



The role of technology in accelerating economic growth

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USAID/KARI/IITA – USAID African Partnership in Biotechnology, Nairobi 21-23 October 2002

Outline

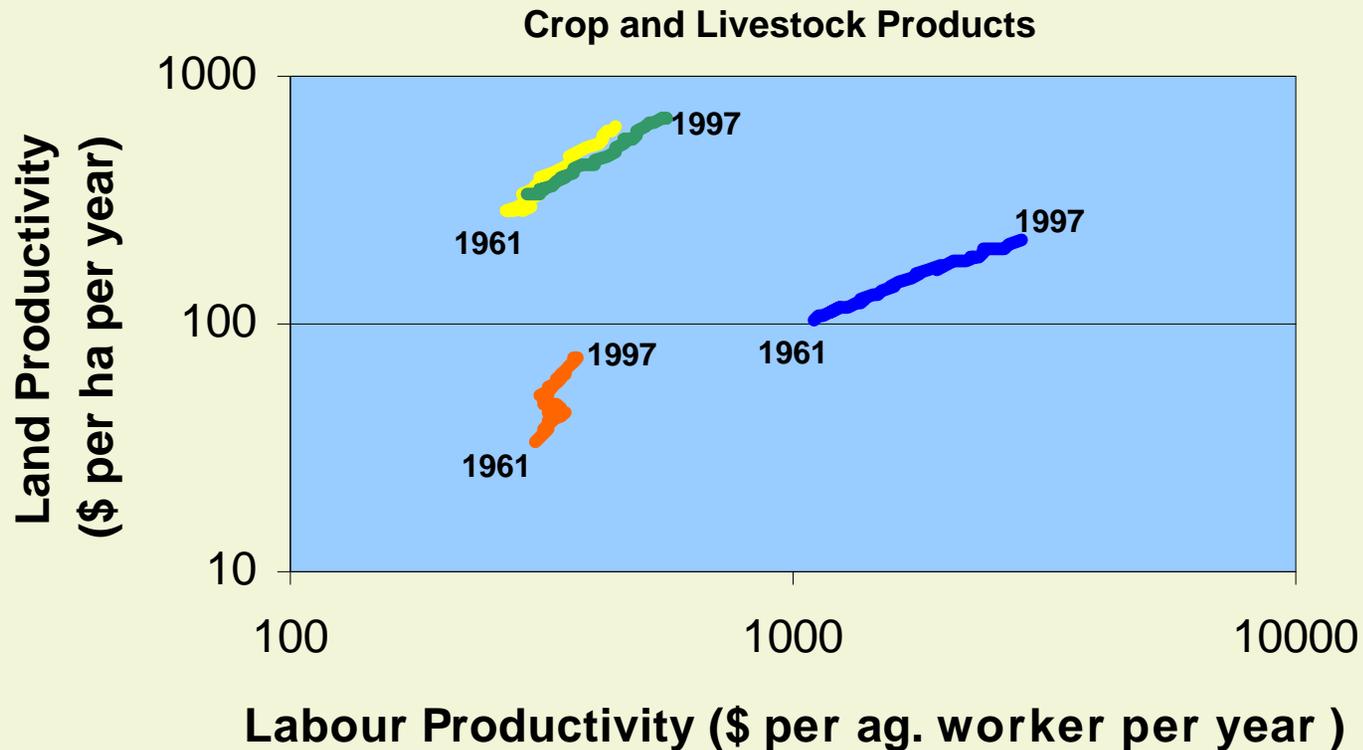
- ❖ **What's happening to agricultural productivity?**
- ❖ **How can technologies help improve productivity and welfare?**
- ❖ **Some empirical evidence on income and growth effects of ag. technologies**
- ❖ **Sub-regional platforms for the strategic evaluation of technologies**

Technology as a Key Growth Strategy

- NEPAD (Science & Technology Platforms)
- World Bank's new Rural Development Strategy. Priority #1 (Fostering Broad-Based Growth)
- Partnership to Cut Hunger and Poverty in Africa
- USAID's Agricultural Initiative to Cut Hunger in Africa
- 2020 Bonn Conference. S&T as a driver of change and investment priority

What's happening to agricultural productivity in Africa?

Land and Labour Productivity (1961-97)

