What Are the Best Policies to Promote Ag-Related R&D?

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Projected World Food Demand

- World food demand could double by 2050
  - 50% increase from world population growth from 6 to 9 billion – all in developing countries
  - 50% increase from broad-based economic growth in low income countries
- How many presently low income consumers are lifted out of poverty will be the *most important* determinant of the future global demand for food.
- The World Bank estimates that the number of people in developing countries living in households with incomes above $16,000 per year will rise from 352 million in 2000 to 2.1 billion by 2030.

Growing Demands on Forests, Too

- The same forces of population and income growth that increase demand for food also increase demand for things made out of wood, e.g. paper, furniture, building materials; poles.
- In rich countries, growing demand for environmental amenities and preservation of (especially old-growth) forested areas.
- Now biofuels production is claiming more and more land to grow feedstocks.

The Land Constraint

- There is at most 12% more arable land available that isn't presently forested or subject to erosion or desertification – and degradation of many soils continues.
- The area of land in farm production could be doubled…
- But only by massive destruction of forests and loss of wildlife habitat, biodiversity and carbon sequestration capacity
- The only environmentally sustainable alternative is to at least double productivity on the fertile, non-erodible soils already in crop production.

Water A Growing Constraint

- Farmers use 70% of the fresh water used in the world. They are both the largest users and the largest wasters of water.
- Water is priced at zero to most farmers, signaling that it is much more abundant than in reality. Anything priced at zero will be wasted.
- With rapid urbanization, cities are likely to outbid agriculture for available water.
- The world's farmers need to double food production using less water than today. Biofuels will add further to this challenge.

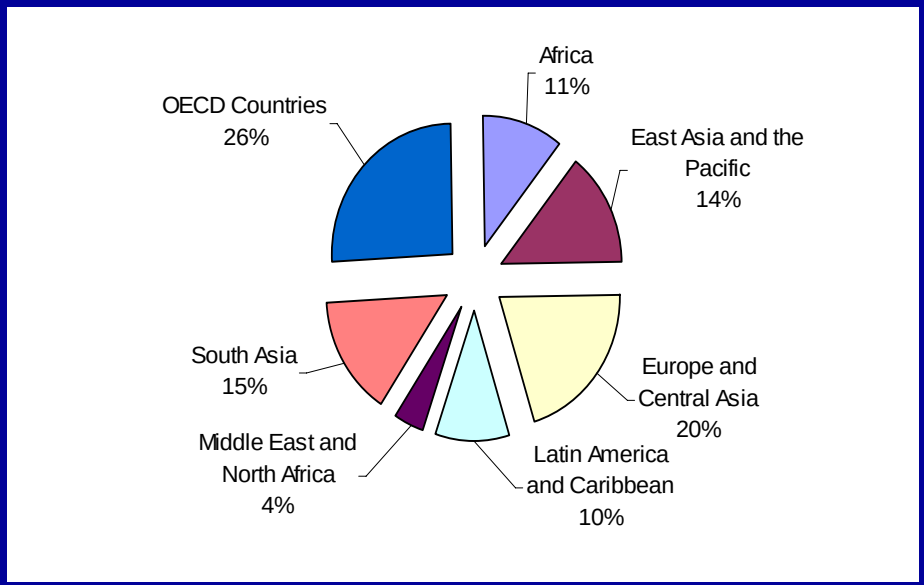
Research Investment Essential

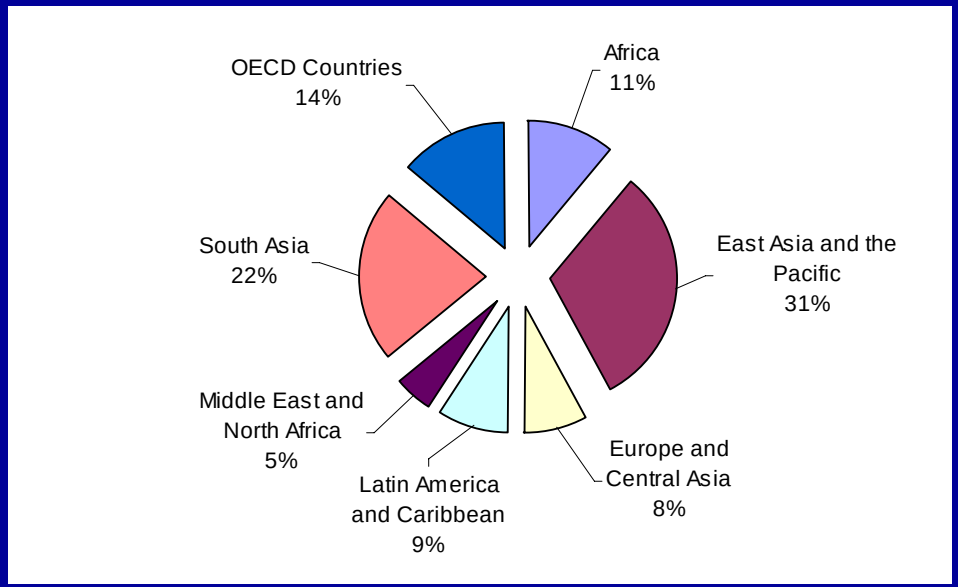
- Since Malthus, prophets of doom have argued population growth will increase food demand faster than agricultural production can grow.
- Public and private sector investments in agricultural research have increased productivity faster than demand growth, with resulting 150 year downward trend in real price of grains.
- Need to more than double world ag production using less water and little more land than today.
- Future world market price trend will depend on whether research increases land and water productivity faster than world demand grows.

