# LSE Economics Courses: Sample Slides and Other Materials

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# **Economics (Year 1)**

INEQUALITY AND REDISTRIBUTION (Acemoglu, Laibson, List, Chapters 10 and 11.3)

## 7.1 Pen's People's Parade

One striking feature of market-based economies is that they tend to produce considerable inequality in outcomes. This inequality is the source of a lot of the controversy about markets, about whether they are good or bad. If market economies produced a very equal distribution of income, we might be inclined to look at the organizational feat of markets and simply remark how extraordinary they are, how they make sure that somebody in a far corner of the world can produce something for somebody to consume without ever communicating. But the fact is that market economies do tend to produce inequality and this is one of their failings in the eyes of many (though, unhelpfully, economists generally reserve the term market failure for other issues).

One way to visualise the size of income inequalities is what is called Pen's Peoples Parades, named after Jan Pen, a Dutch economist. He first used this way of visualising the inequality in income when writing about the UK 1971 but Figure 7.1a presents it for the US in 2006.

Figure 7.1a



In the parade everybody in the population walks past you in an hour, and people are ordered by their income so that the first person is the person with the lowest income and then so on until the last person who goes past has the highest income. Also, Pen

asked us to imagine that people's height is proportional to their income so if someone is of average income then they would also be of average height.

At the start of the hour you would see a lot of very small people. The first people have negative height (they are walking upside down) as they have negative incomes (e.g. the owners of loss- making businesses). Then there are a lot of people, mostly young or old, who have essentially no income. After 20 minutes, a third of the population will have passed but the last person is only 2 foot 6 inches tall. It probably gets a bit boring because the small people go on and on and it is only after 40 minutes that you get to people who are 5 foot 9 inches foot tall, i.e. people of average height.

One might wonder why the person at 30 minutes, the median person, is not of average height. That is because the median income is below the mean income and that is because of what happens in the final minutes. The last 20 minutes start with somebody 5'9" tall and then the people get steadily bigger and bigger and bigger. At the start of the final minute there is someone about 14 foot tall, but in the final seconds you get some people who are 900 feet high meaning that they earn hundreds of times the average amount of income. So, a lot of income is concentrated on a very small number of people, a group that would be popularly known these days as the 1%.

### 7.2 Measuring Inequality: Lorenz Curves and Gini Coefficients

Pen's People's Parade is very striking but sometimes we want a more formal way of measuring inequality. There are lots of measures of inequality and we have little time to discuss this is detail. We will focus on one very commonly used method to represent inequality, the Lorenz Curve. The Lorenz curve is a graph in which people are ordered by their income (as in the parade). The height of the Lorenz curve 20% of the way along the horizontal axis is the share of total income of the bottom 20% of households in the population. If the bottom 20% of households had only 5% of total income for example, that would be the value of the curve at that point.



The Lorenz curve is a plot of the share of total income on the vertical axis against the share of the population on the horizontal axis. The Lorenz curve has to go through two points. One is the origin (because zero percent of the population earn zero percent of the total income). At the other point, 100% of the population have to have 100 percent of the income.

Suppose a society had complete equality. In this case 20% of the population earn 20% of total income, 60% earn 60% etc. etc. With complete equality in income the Lorenz curve would be a 45° line. But, as long as there is any inequality in income, the Lorenz curve must be below the 45° line. That is because the poorest 10% of people must have less than 10% of total income etc. At the other extreme a society in which one person has 100% of the income in society would have a right-angled Lorenz curve.

How can we use the Lorenz curve to measure income inequality? Figure 7.2b shows two possible Lorenz curves. Lorenz curve B is closer to the 45° line than Lorenz Curve A. Society B has a lower level of inequality as the lowest 10% have a higher share of income, as does every percentile.

It is often convenient to have a single summary measure of the level of inequality in a society. Perhaps the most commonly used measure for this is the Gini Coefficient. It should be emphasised that the Gini coefficient isn't the only possible measure of inequality - lots of people have proposed different measures of inequality and they all have advantages and disadvantages.

