DISTRIBUTIONAL EFECTS OF TECHNICAL CHANGE

I. STYLIZED FACTS ABOUT THE GREEN REVOLUTION (AGAIN)

A. Increased labor demand and real wages in affected areas

- Mainly in harvesting, threshing
- Also due to cropping intensity increases

B. Initial gains captured by large farmers (early adopters), with subsequent "catching up" by small farmers

C. More widespread adoption of improved technologies in favored production environments

II. SPECULATIONS ABOUT THE GREEN REVOLUTION

A. Lowered of food prices or dampened food price increases

B. Widened wage and income differentials between favored and marginal production environments

III. POTENTIAL IMPACTS OF SEED-FERTILIZER TECHNOLOGIES

A. Direct (production) Effects

- Increased yields
- Stabler yields
- Reduced production costs
- Shorter growing seasons

B. Indirect (market) Effects

- Producer and consumer prices
- Wages
- Land rents and land prices

IV. KEY ISSUES IN EVALUATING TECHNOLOGICAL CHANGE

A. Impacts on **production**

B. Impacts on **farm profits**

C. Impacts on **farmers' incomes**

D. Impacts on **wages and laborers' incomes**

E. Impacts on **food prices and consumers' incomes**

F. Impacts on **government finance**

V. KEY DETERMINANTS OF THE INCOME EFFECTS OF REGIONALLY DIFFERENTIATED TECHNICAL CHANGE

A. Open vs closed economy

B. Net producers vs net consumers

C. Adopters vs non-adopters

D. Mobility of laborers

E. Government intervention into commodity and factor markets

HANDOUT 12:
PARTIAL EQUILIBRIUM ANALYSIS ASSUMING:

- Zero adoption in "marginal" production environments.
- Complete adoption in "favored" production environments.
- Marginal prod environment is net importer of food
- Favored prod environment is net exporter (excess supply)

A. OPEN ECONOMY CASE

- No price change
- Favored region producers big winners
- National: reduce import demand (or increase exports)

B. CLOSED ECONOMY CASE

- National: Price drops due to aggregate supply shift
- Consumers gain unambiguously (due to price drop)

  $\Rightarrow$ Marginal, urban areas gain as they are net consuming regions
- Results are **ambiguous** for producers in adopting (favored) region

  $\Rightarrow$ price falls but output increases.

C. SEMISUBSISTENCE HOUSEHOLDS (CLOSED ECONOMY)

- Very similar to previous, but substitute "net consumer" for "net importer," and "net producer" for "net exporter"
- National: Price drops due to aggregate supply shift
- **Net Consumers gain** unambiguously (due to P $\downarrow$)
- **Non-adopting net producers lose** unambiguously (due to P $\downarrow$)
- Results are **ambiguous for adopting net producers** (P $\downarrow$, Q $\uparrow$)

D. LABOR MARKET IMPACTS

- Favored $L^D \uparrow \rightarrow W_F \uparrow \rightarrow W_F > W_M \Rightarrow$ Migration
- New equilibrium: Wages equalize at higher level
  Greater L_F, smaller L_M

VI. CONCLUSIONS FROM PARTIAL EQUILIBRIUM ANALYSIS

Open economies

- Adopters are big winners
- Direct (productivity) effects outweigh indirect (wage) effects
- Zero output price effects

Closed economies

- Price drops ⇒ Net consumers are big winners
- Ambiguous welfare effects for adopting net producers
- Adopting net consumers fare better than adopting net producers!

****
*** THE OPEN ECONOMY CASE IS PROBABLY MORE REALISTIC ***
****

SYNTHESIS OF PARTIAL EQUILIBRIUM RESULTS

	Open Economy	Closed Economy
National Effects		
Consumers	0	↑
Food Price	0	↓
Foreign Exchange	↑	0
Adopting Area		
Net Producers	↑	?
Net Consumers	↑	↑
Agricultural wages	↑	↑
Non-adopting areas		
Net Producers	↓*	↓
Net Consumers	↓	↑
Agricultural wages	↑	↑

* = due to wage effects

II. EMPIRICAL EVIDENCE

A. Product Markets

- Alot of empirical work in the 1970s and 1980s using the partial equilibrium framework for the output market (e.g., Scobie & Posada, Hayami & Herdt).
- This work essentially played around with demand and supply elasticities and different levels of supply curve shift ("K") to assess impact of HYV's on welfare of different groups.
- All assumed that markets were closed. Is this reasonable for widely traded (tradable) commodities like rice, wheat and maize?

B. Labor markets

1. Lots of farm management data supports shifting out of L^D in favored (adopting) areas

2. **Little empirical evidence supporting wage increases**

- Mainly stagnant or at best slightly increasing where rapid adoption occurred.

- Pakistan: Wages up by 8% between 1964 and 1969, but not in real terms

- Possible explanations for small wage increases **(consistent with the hypothesis that workers better off after adoption)**:
  - High initial unemployment or underemployment
  - High rates of population growth
  - Heavy in-migration
  - Changes in rural-urban migration patterns (see below)

3. **Migration**

- Significant in India (Bihar, Rajasthan → Punjab) with reduction in wage differentials
- Otsuka and David work claims migration occurred in SE Asia, but their methodology has the following problem:
  - ➢ They assume away the importance of rural-urban migration
  - ➢ This may dominate any rural-rural migration effect both in terms of **wage equalization** and **population growth rates (**man/land ratios)
- Pakistan: Lots of rural-rural migration, but mostly close to home; data is limited by seems to indicate weak support for migration as having limited wage growth

C. Caveats about labor markets

Transactions costs of moving

- Migration will occur gradually over time, **not instantaneously**
- Labor more likely immobile in short run, mobile in long run

Rural-Urban Migration

- More important than rural-rural migration quantitatively
- If adoption narrows the gap between agricultural wages (in adopting region) and urban wages, then adoption → less rural-urban migration → dampened agricultural wage increases.

