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EU-China Agricultural Trade in Relation to China's WTO Membership

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Abstract

China's trade with the world doubled after joining the WTO. This study attempts to identify and measure quantitatively the effects of changing economic environment and trade policies on China's global agricultural imports as well as imports from the EU. The approach is to model behavioral relationships in the agricultural trade between China and the EU by using annual trade data from 1986 to 2005. The results indicate that Chinese agricultural imports are relatively inelastic to absolute price changes, but relative price changes significantly affect the market shares of EU exports due to price competition. Trade liberalization in the form of tariff reductions is trivial in changing the quantity of China's agricultural imports from the EU. Rapid income growth has fuelled most of China's increased appetite for imported agricultural products.

Keywords: China, EU, WTO, agricultural imports, income, tariff, price, model

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Introduction

The economic emergence of the world's most populous nation is having a mesmerizing effect on exporters from the western world. China is on course to overtake Germany as the third largest economy in the world, just behind the United States (US) and Japan. 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 urbanization 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's economic performance has been remarkable since the process of economic liberalization began in 1979. China's gross domestic product (GDP) has increased more than ten fold with an average growth rate of over 9% a year in real terms. China has made a major effort to open up to world trade over the past decades by gradually reducing tariffs and non-tariff barriers, reforming its currency and developing its trade and legal system. China's integration into the globalizing economy accelerated after its entry into the World Trade Organization (WTO) in December 2001. According to studies done by the World Bank (Ianchovichina et al. 2003) and Carnegie Endowment (He Jianwu et al. 2007), WTO accession has generally benefited China's economy. World's trade with China has doubled from 2001 to 2005 with China's foreign trade rising above one trillion euros, making China the world's third-largest trading nation after the United States and Germany.

Previously, China had been a significant net exporter of agricultural products, 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. Schmidhuber (2001) argued that sharp tariff reductions will make EU exports competitive in China's market not only on quality basis but also in price, thus stimulating consumer demand for imported goods. 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).

This paper examines China's agricultural imports in regard to income growth, import price changes, and tariff reductions due to China's trade liberalization. Many studies¹ have estimated the effect of trade policy on agriculture with aggregated commodities, but this paper examines the effect of trade liberalization on specific food products: frozen pigmeat, frozen fish, whey, barley, beer, and wine. More specifically, this paper attempts to model behavioral 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.

The paper is divided into three main parts. First, the general trends and patterns of the agricultural trade between China and the EU countries are examined. Then, demand functions for China's agricultural imports from the EU and globally are estimated by applying a theory-based, dynamic econometric modelling framework and using a sample of annual data that cover EU exports to China from 1986 to 2005 for selected agricultural products. Finally, the estimated functions are used to examine the impacts of China's income growth and tariff reductions on China's agricultural imports from the world and the EU.

Agricultural trade relations between China and the EU

The EU and China are two of the biggest markets in the world, and both are actively trading with each other. In 2006, China remained the EU's second largest trading partner right behind the US, whereas the EU continued in its role as China's first trading partner ahead of both the US and Japan. The EU enjoyed a trade surplus with China at the beginning of the 1980s, but now the EU is experiencing a sizeable widening deficit with China from €51 billion in 2001 to €128 billion in 2006, representing EU's largest bilateral trade deficit (DG Trade 2006).

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 EU holds a commanding market share in China's alcoholic beverage imports and a substantial market share in dairy and meat products imports as well. The product composition of EU agricultural exports to China has stayed more or less the same over the period 2001-2005. The leading exported products groups are shown in Figure 1, and together these products accounted for more than 70% of EU agricultural exports to China.

¹ See for example Anderson and Martin (2006), Bouët et al. (2005), Francois et al. (2005).

