Open Questions

Solve no more than 4 questions out of 5. Indicate your choice of questions to grade on page 3 of your paper.

If you provide solutions for all 5 questions, all of them will be commented by the Jury, but only 4 will add to your score. In this case, if you do not specify which to grade, the maximum grade of 5 will be excluded.

Every open question is worth 30 raw points.

If not stated otherwise, think of all goods, services and assets as of infinitely divisible. Numbers of firms and people may be only integer.

Convey your ideas clearly. Don't skip important logical transitions in your reasoning. Take care of handwriting. If you strike something out, it won't be graded.

If you want to leave the room for a while, raise your hand and ask a volunteer.

Good luck!

Question 1. "Mechanism Design" *(30 raw points)*

There are three kids: Alice, Bob and Clara. Their mother wants to split a cake of size 1 into three pieces and distribute them among the kids. Every kid wants to eat as much cake as possible.

a) *(10 rp)* Consider the following mechanism. Alice cuts the cake in three pieces the way she likes; then Bob takes any piece he likes, and then Clara takes any piece she likes (of the two that are left), so Alice is left with another remaining piece. How will Alice cut the cake?

b) *(20 rp)* Now consider a more complicated situation. A kid is *unhappy* if he or she gets less than a certain share of a cake. In particular, Alice will be happy if she gets at least a piece of size a, Bob needs at least b, Clara needs at least c. For every kid, getting a piece of the minimum required size is better than getting no cake, which is, in turn, better than getting a piece of less than the minimum required size. If one is already happy, he or she nevertheless prefer getting more cake to less cake. The mother knows that $0 < a, b, c < 1$ but does not know a, b or c. All three children know all three numbers. Under which a, b, c does a mechanism that ensures each of the kids is happy exist? Suggest such a mechanism.

Solution

a) She should divide the cake in 3 equal parts. Othewise, hers sibling will take the larger pieces and she will be left with the smallest one.

b) Such mechanism cannot exist if $a + b + c > 1$. In this case, the cake is too small to make everyone happy. We will show that the mechanism exists for any a, b, c such that $a + b + c \leqslant 1$.

For example, the following mechanism can be applied. Alice offers some distribution of the cake to her siblings. Each of the siblings then votes in favour or against this distribution. If both votes are in favour, the distribution is accepted. Otherwise, no one gets anything.

In such a mechanism, Alice has an incentive to offer the distribution that makes both siblings and herself happy (which is always possible as long as $a + b + c \leqslant 1$). Bob and Clara have incentives to accept such distribution because they will get nothing otherwise. Should Alice offer any distribution which makes Bob or Clara unhappy, the unhappy sibling(s) will vote against because they prefer to get nothing.

The crucial features of any proposed mechanism are the following:

1. The distribution of a cake among the kids must be done one of them (because the mother is unaware of a, b, c values).
2. If suggested distribution doesn't satisfy kids' minimal requirements, everyone gets nothing.

Marking Scheme.

a) Right answer and correct explanation – 10 rp; only right answer – 5 rp.

b) Correct mechanism is developed (both necessary features are satisfied) with complete explanation why it works, the right answer is provided and necessity of constraint is explained – 20 rp, if solution is given without explanation of the necessity of the constraint – 15 rp.

Correct mechanism is developed with complete explanation why it works, but only fea-

ture 2 is indicated, a right answer is provided and necessity of constraint is explained – 15 rp.; without answer or without explanation of the necessity of the constraint– 10 rp.

Correct mechanism is developed (both necessary features are indicated), but is not explained why it works, a right answer is provided and necessity of constraint is explained – 10 rp. If only one necessary feature is indicated, explanation is absent or a right answer is not provided or explanation of the necessity of the constraint is absent – 5 rp.

No correct mechanism is developed, only necessary constraint is revealed and is explained – 2 rp.; without explanation – 0 rp.

