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THE IMPACT OF LIVESTOCK AND FISHERIES ON FOOD AVAILABILITY AND DEMAND IN 2020

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Abstract

People in developed countries consume about 3 to 4 times as much meat and fish, and 5 to 6 times as much milk products per capita as in developing Asia and Africa. Yet, meat, milk, and fish consumption per capita has barely grown in the developed countries as a whole over the past 20 years. Growth in per capita consumption and production has occurred in developing regions such as developing Asia, where income has increased from a low level and urbanization is rapid. By 2020, according to projections by IFPRI's IMPACT model, the share of the developing countries in total world meat consumption will rise from 47 percent currently to 64 percent. The net impact on food access for the poor of the world will depend on their role as producers of meat, milk, and fish, their role as consumers, and their need for protein. The amount of cereals per capita consumed directly by rural people will decline as they diversify their diets into animal proteins, but feed use will increase greatly. Available evidence suggests that on balance poor consumers in developing countries will probably be better off.

The Impact of Livestock and Fisheries on Food Availability and Demand in 2020

Recently a number of well-meaning activists have suggested policies intended to reduce consumption of animal proteins in developed countries in order to make grains more available for the poor of the world (e.g.: Brown). The present paper will present evidence suggesting that this argument runs counter to what is known about people's strong preferences for animal proteins in their diets. Per capita consumption of meat rises fastest in countries where current consumption levels are low, rapid urbanization is occurring, and incomes are growing rapidly from a low base. Policy useful for improving the access of poor people to food should take rapidly increasing production and consumption of animal protein in developing countries as a given to build on. The paper draws on past trends and FAO and IFPRI modeling results on long-run demand for animal protein products, to establish that current demand and trade patterns for livestock and fisheries products are changing rapidly, especially in developing Asia. These changes are likely to drive major increases in world consumption and prices of animal protein products to 2020.

Past trends in per capita consumption of major animal protein items as food for different parts of the world are shown in Table 1. The developed countries were clearly the major consumers of animal proteins in the early

Table 1--Per capita consumption of cereals and animal proteins for food[a], and of feed grains[b], by major region, 1975/79-1990/94

Region	Item	Consumption 1990/94	Percent change 1975/79-1990/94	Annual compound growth 1975/79-1990/94[c]
		(kg/capita)	(percent)	
Asia developing (including China)	Cereals	198	13	0.8
	Milk	31	42	2.4
	Meat	18	107	4.9
	Fish	11	57	3.1
	Feedgrains	40	70	3.4
Latin America	Cereals	127	<1	<0.1
	Milk	100	6	0.3
	Meat	45	16	0.9
	Fish	9	17	1.1
	Feedgrains	111	19	1.0
Sub-Saharan Africa	Cereals	116	7	0.5
	Milk	27	-1	-0.2
	Meat	12	-5	-0.4
	Fish	8	-12	-0.9
	Feedgrains	7	0	0.3
Developed countries	Cereals	135	<1	<0.1
	Milk	178	23	1.4
	Meat	78	7	0.5
	Fish	22	-3	-0.1
	Feedgrains	307	-18	-1.3

Source: FAO 1997a.

Note: [a]The food items include derived products such as bread and cheese.
[b]Feed grains includes feed uses of cereals only.
[c]Annual compound growth estimate by semi-log regression.

1990's: 100 kg/capita of meat and fish and 178 kg/capita of milk equivalents in milk products, on average, per annum. Compare this to 29 kg/capita of meat and fish and 31 kg of liquid milk equivalents in developing Asia, and even less in Africa. Yet consumption per capita has barely grown in the developed countries as a whole over the past 20 years; for feed grain use, it has actually declined on a per capita (human) basis. Growth in per capita consumption has occurred in regions where income has increased from a low level, and urbanization has occurred. In Asia there has been an explosion of demand for meat, milk and fish, with annual growth in per capita consumption of the order of 2.5 to 5 percent. In Africa, a region where real incomes have stagnated or fallen, consumption of animal proteins has declined over the past 20 years. Real income has grown in Latin America, but animal protein consumption growth per capita has been modest, perhaps because that region is already largely urbanized.

