Written Exam for the M.Sc. in Economics summer 2012

Advanced Development Economics: Micro Aspects

Final Exam – "Rettevejledning"

29 May 2012

(3-hour closed book exam)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by "eksamen på dansk" in brackets, you must write your exam paper in Danish.

If you are in doubt about which title you registered for, please see the print of your exam registration from the students' self-service system.

Question 1: Labor/Migration

Consider the Harris-Todaro model specified as follows: The labor market consists of two sectors, the modern sector (*M*) and the agricultural sector (*A*). Wages in both sectors are exogenously given as W_M and W_A with $W_M > W_A$. In There are *L* workers in the economy, who allocate themselves between job search and employment in either the urban or the rural area. Employed workers in the city work in the modern sector and receive the wage rate W_M, while unemployed workers in the city receive nothing. Employed workers in the rural area work in the agricultural sector and receive the wage W_A. Workers in the urban area are employed with probability p and unemployed with probability 1-*p*. Modern sector jobs are filled randomly such that each worker in the urban area has the same probability of being hired.

Employment in the modern sector is given by the demand function

$E_M = KW_M^{-0.5}$, where *K* is a constant

With L_M workers in the urban area, the expected wage for a worker in the urban area is

$E(W_U) = pW_M = (E_M/L_M)W_M$ (NOTE: There was an error in the exam: W_M was incorrectly given as W_A)

Workers migrate between the urban and rural areas until the expected wage rate in both areas is the same.

Questions:

a) Give the equilibrium level of unemployment in the model as a function of the two wage rates.

b) Consider a policy by which labor demand in the modern sector is increased from $KWM^{-0.5}$ to $K'WM^{-0.5}$ with $K' > K$. Illustrate the impact of this policy on unemployment, inequality (measured by the Lorenz curve), and the income distribution.

c) Consider a policy by which the wage rate in the modern sector is initially 50% above the wage rate in the agricultural sector and subsequently lowered to be 40% above the wage rate in the agricultural sector. Illustrate the impact of this policy on unemployment, inequality (measured by the Lorenz curve), and the income distribution.

d) The Harris-Todaro model assumes a constant probability of employment for all migrants. Discuss how and why the probability of employment may vary with the number of earlier migrants.

Answers to Q1:

a) The following can be found in Fields (2005).

The equilibrium condition is $E(W_U) = W_A$ and as wages are fixed (thereby fixing modern sector labor demand) this determines the endogenous urban labor supply. The result is $L_M = (W_M/W_A)E_M$. As labor demand is specified by a simple formula the supply can be expressed as a function of the wages only:

$L_M = (W_M/W_A)\ KW_M^{-0.5}$.

Unemployment is

UNEM= $L_M - E_M = (W_M/W_A)*E_M - E_M = [(W_M/W_A)\text{-}1]E_M = [(W_M/W_A)\text{-}1]KW_M^{-0.5}$

(The last part of this equation is not in the text)

b) By simple insertion in the unemployment equation we find that unemployment increases by $[(W_M/W_A)\text{-}1]W_M^{-0.5}](K\text{-}K')$;

In the model, there are just three incomes—W_M for those employed in the modern sector, W_A for those employed in agriculture, and 0 for the unemployed. Any Lorenz curve will therefore consist of three piecewise linear segments and will bend twice, at kink points labeled K_1 and K_2. Because the lowest income is zero, the first segment OK_1 is entirely flat. The middle segment K_1K_2 has slope W_A, which also is the average income in the population, and therefore K_1K_2 also has a slope of 45 degrees. The third segment of the Lorenz curve K_2P is constructed simply by connecting the end of the second segment with the upper corner.

