SUMMER TERM 2023
CENTRALLY-MANAGED ONLINE EXAMINATION
ECON0039: ADVANCED MACROECONOMICS
Solution

Time allowance
You have 2 hours to complete this examination, plus additional collation time of 20 minutes and an Upload Window of 20 minutes. The additional collation time has been provided to cover any additional tasks that may be required when collating documents for upload, and the Upload Window is for uploading, completing the Cover Sheet and correcting any minor mistakes. The additional collation time and Upload Window time allowance should not be used for additional writing time.

If you have been granted SoRA extra time and/or rest breaks, your individual examination duration and additional collation time will be extended pro-rata and you will also have the 20-minute Upload Window added to your individual duration.

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All questions should be answered.

Part A carries 40% of the total mark, Part B 20% and Part C 40%.

PART A : The Liquidity Trap

THIS problem considers a general equilibrium model of the liquidity trap. We assume an endowment economy with two periods (plus a continuation value). The two periods are denoted 1 and 2. The representative household enters period one with an amount of money M_0 and an amount of bonds $B_0 = 0$. They receive endowment y_1 in period one and y_2 in period two. Money is the numéraire. Preferences are given by

$$u(c_1) + \beta u(c_2) + \beta^2 V(M_2, B_2)$$

where V is the continuation value of holding M_2 units of money and B_2 units of bonds at the end of period 2. It is assumed that $u' > 0$, $v'_M > 0$ and $v'_B > 0$. We also make the assumption that $0 < \beta < 1$.

In each period t, the household must first decide on the quantity of bonds B_t to issue (and repay next period) and on the quantity of money M_t to hold. The nominal interest rate on bonds issued in period t is i_t. After this decision has been made, the household decides on its consumption (price P_t), that has to be bought with money M_t (consuming one's own endowment is forbidden) according to the cash-in-advance constraint:

$$P_t c_t \leq M_t$$

It also sells its endowment at price p_t. The set of constraints that the representative household faces therefore contains two budget constraints and two cash-in-advance constraints. The budget constraints are

$$\begin{array}{rcll} P_1 c_1 + M_1 + B_1 & \leq & P_1 y_1 + M_0 + X_1, & (\lambda_1) \\ P_2 c_2 + M_2 + B_2 & \leq & P_2 y_2 + M_1 + X_2 + (1 + i_1) B_1, & (\lambda_2) \end{array}$$

where X_t is new money injection that is distributed to the household at the beginning of the period. λ_t is the Lagrangian multiplier associated to the budget constraint of period t. The cash-in-advance constraints are

$$\begin{array}{rcll} P_1 c_1 & \leq & M_1, & (\mu_1) \\ P_2 c_2 & \leq & M_2, & (\mu_2) \end{array}$$

where μ_t is the Lagrangian multiplier associated to the cash-in-advance constraint of period t.

A.1 Write the Lagrangian of the household problem and first order conditions of the maximisation, including complementary slackness ones.

A.1. $\mathcal{L} = u(C_1) + \beta u(C_2) + \beta^2 V(M_2, B_2) + \lambda_1 (P_1 y_1 + \Pi_0 + X_1 - P_1 c_1 - \Pi_1 - B_1)$

$+ \lambda_2 (P_2 y_2 + M_1 + X_2 + (1+i_1) B_1 - P_2 c_2 - \Pi_2 - B_2)$

$+ \mu_1 (M_1 - P_1 c_1) + \mu_2 (\Pi_2 - P_2 c_2)$

First order conditions are:

$/c_1$: $u'(C_1) = (\lambda_1 + \mu_1) P_1$ (1)

$/B_1$: $\lambda_1 = (1+i_1)\lambda_2$ (2)

$/\Pi_1$: $\lambda_1 = \mu_1 + \lambda_2$ (3)

$\mu_1 (\Pi_1 - P_1 c_1) = 0$ (7), $\mu_1 \geq 0$ (8)

$\lambda_1 (P_1 y_1 + \Pi_0 + X_0 - P_1 c_1 - \Pi_1 - B_1) = 0$ (9), $\lambda_1 \geq 0$ (10)

$/c_2$: $\beta u'(c_2) = (\lambda_2 + \mu_2) P_2$ (4)

$/B_2$: $\lambda_2 = \beta^2 V_B(\Pi_2, B_2)$ (5)

$/\Pi_2$: $\lambda_2 = \mu_2 + \beta^2 V_M(\Pi_2, B_2)$ (6)

$\mu_2 (\Pi_2 - P_2 c_2) = 0$ (11), $\mu_2 \geq 0$ (12)

$\lambda_2 (P_2 y_2 + M_1 + X_2 + (1+i_1) B_1 - P_2 c_2 - \Pi_2 - B_2) = 0$ (13)

$\lambda_2 \geq 0$ (14)

A.2 Explain what is the purpose of assuming a continuation value $V(M_2, B_2)$ for M_2 and B_2.