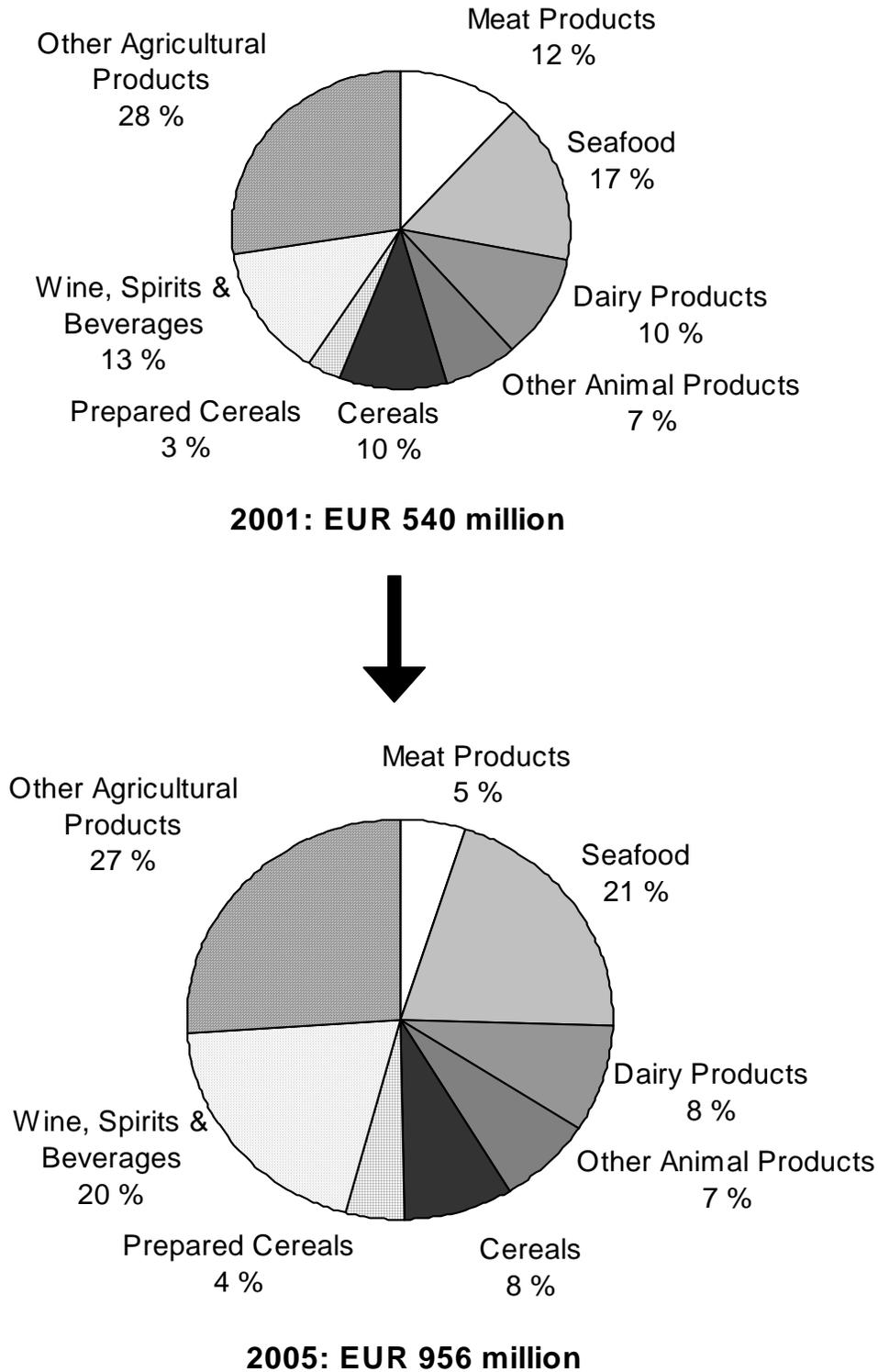


Figure 1: The products groups in percentage share of total EU agricultural exports to China in 2001 and 2005 (Eurostat Comext 2007).

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 €56 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 (see per capita income growth in Figure 2).

