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Revisiting the Economic Costs of Food Self-Sufficiency in China

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Abstract

A global comparative static model is used to project the world economy to 2010, noting the trends in the self-sufficiency rates for agricultural products in China. If there is no change in China's trade policy regime, agricultural self-sufficiency rates are shown to decline but only slowly. Apart from the processed food sector, only small increases in protection would be needed to hold the line at 2001 self-sufficiency levels. To achieve full self-sufficiency in all agricultural products by 2010, however, substantial new protection would be required. Moreover, this protection would be both contractionary and redistributive, harming worker households and retarding growth in the modern sector of China's economy.

1 Introduction

East Asian rapid development has been associated with declines in food self-sufficiency and increases in agricultural protection, particularly in Japan, Korea and Taiwan (Anderson et al. 1986, Krueger 1992). These authors have pointed out that, unfortunately, the decline in economic importance of the agricultural sectors in these countries and in several developed countries has not been accompanied by a similar decline in their political influence. Much of the work of the WTO is now focused on trying to reduce the costly protection (in global terms as well as in domestic terms for the countries adopting such protection) that the agricultural sector has been able to acquire in these countries. Hopefully, China's accession to the WTO will prevent its agricultural sector from receiving protection similar to that in the above-mentioned countries.

In this paper we examine the costs that would be borne by the Chinese economy if it attempted to maintain the existing levels of self-sufficiency in agricultural commodities, or to increase them, rather than continuing to open its agricultural markets. We investigate only the costs of such protection. Much of the political power that the agricultural sector is able to draw upon stems from concerns about the gap between urban and rural incomes. However, closing that gap will not be achieved by the use of protection of the agricultural sector. Rather, it will be achieved through productivity increases in the agricultural sector and the development

of off-farm income opportunities for rural households. Investigation of ways to reduce the urban-rural income disparity is the subject of other papers.

In an early analysis, Yang and Tyers (1989) used a global agricultural sector model to examine the implications of rapid income growth on the composition of food consumption and the implications of this for food self-sufficiency. They found that the anticipated redistribution of consumption toward livestock products would raise import demand for feed grains and that this would make the maintenance of self-sufficiency through protection very costly. Because their analysis was restricted to the agricultural sector, however, they could not examine the redistributive and overall contractionary effects of the protection needed to maintain self-sufficiency. In this paper we do this using a more general global model the scope of which is the entire economy. Our model is adapted originally from GTAP[1], which does multi-region, multi-product general equilibrium analysis. Following Yang and Tyers (2000), to this GTAP base is added 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.[2]

Taking an approach similar to that used by Ianchovichina and Martin (2002), we begin by using this model to project the world economy to 2010, noting the trends in the self-sufficiency rates for agricultural products in China. We then ask two questions. First, if China's food self-sufficiency rates are to be held constant to 2010, will increases in protection be required? Second, what increases in protection would be required to achieve self-sufficiency by 2010 and what would be the contractionary and distributional effects of this protection? Our projections to 2010 do not show large declines in Chinese food self-sufficiency, so that only small increases in protection are needed to maintain the 2001 levels. To achieve self-sufficiency in all agricultural products by 2010, however, substantial new protection would be required. Moreover, this protection would be both contractionary and redistributive, and retard growth in other sectors.

Section 2 offers a description of the model used and describes our approach to projecting the world economy to 2010. Section 3 then reviews the trends in China's agricultural self-sufficiency rates if its trade policy regime is held constant. Section 4

[1] A detailed description of the original model is provided by Hertel (1997).
[2] The nominal side of the model is not used in this analysis, which focuses on long run changes and so money neutrality is assumed.

describes the effects of increases in protection needed either to maintain 2001 levels of self-sufficiency through to 2010 or to achieve self-sufficiency in agricultural products by then. A short summary and conclusions are offered in Section 5.

2 Modelling the Chinese and world economies, 2001-2010

The model is a modified version of that introduced by Hertel (1997), which is global in scope. 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.

Our modifications (Yang and Tyers 2000) make regional governments financially independent by incorporating direct tax regimes. 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 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 in each region is derived.[3] For each region, the above relations imply the balance of payments identity, which sets the current account surplus equal to the capital account deficit: $X - M = S_P + S_G - I$.[4]

[3] 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.

[4] Note that there is no allowance for interregional 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.

