Microeconomics Paper 220525

1ai A's preferences are Cobb-Douglas. A optimally consumes x_A and y_A such that expenditure on x_A is $2/5$ of income (value of endowment) and expenditure on y_A is $3/5$ of income (value of endowment). A's demands are as follows.

$$x_A = \frac{2}{5}\,\frac{5+p}{1} = \frac{10+2p}{5},$$
$$y_A = \frac{3}{5}\,\frac{5+p}{p} = \frac{15+3p}{5p}$$

B has Leontief preferences and optimally consumes x_B and y_B such that $2x_B = 3y_B$ and income ~~is com~~ (value of endowment) is ~~completely~~ exhausted. Any candidate optimum that does not satisfy either of these ~~condition~~ conditions fails to deviation, either by exchanging one good for the other, or by increasing consumption of both goods.

$$\cancel{x_B}\ 2x_B = 3y_B$$
$$x_B + py_B = 1+5p$$
$$\Rightarrow x_B = 1+5p-py_B$$
$$\Rightarrow 2(1+5p-py_B) = 3y_B$$
$$\Rightarrow (3+2p)y_B = (2+10p)$$
$$\Rightarrow y_B = \frac{2+10p}{3+2p}$$
$$\Rightarrow x_B = \frac{3+15p}{3+2p}$$

Aggregate demand for x
$$x_A + x_B = \frac{10+2p}{5} + \frac{3+15p}{3+2p}$$
Aggregate excess demand for x
$$x_A + x_B - \omega_A^x - \omega_B^x = \frac{10+2p}{5} + \frac{3+15p}{3+2p} - 6$$
Denote this as z^x.

ii
$$\frac{\partial z^x}{\partial p} = \frac{2}{5} + \left[(3+15p)(-1)(3+2p)^{-2}(2) + (3+2p)^{-1}(15)\right]$$
$$= \frac{2}{5} + \left[(-6-30p)(3+2p)^{-2} + (3+2p)^{-1}(15)\right]$$
$$= \frac{2}{5} + \frac{1}{3+2p}\left[-\frac{6+30p}{3+2p} + 15\right]$$
$$= \frac{2}{5} + \frac{1}{3+2p}\left[\frac{39}{3+2p}\right]$$
$$= \frac{2}{5} + \cancel{\frac{1}{3+2p}}\ 39(3+2p)^{-2} > 0$$

Aggregate excess demand for x is increasing in p. ~~This~~ This is intuitive. The greater the price of ~~y~~ y the greater the demand for x because of the substitution effect, hence the greater the aggregate demand for x.

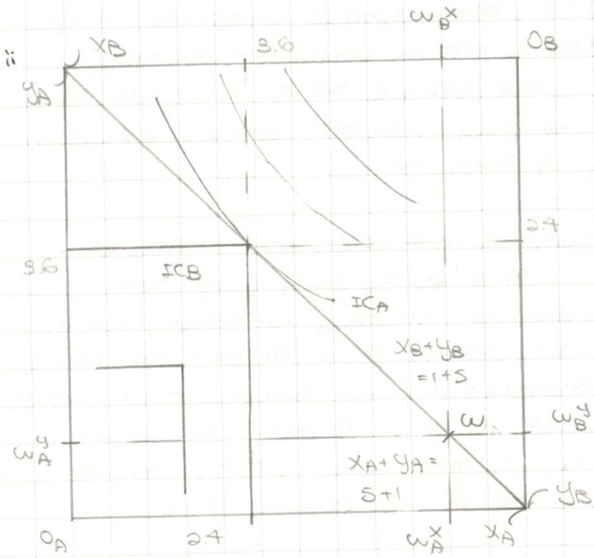
At CE, $\cancel{z^x}$ $z^x = 0$, so p is such that $\cancel{z^x}$ $z^x = 0$

bi $z^x|_{p=1} = \frac{12}{5} + \frac{18}{5} - 6 = 0$

By Walras's Law, given that at $p=0$, aggregate excess demand for x is zero, aggregate excess demand for y is also zero. This follows from the binding budget constraints at each consumer's optimum. ~~So~~ Aggregate excess demand for each good is zero at the allocation corresponding to $p=1$. This allocation and price vector is a competitive equilibrium.

