Midterm Exam – Econ 5700
15 November 2017
Department of Economics
York University

Student name: __________________ SID number:______________________

Notes: As a rule, you must explain how you arrived at your answers. For Problems 4 (a)-(b) you only need to draw the figures correctly.

1. The Solow Model [10 marks]

Consider the Solow model, where we let Y_t denote total output, K_t the total capital stock, and L_t the labor force, all in period t. The production function is here given by

$$Y_t = F(K_t, L_t) = AK_t + BK_t^{\alpha} L_t^{1-\alpha}.$$

where $A > 0$, $B > 0$, and $0 < \alpha < 1$. For simplicity, it is also assumed that the capital stock depreciates fully in each period (i.e., $\delta = 1$). Capital thus evolves over time according to

$$K_{t+1} = sY_t,$$

where s is the rate of investment (and saving), and $0 < s < 1$. The labor force grows at (net) rate n each period, i.e., $L_{t+1} = (1+n)L_t$. We let capital per worker be denoted $k_t = K_t/L_t$.

(a) Find a difference equation for k_t. Your answer should be a function ϕ, such that $k_{t+1} = \phi(k_t)$. Show each step. [2 marks]

(b) Find a condition in terms of (some or all of) A, B, α, n, and s, which ensures the existence of a strictly positive and non-growing steady-state level of capital per worker. [Hint: this is the condition that rules out sustained growth in k_t; it helps to look at the asymptotic slope of $\phi(k_t)$ and interpret it in a 45-degree diagram.] [2 marks]

(c) Suppose that the rates of saving out of labor and capital incomes are s^w and s^r, respectively, where $0 < s^w < 1$ and $0 < s^r < 1$. The production function is the same as above, and labor and capital are paid their marginal products. Thus, payment per unit of capital equals $\partial F(K_t, L_t)/\partial K_t$ and payment per unit of labor (i.e., per worker) equals $\partial F(K_t, L_t)/\partial L_t$. Find the difference equation for capital per worker, $k_{t+1} = \phi(k_t)$. Show each step. [3 marks]

(d) Under the same assumptions as under (c), find a condition in terms of (some or all of) A, B, α, n, s^w, and s^r, which ensures the existence of a strictly positive and non-growing steady-state level of capital per worker. [3 marks]

2. Inequality [10 marks]

Consider the overlapping generations model of Galor and Zeira (1993). Agents work in two periods: in the first as unskilled, and in the second as either skilled or unskilled. Skilled workers earn w_s and unskilled w_n, which are both exogenous, and such that $w_s > w_n$. Agents consume only in the second period of life. An agent who is old in period t consumes c_t, which equals second period income, here denoted y_t, minus a bequest to the (single) child, denoted b_t. That is,

$$c_t = y_t - b_t.$$

The agent's utility is given by

$$u_t = \alpha \ln(c_t) + (1 - \alpha) \ln(b_t),$$

where $0 < \alpha < 1$.

In the first period the agent is unskilled and can earn w_n. To become skilled in the second period, she must invest an exogenous amount $h > 0$ in education in the first period, and forgo her first-period income, w_n. Second-period income, y_t, is the sum of the second-period wage (either w_n or w_s), and savings from the first period (which can be negative), including interest.

If the agent lacks enough resources in the first period to pay the cost of education, h, she can finance it by borrowing at the interest rate i, which is greater than the interest rate she faces if saving, denoted r.

(a) Derive an expression for b_t as a function of y_t. [3 marks]

(b) Find an expression for second-period income, y_t, of an agent who receives a bequest $x_t \leq h$ from her parent, and invests in education in the first period. Denote this $y_{sb,t}$. [3 marks]

(c) Consider a parametric configuration such that there exists an unstable steady-state level of x_t—denoted g in the notes and the paper—that lies on the interval of x_t for which an agent that receives x_t in bequest chooses to borrow at rate i to invest in education. Find an expression for g in terms of α, w_s, i, and h. It is assumed that $i > \alpha/(1 - \alpha)$. [4 marks]

3. Corruption and aid [10 marks]

Questions (a)-(b) below refer to Svensson (2005).

