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A suggested solution to the problem set at the exam in Advanced Macroeconomics February 20, 2013

(3-hours closed book exam)[1]

As formulated in the course description, a score of 12 is given if the student's performance demonstrates (a) accurate and thorough understanding of the concepts, methods, and models in the course, (b) knowledge of the major empirical regularities for aggregate economic variables, and (c) ability to use these theoretical tools and this empirical knowledge to answer macroeconomic questions.

1. Solution to Problem 1

We are told that the dynamics of the economy are given by:

$$\dot{C}_t = (F_K(K_t, N) - \delta - \rho)C_t - m(\rho + m)(K_t + B_t), \tag{*}$$

$$\dot{K}_t = F(K_t, N) - \delta K_t - C_t - G, \qquad K_0 > 0 \text{ given}, \tag{**}$$

$$\dot{B}_t = [F_K(K_t, N) - \delta]\, B_t + G - T_t, \qquad B_0 \text{ given}, \tag{***}$$

the condition

$$\lim_{t\to\infty} B_t e^{-\int_0^t [F_K(K_s,N)-\delta]ds} \leq 0, \tag{****}$$

and a requirement that households satisfy their transversality conditions.

a) Parameters: δ = capital depreciation rate, m = mortality rate (= birth rate, no population growth), ρ = pure rate of time preference (utility discount rate, a measure of impatience). The model relies on the simplifying assumption that for a given individual the probability of having a remaining lifetime, X, longer than some arbitrary number x is $P(X > x) = e^{-mx}$, the same for all (i.e., independent of age).

Eq. (*) shows how the increase per time unit in aggregate private consumption is determined. The first term on the right-hand side reflects the individual Keynes-Ramsey

[1] The solution below contains more details and more precision than can be expected at a three hours exam.

rule at time t (instantaneous utility is assumed to be logarithmic). In general equilibrium with perfect competition, $r_t = F_K(K_t, N) - \delta$. The second term on the right-hand side reflects the generation replacement. The arrival of newborns is Nm per time unit. The newborns enter the economy with *less financial* wealth than the "average citizen". This lowers aggregate consumption by $m(\rho+m)A_t$ per time unit, where A_t is aggregate private financial wealth. In general equilibrium in the closed economy we have $A_t = K_t + B_t$.

Eq. (**) is essentially just national income accounting for a closed economy with public sector. There is no population growth and no technology growth.

Eq. (***) says that the increase per time unit in real public debt equals the real budget deficit, that is, total government expenditure (interest payments plus spending on goods and services) minus net tax revenue. This tells us that the budget deficit is entirely debt-financed (i.e., no money financing).

Finally, the condition (****) is the No-Ponzi-Game condition for the government (recall $r_s = F_K(K_s, N) - \delta$).

b) Given a balanced budget for all $t \geq 0$, we have $\dot{B}_t = 0$ in (***) so that B_t in (*) and (**) is a constant, B_0. Then these two differential equations constitute a self-contained dynamic system for which we can draw a phase diagram. We introduce two benchmark values of K, namely the golden rule value, K_{GR}, and a "critical" value, $\bar{K}$. These are defined by,

$$F_K\left(K_{GR}, N\right) - \delta = 0, \qquad \text{and} \qquad F_K\left(\bar{K}, N\right) - \delta = \rho, \tag{1.1}$$

respectively. In view of the Inada conditions and $\delta > 0$, both values exist and are unique (since $F_{KK} < 0$). We have $\bar{K} < K_{GR}$, since $\rho > 0$ and $F_{KK} < 0$.

Given $B_t = B_{0,}$ equation (**) shows that $\dot{K} = 0$ for

$$C = F(K, N) - \delta K - G,$$

cf. the strictly concave $\dot{K} = 0$ locus in Fig. 1.1.

Equation (*) shows that $\dot{C} = 0$ for

$$C = \frac{m\left(\rho + m\right)\left(K + B_0\right)}{F_K(K, N) - \delta - \rho}. \tag{1.2}$$

