How far can we get toward net zero emissions by changing patterns of food demand?

Food, feed, fuel, other industrial products

\[ D = f(\text{population, income, relative prices, urbanization, tastes...}) \]

(Income elasticity of demand)  (Price (and cross price) elasticity of demand)

Consider differences between:

- Food preferences (what people want to eat)
- Nutritional requirements (what people need for a healthy life)
- Effective demand (what people can afford)
Chad

Ecuador

United States

Mexico

Photographer Peter Menzel and wife Faith D’Aluisio: 2005: *Hungry Planet: What the World Eats*
Measuring Food Consumption

- Paucity of high-quality consumption data comparable across all regions.
- Mainly estimated from production and trade data - food availability (FAO Food Balance Sheets)
- Feed conversion ratios difficult to estimate by commodity, live vs. edible weights
- Co-products (soy), processing waste (input to feed), food waste

D = f(population, income, relative prices, urbanization, tastes...)

Key parameters:
- Location and growth in population
- Income growth, income distribution, and income elasticities

- 20% of SSA countries have per capita income growth >3% pa
- 30% of SSA countries have per capita income growth >3% pa
What impact does a 5% GDP growth rate in China have on global food emissions?
D = f(population, income, relative prices, urbanization, tastes...)

Key parameters:
- Population
- Income
- Changes in relative prices and substitution effects
- Emergence of new food products (Says Law)

Substitution between commodities within groups:
- Large cross price elasticities (oils)

Substitution between groups of commodities:
- Smaller cross price elasticities (meat-fish-other proteins)
Demand for Protein

All regions exceed protein requirements on average.
For world as a whole, plant-based sources of protein are more important than animal products.

FIGURE 5 Per capita protein consumption by region and source (kg/cap/year), 1980, 2000, and 2019

NOTE: The animal protein category includes protein from all terrestrial meat, fish (including crustaceans, cephalopods, and mollusks), dairy, and eggs. The vegetable protein category includes protein from cereals, pulses, fruits, vegetables, starchy roots, tree nuts, oil crops, sugar crops, alcoholic beverages, and all other nonanimal sources.
SOURCE: FAO (2021a).

Src: Falcon, Naylor, Shanker (2022)
Examples of changes in demand during past 20 years that were NOT projected accurately in 2000:

- 35% growth in pork consumption in China
- 15% decline in beef consumption per capita in USA
- 60% increase in milk consumption in India
- Doubling of fish consumption in Bangladesh
- Huge rise in global poultry consumption...

![Graph showing changes in meat and fish consumption](image-url)
<table>
<thead>
<tr>
<th>Region</th>
<th>2019</th>
<th>2050 (estimates)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beef</td>
<td>Pork</td>
</tr>
<tr>
<td>East Asia</td>
<td>14.9</td>
<td>71.5</td>
</tr>
<tr>
<td>Europe/C. Asia</td>
<td>12.3</td>
<td>24.2</td>
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<td>Latin America</td>
<td>15.0</td>
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<tr>
<td>MENA</td>
<td>2.9</td>
<td>0.0</td>
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<tr>
<td>North America</td>
<td>13.4</td>
<td>11.1</td>
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<tr>
<td>South Asia</td>
<td>3.9</td>
<td>0.4</td>
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<tr>
<td>Sub-Saharan Africa</td>
<td>5.3</td>
<td>1.8</td>
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<tr>
<td>World</td>
<td>67.6</td>
<td>117.6</td>
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</tbody>
</table>

NOTE: Meat is disaggregated by beef, pork, poultry, and other meat, and is expressed in dressed carcass weight. The fish category includes fish, crustaceans, cephalopods, and other mollusks, and is expressed in edible weight with the conversion from live-to-edible based on conversion factors from Edwards et al. (2019).

SOURCE: FAO (2021a).

Feed sources and substitutions, novel feeds, processing wastes in feeds