representation of capital controls

The model assumes that savings are perfectly mobile between regions and that the allocation of investment between them depends on region-specific interest premia and, if

[12] More precisely, since for the US $E = 1$, there is one less (usually endogenous) variable. Where nominal exchange rates are to be endogenous and nominal money supplies exogenous, one additional variable must be made endogenous. This could, for example, be balanced by making one price level exogenous, such as by having US monetary policy target the change in the US CPI, P^C.

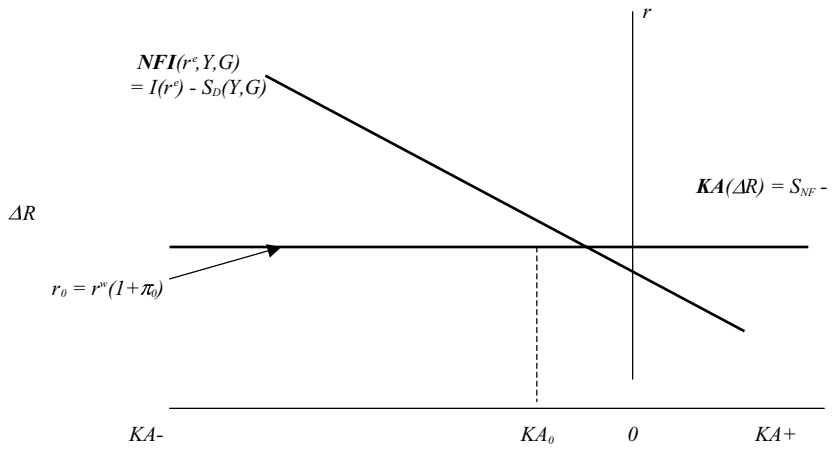

Fig. 1. The domestic capital market without capital controls.

they are present, capital controls. In the absence of capital controls a region's domestic capital market might be represented as in Fig. 1. Net inflows on the capital account (KA), which comprise the net inflow of foreign savings, S_{NF}, less the net outflow associated with the accumulation of official foreign reserves, ΔR, are perfectly elastic at the global interest rate (this rate being adjusted by the exogenous region-specific risk premium, π).[13] The actual scale of net inflows depends on the net demand for foreign investment, $\mathrm{NFI} = I - S_D$, where the relationship between NFI and r is shifted to the right by an increase in the expected future return on installed capital, r^e, via Eq. (1), or by an increase in government spending, G, via its effect on domestic saving. It is shifted to the left by an increase in GDP (Y), via its effect on consumption and tax revenue and hence on domestic savings, S_D. In the figure, net inflows on the capital account are determined by the intersection of the two curves shown. For a balance of payments, these inflows must then equate to net outflows on the current account, CA, and prices, and therefore real exchange rates, adjust to ensure that this is the case.

In this analysis, capital controls take the form of a rigid ceiling on net inflows on the capital account. This case is illustrated in Fig. 2. In this circumstance the link between the home and global interest rates is severed unless net foreign investment falls sufficiently so that the controls cease to bind. To capture this in model simulations, the interest premium, π, is made endogenous while net flows on the capital account, KA, or, equivalently, on the current account, CA, are set as exogenous.

[13] The scope of monetary policy includes alterations in the rate at which official foreign reserves are accumulated. When there are no capital controls, however, the perfect capital mobility assumption implies that changes in reserves have no effect on net capital account flows. Where they are important is in the case where capital controls are effective. Because the manipulation of reserves offers only a short-term approach to exchange rate management that is only available if reserves are sufficient in the first place, ΔR is held exogenous throughout the analysis in this paper.

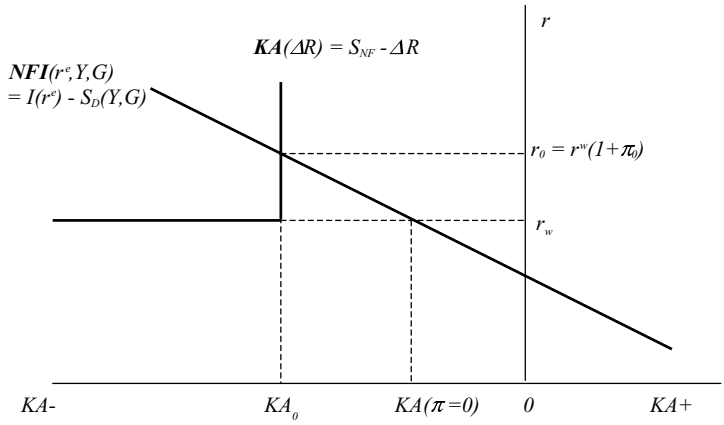

Fig. 2. The domestic capital market with capital controls.

2.2. Data and parameters

The regions, primary factors and sectors identified in our analysis are listed in Table 1. Considering regions first, we draw on the now well-known GTAP Version 5 global database for 1997, which divides the world into 66 countries and regions. Although this database separates mainland China from Taiwan, it amalgamates Hong Kong with the mainland.[14] Our further aggregation of mainland China with Taiwan does overlook effects that are internal to these regions but such effects are not our focus. Instead, we seek to illustrate the strong interaction between trade reforms and macroeconomic policies, and, particularly, foreign exchange regimes. These interactions are important for all the economies of East Asia and particularly for those with regulated foreign exchange regimes. China is the largest developing economy to maintain, at least de facto, fixed US dollar parity and, in this respect, the macroeconomic policy regimes of Hong Kong and Taiwan have been compatible with that of the mainland. Turning to primary factors, skill is separated from raw labour on occupational grounds, with the ''professional'' categories of the International Labour Organisation (ILO) classification included as skilled.[15] The structure of factor demand has skill and physical capital as complements. This enables the model to represent the links between skill availability, capital returns and investment that are important in China, which has large skilled and unskilled labour forces that are increasingly mobile between sectors.[16] Finally, the sectoral breakdown we have chosen aggregates the 57 sectors in the database to our more manageable 14, offering the most detail in agricultural and marine products. This is because, amongst China's merchandise trade

[14] Detailed descriptions of the GTAP database's content and sources as they relate to China are available in Gehlhar (2002), which describes the integration of the data for Hong Kong with that of the mainland and discusses the entrepot nature of some of Hong Kong's trade, Lin, Chung, and Liou (2002) for Taiwan and Wang, Zhai, and Xu (2002) for the mainland.

[15] See Liu, Van Leeuwen, Vo, Tyers, and Hertel (1988) for the method adopted.

[16] For further discussion of the role and representation of skill-capital complementarity, see Tyers and Yang (2000).

Table 1
Model structure

Regions
1. China, including Hong Kong and Taiwan
2. Vietnam
3. Other ASEAN
4. Japan
5. Korea
6. Australia
7. United States
8. European Union[a]
9. Rest of World

Primary factors
1. Agricultural land
2. Natural resources
3. Skill
4. Labour
5. Physical capital

Sectors[b]
1. Paddy rice
2. Beverages (product 8 OCR, ''crops nec'')
3. Other crops (wheat, other cereal grains, vegetables, fruits, nuts, oil seeds, sugar cane and sugar beet, plant based fibres and forestry)
4. Livestock products (cattle, sheep, goats, horses, wool, silk-worm cocoons, raw milk, other animal products)
5. Fish (marine products)
6. Energy (coal, oil, gas)
7. Minerals
8. Processed food (meat of cattle, sheep, goats and horses, other meat products, vegetable oils and fats, dairy products, processed rice, processed sugar, processed beverages and tobacco products)
9. Light manufacturing (textiles, wearing apparel, leather products and wood products)
10. Other manufacturing (paper products and publishing, petroleum and coal products, chemicals, rubber and plastic products, other mineral products, ferrous metals, other metals, metal products, motor vehicles and parts, other transport equipment, electronic equipment, other machinery and equipment, other manufactures)
11. Transport (sea transport, air transport and other transport)
12. Infrastructure services (electricity, gas manufacturing and distribution, and water)
13. Construction and dwellings
14. Other services (retail and wholesale trade, communications, insurance, other financial services, other business services, recreation, other private services, public administration, defence, health and education)

[a] The European Union of 15.
[b] These are aggregates of the 57 sector GTAP Version 5 database.

commitments for WTO accession, a key liberalisation is in the processed food sector, to which these commodities are inputs.