Thus, along the $\dot{C} = 0$ locus,

$$K \nearrow \bar{K} \Rightarrow C \rightarrow \infty$$

and

$$K \searrow 0 \Rightarrow C \rightarrow 0,$$

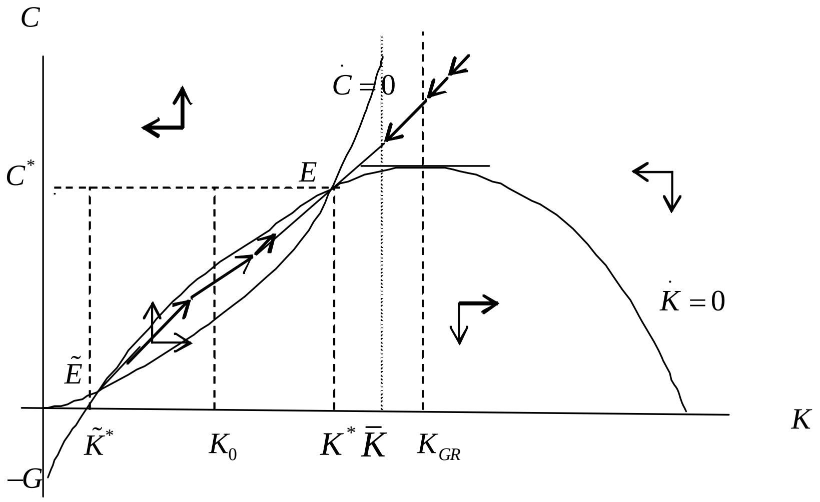

Figure 1.1:

the latter result following from the lower Inada condition. The $\dot{C} = 0$ locus is shown as the strictly convex curve in Fig. 1.1.

We are told that G and B_0 are "modest" relative to the production possibilities of the economy for the given K_0. The interpretation must be that the $\dot{C} = 0$ curve crosses the $\dot{K} = 0$ curve for *two* positive values of K. Fig. 1.1 shows these steady states as the points E and Ẽ with coordinates (K^*, C^*) and $(\tilde{K}^*, \tilde{C}^*)$, respectively. Obviously, $\tilde{K}^* < K^* < \bar{K}$.

The direction of movement in the different regions of Fig. 1.1 are determined by the differential equations, (*) and (**), and shown by arrows. It is seen that E is a saddle point, whereas Ẽ is totally unstable. Since G and B_0 are "modest", we have that the lower steady-state value, $\tilde{K}^*$, is smaller than K_0, as shown in the figure.

The capital stock is predetermined, whereas consumption is a jump variable. The slope of the saddle path is not parallel with the C axis. The divergent paths can be ruled out as equilibrium paths since they violate either the transversality conditions of the households (paths that in the long run point South-East in Fig. 1.1) or the NPG condition[2] of the households (paths that in the long run point North-West in the diagram). It follows that the system is saddle-point stable. The saddle path is the only trajectory satisfying *all* the conditions of general equilibrium (individual utility maximization for given expectations, continuous market clearing under perfect foresight). Hence, initial consumption, C_0, is determined as the ordinate to the point where the vertical line $K = K_0$ crosses the saddle path, and over time the economy moves along the saddle path, approaching the steady

[2] And therefore also the transversality condition.

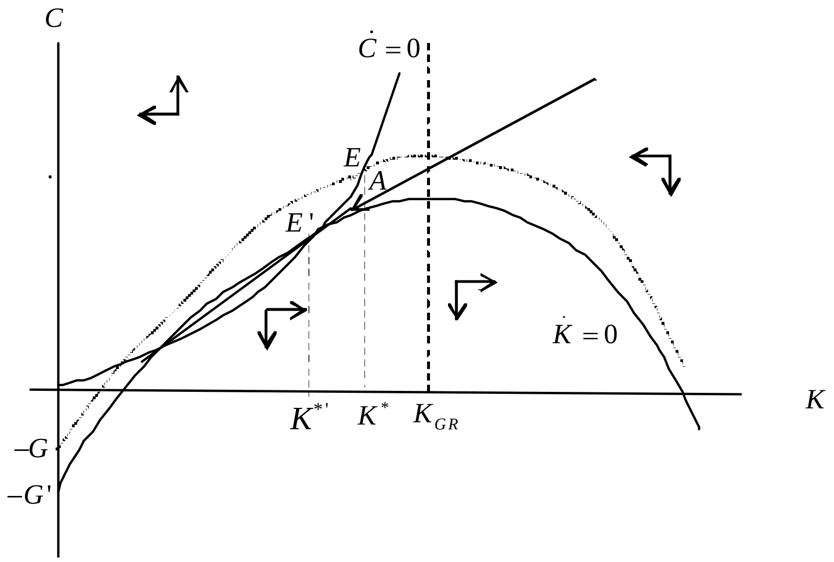

Figure 1.2:

state point E with coordinates (K^*, C^*).

c) It follows from b) that the steady state in which the economy is situated must be the steady state E in Fig. 1.1. Hence

$$r^* = F_K(K^*, N) - \delta, \tag{1.3}$$

where K^* is determined graphically under b). From the definition of $\bar{K}$ in (1.1) and the fact that $K^* < \bar{K}$, follows

$$r^* > \rho,$$

in view of $F_{KK} < 0$.

