Written Exam for the M.Sc. in Economics Summer 2015

Advanced Development Economics: Micro Aspects

Final Exam

28 May 2015

(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.

This exam question consists of 4 pages in total (including this frontpage)

Question 1: Education

The question below refers to the analysis and results in Duflo (2001), "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment", *American Economic Review*, 91(4), 795-813. Between 1973 and 1978, the Indonesian government engaged in one of the largest school construction programs on record. Duflo (2001) evaluate the effect of building schools on education and earnings in Indonesia.

Q1A: Using the Table below, describe in detail the basic idea behind the identification strategy followed in Duflo (2001).

ANSWER SHOULD INCLUDE THE FOLOWING:

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.

Q1B: Discuss the way in which Duflo (2001) seeks to improve the precision of the above estimates. When doing this comment on the conclusion made by Duflo (2001) that estimates are not upwardly biased by mean reversion or omitted programs.

ANSWER SHOULD INCLUDE THE FOLOWING:

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:

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

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 no omitted time- varying and region-specific effects correlated with the program. 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.

Even if the identification assumption is satisfied, the coefficient may slightly overestimate the effect of the program on average education. Note that such a large program could potentially have affected the returns to education by increasing the stock of primary school graduates. Individuals' education choices could then have responded to this decrease in the returns to education. To the extent that Indonesia is an integrated labor market, the returns to education would have declined in the entire country. The estimates do not take this negative effect of the program into account because it is common to all regions. This effect, however, is not likely to be very large. Its size ultimately depends on the elasticity of the demand for educated labor (which is likely to be low in a rapidly growing economy), the sensitivity of educational choice to perceived returns to education, and the extent of integration in the Indonesian labor market.

Question 2: Health and Nutrition

Field et al (2009) examine the effects on child schooling of an intensive and repeated distribution of iodine supplements. They look for evidence of improvements in cognitive ability attributable to the intervention by assessing whether children who benefited from supplements in utero exhibit higher rates of grade progression 10 to 14 years later.

Q2A: Describe the way iodine deficiencies (IDD) can affect human capital accumulation and labor productivity. Include in the description the link between IDD and gender inequality.

ANSWER SHOULD INCLUDE THE FOLOWING:

Ecological conditions related to health environment (malaria transmission rates has a direct effect on economic growth). Iodine is one of the most important for human growth and development (the only micronutrient known to have significant, irreversible effects on brain development). If dietary iodine is a key determinant of cognitive capacity, its deficiency could have important consequences for human capital accumulation and labor productivity. An estimated 1 billion people are at risk of iodine deficiency disorders (IDD) worldwide. IDD may therefore account for a significant fraction of unexplained variation in cross-country growth rates. (Africa has particularly low concentrations of iodine in soil and ground water). What is the influence of iodine deficiency on rates of learning disability. **GENDER: If girls are more susceptible to IDD in utero, geography may contribute directly to gender disparities in schooling outcomes.**

Q2B: Based on the Table below describe the identification strategy pursued and the main results obtained. Remember to comment on the gender dimension.

ANSWER SHOULD INCLUDE THE FOLOWING:

Field et al (2009) examine the effects on child schooling of an intensive and repeated distribution of iodine supplements. Look for evidence of improvements in cognitive ability attributable to the intervention by assessing whether children who benefited from supplements **in utero** exhibit higher rates of grade progression 10 to 14 years later. Compare children likely to benefit from the program in utero to slightly older and younger cohorts within the district. Result: Reducing fetal IDD has significant benefits for children's cognitive capacity.

Estimation Strategy:

Outcome: Years of completed schooling.

Problem: The program favored needier areas.

Solution: Rely only on the within-district comparisons for estimating treatment effects.

EQUATION: Fixed effects specification

$$grade_{id} = \alpha + \beta_1(T_{id}) + \beta_2(\mathbf{A}_i) + \beta_3(\mathbf{X}_{id}) + \mu_d + \varepsilon_{id}.$$

T(i) = child i in district d protected from IDD

A = birth year dummies

X = household and child-level control variables

Table results: Children likely to be protected from iodine deficiency during their first trimester in utero attain an average of 0.35 years of education above older and younger children in their district who were not. When district-level coverage rates are incorporated into the estimates, the implied effect of supplementation rises to 0.56 years. Estimated effects are substantially larger for girls (Micronutrient deficiencies important in explaining gender differences in schooling attainment).

TABLE 3—GRADE ATTAINMENT AND IOC SUPPLEMENTATION IN UTERO (*PART 1*)

				Binary treatment indicator		
	All (1)	Girls (2)	Boys (3)	All (4)	Girls (5)	Boys (6)
Pr(IOC in utero)	0.347	0.594	0.190	0.246	0.429	0.134
	[0.148]**	[0.170]***	[0.160]	[0.114]**	[0.135]***	[0.136]
Pr(IOC in utero) × district coverage rate						
$\Pr(\text{IOC in utero})_{3\le t<5}$	0.033	0.208	−0.095	0.106	0.223	−0.017
	[0.159]	[0.296]	[0.210]	[0.122]	[0.199]	[0.147]
$\Pr(\text{IOC in utero})_{3\le t<5}$ × young mom	−0.055	−0.283	0.080	−0.056	−0.313	0.121
	[0.161]	[0.354]	[0.200]	[0.081]	[0.180]*	[0.112]
Age 11	0.377	0.310	0.360	0.437	0.362	0.412
	[0.115]***	[0.137]**	[0.132]***	[0.126]***	[0.154]**	[0.147]***
Age 12	1.129	1.113	1.115	1.187	1.146	1.170
	[0.125]***	[0.162]***	[0.137]***	[0.130]***	[0.176]***	[0.154]***
Age 13	1.914	2.062	1.735	1.958	2.079	1.778
	[0.143]***	[0.172]***	[0.160]***	[0.148]***	[0.193]***	[0.191]***
Fixed effects	District	District	District	District	District	District
Observations	1,395	678	717	1,395	678	717

Q2C: What are the two confounding issues of the approach chosen? And how likely are they to be valid?

