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1 a) Are firms on their labor curve?

Yes. We see

$$Y_1 = A_1 N_1$$

$$\text{and } w_1/p_1 = A_1$$

which is the level of wage the firm would choose to maximize profits

$$\max_{N_1} A_1 N_1 - \frac{w_1}{p_1} N_1$$

b) Households on their labor curve?

No. The tradeoff between consumption and labor plays no role in the SR equilibrium

c) The households supply the level of labor required by the firm to produce the goods demanded by the households given prices and wages

d) LR Steady State

$$C_t = C_{t+1} = C^*$$

$$M_t/p_t = M_{t+1}/p_{t+1} = (M/p)^*$$

$$w_t/p_t = w_{t+1}/p_{t+1} = (w/p)^*$$

$$\text{let } \pi_{t+1} = p_{t+1}/p_t \quad \pi_{t+1} = \pi_t = \pi^*$$

$$1 = \beta Q^* \pi^* \rightarrow Q^* = \frac{1}{\beta \pi^*}$$
$$M/p = \xi^{1/\nu} (1 - \beta \pi^*)^{-1/\nu} C^{\gamma/\nu}$$
$$A = \bar{x} N^{\varphi} / C^{-\gamma}$$

$$1 = \beta Q^* \pi^* \rightarrow Q^* = \frac{1}{\beta \pi^*}$$

$$M/P = S^{1/\nu} (1 - \beta \pi^*)^{-1/\nu} C^{\delta/\nu}$$

$$A = X N^\varphi / C^{-\delta} = X N^\varphi C^\delta$$

$$A = X N^\varphi / (A N)^{-\delta}$$

$$A^{1-\delta} = X N^{\varphi+\delta}$$

$$N^* = (A^{1-\delta} / X)^{1/\varphi+\delta}$$

$$\rightarrow C^* = A^{1/\delta} (X N^\varphi)^{-1/\delta}$$

$$(M/P)^* = S^{1/\nu} (1 - \frac{1}{\beta \pi^*})^{-1/\nu} C^{*\delta/\nu}$$

e) The classical dichotomy does indeed hold in the long run.

• Consumption and labor choices can be determined without consideration of prices.

f) SR eq for output + money...

$$C_1^{-\delta} = \beta E Q_1 \frac{P_1}{P_2} C_2^{-\delta} \quad C_2 = C^*$$

$$\rightarrow C_1 = (\beta Q_1 P_1 / P_2)^{-1/\delta} C^*$$

$$M_1/P_1 = S^{1/\nu} (1 - \frac{1}{Q_1})^{-1/\nu} C_1^{\delta/\nu}$$

$$= S^{1/\nu} (1 - \frac{1}{Q_1})^{-1/\nu} ((\beta Q_1 P_1 / P_2)^{-1/\delta} C^*)^{\delta/\nu}$$

$$= \left(\frac{1}{S} (1 - \frac{1}{Q_1}) \beta Q_1 P_1 / P_2 \right)^{-1/\nu} C^{*\delta/\nu}$$

$$= \left(\frac{1}{S} (Q_1 - 1) \beta P_1 / P_2 \right)^{-1/\nu} C^{*\delta/\nu}$$

$$P_1 = W_0 / A_1$$

M_1 exogenous, P_2 from forward eq.

$$M_1 A_1 / W_0 = \frac{1}{S} (Q_1 - 1) \beta W_0 / A_1 / P_2)^{-1/\nu} C^{*\delta/\nu}$$

solve for Q_1

Plug P_1, M, Q back into

$$(*) \quad M_1/P_1 = \xi^{1/v} \left(1 - \frac{1}{Q_1}\right)^{-1/v} C_1^{\delta/v}$$

Solve for $C_1 = Y_1$

g) The classical dichotomy does not hold in the short run.
We see that in (*) M_1/P_1 are determined from exogenous factors, then C_1 is set by $M_1/P_1, Q_1$, thus we cannot separate money from real consumption.

h) Consider
$$M_1/P_1 = \left(\frac{1}{\xi} (Q_1 - 1) \beta^{P_1/P_2} \right)^{-1/v} C^{\delta/v}$$
 rewritten as

$$M_1 = (Q_1 - 1)^{-1/v} [\phi]$$

where ϕ are constants in this environment.

$$Q_1 = \left(\frac{M_1}{\phi} \right)^{-v} + 1$$

$$\partial Q_1 / \partial M_1 = -v M_1^{-v-1} < 0 \text{ for } M_1 > 0$$

An increase in M would decrease Q .

An increase in $Q \Rightarrow \left(1 - \frac{1}{Q}\right)$ increases
 $\Rightarrow \left(1 - \frac{1}{Q}\right)^{-1/v}$ decreases

Then from

$$M/P = \xi^{1/v} \left(1 - \frac{1}{Q}\right)^{-1/v} C_1^{\delta/v}$$

Consumption and welfare output \uparrow .

h) In words, an increase in Money supply, because it does not change prices, which are fixed by the wage, decreases the firm's marginal return to money. Because the firm aims to equalize marginal return, they demand more goods, thus output increases.

i) If A_t were to increase, given fixed wages, prices decrease. Then M/P_t is greater, leading the marginal return to drop. Thus for the same reason as in (h), consumption and therefore output increase.

j) Labor wedge

$$(1 - \tau_{+}^n) = MRS / MPL$$

$$= \frac{X N_t^{\varphi} C_t^{-\delta}}{A_t}$$

$$= \frac{X N_t^{\varphi} (A_t N_t)^{\delta}}{A_t}$$

$$= X N_t^{\varphi + \delta} A_t^{\delta - 1}$$

$$\Rightarrow A_t \uparrow \rightarrow N_t \downarrow \text{ if } \delta < 1$$

$$\Rightarrow \tau_{+} \uparrow$$

So the wedge is high. Labor is counter cyclical with Productivity.

k) To discriminate btw sticky prices and wages, we would target the labor wedge. In sticky prices world, labor is procyclical, in sticky wages, labor is countercyclical.