Global Food Consumption and Impacts on Trade Patterns

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Abstract: Driven primarily by per capita income growth, the composition of world agricultural trade has substantially changed in the past two decades. For developing countries, consumption and trade are shifting from basic staples towards higher value livestock products. In high-income countries, demand for foreign brands are expanding intra-industry trade in processed consumer-ready products.

Introduction

Changes in food consumption in one region have implications for production and trade in other countries. In each country, trade acts to balance the difference between production and consumption while at the same time trade links countries in a global economy. With growing interdependency, shifts in consumption can have major impacts on food markets throughout the world. In the last two decades the composition of world agricultural trade has undergone a dramatic shift. Today, grain trade no longer serves as a proxy for agricultural trade as it once did. Bulk commodities (grains, oilseeds, cotton, and tobacco) have become less important in the world trade, representing less than 30 percent of world agricultural trade. Shifts in global food consumption have affected U.S. agricultural trade, which traditionally was comprised largely of bulk commodities. Countries exporting a higher content of non-bulk commodities have generally increased their share in the world market, as bulk commodities become less important in total trade.

What are the major determinants of changes in the structure of global food trade? This question was addressed by Coyle, Gehlhar, Hertel, and Wang (1998) by analyzing historical patterns of world agricultural trade from 1980 to 1995. In that study, different economic factors were identified and used to explain shifts in trade patterns. These included income growth and food expenditures, factors of production, transport costs, and trade policy changes. Of these determinants, income growth and its impact on food consumption was most important in explaining changes in trade patterns over this period. The study employed a global model with a demand system capable of capturing the effect of income on changes in food expenditures over a wide range of income levels. Since the study focused on the composition of world agricultural trade in aggregate, a natural follow-on contained in this chapter is an examination of structural shifts in specific regions. Of interest are differences between developed and developing countries and how they affect the changing structure of global agricultural trade.

It is commonly thought that dietary upgrading, stemming from income growth in developing countries, has contributed to changes in global trade patterns. The linkage between changes in food consumption patterns and changes in world agricultural trade is a complex story involving more than income growth and dietary change. To begin with, a background section on historical trade patterns is provided. This is followed by a discussion of the major determinants of structural change. A final section provides results from a formal modeling exercise focusing on income growth and its effect on consumption and trade.

Background

The composition of world agricultural trade can be described in terms of changes in its major component parts. Total agricultural trade consists of food and non-

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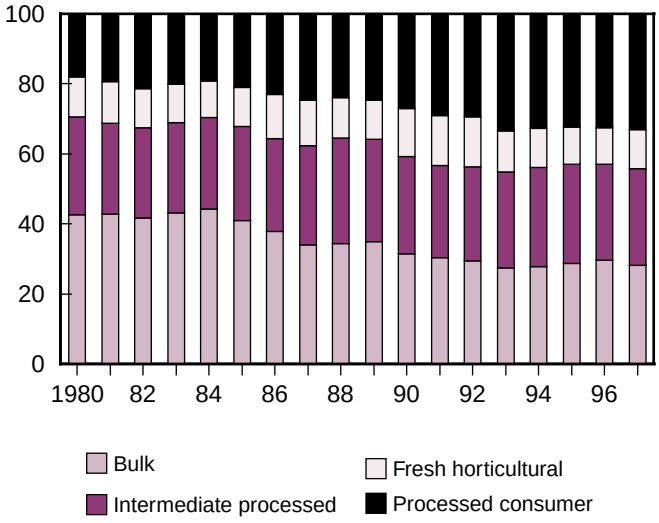
food commodities in both raw and processed forms. A useful classification of agricultural trade is a breakdown of agricultural trade into four components: bulk commodities, processed intermediate products, fresh horticultural products, and processed consumer goods.[2] From 1980 to 1997 the share of bulk has steadily dropped (fig. A-1) while the shares of non-bulk categories have remained steady or increased. Bulk commodities are no longer a valid indicator for measuring world agricultural trade growth. The share of intermediate processed commodities in total agricultural trade has not decreased as bulk commodities have. Slower trade growth for bulk does not by itself mean global demand for bulk commodities has slowed. Import demand for bulk commodities is partly satisfied with growth in intermediate processed products, which are essentially processed bulk commodities. Oilseeds processed into vegetable oil and meal can be subsequently traded, reducing demand for imported oilseeds. Grains fed to livestock ultimately produce a variety of meat and animal products sold in foreign markets, thereby curbing foreign import demand for grains.

Fresh horticultural trade, consisting of products consumed without further processing, has kept pace with total agricultural trade, leaving its share nearly constant over this time period. Improvements in shipping technology have played a role in expanding trade of fresh produce. The fastest growing category has been processed consumer goods. Factors driving trade growth in this product category are more complex than for other categories.

