Written Exam for the M.Sc. in Economics summer 2014

Advanced Development Economics: Micro Aspects

Final Exam

SUGGESTED ANSWERS

28 May, 2014

(3-hour closed book exam)

Please note that the exam is available only in English.

Question 1: Rural credit markets

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 $\pi(t)$, where t represents the type of farmer. Suppose that farming requires no effort, but that there are two types of potential borrowers:

- Type 1 is a low risk, low return
- Type 2 is a high risk, high return

$$\pi(1) > \pi(2)$$
$$R(1) < R(2)$$

The expected return to farming each type of land is identical: $\pi(1)R(1) = \pi(2)R(2) = \bar{R}$

Assume no land market (no wealth), and the farmer therefore has to borrow the necessary working capital from the lender, who offers an interest factor of $i \leq R$. Assume that lenders have access to a risk-free capital market with a return of ρ $(R > \rho \geq 1)$. Assume also that, if the borrower does not farm, she can receive a return of W $(R > W \geq 0)$ in an alternative employment. Based on the above we have that:

- The expected utility of a borrower is: $U(i,t) = \pi(t)(R(t) - i)$
- The expected utility of a lender is: $\Pi(i,t) = \pi(t)i$

a) Consider a rural credit market where lenders might have a good idea about the average characteristics of the pool of potential, but they may not have complete information concerning the characteristics of any particular borrower. Explain and illustrate graphically how a competitive equilibrium model with complete information and markets compares with (i) Competitive equilibrium with adverse selection, (ii) Equilibrium with a fully informed monopolist and (iii) Equilibrium where there is competition between an informed local moneylender and uninformed outside lenders. Note: it is not required that you analyze the possibility of credit rationing.

b) Outline how the consequences of adverse selection can be neutralized.

Suggested answer

The perfect answer follows the description in pages 85-91 in Bardhan and Udry (1999) including Figures 7.2 and 7.3.

a) Consider a rural credit market where lenders might have a good idea about the average characteristics of the pool of potential, but they may not have complete information concerning the characteristics of any particular borrower. Explain and illustrate graphically how a competitive equilibrium model with complete information and markets compares with (i) Competitive equilibrium with adverse selection, (ii) Equilibrium with a fully informed monopolist and (iii) Equilibrium where there is competition between an

informed local moneylender and uninformed outside lenders. Note: it is not required that you analyze the possibility of credit rationing.

Base: Competitive equilibrium model with complete information and markets
We first assume that perfectly informed lenders compete to make loans within the village. Lenders can distinguish between the types of borrowers, so they set different interest rates to each type to maximize profits.

(1) $\max_{i,t} U(i,t) = \pi(t)(R(t) - i(t)), s.t.$

(2) $\Pi(i,t) = \pi(t)i(t) \geq \rho$

(3) $U(i,t) = \pi(t)(R(t) - i(t)) \geq W \quad t = 1, 2$

The solution is:

$$i_1(1) = \frac{\rho}{\pi(1)} < i_1(2) = \frac{\rho}{\pi(2)}$$

$$U(i_1(1),1) = U(i_1(2),2) = \bar{R} - \rho \geq W$$

There will be lending in equilibrium to both types if $\bar{R} - \rho \geq W$. Otherwise, neither type will receive loans. The lender makes zero profit. Lending is done at each type's interest rate, $i_1(1)$ and $i_2(2)$. The interest rate of the first type borrower is lower than the interest rate of the second type of borrower because type 1 is a low risk borrower with the probability of successful harvest that is higher than for the type 2 borrower, who is a high risk borrower.

Case (1): Competitive equilibrium with adverse selection. The lenders in the competitive credit market cannot differentiate between borrowers of different types, though they know the relative proportions of type 1 and type 2 farmers in the village.

Note

$$U(i,1) = \pi(1)[\mathrm{R}(1) - i] = \bar{R} - \pi(1)\mathrm{i} < \bar{R} - \pi(2)\mathrm{i} = \pi(2)[\mathrm{R}(2) - i] = U(i,2)$$

and

$$\Pi(i,1) = \pi(1)i > \pi(2)i = \Pi(i,2)$$

Define the highest rate at which each type wants to borrow as $i^*(t)$:

$$\bar{R} - \pi(1)\mathrm{i}^*(1) = \mathrm{W} \Leftrightarrow \mathrm{i}^*(1) = \frac{\bar{R} - W}{\pi(1)}, \text{ (Type 1's reservation rate)}$$

$$\bar{R} - \pi(2)\mathrm{i}^*(2) = \mathrm{W} \Leftrightarrow \mathrm{i}^*(2) = \frac{\bar{R} - W}{\pi(2)}, \text{ (Type 2's reservation rate)}$$