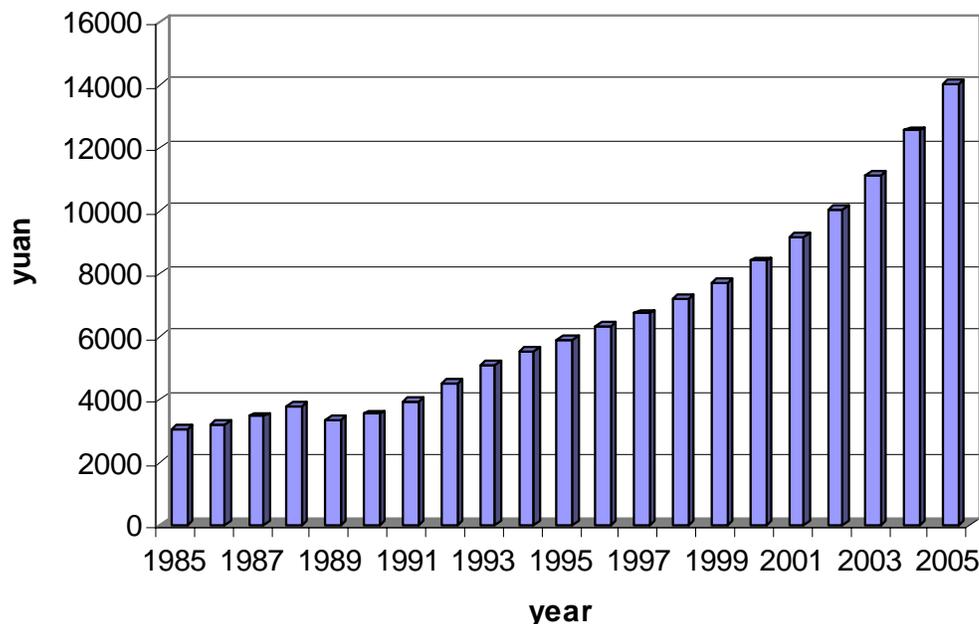


Figure 2: China's deflated per capita income growth from 1985 to 2005 (USDA 2007).

Growing incomes and the onset of a large middle class along with greater urbanization and westernization, particularly in China's coastal regions, has significantly increased the demand for alcoholic beverages such as wine and spirits. Though China produces a significant amount of wine, domestic brands are not often thought of as products of high quality. Opportunities for European wines therefore lie in well-priced and also high-quality varieties. French and Italian wine are the most highly recognized mainly due to marketing advantages as French wine has been heavily promoted for more than a decade. Spirits make up a large share of total alcoholic beverage consumption in China. Foreign spirits such as whisky and cognac are becoming popular among the affluent middle class. As currently there are no domestic companies that are producing such spirits at a quality and taste level equal to foreign products - and as the EU is the leading producer and exporter of spirit drinks worldwide - export potential for EU spirit industry to China is quite high (Fischer et al. 2007).

EU's marketing advantage in China has been supported with the help of production aid and export subsidies. France is the largest agricultural exporter to the Chinese market out of the EU-15 member states. In 2005, France holds a 31% share of the total EU-15 agricultural exports to China, followed by the Netherlands (20%), United Kingdom (11%), Denmark (10%) and Spain (8%). Foreign competitors confronting EU exporters in the Chinese food market are intensifying. Products that compete with EU food products originate from the US, Argentina, Brazil, Australia, Malaysia, Indonesia, Thailand, New Zealand, Canada, and Chile.

Despite success in penetrating to the Chinese market in some specific product markets such as alcoholic beverages, cereals, dairy and meat products over the recent years, EU exporters are facing an escalating number of unjustifiable non-tariff barriers in the form of product certification, labeling standards, import approval requirements, and customs clearance delays. The application of laws is often not uniform or transparent and regional variations in customs procedures have impeded trade. Unreasonable sanitary and health requirements can create barriers that hinder EU agricultural exports to China. Chinese national standards for food products often differ from international standards. These differences will create high compliance costs and extended delays for business transactions that affect particularly EU's small and medium sized enterprises ability to operate in the Chinese market. China's time consuming and cumbersome licensing and registration procedures have especially delayed the entry of new products into the Chinese market.

Regardless of the existing non-tariff barriers, China has progressively lowered its Most Favoured Nation (MFN) tariff and lessened the amount of non-tariff barriers to trade. Tariff remains one of China's main trade policy instruments and a significant source of tax revenue, accounting for some 4.3% of total taxes collected. 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. There are considerable variations within the different groups of products, with average rates for grains (34%), tobacco (25.4%), coffee and tea, cocoa and sugar etc. (20.2%) and beverages and spirits (20.3%) considerably higher than the overall average for agricultural products (15.3%). The final bound rate in 2010 for agricultural products is expected to fall to 15.2% (WTO 2006). According to the WTO, China's average applied tariff rates have closely followed its bound rates (MFN tariff) since it joined the WTO.

China's overall tariff is subject to negative escalation between unprocessed and semi-processed products and escalation between semi-processed and fully processed products. This would suggest that imports of semi-processed products would face lower tariff barriers than raw materials and fully processed goods. In 2005, negative escalation is especially pronounced between semi-processed and processed products in food, beverages and tobacco (WTO 2006).

