Exam for the M.Sc. in Economics

University of Copenhagen

Political Economics, Fall 2014

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3 hours

Answers should be given in Danish or English

No aids allowed except Danish-English / English-Danish dictionaries

Question 1, Short Questions

a)

The table below is taken from Ansolabehere, Snyder, Strauss, and Ting: "Voting Weights and Formateur advantages in the Formation of Coalition Governments", American Journal of Political Science 2005. Using data on the composition of coalition governments in 14 democratic countries, the table shows the results from a linear regression of a party's share of cabinet posts in the government on i) a dummy variable indicating whether it was the formateur party in the government formation process, ii) its share of voting weights in the legislature, and iii) a constant.

	Unweighted (1)	**PM Weighted (2)**
Formateur (β_1)	.15* (.05)	.25* (.04)
Share of Voting Weight (β_2)	1.12* (.13)	.98* (.11)
Constant	.07* (.02)	.06* (.02)
R^2	.72	.82
# Observations	680	680

Dep. Var. = Share of Cabinet Posts
Clustered standard errors in parentheses, where each cluster is a country.
*statistically significant at the .01 level.

What does the legislative bargaining model of Baron and Ferejohn predict about the relationship between the dependent variable and the explanatory variables in the table? Are the results in the table consistent with these predictions? (you may focus on the results in column (1) only if you wish) Why / why not?

Example answer:

One of the main predictions of the legislative bargaining model is that the player who is selected as proposer enjoys agenda power and receives a larger pay-off than any other player. In the context of government coalition formation, the formateur party acts as proposer. So the legislative bargaining model predicts that the formateur party should receive a larger share of the cabinet posts than a non-formateur party with the same voting weight.

A larger voting weight should also lead to a larger share of cabinet posts, for formateurs and non-formateurs alike. Strictly speaking, the original version of the legislative bargaining model - as presented in Baron and Ferejohn's paper - is formulated in terms of individual legislators, not parties, but the model can be extended slightly to accommodate the existence of parties. The extended version of the model predicts that the payoff for a non-formateur party in the coalition is proportional to its voting weight share. The intuition is that parties with larger voting weight shares contribute more to the coalition so they can charge a higher price for their support. In a government formation context this translates into a larger share of cabinet posts. For the formateur party, a larger voting weight share means that it needs to "buy" less support from other parties, so that it can keep a larger fraction of cabinet posts to itself.

In terms of the regression model presented in the table, the legislative bargaining model therefore predicts positive coefficients on both the voting weight share and the formateur dummy variable (to be precise, the closed-rule version of the model predicts a coefficient on the voting weight share equal to 1, and it also predicts that the constant term should be zero, but this does not need to be mentioned in the answer). The results in column 1 are consistent with these predictions: Both coefficients are positive and statistically significant. So as predicted, parties with larger voting weight shares get more cabinet posts (and the coefficient is not too far away from 1). And most importantly, the coefficient on the formateur dummy shows that formateur parties enjoy sizeable advantages (an extra 15 percent of cabinet posts) in the coalition formation process.

b)

In the imaginary country of Atlantis, poor people are able to ride public transportation for free. In particular, the rule is that if a person's total income in some calendar year is 100,000 kr., or below, that person gets free public transportation throughout the following calendar year. A researcher is interested in estimating whether having free access to public transportation makes people more likely to vote because it makes it easier to get to the polling stations. She wants to use a regression discontinuity design and has access to data for all people in Atlantis who are between 20 and 60 years old. For each person the data shows:

- Whether they voted in the general election in Atlantis in November 2013.

- Whether they were born in a city or in the country-side.
- What their total income was in 2012

Explain how the researcher can use regression discontinuity with this data to get an estimate of the effect of free public transportation on election turnout. Also explain how she can test the assumptions underlying regression discontinuity that are necessary for the estimated effect to have a causal interpretation.