Clearly, $\mathrm{i}^*(1) < \mathrm{i}^*(2)$

The expected return for the lender is

$$E(\Pi(i)) = \begin{cases} p(1)\pi(1)\mathrm{i} + (1-\mathrm{p}(1))\pi(2)\mathrm{i} & \mathrm{i} \le \mathrm{i}^*(1) \\ \pi(2)\mathrm{i} & \mathrm{i}^*(1) < i < \mathrm{i}^*(2) \\ 0 & \mathrm{i}^*(2) < i \end{cases}$$

The participation and incentive compatibility constraints are:

(1) $E(\Pi(i_2)) \ge \rho$

(2) $\nexists i' : E(\Pi(i')) \ge \rho \wedge U(i',t) \ge U(i_2,t) \wedge U(i',t) > W, t = 1,2$

The solutions are:

$i_2 = NA \quad if \ \rho > \bar{R} - W$

$$i_2 = \frac{\rho}{\pi(2)} > i^*(1) \quad if \ \rho > E(\Pi(i^*(1))$$

$$i_2 = \frac{\rho}{p(1)\pi(1) + (1-p(1)\pi(2)} < i^*(1) \quad if \ \rho < E(\Pi(i^*(1))$$

Safer borrowers achieve a lower expected utility from a given interest rate, but provide higher expected income to the lender. These results follow directly from the limited liability nature of the credit contract, which limits the loss faced by a borrower when her crop fails. As the interest rate increases, households with safer projects drop out of the pool of borrowers first. For interest rates less than $i^*(1)$, all potential borrowers demand credit. If the interest rate increases past $i^*(1)$, the relatively safe type 1 borrowers stop demanding credit, while type 2 borrowers continue to demand loans. As the safer borrowers drop out of the market, lender income falls discontinuously.

Figure 7.2 illustrates the relationship between the interest rate charged by lenders and the expected income from lending. Lender income rises as the interest rate increases until $i = i^*(1)$. Suppose $p(1)$ is the proportion of the population of potential borrowers who are type 1. Then the expected income from a loan at interest $i \le i^*(1)$ is $E\Pi(1) = p(1)\pi(1)\mathrm{i} + (1-p(1))\pi(2)\mathrm{i}$.

As i increases past $i^*(1)$, type 1 borrowers drop out of the market and the lender income falls. As the interest rate continues to increase, lender income once again increases until $i^*(2)$ at which point type 2 borrowers stop demanding credit and no loans are made. For $i^*(1) < i \le i^*(2)$, $E\Pi(i) = \pi(2)i$. For $i > i^*(2)$, $E\Pi(i) = 0$.

There will be lending in the equilibrium with adverse selection:

- If $\rho > E(\Pi(i^*(1))$, the equilibrium interest rate will be $i_2 = \rho / \pi(2)$ and only the risky type 2 borrowers will demand loans. This is illustrated in Figure 7.2.
- If $\rho < E(\Pi(i^*(1))$, the interest rate will be $i_2 > \rho / (p(1)\pi(1) + (1-p(1))\pi(2))$, and all potential borrowers will demand loans. This is illustrated in Figure 7.3.