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%. The Carnegie Endowment predicted that reduced tariffs on agricultural products and the introduction of the tariff quota system will reduce the share of agriculture in China's exports and increase imports of agricultural goods into China with the full phasing in of China's WTO commitments by 2006 (He Jianwu et al. 2007).

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.

Theoretical and methodological framework of the study

Imperfect competition arising from product differentiation underlies the theoretical framework of the study. Several factors are assumed to affect an importer's

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

The estimation of the demand structures is therefore derived from the 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. In the model, the importing decision is split into two stages. At the first stage, the importer decides how much of the imported product to consume against all other goods. At the second stage, once the level of expenditures for the imported product is determined, the importer decides how much of the commodity to purchase from alternative suppliers by solving the utility maximisation problem.

Now that the assumptions are in place, it is straightforward to derive the importer's overall demand equation, representing a country's j imports (M) as a function of economic activity (Y) and real price of the good imported (P/D),

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

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 good 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 product M has been determined, the solution to the utility maximisation problem of how much of the product to purchase from alternative suppliers - let say an exporter of interest i and its competitors k , which refer each of the $n-1$ other foreign supplying countries, to market j whose corresponding export prices are P_{ij} and P_{kj} - 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 product exported from country i to country j , k_2 is a constant; P_{ij} is the price of the good imported from country i to country j ; P_j is the average price of the product imported to country j ; and ϵ_j^d is the relative-price elasticity of export demand. Product differentiation in equation (2) is reflected in the ability of exporters to influence the demand for their exports through relative-price changes.

International trade of agricultural products does not usually occur without obstacles, however. Agricultural trade policies such as import tariffs, trade quotas and price controls are typical commodity-specific policies driving a wedge between domestic and border prices. The imposition of a tariff into the import demand equation (1) raises the price of the product to $(1+t)P$ in the geographic market j . The resulting import demand schedule is

$$M_j^d = k_1 Y_j \left(\frac{(1+t)P_j}{D_j} \right)^{\epsilon_j^d} \quad (3)$$

The methodological challenge of the study is to combine the theoretical framework with applied econometrics in order to provide a good representation of China's import demand for agricultural products. Econometric models are efficient and convenient way to summarise the trade theory relevant to the study for empirical measurement and testing. Yet there is considerable distance between theoretical specification and empirical implementation in practical econometric models. For instance, the theory may provide little evidence on the process of adjustment, and which variables are exogenous and which are irrelevant or constant for the particular model under investigation. Numerous adjustments must be made in order to build models that fit real world situation and correspond at least approximately to the underlying theory.

Empirical analysis of the study is based on econometric models with recently developed econometric concepts that capture the dynamics underlying China's import demand for agricultural products. Long-run elasticities of Chinese import demand for agricultural products are of particular interest. However, estimating such long-run relationships is challenging because the variables - such as income, the price level, trade flows, and exchange rates - used in the analysis typically exhibit multicollinearity and non-stationarity.² Econometric modelling of import demand should be based on methods, which explicitly take these features of the

² If this is the case, the conventional hypotheses-testing procedures based either on small sample or asymptotic distributions of the estimates (based on t, F, chi-square tests, and the like) may be in suspect. The problems are often dealt with by taking first differences of all the variables before any estimation are done. Nonetheless, taking first differences is a major drawback because the long-run variation of the data is removed, and only short-run effects are explained by the model (Bentzen and Engsted 1992).

data into account, namely co-integration techniques and error-correction model (ECM).

Co-integration among a set of variables may imply that fundamental economic forces make the variables move stochastically together over time (Urbain 1992). Although the variables may drift away from equilibrium for a while, the ECM then corrects for any short-term disequilibrium between variables that are co-integrated in the long-term. There are two main advantages in using the co-integration techniques and ECM. First, it is possible to clearly distinguish between short-run and long-run effects. Second, the speed of adjustment toward the long-run equilibrium can be directly estimated. 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 Carone (1996).

Modelling demand functions for the imported products

In the first stage, the importer decides how much of the imported product to consume compared to all other goods. The decision is based on importer's income and price of the good. Recall equation (1), representing a country's j imports (M) as a function of economic activity (Y) and real price of the good imported (PD).