By the first fundamental welfare theorem, it is also Pareto efficient.

ii



2ai

	X	Y
X	$\underline{a}$, $\underline{a}$	$\underline{b}$, c
Y	c, $\underline{b}$	d, d

$a>c$, $b>d$, best responses underlined. Each player has a strictly dominant strategy to play X. The unique NE is (X, X) because players ~~e~~ play their ~~stD~~ strictly dominant strategy in each NE.

The~~g~~ game is not necessarily a Prisoners' Dilemma. In a ~~p~~ PD, each player has a strictly dominant strategy to defect. But it is also characteristic of a PD that the NE is Pareto dominated by an outcome that cannot be sustained in eqm, namely (cooperate, cooperate), in this case (Y, Y). So the above is a NE iff, in addition, $d>a$.

ii

	X	Y
X	$\underline{a}$, $\underline{a}$	b, c
Y	c, b	$\underline{d}$, $\underline{d}$

$a>c$, $b<d$. Best responses underlined. By ~~inspection~~ inspection, there are two pure NE where players play pure mutual best responses.

Consider arbitrary candidate NE $\sigma^* = (\sigma_1^*, \sigma_2^*)$ such that P1 mixes (non degenerately). Then, P1 has no profitable deviation and P1 is indifferent.
$\pi_1(X, \sigma_2^*) = \pi_1(Y, \sigma_2^*)$, $\Leftrightarrow$
$aq + b(1-q) = cq + d(1-q)$, where
$\sigma_2^* = qX + (1-q)Y$.
Then P2 mixes, by ~~strait~~ ~~e~~ similar analysis
$ap + b(1-p) = cp + d(1-p)$, where
$\sigma_1^* = pX + (1-p)Y$.
If P1 mixes so does P2. By symmetry, the ~~≠~~ converse is true, so there are no hybrid NE.
The remaining NE is the mixed NE ~~(pX+(1-p~~
$(pX+(1-p)Y,\ qX+(1-q)Y)$, where
$aq + b(1-q) = cq + d(1-q) \Rightarrow$
$(a-b-c+d)q = d-b \Rightarrow$
$q = \dfrac{d-b}{(a-b)-(c-d)}$
$p = \dfrac{d-b}{(a-b)-(c-d)}$

b. The relevant eqm concept is SPE. A SPE is a NE that induces a NE in each subgame, including those off the eqm path. This rules out NE that involve threats that are not credible or time inconsistent strategies. ~~A SPE~~

A SPE is some strategy profile ~~under~~, where each strategy is a contingent (on past play) plan of action. So, for example, (~~x~~ X, X) is not a SPE because it is not a strategy profile of the sequential game, but (X, XX) is. XX ~~ste~~ means P2 plays X in response to X and in response to Y.

ii

	X	Y
X	a, a	$\underline{b}$, $\underline{c}$
Y	$\underline{c}$, $\underline{b}$	d, d

In the X subgame, Y is optimal for P2, P2 plays Y, this yields payoff b to ~~x~~ P1. In the Y subgame, X is optimal for P2, P2 plays X. This yields payoff $c<b$ to P1. P1 optimally plays X. The SPE is (X, ~~Z~~, YX), which means that P2 plays Y if P1 played X and X if P1 played Y.

This is BoS with a first mover. P1 has first mover advantage, and leverages this to ensure the P1-favoured outcome is achieved in eqm.

3ai Neither necessarily true nor necessarily false. Given $y_1 < x_1 < x_2 < y_2$, Y is more risky than X, but it could be the case that $y_1 < x_1 < x_2 \lll y_2$ such that Y has significantly greater expected value and the certainty equivalent of Y is greater than that of X despite Y having a higher risk premium, so a risk averse expected utility maximiser prefers Y to X. For example, risk averse expected utility maximiser A with Bernoulli utility on final wealth $u(x) = \ln x$ has the following preferences.

