SUMMARY OF PROBLEMS W/ THEORETICAL MODEL

① Our model

GE: $$\max_{K_1, L_1, S} \sum \beta^t \left[P_t^c A_{1,t} K_{1,t}^{\alpha_1} L_{1,t}^{\alpha_2} S_t^{\,1-\alpha_1-\alpha_2} - W_t L_{1,t} - R_t K_{1,t} - P_t^{IT} IT_t \right]$$

[abstract from spillover for now] $\quad A_{1,t} = \eta_t \psi_t$

Google: $$\max_{K_2, L_2} P_t^{IT} A_{2,t} K_{2,t}^{\phi} L_{2,t}^{1-\phi} - W_t L_{2,t} - R_t K_{2,t}$$

$$A_{2,t} = \eta_t \lambda_t$$

s.t. $K = K_1 + K_2$

$L = L_1 + L_2$

$K_{t+1} = (1-\delta_K) K_t + I_t$

$S_{t+1} = (1-\delta_S) S_t + IT_t$

$Y_t = C_t + I_t$

(2) GHK (Greenwood, Hercowitz, Krusell 1997)

HHs: $\max_{c,h,k_e,k_s} u(c,h) = \ln c - \chi h$

s.t. $-c - \frac{1}{q}k'_e - k'_s + R_e k_e + R_s k_s + wh + (1-\delta_e)\frac{1}{q}k_e + (1-\delta_s)k_s = 0$

Firms: $\max \; z k_e^{\alpha_e} k_s^{\alpha_s} h^{1-\alpha_e-\alpha_s} - wh - R_e k_e - R_s k_s$

$c + i_e + i_s = z k_e^{\alpha_e} k_s^{\alpha_s} h^{1-\alpha_e-\alpha_s}$

$i_s = k'_s - (1-\delta_s)k_s$

$i_e = \left[k'_e - (1-\delta_e)k_e\right]\frac{1}{q_t}$

k_s := "structures"; the usual kind of capital

k_e := "equipment"; the more productive capital

z := TFP exog. AR(1) w/ exog growth rate γ_z

q := productivity of e, exog AR(1) w/ exog growth rate γ_q

$\rightarrow$ $\frac{1}{q}$ = relative price of e by definition

(3) Oulton (2010) (see also Oulton 2007...?)

$$y_c = B_c\, h^{1-\alpha-\beta}\, k_c^{c\ \alpha}\, k_{ICT}^{c\ \beta}$$

labor skill

stock of IT used in cons. sector

TFP in cons. sector grows at rate μ_c

stock of capital used in cons. sector

$$y_{ICT} = B_{ICT}\, h^{1-\alpha-\beta}\, k_c^{ICT\ \alpha}\, k_{ICT}^{ICT\ \beta}$$

TFP in IT sector, grows at rate $\mu_{ICT} > \mu_c$ by ass.

$$K_c = K_c^c + K_c^{ICT}$$

$$K_{ICT} = K_{ICT}^c + K_{ICT}^{ICT}$$

$$\dot{K}_c = I_c - \delta_c K_c$$

$$\dot{K}_{ICT} = I_{ICT} - \delta_{ICT} K_{ICT}$$

$$Y_c = C + I_c$$

$$Y_{ICT} = I_{ICT}$$

$$p = P_{ICT} / P_c$$

And HHs max c & a (assets) getting $\frac{\dot{c}}{c} = \frac{1}{\theta}(r-\rho)$.

Labor (H) exog, grows at the rate n

labor skill / hour, h, grows exog. at g_h.

	Our model	GHK	Oulton
THEORY	• Can derive that p^{IT}/p^{c} won't move after a news shock until the shock materializes	• q only moves in response to IT prod. shocks by definition.	• Can derive that $p = \mu_C - \mu_{ICT} < 0$ ↳ p won't move after a news shock until TFP moves.
MATLAB	• explodes even w/o spillover & st.st is wrong	• explodes & st.st. is wrong	• haven't done

↳ for both I think the reason is that I stationarize wrong

- either you treat exog. growth stuff as variables w/ a LoM and then you have at least 3 or 4 different growth rates that I don't know how to treat
- or you shut off growth in which case there's something that's overdetermined or not determined at all → PTO!

in GHK, I've solved the model & implemented in Matlab 2 different ways:

1.) growth → explodes

conceptual problem: we get γ_q, γ_z, g_e and g → hard to get the relationship between these right; stationarizing is not correct; also an issue of how they stationarize and an issue of net vs. gross growth rates.

2) growth in a reduced 1-sector model ($\approx$ RBC)

→ works

↳ the problem really comes from things growing at different rates.

⇒ But: if you shut off growth, then q is undetermined; it can be set exog. as a parameter but shocking that doesn't make sense.

⇒ So what's my conclusion so far?

1.) To do the model right on Matlab, 2 options

- either do growth & get the 2-sector stationarization right (reasonable!)
- take out growth & shock levels (although for a 2-sector model I'm doubtful b/c this seems to take out all the action)

2) I think we might be able to proceed pencil & paper: our model & Oulton gets the result that

rel. prices = differences in TFP across sectors (more or less) → RP won't move after a news shock until the shock hits TFP .... which we know from our VAR is after ≈ 20 quarters! A 0-restriction on RP <u>before 20 quarters</u> makes sense!