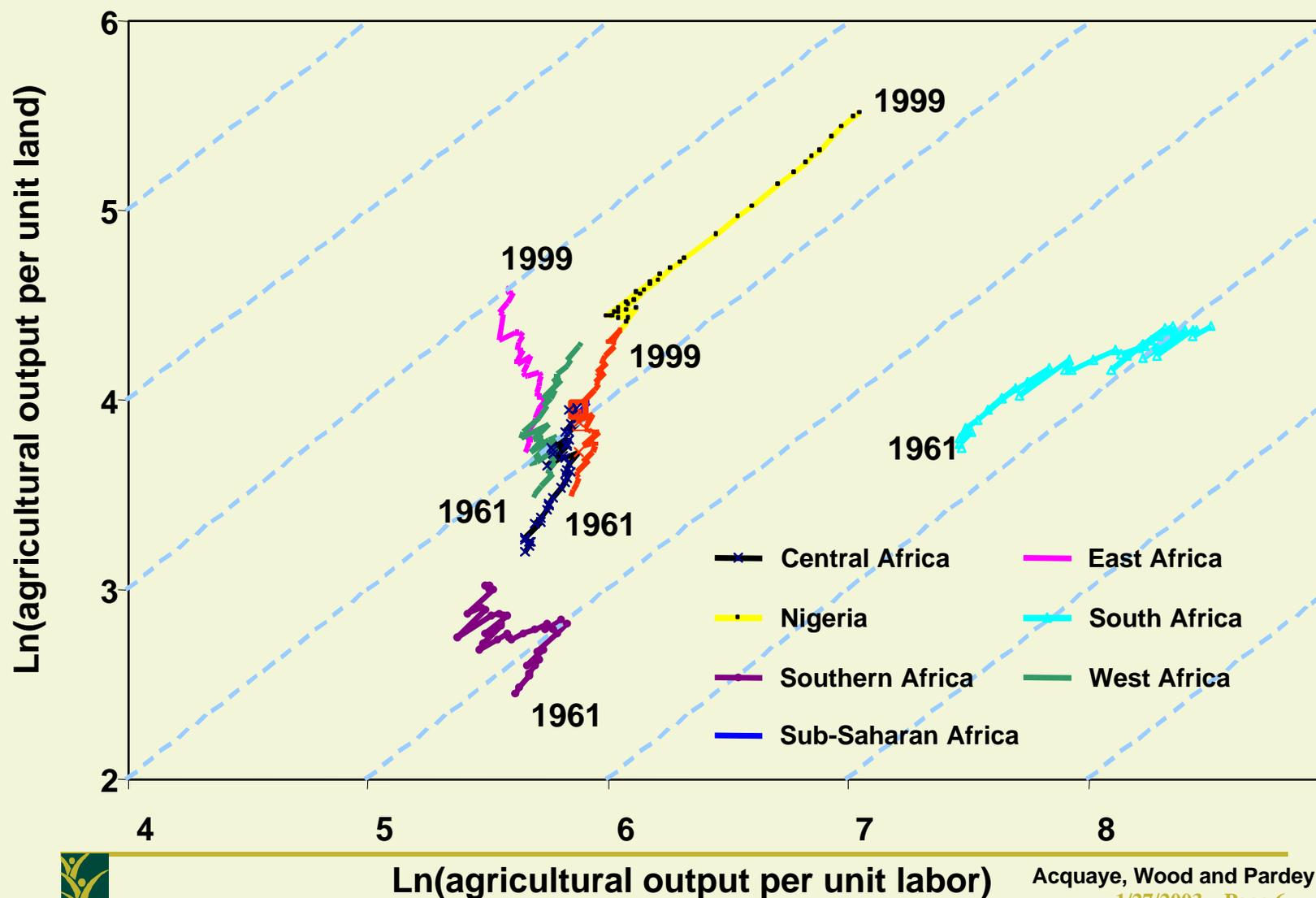


— Tropical LAC
 — Tropical SSA
 — Tropical SAsia
 — Tropical S Asia

\$ = 1989-91 International Dollar

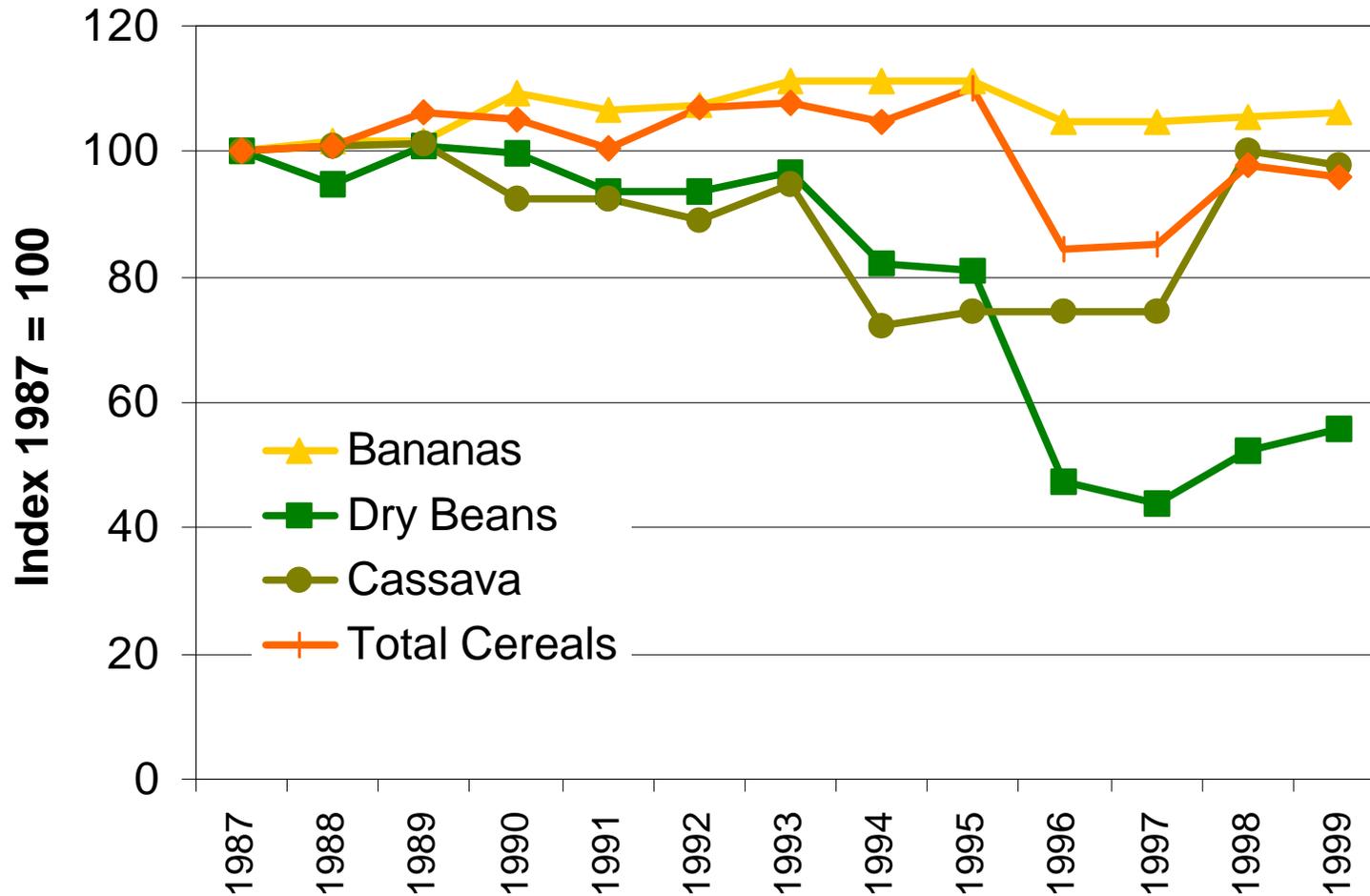


SSA Agricultural Productivity (1961-99)



Yields of Basic Food Crops

Uganda 1987-1999



How can fostering the generation and adoption of new technologies help?

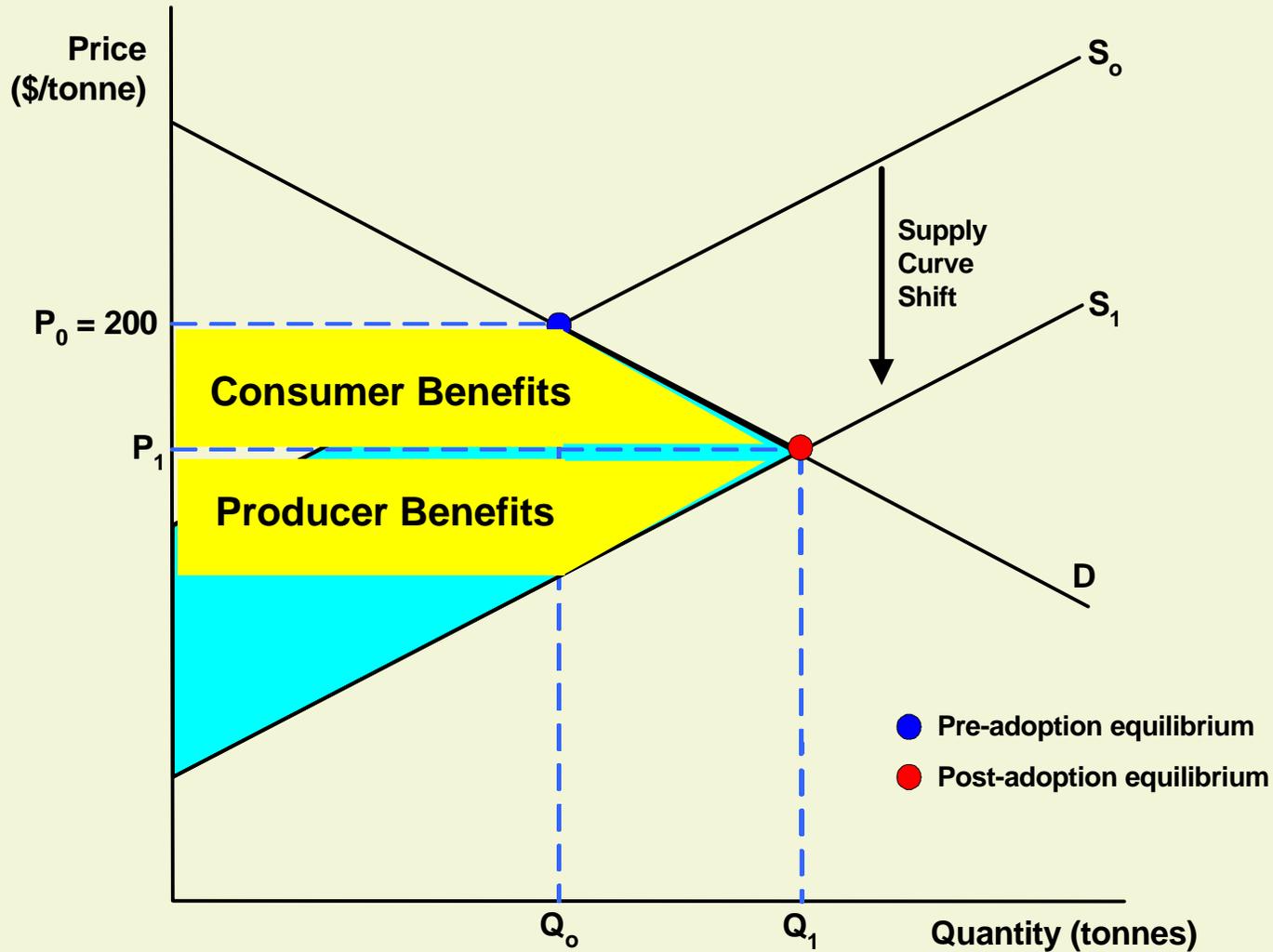
Potential Direct Effects of Technology Adoption - I