Example answer:

Let Y denote an indicator for whether a person voted in the election in November 2013, let X denote an indicator for whether a person was born in a city and let V denote 100.000 minus a persons total income in 2012. Now under the rule described above, a person has received free public transportation in 2013 if and only if $V \geq 0$ (a person with an income of 100,001 has $V = -1$, while a person with an income of 100,000 has $V = 0$). To use Regression Discontinuity to see whether free transportation has a casual impact on voting, one could compare Y for people with V just above 0 with Y for people with V just below. In practice, one could do this in a number of ways (only one needs to be mentioned in the answer):

- Computing the fraction that vote for people with different levels of income, $E[Y|V]$, plotting this against their income, V, and measuring the discontinuous jump at $V = 0$.
- Computing the difference in the fraction that vote between people with V between 0 and δ and people with V between 0 and $-\delta$, $E[Y|0 \leq V < \delta] - E[Y|-\delta < V < 0]$, for some small δ.
- Estimating the regression $Y = \beta_0 + \beta_1 D + g(V) + \varepsilon$, where D is an indicator for $V \geq 0$ and $g(V)$ is a flexibly estimated smooth function of V (for example a fourth order polynomial). β_1 is the *estimated* effect of free public transportation.

To perform a test of the assumptions underlying regression discontinuity, one could compare X for people with V just above 0 with X for people with V just below, by replacing Y with X in one of the methods above. Since X is whether people were born in a city, it is a predetermined characteristic and thus its mean should not exhibit any discontinous jumps at V=0.

Question 2, Political Agency

A particular university has an economics department that consists of a continuum of students who are about to elect a president for their student government, called “Polot-rådet”. The job for the president of Polot-rådet is to secure good teaching at the economics deparment by putting effort, $e \in [0, 1]$, into convincing the teachers at the economics department to provide good teaching. This occurs according to the production function f, which takes president effort as an input. So a president who exerts a level of effort e results in a quality of teaching $T = f(e)$. We will assume that the function f takes the following form:

$$f(e) = e, \qquad 0 \leq e \leq 1$$

Students who are not running to become president of Polot-rådet have a utility function, $U(T)$, that depends on the quality of teaching, T, as follows:

$$U(T) = \sqrt{T}$$

In addition, there are two students, Asger and Nikolaj, who will be running for the job of president of Polot-rådet. Both Asger and Nikolaj get a utility of 0 if they are not elected as the president. If they are elected to become the president, their utility depends on the amount of effort they put in. If Nikolaj is elected to be the president and puts in an effort of e he gets a utility of:

$$V_N(e) = R - e, \qquad 0 \leq e \leq 1$$

If Asger is elected to be the president and puts in an effort of e he gets a utility of:

$$V_A(e) = R - \beta \cdot e, \qquad 0 \leq e \leq 1$$

Here β is a constant satisfying $0 < \beta < 1$.

The election process among the students takes place as follows. First the candidates, Asger and Nikolaj, simultaneously announce and commit to how much effort they will put in if they are elected, e_A and e_N. Next, all students vote for one of the two candidates and the candidate who gets the most votes is elected as president (ties are resolved by a coinflip). Finally, the elected candidate exerts the effort-level he announced in the beginning.

a)

Assume that $R > 1$ and (as usual) that voting students use a coinflip when they are indifferent about who to vote for. Find a (Subgame Perfect) Nash Equilibrium of this model. Which effort levels do Asger and Nikolaj announce?

Example answer:

When the other students vote for one of the two candidates they will simply vote for whichever candidate they prefer. Since the utility of each of these students is strictly increasing in the teaching quality, T, and since the teaching quality is strictly increasing in the effort level of the elected candidate, e, they all prefer as high an effort level as possible. They will therefore all vote for whichever candidate has announced a higher effort level or will decide via a coinflip if the two candidates have announced the same effort level. Since the winner of the election is decided by a simple majority, the probability that Asger wins, p_A can therefore be written as:

$$p_A \begin{cases} 0 & \text{if } e_A < e_N \\ \frac{1}{2} & \text{if } e_A = e_N \\ 1 & \text{if } e_A > e_N \end{cases}$$

Now we examine Nikolaj and Asger's announcements in the first step of the model. We start by noting that since $R > 1$, $V_N(e), V_A(e) > 0$ for all e so both candidates always prefer winning to losing, regardless of the effort level that they have announced.