Comment: In the "corresponding" Ramsey model ($m = 0$) with logarithmic utility (and no technical progress), the steady-state interest rate is ρ. In the present model the steady-state interest rate is higher. The reason is that the positive probability of not being alive at a certain moment in the future leads to less saving, that is, less capital accumulation, smaller K^*, and thereby higher F_K.

d) In view of a balanced budget, (***) gives

$$T_t = (F_K(K_t, N) - \delta)B_0 + G. \tag{1.4}$$

In steady state we get

$$T_t = (F_K(K^*, N) - \delta)B_0 + G \equiv \bar{T}. \tag{1.5}$$

e) The change to a fully tax-financed higher G shifts the $\dot{K} = 0$ curve downwards as shown in Fig. 1.2, but leaves the $\dot{C} = 0$ curve unaffected. At time t_0 when the policy shift occurs, private consumption jumps down to the level corresponding to the point A in Fig. 1.2. So the short-run effect on consumption of the new fiscal policy is negative. The explanation is that the net-of-tax human wealth, H_{t_0}, is immediately reduced as a result of the higher current and expected future taxes.

As Fig. 1.2 indicates, the initial reduction in C is smaller than the increase in G and T. Therefore net saving becomes negative and K decreases gradually until the new steady state, E', is "reached". In the long run the decrease in C is *larger* than the increase in G because the economy ends up with a smaller capital stock. That is, in this full-employment economy a tax-financed shift to higher G crowds out private consumption *and* investment. Private consumption is in the long run crowded out *more* than one to one due to reduced productive capacity. In this way the cost of the higher G falls relatively more on the younger and as yet unborn generations than on the currently elder generations.[3]

As the question is formulated, a formula for the long-run multiplier is not needed.

f) The rise in G with a rise in T results in a budget deficit and thereby we get $\dot{B}_t > 0$. So all three differential equations that determine changes in C, K, and B are now active. These three-dimensional dynamics are complicated and cannot, of course, be illustrated in a two-dimensional phase diagram. Hence, at least a two-dimensional phase diagram analysis is no longer adequate.

g) A given fiscal policy, described by a set of spending and tax rules, is sustainable if the government can be expected to stay solvent under this policy.

No, the fiscal policy $(G', \bar{T})$ is not sustainable. There are at least three different approaches to the proof of this.

Approach 1. As $r^* > \rho > 0$, and after t_0 there will definitely not be positive net saving in the economy, we have $K_t \leq K^*$ for $t \geq t_0$. Therefore, $r_t \geq r^* > 0$, while the long-run growth rate of output (income) is zero. In this situation, a sustainable fiscal policy must, as seen from time t_0, satisfy the NPG condition

$$\lim_{t\to\infty} B_t e^{-\int_{t_0}^{t} r_s ds} \leq 0. \tag{1.6}$$

[3] This might be different if a part of G were public *investment* (in research and education, say), and this part were also increased.

This requires that there exists an $\varepsilon > 0$ such that

$$\lim_{t\to\infty} \frac{\dot{B}_t}{B_t} < \lim_{t\to\infty} r_t - \varepsilon, \tag{1.7}$$

i.e., the growth rate of the public debt is not in the long run as high as the long-run interest rate.

The fiscal policy $(G', \bar{T})$ implies increasing public debt B_t. Indeed, we have, for $t > t_0$,

$$\begin{aligned} \dot{B}_t &= r_t B_t + G' - \bar{T} \\ &> r^* B_0 + G' - \bar{T} > r^* B_0 + G - \bar{T} = 0, \end{aligned} \tag{1.8}$$

where the first inequality comes from $B_t > B_0 > 0$ and $r_t = F_K(K_t, N) - \delta \geq r^* = F_K(K^*, N) - \delta > 0$, in view of $K_t \leq K^*$. This implies $B_t \to \infty$ for $t \to \infty$. Hence, dividing by B_t in (1.8) gives

$$\frac{\dot{B}_t}{B_t} = r_t + \frac{G' - \bar{T}}{B_t} \to r_t \qquad \text{for} \qquad t \to \infty. \tag{1.9}$$

But this violates the NPG condition (1.7) and the fiscal policy $(G', \bar{T})$ is not sustainable.