From the global savings pool, investment is allocated across regions and it places demands on capital goods sectors in each region. A high level of global "capital" mobility is assumed.[5] The allocation to region *j* (net investment in that region) depends positively on the 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 increased.[6] 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 : $\Sigma_j S_j^D = \Sigma_j I_j (r_j^e, r_j)$. Here I_j is real gross investment in region *j*.[7] 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:

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

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 raise a region's marginal product of physical capital and hence the regional average return on installed capital.[8] 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.

The long run closure we adopt for the model in this paper differs from the short run closure used by Yang and Tyers (2000) and by Rees and Tyers (2002) in that: 1) there are no nominal rigidities (no rigidity of nominal wages) and hence full

[5] 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.
[6] r_j^e is the expected rental rate on physical capital, adjusted for depreciation and divided by the price of capital goods to yield a unitless net rate of return.
[7] 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.
[8] 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.

employment is retained and money is neutral[9], 2) larger production and consumption elasticities are used to reflect the additional time for adjustment[10], 3) physical capital is not sector specific; it redistributes across sectors to equalise rates of return, 4) capital controls are ignored, and 5) in China, changes in government revenue associated with tariff changes are assumed to not be offset via direct (income) tax changes with the result that the fiscal deficit changes; so that the ratios of government revenue and expenditure to GDP are endogenous while the average direct tax rate is exogenous.

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 province, it amalgamates Hong Kong, China, with the mainland.[11] Our further aggregation of mainland China with Taiwan province overlooks effects that are internal to these regions but such effects are not our focus. Instead, we seek to illustrate the strong interaction between self-sufficiency rates, agricultural protection and overall economic performance. These interactions are important for all the economies of East Asia. 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.[12] 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.[13] Finally, the sectoral breakdown we have chosen aggregates the 57

[9] The money and asset markets represented by Yang and Tyers (2000) play no role here, as money is neutral and we report only real quantities or relative prices.
[10] The long run elasticity set used is the same as that employed by Tyers and Yang (2000).
[11] 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 et al. (2002) for Taiwan and Wang et al. (2002) for the mainland.
[12] See Liu et al. (1998) for the method adopted.
[13] For further discussion of the role and representation of skill-capital complementarity, see Tyers and Yang (2000).

sectors in the database to our more manageable 14, offering the most detail in agricultural and marine products.

Finally, key parameters in determining the trends in self-sufficiency through time are the elasticities of demand. Our model employs the original GTAP CDE (constant difference of elasticities of substitution) system. Its non-homotheticity is a particular asset for our purpose in that it permits a range of income elasticities to exist, either side of unity. While this system is more general than the homothetic ones often used in such models, it is still restrictive in the width of the range compared to still more general systems. It is used here because of its parametric economy.[14] The income elasticities thus embodied in our demand parameters are listed in Table 2. Because of the restrictiveness of the CDE system, however, the span between the income elasticities of livestock products and processed foods, which are superior goods, and those of cereal grains is less than anecdotal evidence would suggest. One consequence of this is that our results probably underestimate the growth in demand for livestock products and processed foods and hence they underestimate the associated derived demand for cereal feeds and other agricultural inputs. This offers a second downward bias in our estimates of the cost of achieving and maintaining agricultural self-sufficiency. Because the simulations are decade long projections it was necessary to use long-run elasticities of substitution in product and service demand. These are listed in Table 3. These elasticities are larger than the standard GTAP demand elasticities which are useful for simulations over the medium-run.

Constructing the 2010 world economy:

As indicated earlier, our numerical analysis originates with the GTAP Version 5 global database for 1997. Rees and Tyers (2002) use a short run version of the above model to examine key changes in the Chinese economy between 1997 and 2001, including substantial trade reforms. We commence with their simulated image of the 2001 world economy and proceed to use it as a base from which to construct a reference characterisation of the 2010 economy. This latter step is, however, a substantial task in itself. Not only does it require assumptions about the exogenous growth rates of primary factor supplies like labour, skill and physical capital, it also rests importantly on assumptions about the pace of technical change.

[14] For a discussion of the CDE system and its more complicated alternatives, see Huff et al. (1997).

The pace of technical change is incorporated by constructing a set of region-wide total factor productivity growth rates that are consistent with forecast changes in populations and labour supplies on the one hand and a set of non-controversial regional GDP growth rates on the other. We do this by making GDP growth rates exogenous in the first simulation and a corresponding set of region-wide total factor productivity growth rates endogenous. In the subsequent counterfactual simulations, GDP is made endogenous in each region but the total factor productivity growth emerging from the reference simulation is held constant. Total income growth in each region therefore adjusts to the trade policy shocks imposed to achieve target rates of agricultural self-sufficiency. This approach to estimating the effects of new agricultural protection is conservative in that, by making total factor productivity coefficients independent of protection rates we expect to underestimate their contractionary effects.[15] The exogenous population, labour force and capital accumulation rates are listed in Table 4, along with the implied rates of total factor productivity growth.