Here we show how the theoretical structures are implemented in dynamic econometric models. The first-order stochastic difference equation as a logarithmic function of the theoretical relationship in (1) is expressed as

$$\ln M_{jt} = \alpha_0 + \alpha_1 \ln Y_{jt} + \alpha_2 \ln Y_{j,t-1} + \alpha_3 \ln(P_j / D_j)_t + \alpha_4 \ln(P_j / D_j)_{t-1} + \alpha_5 \ln M_{j,t-1} + v_{1t} \quad (4)$$

where the expected signs are $\alpha_1, \alpha_2 > 0$; $\alpha_3, \alpha_4 < 0$; and $0 < \alpha_5 < 1$.

Next we convert equation (4) into ECM formulation, containing information on both the short-run and long-run properties of the model. Equation specified in this manner allows the relevant economic theory to enter the formulation of long-run equilibrium, while the data determines the short-run dynamics of the equation.

The demand for imports in Chinese market ($\ln M_C^d$) has a steady-state response to the domestic economic activity ($\ln Y_C$), and a transient response to the real price of imports (PD). Transformation of the equation (4) to incorporate an ECM driven by economic activity, and with a 'differences' formulation of the real price term - nested in the levels form of the equation - results in the following demand functions for the imported products:

$$\Delta \ln M_{jt} = \alpha_0 + \alpha_1 \Delta \ln Y_{jt} + \delta_2 \ln Y_{j,t-1} + \alpha_3 \Delta \ln \left(\frac{P_j}{D_j} \right)_t + \delta_4 \left(\frac{P_j}{D_j} \right)_{t-1} + \delta_5 \ln \left(\frac{M_j}{Y_j} \right)_{t-1} + v_{1t} \quad (5)$$

where $\delta_2 = (\alpha_1 + \alpha_2 + \alpha_5 - 1)$, $\delta_4 = (\alpha_3 + \alpha_4)$, and $\delta_5 = (\alpha_5 - 1)$. The expected signs of the coefficients are $\alpha_1 > 0$, $\delta_2 > \delta_5$, $-1 < \delta_5 < 0$, and $\alpha_3, \delta_4 < 0$. The fifth term of the equation, $\delta_5 \ln (M_j/Y_j)_{t-1}$, is the mechanism for adjusting any disequilibrium in the previous period. In other words, it measures ‘errors’ (divergences) from the long-run equilibrium and corrects for previous non-proportional responses in the long-run dynamic growth of the demand functions for the imported products.

The long-run dynamic solution of a single-equation system generates a steady-state response in which growth occurs at a constant rate, say g , and all transient responses have disappeared (Currie 1981, Lord 1992). With growth rates of domestic economic activity and the demand for the imported products, $\Delta \ln Y_{jt} = g_1$ and $\Delta \ln M_{jt} = g_2$, respectively, the long-run dynamic equilibrium solution of equation (5), in terms of the original (anti-logarithmic) values of the variable, is

$$M_j = k_1 Y_j^{1 - (\delta_2 / \delta_5)} \left(P_j / D_j \right)^{-\delta_4 / \delta_5} \quad (6)$$

where $k_1 = \exp \{ [-\alpha_0 + (1 - \alpha_1)g_1] / \delta_5 \}$. Equation (6) encompasses the static equilibrium solution when $g_1 = 0$. The income elasticity of import demand is expressed as $\epsilon_m^y = 1 - (\delta_2 / \delta_5)$. The price elasticity of import demand is $\epsilon_m^p = -\delta_4 / \delta_5$.

In summary, the first stage equation examines two key features: (1) the total response of China’s imports to income and real price changes, (2) the length of time required for the mentioned total response to occur.

Modelling demand functions for the exported products from alternative suppliers

In the second stage, the importer decides how much of the product to purchase from alternative suppliers. The decision is based on total expenditure of the product and relative prices between the suppliers. Assuming that the importer view products from different suppliers as being distinct to some degree, each exporting country should possess some market power for manipulation. In other words, the product of each supplier is imperfectly substitutable for those produced by other suppliers in the market. This assumption will be tested.

Recall equation (2), which links country’s j imports from a country i to country’s j total imports and to the relative price of that imports. In terms of the general stochastic difference specification, the export demand relationship in (2) is expressed as

$$\ln X_{ijt}^d = \beta_0 + \beta_1 \ln M_{jt} + \beta_2 \ln M_{j,t-1} + \beta_3 \ln(P_{ij} / P_j)_t + \beta_4 \ln(P_{ij} / P_j)_{t-1} + \beta_5 \ln X_{ijt-1}^d + v_{2t} \quad (7)$$

where the expected signs of the coefficients are $\beta_1, \beta_2 > 0$; $\beta_3, \beta_4 < 0$; and $0 < \beta_5 < 1$.