Because the length of run is short, the real part of the short run model incorporates smaller-than-standard elasticities of substitution in both demand and supply. These are set based on a short run calibration exercise on the Asian crisis, described in Yang and Tyers (2000). For further details of the model, its parameters and its structure, see Yang and Tyers (2000) and Tyers and Yang (2000, 2001).

3. China's merchandise trade policies and reforms

The 2001 pattern of trade and production taxes and subsidies is constructed first from the GTAP Version 5 global database for 1997. Recent updates to the tariff regime are incorporated, as provided by Ianchovichina and Martin (2001) and post-accession changes to the regime are obtained directly from the WTO.[17] The database is not strong on hard-to-measure services trade distortions, so our emphasis is on merchandise trade liberalisation.[18] Of particular importance is the introduction since 1997 of duty drawbacks that are offered to exporting firms on the component of their imports of intermediate goods that is used for export production. The effects of these duty drawbacks are particularly difficult to quantify since it is generally impossible to separate production for export from production for the domestic market.[19]

For the analysis to be conducted here, the effects of duty drawbacks are approximated by, first, constructing a database comprising inter-industry financial flows after the general tariff reforms for the period 1997–2001. This database emerges from a model simulation in which the only shocks are the documented changes in tariffs by sector. The pattern of these inter-industry flows indicates the magnitude of the expenditures on intermediate inputs and on import tariffs by firms in each industry and the proportions of their respective outputs that are exported. Second, the proportions of expenditures on imported (as distinct from home-produced) intermediate inputs are calculated, along with the average proportions of these that enter export production. Expenditures on tariffs for export production follow for each industry. Finally, this sum is then returned through the implementation of equivalent export subsidies (or reduced export taxes).

The application offered here is one in which the manufacturing sector, to which duty drawbacks primarily apply, is aggregated into only ''light manufacturing'' and ''other manufacturing''. At this level of aggregation there is a considerable volume of intra-industry trade. As Table 2 attests, a substantial share of the cost of manufactured exports takes the form of expenditure on manufactured intermediate inputs, of which a significant volume is imported. In these circumstances, the use of export subsidies to proxy duty drawbacks is crude but it offers the following realistic consequences:

(1) The export industry expands in response to its greater profitability.
(2) The price of the industry's product rises in the home market. Although this effect is not realistic in itself, it has the realistic consequence that there is substitution in favour of imports in intermediate consumption and so the home market share in intermediate inputs falls.

[17] The website of the WTO lists China's commitments in detail. See www.wto.org.

[18] The same model is further extended to consider China's services trade reforms in a subsequent paper by Chang and Tyers (2003). More detailed modelling of services trade reform can be found, for example, in Dee and Hanslow (2000), Stern and Brown (2001) and Verikios and Zhang (2001).

[19] Bach, Martin, and Stevens (1996) offer one approximation that requires the construction of a set of equivalent production taxes and subsidies and the rebalancing of the economic database to reflect these. Walmsley et al. (2001), in their long run dynamic analysis, attempted the very difficult task of reconstructing their global database to separate out production for exports and domestic sales.

Table 2
Manufactured inputs as shares of the total cost of production[a]

	Light manufacturing inputs as a share of production cost			Heavy manufacturing inputs as a share of production cost		
	Total	Domestic	Imported	Total	Domestic	Imported
Light manufacturing	44	34	9	11	8	3
Heavy manufacturing	3	2	0	53	39	14

Source: The GTAP Version 5 database, as modified by simulations described in the text.

[a] These are input shares of total value added in each industry, calculated from the 2001 database following the 1997–2001 trade reforms.

(3) The government is denied the revenue that would have come from the tariffs on intermediates used for export production, in this case by giving it back in the form of export subsidies.

The 2001 export tax rates used are thus modified to take account of the ad valorem equivalent export subsidy rates that are proxies for duty drawbacks. The resulting pattern of equivalent trade taxes and subsidies is listed in Table 3. The most substantial effect of the duty drawbacks is in the manufacturing sector with the equivalent export tax rate on light manufacturing falling by about a third and heavy manufacturing receiving an equivalent

Table 3
Chinese equivalent import tariff and export tax rates[a]

Merchandise sector[b]	Equivalent import tariff (%)		Equivalent export tax[c] (%)
	Pre-accession	Post-accession	
Rice	0.04	0.04	−0.13
Beverages	11.00	11.00	−0.11
Other crops	22.00	16.00	−0.25
Livestock	5.00	4.00	−0.02
Food	16.00	6.00	−0.13
Fish	8.00	8.00	−0.19
Minerals	0.40	0.40	−0.32
Energy	3.00	3.00	−0.32
Light manufacturing	14.00	8.00	2.63
Heavy manufacturing	8.00	4.00	−1.01

Sources: The original 1997 numbers are aggregated from the 57 commodity categories in the GTAP Version 5 global database, 2000. They are then modified, as described in the text and based on the work of Ianchovichina and Martin (2002). Finally, the post-accession rates are based on the protocol for China's accession, as obtained from the WTO website at http://www.wto.org.

[a] All tariff and tax equivalents are ad valorem. They are intended to encompass both tariff and non-tariff carriers, though the accounting for non-tariff barriers is incomplete.

[b] The services sectors are represented in the model, as indicated in Table 1, but distortions affecting them are unchanged in all experiments.

[c] Negative export taxes rates indicate export subsidies. These incorporate the export subsidy equivalents of the duty drawbacks available on imported inputs by exporting firms, calculated as explained in the text.

export subsidy of 1%. In the 1990s ''other crops'' and processed food received significant border protection, though at rates that diminished between 1997 and 2001. Moreover, as Table 3 attests, food processing, which is the sector through which most agricultural products flow, still receives considerable protection.

The equivalent tariff rates following China's accession into the WTO are also summarised in Table 3. The associated trade reforms are substantial. The tariff protection in ''other crops'', livestock, food processing, light manufacturing and heavy manufacturing are significantly reduced, with the largest reductions being in the food-processing and heavy manufacturing sectors. For each product, the database obtained from the WTO website details the decline in tariff rates and the timing of the reductions. To obtain the rates in Table 3, the industry classification used in the WTO list of tariff concessions was concorded with the cruder subdivision used in our model and average rates constructed for each sector. The information contained in the database was supplemented by details of the accession tariff rates provided by Ianchovichina and Martin (2001). To represent the behavioural impacts of the changes in equivalent tariff rates as accurately as possible, emphasis was placed on preserving changes in the ''powers of the tariffs'' rather than in the rates themselves.[20]

The equivalent Chinese tariff rates of the 1990s vary by country of origin. This means that the application of the same shock to the powers of these equivalent tariffs might have led to negative post-accession rates for some trading partners. The accession shocks to the equivalent bilateral tariff rates were therefore calculated so as to harmonize the post-shock tariff rates across countries of origin. The proportional changes in ''powers of equivalent tariffs'' are the same as those implied by the changes in rates detailed in Ianchovichina and Martin (2002) (Table 3). For our present purpose, these shocks are the same for both the long run and the short run. As indicated in the WTO database, China is committed to undertaking many of the tariff concessions immediately on accession.[21]

4. Simulated long run effects of accession policy reforms

The reasons for examining long run implications first are two-fold. First, the long run results are useful in their own right, given that they may then be compared with the many other simulations of China's WTO accession reforms. Second, the long run outlook is required in order that the expectations of investors can be formulated. Recall that they are assumed to take changes in long run returns on installed capital into account in determining short run changes in their investment behaviour.

