

FOOD EMBARGOES AGAINST CHINA: THEIR LIKELIHOOD AND POTENTIAL CONSEQUENCES*

China's concern over its food security has increased in recent years as it opens up its domestic food market to the rest of the world. Chinese policymakers often regard food embargoes by the West as a major potential threat to food security. This paper examines the likelihood and consequences of food embargoes against China. The paper concludes that food embargoes are unlikely to occur, and even if they did, the damage that they could inflict on China is probably small. As a deterrent to such actions, however, international rules governing food embargoes should be strengthened. This will give food-importing countries greater confidence in liberalising trade and will weaken the argument for agricultural protection on the grounds of national security.

Introduction

Since rural economic reforms began in China in the late 1970s, agricultural production has increased substantially. For the Chinese people, the supply of food has never been as secure as today. This, however, has not diminished the concerns Chinese policymakers have over food security.¹ With limited arable land, rapid industrialisation has raised the cost of agricultural production and China is losing its comparative advantage in land-intensive agricultural commodities, especially grain (Zhang 2000). Although China's food self-sufficiency rate is still high,² it is widely predicted to decline as imports increase (Rosegrant, et al. 1995; Reeves et al. 2000; Mitchell et al. 1997). Recent developments in the domestic market seem to support this prediction. Domestic grain prices approached world levels in 1994, for the first time in the history of the People's Republic, and since then have even been higher than world prices (Yang and Huang 1997).

The controversial book *Who Will Feed China?* (Brown 1995) warned that rapid declines in domestic production will force China to buy in world food markets, pushing up world food prices. Food self-sufficiency has been a long-held policy of the Chinese government, which would be unlikely to accept this scenario. However, if China joins the World Trade Organisation (WTO) and agricultural liberalisation continues beyond the Uruguay Round, China will have less control over its food imports.³ China regards self-sufficiency as a

necessary condition for food security so this prospect has aroused intensive concern, with policymakers fearing that China will become susceptible to food embargoes.⁴

China's fear of food embargoes is understandable. Since the end of the Cold War and the collapse of the Soviet bloc, conflicts (real and perceived) between China and the United States have been rising, over issues such as Taiwan, Tibet, human rights, religious rights, arms sales, intellectual property rights and trade. The United States, as the world's largest grain exporter, has a large share of China's grain market. China fears that the United States may use a food embargo to achieve foreign policy objectives, as happened in 1980–81 when a grain embargo was imposed against the former Soviet Union following its invasion of Afghanistan (Lu 1997).

China is not alone in fearing that food security could be placed at risk in this way and, as agricultural liberalisation deepens, policymakers increasingly confront this issue. Food security is likely to be a major item in future multilateral trade negotiations – it has already been examined in the context of the Asia Pacific Economic Cooperation (APEC) process (DFAT 1996; Anderson 1999).

This paper assesses the possibility of grain or food embargoes against China, examines the effect on consumption, production and prices with a global general equilibrium model, and evaluates the potential consequences for China's food security. The paper also looks at the impact on the embargoing countries (presumed to be United States and its allies) and at the welfare effects that would be likely to influence a decision to impose an embargo on China.

The history of food embargoes and the relevance for China

There are two motives for imposing a food embargo. The first is domestic economic considerations. The US embargo on soybean exports to Japan in 1973 provides an example – the embargo primarily aimed to prevent soybean prices from increasing in the United States. The second motive is protest against another country's domestic politics or to force that country to change its policies. General embargoes are more likely to be used to achieve economic motives, while political aims usually lead to targeted embargoes against particular importing countries. This type of embargo is China's primary concern, and is the focus of this paper.

Economic sanctions are largely a modern phenomenon. In a world where countries are isolated from each other in terms of trade and finance, economic sanctions have little impact

and hence are not often used. With increasing integration in the world economy, economic sanctions have been increasingly invoked. In a comprehensive survey of economic sanctions, Hulfauer and Schott (1985) examined 103 economic sanctions between 1919 and 1984, including 10 food embargoes. Developing countries were the target of nine of these food embargoes – the other target being the former Soviet Union – and eight were imposed by the United States. According to van Bergeijk (1995) and Hulfauer et al. (1999), governments have increasingly resorted to economic sanctions in the 1990s, largely as a substitute for military action. The United Nations has increased the use of multilateral economic sanctions, the most recent being on Yugoslavia over Kosovo.