As unemployment increases, inequality increases (Fields, 2005, Fig 1). The income distribution has a crossing (both more employed in the modern sector and more unemployed) whereby there is no first order welfare dominance (Fields, 2005, Fig. 5):

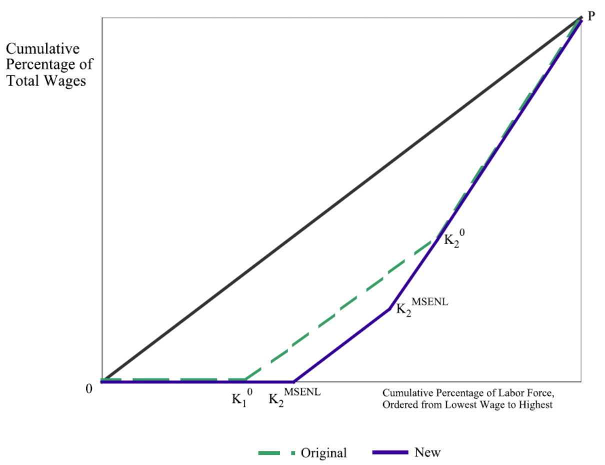

Fig. 1. Lorenz-worsening for MSENL.

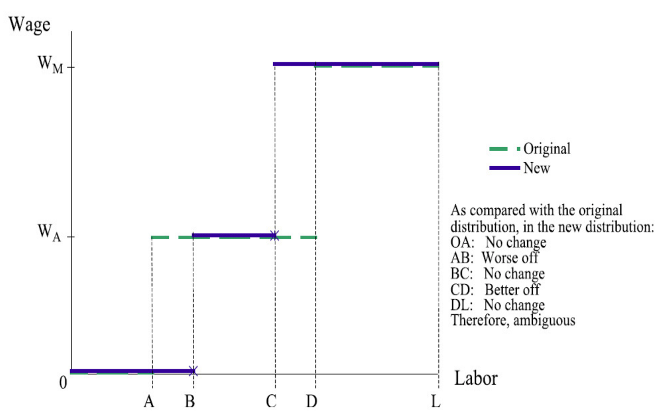

Fig. 5. No welfare dominance for MSENL.

c) This question is harder than (b) above because results depend on the relationship between the elasticity of the labor demand and the mark-up of modern sector wage on agricultural wage, so this is where the top grade is to be found.

Initial unemployment is $[(W_M/W_A)\text{-}1]KW_M^{-0.5} = 0.5*K*(1.5*W_A)^{-0.5}$. New unemployment is $0.4*K*(1.4*W_A)^{-0.5}$

Hence the change in unemployment is $KW_A^{-0.5}[0.4*1.4^{-0.5}\text{-}0.5*1.5^{-0.5}]\ KW_A^{-0.5}\text{=-}0{,}139\ KW_A^{-0.5}$. This is an increase in unemployment because the employment effect dominates the wage restraint effect on urban labor supply.

For the inequality and income distribution analysis we note that –(1/2)* [(W_M/W_A)-1] = -0.25 initially and -0.20 after the change. Both values are larger than the labor demand elasticity (-.5) whereby we have the results for the elastic demand in Fields (2005). Hence the answers are given from Fields (2005), Fig 4 and Fig. 8. Inequality changes are ambiguous, and there is no first order income dominance.

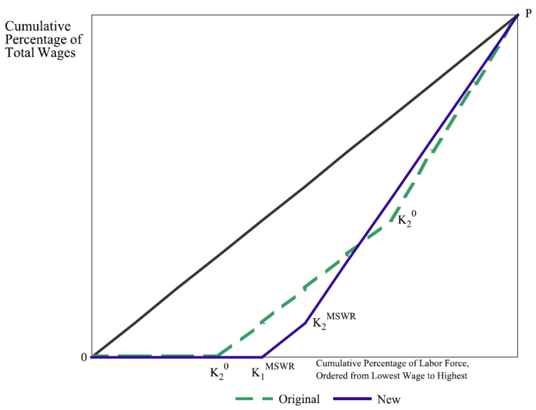

Fig. 4. Lorenz-crossing for MSWR, Case ii.

