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CHANGING FISH TRADE AND DEMAND PATTERNS IN DEVELOPING COUNTRIES AND THEIR SIGNIFICANCE FOR POLICY RESEARCH

by

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Abstract

Trends for major fisheries products are evaluated for the past two decades, using aggregate annual data. Major changes have been propelled by income growth, changes in preferences and health concerns about meat in developed countries, leading to increased consumption of high-valued fisheries items such as shell and filet fish. Developing countries, especially East Asia, are rapidly increasing consumption of lower valued fishery items, and fish-culture is becoming an increasingly important source of food and exports. Developed countries accounted for 85 percent of net world fish imports in 1994, mostly at the high end of the value spectrum, from about twenty countries. In the ten years preceding 1993, the net value of fisheries exports from developing countries went from less than a third of net developing country exports of sugar, beverage crops and tropical specialty products combined, to a level exceeding that total. While real fish prices have remained relatively stable since 1970, real beef prices have declined by 300 percent, suggesting that a rally in meat prices would further accentuate the shift to fish. Current evidence suggests a 15 percent relative strengthening of fish prices to beef through 2020.

Introduction

Consumption of fish and fishery products increases rapidly with income. Thirty percent of world fish production is traded, and an increasingly large share of fish exports to developed countries will be produced in developing countries in the future (FAO, 1997). Policy research in developing countries therefore needs to address the factors that influence demand for fish and competing products in both the developed and developing countries, and how these changing patterns are likely to influence relative fish prices and trade flows.

The objective of the present paper is to marshal and analyze salient evidence on aggregate fisheries trade and consumption trends, almost all of it produced by the Fisheries Department of FAO, and to put this in the context of other work on present and future demand for both meat and fish.[1] Conclusions will be drawn where possible, and priorities for further research highlighted. Other papers, dealing with supply issues, household food security considerations, and interactions with the environment have been prepared by others for the present conference; no effort will be made to deal with those important topics here.

Trade Patterns

Even aggregate trade patterns must be put in the context of broader production changes occurring in the world. Global production of fish and shellfish rose nearly 15 percent from 1990 to 1995. Of the preliminary figure of 112.3 million metric tons of fish and shellfish produced world-wide in 1995, roughly 19 percent came from culture, as opposed to capture, compared to 13 percent in 1990. Growth in marine capture fisheries is mainly limited to lower value, highly variable, stocks of pelagic fish, whereas the generally higher valued production of demersal species has been fairly stable since 1970 (FAO, 1997)[2]. About 28 percent of global production in 1995--largely shoaling pelagics

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[1] The analysis of aggregate fisheries trends draws heavily on the seminal *State of Fisheries and World Agriculture: 1996* (FAO, 1997) and the underlying FAO technical papers prepared for the Kyoto Conference on the Sustainable Contribution of Fisheries to Food Security, December 1995.

[2] For non-fisheries oriented readers, *pelagic* fish refers to surface feeding marine fish. Tuna and Bonitos are in fact pelagic fish, but are relatively high valued species that also tend to be highly migratory. Most pelagics are low-valued species found close to continental shelves (shoaling). They are important as food to artisinal fisherman in developing countries, and as feedstock to capital-intensive industrial fisheries seeking material for fishmeal.

(continued...)

such as anchoveta--was used for reduction into fishmeal. The dynamic factor in world fisheries is China, where fisheries production as a whole grew at 14 percent per annum between 1990 and 1994, with most growth coming from aquaculture production of herbivorous carps. This increase is the main factor behind the increase in the fish production share of developing countries, from 26 percent of world total fish production in 1988 to 35 percent in 1994. In the latter year, China and India alone accounted for roughly 60 percent of world aquaculture, which with annual growth rates of the order of 11 percent in recent years is one of the fastest growing sectors in world food production (FAO, 1997).

In value terms, world fish trade has accounted for a fairly stable 50 percent of the estimated value of fish production since 1980 (FAO, 1997). However, in quantity terms it has increased steadily from 32 percent in 1980 to 38 percent in 1990 (Alexandratos, 1995). Since 1990, this trend has continued, with trade in low value products such as fishmeal accounting for most increased trade. In 1995, 85 percent of fish imports by value were to developed countries, with Japan alone accounting for 30 percent of imports (FAO, 1997).

There has been an important shift in the direction of trade. In the mid to late 1980s, the U.S. was the second largest fish exporter in the world (shown in Table 1 as negative net imports of fresh demersal fish). By the early 1990s, the U.S. had become a net importer of fresh demersal fish. Japan greatly increased its reliance on imports after the mid-1980s. Europe continued as a major player in world trade in fisheries, with increasing net imports over time. As a whole, the developed countries are net importers of fish overall, and of fresh demersal fish, at the present time, and this trend is expected to strengthen (Table 1).

The "real import unit values" for fresh demersal fish shown in Table 1 are obtained by dividing the total deflated value (constant 1980 US$) of gross imports by the total quantity of gross imports.[3] The increase in the import unit value for the U.S. appears to result from an upgrading in the

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[2](...continued)
Demersal fish are mid-water marine fish; they tend to be the higher-valued species common in Western fisheries (such as flatfish).