The effectiveness of economic sanctions has been debated, mainly because of different views on what constitutes the success or failure of a sanction. According to the traditional view of economic sanctions, often known as ‘instrumental theory’, sanctions aim to achieve a policy change in the target country by inflicting the greatest possible economic harm. In this framework, economic sanctions are more likely to work the more intensive trade and other economic relations are between the two sides (Hulfauer and Schott 1985). According to this theory, economic sanctions are ineffective because the target country can find alternative sources of imports or be aided by ‘sanction busters’ (Winters 1990).

The other school of thought is that economic sanctions serve the interests of domestic pressure groups so the main purpose is not to inflict heavy economic losses but to communicate a signal or threat to produce policy change (Kaempfer and Lowenberg 1988). While this public choice approach can explain why an economic sanction is chosen as an instrument of foreign policy and how it can be made more effective in the target country, it does not assess its effectiveness (Lu 1997). If the aim is simply to express disapproval about another country’s behaviour, a more efficient action would be to simply downgrade diplomatic relations.

The West has imposed more sanctions on the People’s Republic of China during its the 50-year history than on any other country during the Cold War (Evans 1987). Sanctions on China have tended to restrict military or technological exports, and food has not been singled out for embargo, although it was included in comprehensive embargoes in the 1950s and 1960s.⁵ Overall, economic sanctions imposed by the West and the former Soviet bloc probably had little impact on China’s economic performance, although it may have put its technological development further behind the West (Evans 1987). In the 1950s the Soviet Union acted as a sanction buster, giving China access to such technology, but when this relationship soured, China was forced to be self-reliant. Some restrictions on technology transfers remain today,

and some were reimposed by the United States after the 1989 military crackdown in China and recent allegations that China has been involved in missile sales to Pakistan and nuclear espionage.

As most embargoes against China have been military or technological, it is difficult to estimate the possibility of a food embargo. Food is essential to human life, and many nations now oppose the embargoing of food. Food and medicine were exempted from recent embargoes against Iraq and Yugoslavia.⁶ The US embargo against the former Soviet Union provides the main example of a food embargo, but the objective then was not to deprive its people of food, but rather to disrupt livestock production and consumption in order to 'punish the Soviet Union for its invasion of Afghanistan' (Paarlberg 1987).

Food embargoes are difficult to implement because unlike technology, food, particularly grain, is highly substitutable. Grain can be replaced by rice or, if the embargo is not worldwide, imports can be sourced from other countries. Food is, however, an easy target for embargo. Food products tend to be bulky and therefore it is difficult to evade embargoes in transport. Food is costly and difficult to store for long periods, especially perishable food such as vegetables, fruit and meat. As production is seasonal, the need to substitute imports with domestic production will be delayed for a year in cold climates while crops grow. In the short run, therefore, domestic food supply tends to be inelastic. Perhaps most importantly, demand for food is less elastic than demand for non-food products. With an inelastic supply response in the short run, food embargoes can cause large price increases. Food stocks can alleviate the pressure on prices in the short run, but price increases can not be avoided in the longer run. If the target country was importing food prior to the embargo, it is likely that it has a comparative disadvantage in producing this food and domestic production has a higher marginal cost.

What chance is there of a food embargo against China? China is integrating into world economic and political systems but economic integration has proceeded more rapidly than political reform.⁷ During the Cold War, common strategic interests in containing the Soviet Union sidelined ideological differences between China and the West. Now the only major Communist power, China could be an easy target for the West. Ideological conflicts with the West have been increasing since the collapse of the Soviet bloc. In the West, especially in the United States, there is still a strong political pressure for the containment of China.

Conflicts are likely to continue, especially over the proposed US missile defence system in Asia, but the chance of a major conflict resulting a food embargo is probably low. China and

the West have common strategic interests, particularly in the areas of arms control and maintaining peace on the Korean peninsula. Even if another cold war occurred, which is hard to imagine, it would not necessarily lead to a food embargo against China, as history has shown.

Trade conflicts with China have been rising in recent years, and this is perhaps inevitable as the rapid integration of the Chinese economy into the world market has forced structural adjustment in both the West and China. The key issues for the West are the wish to access the Chinese market and the need to accommodate sectors in the domestic economy that are having to compete with Chinese exports. China is facing the need to reform its state-owned enterprises and financial sector and to raise farm incomes. Trade disputes will undoubtedly flare up from time to time, but they are unlikely to lead to major conflicts. Indeed, Western restrictions on food imports are more likely than embargoes on food exports.

Taiwan's increasing calls for self-determination is the major issue that could spark a serious conflict between China and the West. If China decides to force reunification, US intervention is a real possibility, but it is difficult to judge whether a food embargo would be part of this intervention.