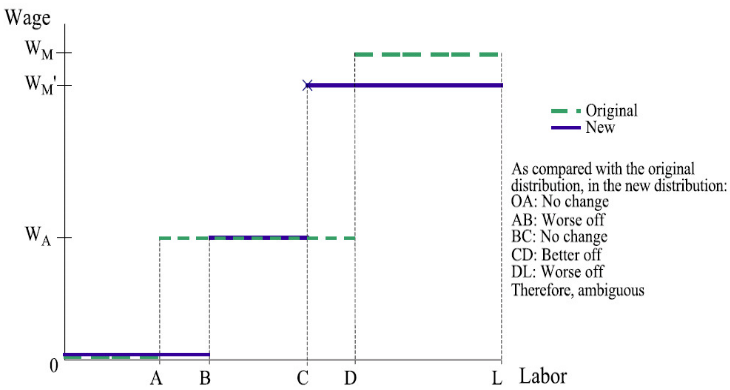

Fig. 8. No welfare dominance for MSWR, case of a sufficiently elastic demand for labor.

d) Bardhan and Udry (p. 56-59) formulate a model in which the migration decision is a function of (i) the wage differential between rural and urban wages, and (ii) migration costs. The migration costs are in turn a function of the presence of previous migrants in the city and of a measure of personal characteristics (age and education).

The reason why previous migrants affect the migration costs is that a move to the city does not guarantee employment. New migrants have to search for jobs, and they are helped in the search by the presence in the city of former migrants who are themselves employed. This assistance is modeled by a change in the probability that a migrant finds employment at any time, *t*.

Question 2: Fertility/AHM

a) Discuss how the increase in provision of free public schooling may have kept fertility high in developing countries

b) Explain how high fertility and child labor may be considered as (bad) labor market equilibrium outcome.

c) Explain why the households size and other demographics may have a negative impact on labor productivity in an agricultural household.

d) Discuss two approaches to empirical tests of the hypothesis that the household size has an impact on labor productivity.

Answers to Q2:

a) Bardhan and Udry (p. 22-23) formulate a model of the household in which there is a tradeoff between the number of children, investment in these children, and current consumption of goods.

Specifically, we consider a household, in which the parents plan to consume and to have educated children. The household seeks to maximize utility

$$(1) \quad \max_{x,n,z,t} U(x,n,z;\alpha), \qquad U_i'(\bullet) > 0$$

$$(2) \quad z = \frac{Z(c,t;\beta)}{n}$$

$$(3) \quad wE^L = p_x x + p_c c + wt \Leftrightarrow w(1-t) = p_x x + p_c c$$

Where *x* is parental consumption, *n* is the number of surviving children (to some arbitrary age), *z* is child quality (in human capital terms), *c* is child consumption, *t* is parental time dedicated to children: *t* is costly as it entails an opportunity cost in terms of wage-labor earnings foregone, and $E^L = L + t = 1$ is parental time endowment and parents can either work or spend time on children (no leisure).

The household's problem is to maximize (1) subject to (2) and (3). The implications of the model are

- Parents face a trade-off between the human capital achieved by their children, the number of children they raise, and their own consumption.
- As the wage increases (with economic growth), the opportunity cost of rearing children increases. This tends to reduce the number of children.
- An increase in the provision of free primary education permits children to achieve higher levels of education at given (*c*,*t*). This raises both *z* and *n*

The last result is what is asked for in the exam.

b) Bardhan and Udry (p. 27-31) presents the classical Basu model of child labor.

In the model children work if household consumption falls below a threshold level, while they do not work if households are above the threshold. Child leisure is a luxury good and adult and child labor are perfect substitutes.

In the model the single adult consumes *c*, while each child in the family consumes *bc* with $0 < \beta < 1$. The household budget constraint is

$c + m\beta c = w_a + mew_c$, where *m* is the number of children in the household, w_a is the adult wage rate, and w_c is the child wage rate.