$[\frac{1}{2}, \frac{1}{2}; 1, 100] \succ_A [\frac{1}{2}, \frac{1}{2}; 2, 3]$
$[\frac{1}{2}, \frac{1}{2}; 1, 4] \prec_A [\frac{1}{2}, \frac{1}{2}; 2, 3]$

ii True. Given $y_1 < x_1 < x_2 < y_2$, Y is more risky than X, it has a higher risk premium (for any risk averse expected utility maximiser). If, in addition, $EV(X) > EV(Y)$, then certainty equivalent $CE(X) = EV(X) - RP(X) > CE(Y) = EV(Y) - RP(Y)$. By definition of CE, ~~$u(CE(X)) = u(Y) >$~~
$U(X) = u(CE(X)) > u(CE(Y)) = U(Y)$, where the inequality follows by strict monotonicity of u. Then, for an expected utility maximiser, $X \succ Y$.

bi True.

Expected utility preferences satisfy independence, i.e. for all $L, L', L'', p \in [0,1]$, iff $L' \succeq L''$ then $[p, 1-p; L, L'] \succeq [p, 1-p; L, L'']$. This is also evident from the additivity of expected utility. The expected utility of X' ~~and Y' are half those of X and Y respectively. So~~ is equal to $\frac{1}{2}U(X) + \frac{1}{2}u(0)$ and likewise for Y'. So $X' \succeq Y' \Leftrightarrow U(X') \geq U(Y') \Leftrightarrow U(X) \geq U(Y) \Leftrightarrow X \succeq Y$, and likewise for $Y' \succeq X'$.

ii False.

Consider the utility function U' on lotteries $L = [p_1, \dots, p_n; x_1, \dots, x_n]$ such that $U'(L) = \min \{x_1, \dots, x_n\}$. Then $U'(X') = U'(Y')$. So X' will not be strictly preferred to Y'. A more degenerate example is $U''(L) = -\sum_{i \in \{1,\dots,n\}} p_i x_i$. Then Y' will be strictly preferred to X'.

Does not apply, it is given that u is monotonic.

4a At equilibrium, where types are perfectly observable, each household is offered actuarially fair insurance. This is because insurers are risk-neutral and competitive. Any candidate eqm where some type of household is offered actuarially unfair insurance fails to deviation by one insurer to marginally fairer insurance. At eqm, ~~p_L~~ $p_L = 1/4$, $p_H = 1/2$.

At eqm, even if households can ~~p_L~~ partially insure, given actuarially fair insurance, all households fully insure. This is because full insurance ~~reduces risk~~ completely eliminates risk but has no effect on expected value, so certainty equivalent hence expected utility is maximised by full insurance. Households find both regulations equivalent.

Formally,

$$k = \arg\max_{a} \pi u(w - pa - a + k) + (1-\pi) u(w - pa)$$

for ~~p, π~~ $(\pi, p) \in \{$ ~~(π_L, p_L)~~ $(\pi_L, p_L), (\pi_H, p_H)\}$

b: By the argument above, at equilibrium, given that insurers are risk neutral and competitive, and all households must fully insure, ~~insure~~ insurers offer insurance that is actuarially fair in expectation (of ~~propor~~ probability of loss)

~~$p = 1/2 \pi_L + 1/2 \pi_H$~~ $p = \bar{\pi} = 1/2 \pi_L + 1/2 \pi_H = 3/8$.

ii ~~By the ar~~ Given risk-neutral competitive insurers, the common premium is no greater than $\pi_H = 1/2$. Then, premiums for high risk types are always ~~actually~~ at least actuarially fair. By the argument in (a), ~~high~~ high risk types always fully insure. ~~Given that~~ + Suppose that insurers break even in expectation, then the common premium p is equal to the weighted average probability of loss. $p = 1/2 \pi_H + 1/2 q(p) \pi_L \iff$ end here

$p = 1/4 + 1/8\, q(p)$. ~~But Given that $q(p) \in [0,1]$ for all p, and $q(p)$ is decreasing there is no eqm at $p = 1/2$ because this implies $q(p) = 2$.~~ $\iff q(p) = 8(p - 1/4) = 8p - 2$.