Any country or countries contemplating a food embargo must first assess the probability of success. China is not a superpower, but it does have considerable political and military clout and this is likely to increase as its economy grows. It is more difficult to impose a food embargo against a large, strong country than a small, weak one. Large countries are less dependent on external economic relations, and powerful countries are less likely to be targets of an embargo because of their greater influence over world politics. In the event of an embargo, a strong country can more effectively defend itself by importing food from elsewhere. Many countries border China, making a food embargo difficult to enforce. China's relations with the former Soviet bloc have improved and any Western embargo would now be less likely to be successful. Indeed, when these countries recover economically, they could be alternative sources of food to the world market, including China (Tyers 1993). In addition, although China has not wanted to form a formal alliance with Russia for fear of attracting adverse reaction from the West, its improving relationship with Russia may provide a major deterrent to any food embargo against China, or Russia.

To what extent could a food embargo hurt China? Once consumption exceeds a certain minimum, demand for food becomes more elastic. The lower incomes are, the less elastic is the demand for food, and therefore an embargo will bring greater deprivation to the

population. In such cases, significant reductions in food consumption will nullify most utility from consumption of other products, regardless of their quantities. Winters (1990) showed that in the UK the elasticity of the demand for food was quite large even in the 1960s when income levels were much lower than today, so reductions in food consumption would not have caused a particularly large decline in overall utility. China's income is much lower than the UK's was in the 1960s, but econometric studies suggest that price elasticities of demand for grain are quite high in China (He and Tian 2000).

To see how Chinese consumers would cope with a food embargo, it is necessary to examine the Chinese diet. Wheat and rice are almost exclusively used for direct human consumption, with corn the only important feed crop (Tan and Xin 2000). China's food intake is just above the world average and is sufficient for its energy requirements. However, 40 million Chinese were in poverty in 1996 (UNDP 1996) and food intake is insufficient in some regions, especially remote inland areas.

Wheat and corn make up most of China's grain imports. In recent years, wheat has accounted for around two-thirds of total grain imports (in value terms). Corn imports have been highly volatile. Corn accounted for 22 per cent of total grain imports in 1995, but only 2 per cent in 1996 despite a substantial fall in total grain imports. It is likely that demand for corn will grow more rapidly than for wheat (assuming that the income elasticity of demand for meat is higher than for wheat). If restrictions on corn imports were reduced, wheat imports would probably decrease as domestic resources shift from corn production to wheat production. If subsidies on wheat imports were abolished, demand would fall and a food embargo would be less likely to result in substantial reductions in calorie intake. If the embargo causes a fall in the consumption of livestock products, which are less efficient sources of calories, then China's domestic production of grain would easily meet the population's energy requirements.

Modelling food embargoes

The impact of an embargo depends on the type of embargo, how many countries are involved in the action and when it occurs.

In modelling the impact of a food embargo, 2010 is arbitrarily chosen as the year of the embargo. The GTAP (Global Trade Analysis Project) global general equilibrium model provides the analytical framework (Hertel 1997). A projection of the world economy from 1995 (the base year) to 2010 is undertaken, following widely used procedures (see for example, Hertel et al. 1996; Yang and Huang 1997). Assumptions about population and GDP growth,

productivity changes and factor accumulation are imposed as exogenous shocks to the model.⁸ We assume that by 2010 trade barriers in the world economy will be half what they were in 1995. More details of these projections are given in the appendix.

If China's import barriers do not increase, grain imports should rise and therefore a food embargo would have a greater impact. Trade liberalisation pushes up world prices, and although agricultural production in China increases, the projection shows self-sufficiency rates for most agricultural commodities decline considerably by 2010 (Table 1). The declines in wheat, coarse grain, other crops and animal products are the most significant. If no trade liberalisation takes place before 2010, self-sufficiency would fall much more, reflecting China's comparatively low protection for agriculture, especially compared with Japan and Europe. Self-sufficiency rates for processed rice, meat and other food increase considerably. China becomes a net rice exporter under this scenario. These results are broadly consistent with most existing studies (see, for example, Rosegrant et al. 1995; Mitchell et al. 1997; Reeves et al. 2000).

With increased dependency on grain and other agricultural imports, China would become more susceptible to food embargoes. This paper examines four possible embargoes and the probable domestic economic responses. Prohibitive export taxes are presumed to be the policy instrument chosen to enforce the embargoes.