Approach 2. An alternative argument is the following. Since for $t > t_0$, $K_t \leq K^*$, we have $Y_t \leq Y^* = F(K^*, N)$ at the same time as $B_t \to \infty$ for $t \to \infty$ by (1.8). Hence, the debt-income ratio, B_t/Y_t, tends to infinity for $t \to \infty$, thus confirming that the fiscal policy $(G', \bar{T})$ is not sustainable.

Approach 3. Yet another way of showing absence of fiscal sustainability is to start out from the intertemporal government budget constraint and check whether the primary budget surplus, $\bar{T} - G'$, which rules after time t_0, satisfies

$$\int_{t_0}^{\infty} (\bar{T} - G') e^{-\int_{t_0}^{t} r_s ds} dt \geq B_{t_0}, \tag{1.10}$$

where $B_{t_0} = B_0 > 0$. Obviously, if $\bar{T} - G' \leq 0$, this is not satisfied. Suppose $\bar{T} - G' > 0$. Then

$$\int_{t_0}^{\infty} (\bar{T} - G') e^{-\int_{t_0}^{t} r_s ds} dt \leq \int_{t_0}^{\infty} (\bar{T} - G') e^{-r^*(t - t_0)} dt = \frac{\bar{T} - G'}{r^*} < \frac{\bar{T} - G}{r^*} = B_0 = B_{t_0},$$

where the first (weak) inequality comes from $r_t = F_K(K_t, N) - \delta \geq r^*$, the first equality from the hint, the second inequality from $G' > G$, and, finally, the last equality from (1.3) and (1.5). So the intertemporal government budget constraint is not satisfied. The current fiscal policy is unsustainable.

h) From time t_1 an onward, because of the balanced budget, the situation is qualitatively similar to that analyzed under question b), although the government debt is at a

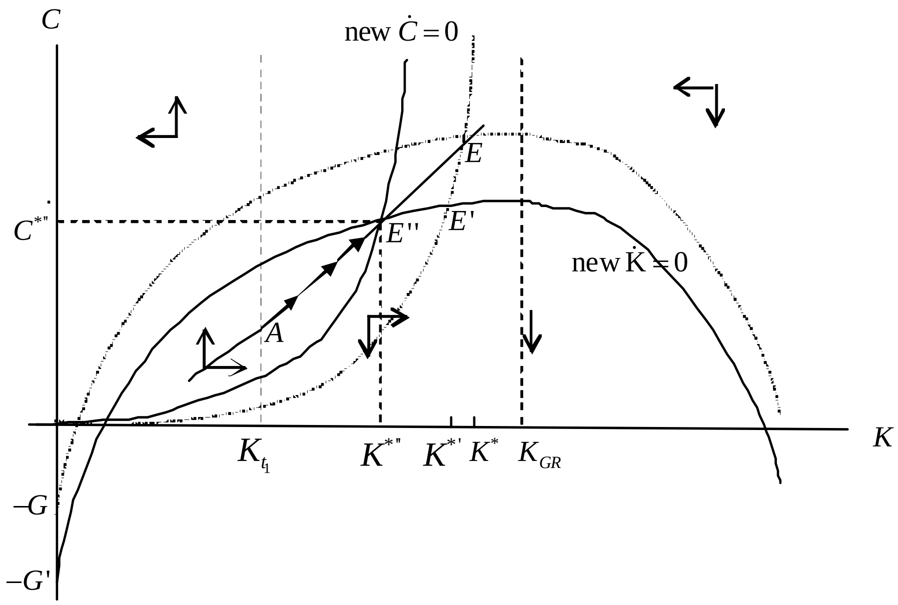

Figure 1.3:

higher level. The latter fact implies that the $\dot{C} = 0$ locus in our new phase diagram, Fig. 1.3, has moved counter-clockwise compared with Fig. 1.1.

What can we say about the new initial value, K_{t_1}? The answer depends, of course, on people's consumption-saving behavior in the time interval (t_0, t_1). This behavior in turn depends on people's expectations prior to t_1 about in what way the government would sooner or later respond to the lack of fiscal sustainability.

One possibility is that people prior to t_1 expect public consumption sooner or later to be lowered rather than taxes to be raised. In this case, immediately after time t_0, aggregate net saving in the economy will be negative because when not fearing tax increases, people maintain their consumption level. At time t_1 we thus have $K_{t_1} < K^*$ in this case.