The key elements of the long run closure were discussed in Section 2. To recap:

(1) there are no nominal rigidities (no rigidity of nominal wages),

[20] Consequently, the rates in Table 3 tend to reflect the proportional changes in powers of tariffs implied by Ianchovichina and Martin and the magnitudes as detailed in the protocol.

[21] To the extent that some of the tariff reductions may in fact be phased in over several years, our analysis will tend to overstate the economic impacts in the short run.

(2) production and consumption elasticities of substitution are chosen at ''standard'' levels to reflect the additional time for adjustment in the long run over the short run (Tyers & Yang, 2001),
(3) physical capital is no longer sector specific; it redistributes across sectors to equalise rates of return,
(4) capital controls are ignored, and
(5) in China, irrespective of short run fiscal policy assumptions, in the long run any loss of government revenue associated with tariff changes is assumed to not be made up via direct (income) tax with the result that the fiscal deficit expands.

The results from the long run simulation are provided in Table 4. They show the expected allocative efficiency gains, reflected here in a rise in GDP, aided by increased returns on installed physical capital that induce greater investment and therefore larger net inflows on the capital account in the long run.[22] The increased average long run return on installed capital in China is therefore part of investor expectations in the short run and so tends to raise the level of investment in the short run, even if capital controls are maintained, as discussed in the next section. Finally, as discussed earlier, the trade reform does cause home consumption to switch away from home-produced goods, the relative prices of home-produced goods to fall and hence an overall real depreciation occurs. This accompanies a rise in Chinese export competitiveness, with overall export volume expanding by 9%.

Of particular interest are the changes in real gross output in each sector of the economy. Although the trade policy regime of 2001 advantaged food-processing, ''other crops'', fisheries and light manufacturing, apart from the smaller ''beverages'' industry, it is the manufacturing sector that is the robust beneficiary of the unilateral trade liberalisation. This somewhat surprising result depends on subtle qualities of China's manufacturing sector in reality and as it is represented in the model. The first of these is its pattern of factor intensities. For all the sectors defined in the model, sets of factor proportions are displayed in Table 5. They show, as expected, that agricultural industries are land intensive, with beverages being more intensive in capital than the other crops. Fishing is labour, capital and natural resource intensive and the energy sector is very capital intensive. Of special relevance in interpreting the effects of unilateral liberalisation, however, are the factor intensities for manufacturing. Note that light manufacturing is highly labour intensive compared to all the traded goods sectors while heavy, or ''other'', manufacturing, is, one of the most capital intensive.

The second subtlety is that, when manufacturing is aggregated into two types, as in this case, the two sub-industries disguise considerable heterogeneity. One consequence of this is that there is considerable intra-industry trade. Light manufacturing is the most export oriented of all the sectors—its exports are largest compared with its domestic value added. Heavy manufacturing, on the other hand, is distinctive by the considerable scale of its

[22] The allocative gains referred to here are measured in terms of national income, or GDP, rather than in raw utility or any other money metric. The model also generates a raw utility metric and equivalent variations in income but their interpretation is problematic in such a comparative static setting where saving is endogenous. Note that, because the initial database is balanced without factor income flows, GDP and GNP are the same.

Table 4
Simulated *long run* effects of a *unilateral* liberalisation of China's 2001 trade policy regime[a]

Change in:	Change
Domestic CPI, P^C (%)	−1.67
Domestic GDP deflator, P^Y (%)	−1.90
Price of capital goods, P^K (%)	−1.37
Terms of trade (%)	−1.25
Real effective exchange rate, e_i^R (%)	−1.98
Real exchange rate against USA, e_{ij}^R (%)	−1.81
Global interest rate, r^w (%)	0.10
Investment premium factor $(1 + \pi)$ (%)	**0.00**
Home interest rate, r (%)	0.10
Current return on installed capital, r (%)[b]	1.30
Real domestic investment, I (%)	0.95
Balance of trade, $X - M = -\text{KA} = -(I - S_D)$ (US$ billion)	−10.87
Real gross sectoral output (%)	
Rice	−3.29
Beverages	2.77
Other crops	−1.25
Livestock	0.03
Food	−5.41
Fish	−0.17
Minerals	0.88
Energy	0.78
Light manufacturing	1.49
Heavy manufacturing	1.08
Transport	1.44
Infrastructure services	0.34
Construction and dwellings	0.73
Other services	0.76
Real GDP, Y	0.41
Unskilled wage and employment (%)	
Nominal (unskilled) wage, W	−0.42
Production real wage, $w = W/P^Y$	1.51
Employment, L^D	**0.00**
Unit factor rewards CPI deflated (%)	
Land	−2.65
Unskilled labour (those employed)	1.27
Skilled labour	1.38
Physical capital	1.24
Natural resources	1.20

Source: Model simulations described in the text.
E is the nominal exchange rate in US$ per unit of local currency.

[a] All results in this table are based on the adoption of fiscal policy 1: government spending is held constant as a share of GDP and the revenue lost from tariff reform is not made up in other taxes, so the fiscal deficit expands. Key exogenous variables are highlighted as per the long run closure discussed in the text.

[b] P^C is the domestic consumer price level; the CPI. Note that this is an index of the prices of both home and imported goods.

Table 5
Factor intensities by industry[a]

	Land	Skilled labour	Unskilled labour	Physical capital	Natural resources
Rice	30	1	58	12	0
Beverages	8	7	36	48	0
Other crops	27	1	60	12	1
Livestock	30	1	58	12	0
Food processing	0	8	38	54	0
Fish	0	0	48	12	40
Minerals	0	6	37	37	20
Energy	0	3	18	42	37
Light manufacturing	0	9	48	43	0
Heavy manufacturing	0	10	42	47	0
Transport	0	16	38	46	0
Infrastructure services	0	11	18	71	0
Construction	0	10	50	39	0
Other services	0	28	30	42	0

Source: The GTAP Version 5 database, as modified by simulations described in the text.

[a] These are factor shares of total value added in each industry, calculated from the 2001 database following the 1997–2001 trade reforms.

competing imports. While intra-industry trade is significant in the beverages and other manufacturing sectors, nowhere is it more important than in light manufacturing. This is clear from Table 6. And finally, as we saw from Table 2, both manufacturing sectors commit approximately half their total costs to inputs in the same product category and about 10–15% of those to imports.

Table 6
Trade to value added ratios by industry[a]

	Exports to value added ratio	Competing imports to value added ratio
Rice	0.006	0.000
Beverages	0.665	0.669
Other crops	0.034	0.108
Livestock	0.044	0.068
Food processing	0.177	0.545
Fish	0.057	0.067
Minerals	0.046	0.205
Energy	0.196	0.577
Light manufacturing	1.583	0.677
Heavy manufacturing	0.937	1.097
Transport	0.241	0.190
Infrastructure services	0.015	0.018
Construction	0.012	0.023
Other services	0.105	0.066

Source: The GTAP Version 5 database, as modified by simulations described in the text.