The first scenario is that the United States alone imposes a grain embargo that completely bans US exports of rice, wheat and corn to China.⁹ In the second scenario, the United States decides a grain embargo is not comprehensive enough to have the desired effect and extends the coverage to all agricultural and food products.¹⁰ In the third scenario, to make the embargo more effective and minimise its own losses, the United States rallies international support from its allies to join a grain embargo against China. The coalition is assumed to include the United States, Canada, the 15 European Union countries, the European Free Trade Area, Australasia (Australia and New Zealand) and Japan.¹¹ In the final scenario, the coalition embargoes all food and agricultural exports to China.¹²

Several assumptions are relevant for interpreting the simulation results. After an embargo, arable land prices should increase, and this encourages marginal and non-arable land to be converted to arable land, increasing the supply of land and dampening the affect on food prices. In addition, higher domestic prices may encourage farmers to seek better technology to increase output.¹³ These supply responses would take several years and are unlikely to provide relief to short-term price increases, therefore it is assumed arable land area and land productivity do not change in response to an embargo.

Table 1 Projected food self-sufficiency rates in 2010, compared to 1995 (per cent)

	1995	2010	
		Without liberalisation	With liberalisation
Paddy rice	100	100	100
Wheat	83	70	77
Coarse grain	91	81	83
Other crops	97	85	83
Animal products	100	92	91
Other ag. products	93	93	91
Meat	93	89	100
Processed rice	98	100	104
Other food	96	96	98

Source: Based on the GTAP database and simulations as described in the text and appendix.

Although non-participating countries are likely to increase exports of grain or food to China and meet their shortfalls from increased imports from the embargoing countries, the model does not allow for transshipment. Embargoing countries may be able to withhold exports to third countries in the short run, but this is more difficult in the longer run unless production is cut or stocks are allowed to increase permanently. The 1980–81 US grain embargo against the USSR showed that embargoing countries tend to send surpluses to third-country markets (Luttrell 1980; Schnittker and Associates 1982).

It is important to distinguish the long-run outcome of an embargo from its short-run consequences. If an embargo occurs without warning, there will be little opportunity for the target country to adjust. Without sufficient information, consumers may start panic buying in the expectation of higher future prices, and prices may rise immediately even if there is sufficient domestic supply. Profit-driven stockholders will probably delay sales until they are convinced that prices have peaked. Thus, in the short run, prices can be pushed up very quickly. If there is sufficient supply, for instance large grain reserves, domestic prices will fall as the market becomes better informed. The model employed here is static and cannot capture these dynamics.¹⁴ The state's reserves of grain would play a significant role in China's response to an embargo. State reserves were estimated at well over 100 million tonnes in the late 1990s (Zhou 1998), which is five times the level of the record grain imports in 1995. When commercial stocks are included, grain stocks are about 280 million tonnes, not including an

estimated 95 million tonnes of on-farm stocks held by farmers (Ke 2000).¹⁵ Not all these stocks are price-responsive, but a timely release of a small fraction of these reserves would be able to dampen price increases in the short run. Ke (2000) estimates that about 20 per cent of on-farm stocks could be released. Presumably a larger portion of commercial grain stocks would be price responsive. There therefore seems to be enough grain to dampen any short-run price increases provided that state reserves are used properly and private stockholders are provided with adequate information to avoid undesirable, irrational hoarding. However, the large cyclical volatility in stocks in the past two decades and various policy swings and errors show that China has not been able to use its reserves and commercial stocks effectively to combat market instability (Ke 2000).¹⁶

Our simulations focus on the medium term (2–3 years). We assume that in the medium run, both the state and the private sector have restored their stocks to their desired levels, which for simplicity are the pre-embargo levels. In the medium term, labour and capital are fully mobile, but the transformation of arable land from one industry to another is sluggish, governed by a unitary elasticity of transformation. The balance of payments is endogenous. While the standard GTAP elasticities are retained for processed food, mining, manufactures and services, those for agricultural commodities were doubled to reflect the fine disaggregation chosen in this study and hence relatively homogenous characteristics (the Appendix gives the elasticities of substitution along with the price elasticities of demand). In light of Gehlhar's (1994) finding that the trade pattern of the Pacific Rim countries is best replicated with doubled standard GTAP elasticities, these elasticities are perhaps in the lower band.