Only a few commodities account for a large share of total agricultural trade. Among major commodities there are dramatic differences in the rates of growth in trade (shown in table A-1 and ordered by growth rates). One recent phenomenon involves certain products entering international trade which previously were thought of as "non-tradeable." This takes place as consumer preferences for foreign goods evolve and shipping technology improves. Pet food is an example,

Figure A-1
Composition of world agricultural trade
Share of total



Source: U.N. COMTRADE, ERS, classification.

and is now one of the fastest growing products in world trade, reaching $3.5 billion in global trade in 1998.[3] Over the past 15 years many of the faster growing categories in trade are non-bulk packaged products, where consumers differentiate products carrying unique brands and labels. Pastry, prepared foods, and chocolates have grown in world trade by nearly 10 percent per year over the past 15 years. These alone account for more than $15 billion in world trade, a value exceeding the value of world wheat trade. Wine, a highly differentiated product, has grown at a rate of 6 percent a year and is now $7.4 billion and likely will surpass trade in corn in value of trade.[4]

Growth in many of the processed intermediate products such as soybean oil, flour, and soybean meal has also exceeded growth rates for total agricultural trade (3.5 percent per annum). Import demand for these commodities originates (or is derived) from consumer's demand for finished processed food and livestock products. Trade in intermediate processed products depends on exporters having a comparative advantage over importers in performing milling/crushing activity required for bulk commodities. Exporting countries

[2] Bulk commodities consist of raw grains, oilseeds, tobacco, and cotton. Intermediate processed commodities consist of semi-processed goods such as flours, meals, and oils. Fresh horticultural products consist of unprocessed fruits and vegetables such as bananas and tomatoes, and nursery products including cut flowers. Consumer-processed products include processed products at or near where a substantial degree of processing has taken place. Items in this category include beverages, bakery products, ready to eat cereals and snack food, fresh and frozen meat, and preserved fruit and vegetables.

[3] Pet food remained a non-traded product for the United States until 1983. U.S export sales doubled between 1993 and 1998, reaching $830 million in 1998.

[4] World trade used here excludes trade between the 15-member European Union.

Table A-1—Major commodities in world agricultural trade

	1980	1998	Annual growth
	Billions $U.S.		*Percentage*
Pet food	0.01	2.0	23.3
Pastry	0.5	3.0	10.6
Chocolate products	0.6	3.2	10.1
Food prepared	1.7	9.2	9.5
Grapes	0.4	1.9	8.8
Cigarettes	1.8	7.9	8.7
Oil of palm	1.8	6.2	7.5
Wine	2.4	7.4	6.0
Beef and veal	2.7	7.3	5.7
Bananas	2.1	5.2	5.5
Cheese and curd	1.5	3.6	4.9
Oil of soya beans	1.8	4.5	4.6
Cake of soya beans	3.8	7.8	3.9
Tobacco leaves	4.0	6.8	3.1
Rice	5.0	9.3	2.7
Hides and skins	3.3	4.6	2.5
Soybeans	7.8	9.7	1.6
Cotton lint	8.5	8.9	1.5
Flour of wheat	2.0	2.4	1.4
Wheat	16.2	14.8	0.6
Corn	9.8	8.7	0.5
Coffee, green	13.3	12.5	0.3
Cocoa beans	3.0	3.3	0.1
Total agricultural products	187.6	323.5	3.5

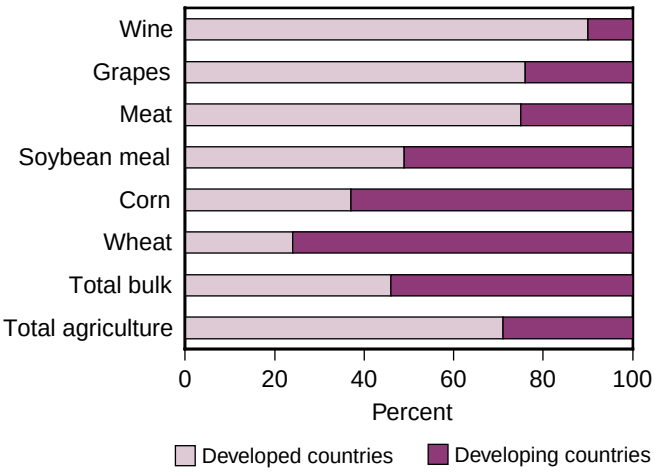
Source: FAOSTAT: excludes intra-EU Trade.

with larger home markets can take greater advantage of economies of scale, if they exist, as well as state-of-the-art processing and shipping technology.