[3] This in fact creates a "price" of imports that is a weighted average import price, in constant dollars, where the weights are the relative contribution of each transaction to the total.

Table 1: Net imports and import unit value of fresh demersal fish, developed countries, 1973-1993

Year	Net imports (metric tons)			Real import unit value (1980 US$/metric ton)		
	U.S.	Japan	All Developed	U.S.	Japan	All Developed
1973/75	41,267	N/A	84,642	$1,584	N/A	$1,505
1976/78	42,463	1,538	67,283	$873	$4,329	$1,593
1979/81	-43,416	2,663	-21,680	$1,023	$4,788	$1,565
1982/84	-403,287	2,557	-433,337	$1,031	$4,704	$1,264
1985/87	-1,173,911	5,449	-1,235,505	$1,089	$4,776	$1,448
1988/90	-815,224	29,837	-816,837	$1,367	$2,897	$1,786
1991/93	26,781	48,539	19,800	$1,723	$2,123	$1,978

Source: Computed from data in FAO, 1996a.

Note: Net imports are imports minus exports in the same calendar year. Real import unit values are the aggregate value of imports for the country and year concerned divided by the aggregate quantities, deflated by the World Bank's G-5 Manufacturing Unit Value Index base 1980. Annual values are first calculated then averaged over three years.

types of fresh demersal fish imported, reflected in higher prices for those items. The opposite effect is observed in Japan after the mid-1980s, with substitution of cheaper demersal fish.

A similar table (Table 2) is shown for net imports of fresh pelagic fish in developing countries. Africa is a net importer on the whole, although less so now than in the mid 1980s, when factory ships of the former socialist economies would unload huge quantities of cheap frozen pelagic fish in West Africa.[4] Developing Asia is once again becoming a major net exporter (negative net importer, in Table 2) of pelagic fish. Both net exports of pelagic fish and the real import unit value are very dependent on five pelagic species that are highly variable in their appearance, and whose production runs tend to alternate between boom and bust (such as the Japanese Pilchard).

High value fisheries exports with a broad market in the developed countries include fresh demersal fish and crustaceans. Most developing countries are net exporters of these items; as shown in Table 3, developing Asia is the big player. Growth of shrimp exports in countries such as Thailand and India has been phenomenal in the past decade. Interestingly, the white-tailed shrimp is the only fisheries product for which there is a developed international futures market (FAO, 1997).

Export Earnings and Prices

Fisheries have become the major foreign exchange success story of the developing countries over the last decade. From 1985 to 1994, foreign exchange earnings from net fisheries exports from developing countries have been estimated to have gone from US$5.1 billion in 1985 to US$16 billion in 1994 (FAO, 1997). After allowing for inflation, this is a 95 percent increase in real terms over ten years, coming at a time when receipts from traditional exports of tropical agricultural products were declining due to sharp price decreases for those items in terms of purchasing power. Developed countries have also rapidly expanded their fisheries trade with each other.

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[4] In West Africa in the mid-1980s, long-distance fleets of ships, particularly from the former Soviet Union and North Korea, delivered cubic meter blocks of frozen pelagics during the high pelagic landing season, from June to September. Although much of this may have gone for human consumption, the rapid rise of the poultry industry in West Africa at that time may have been a factor also. At other times of the year, the ships would concentrate on more valuable species for sale outside Africa.

Table 2: Net imports and import unit value of fresh pelagic fish, developing countries, 1973-1993

Year	Net imports (metric tons)			Real import unit value (1980 US$/metric ton)		
	Africa developing	Asia developing	All developing	Africa developing	Asia developing	All developing
1973/75	-5,174	-268,874	-277,144	$520	$546	$568
1976/78	11,502	-46,012	-35,492	$641	$416	$460
1979/81	22,732	-84,606	-56,556	$981	$342	$476
1982/84	138,464	-34,257	104,933	$615	$478	$550
1985/87	180,703	-40,118	83,795	$475	$436	$457
1988/90	118,546	-152,781	-59,450	$478	$355	$407
1991/93	86,358	-251,246	-190,398	$514	$499	$505

Source and note: See Table 1.

Table 3: Net exports and export unit value for fresh demersal fish and crustaceans, developing countries, 1973-1993

Year	Net exports (metric tons)			Real export unit value (1980 US$/metric ton)		
	Africa developing	Asia developing	All developing	Africa developing	Asia developing	All developing
1973/75	8,164	266,055	-25,987	$3,298	$1,325	$3,251
1976/78	2,736	60,057	13,620	$948	$1,351	$1,517
1979/81	1,784	91,284	29,790	$4,786	$1,211	$1,945
1982/84	2,669	78,636	86,502	$3,965	$1,257	$1,543
1985/87	5,463	123,953	106,899	$3,937	$1,298	$1,919
1988/90	6,589	162,845	63,718	$3,519	$1,245	$2,184
1991/93	8,332	247,123	58,843	$3,566	$1,423	$2,212

Source: Computed from data in FAO, 1996a

Note: Net exports are exports minus imports in the same calendar year. Real export unit values are the aggregate value of exports for the country and year concerned divided by the aggregate quantities, deflated by the World Bank's G-5 Manufacturing Unit Value Index base 1980. Annual values are first calculated then averaged over three years.