Preferences are such that

$$
\begin{aligned}
&u(c+\delta, e) > u(c, e),\\
&u(c+\delta, 1) > u(c, 0) \text{ if } c < s,\\
&u(c+\delta, 1) < u(c, 0) \text{ if } c \geq s,
\end{aligned}
$$

Given family size (1+*m*) consumption and child work is a simple function of the adult wage rate and the subsistence level

$$
(c, e) = \begin{cases} \dfrac{w_a}{1+m\beta}, 0 & \text{if } w_a \geq (1+m\beta)s \\ \dfrac{w_a + mw_c}{1+m\beta}, 1 & \text{if } w_a < (1+m\beta)s \end{cases}
$$

If the economy has N households and adult labor is supplied inelasticly then labor supply is

$$
(S_a, S_c) = \begin{cases} N, 0 & \text{if } w_a \geq (1+m\beta)s \\ N, mN & \text{if } w_a < (1+m\beta)s \end{cases}
$$

If adult and child labor are perfect substitutes in production with (1/□) children being equivalent to one adult worker then the wage pair $(w_a, w_c) = (w_a, □w_a)$ will leave firms indifferent between hiring adults or children.

The model may have multiple equilibria:

High wage -> low fertility + no child labor,

Low wage -> high fertility + child labor

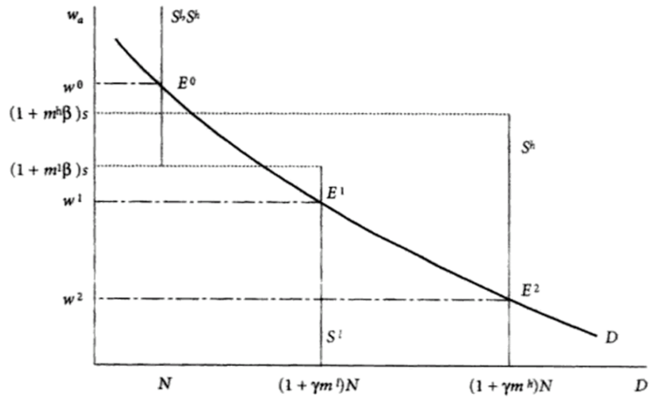

Figure 3.2

c) This question refers to the separation result in AHM and in particular to Benjamin (1992).

Benjamin works with 3 models of the labor market

1. A binding constraint on off-farm employment: A classical surplus labor model. Figure 2, page 293 – basically identical to figure 2.2 in B&U.
2. Rationing on the labor demand side: There is labor shortage during the peak season. The constraint on hiring-in has effects on on-farm employment decisions. Figure 3, page 296.
3. Differing efficiencies model: Off-farm wage differs from the hiring-in wage due to differences in family and hired labor efficiency. Figures 4 and 5, page 297.

It is sufficient if the student reproduces Figure 2.2 fromB&U

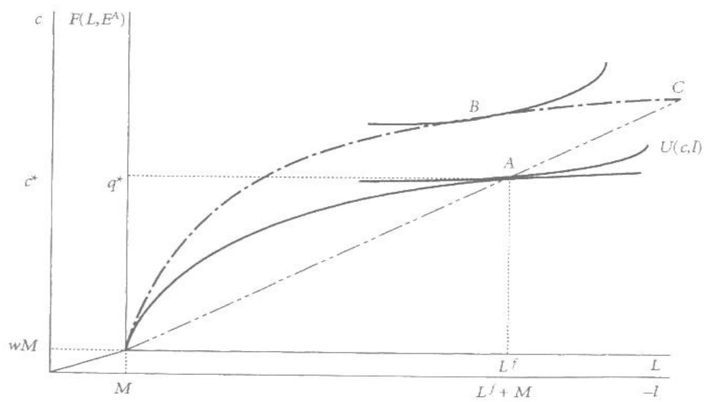

Figure 2.2

The HHs production choice depends on its preferences and its endowment –

The separation property does not hold.

d) The tests are given in Benjamin (1992) and in Le (2010).

- The null hypothesis: Farm employment is determined according to the neoclassical labor demand model.
- Alternative: Farm employment is correlated with household composition.