The consequences of food embargoes against China

The aim of the embargoing country would be to reduce China's food consumption and cause food prices to rise as much as possible, with the hope that sufficient pressure can be put on the Chinese government to achieve a policy change. The results from first simulation shows that if the United States alone imposes a grain embargo, the impact on food consumption in China is small (Table 2). The consumption of coarse grain, China's main grain import from the United States, is most affected, but consumption still only falls by less than 0.5 per cent. The rise in the price of feed grain reduces the production of meat and other animal products, pushing up prices and reducing consumption.¹⁷

Grain production, particularly of coarse grain, increases considerably as domestic consumption switches to domestically produced grain. Rice production falls marginally as

Table 2 The impact of US export embargoes against China, 2010 (per cent)

	Consumption	Grain embargo		Consumption	Food embargo	
		Consumer Price	Production		Consumer Price	Production
Paddy rice	-0.1	0.4	-0.1	-0.4	1.7	-0.3
Wheat	-0.2	1.5	3.5	-0.5	2.6	2.6
Coarse grain	-0.4	2.7	7.5	-0.7	3.9	6.9
Other crops	-0.1	0.2	-0.4	-0.9	2.0	0.7
Animal products	-0.2	0.4	-0.4	-1.0	2.0	-0.1
Other ag. products	-0.1	0.0	-0.1	-0.5	0.2	-0.3
Meat	-0.1	0.2	-0.3	-1.1	1.5	1.6
Processed rice	-0.1	0.2	-0.3	-0.4	1.0	-0.7
Other food	-0.2	0.6	-0.6	-0.8	1.6	-0.8

Sources: Simulations of the GTAP model, Version 4.

resources are competed away by coarse grain and wheat production.¹⁸ Overall, China's grain production increases by just less than 1.5 per cent.

If the United States extends its embargo to all agricultural and food products, the impact on consumption would be more significant, but for no product does consumption fall by more than 1.1 per cent (Table 2). For meat and other animal products, the reduction in consumption is comparatively large, reflecting higher elasticities of demand for these products. The impact on domestic production is similar to that of the grain embargo alone, except that meat and other crop production (mainly cotton and oilseeds) increases following the food embargo. China imports significant amounts of these products from the United States.

China's increasing reliance on coarse grain imports does make it less susceptible to US embargoes than if it was more dependent on imports of rice and wheat, which are both staple foods and therefore have lower price elasticities. For many poor households, coarse grain is still an important staple food, but because most of these households are in remote rural areas, they are unlikely to be able to exert much pressure on the Chinese government. Wealthier urban households would be relatively hard hit by higher prices for meat and other animal products, and these households tend to have a much greater political weight. Even a small negative impact on their living standards could place political pressure on the government.

Furthermore, wheat imports mainly go to coastal cities such as Beijing, Shanghai and Guangzhou, which have disproportionate influence in Chinese politics.

Sharp increases in grain imports from other countries would mitigate price rises in China following a US grain embargo (Table 3). Wheat imports from other countries increase by about 32 per cent, while coarse grain imports rise by 131 per cent. Total imports, particularly of coarse grain, still fall substantially. Much greater increases in imports are required to compensate for the lost coarse grain imports from the United States than for the lost wheat imports. In 2010 the United States is expected to provide about 70 per cent of China's coarse grain imports and 32 per cent of its wheat imports (in value terms).¹⁹

A US-led coalition has more power to reduce China's imports of grain (Table 4). Wheat and coarse grain are the hardest hit, but again consumption does not change by much. If a comprehensive food embargo is implemented, the consumption of grain and all other commodities decreases considerably. When imports of all food products are reduced to zero, there is an increasing demand for domestic grain to substitute for the consumption of these products. Although this induces larger increases in grain production than in the other scenarios, grain consumption falls by more than in the other cases. The demand for grain is rather inelastic, therefore domestic prices, especially those for wheat and coarse grain, increase substantially. The price of processed rice increases moderately, but the price of paddy rice falls marginally. The prices of non-grain products increase by less, despite larger falls in consumption, because demand for these products is more elastic. Overall, these price changes show that a Western coalition can exert some pressure on China if it decides to implement a total embargo on agricultural products and food.

Table 3 Change in China's grain imports by source following a US grain embargo, 2010 (per cent)

	Australasia	Canada	United States	EU	Japan	Rest of the world	Total
Paddy rice	1.8	2.5	-100	2.4	2.0	2.6	0.9
Wheat	40.9	27.3	-100	40.4	43.5	42.8	-13.8
Coarse grain	105.4	112.8	-100	141.1	150	147.3	-40.1
Processed rice	2.1	3.6	-100	2.2	2.2	2.7	-0.4

Source: Simulations of the GTAP model, Version 4.