Global net foreign exchange receipts increased 70 percent in real terms between 1985 and 1994, ending at US$47 billion in the latter year (Ibid.).

Table 4 shows the rise of real foreign exchange receipts of developing countries from fisheries from 1983 to 1993, compared to events in other agricultural and livestock export markets. While other traditional exports stagnate or decline in real terms, fisheries receipts are growing rapidly. By 1993, they surpassed those from sugar, traditional beverage crops (coffee, tea, cocoa) and tropical agricultural exports combined, for developing countries as a whole, although fisheries exports tend to originate from a small number of countries.

Over the long run, prices for developing country fisheries exports have stagnated, even if in the last half-dozen years there has been some improvement. While the increase in nominal shrimp prices since 1970 in Table 5 may seem tremendous, the 1996 actual price was only 2 percent above the 1970 price expressed in 1996 dollars! Seen the same way, fishmeal prices in 1996 were only 55 percent of their real 1970 levels.

In recent years, the market prices of higher valued demersal fish (such as flatfish) have tended to increase because of exhaustion of supply (Alexandratos, 1995). Events affecting prices of substitutes for fisheries products may be more significant for developing countries in the long-term. The price of beef in 1996 was only 29 percent of the 1970 price when the latter is converted to 1996 dollars. Using the figures from Table 5, the ratio of the wholesale prices of shrimp to beef was 2.1 / 1 in 1970, 3.8 / 1 in 1980, and 7.1 / 1 in 1996. The ratio of fishmeal to soymeal wholesale prices was 3 / 1 in 1970, 1.9 / 1 in 1980, and 1.5/1 in 1996.

Shrimp is one of the more expensive fishery items by weight, at 2 to 4 times the value by weight of demersal fish, and 2 to 3 times the value of tuna, as shown in Table 6. Yet shrimp prices do not appear to have moved in radically different manner than demersal fish prices over the long haul. Therefore, the cheapening of beef relative to shrimp also applies to white fish filets, beef's closest competitor on the fisheries side.

Fish Consumption Trends, Past and Present

Average human consumption of fish as food is estimated by FAO as being 13.4 kg/capita in 1994; more surprising, the global average for fishmeal utilization in the same year was 5.6 kg./capita (FAO, 1997). Fish as food has recently been estimated to account for 19 percent of animal protein supply to humans, and 4 percent of total protein (Alexandratos, 1995). Globally, fish consumption per capita has grown only modestly over

Table 4: Real value of exports of fishery products from developing countries in perspective, 1983-1993[a] (in billions of constant 1988 US dollars)

	1983	1988	1993
Fishery products	9.3	15.0	17.4
Sugar, beverages, and tropical products	31.0	24.1	17.1
Oilseeds and products	12.7	13.3	14.2
Cereals and products	8.2	4.8	5.9
Meat and livestock	6.3	5.3	5.0
Milk and products	0.3	0.4	0.6

Sources: Computed from data in FAO *Commodity Review and Outlook* (various) and World Bank *Commodity Markets and the Developing Countries* (various).

Note: [a] Value of gross exports from developing countries including re-exports, deflated by G-5 Manufacturing Unit Value index, base 1988.

Table 5: Shrimp and fishmeal export prices in context, 1970-1996 (current US$/metric ton)

Year	Shrimp[a]	Fishmeal[b]	Soymeal[c]	Beef[d]	MUV[e]
Past					
1970	2,780	309	103	1,304	25.1
1980	10,230	504	262	2,760	72.0
1985	10,490	280	157	2,154	68.6
Recent					
1990	10,790	413	200	2,563	100.0
1991	11,542	478	197	2,663	102.2
1992	10,950	482	204	2,455	106.6
1993	11,390	365	208	2,618	106.3
1994	13,080	377	192	2,331	110.2
1995	13,540	496	197	1,907	119.4
1996	13,119	585	257	1,781	116.4
Projected					
2000	14,036	n.a.	250	2,590	127.6
2010	15,859	n.a.	306	3,220	161.0

Sources: All price data and projections are in current US$ and from various issues of World Bank, *Commodity Markets and the Developing Countries*.

Notes:
[a] U.S. frozen, Gulf brown, shell-on, headless, 26/30 count per lb., c.i.f. New York.
[b] Any origin 64-65%, c.i.f. Hamburg.
[c] Any origin, 44-46% extraction, c.i.f. Rotterdam.
[d] Australia/New Zealand, frozen boneless cow forequarters, 85% lean, c.i.f. U.S. East Coast ports.
[e] G-5 Manufacturing Unit Value index, base 1990 (to measure inflation).