Another possibility is that people expect taxes to be raised sooner or later rather than public consumption to be lowered - in accordance with what actually happens at time t_1. Anticipating such tax increase to arrive sooner or later, people reduce their consumption somewhat relative to its level under the old fiscal policy $(G, \bar{T})$. This reduction in private consumption after time t_0 will, however, be *smaller* than the increase in public consumption and so net saving in the economy again becomes negative after time t_0. The reason that the reduction will be smaller is the following. To reestablish fiscal sustainability, the present value of the tax increase will have to equal the present value of the rise in government spending where this present value is calculated using the government's discount rate, r_t. The households, however, have a higher discount rate, namely the actuarial rate, $r_t + m$. The households know that life expectancy is limited and that part of the future higher taxes will fall on new generations entering the economy. The current generations will therefore not decrease their consumption by as much as they would in a representative-agent model (like the Ramsey model). Hence aggregate net saving in the economy will have to be negative in the time interval (t_0, t_1). Thereby, again, at time t_1 we have $K_{t_1} < K^*$.

Let $K^{*\prime\prime}$ denote the new steady-state value of K. Depending on the length of the time interval (t_0, t_1), we may have $K^{*\prime\prime} < K_{t_1} < K^*$ *or* $K_{t_1} < K^{*\prime\prime}$. In the latter case, illustrated in Fig. 1.3, we assume that K_{t_1} is not as low, or lower, than the new $\tilde{K}^{*\prime\prime}$ corresponding to $\tilde{K}^*$ in Fig. 1.1. In both cases, after time t_1 the economy moves along the new saddle path towards the new steady-state point, E", with coordinates $(K^{*\prime\prime}, C^{*\prime\prime})$.

i) Yes, the longer the time interval (t_0, t_1) the higher tends consumption by the current generations to be because, at least in a *partial equilibrium* analysis, net-of-tax human wealth of the current generations will be higher. Although postponement of the tax increase involves a *larger* tax increase *eventually* (because of the intertemporal budget constraint of the government), the net-of-tax human wealth of the current generations *expands* by postponement. The point is again that the current generations discount expected future after-tax earnings by the rate $r_t + m$ while in the intertemporal budget constraint of the government the discount rate is just r_t.

In a *general equilibrium* perspective, feedback effects from currently lower private saving on future wages and interest rates will partly offset the tendency to lower private saving - but not offset it fully because then there would be no offsetting feedback effects in the first place.

j) Yes, in a representative agent model, like Barro's dynasty model or the Ramsey model, households (or dynasties) are infinitely lived and discount expected future after-tax earnings by the same rate, r_t, as that entering the government intertemporal budget constraint. Then the present value of expected future after-tax earnings is independent of the timing of the future taxes. And so is therefore current private consumption (this is the Ricardian Equivalence result).

2. Solution to Problem 2

The equations of the model are:

$$
\begin{aligned}
Y_t^d &= C(Y_t^p, R_t) + I(Y_t, R_t) + N(Y_t, x_t) + G \equiv D(Y_t, R_t, x_t, \tau) + G, \qquad (*)\\
&\quad \text{where } Y_t^p \equiv Y_t - \mathbb{T} \text{ and } \mathbb{T} = \tau + T(Y),\ 0 < T' < 1,\\
0 &< C_{Y^p}(1-T') + N_Y < C_{Y^p}(1-T') < C_{Y^p}(1-T') + I_Y + N_Y \equiv D_Y < 1,\\
0 &< D_Y < 1, C_R + I_R \equiv D_R < 0, D_x > 0, -1 < D_\tau = -C_{Y^p} < 0.
\end{aligned}
$$

$$
\begin{aligned}
\dot{Y}_t &= \lambda(D(Y_t, R_t, x, \tau) + G - Y_t), \qquad \lambda > 0,\quad Y_0 > 0 \text{ given}, && (2.1)\\
\frac{M_t}{P_t} &= L(Y_t, i^*), \qquad L_Y > 0,\ L_i < 0. && (2.2)\\
R_t &= \frac{1}{q_t}, && (2.3)\\
\frac{1+\dot{q}_t^e}{q_t} &= r_t^e, && (2.4)\\
r_t^e &\equiv i^* - \pi_t^e, \qquad \pi_t \equiv \frac{\dot{P}_t}{P_t}, && (2.5)\\
P_t &= P_0 e^{\pi t}. && (2.6)
\end{aligned}
$$

We are told, among other things, that the real exchange, $x_t = XP_t^*/P_t$, is a constant, x, in that X is a given and constant nominal exchange rate, and the relative price level, P_t^*/P_t, is also constant because the domestic and foreign inflation rates equal the same constant, π.

a) We consider a SOE with fixed exchange rate. Eq. (2.2) expresses equilibrium in the money market. Real money demand depends positively on Y, because Y is a proxy for the number of transactions per time unit, and negatively on the short-term nominal interest rate, the opportunity cost of holding money. Naturally, the asset markets are assumed to clear instantaneously. In view of the UIP, the short-term nominal interest rate equals the foreign short-term rate, i^*, which is assumed constant.