A.2. $V(\Pi_2, B_2)$ represents the value of holding Π_2 and B_2 at the end of period 2. It can be understood as what would be the value if there were more periods in the model. It is a way to write a 2-period model and encapsulate all the future periods in V.

A.3 Prove $\lambda_1 > 0$, $\lambda_2 > 0$. Also prove that $\mu_1 > 0$ when $i_1 > 0$. What is the economic interpretation of this last result?

A.3. • As $V_2 > 0$ by assumption, (5) $\Rightarrow \lambda_2 > 0$

As long as $i_1 \geq 0$ (which is a technological constraint), if $\lambda_2 > 0$, then (2) $\Rightarrow \lambda_1 > 0$.

- If $i_1 > 0$, (2) $\Rightarrow \lambda_1 > \lambda_2$. Then (3) $\Rightarrow \mu_1 = \lambda_1 - \lambda_2 > 0$
- economic interpretation: if $i_1 > 0$, holding money is costly, so that agents do not hold more than what is needed to consume.

Indeed, $i_1 > 0 \Rightarrow \mu_1 > 0 \Rightarrow P_1 c_1 = \Pi_1$: the CIA constraint is binding.

A.4 Define a general equilibrium of this economy. Explain why the bond market equilibrium condition is $B_t = 0$.

A.4. A general equilibrium is a vector of prices (P_1, P_2, i_1) and quantities $(c_1, c_2, m_1, m_2, B_1, B_2)$ such that, given (m_0, X_1, X_2)

(i) the household behavior is optimal given prices – i.e. equations (1) to (14) hold.

(ii) Markets clear:

good: $c_1 = y_1$ and $c_2 = y_2$

money: $M_1 = M_0 + X_1$ and $M_2 = M_1 + X_1$

Bonds $B_1 = 0$ and $B_2 = 0$

$B_1 = 0$ and $B_2 = 0$ because we have assumed a representative agent.

Let's make the assumption that $u(c) = \frac{c^{1-\sigma}-1}{1-\sigma}$ with $\sigma \geq 0$, that $V(M_2, B_2) = \log(M_2) + \log(1+B_2)$ and that $M_2 > 1$.

A.5 Solve for period 2 equilibrium and find the equilibrium values of $(\lambda_2, \mu_2, c_2, P_2)$. What is the equilibrium effect in period 2 of monetary expansion $X_2 > 0$? Discuss.

A.S. Now $u(c) = \frac{c^{1-\sigma}-1}{1-\sigma} \Rightarrow u'(c) = c^{-\sigma}$. Assume also $M_2 > 1$

$V(\Pi_2, B_2) = \log \Pi_2 + \log(1+B_2) \Rightarrow V'_\Pi = \frac{1}{\Pi_2}$, $V'_B = \frac{1}{1+B_2}$

Period 2 equilibrium

(5) $\Rightarrow \boxed{\lambda_2 = \beta^2}$ as $V'_B(\Pi_2, 0) = 1$

(6) $\Rightarrow \boxed{\mu_2 = \lambda^2 - \beta^2 \frac{1}{M_2} = \beta^2\left(1 - \frac{1}{\Pi_2}\right)} > 0$ as $M_2 > 1$

Because $\mu_2 > 0$, $P_2 c_2 = \Pi_2$ and $\boxed{c_2 = y_2}$

Therefore $\boxed{P_2 = \frac{\Pi_2}{y_2}}$

A.6 Solve for period 1 equilibrium $(\lambda_1, \mu_1, c_1, P_1, i_1)$. What is the condition on $M_1 = M_0 + X_1$ under which the economy is in the liquidity trap? Explain.

A.6. Period 1 equilibrium.