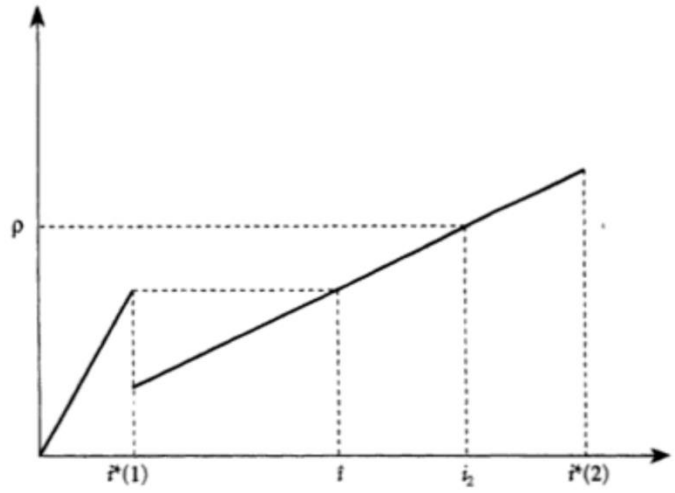

Figure 7.2

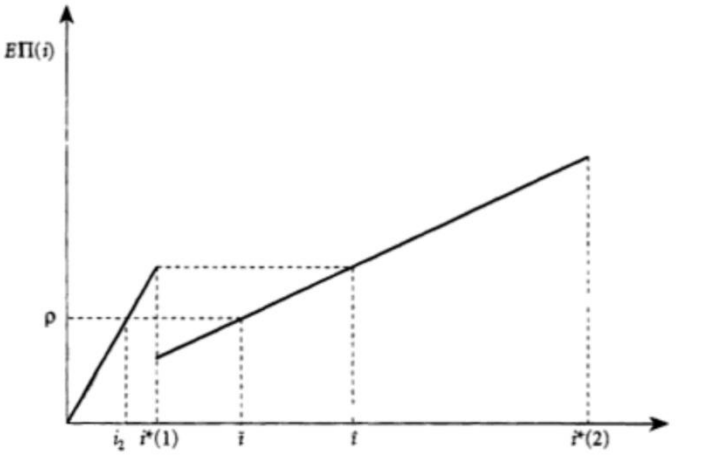

Figure 7.3

Case (2): Equilibrium with a fully informed monopolist
If there is a monopolistic moneylender in a village, he can observe the type of the borrower. His problem is to set an interest rate for each type of borrower to solve:

(1) $\max_{i,t} \Pi(i,\mathrm{t}) = \pi(t)i(t) \geq \rho$, *s.t.*

(2) $\Pi(i,\mathrm{t}) = \pi(t)i(t) \geq \rho$

(3) $U(i,\mathrm{t}) = \pi(t)(\mathrm{R(t)} - i(t)) \geq W \qquad t = 1,\ 2$

The solution is

$$i_3(1) = \frac{\overline{R} - W}{\pi(1)} = i^*(1), \quad i_3(2) = \frac{\overline{R} - W}{\pi(2)} = i^*(2)$$

$$U(i_3(1),1) = U(i_3(2),2) = \mathrm{W}$$

$$\mathrm{E}(\Pi(i_3(\mathrm{t})) = \overline{R} - \rho$$

The equilibrium will involve lending to each type of borrower at interest rates $i_3(t)$. Each borrower achieves the expected utility that is the same as the outside option W, while the lender makes profit $\bar{R} - \rho$.

Case (3): Competition between an informed local moneylender and uninformed outside lenders. There is a competitive market for credit from lenders who do not reside in the village. These lenders cannot distinguish between type 1 and type 2 farmers. They compete with a resident moneylender who knows the type of each farmer in the village. The moneylender can be affected by the outside competition.

If $i_4(2) = \mathrm{E}(\Pi i^*(1))) < \rho \leq \bar{R} - W$:

$i_4(1) = i^*(1), \quad i_4(2) = \rho / \pi(2) < i^*(2)$

If $\rho < \mathrm{E}(\Pi i^*(1)))$:

$i_4(1) = i_2, \quad i_4(2) = \tilde{i}; \quad i_2 < \tilde{i} < i^*(2)$

There are two possible cases:

- If $\rho > E(\Pi i^*(1))$, the equilibrium interest rate will be $i_2 = \rho / \pi(2)$ and only the risky type 2 borrowers will demand loans. The local moneylender can charge different interest rates to different types of borrower; denote the interest charged by the local lender by $i_4(t)$. Because there are outside lenders, local moneylender cannot charge more than i_2 to type 2 farmers, so $i_4(2) = \rho / \pi(2)$. Type 1 farmers have no access to credit from outside lenders in this case; so the local lender can revert to his case 3 behavior for this type of farmer and set $i_4(1)=i^*(1)$. The local lender earns rent on his loans to type 1 borrowers. This is illustrated in Figure 7.2.
- If $\rho \leq E(\Pi i^*(1))$, the equilibrium with competitive uninformed lenders would involve outside lenders setting $i_2 \leq i^*(1)$ and lending to both types of farmer. The local moneylender can lend to type 1 farmers at any interest rate less than or equal to i_2. If $i_4 \leq i_2$ type 1 borrowers would not borrow from the outside lender, but instead would borrow from the local lender. The outside lenders would be faced with a riskier pool of borrowers. Their return would fall below ρ at interest rate i_2. All type 1 borrowers will borrow from the local moneylender at $i_4(1) = i_2$, and the outside lenders will lend at $\tilde{\imath}$ to type 2 borrowers only. The local moneylender will set $i_2(2) = \tilde{\imath}$. This is illustrated in Figure 7.3.

a) Outline how the consequences of adverse selection can be neutralized.

The existence of collateral can eliminate the problem of adverse selection. A pledge of collateral equal in value to the repayment owed by the borrower places the entire risk of the transaction on the borrower. The return to the lender no longer depends on the unknown type of the borrower, hence adverse selection no longer exists. This result depends crucially on the assumed risk neutrality of the borrower. If the borrower is risk-averse, collateral can mitigate but not eliminate the consequences of adverse selection.