When the "long-term real interest rate", R_t, is identified with the internal rate of return on the consol, we have

$$q_t = \int_t^\infty 1 \cdot e^{-R_t(s-t)} ds = \frac{1}{R_t}.$$

Reordering gives (2.3).

Eq. (2.4) is a no-arbitrage condition saying that the expected real rate of return on holding the consol one time unit equals the expected real short-term interest rate, r_t^e. So there is no risk premium.

b) Rational expectations combined with absence of stochastic elements in the model implies perfect foresight. Hence $\pi_t^e = E_t\pi_t = \pi_t = \pi > 0$ for all t, implying that $r_t^e = i^* - \pi \equiv r_t$. Similarly, $\dot{q}_t^e = E_t\dot{q}_t = \dot{q}_t$. Substituting into (2.4), we get

$$\frac{1}{q_t} + \frac{\dot{q}_t}{q_t} = R_t - \frac{\dot{R}_t}{R_t} = i^* - \pi.$$

By reordering,

$$\dot{R}_t = \left[R_t - (i^* - \pi)\right] R_t. \tag{2.7}$$

Combining this with (2.1), we thus have two coupled differential equations in R and Y, respectively, where Y is a predetermined variable while R is a jump variable.

c) Given $R > 0$, (2.7) implies

$$\dot{R} \gtreqless 0 \qquad \text{for} \qquad R \gtreqless i^* - \pi, \qquad \text{respectively.} \tag{2.8}$$

As $i^* > \pi$, there exists $R > 0$ such that $R = i^* - \pi$. This non-trivial steady-state value of R is denoted $\bar{R}$. As $i^* - \pi$ is a positive *constant*, the $\dot{R} = 0$ locus (the "LM curve") is horizontal, cf. Fig. 2.1.

From (2.1) we have

$$\dot{Y} \gtreqless 0 \qquad \text{for} \qquad D(Y_t, R_t, x, \tau) + G \gtreqless Y, \qquad \text{respectively.} \tag{2.9}$$

Hence, $\frac{\partial R}{\partial Y}|_{\dot{Y}=0} = (1 - D_Y)/D_R < 0$. The $\dot{Y} = 0$ locus is thus a downward-sloping curve, named the "IS curve" in Fig. 2.1. The unique value of Y satisfying $D(Y, \bar{R}, x, \tau) + G = Y$ is denoted $\bar{Y}$.

In addition, the figure shows the direction of movement in the different regions, as described by (2.8) and (2.9). We see that the steady state point, E, with coordinates $(\bar{Y}, \bar{R})$, is a saddle point. This implies that two and only two solution paths − one from each side − converges towards E. These two saddle paths, which together make up the stable arm, are horizontal as shown in the figure. Also the unstable arm is displayed in the figure (the negatively sloped stippled line).

Since Y_0 is pre-determined, at time $t = 0$ the economy must be somewhere on the vertical line $Y = Y_0$. Since speculative bubbles are by assumption ruled out, neither the explosive nor the implosive paths in Fig. 2.1 can materialize. We are then left with the path AE (along the saddle path) as the unique solution to the model. So the economy will at $t = 0$ be at point A in Fig. 2.1 and then gradually approach the steady state, E, over time, moving along the horizontal saddle path.