(i) Assume $i_1 > 0$. Then, as we proved in A.3., $P_1 c_1 = M_1$

As $\boxed{c_1 = y_1}$, we have $\boxed{P_1 = \frac{M_1}{c_1}}$

We have (3) $\Rightarrow \mu_1 = \lambda_1 - \lambda_2 = \lambda_1 - \beta^2$

Replace in (1): $y_1^{-\sigma} = P_1 (\lambda_1 + \lambda_1 - \beta^2) \Rightarrow y_1^{-\sigma} = P_1 (2\lambda_1 - \beta^2)$

$$\Rightarrow \lambda_1 = \frac{1}{2}\left[\frac{y_1^{1-\sigma}}{M_1} + \beta^2\right]$$

Let's check that $i_1 > 0$:

$$(2) \Rightarrow (1+i_1) = \frac{\lambda_1}{\lambda_2} = \frac{1}{2}\left[\frac{y_1^{1-\sigma}}{\beta^2 M_1} + 1\right] \Rightarrow i_1 > 0 \text{ iff } \frac{y_1^{1-\sigma}}{\beta^2 M_1} > 1 \Leftrightarrow \boxed{M_1 < \frac{y_1^{1-\sigma}}{\beta^2}\ (*)}$$

(*): If M_1 is too large, $\frac{P_2}{P_1}$ (inflation) is too low $\Rightarrow i_1$ becomes negative, which is impossible

(ii) so if $M_1 > \frac{y_1^{1-\sigma}}{\beta^2}$, then $i_1 = 0$ and $\mu_1 = 0$ $\Rightarrow$ liquidity trap

(2) $\Rightarrow$ $\lambda_1 = \lambda_2 \Rightarrow$ $\boxed{\lambda_1 = \beta^2}$

(1) $\Rightarrow$ $y_1^{-\sigma} = \beta^2 P_1$ $\Rightarrow$ $\boxed{P_1 = \frac{y_1^{-\sigma}}{\beta^2}}$

We see that in the liquidity trap, P_1 does not increase when M_1 increase because the CIA constraint is not binding.

Assume now that $\sigma = 1$, $y_1 = 1$, $M_0 = \frac{1}{\beta}$ and $X_1 = 0$. Prices are flexible in period 2, but fixed in period 1, at the level $P_1 = \frac{1}{\beta^3}$.

A.7 Show that $c_1 < y_1$ and explain why. Collapse the period 1 equilibrium condition into two equations in c_1 and P_1, given the equilibrium in period 2. Make a graph and show that expansionary monetary policy (to $M_1 = \frac{1}{\beta^2}$) can increase c_1 to the level β. Show that increasing M_1 further cannot lead to $c_1 = y_1 = 1$. Explain why.

A.7. Now $\sigma = 1$ so that $u'(c) = \frac{1}{c}$

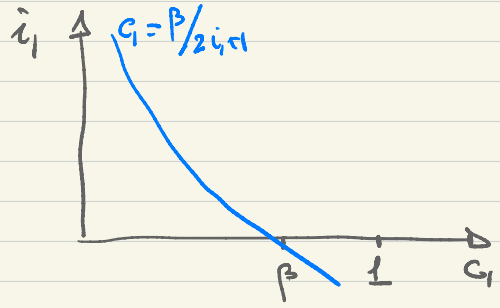
$y_1 = 1$, $M_1 = 1/\beta$, P_1 fixed at level $1/\beta^3$

(3) $\Rightarrow$ $\mu_1 = \lambda_1 - \beta^2$ (2) $\Rightarrow$ $\lambda_1 = (1+i_1)\beta^2$

plug (2) in (3) : $\mu_1 = (1+i_1)\beta^2 - \beta^2 = \beta^2 i_1$

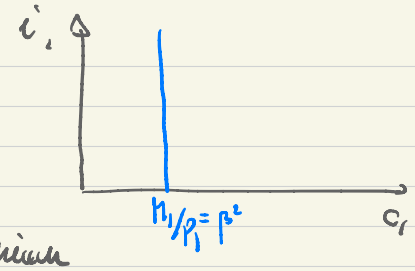
Therefore, $\lambda_1 + \mu_1 = (1+i_1)\beta^2 + \beta^2 i_1 = \beta^2(2i_1+1)$

