(1) (a) $C = w \cdot (1) + \pi - T$

$\Rightarrow \boxed{C = w + \pi - T}$

(b) Aside from "wasting consumption" which we can eliminate as an option since $U_c > 0$, the HH doesn't have a choice other than to consume all its income ie

$\boxed{C^* = w + \pi - T}$

(c) $\boxed{G = T}$

(D) $\boxed{\pi = Y - w \cdot N^D}$

(e) $\max_{N^D} \; z \cdot F(K, N^D) - w \cdot N^D$

FOC: $\boxed{z F_N = w}$

(f) A CE for this economy is:

A set of endogenous quantities C, Y, ℓ, N, T, π and endogenous price w given exogenous variables G, z, K

Such that:

1. The repr. consumer solves the Consumer's Problem

2. The repr. firm solves the Firm's Problem

3. The government satisfies its Budget constraint

4. The labour market clears
5. The goods market clears

(g) $1 = N^D$ labour mkt

$Y = C + G$ goods mkt

(h) $C = w + \pi - T$ (BC)

then in eq$\underline{m}$,

$\pi = Y - w \cdot (1) = Y - w$

$G = T$

$\Rightarrow$ sub into BC

$$C = W + (Y - W) - G$$
$$= Y - G$$

$$\Rightarrow \boxed{C = Y - G}$$

(i) $C = Z \cdot F(K, N) - G$

$$dC = F \cdot dZ + Z \cdot F_K \cdot dK + Z \cdot F_N \cdot dN - dG$$

(j) want $\left.\frac{dC}{dG}\right|_{dZ=0,\, dK=0} = \frac{\partial C}{\partial G}$ if implicit fn theorem holds

set $dZ=0$, $dK=0$. Also, since

$N=1$, $dN=0$

$$\Rightarrow \boxed{dC = -dG}$$

ie $\Delta C = -\Delta G$

(k) from $C = Y - G$,

$dc = dy - dG$

Since $dc = -dG$ from above,

$$\boxed{dy = 0}$$

(L) No, in this model economy, consumption is "completely crowded-out" by government spending.

In the Willamson Ch.5 model, labour supply was endogeneous, and in response to the ΔG, due to the normality of leisure, $\ell \downarrow$'d and $\therefore$ $N \uparrow$. This $\uparrow N$ meant that $Y \uparrow$'d, since $Y = z \cdot F(K, N)$. As a result, since $Y \uparrow$'s, there is "more output" to divide up between $C+G$, and so C can $\downarrow$ less than G $\uparrow$'s.

In this model economy however, labour supply is <u>not</u> endogenous, and $\therefore$ there is no $\uparrow$ in N in response to the $\uparrow G$. $\therefore$ Y doesn't change, and C must $\downarrow$ to offset any $\uparrow$ in G so that the resource constraint of the economy $C+G=Y$ still holds.

(m) $z \cdot F_N(K,N) = w$

$F_N \cdot dz + z \cdot F_{NK}\, dK + z \cdot F_{NN} \cdot dN = dw$ (A)