Table 4 The impact of US-led Western embargoes against China, 2010 (per cent)

	Grain embargo			Food embargo		
	Consumption	Consumer Price	Production	Consumption	Consumer Price	Production
Paddy rice	-0.2	1.0	-0.2	-0.9	3.9	-0.3
Wheat	-0.8	6.2	16.6	-1.5	9.3	15.7
Coarse grain	-0.7	4.8	12.1	-1.3	7.8	11.6
Other crops	-0.3	0.6	-1.1	-1.8	4.2	0.3
Animal products	-0.5	1.0	-1.1	-2.3	4.8	0.2
Other ag. products	-0.3	0.1	-0.4	-1.5	2.2	1.5
Meats	-0.4	0.7	-0.8	-2.3	3.7	1.1
Processed rice	-0.2	0.6	-0.3	-0.8	2.6	-0.9
Other food	-0.5	1.5	-1.5	-1.9	3.8	-0.8

Sources: Simulations of the GTAP model, Version 4.

The political economy of food embargoes

What is the likelihood of other countries joining the United States in an embargo against China, and what incentives would they have to honour this commitment? The answers to these questions depend on the likely impact on economic welfare in these countries, particularly on that of their farm sectors, leaving aside any possible political gains and losses.²⁰

Table 5 shows the welfare impact of the four scenarios. China's welfare loss is quite small in relation to its national income. On average, each Chinese citizen loses less than US\$0.6 a year if the United States alone imposes a grain embargo (assuming a population of 1.4 billion by 2010). In the worst-case scenario of a comprehensive food embargo by a Western coalition, each citizen loses less than US\$6 per year.

The United States' losses are slightly less. American agricultural exporters are highly subsidised, so the welfare gain as production contracts partly offsets the welfare losses from lower exports. The European Union (EU) registers net welfare gains from joining the United States in the sanctions, partly because agricultural subsidies are high and partly through a terms of trade gain from lower US prices. The EU is a net food importer and buys large volumes of grain and other agricultural products from the United States. If the United States alone imposes the embargo, the EU again benefits from the terms of trade effect, and

Table 5 Welfare effects of food embargoes against China, 2010^a (US\$ billion)

	US grain embargo	US food embargo	Western grain embargo	Western food embargo
China	-0.8	-4.1	-1.8	-8.6
Australasia	0.0	0.1	-0.1	-0.9
Canada	0.1	0.3	-0.3	-0.6
United States	-0.7	-3.7	-0.6	-3.5
European Union	0.0	0.5	0.5	1.0
Japan	0.1	0.5	0.3	1.1
Rest of the world	0.6	2.5	1.4	5.6
World	-0.6	-3.9	-0.6	-5.9

Note: a Measured by equivalent variation.

Sources: Simulations of the GTAP model, Version 4.

Australasia and Canada benefit as China switches its imports from the United States to them. As net food exporters, Australasia and Canada would lose from joining the Western embargoes. Like the EU, Japan benefits whether it joins the embargoes or not. Japan exports few agricultural commodities to China, so loses little from export restrictions but gains considerably from cheaper imports from the United States.

Judging solely by the welfare effects, it seems the United States may gain support from its key allies – the EU and Japan. However, neither country is an important supplier of food to China; Australasia and Canada have no economic incentive to support any US-led embargo. The support of the EU and Japan may be diminished by the opposition of their farm lobbies. In all coalition members, farmers stand to lose from an embargo against China and therefore have the greatest incentive to oppose it. Farmers have a disproportionate weight in the political process in these economies (Anderson and Hayami 1986; Tyers 1990).

Table 6 reports the impact of grain and food embargoes on the value-added of grain and agricultural production in various countries and regions. Canadian and Australasian grain farmers would be particularly hard hit if they joined a Western embargo against China. In addition to income losses, land prices fall substantially (by 16 per cent in Canada, 8 per cent in Australasia, 10 per cent in the United States, 5 per cent in the EU and 3 per cent in Japan). In contrast, staying away from embargoes brings considerable gains, not only in terms of income, but also from rising land prices.

Table 6 Effects on grain and agricultural value added of export embargoes against China, 2010 (per cent)

	US grain embargo		US food embargo		Western grain embargo		Western food embargo	
	Grain	Agri.	Grain	Agri.	Grain	Agri.	Grain	Agri.
Australasia	2.2	0.0	1.6	0.3	-7.2	-0.4	-6.4	-3.3
Canada	5.8	0.5	5.8	0.4	-16.6	-1.9	-18.4	-4.8
United States	-3.8	-0.5	-6.1	-2.7	-4.5	-0.6	-6.9	-3.0
European Union	1.4	0.0	1.0	0.1	-3.7	-0.3	-5.9	-1.1
Japan	0.0	0.0	0.0	0.1	-0.1	0.0	-1.0	-1.0
Rest of the world	-0.2	-0.1	-0.6	0.1	0.3	0.0	0.3	0.8

Sources: Simulations of the GTAP model, Version 4.

