

IAPRI-MSU Technical Training: An Introduction to Agricultural Household Models

Part 2

Agricultural Households as Producers and Consumers: Set-Up and Insights from a Basic Ag Household Model

June 23, 2016

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Today's program

- 14:00-14:20 – **Questions** from yesterday and **objectives** for today
- 14:20-15:35 – **Motivation** and **basic ag HH model setup**
- 15:35-15:45 – **Health break**
- 15:45-17:00 – **Input demand, output supply, and consumer demand functions for a basic ('separable') ag HH model; more on 'separability' and the 'profit effect'; implications for empirical work**
- *****Assign time keeper** (for health break & end-of-day)

Objectives

- By the end of today's session (depending on how far we get), you should understand:
 - How and under what circumstances the key determinants of input demand, output supply, and consumer demand are or are not different in AHMs vs. pure producer theory and pure consumer theory
 - The notion of separability
 - The profit effect
 - When to use an AHM

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Introduction to agricultural household models



An agricultural household in Katete, Eastern Province, Zambia.

Photo credit: Joel DeJong

Motivation

- Up to now, considered economic agents as **consumers OR producers**. *Why might this be problematic in many developing country contexts?*
- EX) Suppose a **severe drought in the US** puts **upward pressure on maize prices** in world markets, and this price increase is transmitted to maize markets in **Zambia**. Assuming maize is a **normal good**, is this price increase going to have a **positive or a negative effect** on the economic well-being of **rural households in Zambia**? Why?

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Motivation (cont'd)

- In many developing country contexts, the **same decision-making unit** (e.g., individual or HH) makes **both production and consumption decisions** (and work vs. leisure decisions)
- In “**semi-commercialized**” rural economies, many HHs:
 - Produce ag goods partly for sale, partly for home consumption
 - Purchase some ag inputs but provide other inputs themselves.
Examples of each?
 - Contrast to autarkic HHs?

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Motivation (cont'd)

- By providing an **integrated model** of the ag HH as a producer and consumer, agricultural HH models (AHMs) allow us to **trace the direct & indirect effects of microeconomic response to exogenous shocks** (e.g., natural, policy, price, or technological Δ s). E.g., what are the effects of these shocks on:
 - Labor supply and demand?
 - Farm technology adoption, input demand, & output supply?
 - Consumer demand?
 - Economic well-being (e.g., total consumption or income)?
- **Insights from AHMs also apply to other enterprises where individuals/HHs are jointly engaged in production & consumption.** *Examples?*

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The two basic types of AHMs

1. **Separable**: assume complete and perfectly competitive markets
2. **Non-separable**: relax some assumptions of #1
 - **Today**: **separable** case in detail; intuition on non-separable case
 - **Possible future session**: **non-separable** AHMs

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Separable AHM – 2 core assumptions

1. HHs can trade on a complete set of perfectly competitive markets, including insurance and credit markets
 - → HH is a price-taker for all goods produced and consumed, including labor
2. The HH is the appropriate unit of analysis (not the individual or a group of HHs)
 - “Unitary” model – i.e., HH treated as a single decision-maker
 - *How to define a HH?*

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A basic separable AHM – SS&S (1986)

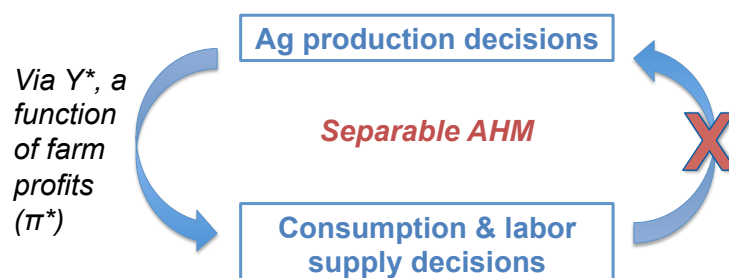
See handouts / work out on white board

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Separability / the recursive property

Definition: Under the aforementioned assumptions (*what were these?*), then:

- HH ag production decisions are independent of HH consumption and labor supply decisions
- BUT HH consumption and labor supply decisions are NOT independent of HH ag production decisions



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Separability / the recursive property (cont'd)

Decisions are made recursively (sequentially):

1. HH makes production decisions to max farm π s.t. production function
2. Then HH makes consumption and labor supply decisions to max U s.t. Y^* , where Y^* depends on farm π^*

Time-permitting, later today we'll discuss when this property breaks down

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Intuition on why decisions are separable under the complete & perfect markets assumption