Table 6: Average landing prices of various seafood groups, 1984-1994 (current U.S. dollars/metric ton)

Year	Fish for reduction	Cods, hakes, haddocks	Flounders, halibuts, soles	Tilapias and other cichlids	Tunas, Bonitos, billfish	Salmons, trouts, smelts	Shrimps, prawns	Lobsters spiny-rock lobsters
1989	$90	$700	$1,198	$1,250	$1,700	$3,500	$4,000	$11,270
1990	$95	$900	$1,217	$1,300	$1,830	$3,430	$3,650	$11,400
1991	$90	$1,250	$1,095	$1,300	$1,560	$3,190	$3,280	$11,700
1992	$93	$1,350	$1,163	$1,350	$1,650	$3,470	$3,750	$12,100
1993	$74	$990	$1,103	$1,250	$1,525	$2,780	$3,900	$11,500
1994	$85	$1,060	$969	$1,255	$1,500	$2,750	$4,000	$11,800

Source: Annual average values from FAO Yearbook, *Fisheries Statistics* (1994).

the past quarter century, from about 10.5 kg in 1970 (Westlund, 1995) to 13.4 kg in 1994 (FAO, 1997).

While the developed countries consumed nearly 27 kg/capita of fish in 1991, developing countries as a whole consumed under 9 kg/capita (Phelan and Henriksen, 1995). The latter figures may be compared to 36.6 kg of milk and 17.7 kg of meat. 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. (Westlund, 1995) 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.*, 1997). It is however noteworthy that growth rates for poultry per capita consumed as food in developing countries were over 5 percent p.a. in the earlier period and 3 percent p.a. in the latter period (Ibid.).

The big growth in fish consumption in the developing world in recent years has been in China, starting from a very low base. In China in 1970, per capita consumption of fish was estimated at 3.6 kg; meat was 10.3 kg. By 1990, fish was 9.8 kg and meat was 27 kg, exhibiting very similar growth rates (Westlund, 1995). In southern coastal areas such as Guangdong, Westlund estimates per capita fish consumption at 35 kg. capita.

Fishery items consumed as food cover a large variety of species; pelagic and demersal fish combined account for about half on average in most areas. Table 7 shows trends for important areas of per capita consumption of these items.

Much of the growth in fish consumption in China has come from freshwater aquaculture production. The increase in per capita marine fish consumption has come mostly from pelagics. The same can be seen to be true for the rest of Asia and Africa, but not for the USA and Japan. Japanese consumption trends also reflect the beginnings of diversification out of a very highly seafood-intensive diet (71.5 kg/capita in 1994) into meat (FAO, 1997). In the U.S. and Western Europe, higher priced calories from higher quality fish is the likely route of the future, reflected in declining consumption of pelagics in the U.S. (mostly canned fish) and rapidly rising consumption per capita of demersals.

Projections of Fish Consumption

Policy research tends to be effective when it reduces the risks of uncertainty faced by investors and governments, both of whom need to take

Table 7: Per capita annual consumption of demersal and pelagic fish in selected countries, 1973-1993 (kilograms)

Year	China		Africa developing		Asia developing except China		USA		Japan	
	Pelagic	Demersal	Pelagic	Demersal	Pelagic	Demersal	Pelagic	Demersal	Pelagic	Demersal
73/75	.19	.85	1.81	1.20	2.22	1.45	3.80	4.12	19.39	29.11
76/78	.31	.68	2.44	1.47	2.36	1.57	3.44	4.38	18.50	22.68
79/81	.28	.81	2.81	1.63	2.40	1.46	3.48	4.28	19.55	17.64
82/84	.31	.75	2.60	1.58	2.66	1.43	3.16	5.00	21.18	16.89
85/87	.39	.71	2.43	1.05	2.55	1.50	3.65	6.13	20.57	18.19
88/90	.38	.72	2.45	1.37	2.64	1.43	3.43	8.68	18.83	17.55
91/93	.59	1.16	2.40	1.22	2.79	1.46	3.18	9.15	18.00	13.58

Source: Computed from FAO 1996a.

a long-term perspective about the world in which they interact. Therefore, projections of future fish consumption in different parts of the world, and of future fish prices relative to other items, are potentially of great interest for policy researchers and analysts.

Projections of fish consumption into the future tend to be scarce due to data limitations and methodological complexity. Because of data problems and the chosen focus on cereals, the detailed IFPRI global food projections to 2020 arising out of the IMPACT model do not include fish (Rosegrant *et al.*, 1995). The IMPACT model does include five sub-categories of livestock products, along with many other agricultural categories, and this work, updated in 1997, arguably employs the most theoretically satisfactory approach to projections in the current global modeling literature, based on heavy data input. The model includes substantial regional disaggregation, allows for endogenous formation of major prices, and generally reconciles supply and demand constraints.

FAO has done the only large scale modeling of long-term future fish demand on a global scale known to the authors. Although reported in different places, it is based on work with FAO's Food Demand Model, and appears to be most extensively documented in an appendix to Westlund, 1995. This work makes major simplifications in order to deal both with data limitations and the need for fast results. The cost is that it assumes constant relative prices for fish products into the indefinite future, which we have seen not to be the case in the past, and which FAO experts have clearly argued is not likely to be the case in the future (Westlund, 1995; Alexandratos, 1995; FAO, 1997).[5] The absence of real price variation therefore does not allow for substitution effects between fish and meat (and fishmeal and soymeal), nor does it allow for induced investment in fisheries from increased relative profitability. On the positive side, it is all we have and it addresses a critical set of issues.