(a) Name one of the country rankings of corruption discussed by Svensson (2005), and one of the 10% most corrupt countries on that list. [2 marks]

(b) According to Svensson (2005), what is the correlation between corruption and growth in the macro (cross-country) data when controlling for schooling and other factors? [2 marks]

Questions (c)-(d) below refer to Burnside and Dollar (2000).

(c) Consider the attached Table 3 from Burnside and Dollar (2000), which reports results from different cross-country regressions with the growth rate in GDP/capita as the dependent variable. Based on the regression reported in column (1), the authors construct a variable they call Policy as follows: Policy = 1.28 + a × Budget surplus − b × Inflation + c × Openness. What are the values of a, b, and c? [3 marks]

(d) How well do the regressions reported in Table 3 support the hypothesis of conditional convergence? Strongly, not at all, or a little? Motivate your answer. [3 marks]

4. Stata Coding [5 marks]

Consider the code below. Recall that each `rnormal(0,1)` generates one normally distributed random variable.

```
#delimit;
drop _all;
set obs 1000;
gen x=(rnormal(0,1))^2;
gen y=x+rnormal(0,1);
label var x "Variable 1";
label var y "Variable 2";
twoway
(scatter y x, msymbol(o) legend(off) ytitle(Nippe!))
(lfit y x);
twoway
(scatter y x if y<x, msymbol(x))
(lfit y x);
```

(a) Draw the first figure produced by the code above. Make sure to indicate numbers etc. on both axes. [2 marks]

(b) Draw the second figure produced by the code above. Make sure to indicate numbers etc. on both axes. [2 marks]

(c) Explain is words what the command `#delimit;` does. [1 mark]

Note: For 4 (a)-(b) you do not need to replicate the graphs exactly, just draw them as correctly and in as much detail as you can.

Answer sheet for Problem____Econ 5700, Midterm 15 November 2017

Student Name: SID Number:

Write your answers below. Do **not** fold the answer sheets or write on the back.

Solutions:

1. (a)

$$k_{t+1} = \frac{s\left(Ak_t + Bk_t^\alpha\right)}{1+n} \equiv \phi(k_t)$$

(b)

$$\lim_{k\to\infty} \phi'(k) = \frac{sA}{1+n} < 1$$

(c)

$$k_{t+1} = \frac{s^r\left(Ak_t + \alpha Bk_t^\alpha\right) + s^w(1-\alpha)Bk_t^\alpha}{1+n} \equiv \phi(k_t)$$

(d)

$$\lim_{k\to\infty} \phi'(k) = \frac{s^r A}{1+n} < 1$$

2. See lecture notes posted on 5110 website for details:
http://www.nippelagerlof.com/teaching/5110/GalorZeiraNotes.pdf
(a)

$$b_t = (1-\alpha)y_t$$

(b)