3 Trends in Chinese Agricultural Self-Sufficiency

The dependence of China's domestic markets on trade is most clearly evident from the ratio of exports to domestic value added in each sector, or the corresponding ratio of competing imports to value added. Estimates of these for 2001 are listed in Table 5. They show that the most export-oriented food-related sector, the "beverages" group also faces the greatest level of import penetration. This sector is characterised by differentiated products and intra-industry trade, which, in China's case, appears roughly to balance out. Livestock products, "processed food" and the "other crops" group, which includes the inputs to the livestock products group, grains and soybeans, are less trade-oriented. Importantly, however, they do not enjoy the balance of exports and competing imports that occurs with beverages. They are import competing and therefore sectors in which China is less than self-sufficient.

To track self-sufficiency, we offer a cruder but more widely used measure: domestic output relative to domestic "disappearance". For a particular product group we compare the value of output at producers' prices, Y, to the corresponding value of

[15] For analyses of the links between productivity and protection, see Chand et al. (1998), Chand (1999) and Stoeckel et al. (1999).

output plus net imports ($M - X$), where the latter are also valued at domestic prices. Our self-sufficiency ratio is then:

$$(2) \qquad SSR = \frac{Y}{Y + M - X} \ .$$

The values taken by this ratio in the original database of 1997 and the constructed ones of 2001 and 2010 are listed in Table 6. Measured in this way, departures from self-sufficiency are only large amongst agricultural products for the livestock products and "other crops" category. Moreover, the shortfall relative to full self-sufficiency is projected to expand through 2010. Though smaller in magnitude, expansions in this shortfall also occur for the beverages group, fish and the processed food group. If self-sufficiency is a policy objective these results suggest some protection will be required in order to prevent deterioration in the ratios through time.

4 Achieving Agricultural Self-Sufficiency through Protection

If the Chinese government were to adopt self-sufficiency as an objective, to be achieved through border protection, it might choose to implement a policy regime that would prevent any negative trend in self-sufficiency ratios for product groups that are already import competing. Alternatively, it might seek a regime that would return the economy to self-sufficiency in all agricultural products. We examine these two possible policy scenarios by constructing alternative simulations of the 2010 global and Chinese economies. In the first, for import-competing agricultural products, the self-sufficiently ratio is held constant at the 2001 level through the implementation of a source-generic tariff in each sector that is additional to existing protection. In the second, these sectors are made to return to full self-sufficiency by 2010 through the more zealous application of such tariffs. The results from these simulations are presented in Table 7. To show their power the additional tariffs required are listed in the form of proportional changes to nominal protection coefficients (ratios of domestic post-tariff to border prices).

Because the declines in self-sufficiency projected to 2010 are modest, the tariffs necessary to retain 2001 self-sufficiency rates are modest and their overall effects on the Chinese economy are quite small. They induce a very slight contraction in overall GDP and some restructuring across industrial sectors that favours the newly protected ones but the changes are small compared with those stemming from overall

growth since 2001. Indeed, in the case of processed food, the self-sufficiency level had been rising, and so the results indicate a decline in tariff protection for this sector in order to maintain the 2001 level.

It is when the additional tariffs are raised to levels that yield full self-sufficiency in the previously import competing agricultural sectors that more substantial changes occur. The tariffs required by 2010 are very large, particularly on imports in the livestock products, processed food and "other crops" groups. These distort incentives in the economy substantially, shifting resources into agriculture and contracting both manufacturing and services, which are the primary growth sectors in the economy. Indeed, in light manufacturing, in which China has a strong comparative advantage, output would be reduced by five per cent.[16] Throughout the economy this decline in allocative efficiency reduces returns to installed capital and therefore investment and the level of GDP is reduced by nearly one per cent.

The resulting misallocation of labour is particularly striking. It is summarised in Table 8. Employment in agricultural and food processing activities is substantially higher, at the expense primarily of light manufacturing. The implications of this for domestic income distribution are indicated by the effects on real unit factor rewards summarised in Table 9. The protection benefits land-holders by a considerable margin while hurting production and skilled workers and capital owners. Indeed, the decline in unit capital rewards is serious for China, since this redirects domestic savings abroad and would retard future investment and overall growth.