Question 2: Inter-firm relationships and informal credit

The question takes point of departure in McMillan and Woodruff (1999), "Interfirm Relationships and Informal Credit in Vietnam", *Quarterly Journal of Economics*, 114(4), 1285-1320.

McMillan and Woodruff (1999) test three hypotheses about relational contracting:

H1: Customers lacking alternative suppliers will receive more trade credit.

H2: There will be more trade credit when the supplier inspects their customers directly and in relationships of longer duration.
H3: A supplier belonging to a network will grant more trade credit.

a) Describe the reasoning behind these three hypotheses.
b) Explain the two additional sets of explanations described in McMillan and Woodruff (1999) of why firms offer credit to their customers rather than leaving financing to specialists like banks.
c) Table IV outlines the main results in McMillan and Woodruff (1999). Based on the table, describe and discuss the main conclusions obtained in the article.

TABLE IV

CUSTOMER CREDIT TOBITS

PERCENT OF BILL PAID BY CUSTOMER AFTER DELIVERY

	(1)	(2)	(3)	(4)	(5) Domestic	(6) Foreign	(7) Big	(8) Small
Customer lock-in:								
# similar manufacturers w/in 1 km	−0.007 (1.66)	−0.008 (1.86)	−0.011 (2.98)	−0.010 (2.54)	−0.006 (1.35)	−0.018 (2.30)	−0.026 (3.10)	−0.006 (1.38)
Most important competitor w/in 1 km	−0.13 (2.46)	−0.12 (2.18)	−0.11 (2.18)	−0.16 (2.92)	−0.14 (2.41)	−0.01 (0.12)	−0.04 (0.43)	−0.19 (3.12)
Manufacturer information:								
Duration of relationship (years)	0.08 (2.96)	0.07 (2.61)	0.07 (2.51)	0.07 (2.42)	0.04 (1.34)	0.13 (1.34)	0.14 (1.74)	0.06 (1.90)
Duration ^2	−0.005 (2.15)	−0.004 (1.95)	−0.004 (1.74)	−0.004 (1.78)	−0.003 (1.19)	−0.007 (0.55)	−0.020 (1.45)	−0.003 (1.43)
Visited customer before first sale		0.08 (1.63)	0.07 (1.71)	0.06 (1.33)	0.12 (2.32)	0.04 (0.36)	0.03 (0.41)	0.10 (1.87)
Currently visit cust at least weekly		−0.03 (0.46)	−0.06 (1.03)	−0.05 (0.84)	−0.09 (1.43)	0.07 (0.49)	0.06 (0.60)	−0.05 (0.76)
Network membership:								
First information from other manufacturers	0.20 (3.36)	0.16 (2.83)	0.10 (1.99)	0.17 (2.98)	0.06 (1.00)	0.22 (2.05)	0.11 (1.30)	0.00 (0.03)
Talk to other suppliers of customer at least monthly		0.19 (2.36)	0.19 (2.63)	0.18 (2.31)	0.27 (3.18)	0.04 (0.26)	−0.19 (1.31)	0.31 (3.20)
First information from family member	0.04 (0.60)	−0.01 (0.17)	−0.08 (1.34)	−0.13 (2.11)	−0.13 (1.91)	0.02 (0.17)	0.00 (0.01)	−0.15 (2.15)
Alternative explanations:								
Manufacturer sets prices by relationship w/customer			0.02 (0.53)	0.08 (1.69)	0.06 (1.13)	−0.05 (0.48)	0.14 (1.62)	0.00 (0.03)
Customer is retail store/wholesaler			0.07 (1.62)	0.03 (0.60)	0.11 (2.25)	0.02 (0.20)	0.20 (2.11)	0.03 (0.57)
Log firm age + 1 (years)			−0.09 (1.76)	−0.10 (1.57)	−0.11 (1.91)	−0.25 (1.62)	0.01 (0.04)	−0.06 (1.04)
Log employment			−0.02 (0.98)	−0.06 (2.28)	−0.04 (1.50)	0.05 (1.15)	−0.10 (0.95)	−0.07 (1.86)
Manufacturer receives credit from bank			−0.02 (0.36)	−0.03 (0.53)	−0.01 (0.10)	0.05 (0.55)	−0.04 (0.45)	0.15 (2.02)
% of bill paid to suppliers after delivery (0–2)			0.40 (6.27)	0.47 (6.23)	0.40 (5.45)	0.13 (1.08)	0.35 (2.74)	0.39 (5.25)
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Manager controls	No	No	No	Yes	No	No	No	No
Number of observations	224	224	224	204	153	71	76	148
% obs not censored	31.70%	31.70%	31.70%	31.37%	35.95%	22.54%	34.21%	30.41%
χ^2	73.5	82.6	134.5	152.0	114.7	48.7	64.1	112.5
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001