Regional production in Asia has largely kept up with demand. Production growth rates in Asia were in excess of 6 percent per annum for livestock in the late 1980's and early 1990's (FAO 1997a); fisheries production from aquaculture development in China grew at 14 percent per annum in the first half of the 1990's (FAO 1997b). In fact, developing Asia has become the world's major fish exporting region, and gross exports of fisheries products from developing countries as a whole surpassed gross exports of coffee, tea, cocoa, sugar and minor tropical products combined in value terms in the early 1990's. On the

other hand, the U.S.A. went from being the world's second largest fish exporter in the 1980's to being a net importer in the 1990's (Delgado and Courbois).

Although growth in animal protein consumption and production in developing Asia has been largely powered by the emergence of China, it is also mirrored in other Asian countries (Huang and Bouis). Not surprisingly, the per capita use of cereals as feed in Asia is not negligible--40 kg/capita in 1990/94, growing at 3.4 percent p.a.--along with an already high level of cereals consumption per capita as food in the region--198 kg/capita in 1990/94 (Table 1). This may be compared to 307 kg/capita as feed and 135 kg/capita as food in the developed countries as a whole (Table 1). Per capita feed grain demand is increasing primarily in the region of the world--Asia--where cereals consumption as food is likely to decline on a per capita basis over time as diets diversify.

Globally, fish consumption per capita has grown only modestly over the past quarter century, from about 10.5 kg in 1970 to 13.4 kg in 1994 (FAO 1997b). While the developed countries consumed 22 kg/capita of fish in 1990/94, developing countries as a whole consumed over 9 kg/capita (Table 1). Excluding China and Oceania, per capita growth rates of fish consumption as food in developing countries since 1970 have been low. Rates of the order of 0.5 to 1 percent p.a. (FAO 1997b) may be compared to aggregate growth rates for beef consumption per capita in developing countries of 0.6 percent p.a. from 1967 to 1982, and 1.1 percent p.a. from 1982 to 1993 (Rosegrant *et al.*). Growth rates for poultry consumption per capita in developing countries were over 5 percent p.a. in the earlier period and 3 percent p.a. in the latter period.

What is powering these trends and will these influences continue? Income growth is clearly important. Ahmed and Gruhn summarize independent case studies from the 1980's on total expenditure ("income") and own-price elasticities for meat in 13 developing countries. Delgado and Courbois cite total expenditure, price and cross-price elasticities for meat and fish from recent separate complete demand systems from the U.S.A., China, Norway, and Egypt, starting from different structural bases in terms of animal protein production, incomes, and urbanization. The evidence overwhelmingly suggests that expenditure elasticities for animal proteins tend to be relatively high (0.8 to 1.7), although different countries seem to prefer different animal protein commodities. The impact of income growth seems to be highest when urbanization is rapid, the initial income base is low, and domestic production is growing rapidly.

Referring to the same sources, uncompensated own-price elasticities tend to be unitary or slightly elastic, leading some perhaps to think that taxation could reduce consumption. However, income-compensated own-price elasticities tend to be quite inelastic, so taxation would reduce consumption mostly by reducing real incomes. Compensated cross-price elasticities for meat and fish in the four cases cited by Delgado and Courbois ranged from 0.1 (U.S.A.) to 0.9 (Norway). Relative prices matter more when people with increasing incomes are selecting among sources of cheap staple animal proteins, rather than when people are increasing the quality of their diets by adding luxury products such as lobster or shrimp.

Past trends in world relative prices for beef and fish products are also examined in Delgado and Courbois. They show that in 1996, the export price of items such as shrimp was barely 2 percent above its 1970 level, expressed in constant dollars. Fishmeal prices in 1996 were only 40 percent of 1970 price levels in real terms. Manufacturing-grade beef, however, was priced at only 29 percent of 1970 levels in 1996, in real terms. Since prices of higher-value food fish tend to be correlated with shrimp prices, it would appear that beef has become more than three times less expensive relative to filet fish since 1970 (the shrimp/beef price ratio has risen from 2.1 / 1 in 1970 to 7.4 / 1 in 1996). This may explain why fish consumption has not grown even faster than it has.