[a] These are quotients of the value of exports or imports at world prices and domestic value added in each industry. They are from the 2001 global database (following the trade reforms of 1997–2001).

Superficially, trade liberalisation removes the sector's tariff protection and so our intuition, stemming from the standard Heckscher–Ohlin–Samuelson (HOS) trade model, suggests it must contract. But here we have two departures from the (HOS) model. First, we have extensive intermediate use from the same sector and, second, competing imports, even though they are from the same sector, are differentiated from home products. Under these conditions the tariff reductions on imported intermediates have a direct effect on home industry total cost. Reductions to tariffs on competing, but differentiated, imports have only an indirect effect the magnitude of which depends on the elasticity of substitution between the two. Indeed, for manufacturing, it turns out that the input cost effect of tariff reductions is considerably greater than that of the loss of protection against competing imports. Cost reductions of similar origin are the reason for similar gains accruing to the domestic transport services sector.

Because the reforms cause the most substantial reductions in protection to China's food-processing sector and therefore lead to long run contractions in rice and ''other crops'' production, they require considerable structural change, including the relocation of employment from agriculture to manufacturing. In the long run, employment in food processing falls by 7%, in rice production by 4% and in ''other crops'' by 2%. As simulated, in the long run, the workers lost from these sectors are re-employed in the energy, manufacturing and the transport and other services sectors.

Finally, it is of interest to compare these long run simulation results with those generated by different models. Ianchovichina and Martin (2002) offer a comparative static analysis over the period 2001–2007 and they avoid the direct presentation of forecast GDP figures, preferring instead to use equivalent variations in income. Their results therefore offer no aggregate basis for comparison, though the directions of changes in sectoral output can be compared. Although their sectoral disaggregation differs from ours, the pattern of changes is consistent with those in Table 4. Walmsley and Hertel (2001) offer a dynamic, though non-macroeconomic, analysis and present cumulative GDP changes through 2020. Interestingly, our long run annual change of 0.41% per year accumulates to 8.5% in 2020. Their cumulative dynamic result is 8.6% (Walmsley and Hertel) (Table 2).

5. Simulated short run effects of trade policy reforms

In the short run, the model used has smaller elasticities of consumption and production, as discussed in Section 2. For all the regions represented, the ''standard'' closure is as indicated in Table 7. Monetary authorities in China and Vietnam are assumed to maintain effective fixed exchange rates against the US$. The other regions identified adopt inflation or CPI targeting. Capital controls are assumed rigid in China and Vietnam, but they are non-existent in the other regions. In the labour markets of China and Vietnam nominal wages are assumed to be ''sticky''. Full short run rigidity is assumed in the industrial countries, while nominal wages are assumed to be fully flexible elsewhere in Asia and the developing world. As to fiscal policies (not shown in the table) government spending in all regions is assumed to absorb a fixed proportion of GDP and the rates of direct and indirect tax are constant, so that government deficits do vary in response to shocks. Henceforth, this

Table 7
Short run closure[a]

Region	Monetary policy target[b]	Labour market closure: nominal wage[c]	Capital controls: capital account net inflow $I - S_D$[d]
China	Nominal exchange rate, E	Sticky ($\lambda = 0.5$)	Rigid
Vietnam	Nominal exchange rate, E	Sticky ($\lambda = 0.5$)	Rigid
Other ASEAN	Consumer price level, P^C	Flexible ($\lambda = 1$)	Flexible
Japan	Consumer price level, P^C	Flexible ($\lambda = 1$)	Flexible
Korea	Consumer price level, P^C	Flexible ($\lambda = 1$)	Flexible
Australia	Consumer price level, P^C	Rigid ($\lambda = 0$)	Flexible
United States	Consumer price level, P^C	Rigid ($\lambda = 0$)	Flexible
Europe (EU)	Consumer price level, P^C	Rigid ($\lambda = 0$)	Flexible
Rest of World	Nominal exchange rate, E	Flexible ($\lambda = 1$)	Flexible

[a] The expected future return on installed capital is exogenous and determined in a separate long run solution.
[b] The nominal money supply is endogenous in each case, the corresponding exogenous variable being the listed target.
[c] When the nominal wage is assumed flexible it is endogenous and the corresponding exogenous variable is the employment level. When it is sticky or rigid, Eq. (2) of Section 2 is activated and the employment level is endogenous.
[d] Capital controls are assumed to maintain a rigid net inflow of foreign investment on the capital account. When $KA = I - S_D$ is made exogenous to represent this, an interest premium opens between the domestic and international capital markets. This premium becomes endogenous. Effectively, the home and foreign capital markets are separated and clear at different interest rates. Where the capital account is flexible (open), this implies that private flows on the capital account are permitted at any level. $KA = I - S_D$ is then endogenous and the home interest premium is exogenous (unchanged by any shock). This means that the home interest rate then moves in proportion to the rate that clears the global savings investment market.

closure is only varied for the case of China in order to investigate the sensitivity of the effects of trade reforms to its macroeconomic policy environment.

For China, six alternative macroeconomic regimes are adopted:[23]

1. The ''standard'' closure, with rigid capital controls, a fixed exchange rate and fixed direct and indirect tax rates.
2. With capital controls and fixed tax rates retained, monetary policy targets the CPI and the exchange rate floats.
3. The ''standard'' closure except that capital controls are removed completely.
4. Closure 2 (floating exchange rate), except that capital controls are removed completely.
5. The ''standard'' closure except that the direct tax rate adjusts to maintain a government deficit that is fixed as a proportion of GDP.
6. Closure 5, except that capital controls are removed.

The results for the first four closures are presented in Table 8 and those for the last two are presented in Table 9. In general, it is clear that the short run effects of the trade reform

[23] For a full enumeration two more cases would need to be considered. These are the cases of fixed tax rates or fixed government deficit with a floating exchange rate regime. These cases are excluded to simplify the presentation but the results applying to them are available on inquiry from the authors.

Table 8
Simulated *short run* effects of a *unilateral* liberalisation of China's 2001 trade policy regime: by monetary policy[a]

Change in:	Retaining capital controls, monetary policy targets E[b]	Removing capital controls, monetary policy targets E	Retaining capital controls, monetary policy targets P^C	Removing capital controls, monetary policy targets P^C
Nominal exchange rate (US$/•), E_i	0.00	0.00	−1.89	−0.96
Domestic CPI, P^C	−1.74	−0.79	0.00	0.00
Domestic GDP deflator, P^Y	−2.15	−1.03	−0.53	−0.31
Nominal money supply, M_S	−2.54	−0.83	−0.62	−0.01
Import price index	−0.10	0.06	1.81	1.01
Price of capital goods, P^K	−1.80	−0.89	−0.16	−0.14
Terms of trade	−1.41	−0.85	−1.60	−1.00
Balance of trade, $X - M = -\text{KA} = -(I - S_D)$, US$ billion	0.00	−9.5	0.00	−8.6
Real effective exchange rate, e_i^R	−2.30	−1.19	−2.56	−1.43
Real exchange rate against USA, e_{ij}^R	−2.17	−1.03	−2.42	−1.27
Global interest rate, r^w	−0.04	0.08	−0.04	0.07
Investment premium factor $(1 + \pi)$	3.58	0.00	2.92	0.00
Home interest rate, r	3.55	0.08	2.88	0.07
Expected long run return on capital, r^e	1.30	1.30	1.30	1.30
Current return on installed capital, r^c	0.82	1.99	1.66	2.31
Real domestic investment, I	−1.76	0.98	−1.24	0.98
Nominal domestic investment	−4.24	0.47	−1.91	1.25
Real consumption, C	−1.71	0.12	0.36	1.01
Real private savings, S_P	−0.21	1.52	2.11	2.54
Government spending as % of GDP (real)	0.00	0.00	0.00	0.00
Power of income tax, $1 + \tau$	0.00	0.00	0.00	0.00
Fiscal deficit, % change	16.01	18.61	18.33	19.56
Fiscal deficit, change in US$ billion	12.1	14.0	13.8	14.8
Real gross sectoral output				
Rice	−0.43	−0.14	−0.16	−0.03
Beverages	0.47	0.49	0.70	0.61
Other crops	−0.30	0.02	0.02	0.15
Livestock	−0.10	0.49	0.25	0.61