Next we consider Asger's decision about what to announce if Nikolaj is announcing $e_N = 1$. If Asger announces $e_A = 1$, he wins with probability $\frac{1}{2}$, yielding an expected utility of $\frac{1}{2}V_A(1) + \frac{1}{2} \cdot 0 = \frac{1}{2}V_A(1) > 0$. If Asger instead announces any $e_A < 1$, he loses for sure, which yields a utility of 0. It follows that $e_A = 1$ is a unique best response for Asger when Nikolaj is announcing $e_N = 1$. Reversing the argument shows that $e_N = 1$ is also the unique best response for Nikolaj when Asger is announcing $e_A = 1$. It is therefore a Subgame Perfect Nash equilibrium for both candidates to announce an effort-level of 1 (and for voting students to behave as described above).

b)

Assuming still that $R > 1$, show that the equilibrium you found under a) is unique. You may assume that voting students always vote for their preferred candidate and use a coinflip when they are indifferent about candidates.

Example answer:

From the answer in a) it follows that the only alternative equilibria we need to consider are ones where both $e_N < 1$ and $e_A < 1$. Assuming we are in such a case, consider Asger's incentives to deviate:

If $e_A < e_N$ so that $p_A = 0$, then Asger gets a utility of 0 from his current announcement. This is less than he could get by deviating and announcing the same effort-level as Nikolaj, which implies $p_A = \frac{1}{2}$ and yields a utility of $\frac{1}{2}V_A(e_N) + \frac{1}{2} \cdot 0 = \frac{1}{2}V_A(e_N) = \frac{1}{2}(R - \beta e_A) > 0$.

If $e_A = e_N$ so that $p_A = \frac{1}{2}$, then Asger gets a utility of $\frac{1}{2}(R - e_A)$ from his current announcement. If he deviates and increases his effort to $e_A + \varepsilon$ (for $\varepsilon > 0$), he instead wins for sure and earns a utility of $(R - e_A - \varepsilon)$. This deviation is profitable if:

$$\begin{aligned} (R - \beta e_A - \beta\varepsilon) &> \frac{1}{2}(R - \beta e_A) \Leftrightarrow \\ \frac{1}{2\beta}(R - \beta e_A) &> \varepsilon \end{aligned}$$

We see that we can always pick ε small enough (for example $\varepsilon = \frac{1}{4\beta}(R - \beta e_A))$ so that this deviation is profitable.

From the above it follows that $e_A < 1$ will never be an equilibrium if $p_A = 0$ or $p_A = \frac{1}{2}$, implying that the only possibility is $p_A = 1$. But the argument above can be repeated for Nikolaj to show that we must also have $p_N = 1$ in order for to $e_N < 1$ be an equilibrium. It follows that there are no equilibria where $e_N < 1$ and $e_A < 1$, showing that the equilibrium in a) is unique

c)

In the unique equilibrium you found above, does the implemented level of effort differ depending on whether Asger or Nikolaj wins? Why? Which feature of the model is driving this result?

Example answer:

No, both Nikolaj and Asger are promising to put in the maximal amount of effort and will do so if elected. The reason is that although both Nikolaj and Asger dislike additional effort, their utility function is continuous in effort and so a small increase in the announced effort-level only lowers their gain from winning a little bit. The probability of winning however increases discretely by a significant amount as soon as either candidate outbids the other by announcing even a little bit more effort. As a result, it constantly pays off to outbid your opponent a little bit. Since both candidates get a positive utility from winning even at the maximum effort level, this outbidding process continues until they both offer the maximum effort-level.

d)

What would happen if the model was changed so that candidates were unable to commit to a certain level of effort in the first step? Would the implemented level of effort differ depending on whether Asger or Nikolaj wins? Alternatively, what if the model was instead changed to include probabilistic voting? Would the implemented level of effort then depend on who wins the election? You do not have have to provide any formal derivations but make sure to explain your answers in words.

Example answer:

Changing the model so that candidates cannot commit to an effort level would not lead to policy divergence. Since both candidates prefer to not put in any effort, both candidates would choose $e = 0$ after elected if they were not bound by any commitment.