Regression are two-tailed Tobits. Coefficients are marginal effects, *t*-values are in parentheses.

a. All regressions include industry dummies (8), and indicators of first customer and location in Hanoi.

b. Regression 4 also includes % sales represented by main product, manager speaks Chinese, % sales to SOEs, % supplies from SOEs, 100% family-owned, collective, manager formerly worked for SOE, age of manager, and manager attended university.

Suggested answers

a) Describe the reasoning behind these three hypotheses.

H1: Customer's ability to buy from alternative suppliers might affect the level of trust. The customer could be locked into the relationship (high costs of search or large transport costs). If the customer is locked in, the supplier can threaten to cut off further trade if the debt is not repaid.

Firms that find it difficult to locate alternative trading partners will invest in maintaining their existing relationships. Lock-in helps making the relational contracts workable.

H2: Adverse selection – learning about different types. The supplier's direct dealings with the customer yield information about its creditworthiness. Supplier visits might provide information about the customer's work habits, business flair, investments (large sunk investments could serve as a signal of the customer's reliability). Cooperation builds up gradually, as the supplier learns through trading about the customer's reliability. The supplier will steadily increase the amount of trade credit it offers as the relationship gets stronger. The frequency with which a supplier visits the customer during the trading relationship may indicate the intensity of information gathering.

H3: Two reasons – First, a network provides information. Firms learn about the reliability of customers both through direct interaction and by asking other manufacturers or family members before the trading relationship begins. Second, networks provide extra ability to sanction customers who renege. The threat of no further trade if debts are not paid gains extra force if it also comes from the creditor's network (community sanctions). Social networks provide the possibility of enacting community sanctions, which is the basis for trade credit.

b) *Explain the two additional sets of explanations offered in McMillan and Woodruff (1999) about why firms offer credit to their customers rather than leaving financing to specialists like banks.*

Industrial organization explanation: *Imperfect banking sector* – use trade credit to avoid paying monopoly rents to banks. *Perfect banking sector competition* – trade credit needed if banking sector is too competitive to allow ongoing relationships in which the banks lose money early in a relationship and earn profits later. *Market power* – firms offer trade credit to price discriminate secretly, to evade legal sanctions, or to hide price cuts from other customers. *Warranty* – trade credit may serve as a for product quality, since the delay in payment gives customers time to inspect the merchandise.

Superior information explanation (firms have an advantage over banks in selecting, monitoring, and enforcing credit contracts): Day-to-day trading allow firms to see which customers are better credit risks. A customer may have no access to bank loans, because of the adverse-selection problem and the seller might have to grant credit in order to make the sale. If the loan is not repaid, firms (creditors) are often better equipped to resell repossessed merchandise.

c) *Table IV outlines the main results in McMillan and Woodruff (1999). Based on the table, describe and discuss the main conclusions obtained in the article.*

Especially columns (1) to (4) should be described. Columns (1) and (2) focus on the three hypotheses mentioned in the question under a), and columns (3) and (4) include alternative explanation controls (described in the question under b). Customer lock-in variables are found to be negative and significant, supporting the hypothesis H1 in a). Manufacturer information: Duration of

supplier/customer relationship is positively associated with having trade credit supporting the H2 hypothesis in a). Visits are generally not well-determined. Finally, network relationships matter, but they are found to be significantly positive only if the information is obtained from the business network. The relational-contracting variables are generally robust to the inclusion of additional controls. Fewer similar firms nearby, longer relationship durations and information from business networks are all consistently associated with higher levels of trade credit.

Question 3: Corruption

The evidence shows that corruption is rampant in developing countries, so much that several international aid agencies have made aid disbursements conditional on a country's corruption record. However, measuring corruption is not an easy task.

a) Name at least two ways of measuring corruption described in Olken and Pande (2012). "Corruption in Developing Countries", *Annual Review of Economics*, 4, 479-509. Discuss the potential problems of those measures and illustrate with examples. Discuss at least two types of efficiency costs of corruption on economic activity.

The questions below refer to the analysis and results in Olken (2007). "Monitoring Corruption: Evidence from a Field Experiment in Indonesia" *Journal of Political Economy*, 115(2), 200-249.

b) Table 1 displays the basic experimental design in Olken (2007). Describe the identification strategy used in the paper.

