Suggested answers
Exam in Advanced development economics - macro aspects
Winter exam 2014/2015

Verbale questions

Question A1.

Main readings of relevance: Dalgaard and Strulik, 2013 and readings on unified growth theory (Strulik/Weisdorf; Galor/Weil)

(i) The fertility transition appears as it is, according to an emerging strand of liteature (unified growth theory) a key marker for the oneset to (sustained) growth. Hence, in analysing income differences at a point in time, there are two broad sources of determinants. (a) *When* the process started (this is captured by YFD), (b) how fast the economy is growing after the take-off (this is the forces of catch-up growth which are captured, in part at least, by neoclassical growth theory and thus the "Solow determinants".)

(ii) Once the fertility transition is controlled we see that the parameter estimates conform with priors. The implied elasticity of capital in the production function shrinks to about 1/3, as expected, down from about 0.6. Accoridingly, YFD and the difference $\log(s) - \log(n+d+g)$ are negatively correlated, inducing the coefficient on $\log(s) - \log(n+d+g)$ to be too big (since YFD and income are negatively realted), nummerically speaking, without a direct control for YFD. The interpretation is as follows. As growth emerges savings and investment usually rise. Hence a higher YFD should be negatively correlated with s. At the same time, fertility rates decline after the fertility transition. A higher TFD should therefore be postively correalted with $\log(n+d+g)$, which also works to lower $\log(s) - \log(n+d+g)$. Hence, the omitted variable biased caused by omitting YFD works to bias the estimate for α towards "too high a value".

Moreover, the point estimate for YFD, is about 0.02. This suggests that each year the fertility transition is delayed it "costs" roughly two percent of foregone growth. Theoretically the coefficient should pick up the long-run trend growth rate in technology; 2 percent is about reasonable.

(iii) the key assumption is that YFD is not correlated with the level of technology at the time of the take-off. If, for instance, the level of technology is systematically higher in later take-off cases the parameter estimate for YFD will be biased (towards zero as it were). Work needs to be done in trying to establish more decisively a causal impact from the timing of the fertility transition on current income.

Question A.2.

Main readings: Acemoglu/Johnson, 2007.

The international epideomoglogical transition followed the discovery of, in particular, penicilin. This discovery can be viewed as random from the point of view of individual countries. But the impact from penicilin would vary depending on the intiial conditions; in particular, mortality within ex-post curable diseases.

The basic idea then is, following Acemoglu and Johnson, to use crude death rates within relevant disease categories (e.g. TB) around 1940 as an instrument for changes in life expectancy subsequently. We expect more growth in life expectancy in places with higher initial levels of life expectancy.

The exclusion restriction is that the initial level of life expectancy (and factors correlated with it; thus, initial death rates in relevant disease categories) are unimportant to subsequent growth beyond its influence via changes in longevity.

If for instance, the initial level of life expectancy matters, conditional on changes in life expectancy, for ex post growth the exclusion restriction would fail.

Question A.3

Main readings: Acemoglu/Johnson/Robinson.

(i) the correlateion is noteworthy in that the period prior to 1500 conventionally is understood to be a period where Malthusian forces dominated. As a result, higher level of population density should be a strong signal of high levels of economic development. So is income per capita today. Hence, the negative correaltion suggests a *reversal of fortune* in former colonies: countries that used to be "successful" are generally not successful today.

(ii) The correlation can be taken to suggest that geographic circumstances are less important than previously thought. In as much as geography exerts a time invariant impact on development (being landlocked would make you less successful in Malthusian times as well as today, for instance) it would appear that it cannot be the leading explanation for prosperity: otherwise density and income should be positively correlated.

AJR propose a theory of institutional change which can account for the data. They hypothesize that the colonialization strategy invoked by the colonial powers depended precisely on initial density; in places featuring low density you saw more "European" settlements, and therefore eventually less extractive institutions (as the settlers were in a better position to lobby for these rights). Conversely, in places with greater density the institutions became more extractive which hampered growth, causing the reversal.

In sum AJR suggests that these observations are strongly indicating that "institutions thrumps geography".

ANALYTICAL QUESTIONS

Question B1.

Main readings: Ashraf/Galor.

The maximization problem is

$$\max_{c,n} \log(c) + \beta \log(n)$$

S.t.

$$c + \lambda n = I$$

Which can be stated

$$\max_{n} \log(I - \lambda n) + \beta \log(n)$$

FOC

$$\frac{-\lambda}{I - \lambda n} + \beta \frac{1}{n} = 0$$

$$\beta \frac{1}{n} = \frac{\lambda}{I - \lambda n}$$

$$\beta (I - \lambda n) = \lambda n$$

$$\beta I = \lambda n (1 + \beta)$$

$$n = \frac{\beta}{1 + \beta} \frac{1}{\lambda} I$$

Essential comments:

If I increases n goes up; n is concieved as a normal good. Higher cost of children (λ) and lower utility value (β down) lowers fertility.

Question B2.

Since

$$L_{t+1} = n_t L_t = \frac{\beta}{1 + \beta} \frac{1}{\lambda} I_t L_t$$

and since $I = y_t$

$$L_{t+1} = n_t L_t = \frac{\beta}{1 + \beta} \frac{1}{\lambda} Y_t = \frac{\beta}{1 + \beta} \frac{1}{\lambda} A L_t^{\alpha} X^{1-\alpha} \equiv \Phi(L_t; A, X), \; L_0 \text{ given.}$$

where the last bit uses the information given on the production function.