- **increase/stabilize yields** (*per unit of input*)
- **decrease inputs** (*per unit of output*)
- **increase output quality, e.g.,**
 - *improve processing characteristics*
 - *target consumer preferences*
- **decrease post harvest losses and marketing costs, e.g.,**
 - *reduce perishability*
 - *improve storage and handling qualities*
- **diversify products and their utilization**
- **improve timing with regard to agronomic and market opportunities**

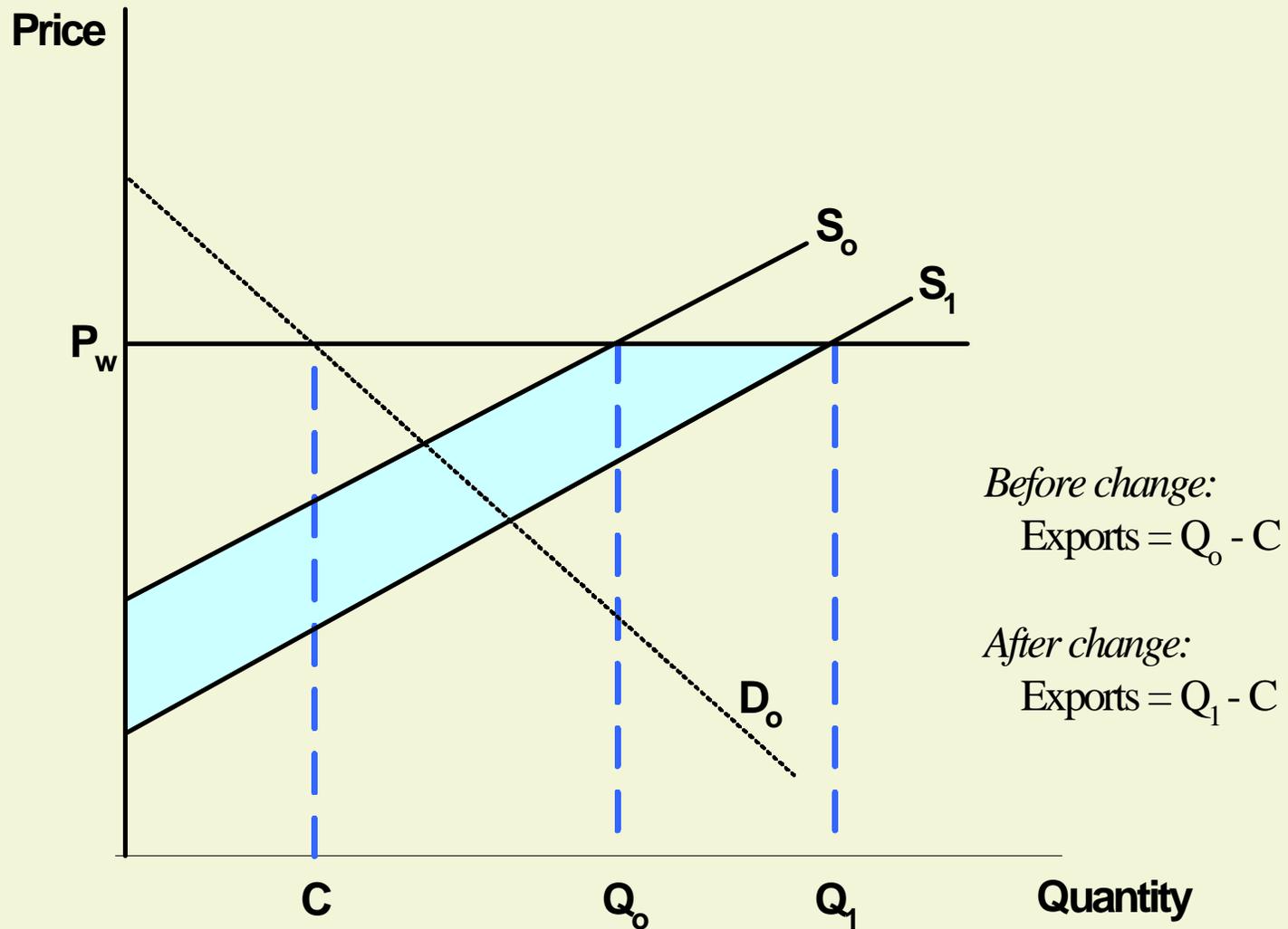
Potential Direct Effects of Technology Adoption - II

- impact sectoral balance of winners and losers amongst producer groups (e.g. pro-growth, pro-poor targeting)
- impact intrahousehold balance of empowerment and resource use (e.g., choice of technology and use of increased income as influenced by gender)
- impact on natural resources and ecosystem services
- potential conflicts with trade/market policies or regulations

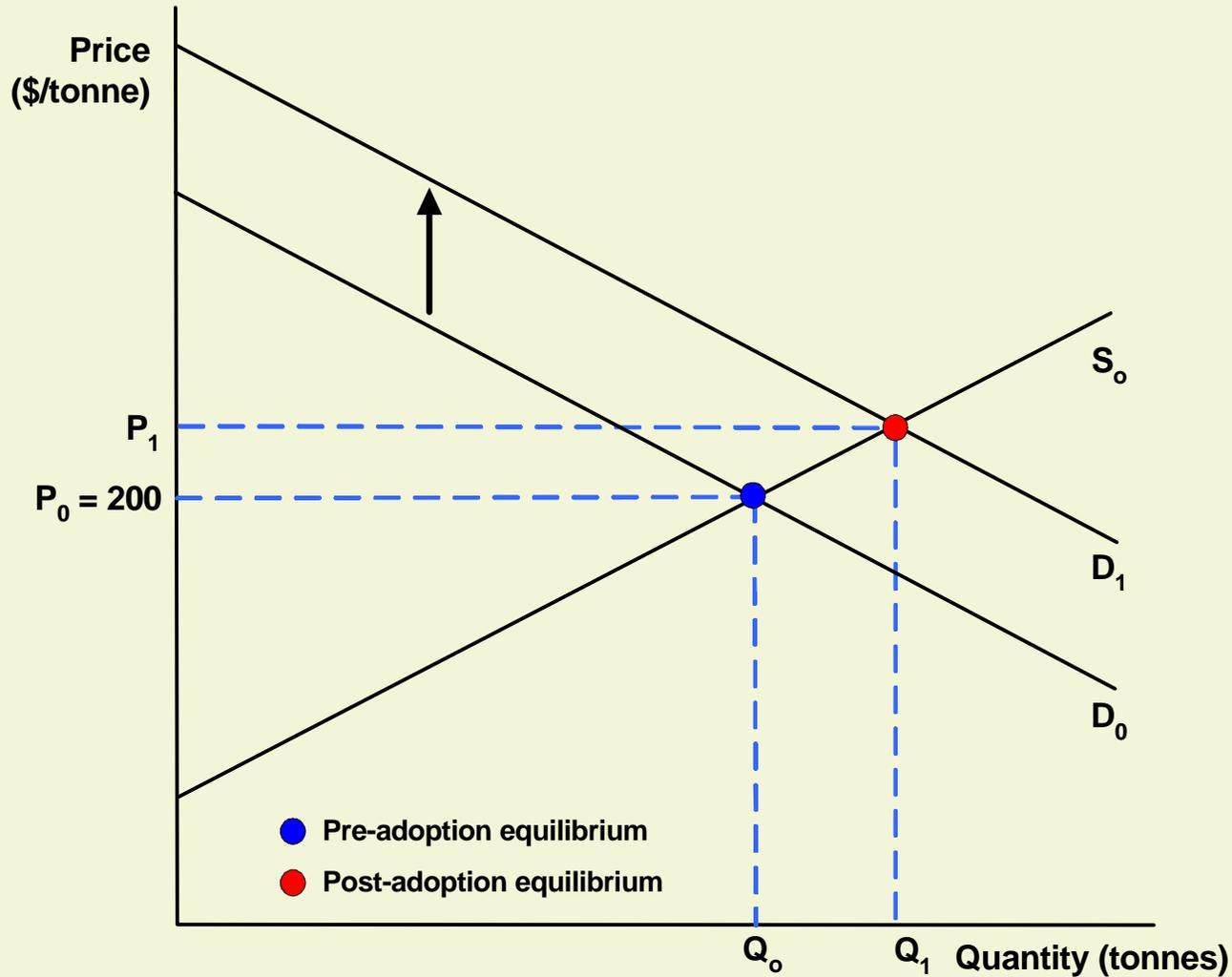
Direct Welfare Benefits of Technology



R&D-Induced Increase in Exports



R&D-Induced Demand Expansion/Quality Change



Benefits and Growth Linkages

- producer (adopter) welfare: production for home consumption, gross revenues of sales, production costs
- consumer welfare through increased availability and lower cost of food
- employment and livelihood in rural areas
- multiplier effects through growth linkages
- availability of raw materials to growing industrial sector
- Earning and saving of foreign currency