Including probabilistic voting in the model could lead to policy divergence, because it would make the probability of being elected a smooth function of the announced effort-level so that small increases in the announced level only lead to small increases in the probability of winning. This makes it possible for there to be interior equilibria, where candidates' choice of effort announcement balances out the (small) marginal benefit of a higher win probability against the lower benefit of winning. Since Nikolaj and Asger have a different marginal cost of providing effort, these equilibria would involve the two candidates announcing different effort-levels.

(As stated in the question, no mathematical derivations are necessary to get full credit. For reference, a brief example of adding probabilistic voting is included below, however:

In addition to their preferences over teaching quality, assume that voting students get an additional utility of δ if Asger becomes president, where δ is a random variable that is uniformly distributed on $[-\frac{1}{2\psi}, \frac{1}{2\psi}]$. Voting students now prefer Asger to win if:

$$\begin{aligned} U(f(e_A)) + \delta &> U(e_N) \Leftrightarrow \\ \sqrt{e_A} + \delta &> \sqrt{e_N} \Leftrightarrow \\ \delta &> \sqrt{e_N} - \sqrt{e_A} \end{aligned}$$

It follows that the probability that Asger wins is:

$$p_A = \frac{1}{2} + \psi(\sqrt{e_A} - \sqrt{e_N})$$

Asger's expected utility from the announcements e_A, e_N is then:

$$p_A(R - \beta e_A) = (\frac{1}{2} + \psi(\sqrt{e_A} - \sqrt{e_N}))R - (\frac{1}{2} + \psi(\sqrt{e_A} - \sqrt{e_N}))\beta e_A)$$

Assuming an interior solution, $0 < e_A < 1$, the first order condition for maximizing this with respect to e_A is:

$$\begin{aligned} \frac{dp_A}{de_A}(R - \beta e_A) + p_A \frac{d(R - \beta e_A)}{de_A} &= 0 \Leftrightarrow \\ \psi \frac{1}{2\sqrt{e_A}}(R - \beta e_A) + (\frac{1}{2} + \psi(\sqrt{e_A} - \sqrt{e_N}))(-\beta) &= 0 \Leftrightarrow \\ \psi \frac{1}{2\sqrt{e_A}}(R - \beta e_A) &= (\tfrac{1}{2} + \psi(\sqrt{e_A} - \sqrt{e_N}))\beta \qquad (1) \end{aligned}$$

In this last expression, the left hand side is the marginal benefit from raising the announced effort and increasing the win probability, while the right hand side is the expected marginal cost of raising the announced effort. The optimal announced effort level equates these two quantities.

By symmetry, the corresponding equation for Nikolaj is:

$$\psi \frac{1}{2\sqrt{e_N}}(R - e_N) = (\frac{1}{2} + \psi(\sqrt{e_N} - \sqrt{e_A})) \qquad (2)$$

The two equations, 1 and 2, form a two-equation system in two unknowns e_A, e_N. Any interior solution (where $0 < e_A, e_N < 1$) defines a Perfect Bayesian Nash Equilibrium of the game and since clearly $e_A = e_N$ can not be a solution, such an equilibrium involves Asger and Nikolaj choosing different effort levels if elected. As is easily verified numerically, the equation system does indeed have an interior solution for appropriate values of the parameters. For example, setting $\psi = 0.5, R = 2, \beta = 0.9$, gives rise to the equilibrium $e_A \approx 0.5567, e_N \approx 0.6087$.)

e)

Assume now that $\beta < R < 1$. Also assume that students now always vote for Asger when they are indifferent between candidates. Find a Subgame Perfect Nash Equilibrium of the model.

Example answer:

If indifferent students always vote for Asger, the probability that Asger wins is now:

$$p_A \begin{cases} 0 & \text{if } e_A < e_N \\ 1 & \text{if } e_A \geq e_N \end{cases}$$

A natural example of an equilibrium among Nikolaj and Asger is then $e_A, e_N = R$. To see that this is an equilibrium, consider the incentives for Nikolaj and Asger to deviate. The equilibrium implies $p_A = 1$ so for Asger, the equilibrium yields a utility of $R - \beta R = (1 - \beta)R > 0$. If Asger deviates by increasing his announced effort level by some amount $\varepsilon > 0$, he still wins for sure but now earns a utility of $R - \beta(R + \varepsilon) = (1 - \beta)R - \beta\varepsilon$, which is clearly less than what he gets if he does not deviate. Conversely, if Asger deviates by decreasing his announced effort level, he loses the election for sure and gets a utility of 0, which is again less than he gets if he does not deviate.