plug in (1) : $c_1 = \frac{1}{\beta^2(2i_1+1)P_1} = \frac{\beta}{(2i_1+1)}$

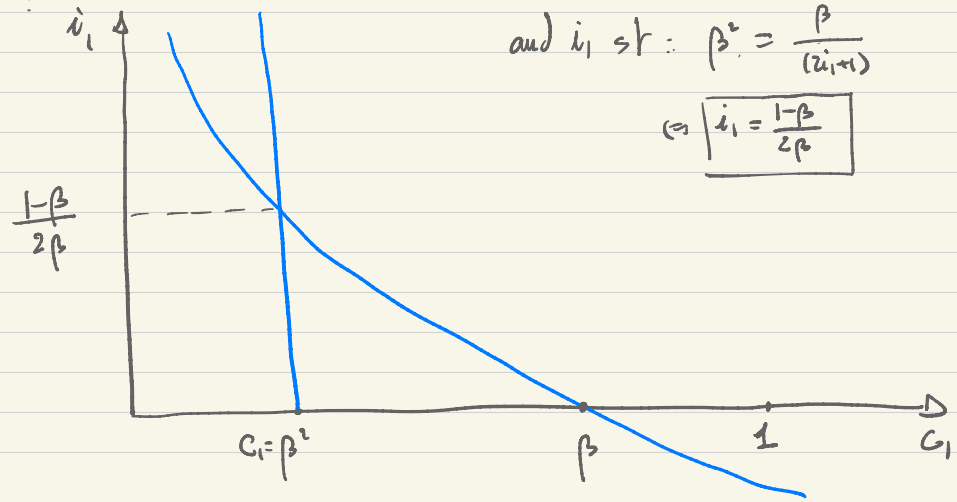


The remaining equation is $\Pi_1 = P_1 c_1$ if $i_1 > 0$

$\Leftrightarrow \boxed{c_1 = \frac{\Pi_1}{P_1} = \beta^2} < y_1$



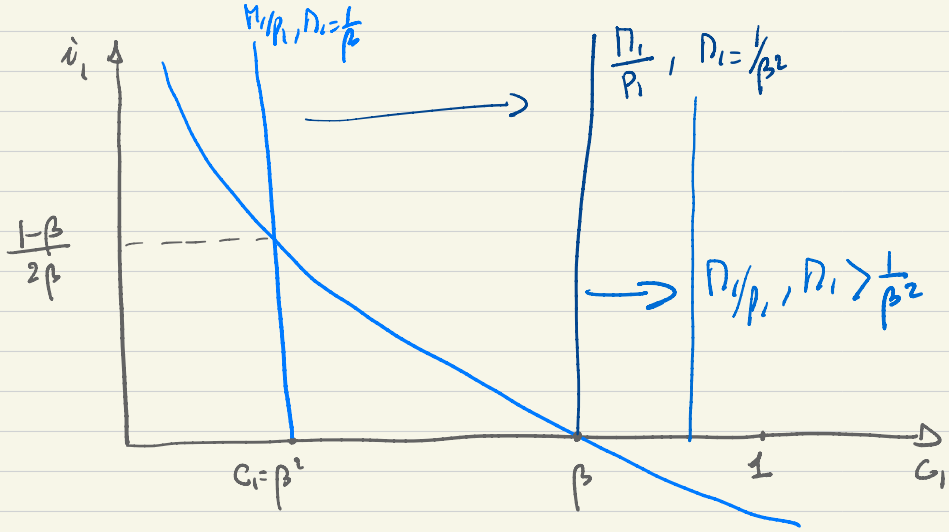
We therefore have the graphical determination of equilibrium in period 1 :



and i_1 s.t. : $\beta^2 = \frac{\beta}{(2i_1+1)}$

$\Leftrightarrow \boxed{i_1 = \frac{1-\beta}{2\beta}}$

If $\Pi_1 \to \frac{1}{\beta^2}$, $c_1 \to \frac{\Pi_1}{P_1} \to \beta$ and $i_1 \to 0$



We see that when $\Pi_1 > \frac{1}{\beta^2}$, $i_1 = 0$, so that monetary policy is inefficient (liquidity trap).

PART B : Question

WHY ARE the positive co-movements between output, investment and consumption a challenge for business cycle modelling? Write a structured short essay of no more than 500 words (less is fine).