Some empirical evidence on the economic impact of technology investments

Payoffs to Agricultural R&D

	Rate of Return		
	Median	Mean	Std. Dev.
	<i>(percent)</i>		
Developed	39	66	120
Developing	50	59	38
<i>Africa</i>	36	46	27
Asia and Pacific	56	77	52
LAC	48	52	27
Developed, up to 1985	41	80	153
Developed after 1985	34	57	93
Developing up to 1985	48	55	32
Developing after 1985	51	60	40

Source: Roseboom 2002, Based on Alston et al 2000

Payoffs to the Poor from Agricultural R&D, contd

India: Number of Poor Reduced Per Million Rupees, 1995

Public Investment Category	Urban Poor	Rural Poor	Total Poor
Agricultural R&D	72.1	84.5	156.6
Rural Roads	28.4	123.8	152.2
Rural Education	7.4	41.0	48.4
Rural Development	5.9	25.5	31.4
Soil and Water Conservation	5.2	22.6	27.8
Rural Health	4.6	17.8	22.4
Irrigation	7.3	9.7	17.0
Rural Electricity	1.4	3.8	5.2

Source: Shenggen Fan 2002

Preliminary results for Uganda due by early November!

Payoffs to the Poor from Agricultural R&D

Poor benefit through “direct” and “indirect” effects of increases in agricultural productivity, e.g., in Africa a 10% gain in factor productivity → 7.6% gain in real income for the rural poor, 77% percent of which comes from direct effects (4.3% income gain for urban poor)

To maximise direct income effects, technological change needs to focus on small farmers’ crops that are maximally tradable (often high value export crops not staple food crops)

Source: De Janvry and Sadoulet, 2002

Multiplier Effect of Increased Farm Income

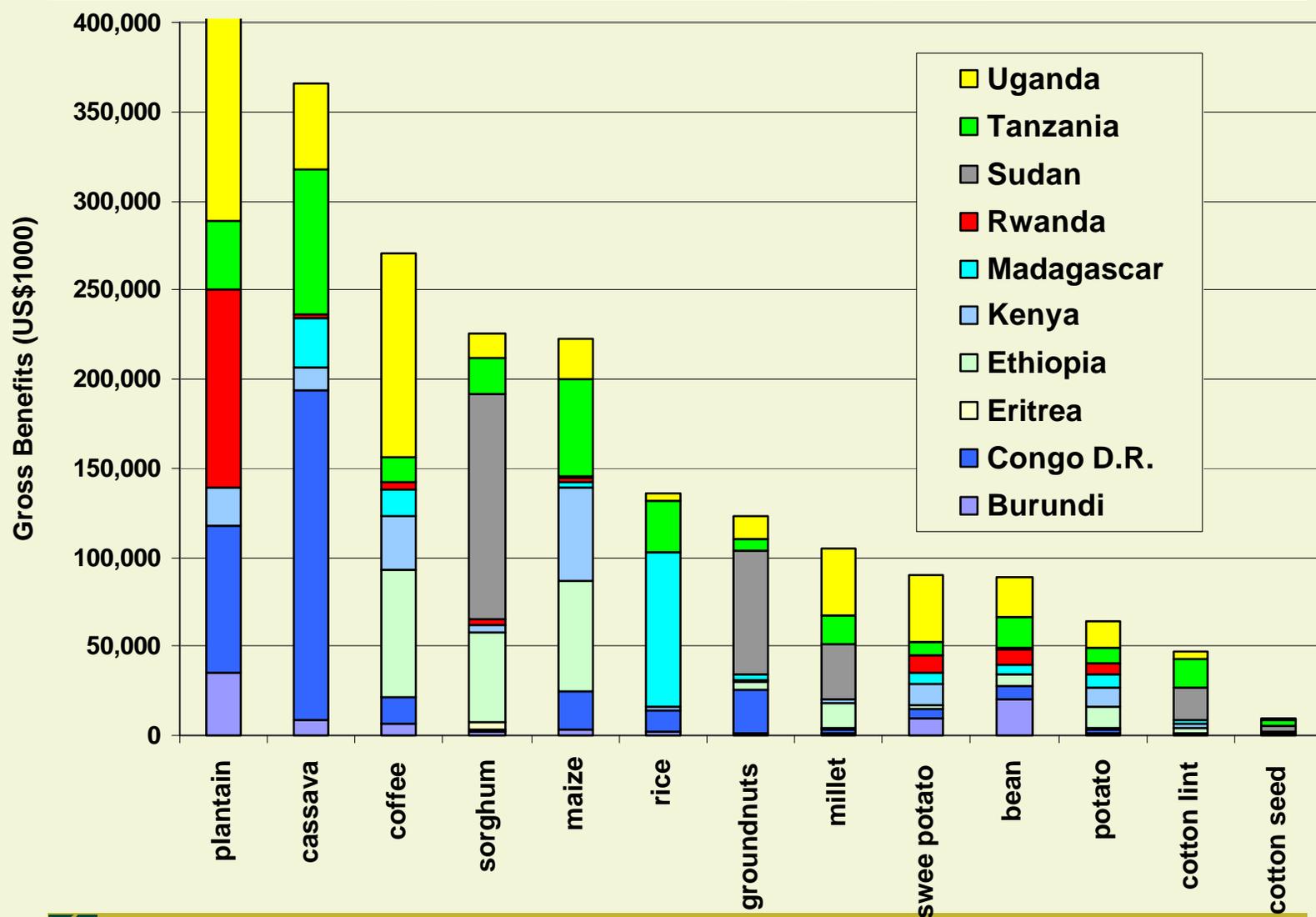
Impact of extra \$1 of tradable farm income	Burkina 1984/85	Niger 1989/90	Senegal 89/90		Zambia 1985/86
			Groundnut Basin South East	Central	
			----- (\$) -----		
Poorest Third of HH*	3.2	2.0	2.2	3.1	
Richest Third of HH*	2.5	2.0	2.3	2.3	
Local	1.3	1.8	1.8	2.0	1.41
National	2.9	2.0	2.2	2.5	2.48
Regional	4.3	3.3	2.7	3.1	n.a.