The Gini coefficient is derived from the Lorenz curve and it takes area A in Figure 7.2c, the area between the Lorenz curve and the 45° line, and then divides it by the sum of areas A plus B which is the right-angled triangle below the 45° line. If we had complete equality (a Lorenz curve the same as the 45° line) the Gini coefficient would be zero. If we had the most extreme form of inequality in which just one person had all the income, the Gini coefficient would be 1. All societies are somewhere in between with a higher Gini coefficient representing a higher level of inequality.

7.3 Variation in the Gini Coefficient across countries and over time Figure 7.3a shows how the

Gini coefficient varies across countries? Figure 7.3a



The darker the colour, the higher the Gini coefficient. There are a number of patterns worth noting. First, Western Europe plus Canada plus Australia is the part of the world with lowest levels of inequality, notably in Scandinavia. The level of inequality in the UK is not particularly high by world standards but is quite high by European standards. The US has a higher level of inequality then most European countries but is not the highest in the world. The highest levels of inequality are to be found in southern Africa, Central and South America and some parts of Asia with China standing out

As having a high level of inequality. South Africa is reputedly the country with the highest Gini coefficient in the world, the legacy of apartheid.

We might also be interested in trends in inequality over time. Figure 7.3b presents some trends in the Gini coefficient and for a selected number of countries going back to the 1970s in some cases.

Figure 7.3b



It shows that the United States' Gini coefficient has risen since the early 1970s. The UK had a sharp rise in inequality in the 1980s but since 1990 the level of inequality hasn't changed very much (though LSE Professor Stephen Jenkins argues that the official statistics understate the growth in incomes right at the top and there is a modest rise in inequality in recent years if one accounts for this). Germany has had a relatively modest increase in inequality over this period. Although the Gini coefficient is higher in many countries today than in the past, there are some countries where inequality has fallen - Brazil is one such country. China has had a sharp rise in inequality going from a country with about the same level of inequality as the UK to one with more inequality than the US.

We might be interested not just in income inequality within countries but in the world as a whole. Working out the level of inequality in the world is quite a hard exercise because one needs surveys of every country. But estimates for the world Gini are in the range 0.61-0.68 (Chinese President, Xi Jinping mentioned 0.7 in a speech in 2016), about the level of inequality in South Africa the country with the highest measured inequality in the world.

## **Economics (Year 1)**

# Racial Bias in Motor Vehicle Searches

- Between 1995 and 1999 on I-95
- 18% of drivers are black
- 63% of drivers searched by police are black
- So, a black driver is **7.7** times more likely to be searched

Is the police racially prejudiced?

#### Does the police statistically discriminate?

Knowles, Persico and Todd, JPE, 2001

	drug No drug	
Search	v-c, -d	-c, 0
No search	0, w	0, 0

In a mixed equilibrium: the police is indifferent

 h : hit rate of the search (probability of drug)
 Police's payoff from search:
 hv-c

 Police's payoff from not searching:
 0

The police is indifferent if:hv-c = 0.That is:h = c/v

Note: h does not depend on d and w

# How should we think about police search?

Consider the following game played by a driver and the police

#### Police:

- Cost of search/car: c
- Reward if drug is found: v
- Payoff is zero if does not search

#### Driver:

LSE

LSE

- Punished if carries drug and searched: -d
- Gets a reward if carries drug and not searched: w
- Payoff is zero if does not carry any drug

LSE

#### This can be represented as a 2-by-2 Game

	drug	No drug
Search	v-c, -d	-c, 0
No search	0, w	0, 0

Is there a pure-strategy equilibrium in this game?

If police searches  $\rightarrow$  driver never carries drug  $\rightarrow$  police should not search

If police does not searches  $\rightarrow$  driver carries drug  $\rightarrow$  police should search

There is only a mixed-strategy equilibrium!



### Section B Questions

1) In recent years central banks have been forced to resort to unconventional monetary policies because policy rates were at (or near) the Effective Lower Bound (ELB). Some economists have argued that, if inflation targets were set to 4% rather than the current 2%, central banks would be less likely to have to use unconventional policies in the future. Can you explain the logic behind this proposal?