The FAO projections predict an aggregate food utilization of fish of 110-120 million MT in 2010, compared to 75-80 million MT in 1994/95. Per capita consumption is expected to grow from 13 to 16 kg. Regionally, significant per capita growth occurs mainly in China and the high-income countries of East Asia. China's per capita consumption is projected to go from 9.8 kg in 1990 to 20 kg in 2010 (15 percent of total world consumption), an enormous increase when population growth is considered. The increase in the high-income countries of East Asia is projected to be an additional 14 kg over the 1990 total

[5] Other areas where the degree of detail in the existing quantitative fish projections is not clear include urban/rural differences in consumption patterns, detailed regional disaggregation of income elasticities, and formal incorporation of supply constraints, although all of these are addressed in detail outside the projections *per se.*

of 23 kg. Other growth is in North America (+5 kg in quantity, plus higher priced items) and Australasia (+3 kg). Otherwise, growth in per capita consumption is projected to be relatively stagnant (Westlund, 1995). Generally, the projections confirm the view that increasing aquaculture production will be associated with higher fish consumption in East Asia, and that quality upgrades will be important for growth in North American markets.

Further Evidence on Demand Projections

Although we do not have better global projections for fish consumption, we do have three kinds of evidence that can be used to improve our view of the future of fisheries demand. These are: (1) detailed and methodologically sophisticated fish consumption projections for China by Huang *et al.* (1997), (2) detailed estimates of future annual growth in consumption for beef and poultry at the global scale, using the IMPACT model, by Rosegrant *et al.* 1997, and (3) a growing literature of systems demand studies for individual countries that include disaggregated information on fish. The first set gives information on the part of the world market for fish that is growing the fastest. The second set shows what is happening to competing commodities. The third set can be used to elucidate income and substitution effects.

With regard to fish in China, Huang *et al.* (1997) distinguish rural from urban and a high income growth scenario from a low income growth scenario. Fish prices are not endogenous, but price substitution and income effects are allowed for. Under low income growth, per capita fish consumption in rural areas is projected to grow from 4 kg in 1991 to 8 kg in 2010, and to 10 kg in 2020. In urban areas under low growth, per capita fish consumption growth is from 12 kg in 1991 to 22 kg in 2010, and to 30 kg in 2020. Under high income growth, fish consumption in rural areas goes from 4 kg in 1991 to 12 kg in 2010, to 19 kg in 2020. In urban areas, it is projected to go from the current 12 kg to 35 kg in 2010 (like Scandinavia currently) to 61 kg in 2020 (like Japan currently). Thus income growth and urbanization are critical to fish demand in China. Huang *et al.* (1997) do back of the envelope calculations to show that urbanization alone will add 10 percent to China's fish consumption by 2020.

With regard to the second set of evidence, using the IMPACT model, Rosegrant *et al.* (1997) project for developing countries as a whole over the 1993-2020 period annual growth in total food demand for beef of 2.78 percent p.a., and 3.14 percent for poultry. The comparable figures for developed countries are 0.28 percent p.a. for beef and 0.94 percent p.a. for poultry. Combined with the fact that population growth will occur primarily in the developing countries, it is clear where the significant growth in demand for animal protein will occur. Furthermore, projected total demand growth is higher in Southeast Asia (3.60 percent p.a. over the period for all meats) and in Sub-Saharan Africa (3.38 percent p.a. for all meats).

Turning to the third type of evidence, properly executed systems demand studies that include the significant complements and substitutes for fish, as well as fish itself, give us considerable perspective on the effects of income and different prices on fish demand. A series of relatively recent studies of this type was surveyed, and four "polar" country studies are reported in Appendix Tables 1 and 2. These were chosen by separation of the studies between developed and developing countries, and choosing "high" and "low response" countries for each group. The elasticities in the appendix are converted for presentation into more user-friendly bar charts in Figures 1 and 2.

Figure 1 shows the importance of income response assumptions to projections of demand. Among developed countries, total expenditure on fish in the U.S. is seen to be highly sensitive to income. Under income growth, U.S. consumers substitute higher priced calories for lower priced ones, rather than increase their caloric intake. It is likely that choice seafood items are being substituted for meat. Grain intake does not grow with income. Norway, on the other hand, represents the case of a developed country where fish is a staple. With income growth, consumers are substituting beef for fish, although total expenditure on fish continues to rise.