Huang and Bouis argue that degree of urbanization is also an important determinant of food demand patterns in Asia, in addition to income and prices, since it is associated with changes in preferences, needs, and experience. They found that in China, urbanization alone accounted for an extra 5.7 - 9.3 kg/capita consumption of meat and fish products per annum, and a decrease on the order of 58.3 - 70.1 kg/capita of rice, once income and price effects had been controlled for. Since Asia's share of population in urban areas is still low (about 34 percent in 1995 compared to 74 percent in Latin America, Europe, and the U.S.A. (United Nations)), it is to be anticipated that the scope for further rapid increase in per capita consumption of meat and fish remains large.

With regard to meat and fish in China, Huang, Rozelle, and Rosegrant project demand growth to 2020 for rural and urban areas of China, under different scenarios. Under low income growth, per capita meat and fish

consumption in rural areas is projected to grow from 20 kg (including 4 kg fish) in 1991, to 40 kg (including 10 kg fish) in 2020. In urban areas under high growth, per capita meat and fish consumption growth goes from 40 kg (including 12 kg fish) in 1991 to 142 kg (including 61 kg fish, less only than Japan currently) in 2020! Thus income growth and urbanization are critical to meat and fish demand in China, and the combination of the two has an exponential effect on demand projections.

Per capita consumption of major meat types is summarized for developing and developed countries in 1993 in Table 2. Furthermore, sub-totals for China and the U.S.A. are given to illustrate the role of lead actors in changing consumption patterns. Developed countries as a group in 1993 consumed roughly 5 times as much beef per capita, 3 times as much pork, 4 times as much poultry as developing countries, although the share of developed countries in global meat consumption was only about half, due to a much smaller share of population. Per capita consumption of all meat in the U.S.A. in 1993 (118 kg) was almost 4 times per capita consumption in China (33 kg).

Table 2--Meat consumption in developing and developed countries in 1993 and 2020, in kg/capita and as a share of world consumption of meat (percent)

Year	Region	Beef	Pork	Poultry	All Meat
1993	All developing countries	5.3	9.0	5.0	20.8
	(Share percent)	*(41)*	*(51)*	*(45)*	*(47)*
	China	2.1	24.5	5.0	32.8
	(Share percent)	*(4)*	*(37)*	*(12)*	*(20)*
	All developed countries	25.2	29.4	20.3	77.7
	(Share percent)	*(59)*	*(49)*	*(55)*	*(53)*
	U.S.A.	45.5	30.5	44.7	118.4
	(Share percent)	*(21)*	*(10)*	*(24)*	*(16)*
2020	All developing countries	7.4	13.4	7.8	30.5
	(Share percent)	*(58)*	*(68)*	*(60)*	*(64)*
	China	4.6	45.2	11.4	62.6
	(Share percent)	*(8)*	*(52)*	*(20)*	*(30)*
	All developed countries	25.0	28.8	24.0	80.1
	(Share percent)	*(42)*	*(32)*	*(40)*	*(36)*
	U.S.A.	39.8	26.7	46.7	113.8
	(Share percent)	*(14)*	*(6)*	*(17)*	*(11)*

Source: Calculated from figures and IMPACT model projections in Rosegrant *et al.*, and supplemented by further information graciously provided by the authors of that paper.

Note: Share percent is always share of world consumption of item in question.

By 2020, according to IMPACT model projections by Rosegrant *et al.* as shown in Table 2, the share of the developed countries as a group in total meat consumption will shrink to just over one-third (36 percent). Meat consumption per capita in China (63 kg) is projected to be about half of U.S.A. per capita consumption (114 kg). Thus the developing countries as a whole will greatly increase their relative and absolute shares of meat consumption, led by China, who will have narrowed the gap with U.S.A. consumption patterns by about one-half. Both meat and cereal prices are endogenous in the IMPACT model, and this rapid expansion of meat consumption in Asia appears to be the principal reason why beef prices are projected by Rosegrant *et al.* to decrease only slightly in real terms (about 5 percent over 1993 levels) by 2020, compared to the World Bank's current commodity price projection for beef to 2010 showing a 19 percent decline in beef prices by 2010, using commodity price projections methodology (cited in Delgado and Courbois).