Question 2. "AItomation"   *(30 raw points)*

The economic growth of the last 150 years has been largely driven by automation – new technologies that allowed mechanization of routine tasks previously performed by labor. The steam engine, electricity, computer chips – all these technologies both contributed significantly to economic growth *and* destroyed jobs.

The most recent wave of automation – the rise of Artificial Intelligence (AI) – seems to be able to automate not only low-skill, physical tasks but also non-routine, cognitive tasks such as driving cars and making medical recommendations. This seems to spur widespread anxiety that artificial intelligence may create mass unemployment in the decades to come. In this task, you are asked to comment on these developments from an economic standpoint.

a) *(10 rp)* Consider the following simple model. Suppose in a certain industry (say, textiles) the quantity produced (Q) is equal to the degree of automation (A) times the number of workers (L): $Q = AL$. The industry is competitive. The wage is fixed at the level w. The demand for textiles is equal to $D(p)$ where p is price, and D is a decreasing function. Economic equilibrium occurs at a price p such that demand equals supply. Suppose the degree of automation (A) grows so that now the industry needs fewer workers to produce a given amount of textiles. Will the *equilibrium* number of workers employed by the industry necessarily fall as a result? Provide a verbal explanation of the insight you get from the model.

In the following parts, do not limit your argumentation to the model above.

b) *(10 rp)* A number of authors note that the growth of economic output due to AI and automation will lead to an increase in aggregate incomes, and thus demand, including the demand for new goods and services that are now barely imagined. All this will create new jobs and thus alleviate the problem of unemployment. Criticize this argument.

c) *(10 rp)* Many people think that publicly financed Universal Basic Income (UBI)[1] is a good solution to the problem of mass joblessness. Identify and address the main problems with the UBI in terms of financing the system and motivation to work (one of each).

Solution

a) The supply will grow, which will increase the equilibrium quantity demanded due to *price effect* which will counter the *productivity effect*. This might increase the demand for labor and employment (due to sticky wages). Mathematically, one gets

$$L(A) = \frac{D(w/A)}{A}.$$

The increasing denominator is the productivity effect, while the increasing numerator is the price effect. When the price effect is larger than the productivity effect, L will increase in A. This happens when demand price elasticity is sufficiently large. Mathematically, one may show that the elasticity should be larger than one.

b) New goods and services might be in the other fields – different from the fields where AI created unemployment. If new goods and services are AI intensive, the growth of employment might be limited. Here we can talk about Structural unemployment which can be solved

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[1]UBI is a periodic cash payment delivered to all on an individual basis without means test or work requirement.

in the long-run through training and education. The aspect of low-skilled and high skilled labor should be addressed, since AI is taking over low-skilled jobs and creating high-skilled jobs (partially solving created unemployment).

c) Universal Basic Income. Student should look at this concept in complex approach and not just concentrating on the questions asked (very narrow approach).

Universal Basic Income is a concept where students have to keep in mind the positive aspects of the concept:

- Universal Basic Income (UBI) reduces poverty and income inequality, and improves health
- UBI leads to positive job growth and lower school dropout rates
- UBI guarantees income for non-working parents and caregivers, thus empowering important unpaid roles, especially for women.

1) How to finance the UBI system. On one hand, UBI should go to the consumption, thus increasing firms' revenues and generating more income tax and more Government income (there are several strong argument against this assumption). At the same time, research shows that even small size UBI will be expensive for the governments that would just increase a government debt. The issue of taxes should be addressed in this question (Laffer curve).

2) Motivation to work. UBI removes the incentive to work, adversely affecting the economy and leading to a labor and skills shortage. At the same time (not to generalize the answer) student should address how the size of UBI would leave a motivational effect on different income level labor.

Marking Scheme.

Marking scheme for every part:

- **0 points** — no answer or answer with almost no argumentation.
- **5 points** — partial answer — most of the answer is correct and make sense, but missing some aspects, that doesn't fully explain the point of view.
- **10 points** — full answer that is well argumented and is logical.