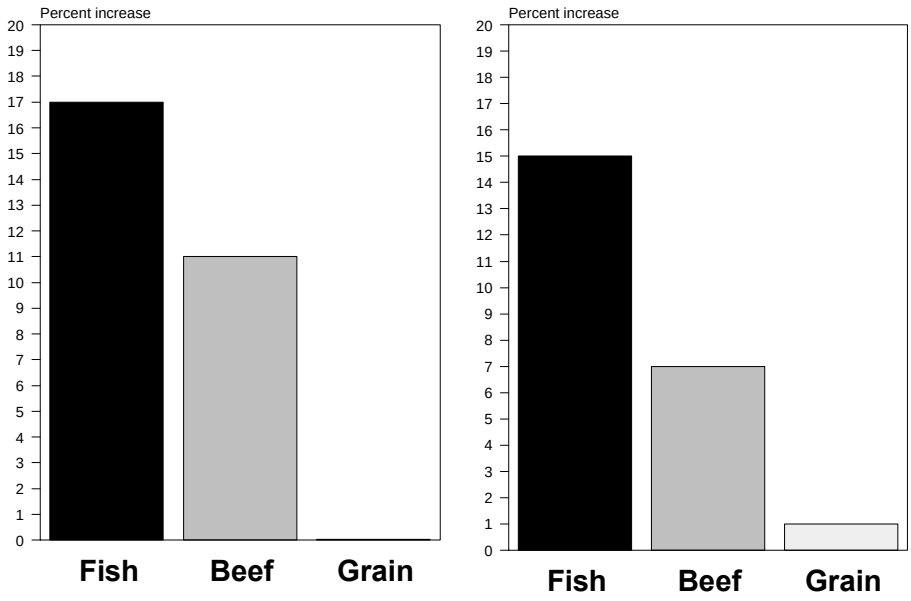
Among poorer countries, China has high fish response, although it is doubtful that fish is being substituted for beef. Instead, consumers are increasing their overall animal protein intake as income rises, and fish is the commodity most in vogue at this time, perhaps due to increased availability. Egypt, on the other hand, already has significant exposure to fish because of the close proximity of virtually the entire population to fish-bearing bodies of water. Incremental demand for animal protein appears to be relatively low, as income increases are associated more with attempts to diversify the diet. Clearly very different mechanisms are at work in the four cases, which illustrates some of the difficulties of global modeling, even with regional disaggregation.

The detailed country demand studies do allow a view of price-substitution relationships among commodities, and the likely reaction of consumers to changes in relative prices. These are partial equilibrium relationships, and therefore are only indicative of the overall impact of price changes.[6]

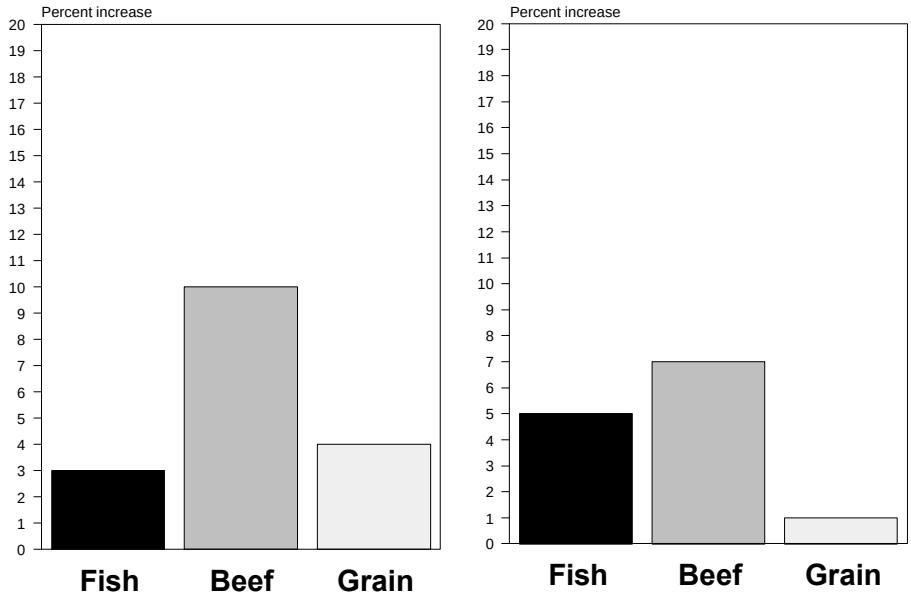
[6] However, they are based on compensated elasticities, that are adjusted to allow for the fact that price changes also affect consumption through changes in overall purchasing power, and this "income effect" of prices is compensated for.

Figure 1: Effects of a ten percent increase in income on consumption of fish, beef, and grain