Food	−0.63	−0.37	−0.37	−0.26
Fish	−0.01	0.32	0.24	0.41
Minerals	−0.15	0.30	0.31	0.48
Energy	0.06	0.08	0.20	0.15
Light manufacturing	0.46	0.19	1.03	0.51
Heavy manufacturing	−0.05	0.14	0.52	0.40
Transport	0.23	0.56	0.77	0.80
Infrastructure services	−0.07	0.32	0.38	0.51
Construction and dwellings	−1.48	0.94	−0.97	0.97
Other services	−0.05	0.49	0.44	0.69
Real GDP, Y	−0.09	0.42	0.39	0.61
Unskilled wage and employment				
Nominal (unskilled) wage, W	−0.87	−0.40	0.00	0.00
Production real wage, $w = W/P^Y$	1.31	0.64	0.53	0.31
Employment, L^D	−0.28	0.64	0.59	1.00
Unit factor rewards CPI deflated				
Land	−0.98	1.65	0.75	2.29
Unskilled labour (those employed)	0.88	0.40	0.00	0.00
Skilled labour	0.81	0.75	0.33	0.51
Physical capital	0.53	1.33	1.04	1.51
Natural resources	0.99	2.77	3.24	3.75

Source: Model simulations described in the text.

[a] All results in this table are based on the adoption of fiscal policy 1: government spending is held constant as a share of GDP and the revenue lost from tariff reform is not made up in other taxes, so the fiscal deficit expands.

[b] E is the nominal exchange rate in US$ per unit of local currency.

[c] P^C is the domestic consumer price level; the CPI. Note that this is an index of the prices of both home and imported goods.

Table 9
Simulated *short run* effects of a *unilateral* liberalisation of China's 2001 trade policy regime: by fiscal policy

Change in:	Tight capital controls, monetary policy targets the nominal exchange rate, E		No capital controls, monetary policy targets the nominal exchange rate, E	
	Fiscal policy 1: increase deficit[a]	Fiscal policy 2: tax mix switch[b]	Fiscal policy 1: increase deficit[a]	Fiscal policy 2: tax mix switch[b]
Nominal exchange rate (US$/•), E_i	**0.00**	**0.00**	**0.00**	**0.00**
Domestic CPI, P^C	−1.74	−1.93	−0.79	−1.36
Domestic GDP deflator, P^Y	−2.15	−2.27	−1.03	−1.59
Nominal money supply, M_S	−2.54	−2.51	−0.83	−1.45
Import price index	−0.10	−0.10	0.06	0.00
Price of capital goods, P^K	−1.80	−1.74	−0.89	−1.18
Terms of trade	−1.41	−1.46	−0.85	−1.12
Balance of trade, $X - M = -$ KA $= -(I - S_D)$, US$ billion	**0.00**	**0.0**	−9.5	−5.9
Real effective exchange rate, e_i^R	−2.30	−2.42	−1.19	−1.75
Real exchange rate against USA, e_{ij}^R	−2.17	−2.28	−1.03	−1.59
Global interest rate, r^w	−0.04	−0.04	0.08	0.03
Investment premium factor $(1 + \pi)$	3.58	2.33	**0.00**	**0.00**
Home interest rate, r	3.55	2.28	0.08	0.03
Expected long run return on capital, r^e	1.30	1.24	1.30	1.24
Current return on installed capital, r^c	0.82	0.67	1.99	1.38
Real domestic investment, I	−1.76	−0.82	0.98	0.97
Nominal domestic investment	−4.24	−2.89	0.47	0.18
Real consumption, C	−1.71	−2.43	0.12	−1.37
Real private savings, S_P	−0.21	−2.23	1.52	−1.37
Government spending as % of GDP (real)	**0.00**	**0.00**	**0.00**	**0.00**
Power of income tax, $1 + \tau$	**0.00**	1.13	**0.00**	1.23
Fiscal deficit, % change	16.01	**0.00**	18.61	**0.00**
Fiscal deficit, change in US$ billion	12.1	0.0	14.0	0.0

Real gross sectoral output				
Rice	−0.43	−0.57	−0.14	−0.41
Beverages	0.47	0.41	0.49	0.42
Other crops	−0.30	−0.45	0.02	−0.26
Livestock	−0.10	−0.32	0.49	0.02
Food	−0.63	−0.80	−0.37	−0.65
Fish	−0.01	−0.19	0.32	0.00
Minerals	−0.15	0.06	0.30	0.36
Energy	0.06	0.09	0.08	0.10
Light manufacturing	0.46	0.49	0.19	0.33
Heavy manufacturing	−0.05	0.11	0.14	0.24
Transport	0.23	0.19	0.56	0.39
Infrastructure services	−0.07	−0.11	0.32	0.12
Construction and dwellings	−1.48	−0.72	0.94	0.85
Other services	−0.05	−0.13	0.49	0.20
Real GDP, Y	−0.09	−0.04	0.42	0.28
Unskilled wage and employment				
Nominal (unskilled) wage, W	−0.87	−0.97	−0.40	−0.68
Production real wage, $w = W/\mathrm{P}^{\mathrm{Y}}$	1.31	1.33	0.64	0.92
Employment, L^D	−0.28	−0.19	0.64	0.39
Unit factor rewards CPI deflated				
Land	−0.98	−2.17	1.65	−0.67
Unskilled labour (those employed)	0.88	0.98	0.40	0.69
Skilled labour	0.81	0.90	0.75	0.88
Physical capital	0.53	0.67	1.33	1.18
Natural resources	0.99	1.08	2.77	2.19

Source: Model simulations described in the text.

[a] Fiscal policy 1 has government spending held constant as a share of GDP and the revenue lost from tariff reform is not made up in other taxes, so the fiscal deficit expands.

[b] Fiscal policy 2 holds government spending constant as a share of GDP but the rate of indirect tax is allowed to rise so that the fiscal deficit also remains constant as a share of GDP.

are heavily dependent on the surrounding macroeconomic policy regime. Indeed, the effects range from the contraction alluded to in the introduction through to considerable short run expansion.