$\frac{\partial N^D}{\partial w}$ implies $dK=0, dz=0$

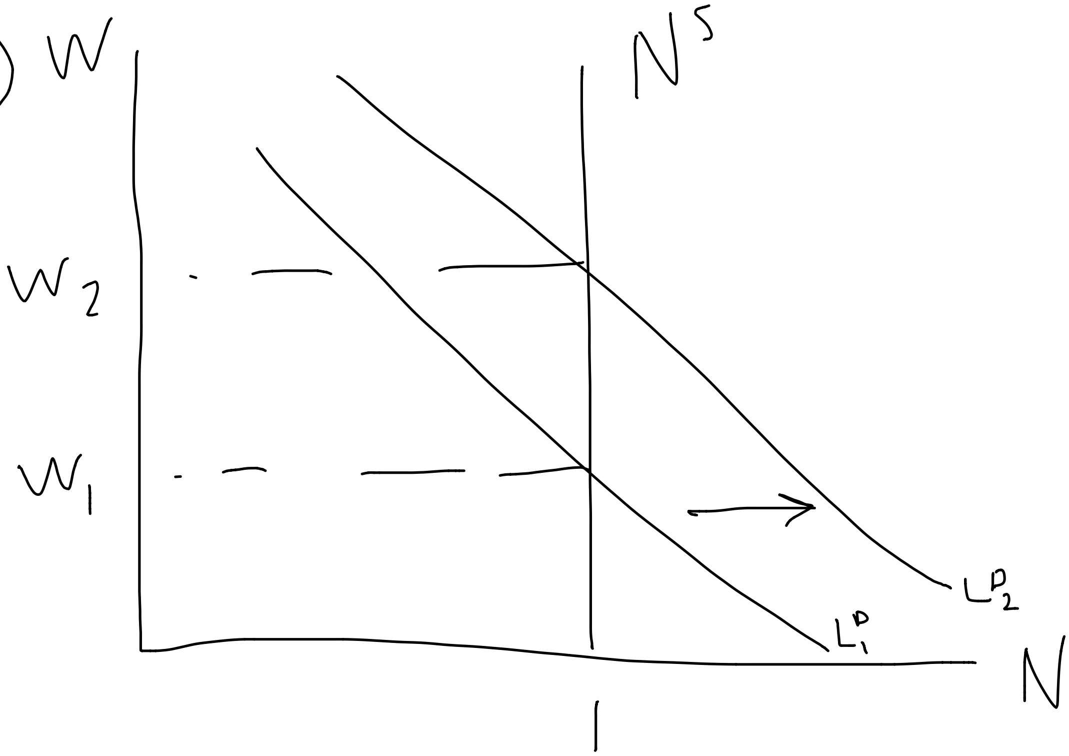
$$\Rightarrow \left.\frac{dN}{dw}\right|_{dK=0,\, dz=0} = \frac{\partial N}{\partial w} = \frac{1}{z \cdot F_{NN}} < 0 \text{ since } F_{NN} < 0$$

(N) from (*), set $dw=0$, $dK=0$

$$\frac{\partial N}{\partial z} = \frac{-F_N}{z \cdot F_{NN}} > 0 \text{ since } F_{NN} < 0$$

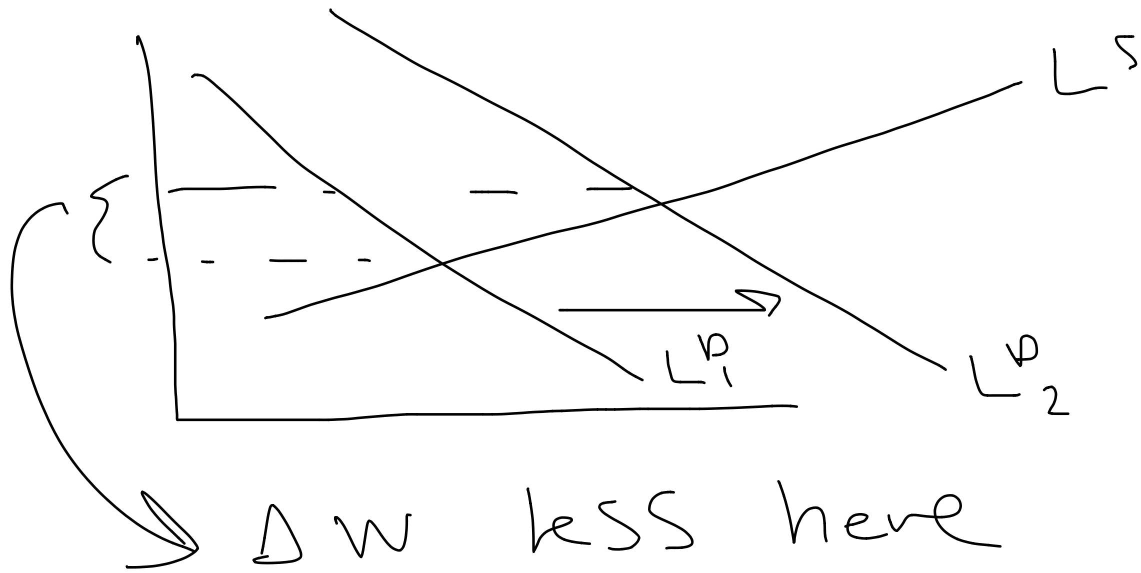
$\Rightarrow \uparrow$ TFP shifts lbr. dmd curve right

(o)



(P) From above, $\uparrow z$ shifts lbr. dmd curve to right, & w $\uparrow$'s. Since L^S is vertical, $\uparrow$ in w is large compared to an alternate

Scenario where N^S has low slope ie



Δw less here compared to vertical L^S

As such, the model with vertical L^S would yield a w that moves a lot as Y Δ's with ΔZ, implying it would be strongly procyclical.

