Written Exam for the M.Sc. in Economics summer 2018

Advanced Development Economics: Micro Aspects

Exam/Master's Course

Suggested answers

15 June 2018

(3-hour closed book exam)

Question 1 (50%): Agriculture

A dataset based on a household survey of farmers in Madagascar and a do-file are included for this question. The dataset contains background information on the households, information on agricultural plots, together with labor and other inputs utilized in the production of rice. The do-file loads the dataset, helps you structure your answers, and sets global variables needed for the empirical models.

a) Discuss a simple relationship between different measures of productivity and farm size using the data for rice production in Madagascar? Does the chosen productivity measure matter for what we can say about the relationship between productivity and land size?

   Students should be able to graphically illustrate the inverse relationship and regress yield against farm size. The students should find the simple inverse relationship is present and comment on the size of the results. A one per cent increase in land is associated with a 0.35 per cent drop in productivity. Further, the students could also discuss why we could expect a positive relationship between productivity and size due to economies of scale.

b) Test in two separate models (using the core control variables are given to you in a global in the do-file) whether the inverse relationship between land productivity and farm size can be explained by: i) factor market imperfections and/or household shadow prices; or ii) soil quality of plots. Does your conclusion in regard to soil quality change when also accounting for household fixed effects? Discuss the potential explanations for the inverse farm size productivity relationship, including at least one other explanation than the ones tested. Discuss measurement error and the edge effect.

Students should estimate four models finding the following coefficient estimates for log(area):

Standard controls ➔ -0.286

Household fixed effects ➔ -0.198

Soil quality ➔ -0.281

Household fixed effects and soil quality ➔ -0.219

Further, students should be able to interpret the results and the sizes, and discuss why we take household fixed effects and account for soil quality. Soil quality variables are jointly significant when accounting for the standard controls and household fixed effects. The students should also discuss how measurement error and the edge effect could influence the inverse relationship. If farmers are systematically underestimating smaller plots, this could explain the inverse relationship. One theory states that plots are more productive on the edges, which could lead to smaller plots being more productive as a larger share of the plot is covered by edges.

c) Explain how land value could potentially capture the effects of soil quality. Test if soil quality is a predictor for land value. Discuss whether we can just leave out the soil quality variables from the model explaining yield.

The students should regress land value against the soil quality variables and further control for household fixed effects. Not controlling for anything leads to significant results, whereas controlling for household fixed effects leads to insignificant results. The student should prefer the latter approach. Further, the students should test the significance of the soil quality variables jointly.

In addition, the students should discuss whether the soil quality variables can be excluded when estimating productivity. Here the students should argue that soil quality could be correlated with other explanatory variables, thereby creating an omitted variable bias if excluded. The students could, however, also argue that based on a general to specific approach, the soil quality variables can be excluded one by one as long as the coefficient estimates remain insignificant.

Question 2 (50%): Agricultural Household Model (AHM)

Consider an agricultural household that is jointly engaged in production and consumption. To answer the following questions you can take point of departure in either Chapter 2 in Bardhan and Udry (1999) and/or Benjamin (1992):

a) Assume complete markets. Describe (graphically) the so-called "separation property" of the agricultural household model (AHM). Is this equilibrium affected if we introduce a land market imperfection (only)?

The answer should be clear about the model assumptions made, even though the answer can be answered graphically. All sub-questions can be answered based on the calculations and figures outlined in Chapter 2 in Bardhan and Udry (1999), but the student could also utilize the insights of Benjamin (1992) if needed. So it should be made clear that we are considering a problem of a household that is jointly engaged in production and consumption. Household utility depends on consumption (*c*) and leisure (*l*). *p* be the price of output, *w* the wage of labor and *r* the price of one unit of land. The household can produce the good on its farm according to the concave production function $F(L,A)$, where *A* is the area cultivated by the household and *L* is the amount of labor used on the farm. E^L be the household endowment of time and E^A the household endowment of land.
The model is therefore:

