Work after

1) I wasn't computing the TC correctly b/c I'm using last H periods, should feed in $hx^J s_t$ for shocks $\{\varepsilon_t\}_{t-H}^{T}$.

2) If I don't impose TC, should impose TR w/a res, or w/o a res but then have a res in A1 or A2.

3) Should check the fsolve thing.

2) Adding TR as a residual eq doesn't change much at all for $\{\pi, x, i\}_t$! (stopped prematurely.)
Making the norm the loss concept however gets me much closer to the Taylor-rule!
Adding TR as a res did bring things closer to the TR-outcome for $\{x, i\}_t$ as input. Here the norm doesn't make a big diff. (stopped prematurely).
Adding TR for $\{i_t\}$ as only input. (local min but VERY unstable.) For norm unstable too, stopped prem.
But it no longer blows up in my face :)

1) Computing the anch TC w/ correct E(·) doesn't change things. Does the norm? It finds a local min, but a strange one. (Both for $\{i_t\}$ only.)

For $\{x_t, i_t\}$, norm or no norm makes no diff, but I'm in general much closer to TR than before, if I initialize there. If not, then further.

For $\{\tau_t, x_t, i_t\}$ as input, I got the same as before. ↗ w/ norm almost the same.

Not if I initialize at TR, I get a strange local min.

With norm too.

↳ Either the method is unstable or I'm not quite doing it correctly

→ Tomorrow: do fsolve thing

✓. Fix H

✓. Fix too long fig titles

✓. Fix fsolve for TR & RE-TC → fixed! (resids are not defined for $t=1$)

- String is f' up w/ the anch-TC.

↳ Or: I don't know if the sol. procedure is unstable, or if I'm doing sthg wrong.

8 April 2020

Back to VFI: Eric Sims does it by sayin' plug in the constraint to rewrite the problem as a fct of the future state:

We had: $V^{t+1}(k_t) = \max_{c_t} \ln(c_t) + \beta V^t(k_{t+1})$

$$\text{s.t. } k_t^\alpha - c_t \geq k_{t+1}$$

$$\rightarrow c_t = k_t^\alpha - k_{t+1}$$

$$V^{t+1}(k_t) = \max_{k_{t+1}} \ln(k_t^\alpha - k_{t+1}) + \beta V^t(k_{t+1})$$

Rewrite in terms of k, k'

$$V^{t+1}(k) = \max_{k'} \ln(k^\alpha - k') + \beta V^t(k')$$

Ok that's fine but I'm stuck – we need the grid for k_t nonetheless! In the nonstochastic world, we just need no evaluation of expectations and possibly no markov chains.

Btw, Eric Sims calls the choice of k' the policy fct. But I guess that's isomorphic w/ choosing c_t.

I've found Collard's value function iteration notes (value_function_Collard_lecture07.pdf)

↝ it seems to suggest that you use the grid for k and k'

for $i = 1 : n_{grid}$

$k_t = kgrid(i)$

for $j = 1 : n_{grid}$ * there's a complication, but ignore for now.

$k_{t+1} = kgrid(j)$

$c(i,j) = c(k_t, k_{t+1}) \rightarrow u(i,j) = u(c(i,j))$ $n_{grid} \times 1$

end

$j^* = \max[\, u(c(i,j)), 2]$

$k_{t+1}^* = kgrid(j^*)$

$V^{new}(i) = u(c(i,j^*)) + \beta \cdot V(j^*)$ (1×1; $V(j^*)$: 1×1)

end

$crit = \max(abs(V^{new} - V))$

Actually Collard does this

$c(i,:)$ is c when $k_t = kgrid(i)$, and for all k_{t+1}

$1 \times n_{grid}$

$\rightarrow util(i,:) = u(c(i,:))$ $1 \times n_{grid}$

$[V^{new}, j^*] = \max[\, u(c(i,:)) + \beta V(:)\,]$ ($n_{grid} \times 1$)

* The additional complication is that $c_t, k_{t+1} \geq 0$

$c_t > 0 \Rightarrow c_t = k_t^\alpha - k_{t+1} > 0$

$k_{t+1} > 0 \Rightarrow$ $\boxed{k_t^\alpha > k_{t+1} > 0}$

The grid makes sure that $k_{t+1} > 0$, but I need to check that k_{t+1} Bin't $> k_t^\alpha(i)$ for each i.

Collard's VFI notes are helpful b/c 9 April 2020
they clarify what the maximization means and what $V(k_{t+1})$ means. $V^{old}(k_{t+1})$ just means $V^{old}(:)$ for all values of the kgrid (k_{t+1})
Similarly, you evaluate $c(k_t(i), :)$ for all values of the kgrid (k_{t+1}).
The maximization then is just to choose the index j^* that max $U(c(k_t(i), :) + \beta V^{old}(:)$,
and that for each i. So $k_{t+1}(i) = kgrid(j)$.
and $V^{new}(i) = U(c(k_t(i), j^*) + \beta V^{old}(j^*)$.

FSOLVE / FMINCON

↳ Could try to attack from several, or smart initialization points.

A potential problem for the anchoring TC: overparameterized?

I input T+H = 60 periods, but I can exclude only T residuals.

① Comparing FSOLVE vs. FMINCON

① 1 Taylor-rule

Fmincon usually gets more solutions, even when fsolve says no sol.