~~For Given that $q'(p) < 0$ for $p \in [1/4, 1/2]$, by reductio, no such pooling eqm exists.~~

7 Consider first merger to monopoly in Bertrand competition. ~~under the~~ ~~the~~ Such a merger involves the Williamson trade off between the loss in aggregate welfare due to a reduction in quantity suffered by consumers and an increase in aggregate welfare due to a reduction in costs enjoyed by producers. ~~Merger to monopoly in Bertrand oligopoly has thus~~ Suppose that pre-merger, two firms produced a ~~t~~ homogenous good at common constant marginal cost c. ~~By the familiar~~ At the Bertrand NE, each firm chooses p=c. Deviation to p>c is not profitable because no consumers buy. Deviation to p<c is not profitable ~~is not profitable~~ because then margin hence profit is negative. Suppose that merger realises non-drastic synergies such that the merged firm produces at ~~lower~~ constant marginal cost c'<c. Then, the merged firm chooses price given by demand at the intersection of marginal revenue and marginal cost to maximise profit. Merger has two effects on consumer surplus. First, consumers suffer because of a higher price. Second, consumers suffer because of a lower quantity (since valuations exceed price for the forgone units). Firms are better off because of the higher price and the lower cost. The change in price constitutes a transfer of surplus from ~~consumers to~~ consumers to producers. So the two effects on aggregate welfare are the loss of CS due to ↓Q and the increase in π due to ↑c. ~~The~~ Where synergies are large and demand is price inelastic, the latter effect is likely to be larger. Competition authorities ~~with a~~ ~~to~~ that use an aggregate welfare standard should look favourably on such mergers.

When there are more than two firms, the merged firm cannot ~~set~~ set monopoly price, the result of the asymmetric Bertrand game holds post merger. The merged firm with lower costs chooses price ~~equal~~ ~~equal to the MC of~~ arbitrarily lower than the MC of the other firms. These other firms choose p=c. Consumers all buy from the merged firm. The merged firm is constrained in the exercise of its market power because if it charges p>c, the other less efficient firms can ~~undercut~~ profitably undercut it. Then, merger has no effect on price hence no effect on quantity. Consumers are no worse off. Outsiders are no worse off either because they continue to make zero profit. The merged firm is strictly better off because of its lower costs, positive margin, hence positive profit. Merger is then equivalent to ~~the shutting of two inefficient~~ rolling two inefficient firms into a more efficient one, and it is Pareto optimal. The merged firm is better off and no other party is worse off. Competition authorities should look favourably on such mergers.

Consider instead a merger to monopoly in ~~Bertrand olig~~ price setting oligopoly with potentially differentiated products. The relevant model here is Farrell and Shapiro (2010).

Date

9a It is true that there is positive agency cost iff the principal P induces high effort and the agent A is risk averse.

~~In P offers A an out: a profit-contingent wage scheme to. P's maximization profit maximization problem given that~~

The agency cost is the increase in expected wage (equivalently the decrease in expected net profit) in the case where effort is unobservable compared to the case where effort is observable.

Consider first the case of observable effort. In this case, to induce some level of effort $e \in \{0, 1\}$, P need only satisfy A's participation constraint PC, which is the condition that A's expected utility from participation in the project is ~~greater~~ weakly greater than A's reservation utility $\bar{u}$. A's utility is strictly increasing in wage w and ~~con~~ decreasing in effort e.