TABLE 1
NUMBER OF VILLAGES IN EACH TREATMENT CATEGORY

	Control	Invitations	Invitations Plus Comment Forms	Total
Control	114	105	106	325
Audit	93	94	96	283
Total	207	199	202	608

NOTE.—Tabulations are taken from results of the randomization. Each subdistrict faced a 48 percent chance of being randomized into the audit treatment. Each village faced a 33 percent chance of being randomized into the invitations treatment and a 33 percent chance of being randomized into the invitations plus comment forms treatment. The randomization into audits was independent of the randomization into invitations or invitations plus comment forms.

c) Tables 4 and 11 present some of the main results reported in Olken (2007). What are the main conclusions to be drawn from these tables? Discuss the implications of the result.

TABLE 4
AUDITS: MAIN THEFT RESULTS

Percent Missing[a]	Control Mean (1)	Treatment Mean: Audits (2)	No Fixed Effects: Audit Effect (3)	No Fixed Effects: p-Value (4)	Engineer Fixed Effects: Audit Effect (5)	Engineer Fixed Effects: p-Value (6)	Stratum Fixed Effects: Audit Effect (7)	Stratum Fixed Effects: p-Value (8)
Major items in roads ($N = 477$)	.277	.192	−.085*	.058	−.076**	.039	−.048	.123
	(.033)	(.029)	(.044)		(.036)		(.031)	
Major items in roads and ancillary projects ($N = 538$)	.291	.199	−.091**	.034	−.086**	.022	−.090***	.008
	(.030)	(.030)	(.043)		(.037)		(.034)	
Breakdown of roads:								
Materials	.240	.162	−.078	.143	−.063	.136	−.034	.372
	(.038)	(.036)	(.053)		(.042)		(.037)	
Unskilled labor	.312	.231	−.077	.477	−.090	.304	−.041	.567
	(.080)	(.072)	(.108)		(.087)		(.072)	

NOTE.—Audit effect, standard errors, and p-values are computed by estimating eq. (1), a regression of the dependent variable on a dummy for audit treatment, invitations treatment, and invitations plus comment forms treatments. Robust standard errors are in parentheses, allowing for clustering by subdistrict (to account for clustering of treatment by subdistrict). Each audit effect, standard error, and accompanying p-value is taken from a separate regression. Each row shows a different dependent variable, shown at left. All dependent variables are the log of the value reported by the village less the log of the estimated actual value, which is approximately equal to the percent missing. Villages are included in each row only if there was positive reported expenditures for the dependent variable listed in that row.

[a] Percent missing equals log reported value − log actual value.

* Significant at 10 percent.

** Significant at 5 percent.

*** Significant at 1 percent.

TABLE 11
PARTICIPATION: MAIN THEFT RESULTS

Percent Missing[a]	Control Mean (1)	Treatment Mean (2)	No Fixed Effects: Treatment Effect (3)	No Fixed Effects: p-Value (4)	Engineer Fixed Effects: Treatment Effect (5)	Engineer Fixed Effects: p-Value (6)	Stratum Fixed Effects: Treatment Effect (7)	Stratum Fixed Effects: p-Value (8)
			A. Invitations					
Major items in roads ($N = 477$)	.252	.230	−.021	.556	−.030	.385	−.026	.448
	(.033)	(.033)	(.035)		(.034)		(.034)	
Major items in roads and ancillary projects ($N = 538$)	.268	.236	−.030	.360	−.032	.319	−.029	.356
	(.031)	(.031)	(.032)		(.032)		(.032)	
Breakdown of roads:								
Materials ($N = 477$)	.209	.221	.014	.725	.008	.839	.005	.882
	(.041)	(.041)	(.038)		(.037)		(.037)	
Unskilled labor ($N = 426$)	.369	.180	−.187*	.058	−.215**	.024	−.143*	.098
	(.077)	(.077)	(.098)		(.094)		(.086)	
			B. Invitations Plus Comments					
Major items in roads ($N = 477$)	.252	.228	−.022	.455	−.024	.411	−.015	.601
	(.033)	(.026)	(.030)		(.029)		(.030)	
Major items in roads and ancillary projects ($N = 538$)	.268	.238	−.026	.409	−.025	.406	−.027	.385
	(.031)	(.026)	(.032)		(.030)		(.031)	
Breakdown of roads:								
Materials ($N = 477$)	.209	.180	−.028	.414	−.022	.496	−.010	.754
	(.041)	(.032)	(.034)		(.032)		(.033)	
Unskilled labor ($N = 426$)	.369	.267	−.099	.255	−.132	.131	−.090	.323
	(.077)	(.073)	(.087)		(.087)		(.091)	

NOTE.—See the note to table 4. Results come from estimating eq. (1), a regression of the dependent variable on a dummy for audit treatment, invitations treatment, and invitations plus comment forms treatments. Each invitations effect and invitations plus comments effect comes from a separate regression, with the dependent variable listed in the row and the fixed effects specification listed in the column heading. Robust standard errors are in parentheses. Regressions without stratum (i.e., subdistrict) fixed effects include a variable for audits and allow for clustering of standard errors by subdistrict.