- Hence: identification of non-separation relies on the observation of a correlation between household demographic composition and observed farm employment.
- A critical assumption in the paper: Household endowments (demographics and land ownership) are exogenous.

Lee discusses the two most popular tests of the separation property; Benjamin’s test and a test by Jacoby that tests equality of the individual farm’s shadow wage and the market wage. Both tests have weaknesses: Benjamin’s test may have a problem with simultaneous determination of the market wage while Jacoby’s test requires estimation of the production function to predict the shadow wage. By an explicit Cobb-Douglas type assumption for labor input Lee computes shadow wages directly from data without estimation.

Question 3: Education

Answers to Q3:

a) One of the UN MDGs is to reach 100% primary school gross enrolment worldwide. Discuss the potential problems (both in relation to quantity and quality of schooling) of focusing on gross enrolment rates only.

The student should be able to discuss the exact definition of gross enrolment rates versus the definition of net enrolment rates

- Gross enrolment rate (the number of children enrolled in a particular level of education as a percentage of the population in the age group associated with that level)
- Net enrollment rate: Number of children enrolled in a particular level of schooling who are of the age associated with that level of schooling, divided by all children of the age associated with that level of schooling.

Gross enrolment rates could therefore be larger than 100% due to early or late enrolment and repetition. The answer should highlight that net enrolment rates by definition cannot exceed 100% and given that that both late enrolment and repetition rates are much higher in developing countries, the distance between gross and net enrolment rates are much higher in the developing world as compared to OECD countries. Moreover, primary school completion rates (Grade 4 survival rates) are especially low in Sub-Saharan Africa and South Asia. In relation to this issue, the good answer also discusses the problems of distinguishing between a school drop-out and a frequent absent student.

In the discussion of quality of schooling (in relations to the use of the gross enrolment rate definition), the answer could in addition consider (i) teacher absence rates, (ii) class size/pupil-teacher ratio issues (to large classes reduce the quality of schooling – increases in enrolment rates have to come hand-in-hand with investments in teachers and schools if quality of schooling is not to suffer), (iii) teacher education, experience and salary and (iv) the effect of school facilities on quality of schooling (Hanuchek).

b) Students often travel long distances to attend school. One way of increasing quantity of schooling is to reduce travel time to schools. Between 1973 and 1978, the Indonesian government therefore engaged in one of the largest school construction programs on record, and Duflo (2001) evaluate the effect of the project on education and earnings in Indonesia. Results are shown in the Table below. Outline the basic idea behind the identification strategy followed in Duflo (2001), and describe the conclusions that can be deduced from the Table. (Hint: Remember to describe the importance of the control experiment in panel B).

The basic idea behind the identification strategy can be illustrated using the simple two-by-two table (Table 3), which shows means of education and wages for different cohorts and program levels. Regions are separated in "high program" and "low program" regions. Panel A compares the educational attainment and the wages of individuals who had little or no exposure to the program (they were 12 to 17 in 1974) to those of individuals who were exposed the entire time they were in primary school (they were 2 to 6 in 1974), in both types of regions. In both cohorts, the average educational attainment and wages in regions that received fewer schools are higher than in regions that received more schools. This reflects the program provision that more schools were to be built in regions where enrollment rates were low. In both types of regions, average educational attainment increased over time. However, it increased more in regions that received more schools. The difference in these differences can be interpreted as the causal effect of the program, under the assumption that in the absence of the program, the increase in educational attainment would not have been systematically different in low and high program regions. The identification assumption should not be taken for granted. However, an implication of the identification assumption can be tested because individuals aged 12 or older in 1974 were not exposed to the program. The increase in education between cohorts in this age-group should not differ systematically across regions. Table 3, panel B, presents this control experiment, by considering a cohort aged 18 to 24 in 1974 and a cohort aged 12 to 17 in 1974. The estimated differences in differences are very close to 0. These results provide some suggestive evidence that the differences in differences are not driven by inappropriate identification assumptions, although they are imprecisely estimated. In panel B, for example, the differences in differences are insignificantly different from 0 but also from the differences in differences in panel A.