Next we consider Nikolaj's incentives to deviate. In the equilibrium, Nikolaj never wins and so earns a utility of 0 for sure. If Nikolaj increases his effort level by some amount $\varepsilon > 0$, Nikolaj instead wins for sure and earns a utility of $R - (R + \varepsilon) = -\varepsilon < 0$ so this deviation is not profitable. If Nikolaj decreases his effort level, he still never wins and thus his utility is the same as in the equilibrium.

From the above we see that neither Nikolaj or Asger has a profitable deviation, showing that $e_A, e_N = R$ is indeed an equilibrium. (In fact, for any $x \in [R, 1]$, $e_A, e_N = x$ is an equilibrium. This follows from exactly the same argument as above once we notice that the equilibrium utility for Asger, $R - \beta x$, is positive for any $x \leq 1$ when $\beta < R$.)

Question 3, Redistribution

French economist Thomas Piketty recently published a book titled “Capital in the Twenty-First Century”. In the book, Piketty describes how the income share of top income earners has increased substantially in recent decades in a number of Western societies due to strong income growth in the very top of the income distribution. Based on the theory and evidence presented in the course, discuss how such an increase in inequality can be expected to affect the level of redistribution in Western societies. Write at most one page.

Example answer:

Below is a list of things that could be mentioned.

- **The income-based theory of redistribution (the Meltzer-Richard model).** This theory asserts that voters' preferences for redistribution depend entirely on their relative position in the income distribution. Voters with below-average income will prefer a high level of redistribution, voters with above-average income will prefer a low (or even negative) level of redistribution. Since the median voter is decisive, the equilibrium level of redistribution will depend on the distance between the median and the mean in the income distribution. The rise in inequality described by Piketty increases this distance, leading to a more *right-skewed* income distribution. This will make redistribution more attractive in the eyes of the median voter, since there is a larger gain associated with taxing the rich. As a result, we should expect a higher level of redistribution.

- **Empirical evidence on the standard income-based model.** The main problem with the standard income-based model is that it generally does not fit the data very well. This is especially true in cross-country comparisons: The model would predict a higher level of redistribution in societies with a more right-skewed pre-tax income distribution, but it is hard to find this pattern in cross-country data. The comparison between Europe vs. US is a prominent example: US has a more skewed income distribution but *less* redistribution than Western European countries. The model's poor performance in cross-country comparisons could lead one to argue that it is simply wrong, in which case the described increase in inequality might not have any effect on redistribution. The model does a little better in within-country comparisons, however: Historically, extending the franchise to poorer voters (thereby increasing the distance between the income of the median *voter* and the average *taxpayer*) has coincided with expansions of various types of government spending, just as the model would predict. This can be seen as supportive evidence for the model and its predictions about the level of redistribution. Since the changes in the income distributions that Piketty documents happen within countries, it could be argued that the within-country evidence is more relevant than the cross-country evidence in this particular case.

- **Extending the model - income dynamics.** A potential shortcoming in the standard income-based model is that it does not take income dynamics into account. For example, a purely self-interested voter with a below-average income level may prefer a low level of redistribution if he/she expects to move up the income ladder in the future. One could argue that if the median voter believes strongly in the possibility of moving to the top of the income distribution, the increase in top-earners' income share should not lead to a higher level of redistribution.

- **Extending the model - reciprocal altrusim and fairness considerations.** The idea of reciprocal altruism implies that people will support a high level of redistribution if they believe that pre-tax income differences are mostly unfair/undeserved, and oppose it if they believe such differences are fair/ deserved. Following this idea, if the median voter perceives the increase in top-earners' share as being due to luck, or undeserved in some other way, he would prefer a higher level of redistribution. On the other hand, if it is perceived as being due to hard work or talent, then he most likely prefers less redistribution, as the relative importance of hard work and talent in determining income has increased.