

China's growing food imports from the EU

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Introduction

China is turning into one of the world's largest and most lucrative food markets. As the incomes of China's 1.3 billion people and urbanisation rates continue to rise, demand for quality, health and environment conscious food products will escalate. Domestic production will eventually be unable to meet the exponential growth in demand due to rising food consumption, marked changes in the composition of diets and continued stress on China's natural resources due to water scarcity and land degradation. China had been a significant net exporter of agricultural products previously, but since 2003 the imports of agricultural products have exceeded exports. China is now a major net importer of agricultural products. The Chinese food market is considered as one of the most dynamic and promising food markets for EU agricultural exports. Given China's enormous size and catch-up potential, Zhi Wang (1997) and Colby et al. (2000) indicated that freer trade after China's WTO accession would substantially expand Chinese demand for food products. China's middle class is expected to number 150 million by 2010. This means new opportunities for EU exporters in the growing processed and high-value food market, mainly in busy urban areas because of convenience, healthier choices, variation and quality. The Chinese market for high-value consumer goods is estimated to be worth 1 trillion euros by 2010 (DG Trade 2007a).

Overall, China was a €25 billion (USD 32 billion) market for agricultural products in 2005, with the EU holding only a 3.8% share. EU's market share in China has been relatively steady over the recent years. The product composition of EU agricultural exports to China has stayed more or less the same over the period 2001-2005. China is increasingly becoming an important destination for EU agricultural exporters even though the EU is having an agricultural trade deficit with China. In 2005, EU-15 agricultural exports (including seafood) reached €956 million (USD 1,214 million), €416 million or 77% more than the 2001 level. The growth in EU exports to China has increased from an averaged 4.6% per year in the period 1990-2000 to an averaged 14.3% per year in the period 2001-2005. The EU will see its agricultural exports to China exceed €2 billion in five years, if current trade trends continue. EU's agricultural exports are likely to hit €4 billion, when China's urban middle class reaches 200 to 250 million (People's Daily 2006). Booming middle class income levels have fuelled most of the country's increased appetite for imported food products and their tastes are expanding to include more western-style foods as more people become more affluent. From

2001 to 2005, the value of wines exported from EU to China rose from €12 million to €36 million, virgin olive oil grew from €500,000 to €8.4 million, cheese exports jumped from €500,000 to €2.7 million, and exports of processed agricultural products increased from €110 million to €206 million (People's Daily 2006). More than 90% of the agricultural trade with China used to be concentrated in raw products. It is worthy of note that the share of raw materials in EU exports is declining fast, and that value added goods are showing a high growth rate as China's buying power increases. China's per capita income has grown at an average annual rate of more than 8% over the last three decades.

This paper examines China's agricultural imports in regard to income growth, import price changes, and tariff reductions due to China's trade liberalisation. Many studies have estimated the effect of trade policy on agriculture with aggregated commodities, but this paper examines the effect of trade liberalisation on specific food products: frozen pigmeat, frozen fish, whey, barley, beer, and wine. More specifically, this paper attempts to model behavioural relationships in the agricultural trade between China and the EU by considering three issues in detail. The first is the long-term relationship between the growth rate of agricultural imports and the rate of income growth in China. The second issue concerns the effects of tariff reductions on China's agricultural imports from the EU and globally. The third issue concerns EU exporters' capacity to influence their market shares. This depends on product heterogeneity, which would suggest that EU can alter China's agricultural imports from the EU through relative-price changes.

Theoretical and methodological framework of the study

Imperfect competition arising from product differentiation underlies the modelling framework of this study. The estimation of import demand systems is derived from Armington's (1969) model, where it is assumed that the same goods of different origins are imperfect substitutes within an importing country's commodity market. Furthermore, in order to reduce to number of parameters to be estimated, the model assumes a constant elasticity of substitution (CES) for each product pair. Following the model, the importing decision is split into two stages. The solution to the utility maximisation problem for the first level of decision yields the overall demand schedules for commodity imports M of importer j , given a commodity import price P and a level of constant dollar income Y , and is expressed as

$$M_j^d = k_1 Y_j \left(\frac{P_j}{D_j} \right)^{\epsilon_m^p} \quad (1)$$

where k_1 is a constant with expected sign $k_1 > 0$; D is the deflator; and ϵ_m^p is the price elasticity of import demand for goods M . The income elasticity is equal to unity, a hypothesis that will later be tested.