The results of the co-integrating regressions suggest that China's demand for exports from the EU ($\ln X_{EU}^d$) has a steady-state response to China's total imports of the product ($\ln M_C^d$). Meanwhile, China's demand for exports from the EU has a transient response to the relative price changes of EU exports ($\ln P_{EU} / \ln P_C$). The following transformation of (7) incorporates an ECM driven by China's total imports M_j :

$$\Delta \ln X_{ijt}^d = \beta_0 + \beta_1 \Delta \ln M_{jt} + \gamma_2 \Delta \ln(P_{ij} / P_j)_t + \gamma_3 \ln(P_{ij} / P_j)_{t-1} + \gamma_4 \ln(X_{ij}^d / M_j)_{t-1} + v_{2t} \quad (8)$$

where $\gamma_2 = \beta_3$, $\gamma_3 = (\beta_3 + \beta_4)$, and $\gamma_4 = (\beta_5 - 1)$. The expected signs of the coefficients are $\beta_1, \gamma_2 > 0$, $\gamma_3 < 0$, and $-1 < \gamma_4 < 0$.

The disequilibrium adjustment mechanism in the fourth term, $\gamma_4 \ln(X_{ij}^d / M_j)_{t-1}$, corrects non-proportional responses in the long-run dynamic growth of the demand for EU's exports. If EU's market share were to fall below its long-run equilibrium level, the negative coefficient in the disequilibrium adjustment term would induce an increase in the demand for EU's exports. Conversely, if EU's market share were to increase above its long-run equilibrium level, that coefficient would generate downward pressure on EU's exports until the growth rate returned to its steady-state path.

With the growth rates of China's total imports and the demand for EU's exports, $\Delta \ln M_{jt} = g_2$, $\Delta \ln X = g_3$, respectively, the long-run dynamic equilibrium solution of equation (8), in terms of the original (anti-logarithmic) values of the variable, is

$$X_{ij}^d = k_2 M (P_{ij} / P_j)^{-\gamma_3 / \gamma_4} \quad (9)$$

where $k_2 = \exp \{[-\beta_0 + (1-\beta_1)g_2] / \gamma_4\}$. Therefore, China's demand for EU's exports is assumed to have a unitary elasticity with respect to China's total imports. The price elasticity of China's demand for EU's exports is expressed as $\epsilon_x^p = -\gamma_3 / \gamma_4$.

In summary, the second stage equation examines whether the exporter's market share of a certain product is influenced by the total level of China's imports of the product, and whether the market share of the exporter is affected by relative price changes of the product.

Data

The success of any econometric analysis ultimately depends on the availability of appropriate data. This section discusses the nature and sources of the 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).

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 summarized 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%.

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.

Table 2: Short-run and long-run elasticities of import demand in China for selected food products³.

Commodity	Income elasticity		Price elasticity	
	Short-run	Long-run	Short-run	Long-run
Frozen Pigmeat	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 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.

³ Tests for model validity yield satisfactory results. The Jarque-Bera test indicates that the data used in the equations do not violate the normality assumption. According to the Ljung and Box (LB) test, it is not possible to reject the assumption of serial independence for the residuals. The Breusch-Pagan-Godfrey (BPG) test shows that heteroskedasticity does not pose a problem at the 5% significance level in 4 out of 6 equations. Based on the RESET test it is not possible to reject the model specifications in 5 out of 6 equations.

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, 90 per cent of the adjustments occur within one year after the tariff reductions have taken place. The case is similar for pigmeat, where it takes only one year to adjust to 90 per cent of the new import level (equilibrium). However, imports of beer and frozen fish react slower to price changes, a characteristic that is reflected in the lower coefficient level of the error-correcting term (clearly less than unity). More specifically, 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). Hence, the impact of tariff reductions is faster on food products such as wine and frozen pigmeat, and the exporters should react quickly to the increase in demand for these products.

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 prices⁴.

Product	Relative price elasticity of export demand		EU's market share 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 changes, 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

⁴ Tests for model validity yield satisfactory results. The Ljung and Box (LB) statistic does not reject the hypothesis of no autocorrelation in the residuals. According to the Breusch-Pagan-Godfrey (BPG) test, heteroskedasticity does not pose a problem at the 5% significance level. Based on the RESET test, it is not possible to reject the assumption of correct functional form in 5 out of 6 equations. In some cases, the Jarque-Bera test, however, provides evidence against normality of the residuals because of extra kurtosis and a few outliers.