- When we look at business cycle fluctuations, we do observe positive co-movements between output, investment and consumption. In an expansion, the three aggregates increase, while they decrease in a recession.
- Is that something that one easily reproduce in a model. It depends on the model and of the type of shock one considers.
- Let us consider first a "Real Business Cycle" model, and use the "UV" formulation we have seen in class.
  - It is a flex price model with resource constraint $c + x = AF(\ell)$ and preferences $U(c, \ell) + \theta V(x)$.
  - In such a model, a technological shock $\partial A > 0$ will increase productivity of labor. If the substitution effect is not strictly dominated by the income effect in labour supply, ℓ will be strictly non decreasing, and therefore c, x and y will increase.
  - Another way to create comovements is ti assume a shock to the disutililty of labour (a "laziness shock"). ℓ goes down, so does production, consumption and investment.
  - Although comovements are indeed possible in the RBC model, they are unrealistic because (a) technological shocks are not procyclical and (b) laziness shock are not realistic.
  - If we now look at "demand shocks" (to the value of investment θ or the the value of consumption), we do not observe comovements.
  - Take for example a shock to the value of investment $\partial\theta > 0$. It represents a positive shock to the future value of investment. It captures all the possible changes in expectations, mood of entrepreneurs, news about future productivity, etc...
  - Everything else equal, economic agents value more investment, and therefore increase their demand for investment ($\partial x > 0$)
  - This increase in x is financed by working more (so that $\partial\ell > 0$ and $\partial y > 0$) ...
  - .. but also by consuming less $\partial c < 0$.
  - c and x therefore move in opposite direction: demand shocks cannot be the main driver of business cycles in that model.
- One then needs to move away from the RBC model. We have seen two extensions in the lectures ans problem sets in which a demand shock can produce positive comovements.

- One model is one in which consumption and investment are different goods, and economic agents are specialised in the production of one or the other. In such a framework, a shock to the value of investment $\partial\theta > 0$ will increase gains from trade between the two agents and will create positive comovements.
- A second example is to assume sticky prices. The model then resembles an IS-LM model. the θ shock or a monetary shock, as in IS-LM, are expansionary and create business cycles like movements.

PART C : Discussion

Below is an article published by Cardiff Garcia on the Financial Times Alphaville blog in July 2017 and entitled "When Keynes pondered Malthus". Read carefully this article (you can skip the endnotes) before answering the questions below. For each question, you should propose a structured answer.

C.1 Write a 10-line summary.

- Often social phenomena become well understood at the same time they cease to be relevant. A good example is Malthusian theory according to which productivity gains translate into population growth and leave income per capita at the subsistence level.
- As noted by Krugman, this has been true 58 out of the 60 centuries since civilisation emerged, but not since the industrial revolution.
- The Engels theory on the low level of industrial wages was also proved to be wrong little after it was developed in 1844: real wage growth caught up productivity growth after 1860, and exceeded it thereafter.
- Will that regime of ever growing living standards last forever? In his 1919 book of the economic consequences of the peace, Keynes questions the sustainability of this high growth regime.
- A century later, we still observe ever increasing levels of living standards. Thanks to the development of economic analysis and statistics, a move away from the current post-Malthusian dynamics will be quickly identified.

C.2 Explain the functioning of the Malthusian regime. Why has the economy exited that regime? (No more than 500 words, less is fine)

- What is the Malthusian Regime? It corresponds to the functioning of human societies before the industrial revolution. In short, income per capita is roughly constant in the Malthusian regime, close to subsistence level. Changes in the availability of resources translate into population changes.

– In the Malthusian regime, average growth rate of income per capita is negligible : 0.05% a year between 1000 and 1820 (Maddison).

– Increases in resource translate into increases in population. World population was 231 millions in 1 AD and 268 millions in 1000 AD, then 438 millions in 1500 AD. Resource expansions after 1500 implied an increase in population growth (1041 millions people in 1820)

– An example of the functioning of the Malthusian regime is given by the English Black Death (1348-1349) and its aftermath. Following the English Black Death, English population went down from 6 millions to 3.5 millions. An increase in the land/labor ratio followed, so that the real wage tripled for 150 years. This caused an increase in population, so that in the 1560's, the real wage was back to the pre-plague level.