In order to construct the phase diagram the student will have to examine the properties of Φ. It should be demonstrated that we have the following: $\Phi(0) = 0$, $\Phi'(L) > 0$ for all L, $\Phi''(L)$ for all L and that $\lim \Phi'_{L \to 0} = \infty$ and $\lim \Phi'_{L \to \infty} = 0$.

Thus Φ is sticktly concave, starting at the orgin. There is a unique intersection with the 45 degree line in the usual (L_t, L_{t+1}) diagram; thus the steady state is unique (the non-trivial one, anyway). It is evidently also stable in the sense that not matter the initial $L_0 > 0$, $\lim_{t \to \infty} L_t = L^* > 0$. The figure below (from Ashraf and Galor) depicts the function Φ in in the (L_t, L_{t+1}) space, for to different values of A.

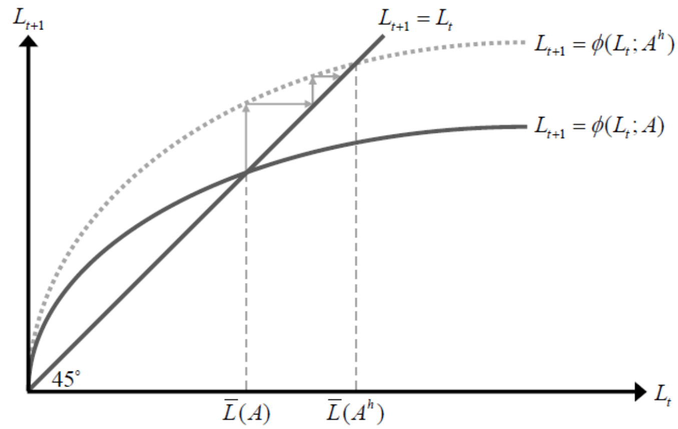

FIGURE 1: The Evolution of Population Size

Question B3.

Income per capita in the steady state is

$$y^* = A\left(\left(\frac{L}{X}\right)^*\right)^{\alpha-1}$$

and (using $L_{t+1} = L_t = L^*$ in the law of motion)

$$\left(\frac{L}{X}\right)^* = \left(\left(\frac{\beta}{1+\beta}\frac{1}{\lambda}\right)A\right)^{\frac{1}{1-\alpha}}$$

thus

$$\begin{aligned} y^* &= A\left(\left(\left(\frac{\beta}{1+\beta}\frac{1}{\lambda}\right)A\right)^{\frac{1}{1-\alpha}}\right)^{\alpha-1} \\ y^* &= \lambda\frac{1+\beta}{\beta}. \end{aligned}$$

Hence, in the long-run (steady state) y is evidently unaffected by technological change. In the short run, where L is given, it is clear from $y_t = A\left(\frac{L_t}{X}\right)^{\alpha-1}$, that innovations do increase y. That will work to increase family size via optimal fertility behavior, which reduces income per capita via diminishing returns until y^* is attained. In the long-run the only impact from innovations is greater population density.

These predictions are supported by empirical evidence. Examining a broad cross sectoin of countries, Ashraf and Galor confirm a positive impact form technological change on population growth, but much less of an impact (statistically insignificant in fact) on growth in income per capita

Question B4.

We observe that the law of motion for L is

$$L_{t+1} = n_t L_t = \frac{\beta}{1+\beta}\frac{1}{\lambda}(1-\tau)Y_t = \frac{\beta}{1+\beta}\frac{1}{\lambda}(1-\tau)L_t^{\alpha}X^{1-\alpha}$$

Hence, changes in taxes are isomorphic to changes in the level of A. We thus have

$$\begin{aligned} y^* &= A\left(\left(\left(\frac{\beta}{1+\beta}\frac{1}{\lambda}\right)A(1-\tau)\right)^{\frac{1}{1-\alpha}}\right)^{\alpha-1} \\ &= \lambda\frac{1+\beta}{\beta}(1-\tau)^{-1}. \end{aligned}$$

Hence, a higher level of taxes works to increase (pre tax) *income per capita.*Living standards, in the sense of net-of-tax income is unaffected by the level of τ. The former result is caused by the fact that higher taxes works to lower fertility and thereby population density in the long-run, which increases the land-labor ratio and thus stimulates productivity.

Steady state welfare is

$$u^* = \log(c^*) + \beta\log(n^*).$$

In the steady state, $n^* = 1$. Consumption is (using the solution to optimal family size and the budget constraint=

$$\begin{aligned} c &= (1-\tau)I - \lambda n \\ &= \left[1-\frac{\beta}{1+\beta}\right](1-\tau)I \\ &= \left[1-\frac{\beta}{1+\beta}\right](1-\tau)y^* \\ &= \left[\frac{1}{1+\beta}\right]\lambda\frac{1+\beta}{\beta} \\ &= \lambda/\beta \end{aligned}$$

which is *independent of taxes.* Hence in the steady state welfare is unaffected by taxes. Some caution in warranted in interpreting the result. The reason why taxation does not affect welfare is because it works to lower fertility outside steady state. The "deadweight loss" from taxation thus translates into lost generations.

Nevertheless, these results indicate that conventional reasoning, which might be that lower income taxes benefit growth and prosperity, may not hold up in countries that are on the “wrong side” of the fertility transition. This illustrates the need to develop appriopriate policies for countries depending on their stage of developement; there is no “one size fits all” initiative that will boost growth everywhere.