If A is risk-averse, then A's utility is concave in w. When ~~is~~ effort is perfectly observable, P offers a fixed ~~wage~~ wage effort pair that just satisfies PC. Any candidate optimum that strictly satisfies PC fails to deviation to a marginally less generous wage (such that PC remains satisfied) given that expected net profit is decreasing in wage.

When effort is not observable, ~~the~~ P offers A a profit-contingent wage that must satisfy not only PC but the incentive constraint IC. IC is the condition that A finds it (weakly) optimal to exert the level of effort that P intends to induce. Suppose that P intends to induce $e=0$. Then, the optimal contract is a fixed wage contract at the same wage as in the observable effort case. This satisfies IC because ~~effort~~ ~~a~~ utility is decreasing in effort ~~so~~ and wage is independent of profit hence ~~a~~ expected wage is independent of effort, so deviation to high effort is not strictly profitable. Then, expected wage and expected net profit are unchanged from the case where effort is perfectly observable and there is no agency cost.

Suppose instead that P intends to induce high effort. Suppose further that A is risk averse. In order to induce high effort, P must offer a variable wage ~~s~~ scheme such that A ~~has incent~~ 's IC is satisfied. By the earlier argument, under any fixed wage scheme, low effort is strictly optimal. Because P must offer a variable wage scheme (supposing further that the low profit outcome remains possible even under high effort), A bears some risk under this contract. Then, A must be compensated for additional risk bearing with a higher expected wage such that PC remains satisfied. This is because the risk premium of a variable wage ~~scheme~~ contract is non-zero, so certainty equivalent is less than expected value, and A ~~and~~ finds participation optimal only if CE of participation exceeds final wealth in the event of non participation. So if P induces high effort and A is risk averse, expected wage is higher than in the case where effort is perfectly observable, and agency cost is positive.

Suppose instead that A is risk-neutral, then A can be offered some absurd contract with very high variability, whose expected ~~value~~ wage is ~~less than~~ no higher than that in the observable effort case. This contract will ~~be so~~ satisfy IC because of the high variability. It will satisfy ~~P~~ PC because A is risk neutral ~~and~~ so the contract has no risk premium and remains perfectly acceptable to A. Expected wage is unchanged, so agency cost is zero.

b Given that P induces high effort, effort is unobservable, and A is risk averse, the more risk averse A is the higher the risk premium.

There is a risk premium in inducing a risk averse agent to exert high effort because a variable wage scheme is necessary such that high effort is incentive compatible. This ~~rate~~ requires that A bear some risk, which has positive risk premium, causing a divergence between expected ~~wage~~ value ~~of~~ and certainty equivalent. A accepts the contract only if certainty equivalent exceeds some level ~~give~~ that is ~~related to~~ positively related to and determined by some exogenous reservation utility. The more risk averse A, all else being equal, the larger the risk premium ~~hence the large~~ of the just incentive compatible contracts that minimises the risk A is made to bear while leaving high effort strictly optimal. Then, the higher the expected wage required ~~to~~ ~~be~~ such that the contract ~~remain~~ continues to satisfy PC. The more risk averse A, the higher the expected wage required to compensate for risk bearing.

Expected wage required to induce high effort in the case of observable effort is ~~wrong~~ unchanged because P optimally offers a fixed wage scheme here, whose expected value will be independent of A's risk aversion.

So agency cost increases with increasing risk aversion.

c It is not true that the 'larger the difference between high and low profit levels the larger the variability in the variable wage scheme offered under unobservable effort. The larger the former difference, the more likely it is that P will find it optimal to induce H. But this does not translate to larger wage variability for A. This is because P has strict incentive to minimise wage variability for A. The greater the variability in A's wage, the higher A's risk premium for the contract, hence the higher the expected wage on the just acceptable contract, as explained earlier.

This is to some extent counterintuitive. We think that the higher stakes are for ~~the~~ ~~agt~~ P the more drastic the incentive structures P will establish for A. One explanation for this is that in the real world scenarios that we draw our intuitions from, principals are not perfectly risk neutral, there is a continuum of effort, and/or (most importantly), the agents utility function (preferences over ~~contracts is not~~ wage and effort levels is not perfectly known). So ~~a~~ it could be that principals offer more drastic incentives where stakes are high to mitigate risk to principals introduced by uncertainty over agent's preferences.