2) In September 2017 the recently-elected French President Emmanuel Macron pushed through parliament a number of changes to labour market regulations. One of the changes concerns lawsuits brought by workers against their employers, when the workers believe they have been fired unfairly. The rule change puts a limit on the amount of money that the judge can order the employer to pay to the worker – which previously was unlimited. What consequences would you expect this change in labour-market regulation to have on unemployment?

3) In several countries there is increasing interest in the idea of a "basic income" (BI). Under a BI regime all citizens receive a regular sum of money, sufficient to live on, from the government. The recipient is not required to work or look for work, and the payment is given independent of any other income. Compare the effects on unemployment of BI and unemployment insurance (UI) (assume that BI and UI are set at the same level, i.e. same amount of money per month).

4) Currently, there is a lull in the Eurozone crisis: no country appears in imminent danger of defaulting on its public debt, and sovereign spreads are relatively low. However, some Italian banks appear to have very large amounts of non-performing loans on their books (a non-performing loan, or "bad debt," is one on which the debtor has been missing interest payments). Furthermore, the economy is widely believed to be entering a recession. Based on this, can you describe a chain of events that might cause the crisis to re-ignite?

### **Microeconomics**

#### Outline

- Will develop a theoretical example to illustrate the main ideas
  - Shows how the tools that we have developed in the course can be used to study resource allocation via government

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- We will suppose that there is a government in place
  - **a** for the moment we will not consider how it got there
  - **question** is how the government use its power to tax
  - there is the possibility of using public resources to favour private interests

#### Motivation in Public Office

- Do we assume that those who enter government care about the citizens
  - Or are they self-interested?

"Political writers have established it as a maxim, that, in contriving any system of government, and fixing the several checks and controls of the constitution, every man ought to be supposed a knave, and to have no other end, in all his actions, than private interest. By this interest we must govern him, and, by means of it, make him, notwithstanding his insatiable avarice and ambition, cooperate to public good." David Hume (1711-1776)

For the purposes of the analysis, we will suppose that the ruling elite is somewhat self-interested.

Ec 201

### Theoretical Example

TJB (LSE)

TJB (LSE)

- $\blacksquare$  A government has a source of tax revenue per capita of T
  - This reflects the "coercive" power of the state.
- It can spend resources either on
  - transfers to the ruling elite: B
  - a public good which benefits all citizens: G
- The governments budget constraint is

$$B+G=T$$
,

It cannot spend more than it has in the form of tax revenues

Ec 201

### Theoretical Example

TJB (LSE)

- We will now suppose that citizens are identical and value public goods equally
  - So we do not worry about preference aggregate across citizens
- Preferences of citizens are

$$\theta \log (G) + m - T$$

where m is income and taxes reduce private consumption.

Preferences of the elite are

$$\theta \log \left( G \right) + \log \left( B \right) + m$$

where  $\log(B)$  is the utility from the transfers that they receive which are funded out of taxation.

For simplicity, we are assuming that the elite do not pay taxes. Ec 201

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Ms. Moneybags is a risk-neutral banker and is considering lending £10 to Mr. Shirk so that he can invest in a project that makes £20 if it is successful. If not successful the project gives zero. Mr. Shirk can either put in effort E = 1 in which case the project succeeds with probability 0.8 and nothing with probability 0.2. If he puts in no effort, E = 0, then the project fails for sure. The cost of setting E = 1 is £4.

- 1. Show that if E = 1 is guaranteed then the project is worth undertaking.
- 2. Suppose now that Ms. Moneybags cannot observe E and only observes whether the project succeeds or fails. Explain carefully why this creates moral hazard in the lending relationship.
- 3. Show that it is incentive compatible to set E = 1 at interest R if and only  $0.8 * [20 10 * (1 + R)] \ge 4$ .
- 4. Suppose that Ms. Moneybags demands an interest rate of 20% for lending to Mr. Shirk, i.e. she expects £12 back if the project is successful.
  - (a) Will Mr. Shirk set E = 0 or E = 1? (Hint compute his payoff in each case and compare)
  - (b) Is it worthwhile for Ms. Moneybags to lend £10 to Mr. Shirk at this interest rate?
- 5. Suppose that the interest rate is increased to 60%, i.e. she expects £16 back from a successful project?