Larger Fraction of World Ag Production to Move Through Trade

- The world's arable land and fresh water are not distributed around in the world in the same proportions as is population.
  - No way for Asia or Middle East to be self-sufficient in food
- With population growth, urbanization and broad-based economic development, many LDCs' food consumption to outstrip their production capacity and they will become larger net importers.
- Efficient producers of animal products, grains and oilseeds, wherever they are, will benefit.

The World's Arable Land (left) Is Distributed Very Differently than Its Population (right)





Exports Are Critical to Ag Profitability

- American agriculture exports the production of one out of three acres of cropland. These exports generate 1/4 of farm sales revenue.
- In 2006 U.S. ag exports totaled $68 billion:
  - Grains & oilseeds $28.4 billion
  - Horticultural products $16.7 billion
  - Animal protein $13.2 billion
  - Cotton $ 4.9 billion
- Most important markets:
  - Canada 18%
  - Mexico 16.5%
  - Japan 12%
  - China 11%
  - E.U. 10%

U.S. Ag Competitiveness

- Fertile soils and favorable climatic conditions are fundamental, but…
- Investments in productivity-enhancing ag research by the public and private sectors and in infrastructure that reduces cost of transport are at least as important.

U.S. Role in World Trade (2002-05)

Commodity	% of World Production	% of World Trade	% of Prodn Exported
Cotton	20	40	70
Corn	40	60	18
Soybeans	38	44	35
Wheat	9	25	50
Rice	2	13	52

Source: Congressional Research Service

U.S. Farm Policy Is Much More than Price & Income Support

- U.S. farm policy is much more than commodity price & income support programs
- When Congress passes agricultural legislation ("farm bills"), it authorizes USDA programs, but nothing happens unless Congress annually appropriates funds for each program.
- 93% of farm program payments go to growers of 5 commodities, and 2/3 of U.S. agriculture receives no commodity support payments, but most is affected by some USDA program(s).

USDA Expenditures, 2005

Program	$ billions
Farm Commodity Programs	39.6
Foreign Programs	5.3
Rural Development	14.3
Food and Nutrition	51.0
Food Safety	0.9
Natural Resources & Environment	8.7
Marketing & Regulation	1.8
Research, Education & Economics	2.7
USDA administrative overhead & other	0.5
Total	124.9

The Current Farm Policy Landscape

- Many farm groups happy with 2002 Farm Bill.
- Rapid growth of ethanol industry with resulting increase in crop prices
  - There's more interest today in ethanol than exports.
  - There's little for corn, soybeans, or wheat in extending 2002 Farm Bill.
- Significant reduction in CBO's budget baseline for ag commodity programs
  - Direct payments and research budget are seen by many farm organizations as place to raid to cover cost of increasing price and income supports

Current Policy Environment (continued)

- WTO trade negotiations and threat of more litigation in WTO continue.
- Unprecedented anti-farm program editorial comment in media across the country
- Numerous groups have proposed alternatives to present farm programs, including Bush Administration

Two Fundamental Philosophical Questions in Writing 2007 Farm Bill

- Of the Federal dollars allocated to agriculture and rural America, how much should go to farmers as individuals & how much should be invested for the greater good of agriculture and rural America?
  - E.g., agricultural research & rural infrastructure
- Of the fraction that goes to farmers as individuals, how much should be linked to the production of *specific* commodities & how much should be decoupled from what the farmer produces?

U.S. Ag Productivity Growth Success Story

- In 2002, U.S. farm output was 2.6 times larger than what it was in 1948.
- It was produced with fewer total inputs than were used in 1948!
- This was a much higher productivity growth rate than in the rest of the U.S. economy!
- The estimated annual real rate of return on public investments in agricultural research is in the range of 30-60 percent – one of the highest payoff investments in the American economy!