10ai $u_i(B, x_i) = \frac{1}{3}\ln B + \frac{2}{3}\ln x_i$

$B = b_1 + b_2$

~~##~~ C1 has utility maximisation problem, given b_2

$\max_{b_1} \frac{1}{3}\ln(b_1+b_2) + \frac{2}{3}\ln x_1$ s.t.

$BC_1 : b_1 + x_1 \leq 600$

At the optimum, the budget constraint BC_1 binds. Any candidate optimum such that BC_1 does not bind fails to deviation by ~~a suff~~ increasing x_1 by ~~s~~ sufficiently small amount ε. The above reduces to

$\max_{b_1} \frac{1}{3}\ln(b_1+b_2) + \frac{2}{3}\ln(600-b_1)$

FOC: $\frac{1}{3}\frac{1}{b_1+b_2} - \frac{2}{3}\frac{1}{600-b_1} = 0 \Rightarrow$

$\frac{1}{3b_1+3b_2} = \frac{2}{1800-3b_1} \Rightarrow$

$3b_1+3b_2 = 900 - \frac{3}{2}b_1 \Rightarrow$

$\frac{9}{2}b_1 = 900 - 3b_2 \Rightarrow$

$b_1 = 200 - \frac{2}{3}b_2$

SOC: $\frac{1}{3}(-1)(b_1+b_2)^{-2} - \frac{2}{3}(-1)(600-b_1)^{-2}(-1)$

$= -\frac{1}{3}(b_1+b_2)^{-2} - \frac{2}{3}(600-b_1)^{-2} < 0$

C1 maximises utility given b_2 by choosing $b_1 = 200 - \frac{2}{3}b_2$. For $b_2 < 300$, the positivity constraint on b_1 is satisfied. For $b_2 \geq 300$, the positivity constraint on b_1 binds and ~~to~~ C1 chooses $b_1 = 0$. (C1 wants to sell some of the books bought by C2, but presumably is not permitted to do this).

ii By symmetry, C2 maximises utility given b_1 by choosing $b_2 = 200 - \frac{2}{3}b_1$ for $b_1 < 300$, 0 otherwise.

~~Suppose~~ First neglect the positivity constraints.

$b_2 = 200 - \frac{2}{3}b_1$

$= 200 - \frac{2}{3}(200 - \frac{2}{3}b_2)$

$= \frac{200}{3} + \frac{4}{9}b_2 \Leftrightarrow$

$\frac{5}{9}b_2 = \frac{200}{3} \Leftrightarrow$

$b_2 = \frac{1800}{15}$

$= 120$

$b_1 = 200 - \frac{2}{3}b_2$

$= 120$

At the NE, each Ci chooses $b_i = 120$. The positivity constraints are satisfied.

bi ~~(Pareto) Optimal provision of books maximises total utility. This is because utility of each Ci is quasilinear in money. Any candidate optimum such that total utility is not maximised fails to deviation to the quantity of books that maximise total utility and som with some transfer of money, if necessary, such that be both C1 and C2 are better off.~~

~~Alternatively, the optimal provision of books satisfies the Samuelson condition, that the ## marginal social benefit (given by the sum of marginal private benefits) is equal to the marginal social cost of provision.~~

~~$\sum_{i\in\{1,2\}} \frac{\partial}{\partial B} u_i(B,x_i) = 1 \Leftrightarrow$~~

~~$\sum_{i\in\{1,2\}} \frac{1}{3B}$~~

The optimal provision of books satisfies the Samuelson condition. In ~~a~~ the case ~~of~~ where utility is quasilinear in money, the Samuelson condition is the condition that the marginal social benefit of provision of the public good (which is equal to the sum of the marginal private benefits) is equal to the marginal social cost of provision. In this case, the Samuelson condition is the condition that the sum of marginal rates of substitution is equal to the marginal rate of transformation.