5. Conclusion

A global comparative static model is used to project the world economy to 2010, noting the trends in the self-sufficiency rates for agricultural products in China. If there is no change in China's trade policy regime, agricultural self-sufficiency rates are shown to decline but only slowly. Only small changes in protection would be needed to hold the line at 2001 self-sufficiency levels. To achieve full self-sufficiency in all agricultural products by 2010, however, substantial new protection would be required. Moreover, this protection would be both contractionary and

[16] Note that China's comparative advantage in light manufacturing declines through time, as does the level of employment in this sector. This is because the growth rates of China's population and production labour forces are slower than those of its populous Asian neighbours. In the reference simulation its production labour to skill ratio declines substantially by 2010.

redistributive, harming worker households and retarding growth in the modern sector of China's economy.

Note two downward biases in our estimation of the economic costs of achieving self-sufficiency. First, the links between productivity growth and trade reform are ignored, so that when new protection is applied with the objective of achieving agricultural self-sufficiency, no associated sacrifice of total factor productivity is imposed. Second, the demand system used tends to restrict the range of income elasticities between the superior food items in "processed food" and livestock products on the one hand and cereals on the other. This leads to an underestimation of the growth in demand for processed food and livestock products as well as a corresponding underestimation of growth in the consumption of their principal intermediate inputs, namely cereals, soybeans, fruits and vegetables. The result is an overestimation of future self-sufficiency ratios and, thus, an underestimation of the cost of raising these to unity via protection.

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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.

Table 2: Income Elasticities of Demand Implied by the Model's Demand Parameters[a]

Merchandise sector	
Rice	0.45
Beverages	0.68
Other crops	0.83
Livestock	1.11
Fish	0.79
Processed food	0.74
Minerals	1.15
Energy	1.29
Light manufacturing	0.88
Heavy manufacturing	1.08
Transport	1.14
Infrastructure services	1.04
Construction	1.09
Other services	1.16

a The raw demand parameters are for the CDE (constant difference of elasticities of substitution) system. These income elasticities of demand are implied by those parameters.
Source: The original 1997 numbers are aggregated from the 57 commodity categories in the GTAP Version 5 global database, published in 2000.

Table 3: Elasticities of Substitution in Product and Service Demand [a]

Merchandise sector	Between home goods and generic imports	Between imports according to source
Rice	4.9	9.2
Beverages	4.9	9.2
Other crops	4.9	9.2
Livestock	4.9	9.2
Fish	4.9	9.2
Processed food	4.9	9.2
Minerals	5.6	11.2
Energy	5.6	11.2
Light manufacturing	5.4	11.8
Heavy manufacturing	5.7	11.9
Transport	3.8	7.6
Infrastructure services	3.9	7.6
Construction	3.8	7.6
Other services	4.0	7.7

a These long-run elasticities of substitution in product and service demand are larger than the standard GTAP values, reflecting the long-run nature of the simulations.
Source: Values are based on the calibration experiments discussed by Gehlhar (1994) and aggregated using the modified GTAP Version 5 database.

Table 4: Reference rates of population, labour supply, capital accumulation, productivity and GDP growth, 2001-2010[a]
(%/yr)

Region	Population	Production labour	Skilled labour	Physical capital	Total factor productivity[b]	GDP[c]
China	.84	1.2	2.8	8.8	3.2	8.0
Japan	.06	-.19	-.71	3.0	1.0	2.0
Korea	1.7	2.0	8.9	3.8	.12	4.0
Vietnam	1.4	2.8	3.1	7.8	2.0	7.0
Other Asia	1.9	2.1	7.2	3.9	3.0	6.5
European Union	.03	-.08	.07	2.7	2.8	4.0
USA	1.1	1.1	1.1	4.1	1.2	3.5
Australia	.98	1.1	1.0	4.5	1.4	4.0
Rest of world	1.5	1.8	4.8	4.2	.23	3.5

a The rates of growth of population, labour supply and capital accumulation are derived from the sources given below and common to all simulations. In the reference simulation the GDP growth rates are made exogenous targets and the model calculates the sector-generic total factor productivity growth rates consistent with these targets. In the subsequent counterfactual simulations the total factor productivity growth rates are fixed as shown in this table and GDP levels are then endogenous.

b Derived in the reference simulation for consistency of factor accumulation and projected GDP growth rates.

c These values apply to the reference simulation only. In the subsequent counterfactual simulations GDP is endogenous and departures from these values are reported subsequently.

Source: Factor accumulation rates are drawn from Ianchovichina and Martin (2002) and reference GDP projections from Graham and Tyers (2002).