Wheat, corn, coffee, and cocoa beans account for most trade in bulk commodities. Bulk commodities are the slowest growing component of agricultural trade. Growth of these commodities has been less than 1 percent per year.

An important factor in the changing structure of world agricultural trade is the dominant role developed countries have played. Most of the growth in consumer processed trade is attributable to developed country imports. Developed countries import a much greater share of processed consumer goods (consumer-ready goods) than developing countries, while the opposite is true for bulk commodities (fig. A-2). In most cases, the developed countries' share of total imports of consumer goods increased, indicating faster import growth than developing countries. For example, in 1980, developed countries imported 70 percent of global meat trade. Since then the share has increased to 75 percent in 1998 (table A-2).

Figure A-2
Shares of world imports by developed and developing countries



Source: FAOSTAT.

As income grows, meat typically becomes a more important source of calories in the human diet (shown in fig. A-3). While the relationship between income and livestock product consumption is well known, the link between economic growth and meat trade is less clear. Regions with faster growth in meat consumption do not necessarily become larger importers of meat. Expansion of domestic meat production plays an important role in determining import growth. Imports will depend on how competitive domestic producers are in producing for the home market. Input costs, technology, and levels of productivity of livestock sectors vary by region. Some production technologies are easily replicated in different regions while others are less transferable.

World imports of red meats are concentrated in a few developed countries. Japan's meat imports alone account for nearly as much as all developing countries' imports combined (fig. A-4). Despite rapid economic growth in most of Asia, only Japan stands out as a major market for meat exporters. Newly industrialized countries of Korea and Hong Kong have been the fastest growing markets for meat in recent years. While consumption of meat has increased in low- and middle-income countries, there has not been a noticeable shift in exports toward these markets. One reason is that there has been a shift in world meat production, with rapid growth in meat production occurring in developing Asia and the Near East (table

Table A-2—Developed countries' import share of world imports, by leading commodities

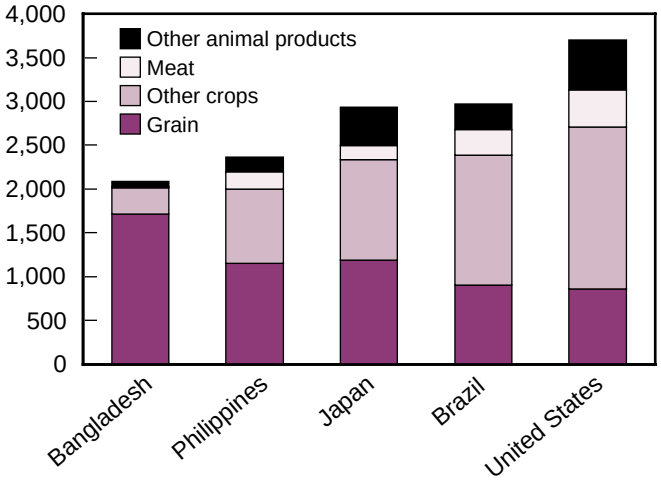
	1980	1985	1990	1995	1998
			Shares of world total		
Consumer Processed					
Chocolate products	0.69	0.75	0.74	0.71	0.73
Meat	0.70	0.68	0.76	0.74	0.75
Pastry	0.47	0.62	0.66	0.69	0.70
Pet food	0.91	0.97	0.93	0.89	0.86
Food prepared nes	0.47	0.52	0.51	0.57	0.57
Wine	0.88	0.92	0.89	0.87	0.90
Horticultural					
Bananas	0.89	0.95	0.95	0.91	0.88
Grapes	0.81	0.82	0.84	0.76	0.76
Tomatoes	0.95	0.92	0.94	0.95	0.95
Intermediate					
Cake of soya beans	0.84	0.77	0.75	0.64	0.49
Hides and skins	0.86	0.74	0.54	0.42	0.42
Oil of palm	0.32	0.27	0.27	0.25	0.29
Oil of soya beans	0.10	0.18	0.11	0.07	0.08
Bulk					
Cotton lint	0.56	0.67	0.48	0.35	0.34
Corn	0.59	0.64	0.56	0.36	0.37
Rice	0.16	0.19	0.22	0.16	0.17
Tobacco	0.82	0.80	0.80	0.76	0.77
Soybeans	0.86	0.79	0.78	0.68	0.59
Wheat	0.37	0.38	0.32	0.22	0.24

Source: FAOSTAT: excludes intra-EU Trade.