– One can formally illustrate this mechanism with the Clark's model we have seen in class. The model has three equations:

Demography (1): the birth rate b is high when income per capita y is high.

$$b(t) = b\underbrace{(y(t))}_{+}$$

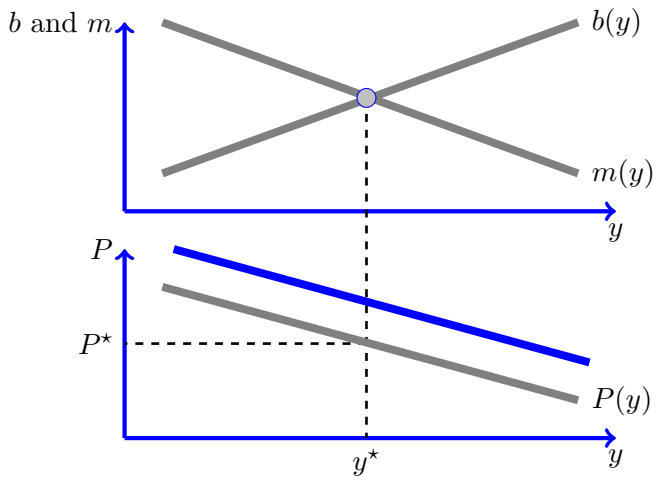
Demography (2): the mortality rate m is low when income per capita y is high.

$$m(t) = m\underbrace{(y(t))}_{-}$$

Technology: Population P is low when income per capita y is high.

$$P(t) = P\underbrace{(y(t))}_{-}$$

– Graphically, medical progress will shift the technology frontier upward (the new blue line), which will increase population but will leave income per capita at $y^{\star}$, as shown on the figure.



– With the Industrial Revolution, the economy exited the Matlhusian regime because the growth of productivity became high enough to outpace population growth and allow income per capita to rise. This was then accompanied by demographic transition (first death rate declined, then fertility rate).

C.3 What was the dynamics of income inequalities according to Ricardo in the Malthusian regime? How have inequalities evolved since? (No more than 500 words, less is fine)

– Malthus and Smith (the pin factory example) noticed that despite productivity increases, wages stayed low. The main reason was that any increase in the general level of wages would lead to an increase of population and therefore of the work force, and this would tend to reverse the initial increase of wages.

– Ricardo explained that the dynamics of income inequalities from the *scarcity (of land) principle*. The price of corn (and therefore the wage) is determined by the cost of labour and capital required to produce a unit of corn on the land with the lowest quality. With technological progress, wages increase above the level of subsistence, leading to population expansion, and increase in the demand for corn and an extension of the margin of cultivation. Even after the wage rate has returned to its level of subsistence, the share of rent and wages in national income go up (because population is larger). Income inequalities are therefore increasing as rentiers become richer while workers income stays flat. The income of capitalist is also likely to go down as profits fall, weakening of the incentive to invest and putting the economy at a stationary state.

– One century after the Industrial Revolution, Kuznets showed that, in the US between 1913 and 1945, inequalities if income did decrease. His hypothesis is that there is a "Kuznets curve" in the growth path of economies. After a first phase of increasing inequality associated with the early stages of industrialization (US in the XIXth century), there is a second

phase of sharply decreasing inequality with industrialization (US in the beginning of the XXth century).

- Using data for the XXth century, Piketty has shown that there is no tendency for income inequalities to systematically get reduced. item Whereas income inequality was larger in Europe than in the United States a century ago, it is currently much larger in the United States.
- The top decile share in Europe is currently almost one-third smaller than what it used to be one century ago.
- The secular decline in inequality would be even larger if one takes into account the rise of taxes and transfers, and measure instead income after taxes and transfers.
- Primary income concentration is currently higher than it has ever been in U.S. history. It is also slightly higher than in pre-WWI Europe.

"When Keynes pondered Malthus "
by Cardiff Garcia
Financial Times Alphaville blog, Jul 26th 2017

In a conversation with Clifford Geertz in 1976, the economist Albert O Hirschman playfully expressed the first law of the social sciences: "Whenever a phenomenon in the social world is fully explained, it ceases to operate."

Perhaps the best historical example of this idea, or at least the most famous in the history of economic thought, was the publication of An Essay on the Principle of Population by Thomas Malthus in 1798.

Paul Krugman blogs that "over the roughly 60 centuries that have passed since civilization emerged in Mesopotamia, the Malthusian proposition – population pressure swallows up any gains in productivity, so that most people live on the edge of subsistence – was true for 58. It just so happens that the two centuries for which the proposition didn't hold were the two centuries after Malthus wrote." [1]

The nineteenth century would provide more such examples of economic thinkers having been right in their time, but wrong for all the time since.

