- A concentration of poor households in India live in rural areas
  - Prospects for reductions for rural income growth?
  - Technology change in agriculture
    - Clearly played a major role in profitability and wage growth in the last 40 years
    - But concern that increased pressures inclusive of access to groundwater suggests that there are limits to expansion in this area.

- Growth in non-farm sector:
  - Services produced for local economy
  - Production of tradable goods—significant evidence of potential here
  - New work: value added sector
    - locally produced agricultural goods are transformed into value added products seems to have particular potential.
- Current paper: A key element of sustained per-capita income growth is increasing worker productivity.
  - This happened in many developed countries through increased capital intensity in agriculture.
  - What are the prospects in rural India

**Figure A2. Cumulative Distribution of Owned Landholdings (Acres), by Data Source**

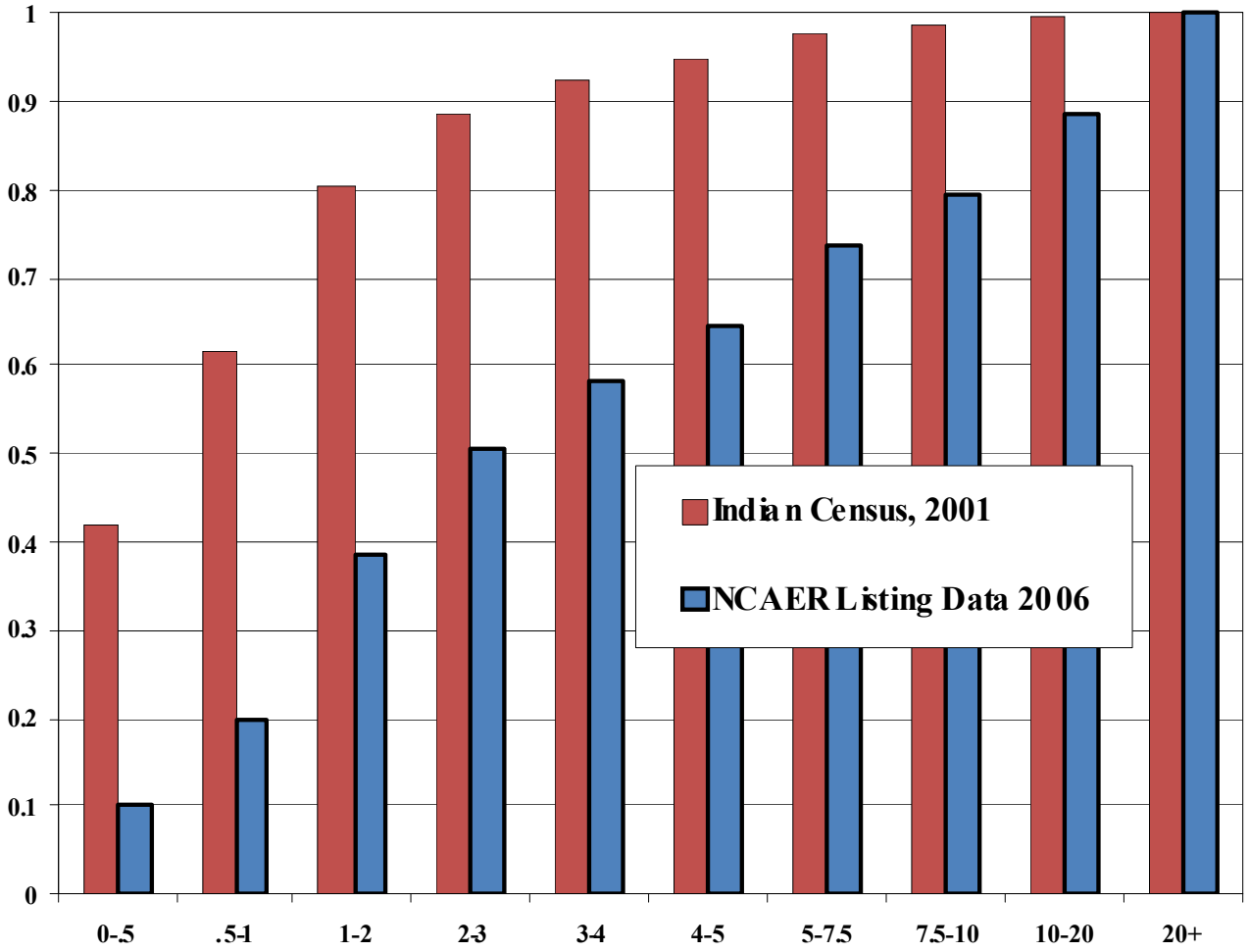
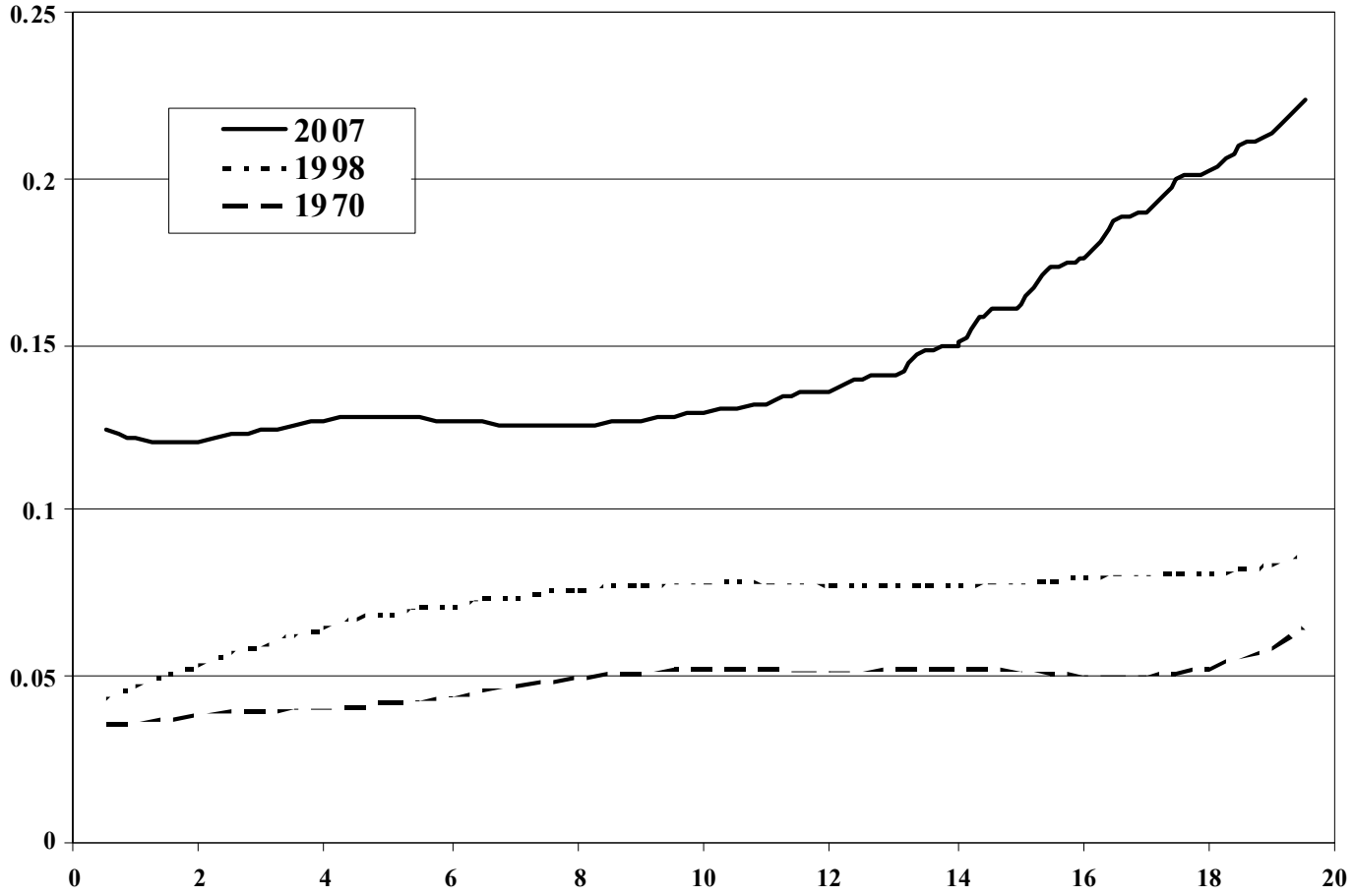
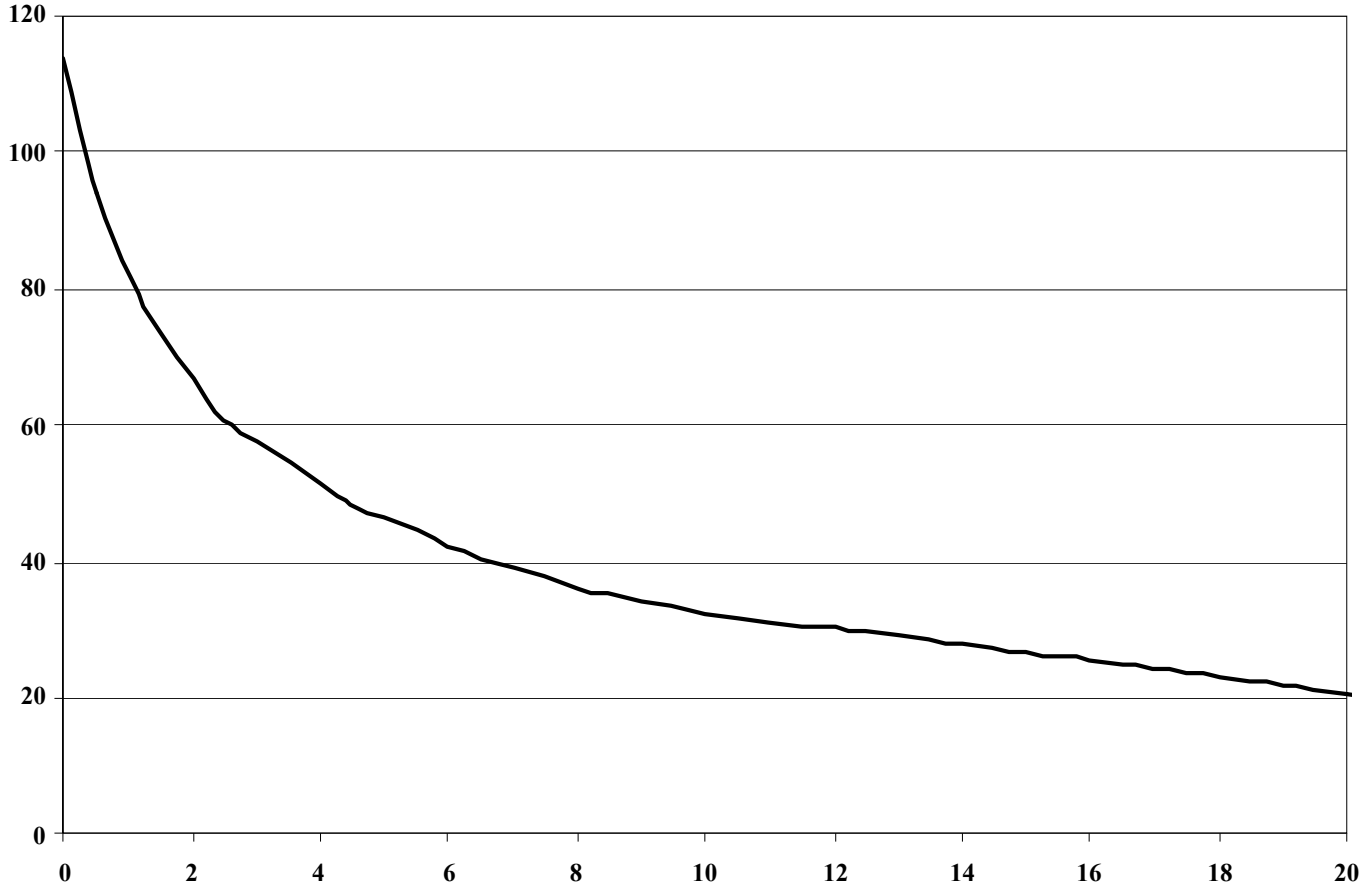


