

SOLUTION GUIDE

A. Verbal questions

Q1. Based on: Galor-Weil (1999); Galor (2010); Hasan and Zoabi (2003); Weisdorf (2008)

In the course we have discussed a number of viable explanations. Income vs substitution effects in consumption and family size, declining mortality, gender equality, rising relative food prices and the quantity/quality trade-off triggered by either faster technological change (Galor/Weil, Galor) or improvements in health (Hasan and Zoabi). These individual mechanism should be explained, and their empirical relevance briefly assessed. On balanced the evidence, today, seems to favor the quantity quality trade-off as a description of the historical fertility decline in Western Europe, at least.

As for the second part of the question. The fertility transition is a unique event in human history. For the first time in human history do we see that fertility declines despite systematic and persistent increases in household income.

Up until this point, which generally occurs in the 1800s in the Western World and considerably later elsewhere, increases in income were associated with increases in family size. In an setting where land plays a central role in production this “Malthusian mechanism” is arguably key to an understand of the epoch of stagnation, which precedes the current regime (within which income rises secularly, in many places). That is, small increases in income (brought forth by technological innovation, or just a good harvest), would instigate larger families. In the follow “period” however, diminishing returns to labor input would serve to bring income per capita back to the pre-shock state. As a consequence population growth slows and ultimately grinds to a halt, absent further shocks to the system. These predictions are supported by the work of Ashraf and Galor (2010). But after the fertility transition the stabilizing element from rising family size is eliminated. Instead, higher income is associated with smaller families, and usually with greater investment per child. This is a key element behind sustained growth in income per capita, for a number of reasons.

Slower population growth reduces capital dilution, which stimulates growth in per capital income. Greater child investments in human capital stimulates productivity in its own right, but also works

to speed up technological change, or technology adoption. The reductions in fertility, associated with the transition, temporarily increases the fraction of the population that is active in the labor market (a “demographic dividend”, elevating growth in income per capita.

Accordingly, countries that managed to have a head start in undergoing the demographic transition will also start growing before countries venturing through the transition at a later date. During the delay an income gap emerges. These income gaps are still visible in the global distribution of income, and thus represents a first order explanation for the fact that European countries (so far) are found at the top of the global distribution of income.

Q2.

Based on Guiso et al. (2006); Becker and Woessmann (2009).

Max Weber argued that a key effect of the Protestant Reformation was to produce new cultural values; Thrift as well as hard work (“the Protestant Ethic” for short), which was instrumental in ensuring the rise of Capitalism and thus eventually the wealth of Western Europe.

More recently, economic historians have argued that other effects may be at work: human capital accumulation may well have been stimulated by the Reformation. This idea is examined by Becker and Woessman. The basic idea is that the Protestant dogma, requiring individuals to be able to read the bible in their own language propelled early human capital accumulation (raised the perceived return on such investments), which later on turned out to be good for growth.

Becker and Woessman examine data from late-nineteenth-century Prussia. They examine the difference in human capital accumulation between regions that underwent the protestant reformation and those that did not. The former seems to be richer today, an effect which can be ascribed almost fully to human capital. In order to try to control for selection (which places converted, which did not?) they use an instrument for conversion which is the geographical distance to Wittenberg, the epicenter of the Protestant Reformation; the home of Martin Luther.

B. Analytical Questions

Based on Ashraf and Galor (2010) and Diamond (Transcript).

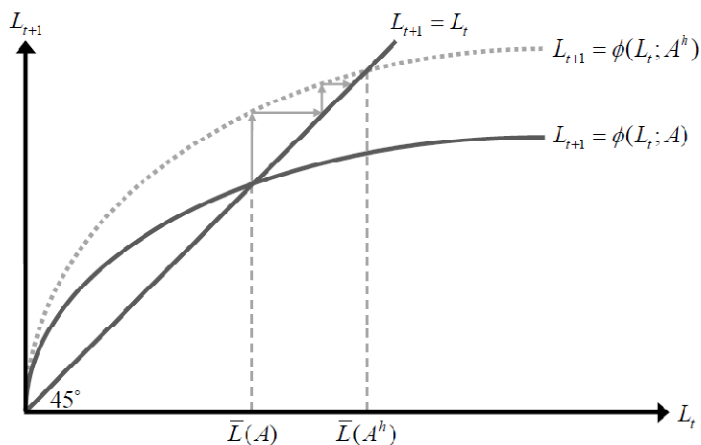
Question 1. The standard calculations leads to the solution $n_t = \frac{\beta / \lambda}{1 + \beta} I_t$. Since both family size and consumption are considered, by the household, to be normal goods (see utility function) it follows that an increase in household income will increase family size (as well as household consumption).

Question 2. We now have information about income per capita. Inserting it into the solution for fertility, and employing the identity, $L_{t+1} = n_t L_t$ we obtain $L_{t+1} = \left(\frac{\beta / \lambda}{1 + \beta} \right) A L_t^\alpha X^{1-\alpha} \equiv \Phi(L_t)$.

Question 3.

Formal analysis. The student should at a minimum show that

$\Phi' > 0, \Phi'' < 0, \lim_{L \rightarrow 0} \Phi' = \infty, \lim_{L \rightarrow \infty} \Phi' = 0$. From this we are able to draw the phase diagram



There is a unique and stable steady state. If the student shows formally that the slope of the law of motion for L is below one near steady state then this is fine; but it is also ok if one simply observes that this is obviously the case when looking at the phase diagram.

Adjustment. Suppose we begin with a L_0 below steady state. At this point, due to diminishing returns, the level of income of the household is high. Consequently, fertility (and consumption) is high. Hence, from one period to the next L rises. As a consequence of diminishing returns, however, income per capita therefore declines. Eventually fertility at the household is reduced all the way to replacement, $n=1$, which is the steady state.

Question 4. Using the steady state condition, we obtain $(L/X)^* = \left[\left(\frac{\beta/\lambda}{1+\beta} \right) A \right]^{\frac{1}{1-\alpha}}$. Since α is

below one, it follows that an increase in A increases population density in the steady state. The experiment is illustrated above. The student should explain the logic of the adjustment process from the initial shock until the economy is once again in steady state.

Question 5. Key points that should be part of an exhaustive answer to the question:

(i) Transition from hunter-gathering to agriculture. (ii) This transition enabled the rise of specialists which enabled faster technological change (see Diamond, Ashraf and Galor for elaboration). (iii) The theory of Diamond is that a greater variety of domesticable species facilitated an early transition. If so, it is less surprising that it occurred in the Fertile Crescent. Subsequently, it spread across the planet. If the diversity of species is exogenous, it may thus provide us with “exogenous” variation in the timing of the Neolithic, admitting a statement about the causal effect of “ A ” on L/X .