

Outline: Agent Based Agricultural Household Modeling

Ben Ewing

March 23, 2019

Outline

This paper will follow less in the footsteps of Singh, Squire, and Strauss (1986), and more in the spirit of Besley and Ghatak (2010). Farmers produce a single good with a standard Cobb Douglas production function:

$$AK^\beta L^\alpha. \tag{1}$$

This good generates utility using a concave (risk averse) function that is linear in consumption and utility, with an absolute risk-aversion parameter, borrowed from Wang (2015):

$$-\exp(-(x + l) * r) + 1. \tag{2}$$

Where x is consumption, l is leisure, and r is the Arrow-Pratt measure of absolute risk aversion. The 1 is added to achieve a positive utility, which is ultimately just convenient for the optimization algorithms used in this paper. We can think of this good as being tradeable, in a market that clears, for any other good that generates utility.

In this model, technology should be thought of as durable farming equipment, capital as productive land area, and labor as household size (this will be an integer for convenience). In the basic models, technology is fixed at 1. Households must consume one unit of output per unit of labor, or else labor falls in the next period (in other words, agents can die).

Empirical Grounding

Where possible, simulation parameters will be grounded in empirical data. Specifically, I will use two surveys of rural agricultural households in Zambia: CFP and TGCC.

Labor Endowment

Labor endowment for each agent will be drawn from a gamma distribution fit to the survey data on household size.

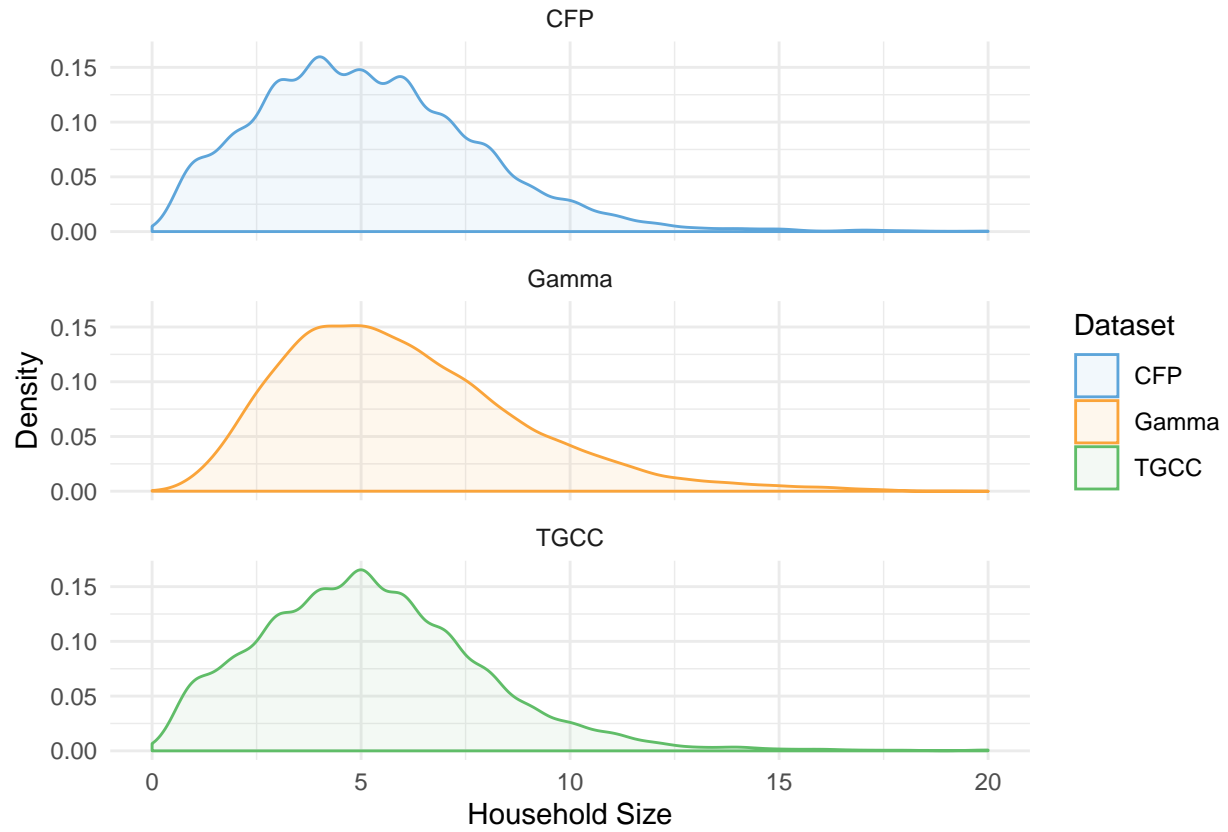


Figure 1: Labor Endowment Distribution

Capital Endowment

Capital endowment will likewise be drawn from a gamma distribution tuned to match the distribution of productive farmland in the survey data.