By the estimates of economic historian Robert Allen, average output per capita did start rising around the year 1800. The technologies of the industrial age were coming on stream. But real wage growth stayed flat until roughly 1840, just before Engels published The Condition of the Working Class in England in 1844. Based on his firsthand observations in Manchester, Engels wrote that the English middle classes "prefer to ignore the distress of the workers and this is particularly true of the industrialists, who grow rich on the misery of the mass of wage earners".

Until that point, Engels was right about the nineteenth century – and he wasn't alone. According to Allen:

> Ricardo, Malthus, and Marx all believed that real wages would remain constant during capitalist development. They differed, however, in their explanations: Ricardo and Malthus believed that population growth would accelerate in response to any rise in income and ultimately force wages back to subsistence; Marx, on the other hand, believed that technological progress had a labour saving bias that would eliminate any upward demand pressure on wages even as output per worker surged.

They would all be proved wrong about the events that came after them. Marx and Engels were immediately wrong following their publication of The Communist Manifesto in 1848, just as real wages were starting to catch up to productivity growth.

Allen writes, my emphasis:

> The acceleration of productivity growth did, indeed, shift income from workers to capitalists, as [Marx] expected. The result, however, was not continually increasing immiseration, for the capitalists invested a portion of their extra income and the increase in the capital stock eventually allowed rising productivity to be manifest as rising real wages. History did, indeed, exhibit a stage pattern of evolution, but *the stage of flat real wages was followed by the most sustained rise in real wages ever seen* - not by socialist revolution.

Real wage growth caught up to productivity growth by 1860, exceeding it thereafter. "The 'modern' pattern was established", Allen writes.

Krugman cites examples even earlier than Malthus, asking:

> Is there a moral to this story? Maybe it is that things economic do change. By and large they change more slowly than many people think; understanding the 1930s was still immensely valuable to understanding the world after 2008. But economic 'laws' – I generally hate that term – aren't immutable, and good economists can be both right about the past and wrong for today.

True – though of course, paradigmatic shifts as dramatic as the end of the Malthusian reality are exceedingly rare. Does the ongoing transition to a world in which automation replaces even heavily cognitive tasks represent another?[2]

We should not be surprised that the question remains hotly debated and unanswerable. Historically it has often taken a very long time to confirm that the world had indeed changed. The example of Malthus is again instructive.

To use Hirschman's formulation, the social phenomenon explained by Malthus in his essay – that a rising population would always overwhelm increased output – did cease to operate at very nearly the same time that the essay was published. But the cessation wasn't clear to economic observers at the time. It would be contested throughout the nineteenth century and in fact was not definitively accepted even twelve decades later.

John Maynard Keynes published The Economic Consequences of the Peace, his brutal excoriation of the Paris Peace Conference, in 1919. The first and second chapters of Consequences explain the socioeconomic trends that defined Europe in the half-century before the start of the Great War. In the essay Keynes is brilliantly alive to the extraordinary, revolutionary nature of economic growth in the last third of the nineteenth century.

His very first lines warned against taking for granted its permanence:

> The power to become habituated to his surroundings is a marked characteristic of mankind. ... We assume some of the most peculiar and temporary of our late advantages as natural, permanent, and to be depended on, and we lay our plans accordingly. On this sandy and false foundation we scheme for social improvement and dress our political platforms, pursue our animosities and particular ambitions, and feel ourselves with enough margin in hand to foster, not assuage, civil conflict in the European family.

Consequences was not primarily about the continued relevance of Malthusian economics. Its focus was the punitive economic demands imposed by the Allied victors on the defeated Germans and, according to Keynes, the existential threat to European stability posed by these demands.[3]

But the "sandy and false foundation" – the assumption of rising living standards on which Europeans had come to rely before the War – also included the possibility that the economic forces observed since 1870 represented merely an anomalous and temporary deviation.

Keynes even suspected that the world had already started returning to its flatter Malthusian trajectory by the turn of the century:

> The pressure of population on food, which had already been balanced by the accessibility of supplies from America, became for the first time in recorded history definitely reversed. As numbers increased, food was actually easier to secure. ... Up to about 1900 a unit of labor applied to industry yielded year by a year a purchasing power over an increasing quantity of food. It is possible that about the year 1900 this process began to be reversed, and a diminishing yield of Nature to man's effort was beginning to reassert itself.

Keynes understood that the world into which he was born was an "economic Eldorado". His contemporaries risked forgetting the prior, gloomier eras that came before theirs:

> Before the eighteenth century mankind entertained no false hopes. To lay the illusions which grew popular at that age's latter end, Malthus disclosed a Devil. For half a century all serious economical writings held that Devil in clear prospect. For the next half century he was chained up and out of sight. Now perhaps we have loosed him again.