Once the level of expenditures Y_j for the imported commodity M has been determined, the solution to the utility maximisation problem of how much of the commodity to purchase from alternative suppliers - let us say an exporter of interest i and its competitors m , which refer each of the $n-1$ other foreign supplying countries, to market j whose corresponding export prices are P_{ij} and P_{mj} - may be expressed as

$$X_{ij}^d = k_2 M_j \left(\frac{P_{ij}}{P_j} \right)^{\epsilon_x^p} \quad (2)$$

where X_{ij}^d is the quantity of the goods exported from country i to country j , k_2 is a constant; P_{ij} is the price of the goods imported from country i to country j ; P_j is the average price of the goods imported to country j ; and ϵ_x^p is the relative-price elasticity of export demand.

The empirical analysis of the study is based on econometric models which capture the dynamics underlying trade and price formation in commodity markets, and it is conducted by means of recently developed econometric concepts. Among these, the so-called ‘general to specific approach’ advocated by Hendry (1986) is applied in the context of data series whose non-stationary properties are investigated. Furthermore, the notion of cointegration (Engle and Granger, 1987) of a set of variables is analysed. The approach follows closely the modelling strategy developed in a series of papers by Davidson *et al.* (1978), Hendry (1986), Lord (1991), Urbain (1992), and Banerjee *et al.* (1998).

Given that economic time series often exhibit non-stationary stochastic processes, the econometric specification is conducted in a framework that allows for non-stationary but

potentially cointegrated variables. The approach adopted is to convert the dynamic model into error correction formulation, and it is shown that this formulation contains information on both the short-run and long-run properties of the model, with disequilibrium as a process of adjustment to the long-run model. Equations specified in this manner allow the relevant economic theory to enter the formulation of long-run equilibrium in levels while the short-run dynamics of the equation are determined by growth rates.

Since the validity of the error correction specification requires the existence of a long-run relationship or cointegration between the variables concerned, the econometric analysis begins with the tests for the existence of a cointegrating vector. The first step in the analysis of cointegration is to determine the time series properties (*i.e.*, the order of integration) of each variable, whether they have a unit root or not. Tests for unit roots are performed using the augmented Dickey-Fuller (1981) univariate tests. Having established the order of integration of each variable, tests for cointegration are undertaken and the nature of any cointegrating vectors explored. A formal test of cointegration is carried out following the residual-based approach proposed by Engle-Granger (1987) as well as the sequential testing procedure put forward by Perron (1988).

Data

The empirical analysis of the study will be conducted with a sample of annual data that cover China's agricultural imports from the EU and the rest-of-world for selected products from 1986 to 2005. To keep the task manageable, econometric analysis is restricted to six agricultural products: frozen pigmeat, frozen fish, whey, barley, beer, and wine. These products represented on average about 23 per cent of China's total agricultural imports from the EU.

Volume and value data on trade flows over the period 1986 to 2005 are obtained from EUROSTAT (2007) and FAOSTAT (2007). Volume data is compiled in metric tons, and value data in thousands of euros. The transaction value is the value at which goods were sold by the exporter at the frontier of the exporting country [free-on-board (fob) valuation]. The unit prices of China's imports (P_C), and unit prices of exports by the EU (P_{EU}), are derived by dividing value by volume. The gross domestic product (GDP) index and the consumer

price index (CPI) are used as a measure of economic activity (Y_C) and price deflator (D_C) of China, respectively. The source of the data is the Economic Research Service of the United States Department of Agriculture (USDA 2007).

As a result of WTO accession, China bound 100% of its tariff at ad valorem rates. The average tariff for agricultural products has declined from 23.1% in 2001 to 15.3% in 2005. Among the agricultural products selected for estimation, beer is foreseen to benefit the most with tariff decreasing from 42% to 0% (Table 1). The tariff for wine (in containers of 2 litres or less) has dropped sharply from 44.6% to 14%. The tariff for dairy products such as whey (animal feed) and tariff for cereals such as barley (animal feed) are remaining the same as the bound rates during WTO accession. Meat product such as frozen pigmeat has declined from 16.8% to 12%.

Table 1. China's tariff schedule for selected agricultural products after accession to the WTO.

Product	HS Code	Bound Rate at Accession	Final Bound Rate
Frozen Pigmeat	020649	16.8	12
Frozen Fish	030379	16	10
Whey	040410	6	6
Barley	100300	3	3
Beer	220300	42	0
Wine	220421	44.6	14

Source: Schedule CLII – People's Republic of China, World Trade Organization.

The responsiveness of China's agricultural imports to income changes

The short-run and long-run responsiveness of Chinese agricultural imports to changes in incomes and absolute prices are summarised in Table 2. The estimated equations of import demand show, as expected, that income is statistically significant in explaining the level of demand for agricultural imports in China. The findings are consistent with earlier studies: Mohd. Yusoff and Salleh (1987), Honma (1991), and Lord (1991), among others, have shown that income is an important factor in determining the import demand for agricultural products.