*Based on national level definition of tradability

Source: Delgado, Hopkins and Kelley, 1998

**Developing sub-regional
platforms for assessing
the potential productivity
and growth impacts of
potential technology
investment strategies**

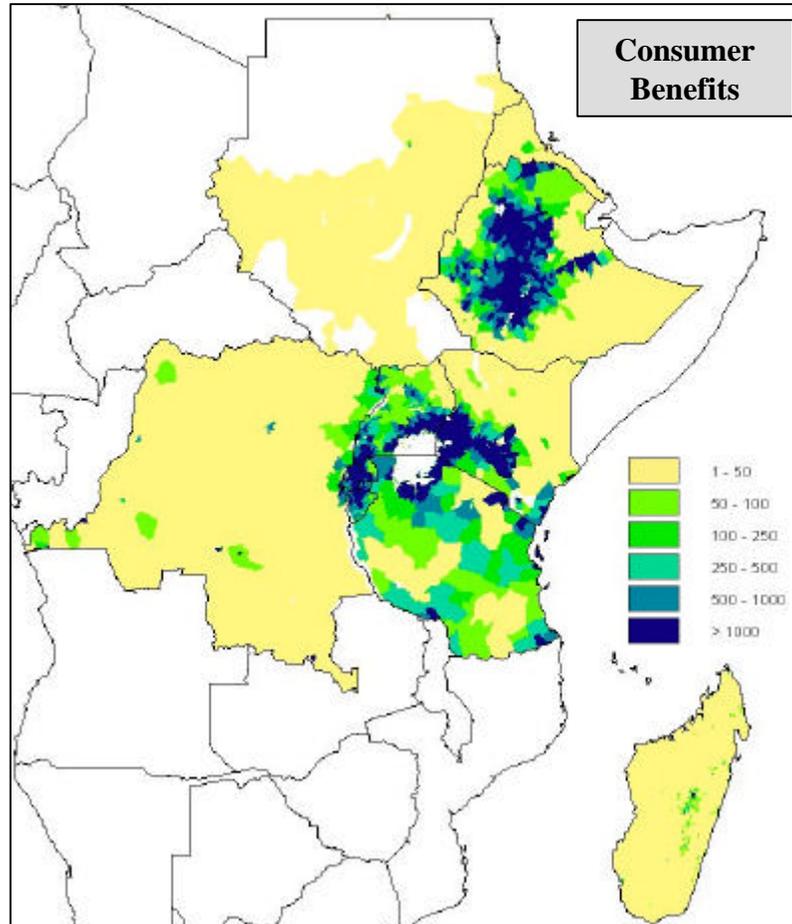
ASARECA Baseline: Gross Benefits of Productivity Gain



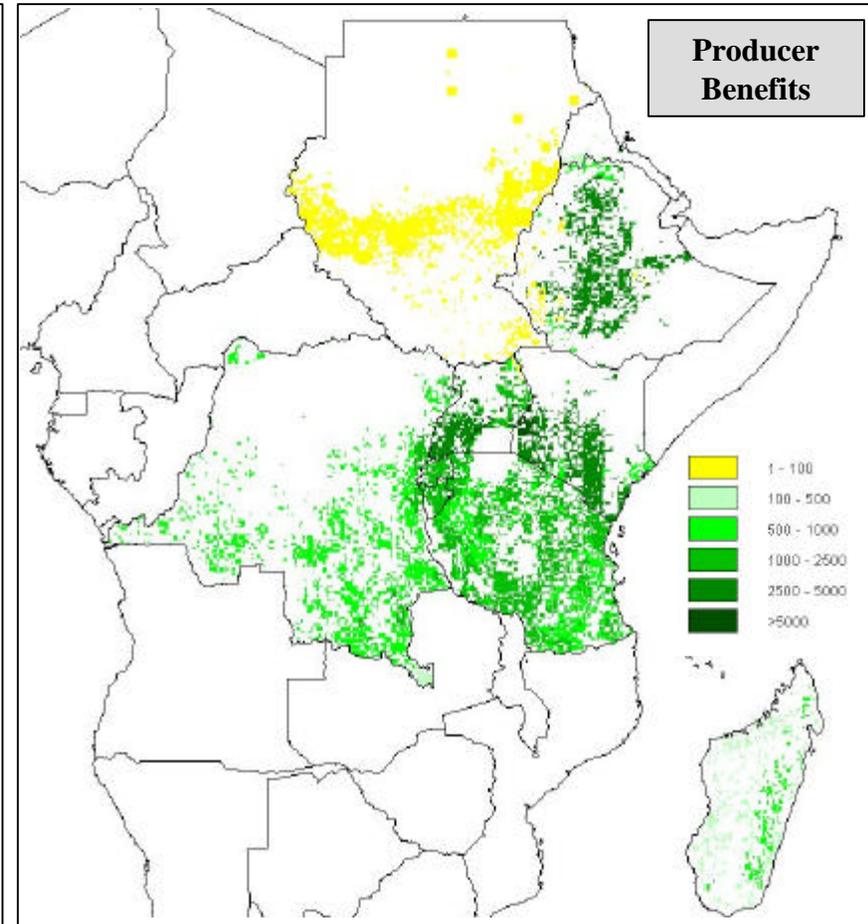
* Gross benefits from a baseline 1 percent R&D impact over the period 1997-2020