(1) $\max U(c,l)$

subject to

(2) $pc + wL^h + rA^h \leq pF(L,A) + wL^m + rA^m$

(3) $L = L^f + L^h$

(4) $A = A^f + A^h$

(5) $E^A = A^f + A^m$

(6) $E^L = L^f + L^m + l$

(7) $c, l, L^f, L^m, A^f, A^m \geq 0$

Maximization is with respect to consumption (c), leisure (l), hired labor (L^h) and land (A^h), labor (L^m) and land (A^m) supplied to the market, and labor (L^f) and land (A^f) used on the farm. Assuming complete markets it can be shown that the above maximization problem can be simplified to:

(1) $\max U(c,l)$

subject to

(7*) $pc + wl \leq \pi + wE^L + rE^A$

(8*) $\pi = pF(L,A) - wL - rA$

(9*) $c, l, L, A \geq 0$ (Only choice variables)

Maximization problem: max (1) s.t. (7*), (8*) and (9*). Notice that (1), (7*), (8*) and (9*) can be solved in two steps: First maximizing (8*) with respect to L and A, and then solve (1) subject to (7). This illustrates the separation property: Consumption decisions are separable from production decisions. Graph figure 2.1 page 10 in Bardhan and Udry (1999) illustrates the problem and the assumptions made. Important: It is the twin assumption of utility maximaization and complete markets that leads to the separation property (profit maximization is not assumed). F(L, E(A)) is the household production function with land endownment E(A). Given the real wage w/p, farm profits are maximized at using L* units of labor. Given the budget constraint household utility is maximized by choosing c* and l*.

b) Assume now that there is no land market combined with a binding constraint on the time spent by the household working for a wage in the labor market (involuntary unemployment). Describe (graphically) what happens to the "separation property".

No land market: r=0 and E(A)=A. Binding constraint in labor market: L(m)=M and L(h)=0. The maximization becomes

(*) $\max U(c,l)$
Subject to
(**) $c = F(E^L - M - l, E^A) + wM$

The household production choices depends on its preferences and its own endowments, and the separation property does not hold. Illustrate as in Figure 2.2 page 12 in Bardhan and Udry (1999) or figure 2 in Benjamin (1992). The outer axes measure the HHs consumption (goods consumption on the vertical axis, the time endowment minus leasure on the horizontal axis). The inner axis illustrates the HHs farm with output on the vertical axis and labor input on the horizontal. M hours are spent working in the market, earning wM. The HHs remaining labor time is spent on the farm, producing q*. HHs work M+L(f) and consumes c*=wM+F(L(f), E(A)). Utility is max in point A. Household production depends on preferences and endowments, and the separation property does not hold.

c) Describe how the AHM model is related to the discussion of the inverse relationship between land productivity and farm size.

(*) and (**) leads to $\max U(c,l) = \max U(F(L,E^A) + wM, E^L - M - L)$
FOC: Necessary and sufficient
$H = U_c^{'}(c,l)F_L^{'}(L,E^A) - U_l^{'}(c,l)$
Important is that to reach the result in Bardhan and Udry (1999) is the CRTS conditions and the imposed assumption $U_{cl}^{"} \geq 0$ that leads to the conclusion that $\frac{dL}{dE^A} = \left(\frac{L}{E^A}\right)\Omega < \left(\frac{L}{E^A}\right), where\ \Omega < 1$. Figure 2.2 can effectively be used to illustrate the result and the main point that as household's endowment of land increases, the intensity with which it cultivates declines. Consider a HH with more land than the one in point A in the previous question, but facing the same labor market constraint. If that HH were to cultivate with same intensity as HH A, it would have to produce in point C. If leisure is a normal good, point C will not be chosen. Instead HH will choose to produce and consume at point B, cultivating its larger farm less intensively than the smaller farm. The very good answer will relate this result to the findings in Q1 showing that not only market failure could lead to the inverse relationship, but that several measurement error concerns may have led researchers to build a model trying to replicate stylized facts that are in fact biased.