US farmers may also oppose the embargoes, and would certainly demand compensation. After the 1980–81 grain embargo against the former USSR, various farm bills were passed in the United States allowing farmers substantial compensation if grain embargoes were imposed for national security or foreign policy reasons.²¹ The need to compensate farmers would cripple the US federal budget (Paarlberg 1996), and to raise additional taxes would be a huge political challenge. While compensation might secure the short-term support of farmers, this support would be difficult to maintain. Embargoes can give a supplier a reputation for being unreliable and can create a legacy of mistrust (USDA 1986). The prospect that the embargo might fail would also reduce farmers' support, as happened in the embargo against the Soviet Union.

Conclusion

The fear of food embargoes is a fundamental factor behind China's policy of food self-sufficiency. This fear has been heightened by the growing disputes with the West over issues such as Taiwan, trade and human rights. Such disputes, however, have mostly resulted in restrictions on military exports or threats of import restrictions, rather than restrictions on food exports. Short of an all-out military conflict, it seems unlikely that the West would impose a food embargo against China, as evidenced by the exemption of food from the recent United Nations economic sanctions against Iraq and Yugoslavia.

Given China's growing economic and political power, any country contemplating a food embargo against China would have to seriously consider the chances of success and think twice about the global implications. The damage an embargo could inflict on China is likely to be limited. The simulations in this paper show that even if China became considerably more reliant on the world food market, it would only suffer small declines in food consumption and moderate increases in food prices except perhaps under the extreme (and unrealistic) assumptions that the substitutability between food from the West and other countries is low and that a total embargo on food could be successfully implemented.²²

An embargo inevitably creates a free-rider problem. Major food exporters can benefit from embargoes they do not participate in, and embargo members can cheat or only commit themselves to minimum export restrictions, as occurred during the US embargo against the former Soviet Union in 1980–81. Domestic opposition tends to make food embargoes difficult to sustain as farmers do not wish to lose long-term commercial opportunities, especially in a market as large as China. Compensation for lost income can be very expensive, as the US embargo against the former Soviet Union showed.

China's concern over its food security is understandable given its long history of famines. However, there are other options available to help China increase food security. Each of the options needs to be assessed on the basis of its costs and benefits.

China is not the only country to be concerned about food embargoes and therefore there seems to be a case for establishing some rules governing food embargoes under the auspices of an international organisation, such as the World Trade Organisation. Such rules, if properly formulated, could act as a deterrent to any potential abuse of food export restrictions and hence reduce the real and perceived threat to food security. As agricultural liberalisation deepens, the need for such rules becomes stronger. These rules would also help reduce the political resistance to agricultural trade reform and make it less tenable for countries to invoke food security as an excuse for agricultural protection.

Appendix: Projection of the world economy to 2010

As described in the text, all comparative static analysis of food embargoes against China is counterfactual against the projected 2010 database. In the projection, an economy-wide technological change variable is endogenised to reach the World Bank's forecast of GDP. Forecasts of factor accumulation are based on Hertel et al. (1996). In addition to endogenous technological change, sector-specific technological changes are also imposed. These include a 20 per cent improvement in land productivity in developing countries, including China, and a 20 per cent increase in the labour productivity in agriculture in industrial countries (based on the evidence provided by Hayami and Ruttan 1985; Fecher and Perelman 1992; and Martin and Mitra 1993). In addition, total input productivity in Chinese agriculture is assumed to grow 0.8 per cent faster than the rest of the economy. This is to represent the effect of catching-up investment after the slow growth since the mid-1980s. The following table shows the elasticities of substitution as well as the price elasticities of demand used in the projection and the subsequent comparative static simulations. Details of the GTAP database and its elasticities of substitution can be found in McDougall et al. (1998). It is worth noting the price elasticities of demand in the GTAP database are considerably smaller than those surveyed by He and Tian (2000). This leads to relatively large price responses but relatively small consumption responses in our simulated results.