Figure A-3

Income level and source of calories

Calories per capita

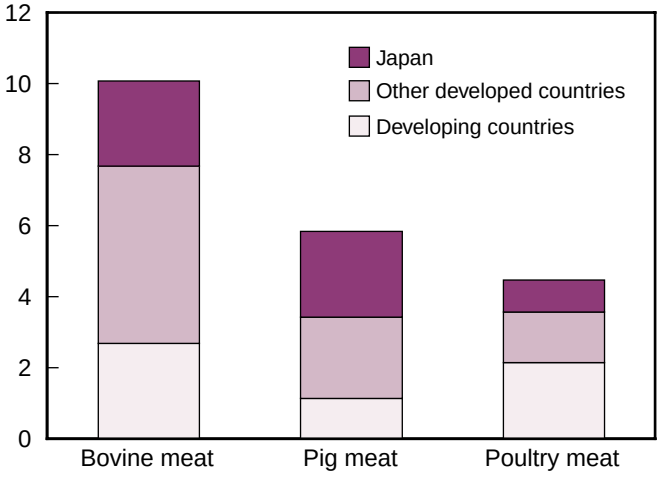


Source: FAOSTAT.

Figure A-4

World meat imports

$ billion



Source: FAOSTAT.

Table A-3—World meat production 1980-1998

	1980	1985	1990	1995	1998	1980-98
			Share of world total			*Growth per annum*
North America	0.20	0.19	0.18	0.18	0.18	2.13
Western Europe	0.22	0.21	0.19	0.17	0.16	1.14
Oceania	0.03	0.03	0.02	0.02	0.02	1.44
Total high income OECD	0.45	0.42	0.39	0.37	0.36	1.61
East and S. East Asia	0.04	0.04	0.04	0.05	0.05	4.97
South Asia	0.03	0.03	0.03	0.03	0.03	4.07
China	0.11	0.13	0.17	0.23	0.26	8.09
Near East	0.02	0.03	0.03	0.03	0.03	3.99
Asia and Near East	0.19	0.23	0.27	0.35	0.38	8.00
South America	0.09	0.08	0.09	0.10	0.10	3.28
Rest of World	0.27	0.27	0.25	0.18	0.16	-0.29
World	1.00	1.00	1.00	1.00	1.00	2.76

Source: FAOSTAT.

A-3). As livestock sectors expand in these regions, import demand for meat lessens. Domestic meat production in Asia has kept pace with economic growth and consumption in the region. In 1980, high-income Organization for Economic Co-operation and Development (OECD) countries produced 45 percent of the world meat while Asia and the Near East produced less than 20 percent. But by 1998, high-income OECD produced just 36 percent of world meat while Asia's share increased to 38 percent. Much of this growth has been in non-ruminant animal production where production takes place without major land requirements.

Imports of animal feeds have shifted away from developed countries to developing countries. For example, the share of soybean meal imported by developed countries was 84 percent in 1980, but fell to less than 50 percent in 1998. An important use of soybean cake is in livestock production, and this has been a major factor driving import growth in developing countries. China's livestock growth has kept pace with its overall economic growth, dampening its import demand for meat. An abundant labor force has facilitated livestock production, with low wages keeping production costs low. Overall, the increase in domestic consumption has been matched by increases in domestic production. Meat provides a good example of why there is not always a direct link between consumption growth and trade growth.

Determinants of Structural Changes in World Food Trade

Determinants affecting trade structure can be basically broken into factor growth on the supply side, income growth on the demand side, and barriers to trade. This section summarizes these factors and their linkage to trade. Together, these economic forces alter the structure of world agricultural trade. Measuring their individual impact requires a method capable of isolating the effects of each.[5]

Growth in Factors of Production

On the supply side, changes in the relative abundance of primary factors (labor, capital, and land) determine changes in production costs. Differences in production costs across countries are influenced by relative differences in wages, cost of capital, and land. The relative abundance of arable land is the most important determinant of agricultural production. Land, however, is a fixed resource for most regions. Long-run changes in agricultural production must be accompanied by changes in other variable factors such as capital, labor, or productivity growth. Factor intensities (relative input use of factors) can vary for different commodities and countries. Some countries rely more heavily on capital inputs, while labor-abundant countries use labor more intensively. In theory, sectors intensively using the more abundant factor expand more than those sectors requiring greater input use of a more scarce resource.[6] Countries with higher rates of capital accumulation but slow population growth become rela-

[5] These factors were taken into account in the modeling framework employed in the study conducted by Coyle *et al*. The Global Trade Analysis Project (GTAP) is employed in this study to simulate the historical changes in world trade.

[6] The Rybczynski theorem in trade theory predicts that when the endowment of one factor increases faster than others, the sectors that use this resource most intensively increase their output faster than other sectors (Bowen 1994).

tively more capital intensive, which in turn favors sectors using capital more intensively.