- (a) Will Mr. Shirk set E = 1 or E = 0?
- (b) Show that Ms. Moneybags will not want to make a loan at an interest rate of 60%?
- (c) Why can it be worse for Ms. Moneybags to lend money at a higher interest rate?
- (d) Would this change if Mr. Shirk could pledge £4 in collateral to be forfeited and paid to Ms. Moneybags in the event that he defaults? Explain.
- (e) Would Mr. Shirk accept this contract?
- 6. Does this give an insight into how interest rates might be set in real world loan contracts?

## **Microeconomics**

# Independence axiom: illustration



# Consumer choice with a variety of financial

assets



# The victim's problem and solution

- Firm 2 (the victim) offers firm 1 a side-payment β
- accounted for in the computation of profits

-

•  $\beta$  a is a control variable for firm 2 in the maximisation problem:

$$\max_{\mathbf{q}^{2},\beta} \sum_{i=1}^{n} p_{i}q_{i}^{2} - \beta - \mu_{2}\Phi^{2}\left(\mathbf{q}^{2}; q_{1}^{1}\right)$$

• FOCs:

$$\begin{aligned} p_i &- \mu_2 \Phi_i^2(\mathbf{q}^2 ; q_1^1) = 0 \\ &- 1 - \mu_2 \frac{\mathrm{d} \Phi^2 \left( \mathbf{q}^2 ; q_1^1 \right) \mathrm{d} q_1^1}{\mathrm{d} q_1^1} \mathrm{d} \beta = 0 \end{aligned}$$

• Using the definition of the externality and rearranging:

$$-1 + \mu_2 \Phi_2^2(\mathbf{q}^2; q_1^1) e_{21}^1 \frac{dq_1^1}{d\beta} = 0$$
$$\frac{d\beta}{dq_1^1} = p_2 e_{21}^1$$

## Private Contribution Equilibrium (cont'd)

Since the constraints are binding, the problem of consumer i simplifies to:

$$\max_{s_i} U^i\left(X_i - d_i, f\left(\sum_{i=1}^n d_i\right)\right)$$

The first order conditions are then:

$$\frac{U_z^i(x_i, z)}{U_x^i(x_i, z)} = \frac{1}{f'\left(\sum_{i=1}^n d_i\right)}$$

► To be compared to BLS:

$$\sum_{i=1}^{n} \frac{U_{z}^{i}(x_{i}, z)}{U_{x}^{i}(x_{i}, z)} = \frac{1}{f'(x)}$$

#### Problem set questions

- 9. Anne has an initial stock of wealth *W* and risks losing some of this wealth through fire. The probability of such a fire is known to be  $\pi$  and the loss if the fire occurs would be *L* (where L < W). Insurance cover against a fire is available at a premium  $\kappa$ , where  $\kappa > \pi L$ ; it is also possible to take out partial cover on a pro-rata basis, so that an amount *tL* of the loss can be covered at cost  $t\kappa$  where 0 < t < 1.
  - (a) Draw and explain a diagram that depicts Anne's budget set. [4 marks]
  - (b) Anne's preferences under uncertainty are given by a standard von Neumann-Morgenstern utility function. Explain why Anne will not choose full insurance, even if she is risk averse. [5 marks]
  - (c) Assuming that she is risk averse, find the conditions that will determine Anne's optimal value of *t*. [6 marks]
  - (d) Beth's wealth is greater than Anne's, but she faces the same possible loss through fire L with the same probability  $\pi$ ; she can get insurance cover on exactly the same terms as Anne. Beth has the same preferences as Anne and these preferences exhibit decreasing absolute risk aversion. Use your answer to part (c) to show that the insurance cover Beth chooses is less than that chosen by Anne. [5 marks]
- Consider a static game of incomplete information with two players and in which player 2 has two possible types. Call them type *a* and type *b*. Suppose that the probability of player two being of type *a* is 0.7 and that payoffs are described by the matrix below:

$1 \backslash 2.a$	L	R	$1 \backslash 2.b$	L	R
T	4, 2	0, 1	T	0, 1	0, 2
M	3,0	1, 1	M	1,1	9,1
B	2, 4	3, 3	В	3, 2	4, 1