Spatial Distribution of R&D Benefits

Maize

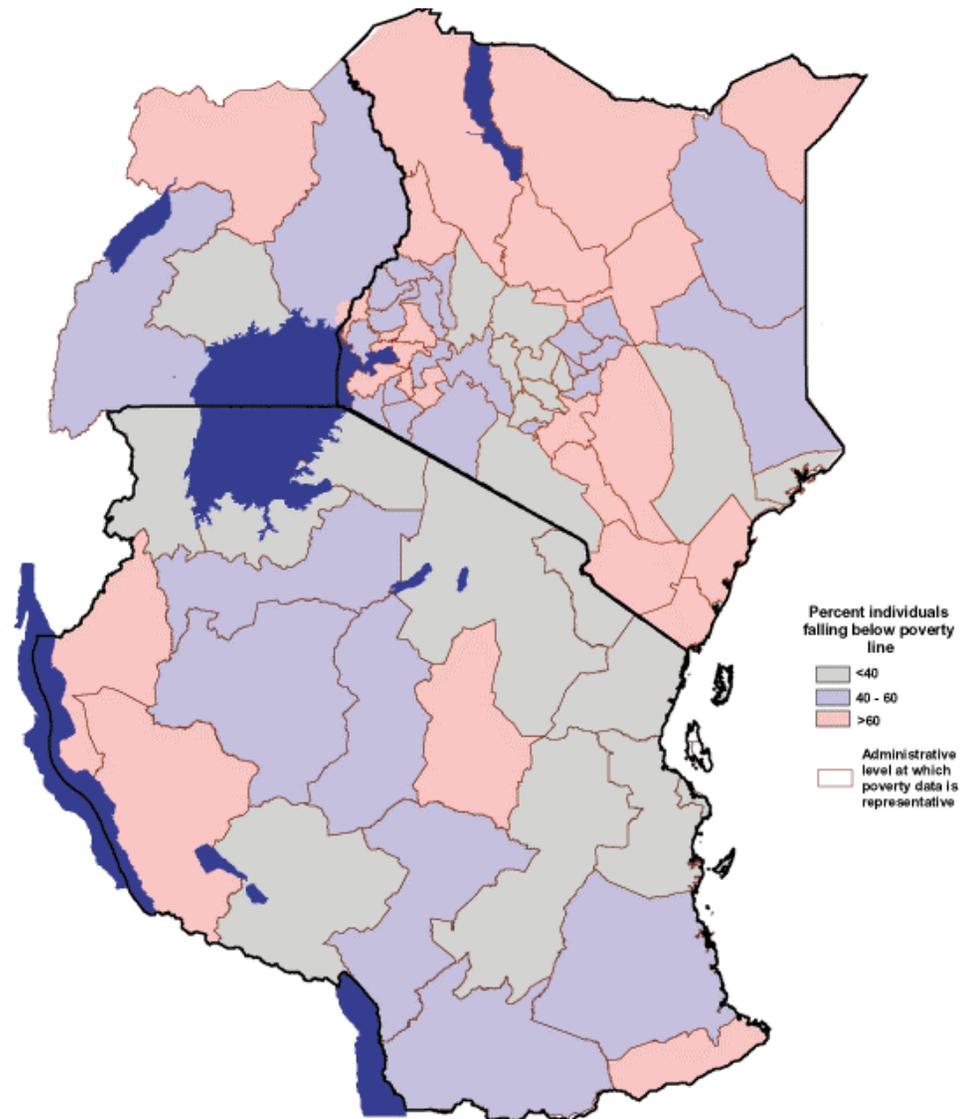


Population distribution * av. per capita consumer benefits



Cropland extent * Maize distribution * Producer benefits

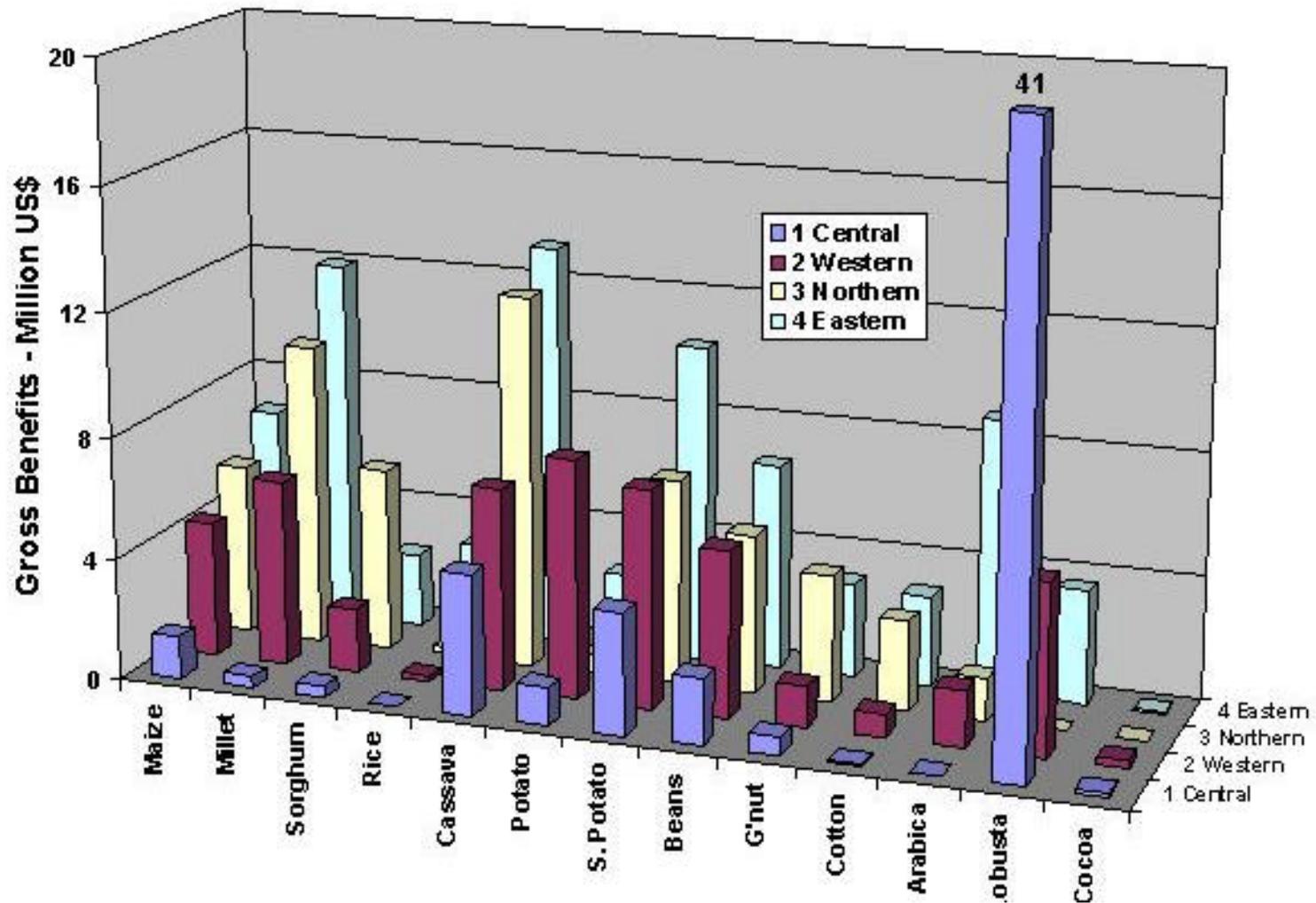
East Africa Regional Poverty Map



Source: ILRI 2002

Gross Benefits of Productivity Gains

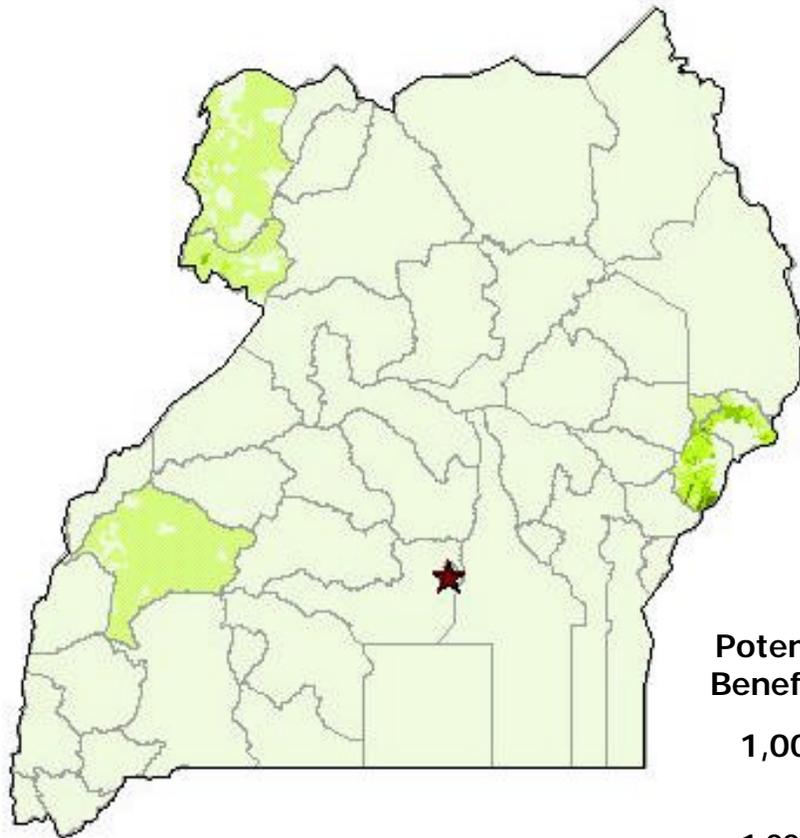
Gross benefits of a single-shot 1% increase in productivity (1997-2020, 3% real interest rate)



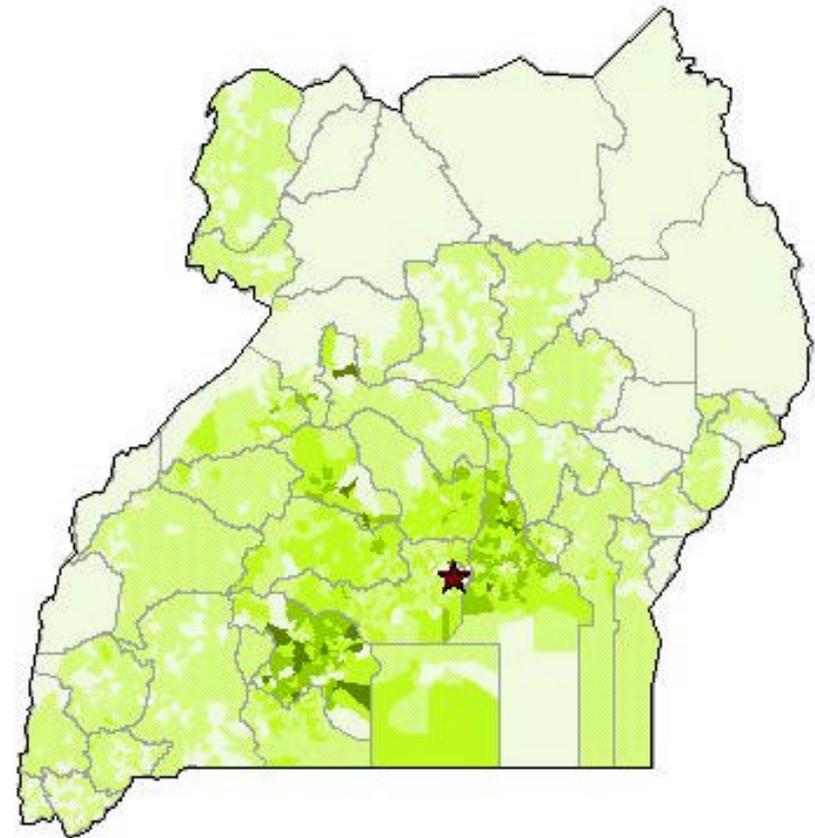
Potential Impacts of Productivity Growth