TABLE 3—MEANS OF EDUCATION AND LOG(WAGE) BY COHORT AND LEVEL OF PROGRAM CELLS

	Years of education			Log(wages)		
	Level of program in region of birth			Level of program in region of birth		
	High (1)	Low (2)	Difference (3)	High (4)	Low (5)	Difference (6)
Panel A: Experiment of Interest						
Aged 2 to 6 in 1974	8.49	9.76	−1.27	6.61	6.73	−0.12
	(0.043)	(0.037)	(0.057)	(0.0078)	(0.0064)	(0.010)
Aged 12 to 17 in 1974	8.02	9.40	−1.39	6.87	7.02	−0.15
	(0.053)	(0.042)	(0.067)	(0.0085)	(0.0069)	(0.011)
Difference	0.47	0.36	0.12	−0.26	−0.29	0.026
	(0.070)	(0.038)	(0.089)	(0.011)	(0.0096)	(0.015)
Panel B: Control Experiment						
Aged 12 to 17 in 1974	8.02	9.40	−1.39	6.87	7.02	−0.15
	(0.053)	(0.042)	(0.067)	(0.0085)	(0.0069)	(0.011)
Aged 18 to 24 in 1974	7.70	9.12	−1.42	6.92	7.08	−0.16
	(0.059)	(0.044)	(0.072)	(0.0097)	(0.0076)	(0.012)
Difference	0.32	0.28	0.034	0.056	0.063	0.0070
	(0.080)	(0.061)	(0.098)	(0.013)	(0.010)	(0.016)

Notes: The sample is made of the individuals who earn a wage. Standard errors are in parentheses.

c) Explain how Duflo (2001) improves the precision of the impact estimates.

Duflo (2001) use the variation in treatment intensity across regions and cohorts, and generalizes the strategy to a regression framework. First she considers the difference between the average education of a young cohort exposed to the program and that of an older cohort not exposed to the program. If additional schools led to an increase in educational attainment, the difference will be positively related to the number of schools constructed in each region. The regression specification is as follows:

$$(1) \qquad S_{ijk} = c_1 + \alpha_{1j} + \beta_{1k} + (P_j T_i)\gamma_1 + (\mathbf{C_j} T_i)\delta_1 + \varepsilon_{ijk}$$

S = education of individual I born in region j in year k. T is a dummy indicating whether the individual belongs to the "young" cohort, alfa is a district of birth fixed effect, P denotes the intensity of the program in the region of birth and C reflects region specific effects. Using Equation (1) Duflo (2001) compares children aged 2 to 6 in 1974 with children aged 12 to 17 in 1974, controlling only for the interaction of a cohort of birth dummy and the population aged 5 to 14 in 1971. The suggested effect is that one school built per 1,000 children increased the education of the children aged 2 to 6 in 1974.

This interpretation relies on the identification assumption that there are <u>no omitted time- varying and region-specific effects correlated with the program</u>. The allocation of schools to each region was an explicit function of the enrollment rate in the region in 1972 (low enrolment rates = more schools build). Therefore, the estimate could potentially confound the effect of the program with mean reversion that would have taken place even in its absence. The identification assumption will also be violated if the allocation of other governmental programs initiated (and potentially affecting education) was correlated with the allocation of schools. Duflo (2001) therefore control for the interactions between cohort dummies and the enrollment rate in the population in 1971, as well as for interactions between cohort dummies and the allocation of the water and sanitation program (the second largest INPRES program centrally administered at the time). Controlling for both the enrollment rate and the water and sanitation program makes the estimates higher suggesting that the estimates are not upwardly biased by mean reversion or omitted programs.

Duflo (2001) again carries out a control experiment (comparing the cohort aged 12 to 17 to the cohort aged 18 to 24 in 1974). If, before the program was started, education had increased faster in regions that received more schools, the control experiment would show (spurious) positive coefficients. But the impact of the "program" in the control experiment is very small and never significant.