All parts are not limited to only these suggested answers. Points will be awarded if students apply other arguments and they make sense.

Question 3. "Fighting drugs" *(30 raw points)*

Chicago is one of the largest cities in the United States with an estimated population of 2.7 million. Located on the shores of freshwater Lake Michigan, Chicago is an international hub for finance, culture, commerce, industry, technology, and transportation. The University of Chicago boasts one of the best economics departments in the world, with at least 30 Nobel Prize winners affiliated with the department. Unfortunately, the city of Chicago has had a serious problem with drug (narcotic) consumption and drug trafficking.

In 2012 alone, there were more homicides in Chicago than in any other metropolis in the United States — a total of over 500, most of which linked to gang violence. According to reports in 2013, "most of Chicago's violent crime comes from gangs trying to maintain control of drug-selling territories", and is likely related to the activities of the Sinaloa Cartel, one of the most powerful Mexican drug cartels, which by 2006 sought to control illicit drug distribution.

Chicago's reputation of a drug trafficking city costs it billions of dollars every year in lost consumption, investment, and unnecessary spending. Chicago public policy officials aspire to reduce drug consumption as it produces negative externalities, which harm the society as a whole, not just the drug addicts.

a) *(10 rp)* Name at least four negative externalities of drug consumption. Be specific and discuss how, and to what extent, they harm society. Can you think of any positive externalities of drug consumption? Elaborate.

b) *(10 rp)* Officials have the choice of punishing drug dealers (supply side), drug users (demand side), both or neither, with different levels of severity. Why might you want to target the supply side (drug dealers) as against the demand side (drug users)? Why might you want to target the demand side (drug users) as against the supply side (drug dealers)? Give at least three examples of each. Based on your understanding of the drug-related issues, what problems do you foresee with implementing both policies?

c) *(10 rp)* Design a specific public policy that you think would be best in reducing drug consumption in Chicago. Bear in mind the specific issues of drug-related problems, for example (1) the fact that drugs are addictive; 2) drug production is illegal in most countries; 3) selling drugs is often connected with violence and other types of crime.

Solution

a) An externality is the cost or benefit that affects a third party, so one who did not choose to incur that cost or benefit. Drugs in the question concerned illegal narcotics, not medical products certified by relevant medical officials.

The answer should be insightful, clearly worded and unambiguous. The answer should show that the author deeply understands the problem. Answers that were clear and avoid wordiness are given extra marks. The answer should contain no errors of significance.

Correct answers include, but are not limited to, the healthcare costs that sick drug addicts incur on the public healthcare system in countries where such system exists or lower level of safety among non-drug users in areas where drug cartels operate.

Internalities such as deteriorating health of drug users or diminished income of drug

addicts are not externalities and won't be considered. Similarly, the reasons why drugs are bad for society are not necessarily negative externalities. Also note that the question concerned drug consumption, not drug production.

b) The supply-side is more elastic to punishment. Therefore, measures targeted at reducing supply could be more effective. The demand side is relatively less elastic because drugs are addictive. Measures targeted at decreasing demand could be less effective. To get a full score any discussion about relative elasticities is essential. Problems related to any measure should involve a discussion about externalities. For instance, if the demand or supply of drugs is targeted and as result "price" of drugs increase, the amount consumed is unlikely to decrease (inelastic demand) therefore addicts may do more related crimes to keep consumption levels constant. Hence, any discussion about externalities is important. The argument related to the heterogeneity of levels of addiction users (different elasticities of demand depending on the type of agent) will get additional credit. We require economic reasoning and fully fleshed out arguments behind answers. We care more about the chain of economic reasoning than the correct answer. Unspecific moral or ethical concerns such as "drugs are bad because they are illegal" will not be counted as an answer.

c) This answer should come from a reasoning given in parts (a) and (b). There are many ways to give a reasonable answer to this question. Discussions could be about elasticities of supply/demand, eradicating externalities, costs of enforcement, tradeoffs and constraints of enforcement, probability of adjudication. If the argument involves some type of mental model, discussion of the assumptions under which the mechanism is under work will get extra points. The full score will be given if a student demonstrated knowledge of economic principles in describing the mechanisms of the argument.