Coffee: 1 percent productivity gain. NPV of producer benefits 2000-2020

Arabica

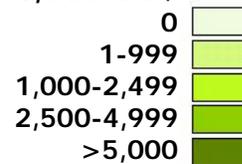


Robusta



Potential Producer Benefits Per Parish

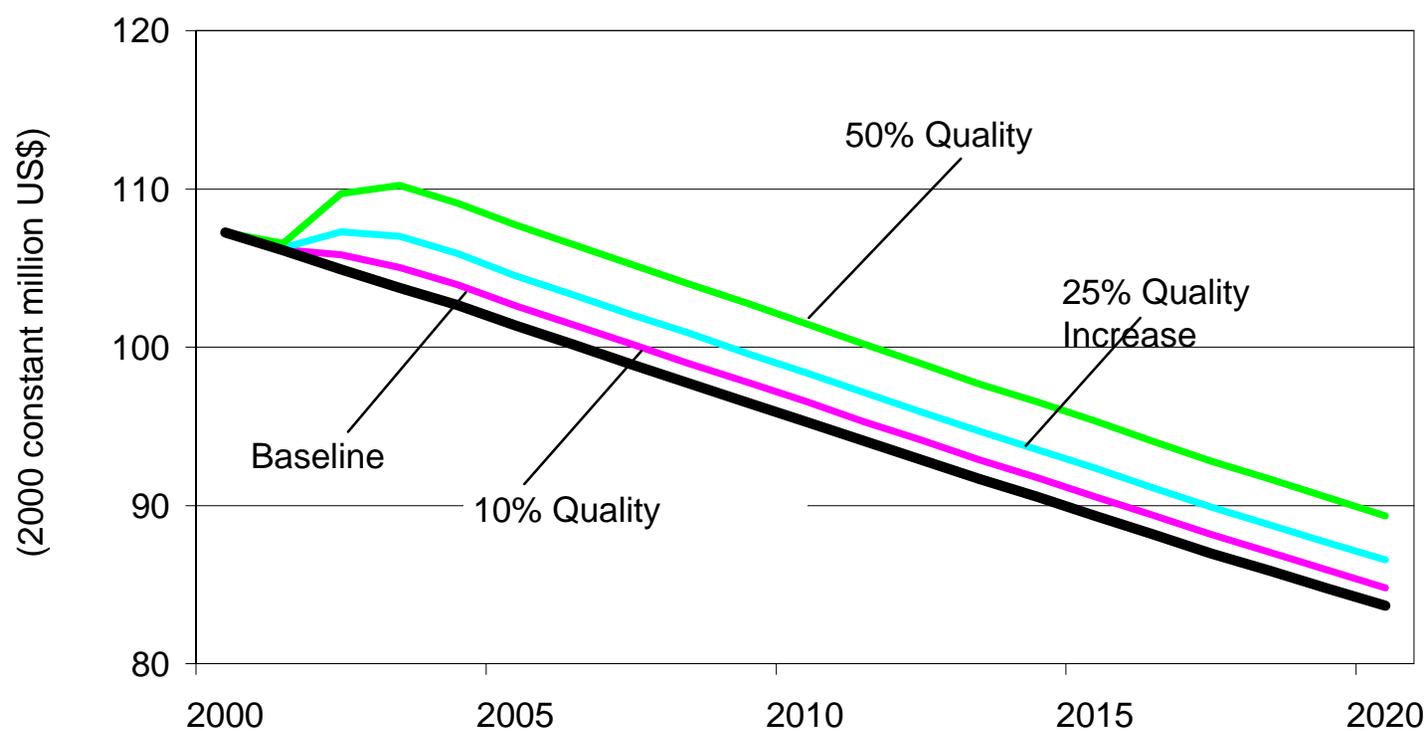
1,000 US\$



IFPRI calculations & UNHS 1999/2000

Robusta Coffee: Uganda & RoW Scenarios (2000-20)