- (i) What are the possible strategies of each player? Is any one of them dominated. [14 marks]
- (ii) Compute a pure strategy Bayes Nash equilibrium. [14 marks]
- (iii) Is it a dominant strategy equilibrium? [5 marks]

### **Macroeconomics**

<u>Discussion question</u>: In your summer internship at an investment bank, you are asked to advise the CEO of a company that is investing in a very large housing project that will take 4 years to come to fruition. The CEO argues that if she gets financing from overnight loans, rolled over every night and keeping only a small buffer in cash on the side, the interest rate she would pay right now is 0.5% per annum. If instead she got a loan for 4 years, the interest rate would be 4% fixed per annum, so she confidently concludes that the rollover strategy is better. Convince her otherwise by explaining two risks with the roll-over strategy. Would one of these risks change if you thought monetary policy was about to raise interest rates? Would one of these risks change if she told you that she is the largest and most popular employer in her region and the local government would always rescue her from bankruptcy because of its macro consequences?

Long question: This problem asks you to work through a slightly harder version of the Diamond Dybvig model, that I mentioned in class. In an economy, there is one good, three periods 0, 1 and 2, and N agents, all identical ex ante at date 0 and with 1 unit of a good. A fraction g of the agents turn out to be impatient and get utility from consuming in period 1  $u(c_1)$ , and a fraction 1 - g gets utility from consuming in period 2,  $u(c_2)$ . Ex ante expected utility then is:

$$gu(c_1) + (1-g)u(c_2)$$

The utility function is u(c) = 1 - 1/c.

There are two investments. One, on short-term storage, returns 1 unit at date 1 per unit invested at date 0. Likewise, a unit stored at date 1 gives one unit at date 2. The other investment is on a long-term technology that per unit invested at date 0 returns R > 1 at date 2, but only L < 1 if it is liquidated at date 1.

a) Imagine that each consumer must make his choice of what amount, *I*, of his one unit of wealth at date 0 to invest in the illiquid asset (long-term asset). If he is an impatient agent, then he will liquidate the long-term technology and consume:

$$c_1 = (1 - I) + LI,$$

since he put 1 - I in storage and I in the long-term technology that is being liquidated early. Write down what is the corresponding  $c_2$  (his consumption if he turns out to be patient).

- b) Show that  $c_1 \le 1$  and  $c_2 \le R$  under autarky, that is without any trading between patient and impatient consumers.
- c) Assume now that there is a financial market at date 1 where early consumers, instead of having to liquidate their long-term investments in order to consume, can sell one unit of investment in the long-term technology in exchange for *pR* units of the consumption good at date 1 (that is, they swap their long-term investments for the goods held in storage by the late consumers who do not wish to consume date 1). Now, the early consumer at date 1 consumes:

$$c_1 = (1 - I) + pRI$$

Conversely, the patient agent will go to this financial market at date 1 and swap their goods held in storage for additional investments in the long-term technology. Write down the consumption of the patient agent  $c_2$ .

- d) Use the fact that p = 1/R in equilibrium (you don't have to show this) to show that  $c_1 = 1$  and  $c_2 = R$ . With a financial market, are we better off than under autarky?
- e) Now assume that we have a bank, which can also invest in short-term storage or in the long- term technology, and promises  $y_1$  and  $y_2$  payments to depositors who withdraw early or late, respectively. The bank plans to not liquidate early any part of the long-term technology. Therefore, equating the bank's payments and receipts at each date we get:  $gy_1N = N(1 I)(1 g)y_2N = NRI$

Explain the two sides of each of these equations. Substitute out / in these two equations to derive one equation linking  $y_1$  and  $y_2$ .

- f) Maximize expected utility subject to the constraint you derived in question e to derive  $y_1$  and  $y_2$ . If the bank offers this contract show then that consumers put all their money in the bank and consume  $c_1 > 1$  and  $c_2 < R$  in the good equilibrium.
- g) Does the bank contract make agents better off relative to either autarky or the financial market solution?
- h) Is there also a bad, run, equilibrium? Describe it verbally.