[a] Percent missing equals log reported value − log actual value.

* Significant at 10 percent.

** Significant at 5 percent.

*** Significant at 1 percent.

Suggested answers

a) Name at least two ways of measuring corruption described in Olken and Pande (2012). "Corruption in Developing Countries", Annual Review of Economics, 4, 479-509. Discuss

the potential problems of those measures and illustrate with examples. Discuss at least two types of efficiency costs of corruption on economic activity.

A model answer to this question would describe any two points from section 2.1. Estimating the Magnitude of Corruption in Olken and Pande (2012). Here are all the cases they describe. Good answer would contain two of the following measures:

[For this question, there is no need to name the authors of the studies, just to describe the example.]

1. Perceptions. Surveys of perception have the advantage of measuring someone's perceptions of corruption, which is easier than measuring corruption directly. The challenge with perception-based measures is that they may not measure corruption accurately. Perception surveys are biased in at least two ways: a) people may not be able to make an inference about the aspects of corruption they cannot perceive (for example, it may be easier for people to judge prices than quantities) and b) individual characteristics predict perceived corruption, so comparing results of multiple perception surveys may lead to systematic inaccuracies if the samples are heterogeneous. Example of a perception-based corruption survey is given in Olken (2007 or 2009) where he measures villagers' perceptions of the corruption level in a local road building project.
2. Survey estimates of bribes. Surveys of bribe payers can be conducted among firms or households. Surveys are facilitated by relatively little stigma associated with paying bribes in most contexts. Survey-based measure of bribes is the most easily replicable. If the bribes are not measured consistently across different locations (countries), the inference will be biased. Examples of cross-country comparable surveys include the World Bank Enterprise Surveys and the International Crime Victims Survey.
3. Estimates from direct observation. Observing direct corruption is the best way to measure it, but this is difficult as officials rarely let the corrupt behaviour to be observed. Example is the case of Montesinos in Peru, who kept detailed records of the bribes he paid, Olken and Barron (2009) who directly measured bribes the truck drivers pay to the police in Indonesia or Sequeira and Djankov (2010) who directly measured bribe payment for cargo as it passes through the ports in Mozambique and South Africa.
4. Graft estimation by subtraction. The theft of government funds (called graft) is usually measured by subtraction such that one uses two measures of the same quantity: one measure before corruption takes place and one measure after corruption takes place. The estimate of corruption is the difference between the two measures. Example is Reinikka and Svensson (2004) who measure the difference in the amount of an education grant sent from the central government to schools in Uganda and the amount of the grant received by schools. Problems with this measure include the quality of records. For example, if schools have poor records, some of the money might not show up on the books even though it may have been received. Other examples: Olken's (2007) case of rural road projects or Olken's (2006) study of the theft of rice from a program that distributed subsidized rice in Indonesia. [Here, either example will do.]
5. Estimates from market inference. This approach combines the theory of market equilibrium with data on market activity to estimate the amount of corruption. There are two examples of the application of this method. First, it can be used to assess the value of political connections to firms by measuring the changes in the company's share value as a result of company's political connections. Second, corruption can be measured by looking at the equilibrium conditions in the labor market. This is done by comparing the salaries for people in the public and the private sector. If it is established that the pay is lower in the public sector while the consumption levels are the same as for the individuals employed in the

private sector, one could infer that those in the public sector are likely receiving bribes. [Here, either example will do.]

Efficiency costs of corruption – Some examples of the efficiency costs of corruption: the costs imposed on firms, the costs imposed on government activity and the costs imposed through the government's lack of ability to correct externalities. A model answer for this question would describe any two points from section 2.2. Does Corruption Matter? in Olken and Pande (2012).