**Figure 1. Proportion of Farms with Mechanized Farming Equipment, by Owned Landholdings and Survey Year**



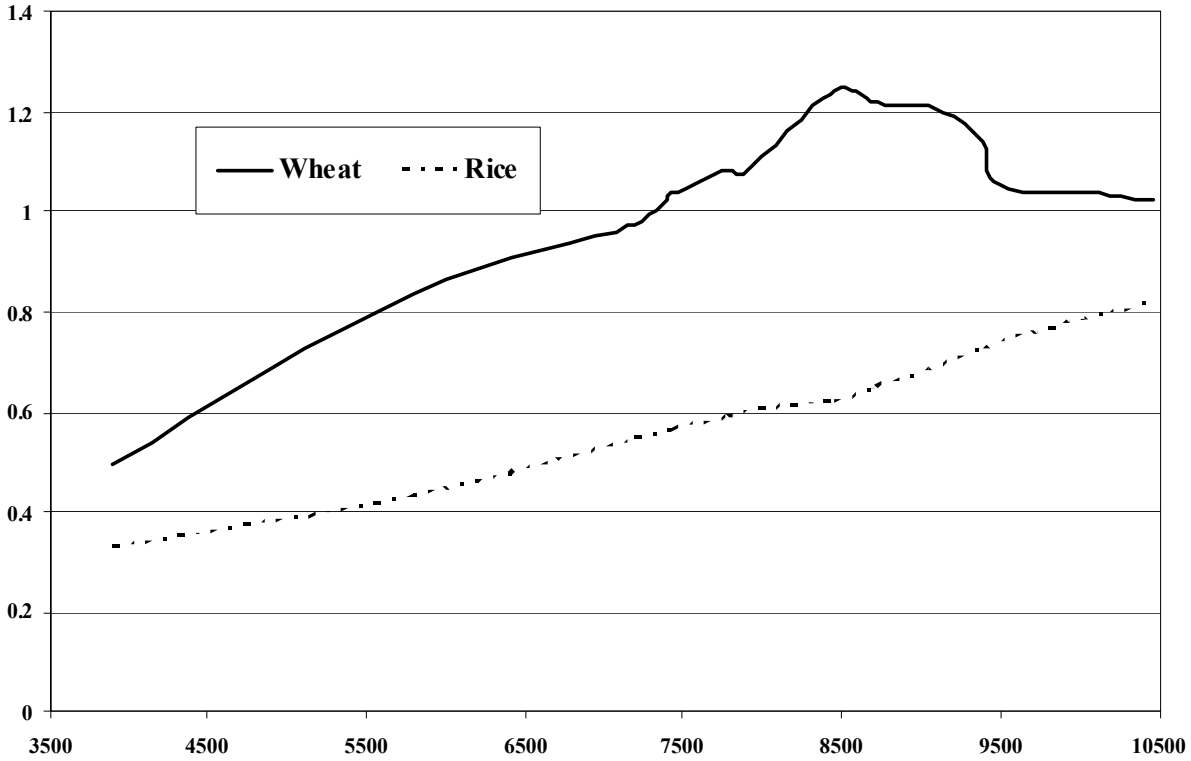

1.

**Figure A3. Total Mandays of Labor Used per Acre, Adjusted for Gender and Age, by Owned Landholding Size**



- Are small Indian farms efficients:
  - Large empirical literature using data from 1970s/1980s
  - Higher labor use and negative yield area relationship
  - But this ignores costs of inputs
- When costs are priced out at market wages generally see higher profitability for larger farms. (Carter, 1984; Lamb, 2003)
  - But it is not clear that either approach is right.
  - Clearly given activity of labor market the shadow value of family work is not zero
  - But if shadow value is the wage then it is unclear why labor-land ratio is higher on small farms.
- One hypothesis–tied to differences in supervisory cost. Feder (1985); Eswaran and Kotwal (1986)
  - But how important is this wedge?

**Figure A1. Relationship Between Mean Hectares Harvested per Hour and Combine Weight, by Crop: Indigenous Indian Combines (Source: Singh (2006))**

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## 3. Data

Main data sets

- 2007-8 Rural Economic Development Survey (REDS 2007-8)
- 1999 REDS both carried out by the National Council of Applied Economic Research (NCAER).
- 17 of the major states of India, with Assam and Jammu and Kasmir the only major states excluded.
- Original 1968-69 representative with over sampling of better off households.

Sample sizes

- Listing 120,000 households,
- 2007-8 household survey includes 4,961 crop cultivators who own land.
- Panel households  2,848 panel households (1999 and 2007-8)
- Data on 10,947 plots most for multiple seasons,

Plots

- Plots include multiple parcels of land
- With about two-thirds of the plots observed at least twice (two seasons or more).
- Plots compose of contiguous parcels that operate as a cultivating unit–only 4% of plots split
- Plots median distance is 400 meters
- Includes soil characteristics and distance to home
- Detailed inputs/outputs/cost at plot level for 2007-2008 survey, farm level 1999.

Contents

- Profits “empirical” output priced at farm gate, labor and market wage by male/female/child. Includes family labor cost.
- Inputs divided up by stage of productions
- Land and equipment that is sold, purchased, destroyed, transferred or inherited.
- Less than 3 percent of farmers bought or sold land
- Land is augmented largely through household division/death of father.
- Leasing
  - Only 4.6 percent of cultivated plots, over the three seasons, are rented (4.9 percent of area).
  - Mostly lease from parents and siblings (moral hazard/contiguous)