More responsive

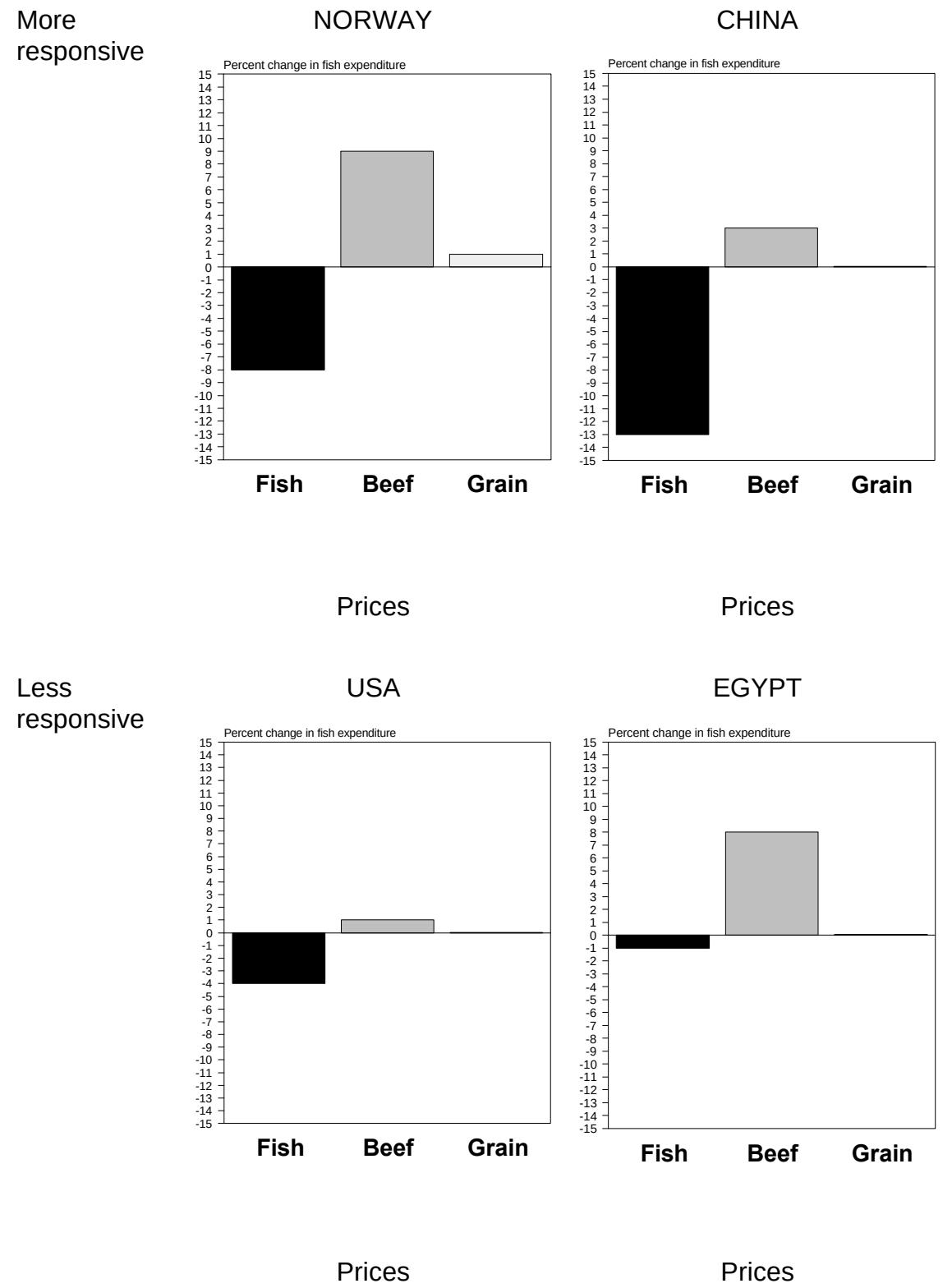


Less responsive



Sources: See Appendix Table 1.

Figure 2: Effects of a ten percent price increase on consumption of fish



Source: See Appendix Table 2.

Figure 2 shows the impact on demand for fish of a 10 percent change in the price of each of three commodities. Fish consumption falls when its own price rises in all four countries, since it is more expensive. Fish price increases affect demand most in China. A rising fish price is bad news for fish producers in China (besides consumers), since a 10 percent price increase for fish is forecast to provoke a 13 percent cutback in expenditures on fish. The effect of higher fish prices in China is lower fish producer revenues. More revenue is lost through decreased sales than is gained through higher prices. In Norway, higher fish prices also have significant effect on the amount of fish consumed, and it seems unlikely that producers would gain much revenue from higher fish prices. In the U.S., higher fish prices increase the revenues of fish sellers (a 10 percent rise in prices is associated with only a 4 percent fall in sales). In Egypt, higher fish prices hardly affect fish consumption, suggesting that producers and sellers can potentially capture most of the increased revenue from higher prices.

Beef sellers should not be indifferent to these results. In countries where fish consumption is an important part of the diet, such as Norway and Egypt, beef prices have significant opposite effects on fish consumption; higher beef prices increase fish demand on almost a one percent for one percent basis. Since cross price effects such as these tend to work in both directions, higher fish prices are likely to affect beef consumption significantly also. In Norway, consumers appear to be ready to shift from fish to beef, and back, rather responsively. In relatively poor China, the effect of higher fish prices may be to provoke a cut-back in fish, with relatively minor substitution into beef; possibly some of this decreased demand for fish shifts to other proteins. In the U.S., where fish is hardly a staple food, fish consumption patterns tend to be rather unresponsive to prices of either fish or beef. In all four countries, fish consumption is not much affected by grain prices.

If we accept the view in Rosegrant *et al.* (1997) that world beef prices are likely to decline about 5 percent in real terms by 2020, and the emerging consensus that real fish prices are likely to rise on the order of magnitude of 10 percent, we would look for a long run change in relative fish / beef prices of 15 percent. As seen above, this is actually a rather conservative estimate, given the three-fold decline in the price of beef relative to fisheries products since 1970 (Table 5). Coupled with the cross-price elasticity estimates between fish demand and beef price in Figure 2, other things equal, this implies major adjustments in world markets for both fish and beef. In China, for example, thought to account for roughly 15 percent of world fish consumption in 2010 under constant prices (Westlund, 1995), such a relative price increase for fish would imply that fish demand would be 13-16 percent lower than it would have

been if world relative prices had stayed at 1990s levels.[7] In Egypt, beef demand would be at least 10 percent higher.