These projected major shifts in consumption of animal proteins are reflected in projected changes in world trade patterns. The IMPACT model estimates net trade flows of meat from developed countries to developing countries to go from 610,000 tons in 1993 to 11.66 million tons in 2020 (Rosegrant *et al.*). Delgado and Courbois estimate that current exports of high-value fisheries products from developing countries to developed countries, worth US$20 billion in 1993, will continue to increase over the next 20 years. Powerful forces of consumer sovereignty and large sums of effective demand are

involved, as well as dynamic structural changes in incomes and urbanization in Asia.

Reduction of consumption of animal proteins is not likely occur in the foreseeable future, and is not likely to create cereals surpluses that the poor in developing countries would have access to. On the contrary, per capita and absolute increases in animal protein consumption are likely to be largest in the developing countries themselves. Furthermore, it is precisely this rise in animal protein consumption that is likely to reduce cereal food needs per capita in Asia. At 198 kg average direct human cereals consumption per capita, current Asian consumption patterns reflect non-diversified diets stemming from the largely rural nature of the continent and its low income base. The same powerful forces that will drive the rise of meat and fish consumption in Asia are likely to reduce per capita Asian cereals consumption as food to closer to the 115-135 kg/capita found in other parts of the world, as diets are diversified. On the other hand, use of cereals as feed will surely increase in Asia from its presently low base. Assessment of the net effects on food intake by the poor would need to take into account the impact of major demand and supply shifts on relative prices and incomes of different strata of the affected populations, which will feed back into demand and supply patterns. While this is feasible, it seems that there are more urgent ways to look at how shifts in demand for fish and livestock can be used to improve the real incomes of the poor, traditional net producers of these items in Asia and other developing countries.

References

Ahmed, R., and P. Gruhn. "Selected Issues in the Supply and Demand for Red Meat and Poultry Products in Developing Countries." *Supply of Livestock Products to Rapidly Expanding Urban Populations.* Rome: Food and Agriculture Organization of the United Nations, 1995.

Brown, L. "Facing the Prospect of Food Scarcity." *State of the World 1997.* Worldwatch Institute. New York: W.W. Norton & Company, 1997.

Delgado, C., and C. Courbois. *Changing Fish Trade and Demand Patterns in Developing Countries and Their Significance for Policy Research.* Paper presented at the International Consultation on Fisheries Policy Research in Developing Countries. North Sea Center, Hirtshals, Denmark, June 2-5, 1997.

Food and Agriculture Organization of the United Nations. "FAOStat." Available HTTP: *http://faostat.fao.org/default.html*, (May 1997a).

____. *The State of World Fisheries and Aquaculture 1996*. Rome, 1997b.

Huang, J., and H. Bouis. *Structural Changes in the Demand for Food in Asia*. Food, Agriculture, and the Environment Discussion Paper 11. Washington, D.C.: International Food Policy Research Institute, 1996.

Huang, J., S. Rozelle, and M. Rosegrant. *China's Food Economy to the Twenty-First Century: Supply, Demand, and Trade*. Food, Agriculture and the Environment Discussion Paper 19. Washington, D.C.: International Food Policy Research Institute, 1997.

Rosegrant, M., M. Sombilla, R. Gerpacio, and C. Ringler. *Global Food Markets and US Exports in the Twenty-First Century*. Paper presented at the Illinois World Food and Sustainable Agriculture Program Conference "Meeting the Demand for Food in the 21st Century: Challenges and Opportunities for Illinois Agriculture", Urbana-Champaign, Illinois, 27 May, 1997.

United Nations. *World Urbanization Prospects: The 1994 Revision*. New York, 1995.