The estimated long-run income elasticities of import demand range from clearly less than unity (0.5) for beer to 3.0 for wine. The results suggest that a 1% increase in income level would increase beer imports by only 0.5%, but wine imports would increase by 3% (6 times more than beer imports).

The large differences in income elasticities have important implications for EU exporters. Wine exports have a considerably stronger growth potential in China than other products because of a strong response from consumers in China due to improvement in their real incomes. At the same token, wine exports will also be susceptible to larger swings of demand during business cycles. The results suggest that a 1% decrease in income level would eventually decrease wine imports by 3%.

Table 2. Short-run and long-run elasticities of import demand in China for selected food products.

Commodity	Income elasticity		Price elasticity	
	Short-run	Long-run	Short-run	Long-run
Frozen Piguemeat	1.77	1.65	-0.07	-0.39
Frozen Fish	0.17	1.49	-0.09	-0.26
Whey	-	1.00	-0.04	-0.14
Barley	0.39	0.98	-0.11	-0.07
Beer	-	0.47	-0.43	-0.47
Wine	1.50	3.04	-0.30	-0.80

The adjustment of import demand from one level of income to another is determined by the error correction term. For example, the coefficients of the error correction terms in the import demand relationships are close to unity in absolute terms for barley, frozen pigmeat, whey and wine. This fact reflects the relatively quick response of Chinese importers to changes in income and prices, i.e. it does not take a great deal of time for import demand to resume its long-term equilibrium growth path when a short-run disequilibrium arises between import demand and income. In the case of beer and frozen fish, the situation is slightly different. The error correction term in the import demand relationship is clearly less than unity (-0.35 and -

0.37) in absolute terms. This fact reflects the relatively slow response of beer and frozen fish importers in China to changes in income and prices.

The responsiveness of China's agricultural imports to price changes

Examination of the price elasticities confirm the expectation that demand for Chinese agricultural imports is relatively inelastic with respect to price. Among the products listed in Table 2, five out of six products have elasticities less than 0.5 in the long-run. Barley has the lowest long-run price elasticity ($\cong -0.1$). This result suggests that on average a 1% decrease (increase) in the real price of barley would increase (decrease) imports of barley by only 0.1% in the long-run. Wine has the largest long-run import price elasticity ($\cong -0.8$). The policy implication of these low price elasticities is that exchange rate policies and commercial policy intervention measures in the form of tariff barriers to trade would not be very effective in changing the quantity of imports demanded.

The effects of a reduction in imports tariffs under China's WTO commitments are summarised in Table 3, from which a number of points can be made. The reductions in tariffs have had a price-decreasing effect on the Chinese import market. As a result, an increase in China's imports has taken place. Imports of frozen pigmeat and frozen fish have increased 14% and 83%, respectively, during the period from 2000 to 2005. However, according to our modelling results, the contribution of tariff reductions for these increased volumes of imports has been very small, 1.8% and 0.5%, respectively. Relatively low tariff cuts as well as low price elasticities of these products have resulted only very minor changes in import volumes. Most of China's increased appetite for imported pigmeat and fish has been fuelled by rapid income growth and increased trade.

In the case of beer and wine imports, tariff reductions explain part of the increase in China's import volumes. Our modelling results suggest that China has increased its wine imports by 33% due to tariff reductions, which is responsible for half of the total increase in import volume (63%) for wine from 2000 to 2005. The case is similar for beer, where tariff reductions accounts for about 18% increase in total imports; and China's total import of beer increase by 23% from 2000 to 2005.

Table 3. Percentage changes in prices and volumes imported into China due to WTO tariff reductions for selected food products.

Commodity	Import price	Import volume		Number of years for % response		
		Initial effect	Long-term effect	75%	90%	99%
Frozen Pigmeat	-4.6	0.3	1.8	1	1	4
Frozen Fish	-5.7	0.1	0.5	1	4	6
Whey	0	0	0	-	-	-
Barley	0	0	0	-	-	-
Beer	-29.6	16.3	17.8	3	5	7
Wine	-23.1	10.7	33.1	0	1	2

Since tariff reductions take several years to have a full impact on import demand, the effect would continue even after the tariff reductions have taken place. The estimations demonstrate the extent of the time lag between the initial reduction in import prices after tariff reduction and the time required for imports to adjust fully to the new price level in the Chinese market. Imports of frozen pigmeat and wine respond relatively quickly to changes in prices. In the case of wine and frozen pigmeat, 90 per cent of the adjustments occur within one year after the tariff reductions have taken place. However, imports of beer and frozen fish react slower to price changes, whereby it takes four years for frozen fish imports, and five years for beer imports to adjust to 90 per cent of the new import level (equilibrium).