$MU_i^B = \frac{1}{3B}$

$MU_i^x = \frac{2}{3x_i}$

$MRS_i = -MU_i^B/MU_i^x = x_i/2B = 600-b_i/2(b_i+b_j)$

$\sum_{i\in\{1,2\}} MRS_i = MRT \Leftrightarrow$

$\frac{1}{2(b_i+b_j)}(600-b_i+600-b_j) = 1 \Leftrightarrow$

$1200 - B = 2B$

$B = 400$

At the optimum, ~~each C~~ the total provision of books is greater than at the earlier equilibrium. This is because ~~at the earlier optimum~~, the provision of books by one college has a positive externality on the other that the former does not account for in its decision to provide books ~~so each college C has less incentive to provide books than a social planner. Marginal private benefit of provision of books intersects the marginal cost (cost both private and social) at at a lower quantity~~ At the equilibrium, marginal provision has marginal private benefit equal to marginal cost, but marginal social benefit in excess of marginal cost, so there is less than optimal provision at equilibrium.

ci Under Lindahl pricing, each Ci assumes that ~~it is entirely~~ the provision of B will be entirely determined by its decision, and is offered some price p_i for the books. This price will be equal to the college's marginal benefit at the socially optimal quantity. ~~Supp~~

~~At~~ Suppose the social optimum, $b_1 = b_2 = 200$.

$$MRS_i = x_i/2B = 600-b_i/2(b_i+b_j) = 1/2$$

~~So~~ So each college faces a Lindahl price of 1/2 and ~~as~~ assumes that it is solely responsible for the provision of ~~the public g~~ books. Then, each college's privately ~~optimising~~ maximising utility given its Lindahl price yields the socially optimal provision.

Given $p_i = 1/2$, each college has ~~utility~~ (reduced form) utility maximisation problem

$$\max_B \tfrac{1}{3}\ln B + \tfrac{2}{3}\ln(600 - B/2)$$

$$FOC: \tfrac{1}{3B} - \tfrac{1}{2}\tfrac{2}{3}\tfrac{1}{600-B/2} = 0 \Leftrightarrow$$

$$B = 600 - B/2 \Leftrightarrow$$

$$B = 400$$

It is verified that each college chooses the ~~pa~~ socially optimal number of books.

ii The Lindahl pricing mechanism is not strategy-proof because, if utility functions are private information, each college has strict incentive to under-report its valuations at ~~the~~ the optimum ~~(and a~~ ~~op~~ level of provision because it then ~~pays less in tax~~ has a lower price for books.

iii ~~So~~ Denote the subsidised price as p.

Each college has reduced form ~~profit maximisa~~ utility maximisation problem given the contribution of the other college

$$\max_{b_i} \tfrac{1}{3}\ln(b_i+b_j) + \tfrac{2}{3}\ln(600 - pb_i)$$

$$FOC: \tfrac{1}{3(b_i+b_j)} - \tfrac{2p}{3(600-pb_i)} = 0 \Rightarrow$$

$$3b_i + 3b_j = 900/p - 3/2\, b_i \Rightarrow$$

$$9/2\, b_i = 900/p - 3b_j \Rightarrow b_i = 200/p - 2/3\, b_j$$

$$SOC: -\tfrac{1}{3}(b_i+b_j)^{-2} - \tfrac{2}{3}p^2(600-pb_i)^{-2} < 0$$

Each C_i has ~~a~~ best response function

~~brf~~ $B_i(b_j) = 200/p - 2/3\, b_j$

$(b_i, b_j) = (200, 200)$ is sustainable in NE iff ~~it is~~ 200 ~~=~~, 200 are mutual best responses.

$$200 = 200/p - 2/3(200) \Leftrightarrow$$

$$1000/3 = 200/p \Leftrightarrow$$

$$p = 600/1000 = 0.6.$$