ANSWER SHOULD INCLUDE THE FOLOWING:

1. Treatment may have influenced early fetal outcomes through channels other than iodine availability (For example through interaction with health care workers or offer of alternative health inputs at the time of IOC).
2. The timing of distribution rounds was driven by irregular declines in the quality of district prenatal health services. In this case, children in utero during program gaps may have experienced other deficiencies in fetal health inputs, relative to those born immediately before or after, which could lead to permanently poorer health—and possibly schooling— among children who did not benefit from IOC that is independent of reductions in IDD.

HOWEVER: the duration of IOC coverage makes such stories difficult to construct.

Question 3: Credit

Based on the framework outlined in Bardhan and Udry Chapter 7, consider a rural credit market where borrowers and lenders are risk neutral. Each individual in a village has access to the same amount of land, and can farm this land at a fixed cost (equal to 1). The farm yields 0 if there is harvest failure, and *R>1* otherwise. The probability of a successful farming season is $\pi(e)$, where *e* represents effort of the farmer. $\pi(e)$ is strictly increasing and concave. The utility cost to the farmer of working is given by *D(e)*, which is increasing and strictly convex. There is no land market (no wealth), the farmer therefore has to borrow the necessary working capital. If a lender offers an interest factor of $i \leq R$, the returns to the farmer and lender are as follows:

	Borrower	Lender
Success	*R-i-D(e)*	*i*
Failure	*D(e)*	0

Lenders have access to a risk-free capital market with a return (ρ) of $R > \rho \geq 1$. Moreover, if the borrower does not involve herself in farming, she can receive a return (*W*) of $R > W \geq 0$ in alternative employment. Based on the above we have that;

Q3A: Outline the expected utility for the borrower and the lender and illustrate graphically how a competitive equilibrium loan market model with complete information and markets compares with a

- **(i) Competitive equilibrium with moral hazard**
- **(ii) Equilibrium with a fully informed monopolist**
- **(iii) Equilibrium where there is competition between an informed local moneylender and uninformed outside lenders.**

ANSWER SHOULD INCLUDE THE FOLOWING:

The expected utility of a borrower can be written as: $U(i,e) = \pi(e)(R-i) - D(e)$

The expected utility of a lender can be written as: $\Pi(i,e) = \pi(e)i$

Assumptions needed: 1) The loan contract has limited liability: If the borrower's harvest fails, she has no funds to repay the loan and the lender receives nothing. 2) No problems of enforcement: If the harvest is

successful, the borrower cannot renege on her commitment to repay the loan if the project is successful. The perfect answer follows the description in page 80-85 in Bardhan and Udry (1999) including Figure 7.1.

Q3B: Outline and describe an example of how the consequences of moral hazard can be neutralized.

ANSWER SHOULD INCLUDE THE FOLOWING:

The consequences of moral hazard in the credit market can be neutralized by the use of collateral, when both borrowers and lenders are risk-neutral. Suppose that each borrower owns some assets with value greater than *R*. If the project fails, the borrower transfers the collateral pledged for the loan to the lender. The borrower absorbs the entire risk of the transaction, and the return to the lender no longer depends on the choice of effort by the borrower (collateral removes the moral hazard problem). The loan is now riskless to the lender, so the interest rate is at the level of the riskless rate. Borrowers are induced to put the optimal effort into the project. Lenders make zero profits, and borrowers achieve the same utility as they achieve in the complete info equilibrium. The result depends crucially on the assumed risk neutrality of both parties. If the borrower were risk-averse the use of collateral could not entirely alleviate the difficulties induced by moral hazard, because the borrower would not be willing to absorb the entire risk of the transaction without some compensation from the lender.

Q3C: Describe the pros and cons of the three main mechanisms used in microfinance (group lending, dynamic incentives and regular repayments).

ANSWER SHOULD INCLUDE THE FOLOWING:

1 **Group lending:**

Advantage: Peer selection in groups leads to **assortative matching**. Safe types form groups with safe types because this is more profitable. The limited liability payment has to be made less often when you team up with a safe type. This mechanism utilizes that borrowers have local information about one another (Disadvantage: questionable in ethnic diverse populations). Peer monitoring in groups therefore mitigates moral hazard problems (Disadvantage: But no difference in default rates between individual and group lending are observed empirically when group and individual loans are offered in **similar populations**).

Disadvantage: So one element of group lending argues in favor of targeting homogeneous populations, but here it seems (from the empirical literature) that group lending is not superior to individual loans.

2 **Dynamic Incentives:**

Advantage: Lending is made progressive: loan size increase contingent upon repayment. Dynamic incentives reduces moral hazard

Disadvantage: Increased competition erodes this beneficial effect.

Disadvantage: Works better in areas with low mobility; note women have lower mobility and less access to credit than men.

3 **Regular Repayments**

Payments start almost immediately and continue on a regular—often weekly—basis

Advantage:

- Provides interim information on borrower type.
- Undisciplined borrowers can be detected early.

Disadvantage:

- Households must have another income source.
- Agricultural cultivation with strong seasonality is not suited for these regular repayments.