

# Written Exam Economics Summer School 2017

## Dynamic Political Economy

From July 22, 10:00 to July 24, 10:00

This exam question consists of three pages in total

Please note that the language used in your exam paper must be English.

Your answer must not exceed 10 pages

**The paper must be uploaded as one PDF document. The PDF document must be named with exam number only (e.g. '1234.pdf') and uploaded to Digital Exam.**

### Focus on Exam Cheating

In case of presumed exam cheating, which is observed by either the examination registration of the respective study programmes, the invigilation or the course lecturer, the Head of Studies will make a preliminary inquiry into the matter, requesting a statement from the course lecturer and possibly the invigilation, too. Furthermore, the Head of Studies will interview the student. If the Head of Studies finds that there are reasonable grounds to suspect exam cheating, the issue will be reported to the Rector. In the course of the study and during examinations, the student is expected to conform to the rules and regulations governing academic integrity. Academic dishonesty includes falsification, plagiarism, failure to disclose information, and any other kind of misrepresentation of the student's own performance and results or assisting another student herewith. For example failure to indicate sources in written assignments is regarded as failure to disclose information. Attempts to cheat at examinations are dealt with in the same manner as exam cheating which has been carried through. In case of exam cheating, the following sanctions may be imposed by the Rector:

- 1) A warning
- 2) Expulsion from the examination
- 3) Suspension from the University for at limited period or permanent expulsion.

The Faculty of Social Sciences  
The Study and Examination Office  
October 2006

Suppose in an economy there are two types of workers, a) those that work in the formal sector, pay taxes and collect social security benefits, and b) those that work in the informal sector and initially do not participate in the social security system. You are asked to develop a model to estimate the impact on social security of providing universal coverage to informal workers when they reach retirement age. For this you consider an economy inhabited by two overlapping generations: workers, and retirees. Each cohort consists of a continuum of heterogeneous agents. The gross population growth rate and thus, the ratio of workers to retirees equals  $\nu_t$ , which follows a deterministic process.

There are two production sectors, one formal, the other informal (in which workers engage in “home production”). In the formal sector a continuum of competitive firms transform capital and labor into output by means of a Cobb-Douglas technology. Output per unit of effective labor in period  $t$  is given by  $y_t = k_t^\alpha$ , where the capital share  $\alpha \in (0, 1)$ , and capital is owned by saving retirees and fully depreciates after one period. The capital stock per worker in efficiency units is  $k_t$ . Production factors are paid their marginal products, due to competition among firms.

Home production gives consumption of  $\theta w_t$ , and  $\chi \theta w_t$  (with  $\chi < 1$  and  $\theta < 1$ ) to young and old households that engage in it respectively in period  $t$ , where  $w_t$  is the wage rate in the formal sector.

The government taxes labor income in the formal sector in period  $t$  at rate  $\tau_t$ . Revenues collected from workers fund transfers to retirees (such that the government has a balanced budget). Denoting by  $\phi_t$  the share of workers in the formal sector,  $\bar{\epsilon}_t$  their average efficiency, and per-capita transfers to retirees by  $b_t^j$ , we then have

$$\begin{aligned} b_t^c &= \nu_t \frac{\phi_t}{\phi_{t-1}} \bar{\epsilon}_t w_t \tau_t, \\ b_t^u &= \nu_t \phi_t \bar{\epsilon}_t w_t \tau_t. \end{aligned}$$

The superscript refers to the type of social security in place. Under a contributive system only contributing workers receive benefits when old, and we denote the benefit as  $b^c$ . Under a universal system every retiree receives benefits, and we denote this as  $b^u$ .

Workers value consumption during working-age,  $c_1$ , and retirement,  $c_2$  and supply labor inelastically to firms if they work in the formal sector when young. They discount the future at factor  $\beta \in (0, 1)$ . For analytical tractability, assume that the period utility function of consumption is logarithmic.

Some workers in the formal sector, a fraction  $\gamma$  of all young workers, are standard intertemporal utility maximizers. They all have the same labor productivity,  $\epsilon_t^i = 1$ . They thus choose savings taking prices, taxes, and future benefits as given. Their indirect utility function in period  $t$  is then given by

$$\begin{aligned} \max_{s_t} \quad & \ln(c_{1,t}) + \beta \ln(c_{2,t+1}) \\ \text{s.t.} \quad & c_{1,t} = w_t(1 - \tau_t) - s_t, \\ & c_{2,t+1} = s_t R_{t+1} + b_{t+1}^j. \end{aligned}$$

where  $R$  is the gross interest rate.

Assume that a fraction  $1 - \gamma$  of young workers have hand-to-mouth behavior. Furthermore, assume that they have heterogeneous productivity in the formal sector, with  $0 < \epsilon_t^i < 1$  (the distribution of productivities is given by  $F(\epsilon)$ ). If they were to work in the informal sector they would get incomes,  $\theta w_t$ , and  $\chi \theta w_{t+1}$  when young and old respectively, regardless of their productivity in the formal sector. Furthermore, we assume that hand-to-mouth retirees work in the informal sector regardless of whether they receive social security benefits or not. Thus, denoting with a superscript  $f$  or  $x$  whether a hand-to-mouth worker is in the formal or informal sector respectively, their consumption levels would be given by

$$\begin{aligned} c_{1t}^f &= \epsilon_t^i w_t (1 - \tau_t) \quad , \quad c_{2t+1} = \chi \theta w_{t+1} + b_{t+1}^j, \\ c_{1t}^x &= \theta w_t \quad , \quad c_{2t+1} = \chi \theta w_{t+1} + b_{t+1}^u. \end{aligned}$$

a) Find an expression for the individual and aggregate savings rates of intertemporal utility maximizers (i.e. the ratio of savings to after tax labor income  $w_t(1 - \tau_t)$ ). Do you get a closed form solution for the latter? Explain.

b) Is the savings rate under a universal system higher or lower than under a contributive system? (you can answer this even if there is no closed-form solution for the savings rate) Explain.

c) Characterize the productivity of the marginal hand-to-mouth worker that is indifferent between working in the formal or informal sectors (Hint: her lifetime utility must be the same). Show that universal coverage increases informality.

Assume that policy is determined by probabilistic voting and that the political process attaches relative weight  $\omega$  to retirees relative to workers (and within cohorts all households have the same weight)

d) Write the problem that characterizes the optimal choice of policy under probabilistic voting (clearly note what is being chosen and what is being assumed as constraints to this maximization).

e) How do you expect the politico-economic choice of  $\tau_t$  under a universal system compares to the political choice if policy-makers did not perceive the effects taxes have on informality? And if the system was contributive? Explain. (you are not expected to solve the problem to answer this question)

f) Under what circumstances (e.g. for what parameters, say  $\theta$  high or low) would you recommend a government to switch from a contributive to a universal system. (since you are not expected to solve the problem, explain your intuition behind your assessment)