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.

China's import demand from the EU generally takes several years to adjust to the relative-price change. China's imports of barley and frozen fish reflect quite quickly to changes in relative-prices. It takes only two years for China's barley imports from the EU to adjust to 90 per cent of the new import level (equilibrium). However, China's imports of beer and whey adjust slowly to the relative-price change, which is reflected in the near-zero coefficient of the error-correcting term. For example, it takes five years for China's beer imports from the EU and it takes four years for China's whey imports from the EU to adjust to 90 per cent of the new import level (equilibrium). Consequently, the impact of price competition is slower on food products such as beer and whey, and the exporters have more time to react to the increase in demand for these 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 behavioral relationships in the agricultural trade between China and the EU by using annual trade data from 1986 to 2005. A relatively unrestricted, data determined, econometric modelling approach based on the error correction mechanism was used, in order to emphasize the importance of trade functions' dynamics. Econometric models were constructed for six agricultural products exported from the EU to China – frozen pigmeat, frozen fish, whey, barley, beer, and wine. Prior to the estimations, several econometric issues relating to

specification, pre-estimation testing and dynamic specification tests were implemented.

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. Among the examined trade flows, China's imports of EU whey are found to be the least sensitive to relative price changes, followed by China's imports of wine from the EU. In contrast, China's imports of EU pigmeat and beer are shown to be very sensitive to relative price changes. 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. The results support findings that 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 where they want to compete in the domestic Chinese market and not to produce for the export market. Since the early 1990s, China has allowed foreign investors to manufacture and sell a wide range of goods on the domestic market. Now, the preferred form of foreign direct investment in China is the establishment of wholly foreign-owned enterprises. Foreign-invested enterprises produce about half of China's exports, and the flow of foreign direct investment into China increased from about USD 2 billion in 1986 to USD 72 billion in 2005. At the moment, China is the world's largest host country for foreign direct investment.

Opening to the outside remains central to China's economic development. China's WTO accession and deeper integration into the world economy present a range of opportunities and challenges for EU exporters. China's accession to the WTO meant

100% binding of China's tariffs and China's commitment to reduce agricultural tariffs. It was expected that this would eventually increase EU agricultural exports to the Chinese market. As tariff and non-tariff barriers are being reduced, the costs of China importing from the EU would be less. The results suggested that China's tariff reductions have been quite significant in changing the quantity of wine and beer exports from the EU to China. However, tariff reductions do not have an important role in changing the quantity of EU exports to China for the rest of the examined products. 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. Continued growth in China's economy and huge domestic markets will fuel further export growth and opportunities for the world.

References

- Anderson, K. and Martin, W. (2006). *Agricultural Trade Reform and Doha Development Agenda*. Palgrave MacMillan, co-published by World Bank. Available at <http://publications.worldbank.org/e-commerce/catalog>.
- Armington, P. (1969). A theory of demand for products distinguished by place of production, *International Monetary Fund Staff Papers* 16:159-178.
- Bentzen, J. and Engsted, T. (1992). Short and Long Run Elasticities in Energy Demand. Working Paper 18, *Institute of Economics, Århus School of Business*. 20 p.
- Bouët, A., Bureau, J.-C., Decreux, Y. and Jean, S. (2005). Multilateral Agricultural Trade Liberalization: The Contrasting Fortunes of Developing Countries in the Doha Round, *The World Economy*, 28-9: 1329-1354.
- Carone, G. (1996). Modelling the U.S. Demand for Imports Through Cointegration and Error Correction. *Journal of Policy Modelling* 18:1-48.
- Colby, H, Price, J. and Tuan, F. (2000). China's WTO Accession Would Boost U.S. Ag Exports and Farm Income," *Agricultural Outlook*, Economic Research Service/USDA, AGO-269, March 2000.
- Currie, D. (1981). Some Long-Run Features of Dynamic Time Series Models. *Economic Journal* 91: 704-715.