## Estimated Supervisory Cost for Hired and Family Labor over time

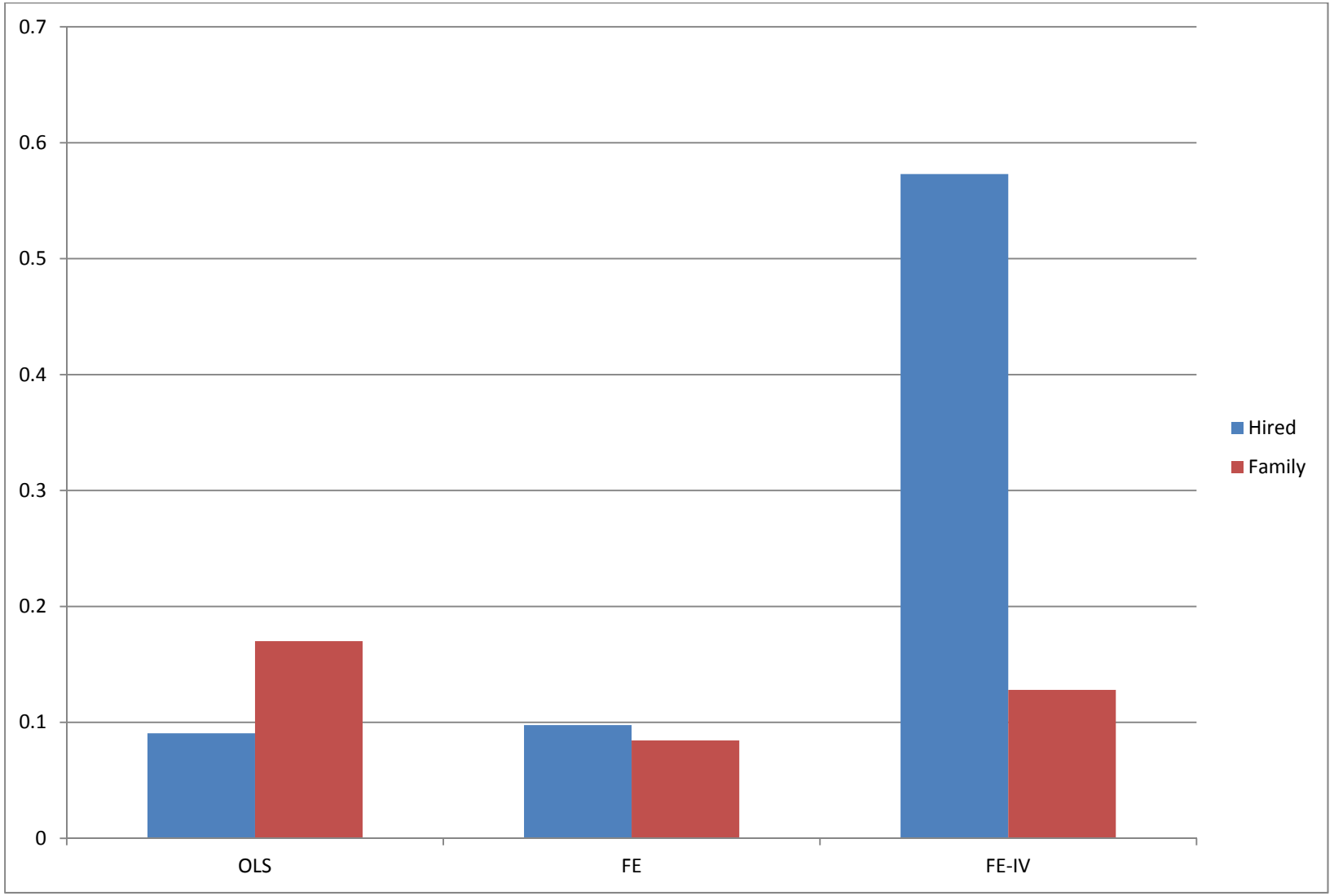


**Figure 2. Fraction of Agricultural Labor Employed in Three Labor Regimes, by Landholding Size**

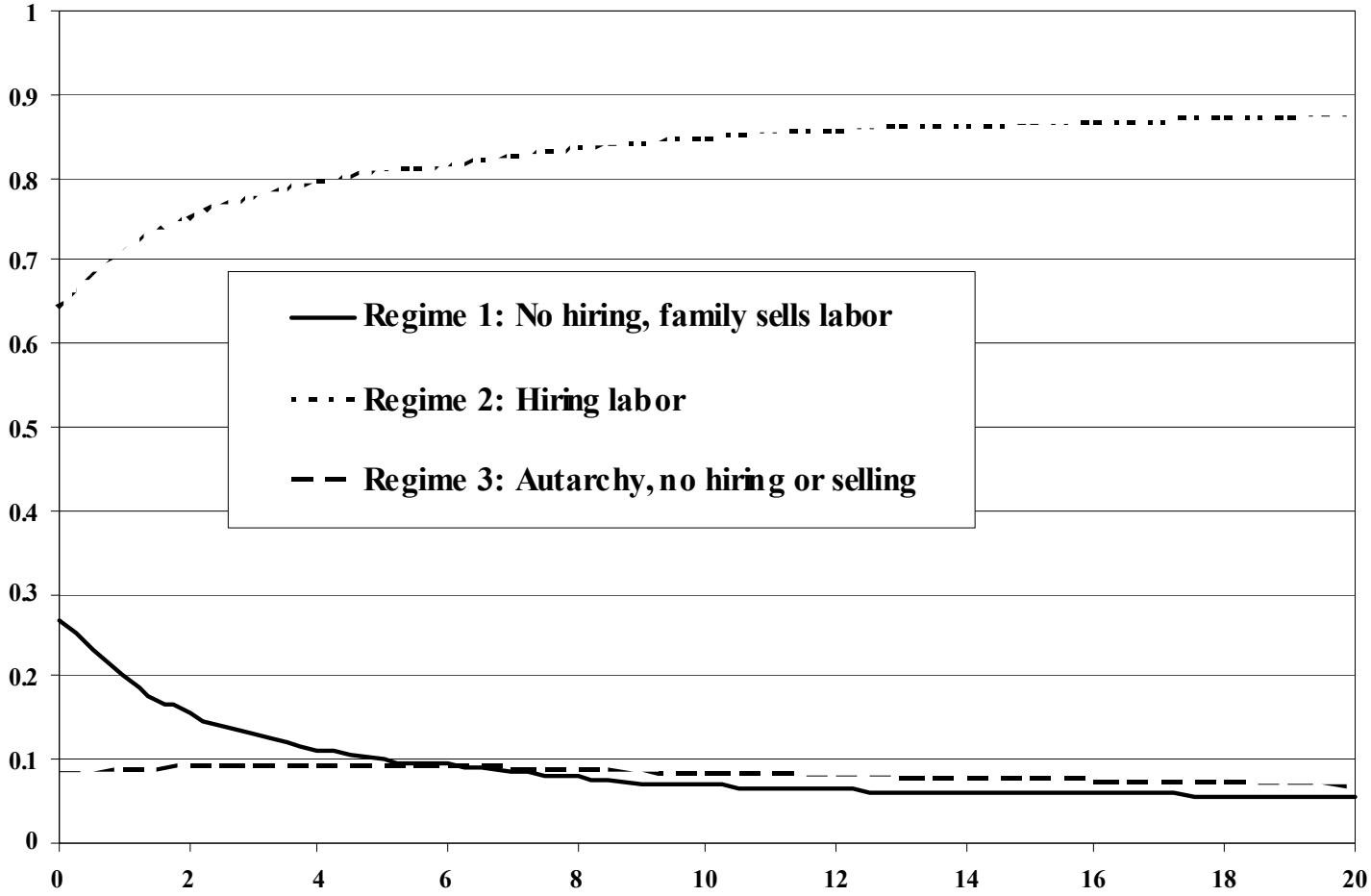
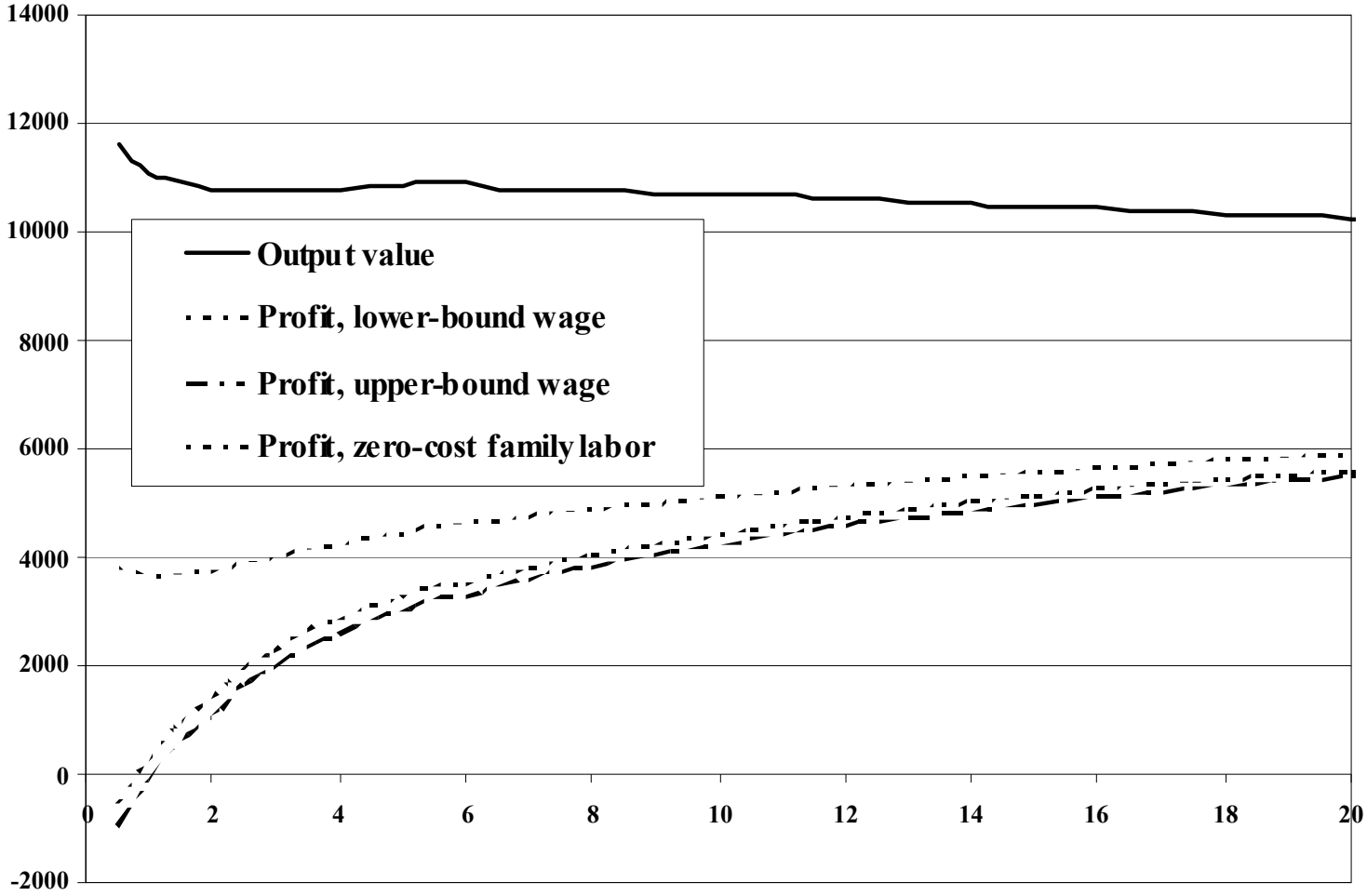


