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Measuring the production efficiency of alternative land tenure contracts in a mixed crop–livestock system in Ethiopia

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A major argument put forward in favour of individualised land rights in sub-Saharan Africa is that farmlands held under exclusive and secure rights are more productive than farmlands held under other public or customary forms of tenure. If true, this argument implies that reforms to individualise land improve production efficiency and relegate efforts to develop technologies to a secondary position. From a public policy view point, better information on the relative efficiency of farmlands under different tenure contracts would provide a better indication of how land tenure systems affect resource use and the hence the overall productivity of farming operations. Despite the importance of the question of relative production efficiency of indigenous land rights, the subject has not benefited from rigorous empirical analysis, largely due to lack of sufficiently disaggregated data. This study examines the relative production efficiency of alternative land tenure arrangements and the sources of differences in productivity levels in a fairly productive, mixed farming system in the Ethiopian highlands.

Conceptual framework

Most productivity analyses attempt to estimate efficiency from econometric estimation of reduced-form production functions using partial productivity measures. Although providing insights into the efficiency of a single input in the production process, partial measures mask many of the factors accounting for observed productivity differentials.

Unlike conventional studies, this analysis relies on the concept of interspatial total factor productivity (TFP). TFP, defined as the ratio of aggregate outputs to aggregate inputs used in the production process, is well suited to the complexity of smallholder farming. This is because it measures productivity across fields with varying or multiple inputs and outputs under different tenure arrangements.

There are two basic approaches to the measurement of productivity: the growth accounting approach, which is based on index numbers, and the parametric approach based on an econometric estimation of production, cost or profit functions. In this study, the index number approach is used because it allows the use of detailed data with many input and output categories regardless of number of observations over time, and avoids aggregating outputs into a single index. The major difficulty with the index number approach (of deriving aggregate output and input measures for numerous outputs and inputs), is tackled by using the Divisia index which allows proportional adjustment of marginal productivities to changing prices.

Study area and methodology

The study area is located in one of the most productive regions of the country, Arsi zone. Four Peasant Associations (PA) in Tiyo *woreda* (district) were selected on the basis of their varying altitudes, crop mix and

livestock activities. A random sample of 161 households, composed of 115 PA member and 46 non-PA (NPA) member households, was drawn. These households controlled 510 crop fields from which a final sample of 317 crop fields was selected. Each of the sampled crop fields was subdivided into plots, a plot being defined as a distinct management unit due to the farmer's choice to plant a unique crop or intercrop on it. The sampled crop fields contained 477 separate plots for which data on area, inputs (human labour, oxen and tractor power, seeds and chemicals including fertilisers) and outputs (wheat, barley, legumes and residues) were collected during the main 1994 growing season. The prices of sample crop species and residues found on the sampled plots were collected in a separate survey in each of the two major rural markets frequented by sample farmers.

In terms of land contracts, control over land in the study region is, like elsewhere in Ethiopia, officially vested with the government, which is represented at the lowest administrative level by the PA. There are, however, numerous informal contracts and arrangements through which farmers gain access to crop lands without involving the PA. Thus, in Tiyo *woreda* in 1994, 76% of all fields were allocated directly by the PA to the current farmers and over half of the PA households farmed uniquely the lands allocated to them. The remaining 24% of fields, originally allocated to PA members, were informally subcontracted to NPA farmers. While over one-fifth of the PA households contracted out one of their fields, about the same proportion contracted in at least one field.

Based on differences in the nature of land contracts, in terms of duration, rights and costs, fields were grouped into one of four categories: PA-allocated, rented, share-cropped and borrowed. PA-allocated fields, which are essentially free, are held longer and have a greater range of use, modification and transfer rights than informally contracted fields. Of the informally contracted fields, rented fields which accounted for about 8% of all cropped lands and 33% of contracted fields in Tiyo *woreda* in 1994, have the shortest leases (average one year). Share-cropped fields, which made up 4% of all crop lands and 17% of contracted fields, are held somewhat longer, with 23% under long-term (average three years) agreements. The average holding time of borrowed and gift fields, which made up 12% of all crop lands and half of all contracted fields, comes closest to the duration of holding of PA-allocated fields (average three years).