(g) While we could calculate a more detailed theoretical corr. coefficient, for this question it is enough to say that 0.12 is moderately procyclical, yet our argument above claimed w would likely be strongly procyclical. So no, the result is <u>not</u> consistent.

(2)

(a) $c = w(h-\ell) + r \cdot K^s + \pi - T$ where $K^s \leq K_0$

(b) $\max\limits_{c,\ell,K^s} u(c,\ell)$

$\quad$ st $c \leq w(h-\ell) + rK^s + \pi - T$

since $u_c > 0$, must have that $K^s = K_0$

and $\therefore$ BC holds with equality

FOC:

$$u_\ell = u_c \cdot w$$

$$c = w(h-\ell) + rK_0 + \pi - T$$

(c) $G = T$

(D) $$\max_{N^D, K^D} \pi = Y - w \cdot N^D - rK^D$$

where $Y = z \cdot F(K^D, N^D)$

FOC:

$$z \cdot F_N = w$$

$$z \cdot F_K = r$$

(e) $$\pi = Y - w \cdot N^D - r \cdot K^D$$
$$= Y - z \cdot F_N \cdot N - z \cdot F_K \cdot K$$
$$= Y - z \cdot (F_N \cdot N - F_K \cdot K)$$

Since $F(\cdot)$ CRS, from Euler's Theorem

$$F = F_N \cdot N + F_K \cdot K$$

So $$\pi = Y - \underbrace{z\{F(\cdot)\}}_{Y}$$

$$= 0$$

$\boxed{\pi = 0}$ Zero Economic profits

(f) Set of endog. variables C, Y, ℓ, N, K, T, π & exog. variables G, Z, K_0 & endog. prices w and r such that

(1) Consumer solves Consumer's Problem

(2) Firm solves firm's problem

(3) Govt satisfies its BC

(4) Labour mkt clears

(5) Goods mkt clears

(6) Capital services mkt clears

(G) $N^S = N^D$ lbr

$Y = C + G$ goods

$K_0 = K$ capital services

(H) $C = w(h-\ell) + rK_0 + \pi - T$

$$= wN + rK + Y - wN - rK - G$$
$$= Y - G$$

$$\Rightarrow \boxed{C = Y - G}$$

(I) $C = z \cdot F(K, h - \ell) - G$

(J) From HH problem,

$$\frac{u_\ell}{u_c} = MRS_{\ell c} = \underbrace{w = MPN}_{\text{from firm's problem}}$$

From PPF, slope $\equiv MRT_{\ell, c}$

$$-MRT = \underbrace{\frac{dc}{d\ell} = -z \cdot F_N}_{\text{from PPF above}} = -MPN$$

$\therefore$ $MRS_{\ell c} = MRT_{\ell c} = MPN$

Same conditions as social optimum, so yes, CE here is optimal

(k) No. let $S_N = \frac{wN}{Y}$

and $S_K = \frac{rK}{Y}$

$$S_N + S_K = \frac{rK + wN}{Y} = \frac{zF_K \cdot K + z \cdot F_N \cdot N}{Y} = \frac{Y}{Y} = 1$$

$\Rightarrow$ Payments to labour and capital exhaust income $\rightarrow$ no fractional of output left over.

(l) No. There, like here, payments to labor & capital exhaust output $\rightarrow$ the only difference is who owns capital.

In Williamson, the firm owns K so the firm in effect collects the payments to capital by retaining the excess of its revenues over labour. ie

$$\pi = Y - wN$$
$$= Y - zF_N \cdot N$$

which by Eulers Theorem)

$$= Y - z[F - F_K \cdot K]$$
$$= Y - Y + z \cdot F_K \cdot K$$

$$= MP_K \cdot K$$
$$\equiv \text{Payments to capital.}$$

ie when the firm owns K, it collects the marginal product of capital per unit of K (Note though this ultimately flows to HH through π)

In contrast, when the HH owns K, it collects the payments to capital.