Table A1 Elasticities of substitution used in the projection and central scenarios

	Price elasticities of demand	Between domestic goods and imports	Among imports from different regions
Paddy rice	-0.08	4.4	8.8
Wheat	-0.07	4.4	8.8
Other grain	-0.07	4.4	8.8
Other crops	-0.26	4.4	8.8
Animal products	-0.30	4.4	11.2
Other ag. products	-0.22	5.6	10.8
Meats	-0.23	2.2	4.4
Processed rice	-0.08	4.4	8.8
Other food	-0.28	2.5	4.8
Minerals	-0.26	2.8	5.6
Manufactures	-0.58	2.9	6.4
Services	-0.56	1.9	3.8

Source: Based on GTAP database, Version 4.

Notes

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- 1 The Food and Agricultural Organisation (FAO) defines food security as a situation in which all households have both physical and economic access to adequate food and are not at risk of losing such access.
- 2 The food self-sufficiency rate is the ratio of domestic production to total food consumption.
- 3 With the signing of US-China WTO Accession Agreement on 15 November 1999 and the agreement with the European Union on 19 May 2000, it appears that China's WTO membership is not far away. China will have to trade the benefits of membership against the perceived risk of external shocks, including food embargoes.
- 4 A food embargo is the restriction of food exports to a country that is customarily traded with. A food embargo imposed for political or diplomatic reasons is a type of economic sanction. There is a vast economic literature on economic sanctions. For theoretical treatment of the issue, see, for example, Bhagwati and Srinivasan (1976); Mayer (1977); Tolley and Wilman (1977); Arad and Hillman (1979); Thompson (1979); Bergstrom et al. (1985); and Eaton and Engers (1992). For empirical studies, see Hulfauer and Schott (1985); Lundberg (1987); Leyton-Brown (1987); Hulfauer et al. (1999); Miyagawa (1992); Chatterji et al. (1994); Cortright and Lopez (1995); Hufbauer, et al. (1999) and Levy (1999).
- 5 This did prevent China from importing grain from Australia and Canada after the failure of the Great Leap Forward in 1958.
- 6 This, of course, does not mean that exemptions of food and medicines will not affect food supply in the target country. In the case of Iraq, economic sanction have often been blamed for food shortages.
- 7 Some may question whether China is integrating its political system with the rest of the world given its slow progress in political reform. Nevertheless, it seems inevitable that China will have to go down the path of political reform if economic reform is to continue.
- 8 Sectoral productivity estimates are primarily based on Tyers and Yang (1997).
- 9 If prior commercial contracts exist, it may not be possible for the United States to completely ban exports to China. For simplicity, this possibility is ignored here, as is the fact that grain embargoes are difficult to completely enforce.
- 10 The reason to include non-food agricultural commodities is that imports of these commodities can reduce the pressure on land use for food crops.
- 11 This assumption is again somewhat unrealistic. In the embargo against the former Soviet Union in 1980-81, no United States ally completely withheld grain exports to

- the Soviet Union, and there is no reason to believe that a grain embargo against China would be any different.
- 12 The logical conclusion of this scenario would be an all-out trade embargo from both sides, which would be devastating to the world economy, and would probably never happen without a major military conflict. In addition, embargoes on energy and military technology would be more likely than a food embargo, as recent military conflicts in the Middle East and Europe showed.
 - 13 However, increases in agricultural inputs may discourage improvement in land productivity.
 - 14 See Tyers and Anderson 1992 for a dynamic model that incorporates the stockholding behaviour of the private sector.
 - 15 There are several other estimates, including those by Crook (1994) and Huang (1995).
 - 16 Lu (1999) provides a thorough survey of these policy cycles and errors over the past two decades.
 - 17 It is possible, or even likely, that the supply of meat and other animal products increases in the short run if high feed prices force farmers to slaughter their animals prematurely. This occurred in the former Soviet Union during the US grain embargo of 1980–81 (USDA 1986).
 - 18 Most rice trade occurs in processed rice rather than paddy rice.
 - 19 Down from 73 per cent and 35 per cent in 1995, respectively.
 - 20 It is difficult to evaluate political gains or losses quantitatively, or even qualitatively, without strong assumptions about the circumstances under which an embargo arises. The political power of the United States is such that its allies would probably lose if they do not cooperate. If America's power lessens, however, these losses may diminish and decisions would be more likely to be based on economic considerations.
 - 21 A description of the embargo provisions in the 1996 Farm Act can be found at <<http://www.econ.ag.gov/epubs/pdf/aib729/aib729c.pdf>>.
 - 22 A number of sensitivity tests have been conducted with respect to the elasticities of substitution. The results are available on request.

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