- Davidson, J.E.H., Hendry, D.F., Srba, F., and Yeo, S. (1978). Econometric Modelling of the Aggregate Time-Series Relationship Between Consumers' Expenditure and Income in the United Kingdom. *Economic Journal* 88: 661-692.
- Dickey, D. and Fuller, W. (1981). Likelihood Ratio Tests for Autoregressive Time Series with a Unit Root. *Econometrica* 49: 1057-1072.
- DG Trade (2007a). New China study sees huge opportunities for EU exporters of green technology, high value goods and business services, 19 February 2007. Press Release, Directorate General for Trade, European Commission, Brussels.
- DG Trade (2007b). Study on the Future Opportunities and Challenges in EU-China Trade and Investment Relations 2006-2010, 15 February 2007. China, Conferences and Studies, Directorate General for Trade, European Commission, Brussels.
- DG Trade (2006). China, EU Bilateral Trade And Trade With The World, 15 September 2006, Directorate General for Trade, European Commission, Brussels.
- Engle, R. and Granger, C. (1987). Co-integration and error correction: representation, estimation and testing. *Econometrica* 55: 251-276.
- EUROSTAT Comext (2007). Eurostat Statistics and Intra-Extra-EU Trade Statistics, Statistical Office of the European Communities, Luxembourg.
- FAOSTAT (2007). The detailed trade data of FAOSTAT, Food and Agricultural Organization of the United Nations (FAO). Updated date: June 30, 2007. Available at <http://www.fao.org/site/406/default.aspx>.
- Fischer, C., Schiefer, J. and Schornberg, S. (2007). Study 6: Agriculture, Study on the Future Opportunities and Challenges in EU-China Trade and Investment Relations 2006-2010, Conferences and Studies, 15 February 2007, Directorate General for Trade, European Commission, Brussels.
- Francois, J., Van Meijl, H. and Van Tongeren, F. (2005). Trade liberalization in the Doha Development Round, *Economic Policy*, 20-42: 349-391.
- He Jianwu, Li Shantong, Polaski, S. (2007). China's Economic Prospects 2006–2020, Carnegie Paper No. 83, April 2007, Trade, Equity, and Development Program, Carnegie Endowment for International Peace, Washington, DC.

- Hendry, D.F. (1986). Econometric Modelling with Cointegrated Variables: A Overview of An Overview. *Oxford Bulletin of Economics and Statistics* 48: 201-212.
- Honma, M. (1991). Growth in Japan's Horticultural Trade with Developing Countries: An Economic Analysis of the Market. International Food Policy Research Institute (IFPRI), Research Reports 89. Washington DC: IFPRI. 87 p.
- Ianchovichina, E., Suthiwart-Narueput, S. and Min Zhao (2003). Regional Impact of China's WTO Accession. In Krumm, K. and Kharas, H. (eds), *East Asia Integrates: A Trade Policy Agenda for Shared Growth*. Washington, D.C.: The World Bank, 57-78.
- Lord, M. (1991). Imperfect Competition and International Commodity Trade: Theory, Dynamics and Policy Modelling. Oxford University Press, New York. 403 p.
- Mohd. Yusoff & Salleh, M. B. (1987). The Elasticities of Supply and Demand for Malaysian Primary Commodity Exports. *Malaysian Journal of Agricultural Economics* 4: 59-72.
- Phillips, P. and Ouliaris, S. (1990). Asymptotic Properties of Residual Based Tests for Cointegration. *Econometrica* 58: 165-193.
- People's Daily (2006). EU agriculture exports to China to exceed 2 billion euros in five years. July 06, 2006, People's Daily Online. Available at http://english.people.com.cn/200607/05/eng20060705_280369.html
- Schmidhuber J. (2001). Changes in China's agricultural trade policy regime: Impacts on agricultural production, consumption, prices, and trade. *China's Agriculture in the International Trading System*, OECD, 2001. pp: 21-49.
- USDA (2007). China Agricultural and Economic Data: National Data, Economic Research Service, United States Department of Agriculture. Updated date: March 12, 2007. Available at <http://www.ers.usda.gov/Data/China/NationalForm.aspx>.
- Urbain, J-P. (1992). Error Correction Models for Aggregate Imports: the case of two small and open economies. In: Dagenais, M. & Muet, P-A. (eds.). *International Trade Modelling*. Chapman Hall Ltd., London. pp. 237-278.
- WTO (2006). People's Republic of China, Trade Policy Review Report by the Secretariat, Trade Policy Review Body, World Trade Organization, 28 February 2006. Available at www.wto.org, document WT/TPR/S/161.

Zhi Wang (1997). The Impact of China and Taiwan Joining the World Trade Organization on U.S. and World Agricultural. Economic Research Service/USDA, Technical Bulletin No. 1858. Washington DC.