China's demand for EU agricultural exports

The estimations indicate that relative price movements affect significantly China's demand for EU exports, implying that EU's market share is influenced by price competitiveness (Table 4). In other words, EU exporters confront a downward-sloping demand schedule in China. For the combined agricultural exports of the selected EU products, the trade-weighted average price elasticity for China's import demand from the EU (which is equivalent to the elasticity of substitution for market share in China) is equal to -3.5 in the long run. This

indicates that China's import demand for the selected EU agricultural products will increase by 3.5% on average if the relative prices of these products decrease by 1% on average.

Table 4. The short-run and long-run responsiveness of China's agricultural imports from the EU to changes in relative prices.

Product	Relative price elasticity of		EU's market share	
	export demand		in China (%)	
	Short-run	Long-run	1995-1997	2003-2005
Frozen Pigmeat	-	-7.97	56.5	61.6
Frozen Fish	-4.22	-3.31	10.7	23.2
Whey	-2.27	-1.33	27.2	39.8
Barley	-3.18	-2.82	18.7	17.0
Beer	-1.41	-4.66	31.9	36.8
Wine	-0.94	-2.04	73.5	49.4

Among the examined trade flows, the export of EU whey is the least sensitive to relative price change, followed by wine exports. Whey and wine exports from the EU have relative-price coefficients of -1.3 and -2.0, respectively. This indicates that China's import demand for EU whey will increase by only 1.3% if the relative price of whey decreases by 1%. In contrast, the relative-price coefficient of the EU pigmeat exports is exceptionally large, -8.0. This indicates that China's import demand for EU pigmeat will increase by 8% if the relative price of pigmeat decreases by 1%. The observed differences in relative-price coefficients by trade flow reflect the dynamic aspect of the Chinese agricultural trade, whereby trade flow rise and fall due to price competitions. Thus, price competition has the largest impact on frozen pigmeat and beer among the examined food products.

The results from the import price elasticities (Table 2) combined with the results from the relative price coefficients (Table 4) indicate that China's total agricultural imports on a product basis is insensitive to absolute price changes, but Chinese importers are sensitive to relative price changes on a product basis due to price competition among suppliers; once the expenditure for the imports of a product is determined, Chinese importers will seek for the cheaper products among the foreign suppliers. The results support the key findings of a study (DG Trade 2007b) by the European Commission that assesses market opportunities for EU

companies in China: EU companies wanting to compete on price in the Chinese market will need to produce goods in China itself in order to be cost-competitive. Successful European companies are already diversifying into China-based manufacturing because they want to compete in the domestic Chinese market and not to produce for the export market. Good examples would be China-based manufacturing for European beer and meat processing for European slaughterhouses.

Conclusions

This paper examined China's agricultural imports in regard to income growth, import price changes, and tariff reductions due to China's trade liberalisation. More specifically, it attempted to model behavioural relationships in the agricultural trade between China and the EU by using annual trade data from 1986 to 2005. Econometric models were constructed for six agricultural products exported from the EU to China – frozen pigmeat, frozen fish, whey, barley, beer, and wine.

In dealing with China's demand for agricultural imports, products are distinguished by their place of production and are not considered perfect substitutes for each other (product differentiation). This leads to a presumption that importers differentiate between commodities by place of production. Imperfect competition arising from product differentiation underlies the theoretical framework of this paper. Price of the product is an obvious and often the most important factor affecting an importer's purchasing decisions. Nevertheless, the importer does not necessarily purchase all of its agricultural products from the least expensive supplier. There are other factors affecting the trade flows of agricultural products such as qualitative characteristics - brand image (for luxury goods), brand names and cultural background (marketing), quality, delivery time, reliability of supplies, packaging - and established relationships (e.g. cultural, historical or political ties between trading partners).

The results indicated that China's agricultural imports on a product basis are insensitive to absolute price changes. Therefore, the examination of the price elasticities confirmed the expectation that demand for Chinese agricultural imports is relatively inelastic to absolute price changes. However, Chinese importers are sensitive to relative price changes on a product basis due to price competition among suppliers. Chinese importers will seek for the

cheaper products among the foreign suppliers. The estimations indicated that relative price changes affect significantly China's import demand from the EU, implying that the exporter's market share in China is influenced by price competition. China's import demand analysis suggested that income growth effects play a dominant role in determining China's import demand for agricultural products, both in the short and long term. Rapid income growth has fuelled most of China's increased appetite for imported agricultural products. Strong economic growth is the major force behind the increasing buying power of the Chinese consumers.

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