

MOVING THE NEXT NOTES
to the iPad.

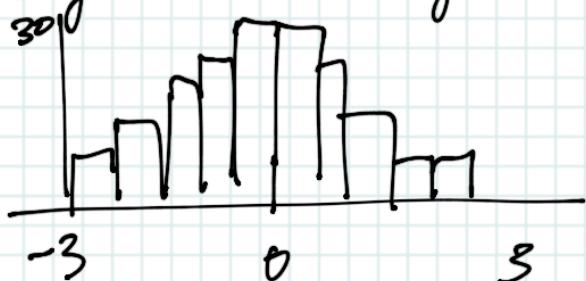
10 August 2020

So: trying to generate truth w/ more action in expectations (R, b).

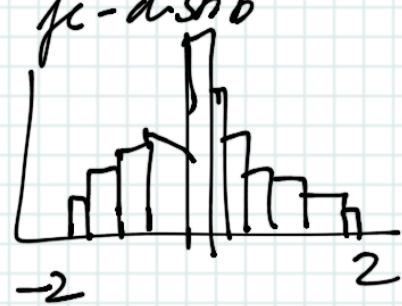
Observed:

- 1) If you increase the α -support, α 's in the simulation become more tight around zero, and extremes are smaller. (E.g. $\alpha \in (-2, 2)$ vs. $\alpha \in (-0.5, 0.5)$).
- 2) If you scale up α 's, α -distribution becomes more spread out: fatter tails

E.g. 4. α^{true} gives the following α -distrib



instead of
being like



and $\bar{\alpha}$ fluctuates much more.

Estimating $\hat{\alpha}$

- loss was initially much smaller 4.95 instead of on the order of 4000.
- estimation gets a lot of "fe was nan" messages and also a new one: "obj function returned NaN, trying a new point". Then...
 - ↳ I already got this message 9 times
- It took 585 sec.
- Implied k^{-1} is < 0 4 times!
 - maybe that's for negative k ?
- Again, $\text{loss}(\hat{\alpha}) = 3.2 < \text{loss}(\alpha^{\text{true}}) = 416$.
- Not possible to evaluate loss function?!
- ↳ It seems to be nans everywhere?
 - Is that why the loss just returned nan b/c all simulations were nan in the cross-section?
- Look at the loss: it sucks:
 - for α_1, α_5 , it's apparently always nan
 - for α_2, α_4 it blows up
 - for α_3 , it's oscillatory.

Any $\alpha > 0.5$ gives all nans. Maybe that's b/c since the truth is higher, it more quickly explodes?

- I'm not shocked that many histories explode.
- Also very many VAR instability problems.

$\hat{\alpha}$'s do more or less peak at the truth even now.
 (well, $\hat{\alpha}_3$ doesn't and $\hat{\alpha}_1$ & $\hat{\alpha}_5$ have 2 minima around the true value, but still)

→ Does this indicate that the data-generation is wrong or the estimation?

- True moments changed very much:
 - moments pertaining to x scaled up, ones pertaining to π or i scaled down / were unchanged
 - own moments or cross-moments w/ π or i have the same shape
 - cross-moments w/ x have changed shape:
 are now more U- or reverse U-shaped.

↳ I think these make sense b/c since κ is low, and $i = 1.5\pi$, x is the one that absorbs movements in expectations, while the pass-thru to π and to i is small.

⇒ The data-generation I think is correct. But this kinda suggests that the mean moments are also (more or

(loss) computed correctly, of which I'm not convinced.

↳ Let's try an estim w/ $\eta_x = 0.5$.

- But suppose the data is generated correctly. Why isn't the "x absorbs all" mechanism catchable by the estimation? I mean, moments didn't move far from initial ones.

↳ Explosion % reveals that in the estimation, either 0% or 100% of the N simulations explode. No, sometimes it's 19, 79 or 99%. And it seems that the obj fct returns nan' when 100% explode. Yes.

I learn also, by the way, that each ite of the solver evaluates the loss function exactly 6 times.

→ Why? It's not changing α , or if it is, only one and only marginally.
I'm also noticing that it's only considering α 's really close to $\alpha_0 \Rightarrow$ multistab!

I'm also noticing that the simulation is not giving the 'f' was nan' error most of the time, even though the solver gets a positive expl-percent. Hm!

Ask Ryan →

When the "fe was nan" error comes, then the explosion-counter does catch it. But apparently there are a bunch of explosions that come not from there.

Ok, it's clear: when fe is nan, it's always caught.
The other thing that causes "explosive" simulations is $k^{-1} < 0$. These get caught and register as explosions, but aren't really.

→ My check for "global nonnegativity" and wasn't catching everything!

Her ho : That's where the troubles start.

⇒ Initially, fe is nan (maybe the gain is too high) but then the bulk of the supposed explosions come from $k < 0$.

Ok... even when fe is nan it seems it's b/c or at the same time as $k < 0$...

→ It's at the same time. The initial iteration involves 5% "fe was nan" (5/100 simulations) but 100% have $k < 0$ at one point!