**Figure 3. Measures of Per-Acre Productivity, by Owned Landholding Size (2007-8)**



## Effects of landholding on profits and equipment over time

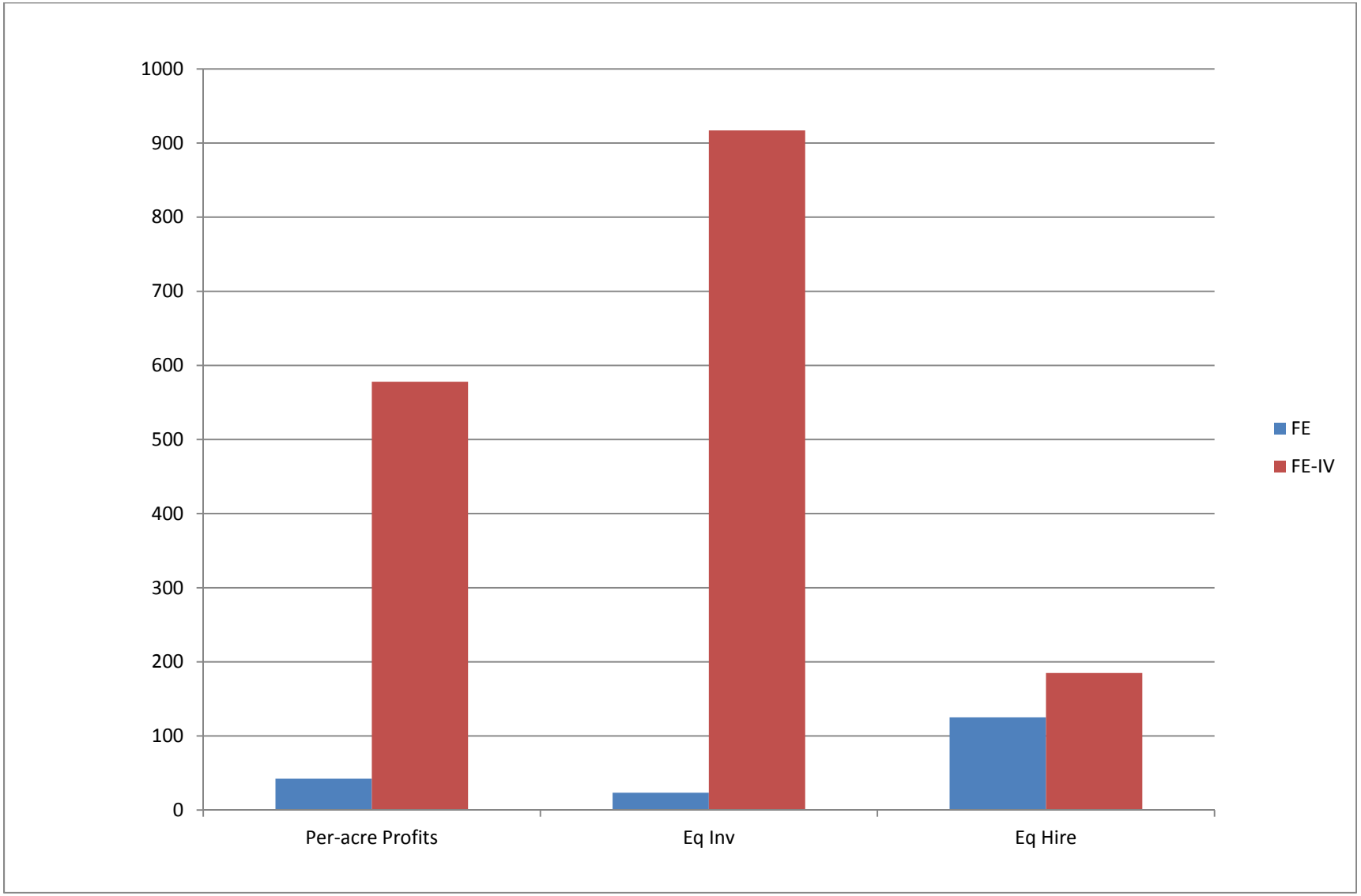
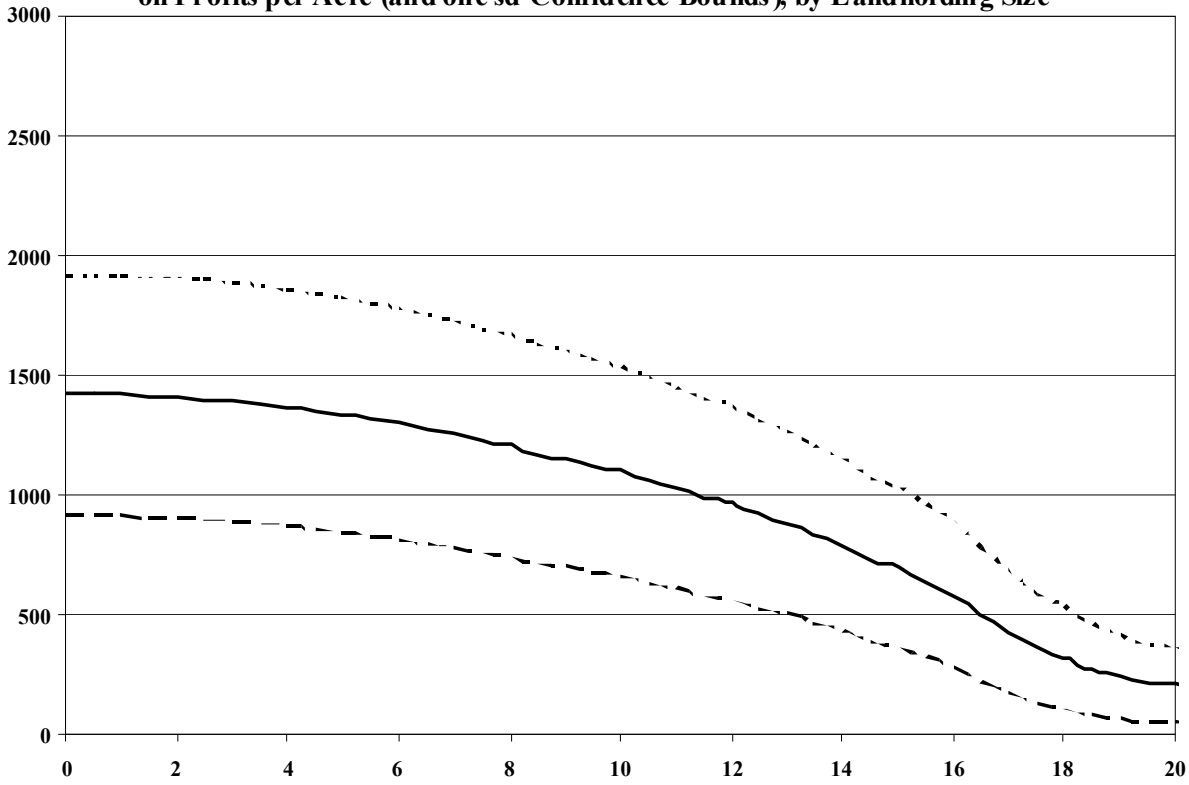
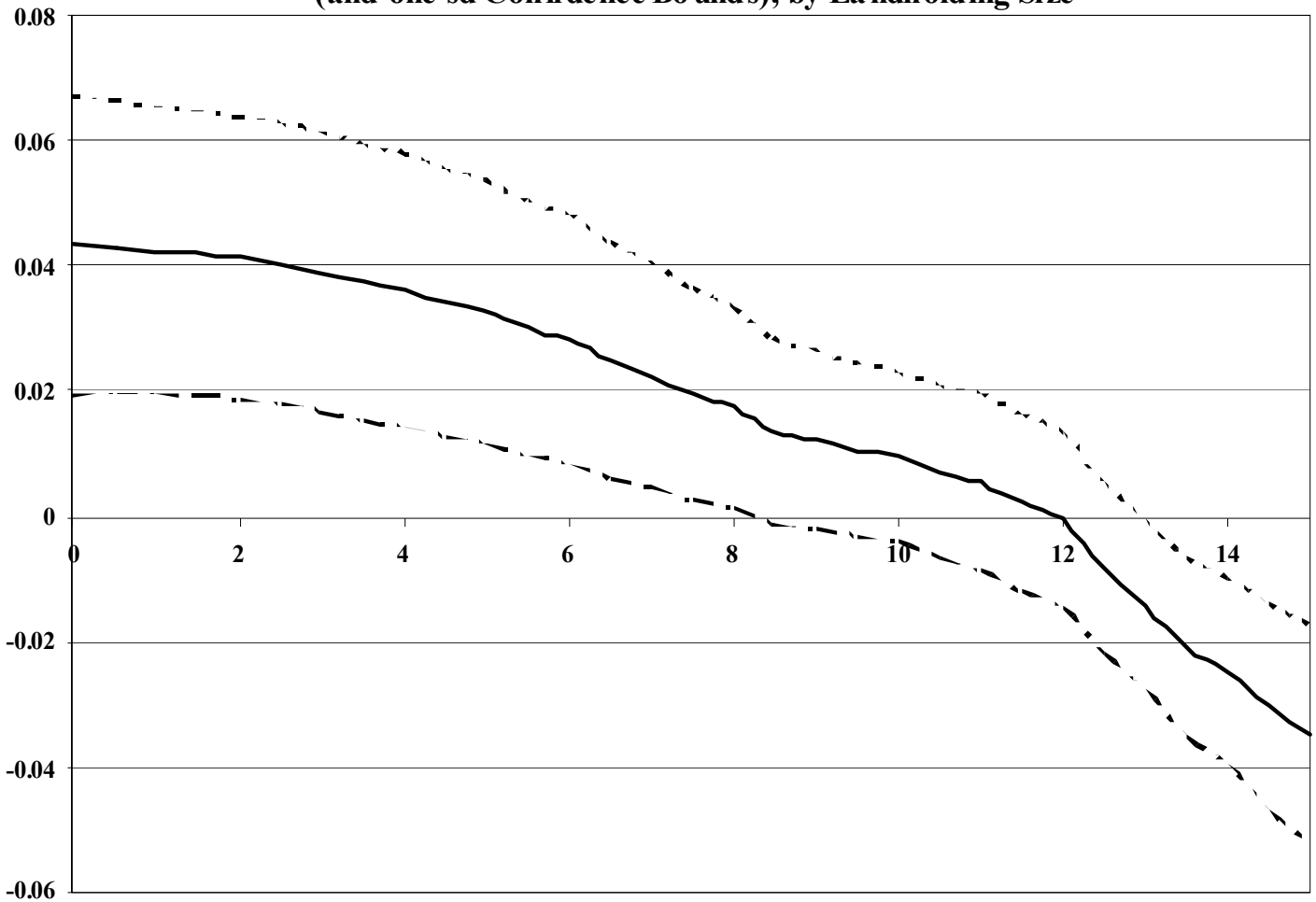