As growth occurs, the supply of factors used in production changes, with different sectors in the economy competing for resources. This affects production costs differently in each sector. For example, rapid economic growth driven by industrial production in East and Southeast Asia bids up wages for workers in this region. As a greater share of the labor force is employed in manufacturing and service sectors, agricultural labor costs rise. As an example, the cost of producing rice in Thailand increased when wages rose from rapid expansion in light manufacturing and services activity during the mid-1990s.

In each country, growth rates of the labor force and physical capital stock differ. In many developing countries, capital is often relatively more scarce than other inputs. This has implications for production and trade. As an example, the processing of oilseeds for vegetable oils and protein meal is capital-intensive, requiring plant and equipment investments. In regions where capital is scarce it may be more economical to support a livestock sector by importing processed feed ingredients.

Skill, Technology, and Productivity

A higher rate of educational attainment generally results in an expansion in the supply of skilled labor. Skill requirements can vary with technologies employed in the production process. For example, in many developing countries, lower skilled production technology is employed in primary agriculture and processing.

The relative abundance of lower waged labor has helped support growth of poultry and pork sectors in many low-income and middle-income countries. However, modern poultry production and processing requires high capital investments. In higher income countries, meat production and meat processing sectors have had to adopt labor saving technology. This is particularly true for Europe, Japan, Canada, and the United States where it has become imperative to employ more capital-intensive technology to remain profitable.

Productivity growth through technological progress has played an important role in agricultural growth. It is a well-documented source of growth for most developed countries. Measuring the effect of productivity on the composition of trade requires commodity-specific productivity rates by region.[7] This could be an important factor driving production and trade composition change.

Have supply-side effects had an impact on the shift in agricultural trade away from bulk to non-bulk commodities? In the study conducted by Coyle *et al*, supply-side effects did not contribute to major changes in the structure of world agricultural trade. One reason is that there have not been substantial factor price changes or significant differences in factor intensities. The supply-side effects have had more to do with shifts in economy-wide structure rather than compositional changes within agriculture.[8] Rapid capital accumulation has fostered faster growth in industrial production, particularly in the East Asian region.

Income Growth

The specific food sectors that account for the largest changes are largely demand driven. Demand-side effects come about as household income rises. Food in general is a 'normal' good where an increase in income brings about an increase in food expenditures. But the share of a household's budget devoted to food generally falls as incomes rise, while expenditure share for services rises.[9] However, not all shares *within* the food sector fall proportionately due to the household's preference for diet upgrading. This behavior can be empirically measured and represented in a demand system used for formal modeling applications. As income-driven shifts in consumption take place in a country, it can lead to changes in the structure of imports.

Consumption patterns are a function of many factors and not always directly related to income changes. They can coincide with lifestyle changes where greater emphasis is placed on convenience. This can lead towards greater food purchases away from home, reducing preparation costs at the same time the mix of commodities consumed may change. As this occurs some food commodities may experience not only a decrease in the share of food expenditure, but an absolute decline in per capita consumption. In East

[7] This type of detail was not available in the study conducted by Coyle *et al*.
[8] As economic growth occurs, agricultural output generally declines as a share of total GDP.
[9] This is known as the Engel effect.

Asia, for example, per capita rice consumption has actually dropped in Japan, Taiwan, and South Korea as per capita incomes rose. Since these countries were previously not major rice importers due to import controls, the impact on world rice trade from income effects is unnoticeable.[10] The impact on trade comes about as consumption of different types of foods such as dairy, meat, beverages, and prepared food increases.

Another interesting aspect concerning the consumption and trade link is that changes in total food intake may not occur when the composition of food consumption and trade changes. This is important for high-income countries and can account for large changes in global food trade.

As income rises, preferences for foreign brands or varieties may increase as per capita consumption of that item remains relatively flat. A small change in foreign share of total domestic consumption in a country can bring about changes in the composition of total food imports.[11] The demand for foreign varieties of products contributes to simultaneous exporting and importing of similar products between the same trading partners. This results in *intra-industry* trade.

Trade Barriers

Other factors can affect trade structure besides supply and demand-side factors. These are barriers to trade, which exist in the form of policies and transportation costs. There are substantial differences in tariff rates for different commodities. In temperate countries, tropical products such as bananas and coffee beans tend to have very low levels of protection, whereas commodities that compete directly with domestic production in those countries may have much higher barriers such as rice, wheat, meat, and dairy products. In some cases reductions in trade barriers affect trade but may not alter consumption. This occurs as barriers are reduced and consumers directly substitute domestically produced goods for imported goods, leaving consumption unchanged. In other cases, lowering tariff barriers can greatly expand consumption. This is particularly true for developing countries where certain commodities are deemed luxury items and governments can raise revenues with heavy taxes at the border. For many years, fresh apples in Southeast Asia carried very high import tariffs, severely limiting their consumption since domestic production was small or non-existent.