5.1. The effects of capital controls and the choice of monetary policy target

The broad behaviour of the model in the short run with rigid capital controls retained can be represented as in Fig. 3. The upper diagram represents the domestic capital market and the lower one the domestic market for foreign products. These markets are linked by the requirement that, for a balance of payments, net flows on the capital account must mirror those on the current account. Net demand for foreign products (the downward sloping line in the lower diagram, $\mathrm{NM} = M - X$) depends on the relative price of foreign goods. For this purpose define the real exchange rate as the common currency ratio of the price of home goods to the price of foreign goods:

$$e_R = E\left(\frac{P^Y}{P^*}\right) = \frac{P^Y}{P^*/E} \tag{3}$$

where, as before, E is the nominal exchange rate in foreign currency per unit of home currency, P^Y is the GDP deflator and P^* is the foreign price level. In the numerical model a real effective exchange rate is estimated as the trade-weighted average of the ratio of the home and the foreign GDP deflators. Net imports depend positively on this and negatively on its inverse (the common currency foreign to home product price ratio). This relationship is shifted to the right by an increase in GDP, Y, or a reduction in protection, τ. The real exchange rate is then determined by the balance of payments requirement that net inflows on the capital account must equal net outflows on the current account, $\mathrm{KA} = -\mathrm{CA} = \mathrm{NM} = M - X$.[24]

The trade liberalisation reduces τ and shifts NM to the right. With tight capital controls, the current account balance cannot change. The shock therefore raises the relative price of foreign goods in the home market and thus depreciates the real exchange rate. If the nominal exchange rate is the target of monetary policy and the home economy is small by comparison with its trading partners then, from (3) a fall in P^Y (a deflation) is required. This must be brought about by a monetary contraction in defence of the exchange rate. To the extent that wages adjust more sluggishly than product prices, the deflation causes the real wage to rise. Were the real depreciation the only consequence of the liberalisation shock its effects would therefore be contractionary. Fortunately, this need not be the case. The trade reform brings gains in allocative efficiency.[25]

When capital controls remain rigid and the exchange rate fixed, however, these allocative gains are insufficient to offset the contractionary effects of the deflation. This can be seen from the first column of Table 8. The real depreciation is substantial and the

[24] The net factor income component of the current account is zero at the outset because that is the assumption embodied in the construction of the original database.

[25] To see these at least partially offsetting gains in allocative efficiency it is necessary to use a multi-commodity general equilibrium framework, such as that in this paper. Standard "corn" models of macroeconomic behaviour cannot capture them (Tyers, 2001).

deflation required is of the order of 2% per year. The production real wage rises by half this and employment falls. Investment demand responds to the expectation of higher real returns to installed capital in the future by shifting outward. The loss of tariff revenue drives the government deficit higher, reducing domestic saving, further reinforcing the outward shift of the NFI curve. But the rigidity of the capital controls causes this to simply push up the interest rate and so real investment actually falls. Output falls in all sectors except manufacturing and transport. The latter sectors gain in the short run for the same reasons they gain in the long run—cheaper imported inputs. Under these policy circumstances, then, the overall net gains from trade reform are not robust in the short run.

Now suppose that the monetary policy regime allows the exchange rate to float, targeting the consumer price level instead of the nominal exchange rate. The consumer price is a weighted average of the prices of home-produced goods and the after-tariff home prices of foreign goods in the domestic market:

$$\bar{P}^C = Av\left\{P^Y, \frac{P^*(1+\tau)}{E}\right\} \tag{4}$$

where the tariff rate indicated in (4) is an average across imported products. The fall in this tariff rate lowers the domestic price of imported products and therefore shifts demand away from home-produced goods. So, there must be a real depreciation (Eq. (3)). But now the nominal exchange rate can carry some of this adjustment. The question is how much? If monetary policy targets the consumer price level, as expressed above, the primary shock is to the tariff rates. The nominal depreciation cannot be so large as to reverse the effect of this primary shock on the domestic prices of imported goods. The second term in (4) should therefore fall. Thus, to keep the consumer price target a rise in the GDP price index P^Y is expected, so that monetary policy must be expansionary.

But this is not what is observed in our multi-commodity simulation. In fact, there is a fall in P^Y (a deflation), and this counterintuitive result arises because the two price indices, P^Y and P^C, have significantly different sectoral weightings. The GDP price index has a collective weighting of 55% on ''construction and dwellings'', ''light manufacturing'' and ''other manufacturing'' (Table 1) and all three of these product groups have declining prices driven by the tariff reductions. Consumption, on the other hand, is spread more evenly across commodities, and products that are not subjected to tariff changes weigh more heavily in the consumer price index. Over half of domestic consumption expenditure is allocated to ''other services'', ''livestock'' and ''other crops''. These three sectors experience a substantial increase in domestic prices whereas both ''light manufacturing'' and ''construction'' experience a decline. The average price of *home goods* in consumption actually rises as aggregate demand rises and this increase is sufficient to just offset the fall in the average price of imports in consumption. The result is that a monetary contraction is required to achieve the slight P^Y deflation. The consequence of exchange rate flexibility (with P^C targeting) is a smaller GDP price deflation and hence a smaller real wage increase, a smaller employment slow down and therefore a larger net gain from the liberalisation.

In the capital market (upper) part of the diagram in Fig. 3 this means the GDP-driven tendency of the NFI curve to shift left is larger. This offsets the tendency for investment to rise (which is the same as in the fixed exchange rate case since the same change in return to installed capital is expected). So the net rightward shift in the NFI curve is smaller, as is the

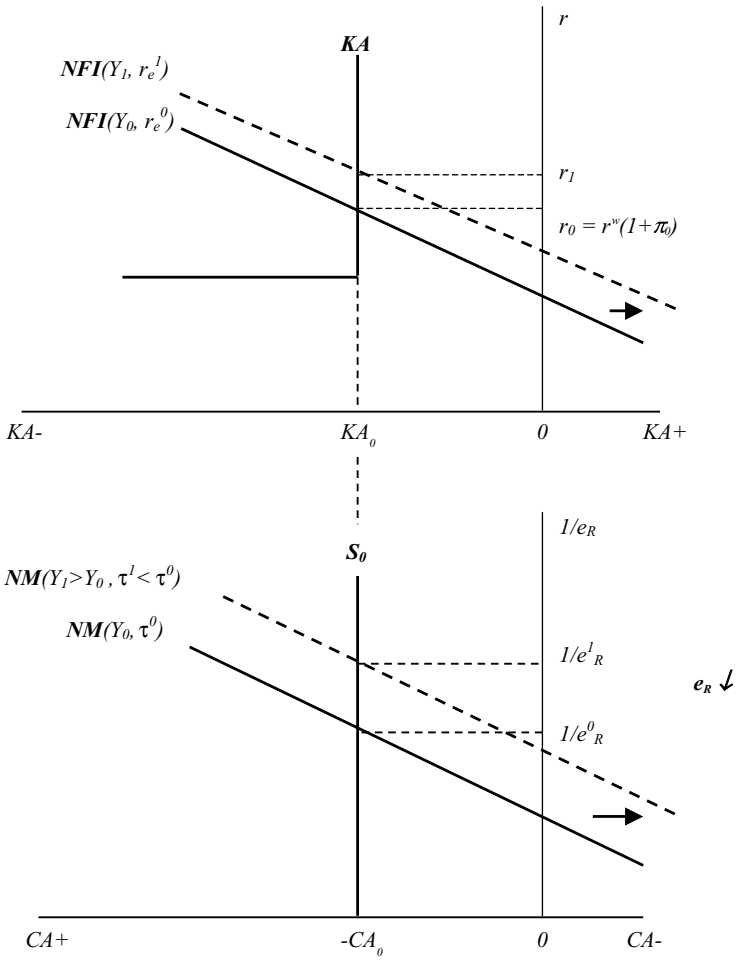

Fig. 3. Trade reform with capital controls.

rise in the home interest rate and hence the fall in real investment spending. All these results are verified numerically in column 3 of Table 8. The key result in the floating rate case is that, although the real production wage still rises, it does so by less than would have occurred had employment been fixed. The gain in allocative efficiency would have yielded a larger real production wage gain. Because this gain is restrained by nominal wage stickiness, there is a rise in employment and an unambiguous increase in GDP in the short run. If it can be managed, therefore, exchange rate flexibility is superior to a fixed rate regime during a trade reform where capital controls are tight.