- Amt of ag staple (e.g., maize) produced & consumed can be determined separately b/c **HH can always buy or sell maize at a fixed price**
- Total amt of labor vs. amt of family labor to use for maize prod can be determined separately b/c **HH can hire the difference at a fixed wage**
- **Only constraint** on maize cons. & family labor supply/leisure **is full income**
- **Since HH always prefers more income, makes sense to max π , then allocate the resulting income to consumption of maize, the market purchased good, and leisure, given prevailing market prices**
- **→ With prices fixed, production and consumption related only through income & only in one direction, production → consumption**

Singh, Squire, and Strauss, 1986: 7

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The profit effect

$$\begin{aligned} X_a^* &= X_a^*(p_a, p_m, w, Y^*) \\ &= X_a^*(p_a, p_m, w, Y^*(p_a, w, \bar{A})) \end{aligned}$$

How does the HH's demand for the ag staple (X_a^*) Δ when the price of the ag staple (p_a) Δ s (assuming it is a normal, non-Giffen good)? Does it \uparrow or \downarrow ?

$$\frac{\partial X_a^*}{\partial p_a} = \frac{\partial X_a^*}{\partial p_a} \Big|_{Y^*=const} + \frac{\partial X_a^*}{\partial Y^*} \cdot \frac{\partial Y^*}{\partial p_a}$$

(?)
(-)

(+)
(+)
Profit effect

What would we have concluded if we had used a standard consumer demand model for X_a ?

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Empirical separable AHMs - variables

What are **input demand & output supply** a function of in a separable AHM?

- Input prices (all inputs)
- Output prices (all outputs)
- Levels of quasi-fixed factors
- Other exogenous factors affecting production

What about **commodity (consumer) demands**?

- Commodity prices (all goods, incl. subst. and compl.)
- Full income (but keep in mind that $Y^* = \pi^* + wT + E$, and that everything above affects π^* ; E is exogenous income)
- HH characteristics affecting consumption tastes & preferences
- Same as in consumer theory except full income

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When should we use an AHM?

- *Do we need an AHM if we are only interested in the production side of the model and separability holds?*
- Use an AHM if:
 1. **Separability** holds, we are interested in the **consumption** side of the model, and:
 - a. We expect the **profit effect** to be **large**,
 - b. **Farm profits** are a **large share of full income**, and/or
 - c. The **income elasticity** of the commodity of interest is **high**
 2. There are **multiple, important market failures (missing or imperfect markets)**

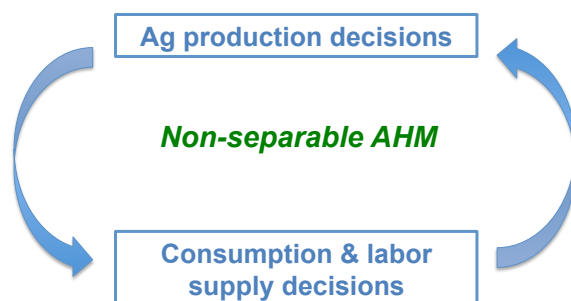
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Missing and imperfect markets

- What do we mean by “missing markets”? Examples?
- Examples of market imperfections?
 - Participation constraints – e.g., in credit, labor, land, other input markets, and/or product markets
 - Transactions costs – definition?
 - Risk aversion when have risk/uncertainty & no insurance market
 - Other market failures (i.e., cases where market outcomes are not Pareto efficient) – imperfect competition, externalities, public goods, information asymmetries, etc.

In general, when specifying a non-separable HH model, we need to be explicit about which market(s) are missing or imperfect

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Key differences of non-separable model compared to separable AHM:

1. HH no longer behaves like a π -maximizing producer
2. HH prod., cons./L supply decisions jointly determined (not recursive)
3. Prices of all consumer goods and HH's consumption characteristics/tastes/preferences affect its production decisions

Simple example:

$$\text{Separable: } L^* = L^*(p_a, w, \bar{A})$$

$$\text{Non-separable: } L^* = L^*(p_a, w, \bar{A}, p_m)$$

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Practical considerations & non-separability

- If the HH buys or sells a commodity, then we can consider it to be a **price taker** no matter how small the quantity it transacts on the market (Barrett, 2013)
- There will almost always be at least **some market imperfections** ... but moving from a separable to **non-separable model significantly complicates things** ... so need to consider how important are the market(s) that are imperfect for your research question?
 - If not very important, **costs** of estimating a non-separable model may outweigh the **benefits**

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Acknowledgements



This training session was supported by the Innovation Lab for Food Security Policy through funding from the U.S. Agency for International Development.



Development of the training materials was also supported by Michigan State University.

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