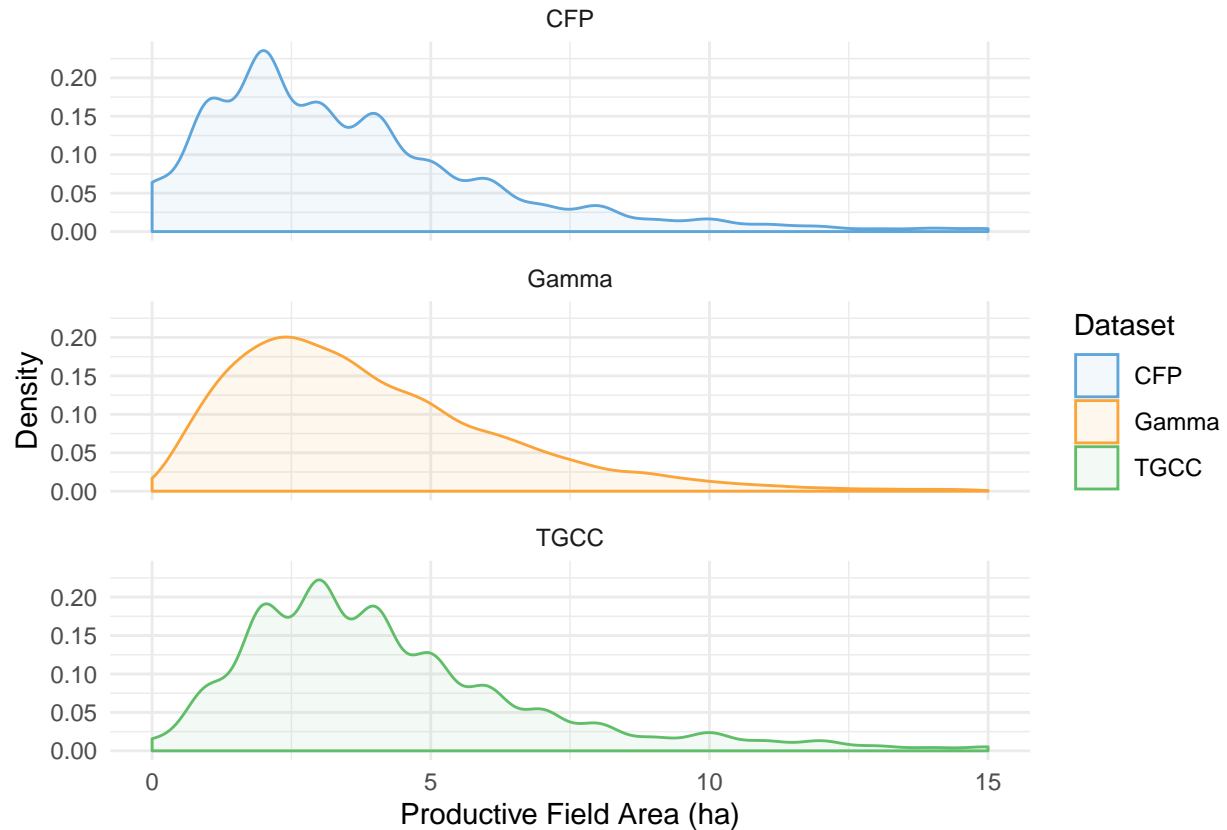


Figure 2: Capital Endowment Distribution

Arrow-Pratt Coefficient of Absolute Risk Aversion

The Basic Model

- Agents only have labor/leisure choice

Technology

- Agents can now invest some product in production technology for future periods

Technology Two

- Agents can choose to invest in two kinds of technology
- available in the next period (e.g. fertilizer)
- available several periods in the future (and requires some labor, e.g. agroforestry trees)
- Fertilizer is not permanent, should I consider permanent/temporary investments

Land Clearing

- Agents can now use some labor to clear additional land

Property Rights

- Agents now consider the overall security of their land
- Agents can also take land from other households?

Besley, Timothy, and Maitreesh Ghatak. 2010. “Chapter 68 - Property Rights and Economic Development*.” In *Handbooks in Economics*, edited by Dani Rodrik and Mark Rosenzweig, 5:4525–95. Handbook of Development Economics. Elsevier. doi:<https://doi.org/10.1016/B978-0-444-52944-2.00006-9>.

CFP.

Singh, Inderjitl, Lyn Squire, and John Strauss. 1986. “Agricultural Household Models : Extensions, Applications, and Policy,” February. <http://documents.worldbank.org/curated/en/621291468739297175/Agricultural-household-models-extensions-applications-and-policy>.

TGCC.

Wang, Xiao Yu. 2015. “Risk Sorting, Portfolio Choice, and Endogenous Informal Insurance.”