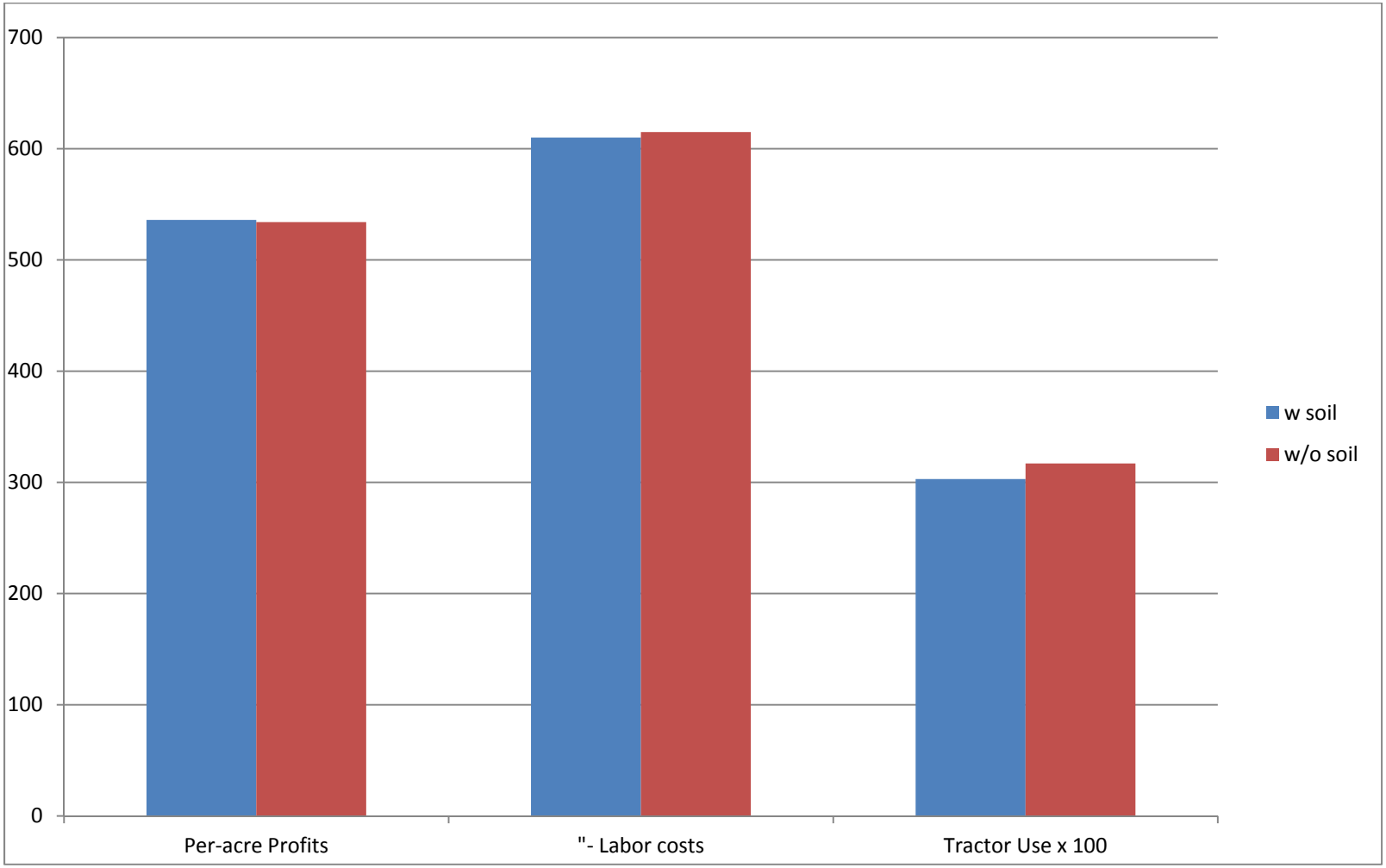
**Figure 4. Locally-weighted FE-IV Estimates of the Effects of Land Owned on Profits per Acre (and one sd Confidence Bounds), by Landholding Size**