As mentioned earlier, theory suggests that farmers are reluctant to invest in insecure fields. But the concept of security is complex and elusive, depending mainly on the farmer's subjective assessment of the political and legal climate. In this study, land tenure security is defined as a combination of the expected longevity of the contract and the breadth of rights to carry out a range of field-related activities. Because none of the tenure contracts is long-term or alienable, and nearly all farmlands are under exclusive control only for the duration of the growing season (dry season grazing), this definition of security is necessarily relative.

The four tenure arrangements described were ranked from 1 to 4 in terms of: (a) duration of holding, (b) use rights (planting, fallowing), (c) modification rights (trees, wells, fences, bunds), and (d) transfer rights (share, rent, lend, bequeath). A ranking of 4 indicates that the tenure arrangement is superior to all the other arrangements on the particular measure, while a ranking of 1 indicates that the tenure arrangement ranked lowest. This ranking procedure allows an ordering of the four land tenure arrangements in terms of declining security: PA, rented, shared and borrowed. As is evident, although PA-allocated lands are not 'secure' in a long-term sense, they offer greater security than informal contracts between farmers.

Productivity estimates

The results of the analysis show that average TFP levels for each of the three informal contracts considered are lower than for the PA-allocated land tenure arrangement. With a TFP level of 0.84, borrowed lands are

the least productive, followed by shared lands (0.87) and rented lands (0.90).

Overall land productivity levels for informally-contracted fields are also lower than for PA-allocated fields. However, the higher level of total inputs applied to informally contracted fields increases the level of land productivity but not the level of TFP. Differences in most input levels between informally-contracted and PA lands were also positive, whereas differences in land productivity were negative thus resulting in a negative change in TFP levels for all lands under informal contracts.

Lower levels of TFP were due to increases in quantities of factor inputs without corresponding increase in land productivity. Chemical inputs were also the major contributor to higher levels of inputs for all informal contracts. Rather than applying less input, as theory would suggest, farmers on informally-contracted fields applied more inputs. The high input intensities, combined with low land productivity ratios and thus low TFP, indicate that the capacity of rented, shared and borrowed lands to produce more output is not hampered by under-investment in variable inputs due to land insecurity. In other words, formal and informal land contracts did not act as an impediment to short-term investment decisions.

There are several reasons for this high input/low output combination on informally contracted fields. First, the soil quality of informally contracted fields, and especially borrowed fields granted at the discretion of the lender, can be lower than that of PA fields. Second, farmers contracting land may use labour inefficiently, and not plant or harvest at the optimal time because of labour and/or animal power constraints.

Conclusions

Many researchers believe that farmlands held under customary or informal contracts in sub-Saharan Africa are less productive than those held under individualised land rights. Using plot-level data and the concept of interspatial TFP, this analysis determined the relative production efficiency of four alternative land tenure arrangements prevailing in one region of the Ethiopian highlands.

The results of the analysis suggest that the duration and range of use rights of particular land contracts are more important than changes in the land tenure system *per se*. The finding that productivity was lower on informally-contracted fields, in spite of relatively higher levels of chemical input use may be indicative of the fact that tenure security is not a major farmer concern. Factors other than tenure, such as poor soil quality, farmer endowments and farmer experience, may contribute more to the low productivity levels of farming operations.

There thus seems to be little evidence to support the argument that individualised land rights result in increased productivity, unless institution of such rights also changes soil quality and farmer experience. This study supports the conclusions of agricultural productivity and property right studies which argue that land tenure does not constrain productivity at the current level of development in sub-Saharan Africa. Though restricted to a particular region of Ethiopia, the findings of this study suggest that a major change in the current land tenure system is not warranted. Public action is, however, required to assess farmers' demand for formalisation of informal land tenure contracts for increased input use to translate into increased land productivity and sustainable growth.

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For more information on this issue see: Gavian S. and Ehui S. 1998. Measuring the production efficiency of alternative land tenure contracts in a mixed crop-livestock systems in Ethiopia. *Agricultural Economics* 20(1):37-49.