① 2 RÉ-TC

Same

① 3 Anch-TC

Same.

I think this just means that fmincon is a little more easy-going w/ the sol. crit, since fsolve seeks to set $F(x) = 0$, while fmincon just tries to min $F(x)$

FSOLVE never finds a sol (it stalls once: $\{x, i\}_t$ in RE-TC, rand init.)

FMINCON always finds at least 1 or 2 local mins.

But they are of 3 groups

- nonsensical: extremely volatile & huge
- really close to TR
  - ↳ for TR & RE-TC → makes sense
    - b/c you're either implementing the TR
    - or the TR is a good implementation of RE-TC
- less volatile for x & i and more for π for anch-TC
  - ↳ anch-TC calls for a less aggressive TR!

I actually think I should prioritize the "approximating the reaction function" approach of Peter over the value function iteration b/c it's more promising in terms of results.

But first I try reoptimizing by inputting the first $\{i^*_t\}$ as an initial guess for $\{i_t\}$.
→ doesn't work either.

command_approx_reaction.m

Problems:

- ✓ g_{π} is blowing up → a problem for the previous exercise too.
- Besides, in previous ex., was still evaluating the anchTC wrong b/c at each t, need to account for CB's E( ) of future shocks
- Loss isn't decreasing in any direction.
- ✓ forgot $g_{\bar{\pi}}$.

$$\frac{\partial}{\partial \pi} \frac{1}{(dfe)^2} = \frac{\partial fe}{\partial \pi}\left(-2\frac{1}{(dfe)^2} fe^{-1}\right)$$

$$= 2\frac{1}{(dfe)^2} fe^{-1} \leftarrow =: g_{\bar{\pi}}^{-1}$$

The problem w/ this is that $fe^{-3} \to \infty$ if fe is small.

I've inverted g_π and $g_{\bar{\pi}}$ b/c in the materials, I've defined $k_t^{-1} = g(\cdot)$, while in the code I have $k_t = g(\cdot)$.

Next: need to be smart about anchoring fe. Correct combination of anchTC in the festive/frivolous exercise. Regenerate.

$$fe = \pi_t - (\bar{\pi}_{t-1} + bs_{t-1})$$

$$k_t = g(fe) = \frac{1}{dfe^2}$$

$$k_t^{-1} = g(fe)^{-1} = dfe^2$$

$$\frac{\partial k_t^{-1}}{\partial \pi_t} = 2dfe =: g_\pi \quad \text{vs.} \quad g_\pi^{-1}$$

$$\frac{\partial k_t^{-1}}{\partial \bar{\pi}_{t-1}} = -2dfe =: g_{\bar{\pi}} \quad \text{vs.} \quad g_{\bar{\pi}}^{-1}$$

- Still loss isn't decreasing
- Still TC eval is wrong for previous.
  ↳ While I fixed that now – it takes waaay longer to run → 25-30 min?
  → Took 17 minutes! (47 iter)
  Or up to 30!

While it's running, let's work thru Bellard's VFI

$$u(c) = \frac{c^{1-\theta} - 1}{1-\theta}$$

$$k' = k^{\alpha} - c + (1-\delta)k$$

$$\Rightarrow V(k) = \max_{c} \frac{c^{1-\theta}-1}{1-\theta} + \beta V(k'), \text{ or,}$$

plugging in $\text{con}(k)$ for c,

$$V(k) \max_{k'} \frac{\left(k^{\alpha} + (1-\delta)k - k'\right)^{1-\theta} - 1}{1-\theta} + \beta V(k')$$

Let's make sure that for no grid value of $k(i)$, $k'(j)$ is $c < 0$ → for any $k(i)$, $k_{(i)}^{\alpha} + (1-\delta)k(i) - k'(j) \overset{!}{\geq} 0$

I think I'm still evaluating the TC wrong 10 April 2020
- in all exercises, b/c if you input zero innovations, that's gonna change f_A & f_B too. NO - it's correct b/c those are f_B & f_A that the CB expects people to have. Phew!

Now I have the problem that sim_learnLH.m doesn't work. It doesn't produce IRFs, and the simulation doesn't seem to converge to RE either.

Sorry - it was b/c I turned γ_{LP} of shocks to 0. IRFs are working.

And sorry, it is converging, I plotted diff and it does.

I'm cleaning up!

sim_learnLH.m is no longer touched!

sim_learnLH_clean.m = simlearnLH.m and is meant as a basis for subsequent work. (materials24.m

compares the two.)

sim_lcavLH_clean_smooth.m is meant for the smooth anchoring function only!

Ryan meeting 10 April 2020

→ should get a resid of zero if init at Taylor rule sequence.

→ feed fsolve the T residuals and not the square and the level

whereas fminicon will need the square.

Don't use fminicon b/c it takes lots of info and since it uses a scalar

lsqnonlin

↳ similar to fminicon

Fsolve is the way to go when you know a resid of 0 exists. Else lsqnonlin b/c it won't hit 0.

fsolve

1st thing to check: # of exog vars & # equations

→ you can check that mistake in EE or in the last period

A brute force: if $T = 200$, $H = 100$, then at $t = 150$, the $E(\cdot)$ in 2nd line of (B.1) is fixed.

An implementable TC sounds interesting for a discussion. It can also be an option for this optimization. But it's not a concern for the CB unless communicating w/ the public is a concern.