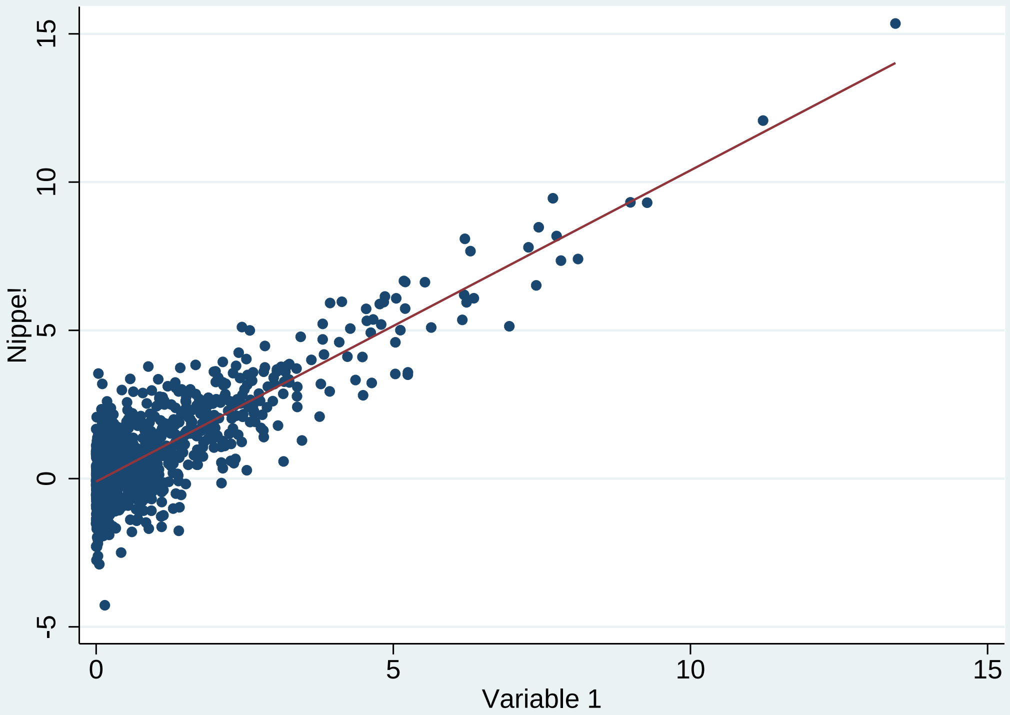
$$y_{sb,t} = w_s + (x_t - h)(1+i)$$

(c) Use $x_{t+1} = b_t = (1-\alpha)y_{sb,t}$, and the answer to (b) above, to get a first-order difference equation for x_t, applying to relevant interval for x_t. Setting $x_{t+1} = x_t = g$ gives

$$g = \frac{(1-\alpha)\left[h(1+i) - w_s\right]}{(1+i)(1-\alpha) - 1}.$$

3.
(a) For example, International Country Risk Guide, and Nigeria.
(b) See Table 6 in Svensson (2005). When controlling for log initial schooling and log initial GDP/capita, there is no signifcant effect from corruption on growth, and the sign of the effect depends on specification.
(c) $a = 6.85$; $b = 1.40$; $c = 2.16$
(d) A little. The sign of the coefficient on initial GDP/capita is negative, but not significant even at the 10% level.

4. (a)-(b) See attached figures.
(c) `#delimit;` means that every command from that point on will end with a semicolon (;).



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Variable 1
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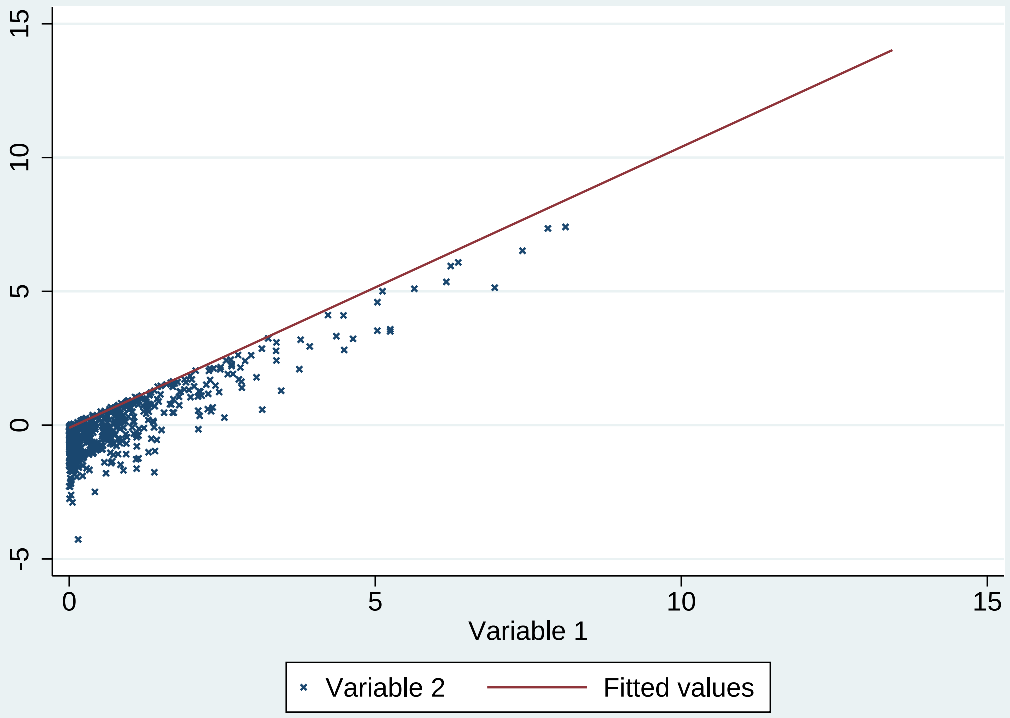

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Variable 1
Variable 2
Fitted values