Conclusions

This paper has attempted to raise empirical and analytical issues from the recent literature pertaining to fish exports and consumption in developing countries, recognizing the increasing interrelatedness of events affecting fisheries around the world. It has highlighted major changes in the world over the past 15 years that imply that bodies interested in poverty alleviation and growth in the developing world cannot ignore the potential impact of fisheries on real incomes of producers and consumers.

Fisheries are increasingly becoming one of the means that the developing world can use to pay for what by common agreement will be burgeoning cereals imports from the developed countries over the next 20 years. The developed countries are clearly going to become even more significant net importers of fish than they are presently (85 percent of net imports in 1994). Markets for high-value products, and for inputs to produce these items (such as fishmeal) will continue to expand rapidly. Fisheries have already surpassed the traditional export crops as a foreign exchange earner for developing countries (US$19.7 billion in 1993 in current dollars). Prospects for aquaculture-based high value exports appear good, at least from a market-outlet perspective. It seems likely that policy attention to fisheries issues will increase as was the case previously for cash crops in developing countries, once policymakers in those countries recognize that fisheries issues are no longer an obscure sectoral concern, or solely a welfare consideration for coastal people.

As this policy attention increases, the glaring knowledge gaps will become more obvious. The most obvious one in the context of this paper is that we really have little idea of the forces driving relative fish prices, at least in a quantitative sense that would permit consistent long-term prediction. Data availability is improving, and this area needs to become better integrated within mainstream food modeling.

Second, sectoral marketing policies, as well as trade liberalization, will do much to permit the expansion of high-valued fisheries production in the developing countries. However, fisheries products, like milk, meat and other perishables, tend to be associated with high transactions costs in trade, since

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[7] These partial equilibrium estimates should not be over-worked, but they are indicative of orders of magnitude: 10% fish price change times 1.3 price elasticity of fish demand plus 1-2% (0.3 X 5%) further decrease in demand for fish because of lower beef prices.

processing is an important part of value-added, and consistency and trust are so important in quality control along the market chain. The high importance of transactions costs in the growth of fisheries exports for developing countries suggests an important role for governments in fisheries, not as a substitute for producers or traders, but as builders of infrastructure, enforcers of rules, and facilitators of information flows.

Third, many of the high value opportunities in fisheries are capital and information intensive, which will mean that artisanal fisherfolk will have trouble participating in the fisheries boom without participatory institutions of collective action to allow them an equal footing. Governments faced with a need to involve such populations need urgently to explore how they can facilitate the growth of such institutions without stifling them. Many issues appear, at least on the surface, to be similar to the construction of smallholder dairy systems in tropical climates. There may be symbiosis to explore here.

Finally, this paper has intentionally ignored supply side issues such as technology development and environmental questions, to avoid duplication. Yet there is an urgent need for more policy research on the full costs and returns to technology development in fisheries, especially for aquaculture adapted to the needs of rural and coastal people in developing countries. This may end up being one of the most important policy areas to explore.

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Appendix Table 1: Income effects on fish, beef, and grain expenditures[a] (percent)

Effect on	Developed		Developing	
	More responsive (USA)[b]	Less responsive (Norway)[c]	More responsive (China)[d]	Less responsive (Egypt)[e]
Fish expenditure	1.7	.3	1.5	.5
Beef expenditure	1.1	1	.7	.7
Grain expenditure	0	.4	.1	.1

Sources and notes:

[a] Total expenditure elasticities, rounded to one decimal place.
[b] The fish and beef elasticities are from Gao and Spreen (1994). The beef elasticity is the average of steak, roast, and ground beef expenditure elasticities. The 'cereals and baking products' estimate is from Brandow (1961).
[c] Fish, meat, and 'bread and cereals' elasticities from Edgerton et al. (1996).
[d] Fish, 'beef and mutton,' and grain expenditure elasticities from Huang and Bouis (1996). The values are averages of urban and rural estimates.
[e] Fresh fish, fresh meat, and balady flour expenditure elasticities from Alderman and von Braun (1984). The values are averages of urban and rural estimates.

Appendix Table 2: Price effects on fish consumption[a] (percent)

Effect of a	Developed		Developing	
	More responsive (Norway)[b]	Less responsive (USA)[c]	More responsive (China)[d]	Less responsive (Egypt)[e]
One percent increase in the price of fish	-.8	-.4	-1.3	-.1
One percent increase in the price of beef	.9	.1	.3	.8
One percent increase in the price of grain	.1	0	0	0

Sources and notes:

[a] Compensated price elasticities from expenditure systems estimators, rounded to the first decimal place.

[b] Own-price elasticity and cross-price elasticities of fish demand with respect to meat and 'bread and cereals' prices from Edgerton et al. (1996).

[c] Own price elasticity and the average of the cross-price elasticities of fish demand with respect to retail steak, roast, and ground beef prices from Gao and Spreen (1994). The cross-price elasticity of fish demand with respect to cereals is from Brandon (1961).

[d] Compensated own-price and 'beef and mutton' and grain cross-price elasticities of fish demand are calculated from data reported in Huang and Bouis (1996). The values are averages of urban and rural estimates.

[e] Own-price elasticity, and cross-price elasticities of demand for fresh fish with respect to prices of fresh meat and balady flour are from Alderman and von Braun (1984). The values are averages of urban and rural estimates.