A commodity-specific policy can affect the composition of trade. Subsidization of soybean meal production creates a bias in favor of exporting processed products over soybeans, a bulk commodity. On the other hand, an import policy of tariff escalation over processed products creates a bias in favor of bulk trade. Overall, the combined effect of trade policy has an indeterminate effect on the composition of trade. Reduction in barriers can expand total agricultural trade while leaving the composition (bulk and non-bulk shares) unaffected. This is because trade barriers are applied to both bulk and non-bulk commodities, leaving the change in composition unnoticeable. Under simulated conditions, reductions in trade barriers from 1980 to 1995 showed little change in the composition of agricultural trade. A further complication is that non-tariff barriers (NTB), such as quotas, were replaced by tariffs, creating measurement problems for change in actual rates of protection. As a result, tariff protection in the OECD countries has generally increased while the share of imports covered by NTBs declined over this time period. It was found in the Coyle *et al*. study that policy reform over the 15 years before 1995 were not a significant factor affecting the change in the composition of agricultural trade.

Transport costs can act as a formidable barrier to trade just as tariffs and, like tariffs, these costs vary by commodity. Higher transport costs are generally associated with non-bulk perishable commodities. Thus, it would seem more likely that a reduction in overall transport costs would benefit trade in non-bulk commodities, thereby affecting the composition of trade. Furthermore, technological innovation has been greater for perishable products. A problem in measuring transportation's effect on trade is that technological innovation is not easily captured by changes in shipping costs alone. It was found that even while technological change took place in shipping it does not necessarily lead to lower freight rates but to better and faster service.

[10] Rice imports of these countries represent less than 3 percent of world rice trade.

[11] For example, trade in beer has grown faster because of increased consumption of foreign brands rather than in increased total beer consumption. Canada and the United States concurrently export and import beer and grain-based food products. In high-income countries, import demand for new varieties is an area that deserves greater attention (see Feenstra 1994).

Modeling Income Effects

This study employs a modified version of the GTAP model. For our purpose here it is used to simulate the effects of historical growth on world trade. Specifically we are interested in the changes in the historical trade patterns attributed to income growth.

Income effects in the model are driven principally by income elasticities. The income elasticities used in our modified version of the GTAP model are reported in table A-4. These are based on estimates provided by Cranfield et al. and mapped to the GTAP regions. The 1995 parameters are calibrated to the model's base period whereas the 1980 elasticities are derived in a backcasting exercise where prices are held constant and real expenditure is reduced in each region to the 1980 income level (shown in table A-4). The differences across regions reflect variations in the level of income in each region. The change from 1995 back to 1980 depends on the changes in income growth on a per capita basis. Clearly the most dramatic changes are in those regions where there has been greater changes in per capita income. In the Asian NICs region for example, the expenditure elasticity of demand for grains fell from 0.44 to 0.08. This would suggest that the effect of income growth on the demand for grains would be far greater in 1980 than in 1995. According to these estimates, in 1980 livestock products in China are considered a luxury good given that the income elasticity exceeds 1, however, this parameter is reduced to 0.96 in 1995 as per capita incomes have risen in China. In the high-income regions of Australia, Canada, Japan and the United States, the income elasticity of demand for livestock products was only marginally higher in 1995.

The general approach in performing the demand-side experiment is a form of "backcasting" where observed changes in population and economic growth are the exogenous variables in the model. Prices and quantities are endogenous for all other domestic and trade variables. In this type of experiment the model produces change in trade composition attributable to income effects alone. In most regions of the world economic growth exceeds population growth (table A-5). In China, per capita incomes grew the fastest in the world. In some regions per capita income was negative, including Mexico, the Middle East and North Africa and the Economies in Transition. Of primary interest is how the composition of trade changes as a result of changes arising from per capita income growth in individual regions.

Table A-5—Population and economic growth by region, 1980-1995

Regions	GDP	Population
	Percent	
Australia	2.9	1.3
Japan	3.2	0.5
E.Asian NICs	7.7	1.2
ASEAN	6.2	1.9
China	10.1	1.3
Canada	2.4	1.2
United States	2.5	1.0
Mexico	1.3	2.0
Mercosur	1.8	1.7
Western Europe	2.0	0.3
Economies in Transition	0.0	0.6
Mideast and North Africa	0.7	2.9
Rest of the World	2.5	2.3
World	2.6	1.7

Source: World Development Indicator, The World Bank.