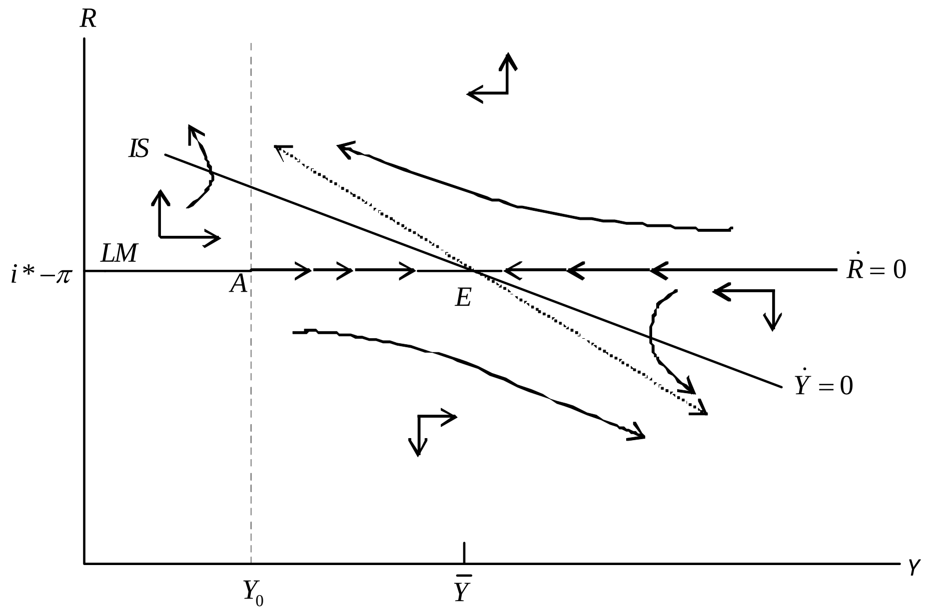

Figure 2.1:

d) We have already found the steady-state value of R, namely $\bar{R} = i^* - \pi$. The steady-state equation,

$$\bar{Y} = D(\bar{Y}, i^* - \pi, x, \tau) + G, \tag{2.10}$$

determines the steady-state value of Y as an implicit function, $\bar{Y} = f(i^* - \pi, x, \tau, G)$. We find the fiscal policy multipliers by taking the differential on both sides of (2.10) w.r.t. $\bar{Y}$, τ, and G:

$$d\bar{Y} = D_Y d\bar{Y} + D_\tau d\tau + dG.$$

This gives

$$\begin{aligned} \frac{\partial \bar{Y}}{\partial \tau} &= \frac{D_\tau}{1 - D_Y} < 0, \quad \text{and} \\ \frac{\partial \bar{Y}}{\partial G} &= \frac{1}{1 - D_Y} > 1. \end{aligned} \tag{2.11}$$

e) In view of (2.11), the upward shift in government spending, G, at time t_0 moves the IS curve (the $\dot{Y} = 0$ locus) to the right. The higher output demand results in a gradual rise in production, which further raises demand and so on. The system moves rightward along the saddle path in Fig. 2.2 and settles down in the new steady state at E'.

That the short-term nominal interest rate remains unchanged can be explained as follows. The rising G stimulates production and income and thereby the transaction-motivated demand for money is raised. This generates an incipient tendency for both the

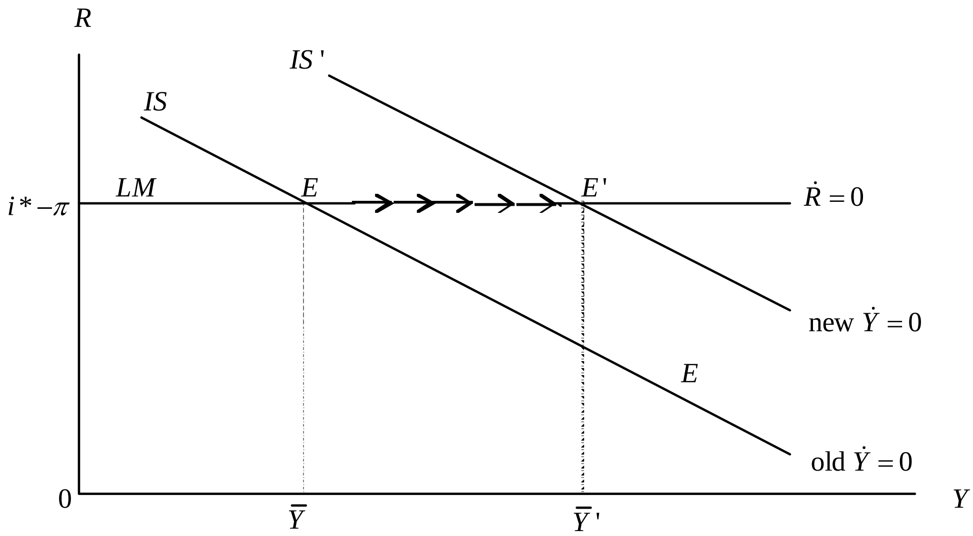

Figure 2.2:

short-term nominal interest rate and the exchange rate to rise as financial investors want to convert foreign currency into the domestic currency in order to buy domestic bonds and thereby take advantage of a higher interest rate than on foreign bonds. Owing to its commitment to maintain a fixed exchange rate, the central bank accommodates this tendency by buying bonds and foreign currency in a sufficient amount so as to avoid a rise in the short-term nominal interest rate and to maintain the exchange rate at par value.