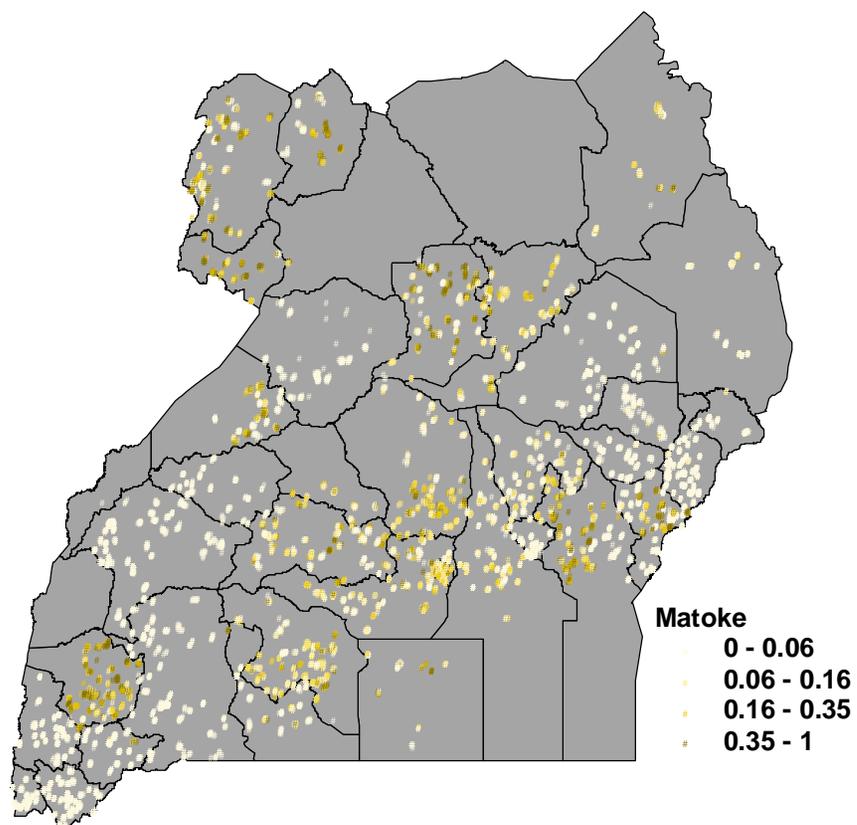
(b) Export Revenue - Robusta



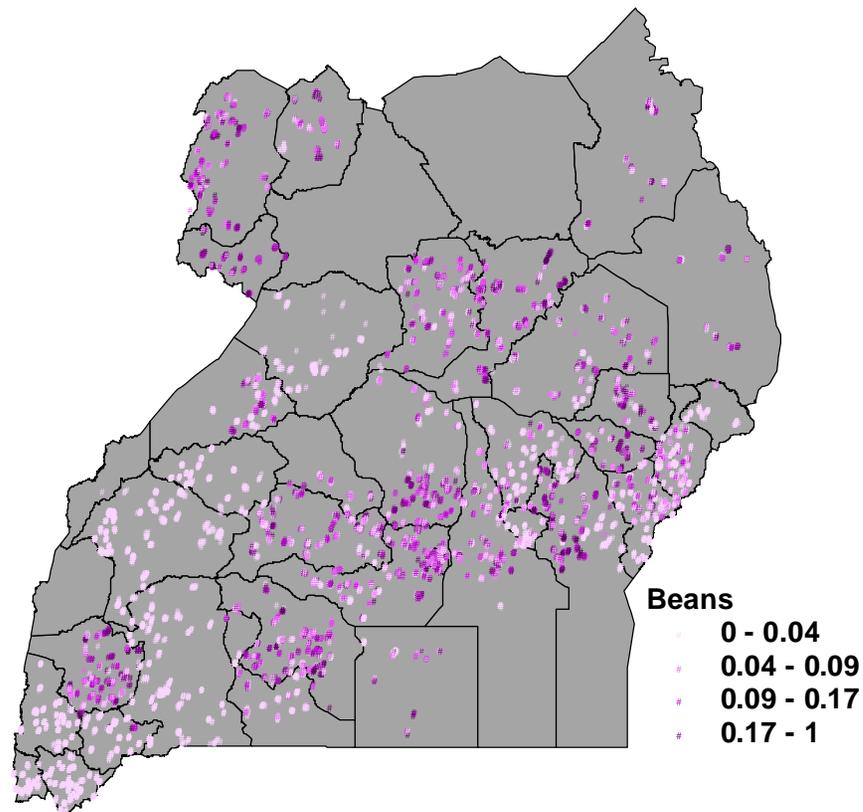
Source: Bolwig and You, 2002



Distribution and Economic Importance of Agriculture



**Matooke share of
HH agricultural income**

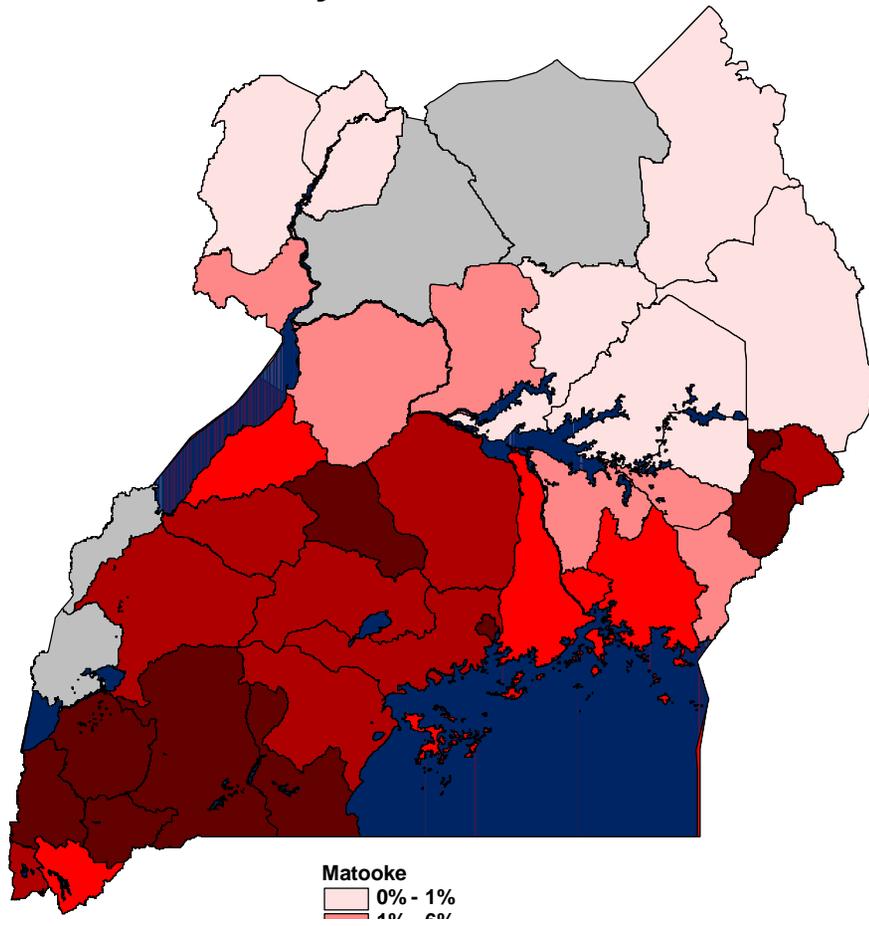


**Bean share of
HH agricultural income**

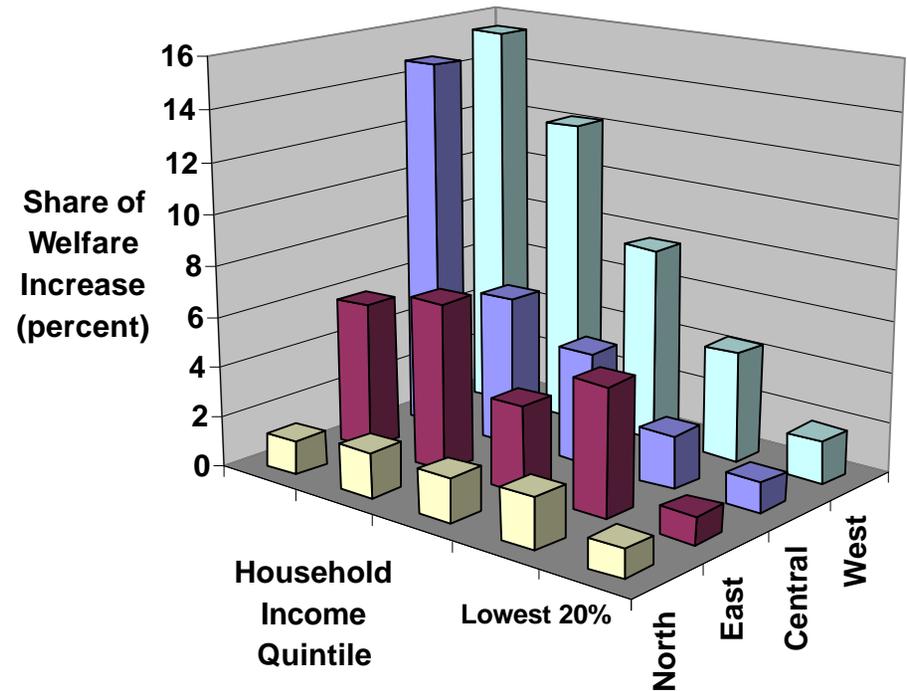
Household Level Distribution of Productivity Benefits

Average Share of HH
Agricultural
Revenue by District

Matooke



Share of Total Benefits of
Productivity Increase by Region and
Household Income Group



Disaggregated Uganda National Accounts

Activities (25)

Agriculture (12)

Coffee
 Other Cash Crops
 Maize
 Sorghum/Millet
 Cassava
 Sweet Potatoes
 Matooke
 Horticulture
 Other agriculture
 Livestock
 Forestry
 Fishing

Industry (7)

Meat and dairy processing
 Coffee processing
 Grain milling
 Other beverages
 Textiles and leather
 Manufacturing
 Petroleum and chemicals

Services (6)

Utilities
 Construction
 Commerce
 Transport
 Private services
 Public services

Commodities (26): Same as activities, plus Fertilizer

Factors of production (9)

Unskilled labor	Skilled labor	Capital
Land [zones 1-6]*		

Households (9)

Urban poor	Urban non-poor	Farmers [zones 1-6]*
Non-farm rural		

Other institutions (2)

Government	Rest of the world
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Applying Uganda (Micro-)CGE Model

For “adding up” to assess aggregate and feedback across commodities and sectors, including employment, wages, poverty rates, foreign exchange and trade.

Sample results:

Increasing the effective average price of coffee exports from Uganda by 20 percent by increasing quality would :

- i) increase av. incomes of unskilled labour by around 1 percent*
- i) increase overall consumption by 0.7-3.0 percent*
- ii) increase the price of maize, sorghum, sweet potatoes, matooke and other food crops by 1.8-2.0 percent.*
- iii) increase transport costs nearly 1 percent.*

Source: Dorosh et al, 2002

In Conclusion

The growing strategic focus on improving access to agricultural and agriculture-related technologies that better serve the needs and opportunities for farmers, processors and consumers appears relevant and justifiable

Increased agricultural productivity has the capacity to generate direct welfare benefits, exhibit multiplier effects through sectoral linkages, and provide a platform for accelerated economic growth

Databases and tools exist, or are being developed, to support the strategic evaluation of technology investment options in increasingly rigorous ways. This can help prioritize and target investments in ways that might best serve local welfare and aggregate growth outcomes