Table A-4—Income elasticities estimated from AIDADS by region, 1980 and 1995

	Grains		Livestock		Horticulture		Other food	
	1980	1995	1980	1995	1980	1995	1980	1995
				Elasticities				
Australia	0.103	0.057	0.696	0.760	0.419	0.478	0.524	0.594
Japan	0.082	0.032	0.652	0.727	0.368	0.428	0.474	0.550
Asian Newly Industrialized Countries	0.439	0.084	0.685	0.663	0.538	0.376	0.589	0.486
ASEAN countries	0.597	0.307	0.769	0.677	0.661	0.468	0.702	0.545
China	0.938	0.757	1.079	0.959	0.985	0.826	1.074	0.925
Canada	0.048	0.025	0.716	0.776	0.425	0.493	0.540	0.613
United States	0.022	0.010	0.754	0.814	0.465	0.547	0.583	0.665
Mexico	0.184	0.142	0.662	0.680	0.409	0.408	0.504	0.513
MERCOSUR	0.190	0.122	0.663	0.651	0.390	0.377	0.478	0.481
Western Europe	0.098	0.065	0.694	0.738	0.419	0.452	0.522	0.568
Economies in Transition	0.337	0.335	0.686	0.685	0.479	0.478	0.561	0.560
Mideast and North Africa	0.439	0.404	0.714	0.704	0.550	0.528	0.613	0.595
Rest of the World	0.812	0.739	0.982	0.936	0.871	0.808	0.958	0.899

Estimated by Cranfield, Hertel, Eales, and Preckel 1998.

Evidence of Income Growth Effects on Agricultural Trade Patterns

This section reports results from a formal modeling exercise (see box "Modeling Income Effects"). Results for the income growth experiment (shown in tables A-6-A-9) are reported for four aggregate commodities, including processed commodities, livestock products, bulk commodities, and horticultural products. Import value shares are calculated for each of the 13 regions and for the world for each of the four time periods.

Overall, the direction of share changes is consistent with historical changes over this period. This confirms that income effects on food consumption have contributed to the changing structure of world trade. However, there are wide differences across individual regions. A large proportion of the shift occurs in higher income countries. Generally, the regions that have experienced the greatest per capita income change generally have the largest change in their trade structure.

High-income countries exhibited the greatest shift toward processed products. For example, Japan's processed share expanded from 0.26 in 1980 to 0.32 in 1995, reflecting the relative importance of expenditure growth for these products. Similarly for Asia's Newly Industrialized Countries (NICs), the processed commodity share increased from 0.23 to .30. While China experienced the fastest growth of all regions, this did not lead to dramatic changes in its trade structure. Much of the adjustment from income effects takes

Table A-6—Simulated import shares for processed commodities

Regions	1980	1985	1990	1995
		Percent		
Australia	0.47	0.49	0.50	0.52
Japan	0.26	0.28	0.31	0.32
E. Asian NICs	0.23	0.24	0.27	0.30
ASEAN	0.25	0.25	0.26	0.28
China	0.14	0.15	0.15	0.16
Canada	0.37	0.39	0.42	0.42
USA	0.31	0.33	0.36	0.37
Mexico	0.20	0.20	0.20	0.19
Mercosur	0.30	0.30	0.30	0.31
Western Europe	0.30	0.31	0.34	0.34
Economies in Transition	0.43	0.44	0.50	0.42
Mideast & North Africa	0.23	0.22	0.20	0.20
Rest of world	0.31	0.31	0.31	0.31
World	0.30	0.31	0.33	0.33

Source: Simulated from Modified GTAP Model.

Table A-7—Simulated import shares for livestock commodities

Regions	1980	1985	1990	1995
		Percent		
Australia	0.10	0.10	0.10	0.10
Japan	0.25	0.26	0.27	0.28
E. Asian NICs	0.23	0.23	0.23	0.23
ASEAN	0.14	0.14	0.14	0.14
China	0.08	0.08	0.08	0.09
Canada	0.12	0.13	0.13	0.14
USA	0.14	0.14	0.15	0.15
Mexico	0.20	0.20	0.20	0.20
Mercosur	0.15	0.15	0.15	0.15
Western Europe	0.22	0.23	0.24	0.24
Economies in Transition	0.19	0.19	0.20	0.19
Mideast & North Africa	0.19	0.18	0.18	0.18
Rest of world	0.13	0.13	0.13	0.13
World	0.20	0.20	0.21	0.21

Source: Simulated from Modified GTAP Model.