f) Fig. 2.2 still contains the relevant phase diagram, although now the interpretation is that until time t_1, the system stays at the point E, but then the rightward movement in production takes off along the saddle path towards the new steady state. The reason that nothing happens until the rise in G actually takes place is that the anticipation itself of this event does not affect the forward-looking variable, R, which remains unchanged throughout. The explanation for this is that the foreign short-term nominal interest rate, i^*, remains unchanged, hence implying unchanged domestic short-term nominal interest rate i by the mechanism described under e) above. Since there is no anticipating response in the time interval (t_0, t_1), the phase diagram in Fig. 2.2 still describes the (Y, R) dynamics.

Fig. 2.3 illustrates by graphical time profiles the evolution of R_t, r_t, Y_t, and $m_t \equiv M_t/P_t$ for $t \geq t_0$.

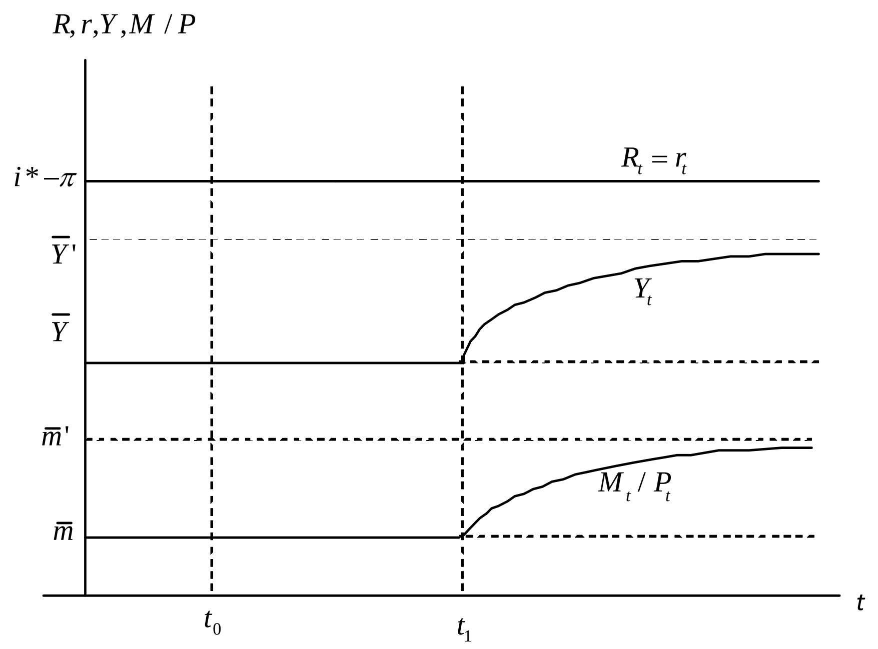

Figure 2.3:

3. Solution to Problem 3

a) False. In its pure form the expectations theory of the term structure ignores the term premium (the premium for holding long-term bonds) and predicts that the long-term interest rate will be a weighted average of the expected future short-term interest rates. The shape of the yield curve just depends on market participants' expectations of future interest rates.

b) In the light of the listed facts, we may compare the RBC theory with Keynesian business cycle theory.

A believer of the RBC theory sees employment fluctuations as fluctuations in labor supply, triggered by procyclical real wage fluctuations caused by technology shocks. In principle, this corresponds to one of the first-order conditions of the representative household in the RBC theory, namely the one concerning the trade-off between more leisure or higher labor earnings by working more when facing the wage level in a given period. But according to the stylized fact (iii), real wages are only weakly procyclical and do not fluctuate much. This fact, combined with the low labor supply elasticity found in microeconometric studies, makes fact (i) an empirical puzzle for the RBC theory. But not for the Keynesian theory within which households are often rationed in the labor market so that the mentioned first-order condition no longer involves an equality but an inequality.

Thereby there is scope for employment to be procyclical and fluctuate as much as GDP in accordance with fact (i).

When real wages fluctuate only little, a believer of the RBC theory would from the mentioned first-order condition expect a positive correlation between goods consumption and leisure consumption, that is, a *negative* correlation between goods consumption and employment. But the stylized fact (ii) tells the opposite, namely that goods consumption and employment are positively correlated. For the Keynesian theory, allowing involuntary unemployment, this positive correlation is no problem but rather to be expected.

Similarly, fact (iii) is no puzzle for Keynesian theory since under involuntary unemployment, a rise in employment does not require any immediate rise in wages.

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