Now perhaps we have loosed him again. By then, approximately 120 years had passed since the "devil" had first been chained – and the finest economic mind of the time (and perhaps of any time) still did not know if the chains would be strong enough to hold him.

Modern economic observers should recognise the next big economic mutation more quickly than was ever possible for their predecessors. The social sciences are much further developed as disciplines than in the time of Keynes, much less the time of Malthus and Ricardo, much less that of Hume and Smith. The development of useful national accounts would not start for another decade after the publication of Consequences in 1919.

Keynes wasn't completely in the dark when he wrote Consequences. He had access to rudimentary but useful data about foreign trade and investment, coal production, crop yields, and population numbers for the relevant countries. He wrote about the number and kind of Germany's mercantile marine vessels ceded to the Allies. In the final chapter he encouraged the Allied countries to fully cancel the debts they owed each other, presenting a simple chart.

But there was nothing like the virtual armies of social scientists now devoting their careers to understanding trends that would be considered impossibly granular in the 1920s. Not only in the academy, but embedded within the statistical agencies of every reputable government and multilateral institution.

Plenty of confusion still exists about current topics, even – or especially – about the defiantly enigmatic issue of productivity growth. Its fluctuations remain hard to measure, hard to understand, impossible to predict.

But if a new, unexpected, and previously unimagined economic dynamic does assert itself, it seems unlikely that another twelve decades will pass before economic thinkers realise that the world has been knocked off its post-Malthusian trajectory and onto a new path.

Notes

[1]Democratic Athens and a few other, earlier societies might well have breached the Malthusian cap, but just temporarily. Krugman's point holds.

[2]I first made similar points in the different context of the looming robot takeover, and my attention was directed to the example of Keynes on Malthus in Economic Consequences by Brad DeLong. Brad writes:

> When we come to the 1950s of Simon Kuznets, Robert Solow, and Walt Whitman Rostow, the Malthusian Devil is ignored as a result of the confluence of the demographic transition, the technological creativity of the industrial research lab, and the political victory of social democracy: output per worker is seen as high and growing indefinitely; moreover, income inequality is under control-a Dickensian (or Marxist) society of great wealth but also great mass poverty is off the table as well.

[3]Keynes worried about more than just a newly Malthusian existence. He also warned against the immediate return to the freewheeling laissez faire liberal-capitalism of the late nineteenth century, preferring lenient terms for Germany and debt forgiveness for the net-debtor Allies. For a critical assessment of Economic Consequences and a helpful treatment of the power dynamics contributing to the terms of peace, try chapter 15 of Adam Tooze's The Deluge, from which:

> Generations of economists have picked apart the flaws in Keynes's argument. But his critique stands both as a reflection and a contributor to the mood of disillusionment that followed Versailles. Combining the authority of an economic expert, the colour of an insider and magnificent rhetorical force,

> Keynes's book sold in the hundreds of thousands. It was quoted verbatim in the Republican assault on Wilson's treaty in the US Senate. Both Lenin and Trotsky recommended Keynes as essential reading to the Comintern. He was welcomed with open arms in Germany and helped to poison yet further the atmosphere between London and Paris. Superficially, of course, Keynes stood on Germany's side.
>
> But it was far from obvious, even from a German standpoint, whether he did not do more harm than good. His influence encouraged those in Germany who insisted that any payment was impossible, when a good faith effort to honour the treaty, even if it had fallen short, might well have steered the Weimar Republic away from the ruinous crisis of 1923. Of course, the point is not that Keynes was personally responsible for the ensuing disaster. The point is that rather than reading Keynes as a guide to the reparations problem, we should see The Economic Consequences as symptomatic of the crisis that is the central preoccupation of this book [The Deluge]. ...

But also:

> ... Keynes's aim was not to to create an elaborate long-term structure of government control to replace free trade or private lending. But he was scathing about those who believed that 'with the early removal of obstacles in the form of the blockage and similar measures to free international intercourse, private enterprise may be safely entrusted with the task of finding the solution'. ... The governments of Europe and America must act to restore basic lines of credit so that private initiative might then take over, otherwise those countries most in need of credit would be caught in a vicious circle of economic crisis, political uncertainty and diminished creditworthiness.