MULTI-MARKET MODELS

I. PARTIAL VS. GENERAL EQUILIBRIUM APPROACHES

- **Partial equilibrium** good for understanding **impulses** emanating from different markets

- **General equilibrium** need to sort out the **multiple effects** of a specific technology (or other shock)

- This is particularly important in the context of **LDC** households because of their **semisubsistence** nature (multiple "hats")

II. BENEFITS OF GENERAL EQUILIBRIUM ANALYSIS

- Allow analyst to "add" up the indirect effects operating through different markets

- Synthesizing multiple markets in the analysis is superior to partial equilibrium analysis

- G.E. models need not be terribly complex (e.g., multimarket models) – strike **balance between completeness and tractability**

- Once operational, they allow simulation of the impacts of various policies and exogenous events (e.g., technology shocks, govt policies)

III. MULTI-MARKET MODEL BASICS

1. Choose the key mkts, classes of economic agents of interest

Pak Example: Focus on impact of technical Δ across region, HH type

- 3 regions – Favored, Marginal, Urban
- 2 commodities produced – Wheat and "other"
- 2 inputs – Labor and fertilizer
- 2 commodities consumed – Wheat and "other"
- 3 rural HH types – landless, small landowner, large landowner
- 2 urban HH types – "rich" and "poor"

2. Write down set of behavioral equations describing HH economic activity

Pak Example:

Production

$$Q_W^{Irr} = Q_W^{Irr}(P_W, P_{NW}, W, P_F, \tau) \qquad Q_W^{RF} = Q_W^{Rf}(P_W, P_{NW}, W, P_F, \tau)$$

$$Q_{NW}^{Irr} = Q_{NW}^{Irr}(P_W, P_{NW}, W, P_F, \tau) \qquad Q_{NW}^{RF} = Q_{NW}^{Rf}(P_W, P_{NW}, W, P_F, \tau)$$

$$L^{dI} = L^{dI}(P_W, P_{NW}, W, P_F, \tau) \qquad \text{----------etc----------}$$

$$F^{dI} = F^{dI}(P_W, P_{NW}, W, P_F, \tau) \qquad \text{----------etc----------}$$

Labor supply

$$L_i^{SI} = N_i^I l_i^{SI}(W), \quad i = LL, Sm, Lg \qquad \text{----------etc----------}$$

Consumption

$N_i \bullet C_i(P_W, P_O, Y_i)$, $i = LL, Sm, Lg$ --------same for RF----------

Income

$Y_i = WL_i^{SI} + \pi_i^{IR} + X_i^{IR}$, i=LL, sm, lg ------same for RF-------

Group-specific Price Index changes

$\hat{P}* = \Sigma_i \mu_i P_i$

Closure

1. $\sum_i L_i^D = \sum_i L_i^S$ either nationally or regionally

2. $G + \Sigma Q = \Sigma C$ nationally (G = net imports)

3. **Do proportional change algebra to each (general) equation to express everything in "rate-of-change" form:**

Example 1: $Q^i_W = \dot{Q}^i_W(P_W, P_{NW}, W, P_F, \tau)$

becomes

$$\hat{Q}^i_W = \varepsilon_W \hat{P}_W + \varepsilon_{NW} \hat{P}_{NW} + \varepsilon_L \hat{W} + \varepsilon_F \hat{P}_F + \frac{\partial Q}{\partial \tau} \cdot \frac{\partial \tau}{\partial t}$$

or

$$\hat{Q}^i_W = \varepsilon_W \hat{P}_W + \varepsilon_{NW} \hat{P}_{NW} + \varepsilon_L \hat{W} + \varepsilon_F \hat{P}_F + \hat{E}$$

Example 2: $Y_i = WL^{SI}_i + \pi^{IR}_i + X^{IR}_i$

becomes

$$\hat{Y}_i = \mu_{Li}(\hat{W} + \hat{L}^S_i) + \mu_{\pi i}\hat{\pi} + \mu_{Xi}\hat{X}_i)$$

POINTS

1. These kinds of models compare **"snapshots"** taken at two different points in time

2. They are also **equilibrium models** in that they assume **market clearing** in all markets.

3. They can and should therefore be interpreted as comparing **pre-** and **post-shock equilibria.**

4. They ignore possible disequilibria in initial shapshot!!

IV. EMPIRICAL IMPLEMENTATION

Two traditions:

1. **Binswanger and Quizon:**

- Estimate all producer, consumer and factor market relationships to get elasticities.
- More rigorous, more data intensive

2. **Braverman and Hammer:**

- Pick "plausible" estimates from other studies
- Quicker, dirtier, more pragmatic

Resolution: Sensitivity analysis (systematically Δ exog. parameters)

EXAMPLES OF MULTIMARKET MODELS (S & DJ)

1. **Effect of public investment in India (Quizon & Binswanger)**

- Technological change
- Fertilizer subsidies
- Investment in irrigation/infrastructure
- Tax and subsidy schemes

2. **Price Policies in Senegal (Braverman and Hammer)**

- Producer subsidies
- Consumer subsidies
- Fertilizer subsidies
- Devaluation