Table 5: Trade to value added ratios by industry in 2001[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

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 (simulated, based on the trade reforms of 1997-2001 as per Rees and Tyers 2002).
Source: The GTAP Version 5 Database, as modified by simulations described in the text.

Table 6: Implied Chinese self-sufficiency rates, past and projected, %[a]

Merchandise sector[b]	1997	2001	2010
Rice	100.4	100.4	100.3
Beverages	98.4	99.5	98.8
Other crops	94.5	94.3	93.5
Livestock	98.8	99.0	97.8
Processed food	92.2	87.6	89.0
Fish	99.1	99.3	98.2
Minerals	95.3	95.3	94.4
Energy	79.9	79.9	75.8
Light manufacturing	123.2	123.3	125.7
Heavy manufacturing	94.5	94.6	97.8

a Self-sufficiency rates are calculated from values of domestic output, Y, imports, M, and exports, X, evaluated at domestic producer prices, from the formula: $SSR=Y/(Y+M-X)$.
b The services sectors are represented in the model, as indicated in Table 1. Since trade in these is relatively costly, self-sufficiency rates are near unity. They are, in any case, not the focus of this analysis and so they are omitted from this table.

Sources: The original 1997 numbers are aggregated from the 57 commodity categories in the GTAP Version 5 global database, published in 2000. Those for 2001 are based on short run projections from 1997, as conducted by Rees and Tyers (2002). For 2010, rates are from the reference simulation discussed in the text.

Table 7: Effects of Protection to Raise Agricultural Self-Sufficiency in 2010

	Reference change, 2001-2010, %	Departure from reference 2010, %	
		Protection to hold self-sufficiency rates at 2001 levels	Protection to achieve full self-sufficiency
Rise in agricultural nominal protection coefficient			
Rice	0	0.0	0.0
Beverages	0	2.6	14.98
Other crops	0	2.9	42.58
Livestock	0	12.5	40.20
Processed food	0	-2.0	42.61
Fish	0	10.6	25.19
Real effective exchange rate	-3.7	0.1	1.45
Terms of trade	-3.4	0.0	0.5
Return on installed capital	20.5	0.0	-0.2
Investment	131.0	-0.1	-0.2
Real gross sectoral output			
Rice	47.5	-0.9	5.3
Beverages	60.5	0.6	0.4
Other crops	57.8	0.6	5.4
Livestock	66.0	0.6	0.7
Processed food	59.5	-1.4	9.5
Fish	51.3	0.6	2.1
Minerals	99.3	-0.1	-0.6
Energy	76.0	0.0	-0.5
Light manufacturing	88.3	-0.5	-4.6
Heavy manufacturing	117.0	-0.1	-1.2
Transport	101.1	-0.1	-0.6
Infrastructure services	104.1	-0.1	-0.3
Construction	125.3	-0.1	-0.2
Other services	99.8	-0.1	-0.7
GDP	**99.9**	**-0.1**	**-0.8**

Source: Model simulations described in the text.

Table 8: Effects of Additional Protection to Raise Agricultural Self-Sufficiency in 2010 on the Employment of Production Workers

	Reference change, 2001-2010, %	Departure from reference 2010, %	
		Protection to hold self-sufficiency rates at 2001 levels	Protection to achieve full self-sufficiency
Rice	5.4	-0.9	6.9
Beverages	7.6	1.0	3.8
Other crops	11.8	0.7	6.5
Livestock	17.0	0.8	2.8
Processed food	9.6	-1.4	14.2
Fish	5.4	0.7	3.2
Minerals	27.8	0.0	-0.6
Energy	6.1	0.0	-0.5
Light manufacturing	-3.1	-0.6	-6.4
Heavy manufacturing	18.3	-0.1	-2.0
Transport	-5.9	-0.1	-1.4
Infrastructure services	-33.3	-0.1	-1.1
Construction	28.3	-0.1	-0.4
Other services	4.2	-0.1	-1.2

Source: Model simulations described in the text.

Table 9: Effects of Protection to Raise Agricultural Self-Sufficiency in 2010 on Factor Income Distribution

	Reference change, 2001-2010, %	Departure from reference 2010, %	
		Protection to hold self-sufficiency rates at 2001 levels	Protection to achieve full self-sufficiency
Unit factor rewards CPI deflated			
Land	111	1.2	10.6
Unskilled Labour (those employed)	37	-0.1	-1.8
Skilled Labour	43	-0.2	-2.1
Physical capital	14	-0.2	-1.9
Natural Resources	154	0.2	-0.2

Source: Model simulations described in the text.