Let's see for the July 6 dataset ... and yes,

the initial iters involve 1% fcnan

69% $k < 0$

and later iters have 2% fcnan

86% $k < 0$

Converges after 23 iter.

Has no more problems after iter 5.

Why is fe often nan early in the search and not later? Is it b/c of the initial values x_0 ?

And could a finer, and more broad fe-grid for
the global nonnegativity test work?

! \hookrightarrow I introduced the variable broaden=2,
which extends the fegrid-file by \pm broaden at
both ends. It seems like this catches & subsumes
all the previous errors!

It still finds the same min though :S
(But at least it's 2/3 of the time)

If I make the loss fct=nan when $k < 0$ globally, I can
engineer the "Obj fct returned nan" error message.

Does this influence the estimate? (Previously I had set the objective to $1e+10$) No it doesn't.

→ I don't think so but it does affect the plots of the loss I would think!

Let's go back to the scaled-up truth and plot the loss. Should understand why $k < 0$: is it, as I think, that d isn't convex and so a f_e outside the grid is extrapolated to a $k < 0$?

The other thing is that this doesn't seem to really affect the behavior of the loss fit. It still converges to the same (wrong) thing. Actually, for the 4x4 truth, it converges to something different, but most likely that's b/c it took an avg of a smaller set.

The loss: $k < 0$ and $f_e = \text{nan}$ return. Does that mean that fgrid-fine needs to be over broader?

Not necessarily b/c now it happens that e.g.

$f_e = \text{nan}$ in 14%

but $k < 0$ in 0%.

In fact, $k < 0$ doesn't happen a lot! f_e is the problem here!

Why is it that for the estimation, k_{20} is the root of all evil, but in plotting the loss, suddenly $\text{je} = \text{van}$ becomes the problem #1? Is it that the estim avoids high α 's (or maybe also very low ones) that could cause turmoil?

Materials 40, Section 4: Look into behavior of simulation. I think I learn a lot from this. Fig 7, which shows means & distros of k^{-1} , $\bar{\pi}$ and je are indicative.

- 1) While k^{-1} spends a lot of time being near 0 (see histogram), $\text{mean}(k^{-1}) \approx 0.0185$ (see means)
↳ If the moments capture the latter aspect, then the estim should have a hard time pushing α_s down.
But the moments should more capture the first.
Moreover, what does it matter if $\text{mean}(k^{-1}) = 0.013$?
It still can enter the lower parts of its state space, and it does! So scrap that.
- 2) The cross-sectional mean of $\bar{\pi}$ & of $\text{je} \downarrow$ as $N \uparrow$.
Maybe this is why $\text{loss} \uparrow$ in N ?
I'm not sure this should happen! →

As $N \rightarrow \infty$, $\epsilon \rightarrow 0$. So $f_e \rightarrow 0$ and thus \bar{x} too.

But that means that mean moments will reflect a sim in which \bar{x} isn't moving much, and f_e are very small.

Now turn to changing α 's: do the following exercises:

- $\alpha = \alpha$
- More edges: $\alpha_1 \& \alpha_5$
- More middle: $\alpha_2 \& \alpha_4$
- More O-point: α_3

Obs. 1: If all α 's ≤ 0.1 , simulation doesn't blow up.

At 0.11, they do. (2 occurrences of "f_e was nan", one of which was also $k_{t-1} < 0$)

Obs. 2: $\alpha = 0$ doesn't cause explosions.

Obs 3: In the early scenarios, "f_e was nan" is the only message. In the late ones, it comes together w/ " $k_{t-1} < 0$ ". Does this mean that $k < 0$ when α_3 is large?

↳ Making the code output α suggests that:

- "f_e was nan" alone occurs when $\alpha_1 \& \alpha_5 \geq 0.11$
- "f_e was nan" + " $k_{t-1} < 0$ " occurs when $\alpha_2 \& \alpha_4 \geq 0.11$

- α_3 doesn't shift any water: it can also be 0.5, that doesn't cause explosions. (0-neighborhood indifference problem)

- these seem to occur across shock histories.

Now let's look at the plots of the means:

Scenario 1: Varying α_1 and α_5 : 0, 0.05, 0.1

- Shifts k^{-1} up from $(0.01, 0.02)$ to $(0.02, 0.03)$
- Shifts $\bar{\pi}$ from $(-0.01, 0.01)$ to $(-0.02, 0.04)$
- Barely shifts f_e : it remains in the $(-0.2, 0.2)$ range

Scenario 2: Varying α_2 and α_4

- Shifts k^{-1} up from $(0.005, 0.001)$ to $(0.05, 0.06)$
- Barely shifts $\bar{\pi}$: it remains in the $(-0.01, 0.03)$ range
- Barely shifts f_e : it remains in the $(-0.2, 0.2)$ range

Scenario 3: Varying α_3 :

- Shifts k^{-1} up from $(0.015, 0.02)$ to $(0.05, 0.06)$
- Barely shifts $\bar{\pi}$: it remains in the $(-0.01, 0.03)$ range
- Barely shifts f_e : it remains in the $(-0.2, 0.2)$ range