If the capital controls are removed, the corresponding liberalisation shock is as depicted in Fig. 4. Here, reduced protection also yields a gain in allocative efficiency and hence a rise in GDP, reinforcing the rightward shift in the net imports curve. In this case, however, the absence of capital controls allows investment to flow in, responding to the increase in

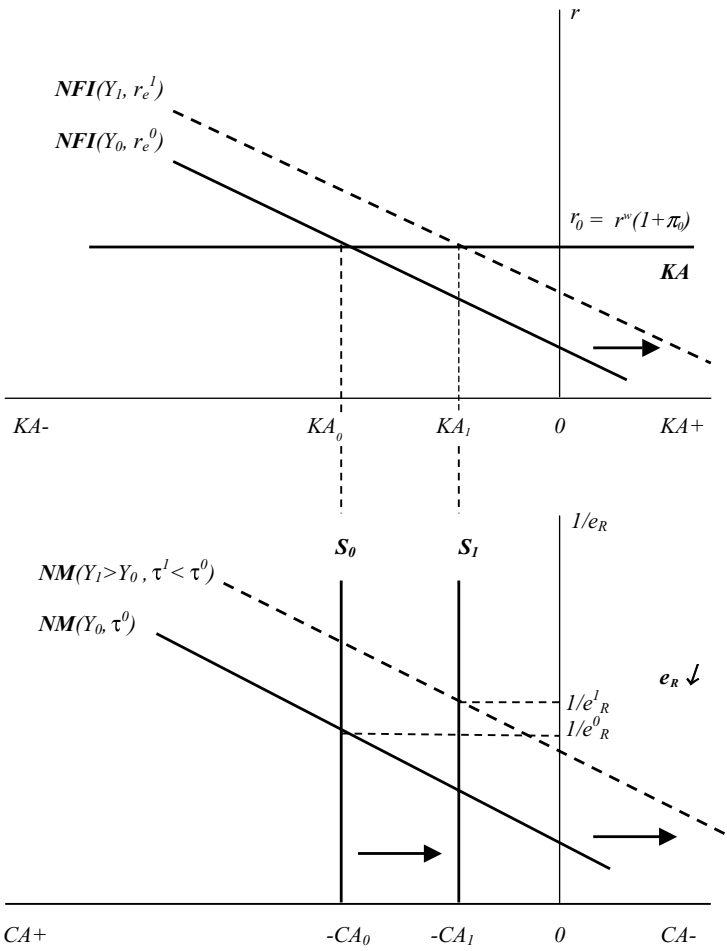

Fig. 4. Trade reform with no capital controls.

the expected long run return on installed capital. The increased inflow on the capital account relaxes the balance of payments constraint in the lower diagram and allows a substantial increase in net imports. The net effect on the real exchange rate depends on whether this effect, in raising the net supply of foreign goods, is larger or smaller than the increase in net demand for them due to the tariff reduction and the rise in domestic income. In the case of China, the rise in net demand is dominant and the real exchange rate still depreciates, albeit to a lesser extent than in the presence of capital controls (compare columns 2 and 4 of Table 8). Fig. 4 is drawn correspondingly.

With a real depreciation on the left-hand side of (3), the result is either a nominal depreciation or a domestic deflation, or both, depending on the target of monetary policy. If the nominal exchange rate is fixed, the domestic (P^Y) deflation is larger. With sticky nominal wages, this causes a larger rise in the real production wage and hence a smaller

expansion in employment and GDP. The floating rate regime with consumer price targeting therefore gives a better short run outcome when capital controls are relaxed than a fixed exchange rate because then there is a smaller deflation and hence greater employment growth. The superiority of the floating rate regime would have seemed even stronger had the target of monetary policy been set, instead, at P^Y. Then, there would have been a little (unanticipated) CPI inflation and employment would have expanded further.[26]

To summarise the monetary policy effects, when capital controls are weak or non-existent, the trade liberalisation is seen to attract increased inflows on the capital account and hence to mitigate the real depreciation and associated GDP price deflation that are its inevitable consequences. The real volume of domestic investment rises irrespective of the target of monetary policy, as does the level of GDP. The choice of monetary policy target still matters, however, with CPI targeting offering a smaller GDP price deflation, more modest gains in the real production wage and better short run GDP gains.[27]

5.2. *Fiscal policies*

The fiscal impact of the trade reform comes through the associated decline in tariff revenue. Only two alternative fiscal policies are considered. Fiscal policy 1 has no tax revenue switch. Government spending continues at a constant share of GDP and all rates of direct and indirect tax are held constant except tariffs, which are reduced by the shock. The result of the trade liberalisation is therefore an expanded fiscal deficit. This is the fiscal policy applying in the simulations reported in Table 8. Fiscal policy 2 has the lost revenue made up via an increase in the direct tax rate, so that the fiscal deficit, government revenue and government spending are all maintained as constant proportions of GDP. The two fiscal policy responses are compared in Table 9.

As with monetary policies, the ranking assigned to the two depends on the strength of capital controls. In the presence of tight capital controls (that keep net flows on the capital account constant) policy 2 outperforms policy 1 in terms of GDP expansion. This is because the expanded fiscal deficit under policy 1 adds to the demand side of the domestic capital market, pushing up the domestic interest rate and crowding out private investment. Indeed, the home interest rate rises by more than the expected long run return on installed capital and so the volume of investment falls. Under policy 2, the rise in income taxation reduces pressure on the domestic capital market so that the rise in the home interest rate is smaller as is therefore the fall in real investment. This mitigates, but does not reverse, the overall contraction in GDP that occurs under policy 1.

In the absence of effective capital controls the ranking is reversed: policy 1 outperforms policy 2. This is because net inflows on the capital account are now perfectly elastic at the international interest rate (plus an exogenous country risk premium). The added

[26] It is, at least in part, for this reason that CPI targeting countries set targets of 2–3% per year. This avoids GDP price deflation following trade reforms or negative external shocks.

[27] The trade reform is a positive shock and so it should not be surprising that an open capital account is advantageous in its wake. Such openness would, however, risk outflows following negative shocks and it is this risk that justifies the controls in the first place. If the risk of capital flight is to be minimised, controls on the composition of investment may be required. These simulation results simply confirm that such controls should do as little as possible to inhibit the inflow of investment following positive shocks.

government borrowing therefore draws in additional saving from abroad and does not crowd out new private investment in the short run. Net inflows on the capital account, and domestic investment, increase substantially, the more so under policy 1. The expanded deficit under policy 1, therefore, mitigates the depreciation of the real exchange rate. There is a smaller deflation and, while ever wages adjust more slowly than product prices, this retards real wages more and hence accelerates employment and GDP growth. Thus, the tax mix switch of policy 2 is contractionary by comparison with policy 1 when capital controls are lifted. Yet, both give superior results without capital controls than either does in their presence.

5.3. Sectoral impacts in the short run

The key determinant of the sectoral mix of changes in the economy is the size of the short run real depreciation that occurs following the trade reform. When capital controls are tight this real depreciation is comparatively large. Traded sectors, such as light manufacturing, are advantaged, while non-traded services sectors, such as construction and dwellings, are disadvantaged. When capital controls are ineffective, on the other hand, manufacturing gains are smaller and the non-traded services sectors are benefited. Across the board, however, and for reasons that match those given in addressing the long run simulation, agriculture and food processing are disadvantaged by the reforms. Interestingly, however, it is only in the case when capital controls are retained and the exchange rate is fixed that almost the entirety of the agricultural sector is hurt. Even where capital controls are retained, a switch to a floating exchange rate would enable the trade reforms to be consistent with further growth in the ''other crops'', livestock and fisheries sectors.