**FigureA4. Locally-weighted FE-IV Estimates of the Returns to Capital Equipment Value (and one sd Confidence Bounds), by Landholding Size**



## Across plot estimates of scale effects



## Lagged Effects of Past on Current Profits on Given Plot and Other Plots Net of Fertilizer Usage

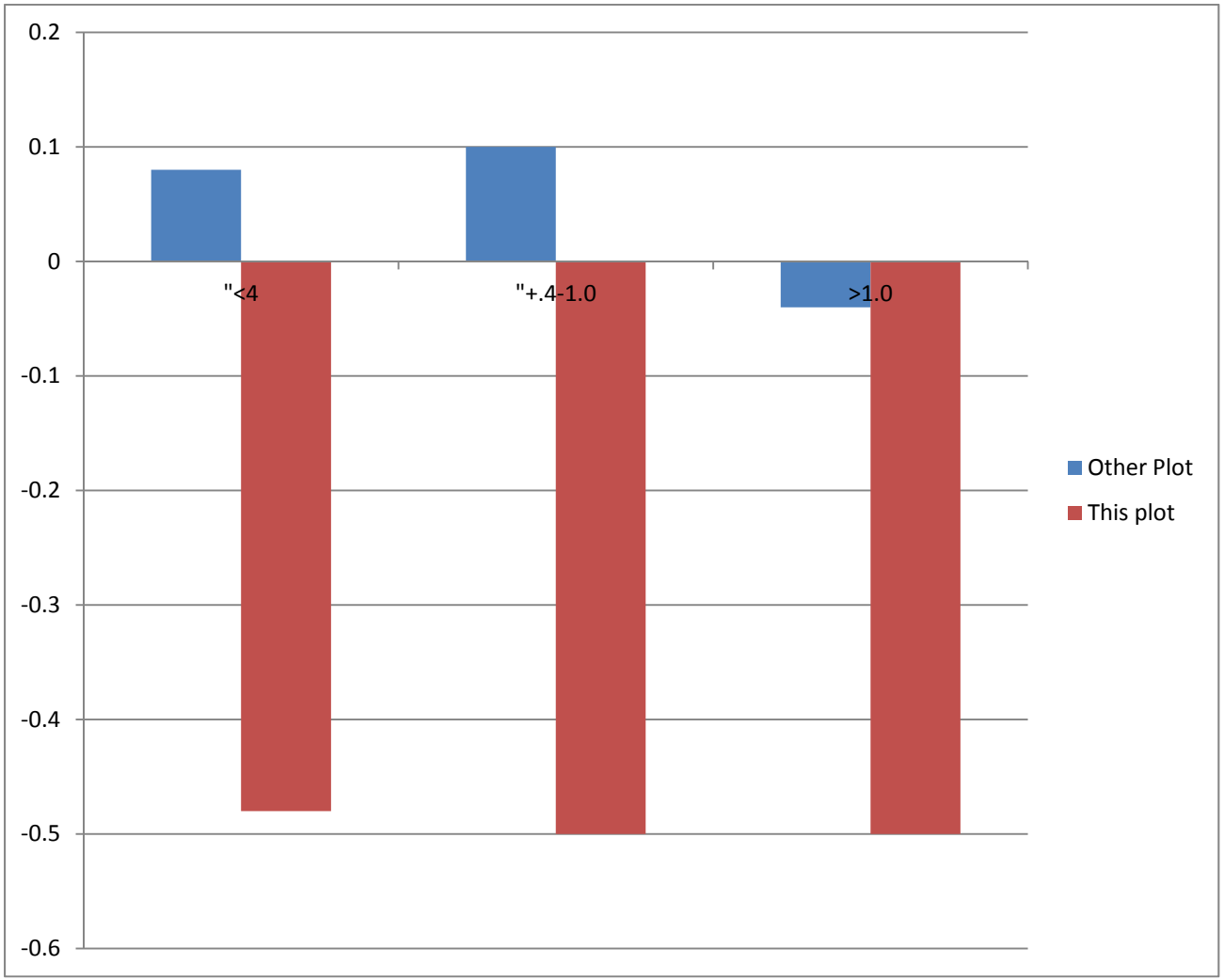


**Figure 5. Estimated Reservation Rental Rate, by Owned Landholding Size**

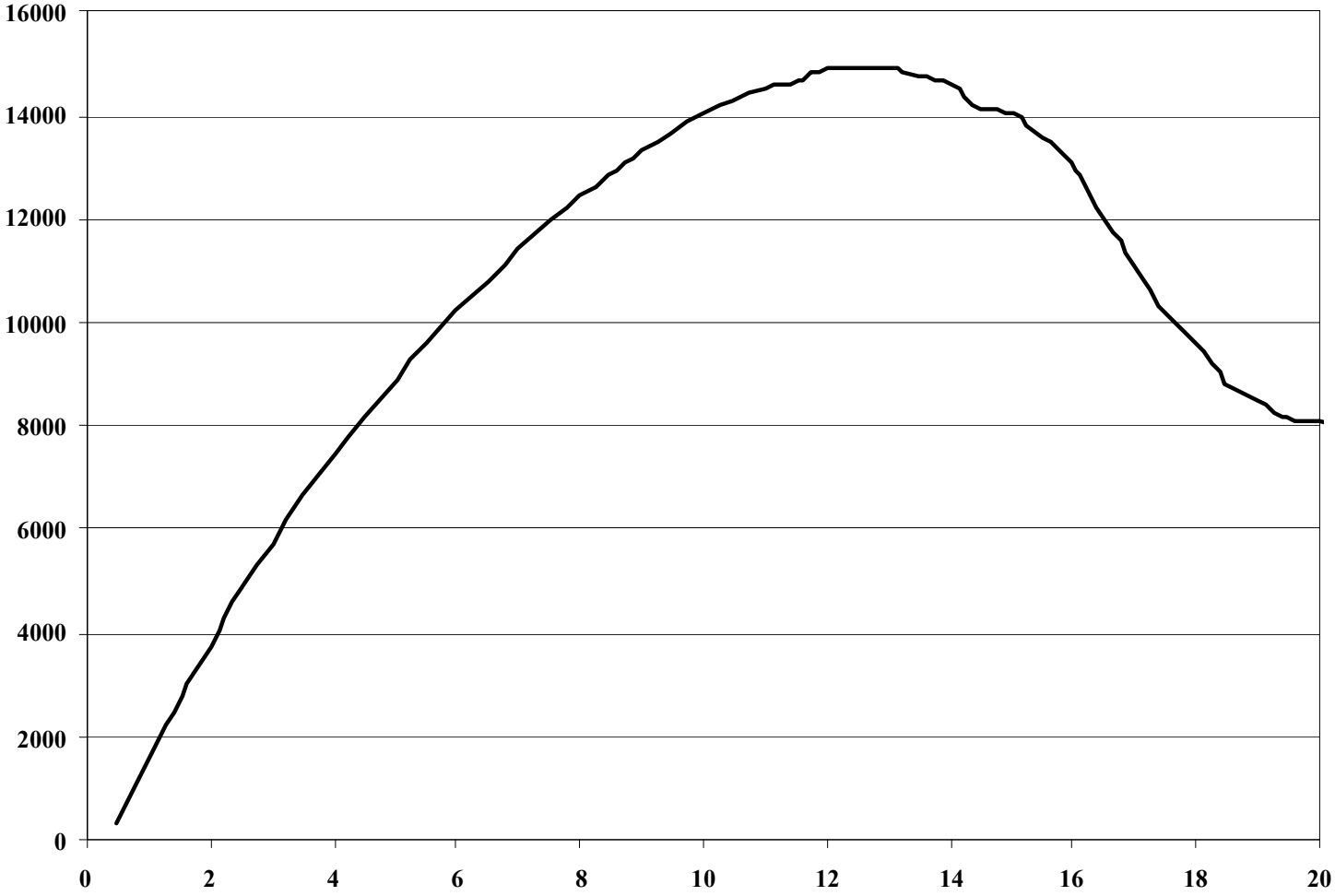
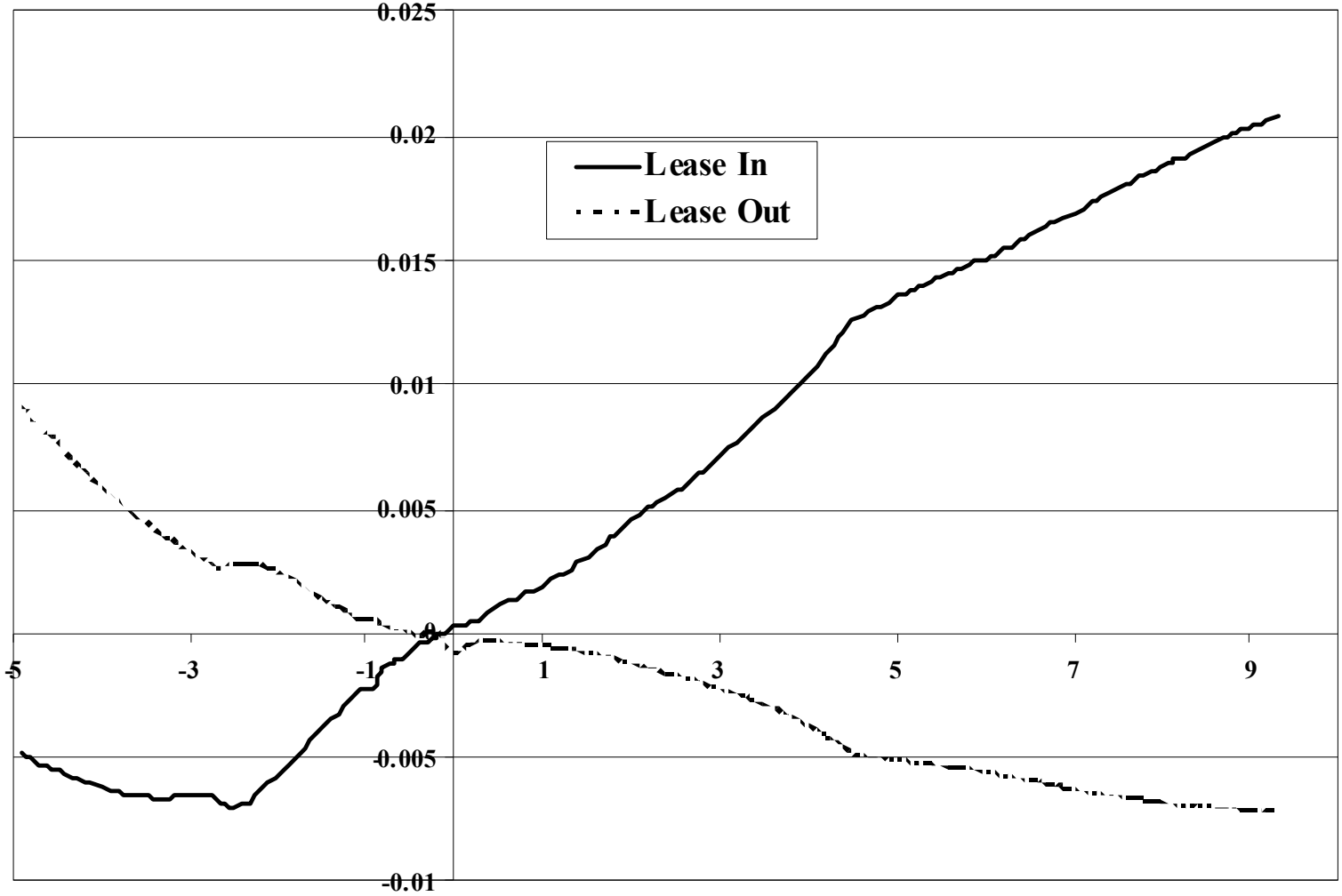


**Figure 6. Within-Village Relationship Between the Probability of Leasing In and Leasing out Land, by Ownership Holdings (N=119,349)**



- Conclusions:
  - There is scope for increasing labor productivity in agriculture through increased mechanization
  - The evidence suggests, however, that this can primarily be done through consolidation of landholdings
  - It also leads to substantial shedding of agricultural labor—as much as 20% at optimal levels of profitability.
  - This in turn would lead to decreases in the wage and increased poverty
  - Thus it is only tenable if there is a source for expanding productivity outside of agriculture through
  - Migration
  - Non-farm sector particularly for tradable goods that make use of local agricultural products