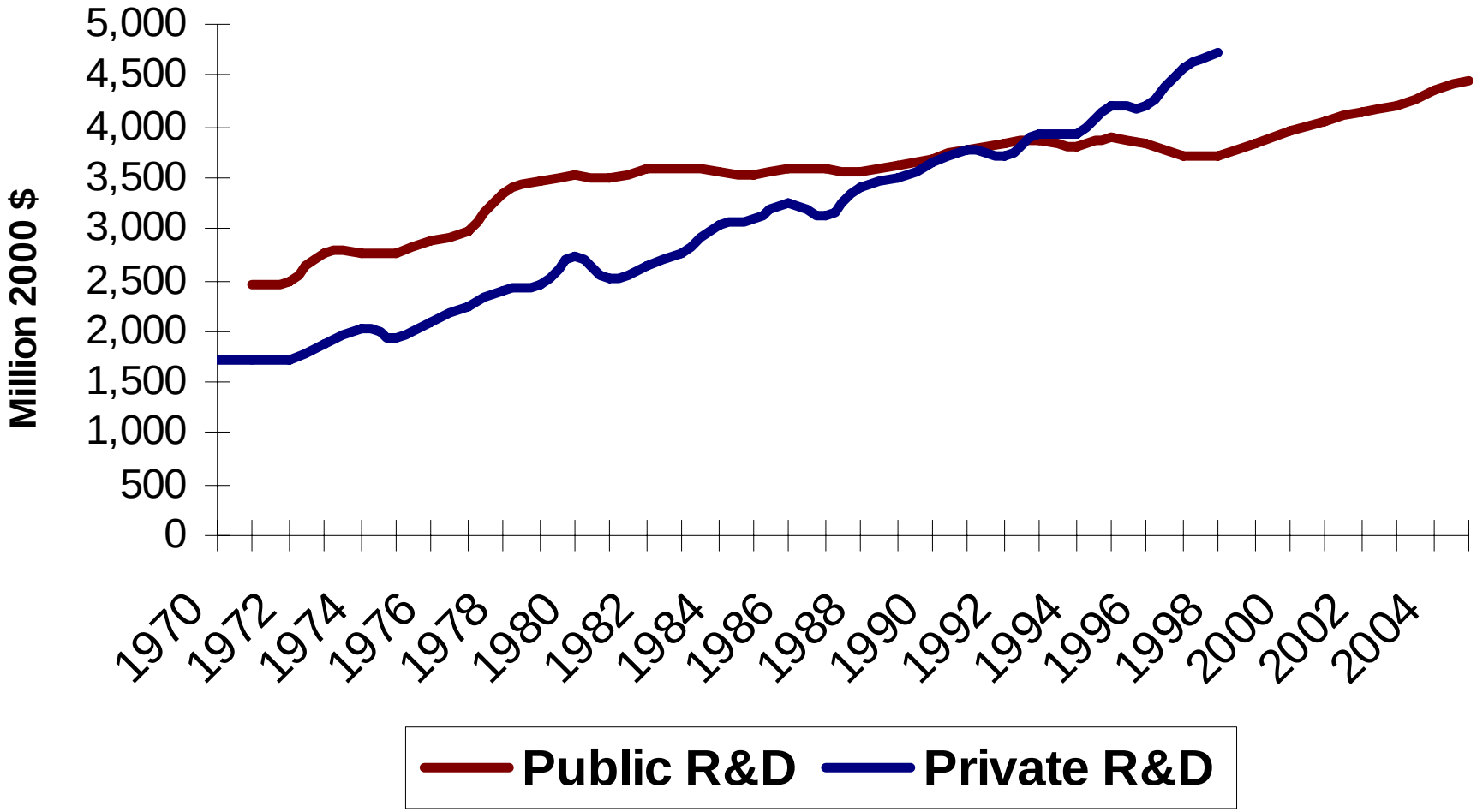
Public vs. Private Ag Research

- Historically public support of biological research key to agricultural development (“public good”)
- Private sector did most of the mechanical, pesticide & animal pharmaceutical research (could patent resulting intellectual property)
- Private sector role in biological ag research only took off after late 1970s when Congress reduced appropriations for research and encouraged the private sector to take on this role.
- Private investment in ag research is now more than twice as large as public investment.

Need Both Public & Private Agricultural Research

- There are many areas of research in which the private sector will invest less than the social optimum, such as:
  - Basic research: Payoff is too uncertain and too far in the future
  - Where hard to protect intellectual property, e.g. open-pollinated varieties
  - Where no market exists, e.g. conservation and public policy
- Universities must be involved to produce credible PhD researchers for the private sector to hire.

Public and private sector investments in R&D



U.S. Ag Research Issues

- Balance between public and private investments in agricultural research
  - Level of public funding more important than how we structure administration of the funds!
- Balance between formula funds and competitive grants
- USDA research grants inadequate relative to NSF & NIH (too few dollars & too short duration)
- Earmarking
- Indirect cost recovery (overhead) rate

Other U.S. Research Issues

- How efficient is our present Federal ag research system?
  - How many Land-Grant Universities and ARS labs are needed? ARS – Land-Grant balance?
- What role agricultural extension in the future for agricultural tech. transfer?
- How to attract more bright young Americans into ag sciences? Need immigration reform to allow more foreign Ph.D. students to stay in the U.S.

International Ag Research

- Under-funding by national governments, foreign aid programs and World Bank.
  - Agriculture has been off the international development agenda
  - Nutritional deficiency diseases have been off the international health agenda