

# EC320 Solutions to Problem Set 5

## 1 Informal Credit Market

- (a) *Would a lender in the informal market manage to break even if they were to lend \$100 without collateral at an interest rate equal to the formal sector rate of 8%? What does this imply about the relation between formal and informal sector interest rates?*

For a borrower who borrows \$100, s/he will choose to declare a default if

$$x < 100 * (1 + 0.08)$$

Therefore, the probability of default is  $\frac{108}{500} = 0.216$ . Then,

$$\begin{aligned} \text{Lender's expected revenue} &= 0.216 * 0 + 0.784 * 100 * (1 + 0.08) \\ &= 84.672 \\ &< 100 * (1 + 0.08) \\ &= \text{Lender's opportunity cost (outside option)}. \end{aligned}$$

The lender will not be able to break-even if he charge the same interest rate as in the formal credit market without collateral. This is because the borrowers can default based on their own default cost, which generates a risk of 'not getting anything back' for the lender. Therefore, the informal sector interest rate will be higher than that of the formal sector.

- (b) *How would the answer to (a) change if the loan were secured with a collateral of \$50? With such a collateral, would an informal lender break even on the \$100 loan at a 20% interest rate?*

The borrower now has an incentive to default if

$$x < 100 * (1 + 0.2) - 50 = 70.$$

The probability of default if  $\frac{70}{500} = 0.14$ , and it follows that

$$\begin{aligned} \text{Lender's expected revenue} &= 0.14 * 50 + 0.86 * 100 * (1 + 0.2) \\ &= 110.2 \\ &> 100 * (1 + 0.08) \\ &= \text{Lender's opportunity cost (outside option)}. \end{aligned}$$

Therefore, the lender will be able to not only break-even but also earn a positive profit. However, since the informal credit market is competitive, the lender will not get any borrower. S/he will need to adjust the interest rate to compete with other informal lenders and to attract borrowers.

- (c) Show that with a collateral of \$50, informal lenders must impose a credit limit, above which they would be unwilling to lend at any interest rate. Does the answer change if the ratio of collateral to loan size is fixed at 50%?

Let  $L$  be the size of loan and  $r$  be the informal interest rate.

- Collateral=\$50

The borrower will choose to default if

$$x < L * (1 + r) - 50.$$

Then the probability of default is

$$\frac{L * (1 + r) - 50}{500} = \frac{L - 50}{500} + \frac{r * L}{500}.$$

Therefore, for  $L \geq 550$ , the probability of default is 1 no matter what  $r$  is. The lender will never want to lend more than 550.

- Collateral= $0.5 * L$

Now, the borrower will default if

$$x < L * (1 + r) - 0.5 * L.$$

Then the probability of default is

$$\frac{L * (1 + r) - 0.5 * L}{500} = \frac{(0.5 + r) * L}{500} = \frac{0.5 * L}{500} + \frac{r * L}{500}$$

Therefore, for  $L \geq 1000$ , the probability of default is 1 no matter what  $r$  is. The lender will never want to lend more than 1000. By fixing the relative size of collateral to loan size to 0.5, the credit limit is increased by 450.

## 2 International Trade and Government Intervention

- (a) Describe the outcome of the cement market when country C imposes no restrictions or tariffs on cement exports or imports.

Since the cement industry of country C is competitive, the domestic price of cement is equal to the cost of production, \$5, while the world price is \$1.5. Therefore, consumers in country C will import cement, and the domestic cement producers will go out of business.

Consumer surplus under this setting is \$55 million ( $(10 - 1.5) * 5 + (2 - 1.5) * 2 = 5$ ) with zero producer surplus.

- (b) Suppose the government needs to raise revenues of \$20 million a year for a public project. Could this revenue target be achieved with an import tariff on cement? Or with a sales tax on cement? If so, describe the outcome in each case.

- Claim: It is impossible to satisfy both types of consumers.

- Import tariff

To make household construction companies to be willing to purchase, maximum possible tariff is \$0.50/lb.

$$\text{Tariff revenue: } 0.5 * 5 + 0.5 * 25 = 15 < 20$$

The government cannot achieve its goal of raising \$20 million.

- Sales tax  
Sales tax applies to both domestic and imported cement. This will make the domestic price always higher than the world price, and consumers will purchase imported cement. The same analysis as in the previous case applies.

► Therefore, we need to focus on the industrial construction companies only.

- Import tariff  
\$4/lb tariff is necessary to earn a revenue of \$20 million. However, this will increase the effective world price to \$5.5/lb, which is greater than the domestic price. As a result, industrial construction companies will buy from domestic producers, and the government will not be able to achieve the revenue target.

- Sales tax  
Let  $t$  be the tax rate. Sales tax applies to both producers, and buyers will purchase imported cement since

$$5 * (1 + t) > 1.5 * (1 + t) \quad \forall t > 0.$$

To collect \$20 million, we must have

$$1.5 * (1 + t) * 5 = 20.$$

This gives us  $t = \frac{8}{3} \simeq 2.667$ , and the resulting price is  $1.5 * (1 + t) = 1.5 * 3.667 = 5.5$ . The government successfully collects \$20 million, but consumer surplus drops from \$55 million to  $(10 - 5.5) * 5 + 0 = \$22.5$  million. The producer surplus is still zero. Therefore, the introduction of sales tax brings deadweight loss of \$2.5 million.

- (c) *Show that there is a policy involving choice of a sales tax combined with an import tariff that will succeed in ensuring the survival of the domestic cement industry, as well as meeting the governments revenue target. What are the costs and benefits of such a policy compared to feasible policy options in (b) above?*

We need to find the set of  $t$  and  $T$ , the size of tariff, that satisfies the below three conditions.

$$5 * (1 + t) \leq 1.5 * (1 + t) + T : \text{Domestic industry survives}$$

$$5 * (1 + t) \leq 10 : \text{Consumers are willing to buy}$$

$$(5 * (1 + t) - 5) * 5 = 20 : \text{Government earn \$20 million}$$

Solving the set of equations, we obtain that for all combinations of  $t = 0.8$  and  $T \geq 6.3$ , the policy that combines sales tax and import tariff will ensure that the domestic cement industry survives as well as that the government achieves its target revenue. As a result, the industrial construction companies now purchase cement at \$9/lb, and the consumer surplus is now  $(10 - 9) * 5 = \$5$  million with the same government revenue (\$20 million) and zero producer surplus. Compared to the sales-tax-only policy in (b), the consumer surplus is decreased by \$17.5 million, which results in the same amount of increase of deadweight loss.