1. Impact on firms. Corruption changes the effective marginal tax rate faced by firms and affects firm behavior through uncertainty. If bribes are used to reduce tax liabilities the marginal bribe rate should be below the official marginal tax rate, so corruption reduces effective tax rates. But if bribes are charged for other types (or on top) of government activities, this could increase the effective marginal tax rate faced by firms. Negative consequence of bribes include: reduced annual firm growth, efficiency loss (firm's production choices are sometimes designed to avoid corruption) or decreased firm-level investment.
2. Impact on government provision of goods and services. Corruption can have efficiency consequences through impacts on government provisions of goods and services. First, if it increases the cost of government goods and services, this could have a similar effect as raising the price of these goods and services. Second, corruption could create distortions by a way of convoluted, inefficient procedures that corrupt officials invent in order to extract rents while decreasing the risk of being discovered.
3. Impact on correcting externalities. Corruption may lessen the government's ability to correct an externality. For example, if someone can bribe a police officer or a judge instead of paying an official fine, the marginal cost of breaking the law is reduced from the official fine to the amount of the bribe. Also, if the police officer extracts the same bribe regardless of whether the person has broken the law, the marginal cost of breaking the law falls to zero, and the law ceases to have a disincentive effect altogether. Overweight trucks are a good example here: The benefits to a trucker from loading on additional weight are concave, whereas the damage the truck does to the road rises to the fourth power with the truck's weight.

b) Table 1 displays the basic experimental design in Olken (2007). Describe the identification strategy used in the paper.

Olken (2007) designed and conducted a randomized controlled field experiment in 608 Indonesian villages. At the beginning of the data collection each village was about to start building a village road as part of a nationwide village-level infrastructure project. To examine the impact of external monitoring (top down), some villages were randomly selected to be told (after funds had been awarded but before construction began), that their project would subsequently be audited by the central government audit agency (increasing the probability of an external government audit in those villages from a baseline of about 4 percent to essentially 100 percent). Government audits carry with them the possibility of criminal action. Moreover, the results of the audits were read publicly at an open village meeting by the auditors and so could result in substantial social sanctions. The audits were subsequently conducted as promised.

To investigate the impact of increasing community participation (grassroots approach) in the monitoring process, two different experiments were carried out. Specifically, the experiments sought to enhance participation at "accountability meetings", the village-level meetings in which project officials account for how they spent project funds. In one experiment (invitations), hundreds

of invitations to these meetings were distributed throughout the village, to encourage direct participation in the monitoring process and to reduce elite dominance of the process. In the second experiment (invitations plus comment forms), an anonymous comment form was distributed along with the invitations, providing villagers an opportunity to relay information about the project without fear of retaliation. This comment form was then collected in sealed drop boxes before the accountability meetings, and the results were summarized at the meetings. Both of these experimental interventions were successful in raising grassroots participation levels: the invitations increased the number of people participating in the accountability meetings by about 40 percent, and the comment forms generated hundreds of comments about the project, both good and bad, in each village. Table 1 displays the basic experimental design. Randomization into the invitations and comment form treatments was independent of randomization into the audit treatment. In both cases, the treatments were announced to villages after the project design and allocations to each village had been finalized, but before construction or procurement of materials began. Thus the choice of what type of project to build, as well as the project's design and planned budget, should all be viewed as exogenous with respect to the experiments.

c) *Tables 4 and 11 present some of the main results reported in Olken (2007). What are the main conclusions to be drawn from these tables? Discuss the implications of the result.*

Given the randomized nature of the experiments estimating their effects is straightforward. Olken (2007) estimate an equation of the following form using OLS:

$$\text{PercentMissing}_{ijk} = \alpha_1 + \alpha_2 \text{Audit}_{jk} + \alpha_3 \text{Invitations}_{ijk} + \alpha_4 \text{InvitationsandComments}_{ijk} + \epsilon_{ijk}, \quad (1)$$

The effects of audits (alfa2) are found in Table 4, column 3. The audit experiment showed that audits lead to substantial reductions in missing expenditures. Audits were associated with reductions in missing expenditures of about 8.5 percentage points. These reductions came from reductions in both (i) unaccounted-for materials procured for the project and (ii) unaccounted-for labor expenditures.

Table 11 examines the overall impact of the two participation treatments on the percent missing in the projects. Panel A shows the effect of the invitations treatment while panel B shows the effect of the invitations plus comment forms treatment. The results suggest that the invitations and the invitations plus comment forms treatments had a small, and statistically insignificant, impact on the overall percent missing from the project. Depending on the specification and the measure of corruption, the point estimates suggest that these treatments reduced the percent missing by between 1.5 and 3 percentage points, though these estimates are never statistically distinguishable from zero. The invitations treatment substantially reduced missing labor expenditures but had no effect on missing materials expenditures, possibly because labor expenditures are more visible than thefts of material.

Results in Olken (2007) suggest that while grassroots monitoring has the potential to reduce corruption, care must be taken to minimize free-rider problems and prevent elite capture.