Marking Scheme. Questions are graded on the scale from 0 to 10 with possible scores being 0, 3, 6, 8 and 10.

Question 4. "Inequality of Opportunity" *(30 raw points)*

Economists often talk about two types of inequality – *inequality of outcomes* (such as income inequality) and *inequality of opportunity.*

a) *(15 rp)* Give an example of inequality of opportunity. Explain why inequality of opportunity, as opposed to inequality of outcomes, is considered detrimental for economic efficiency and social welfare.

b) *(15 rp)* There are several well-established measures of income inequality, such as the Gini index. How would you go about measuring inequality of opportunity in a country?

Solution

a) For example, a child of wealthy parents may be more likely to get a high-paying job than a child of poorer parents because it is easier for the former to get into an elite university or because the wealthier parents have better connections.

To demonstrate that inequality of opportunity can be bad for social welfare, consider the following extremely stylized example. Suppose there are two types of jobs – low-skill and high-skill. Any person working in a low-skill job produces one unit of output. The output of a person in a high-skill job is equal to her productivity A. Suppose a person from a low-income family happens to have higher productivity than a person from a rich family: $A_{poor} > A_{rich}$. Ideally, the society would want to let the former have the high-skill job (after training, if necessary), thus enjoying the total output of $1 + A_{poor}$. However, if the poor is barred from the high-skill job due to inequality of opportunity, the total output will be $1 + A_{rich}$, which is lower. The moral is that inequality of opportunity acts as a constraint for a society seeking an optimal allocation of resources.

In contrast, inequality of outcomes can be just a natural consequence of different abilities and different levels of effort chosen by people, even if the allocation of resources is optimal.

- 5 points. An adequate example that captures the essence of inequality of opportunity. No partial credit.
- 10 points. A reasoned explanation of the detrimental consequences of inequality of opportunity. 5 points if the argument is incomplete or includes minor mistakes.

b) A popular approach to measuring inequality of opportunity is to measure the extent to which parents' income or wealth determines their children's income of wealth. For example, one can consider the parents who are within 10% richest people and ask which share of their children is also within 10% richest people. Or the other way around: one may ask which share of 10% poorest people's children remains in the bottom 10% of the income distribution. The higher these shares, the higher is the inequality of opportunity. Indeed, if the rich remain rich and poor remain poor, the inequality of opportunity must be severe. And vice-versa: if children's income depends little on that of their parents', this probably means that the opportunities are close to equal.

One can find more information on this topic, as well as research attempting to compute measures of inequality of opportunity for the US at https://opportunityinsights.org

15, 10, 5 or 0 points. Grading takes into consideration the proposed measure, the reasoning behind it, and its feasibility. Partial credit may also indicate minor mistakes or incorrect arguments.

Question 5. "Connecting Short Run and Long Run" *(30 raw points)*

Fighting economic crises and recessions has become one of the well-recognized functions of government. But are the fluctuations around the trend really important? In most recessions, the fall in GDP is not more than 3-4 % and the return to the trend is relatively quick. Moreover, one may argue that what is lost in a recession, may be recovered during a boom. In contrast, a one-percentage-point increase in the rate of economic growth can accumulate into a several-fold rise in GDP over the years. So shouldn't we abandon fighting recessions and concentrate fully on long-term growth instead? This task asks you to explore some connections between short run and long run and discuss if recessions are necessarily worth fighting.

a) *(10 rp)* Argue why recessions may have a long-term negative effect on labor market and therefore may slow down long-term growth.

b) *(10 rp)* Suppose that banks require a minimum level of collateral for loans, and it limits a lot of entrepreneurs from getting loans. Argue why recessions may have a negative effect on the rate of long-term innovation, while booms don't have the opposing positive effect.

c) *(10 rp)* Alternatively, suppose that banks do not know the quality of the investment projects of entrepreneurs and offer all applicants the same loan rate, such that it allows banks to at least break even. Argue why recessions might be stimulating long-run economic growth.