As in the long run a key immediate effect of the reforms is a reduction in protection to China's food-processing sector and therefore a contraction in agricultural output. Significant structural change is therefore required in the short run with the movement of employment from agriculture to manufacturing, however, as expected, the scale of the movement is smaller than in the long run. Employment in food processing falls regardless of the macroeconomic policy regime. Under either fiscal regime the greatest contraction to employment in food processing occurs when capital controls are tight and monetary policy targets the nominal exchange rate. Unlike the long run, employment in the other agricultural sectors is not necessarily contractionary—the outcome is dependent on the macroeconomic policy regime.

5.4. Implications for China's Asian neighbours

The macroeconomic policy regime, including the setting of the exchange rate and capital controls, are assumed to be neutral in the long run. In the short run, however, trade reform under different macroeconomic policy regimes in China affects her neighbours in two ways. First, as in the long run, China's trade reforms change the international terms of trade. Countries whose mix of exports and imports is complementary with China's stand to gain from her trade liberalisation. Countries whose exports largely compete with China's tend to lose. The magnitudes of the associated terms of trade changes in the short run depend on China's and the other countries' macroeconomic policy regimes. Second, China's trade

reforms change interest rates at home and in other countries and hence the levels of regional investment. They affect the way in which investment is allocated across countries from the global savings pool. In general, these two effects need not act in unison.

Taking the four Chinese policy regimes of Table 8, summaries of the implications for the four neighbouring Asian countries and regions are provided in Table 10. The short run effects on GDP in all of these regions are small. This is because elasticities of adjustment are small in the short run, so that it takes substantial price changes to cause significant changes in quantities, particularly in demand for imports in third markets where trade competition is taking place. The implications of fixed versus floating exchange rate regimes in China are also diminutive. These are made smaller by our choice of the consumer price level as China's hypothetical nominal target. The resulting nominal depreciations are less than 2% and, because of China's larger real depreciations, her GDP price still deflates. The Chinese nominal depreciations would have been larger had the nominal target been the GDP price, as would their implications for neighbours. Finally, we have assumed (Table 7) that these Asian neighbours have floating exchange rates. This is optimistic from these countries' points of view since floating rates facilitate adjustment to shocks in China and since many of them have managed exchange rate regimes and have avoided large departures from fixed parity with the US dollar in recent years.

From Table 10 it is clear that the ASEAN group is a short run net loser from China's accession, with adverse terms of trade effects dominating throughout. Korea is a net gainer, with both the terms of trade and investment changes emerging as beneficial. Japan, also,

Table 10
Simulated *short run* effects on Asian neighbours of a *unilateral* liberalisation of China's 2001 trade policy regime: by monetary policy[a]

Change in:	Retaining capital controls, monetary policy targets E[b]	Removing capital controls, monetary policy targets E	Retaining capital controls, monetary policy targets P^C	Removing capital controls, monetary policy targets P^C
ASEAN, including Vietnam				
GDP	−0.07	−0.08	−0.06	−0.07
Terms of trade	−0.09	−0.09	−0.07	−0.08
Investment expenditure	0.02	−0.14	0.04	−0.12
Korea				
GDP	0.04	0.04	0.04	0.04
Terms of trade	0.82	0.81	0.80	0.80
Investment expenditure	0.46	0.30	0.44	0.31
Japan				
GDP	0.07	0.06	0.07	0.06
Terms of trade	0.58	0.46	0.59	0.47
Investment expenditure	0.11	−0.22	0.11	−0.18

Source: Model simulations described in the text.
P^C is the domestic consumer price level; the CPI. Note that this is an index of the prices of both home and imported goods.

[a] All results in this table are based on the adoption of fiscal policy 1: government spending is held constant as a share of GDP and the revenue lost from tariff reform is not made up in other taxes, so the fiscal deficit expands.

[b] E is the nominal exchange rate in US$ per unit of local currency.

enjoys terms of trade gains across the board that are sufficiently large to determine the direction of the net effect on its GDP. For all three countries/regions, investment is influenced strongly by the tightness of China's capital controls. When these are removed, China absorbs a greater share of the world's savings and investment tends to be smaller in other regions. This is so unless the long run effect of China's reform is so beneficial to the region's terms of trade that its return on installed capital rises sufficiently to dominate the effect of macroeconomic policy on domestic interest rates in the short run. This is the case with Korea.[28]

6. Conclusion

Experiments using a global multi-product comparative static macroeconomic model indicate that the trade reforms to which China is committed as part of its WTO accession yield the well-known net gains in the long run. In the short run, however, these gains are not directionally robust to the macroeconomic policy regime. If capital controls are too tight and the quasi-fixed nominal exchange rate regime is retained, the reforms are deflationary. Then, the comparative sluggishness of its labour markets to adjust will slow employment growth and the overall reform package will be contractionary in the short run. The potential allocative efficiency gains from trade reform are such that, to ensure positive short run results, the Chinese government has only to allow sufficient net inflow on the capital account to at least maintain the level of domestic investment. Even if it does not do this, the trade reforms would be expansionary in the short run if a small nominal depreciation were allowed.

The magnitudes of the short run effects on the rate of economic expansion are quite sensitive to the particular monetary and fiscal policies adopted. When capital controls are tight a monetary policy that targets the domestic consumer price level mitigates the GDP price deflation and therefore outperforms one that targets the nominal exchange rate. Moreover, if monetary policy must target the exchange rate and capital controls are tight, the short run contraction can be mitigated if lost tariff revenue is made up through an increased direct tax rate, rather than left to expand the fiscal deficit and thereby crowd out private investment.

When capital controls are ineffective or the government allows in substantial foreign investment inflows on the capital account are greater and so the real depreciation caused by the reforms is reduced. Although net gains are experienced irrespective of monetary target, the floating rate alternative with CPI targeting is again superior. Without effective capital controls, however, a fiscal expansion does not crowd out domestic investment. Failing to replace the lost tariff revenue through increased direct taxation is therefore no longer deleterious to short run growth. Indeed, the associated fiscal expansion augments the growth achieved in this case.

Because the trade reforms to which China is committed remove a comparatively large proportion of the existing protection afforded the food-processing sector, that and some feed-in agricultural activities contract with the reforms, irrespective of the macroeconomic

[28] These results, and their long run counterparts are consistent with the long run simulations by Walmsley and Hertel (2001).

policy environment chosen. The magnitude of the short run structural change required is, however, reduced if capital controls are relaxed and investment therefore has a larger share of GDP. The fiscal policy response to the loss of import tariff revenue has comparatively little influence over China's economic performance in the short run. In fact, regardless of whether it is the government spending or the government deficit that is held constant, the optimal macro policy environment for China's economy during these reforms is a floating exchange rate regime with no capital controls.

These results are consistent with the trend of Chinese macroeconomic policy in recent years. Moreover, pressure on the Chinese government for exchange rate flexibility has also come from the IMF and, more self-interestedly, from its larger trading partners.[29] The reform of China's banking system and the strategic interests of its Asian neighbours remain major considerations in determining the content of its macroeconomic policy regime.[30]

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[29] See DJI (2003).

[30] For further discussion of these issues, see Roberts and Tyers (2003).

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