Table A-8—Simulated import shares for bulk commodities

Regions	1980	1985	1990	1995
		Percent		
Australia	0.30	0.30	0.30	0.29
Japan	0.35	0.31	0.26	0.24
E. Asian NICs	0.38	0.36	0.32	0.29
ASEAN	0.41	0.40	0.39	0.37
China	0.50	0.50	0.49	0.47
Canada	0.23	0.23	0.22	0.22
USA	0.35	0.34	0.33	0.32
Mexico	0.38	0.38	0.38	0.39
Mercosur	0.27	0.27	0.27	0.27
Western Europe	0.25	0.25	0.24	0.24
Economies in Transition	0.24	0.23	0.17	0.25
Mideast & North Africa	0.33	0.33	0.33	0.33
Rest of world	0.33	0.33	0.33	0.33
World	0.29	0.28	0.27	0.28

Source: Simulated from Modified GTAP Model.

Table A-9—Simulated import shares for horticultural products

Regions	1980	1985	1990	1995
		Percent		
Australia	0.07	0.06	0.06	0.06
Japan	0.06	0.06	0.07	0.07
E. Asian NICs	0.05	0.05	0.06	0.06
ASEAN	0.06	0.06	0.06	0.06
China	0.02	0.02	0.02	0.02
Canada	0.19	0.19	0.19	0.20
USA	0.15	0.15	0.14	0.14
Mexico	0.04	0.04	0.04	0.03
Mercosur	0.08	0.08	0.08	0.08
Western Europe	0.13	0.13	0.13	0.13
Economies in Transition	0.09	0.09	0.09	0.09
Mideast & North Africa	0.06	0.06	0.06	0.06
Rest of world	0.06	0.06	0.06	0.06
World	0.11	0.11	0.10	0.10

Source: Simulated from Modified GTAP Model.

place domestically rather than in China's external trade.[12] Among some of the lower income regions, the share of processed commodities actually fell. This was the case for Economies in Transition, Mexico and the Middle East and North African region.

The growth in imports of livestock products was roughly proportional to agricultural trade growth, keeping the share nearly the same for most countries. Based on our simulation exercise, the largest change in the livestock import shares are found in the high-income countries of Japan, Canada, and Western Europe. For these regions the income elasticity increased marginally from 1980 according to simulated estimates. The opposite occurs for developing countries where the income elasticity has fallen. In those cases, import shares for livestock have remained the same over this period.[13]

In nearly all regions of the world the import share of bulk commodities declined. Much of the shift away from this aggregate category took place in higher income regions, particularly in the higher income Asian regions. For Japan, the share dropped the most, from 0.35 to 0.24. For the Asian NICs, the drop in the bulk share was nearly as large.

Of these aggregate commodities, horticultural products represent the smallest share of agricultural imports. Like livestock products, this category grows roughly proportional to total agricultural trade. The direction of change for the horticultural product share differs by region. This is partly due to the fact that, across this time period, expenditure elasticities also vary by region.

Conclusions

Several factors can contribute to the changing composition of world agricultural trade. An earlier study indicated per capita income levels to be the most important factor affecting food consumption patterns. Developed countries have played a major role in the aggregate shift of world agricultural trade towards imports of non-bulk commodities. Income growth effects on import demand differ between developed and developing countries. The growth in imports of processed food products by developed countries is not necessarily a reflection of increased per capita consumption or diet upgrading but rather diversification of consumption towards foreign varieties.

For an individual commodity there is not always a direct link between consumption and trade growth. In developing countries, diet upgrading and increased consumption of livestock products do not necessarily translate into higher import shares of these products over grains and other bulk commodities. Imports of animal feed help expand domestic livestock production while reducing the need for direct imports of livestock products. The most noteworthy example is China, where rapid economic growth has not yet created a major import demand for meat and livestock products. Rather, domestic livestock production has accelerated in China in the past two decades.

There are likely many complex factors driving changes in world food trade besides the standard economic determinants discussed here. Future research challenges will be to examine other factors besides income such as the role of urbanization in developing countries. It is likely that not only are income effects important, but the stage of development, distribution of income, and the geography and culture of a country are important factors affecting the changing content of a country's food imports.

[12] China has a low import share of total domestic consumption. In the model, substitution between foreign and domestic sources (Armington specification) governs the degree to which imports can compete with domestic production.

[13] Part of the problem is with the use of an aggregate livestock category containing a large non-food component (hides and skins). Industrial uses of livestock products are not directly related to income-induced dietary changes in developing countries. Furthermore, demand for hides and skins imports is a derived demand for footwear. This is complicated by the fact that hides and skins are used for leather in shoe-making where demand in footwear (the final good) is derived from the export demand in developed countries.

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