Solution

a) 5 rp: Recessions feature a decline in the aggregate demand, and as a result, a reduction in the demand for labor force. While salaries are mostly fixed contractually and are hard to change, some workers are fired, while others, mostly temporary workers, are hired for a smaller number of hours. This leads to higher rates of unemployment and a reduction in the disposable income of households.

5 rp: Unemployment and a reduction in the disposable income can have a long-lasting negative effect on the human capital stock in the economy. Some workers might lose motivation to look for a job or faith and confidence in their ability to find one, and leave labor force. Others can chose to leave the country and search for employment in another country with better economic prospects. A decline in the disposable income can negatively affect parents' ability to invest in their kids' education. Government's tax revenues are declining at the same time, so it is also constrained in its spending on education, further reducing the productivity of labor force in the country.

b) 5 rp: During recessions asset prices fall. So houses or any other tangible properties are worth less, and therefore, it is harder for entrepreneurs to pass the collateral hurdle imposed by banks. Entrepreneurs with bright innovation ideas can not implement them because they are credit-constrained. This hurts the innovation process, and slows down economic growth.

5 rp: Booms do not have a fully-offsetting positive effect. Innovation ideas that were very relevant at the time of recession might become obsolete two or three years later, when the boom period comes. This could be because entrepreneurs in other countries have implemented them already. Entrepreneurs that had the innovation ideas in recession might have gotten discouraged and pursued a different career path. In addition, profitable companies have less incentives to do risky cost-cutting innovations. Hence, they might be hesitant to

do significant business restructurings in booms, opting for safer but less innovative growth strategies.

c) 5 rp: When banks can not differentiate between good and bad projects, they have to offer all borrowers the same rate. Because among the potential borrowers some are very risky, banks have to charge a very high loan rate to compensate for the potential losses on bad projects. Both good and bad projects face high cost of borrowing, since bank can't tell the two apart. Entrepreneurs with good innovations face high, potentially prohibitively high, loan rates and are deterred from implementing their projects.

5 rp: Recessions put out of business a lot of firms, but it hits first the least profitable firms. Once they go out of business, banks have a better pool of borrowers, and can offer better loan rates to everyone. Including entrepreneurs with good innovation projects, which increases economic growth rate.

This is similar to the phenomenon of creative destruction - crisis is a time when resources are reallocated towards more productive firms through defaults of less productive ones.

Important, please note: Many students wrote that since the bank offers the same loan rate to all applicants, it means that entrepreneurs get cheap funding. It is false, and the opposite is true. The same rate does not by any means imply a low rate. To break even on a pool of borrowers, some of which are very risky, the bank has to charge a very high loan rate. Think about payday loans vs mortgages — payday loans are extremely expensive because a lot of borrowers default on their loans, and to cover these losses lenders charge all borrowers high rates, sometimes as high as 1 % a day. Mortgages, on the other hand, have smaller loan rates. This is because banks first of all screen all borrowers and make sure only credit-worthy borrowers get the loan, and second, they use the house as a collateral. In case the mortgage is not repaid, the bank can seize the house and sell it to cover the losses on the loan. Therefore, the bank can offer a very low rate for mortgages.

Because banks do not know which projects are good or bad, they charge all projects the same rate. Good projects could have gotten a much smaller rate if the bank could see the quality of their project, but it can not. Recessions help the good entrepreneurs reveal to the bank that they are in fact of good quality, and once low quality entrepreneurs exit the market, high quality entrepreneurs receive loans at a smaller rate.