Information, heterogeneity and market incompleteness by Liam Graham and Stephen Wright

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Intro

- Wonderful paper, enjoyed reading it
  - testing endurance, however: main text 36 pages, appendices 34 pages.

- Covers a rich set of issues on information, market incompleteness and macro dynamics
  - optimization by heterogenously informed rational agents (state estimation, expectations formation etc).
  - higher order expecations (hierarchy of expectations)
  - aggregation (market specific shocks, aggregate shocks)
  - aggregate dynamics (differences between realized shocks and different averages of expected shocks important)
  - certainty equivalence only in special cases
  - (impact) response of private consumption markedly different from the full info case
    - fragile result? (return to this later)

- Policy experiments? Policy conclusions? .

Outline

- Model
- Results
- Comments
- Conclusions

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- Robustness check: introducing a public signal

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- $\therefore$ Hierarchy of expectations (higher order expectations) play an important role
  - anticipated deviations of the actual aggregate productivity shock from the hierarchy of expectations concerning the productivity shock, $\left[a_t^{(1)}, \ a_t^{(2)}, \ldots, \ a_t^{(k)}, \ldots \right]$, key driver underlying deviations from CE

Results

- Benchmark case: complete markets and complete info

$$c_t^s = c_t^* = \eta_{\tilde{\zeta}}^* \tilde{\zeta}_t \tag{2}$$

ie. individual (and aggregate) consumption depends only on the aggregate state $\tilde{\zeta}_t$

- Full info coupled with incomplete markets results in individual consumption depending also on idisyncratic states

$$c_t^s = \eta_W^* \mathcal{W}_t^s \tag{3}$$

with the dependence on aggregate state being the same as in the complete market case

- However, in the latter case **aggregate** consumption is identical to the full info, complete market case

$$\frac{1}{S} \sum_{s=1}^{S} c_t^s | \Omega_t^* = \eta_{\tilde{\zeta}}^* \tilde{\zeta}_t \tag{4}$$

Results

- Under incomplete info and incomplete market, the state vector of an individual hh includes also the hierarchy of expectations
  $\left[W_t^{(1)}, \ W_t^{(2)}, \ \ldots, \ W_t^{(k)}, \ \ldots \right]$
  - results from the fact that hhs must forecast aggregate consumption, which leads to "infinite regress of expectations" (Townsend 1983) $\Longleftarrow$ compelling argument, I think!

- If idiosyncratic shocks are nontrivial (ie. pos. variance), incomplete info & incomplete market economy can never replicate the full info economy (Prop 3)
  - deviations from full info economy always transitory (ie. also when shocks to aggregate technology permanent)

- Once the pr distribution of the idiosyncratic prod shock degenerates (to a single point) the economy approaches the complete market economy; asymptotically, as $t \rightarrow \infty$ the entire history of returns (to capital) becomes informationally redundant (Cor 1); ie. market incompleteness only matters when hhs differ from each other

Results

- On impact hh estimates of aggregate capital stock fall; hh and aggregate consumption lower than under full info, if idiosyncratic productivity is sufficiently, but not too persistent (Prop 4)
    - reflects the properties of optimal filtering in that forecasts of states are less volatile than actual states; hence, hh estimate of aggr productivity responds less to shocks than actual productivity
- CE allocations can be sustained in two separate cases; homogenous hhs ($\sigma_z \to 0$) and extremely heterogenous hhs ($\sigma_z \to \infty$)
    - in the latter case the economy is effectively segmented into two distinct blocks with returns providing info on aggr block and the wage on idiosyncratic block; each hh knows others will update their estimates in the same way (Ass 2) so that the hierarchy of exp is known to everybody

Results

- Standard NC growth model; a positive shock to aggregate productivity increases (on impact) private consumption
    - Fig 1 shows that consumption instead fall on impact in an economy with incomplete info and incomplete markets
    - the intuition is that not only aggregate returns but also (idiosyncratic) wages increase due to the shock to aggr productivity; hence agent revise downwards their previous state estimates, which revision drives consumption down on impact
- Sensitivities: parameters of the distributions of the two shocks important as they affect the informational problem (filtering) the most; also the Frisch elasticity of labour supply is important
- Question: reductions in the threshold value for the persistence of idiosyncratic prod requires implausible parameter values?

Results

- Negative impact effect on consumption of aggregate technology shock fairly robust to changes in the persistence of the shocks (Table 3)
- Only if the "signal to noise ratio" (σ_a/σ_z) is sufficiently large will consumption increase on impact when aggr prod shock hits the economy (Table 4)
- Negative impact response of consumption stronger under more (Frisch) elastic labour supply
    - intuition: higher elasticity implies larger increases in hh hours as they observe positive innovations to returns and wages; as all hh respond identically to a shock to aggr prod, aggr hours increase more with more elastic hh labour supply, so returns increase more, which leads, through optimal filtering, to larger downward revision in the state of the economy and, consequently, consumption.
- Introducing a noisy public signal can overturn the result about the negative impact response of consumption to aggr prod shock
    - more likely so as the precision in the public signal increases

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- $\therefore$ This means that since all hhs solve a similar signal extraction problem before setting consumption, it also becomes relevant for each hh to form higher order expectations, ie. expectations of average expectations, and so on

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  - I don't think this is specific to GW, but more general feature of the underlying filtering/signal extraction problem

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- That consumption response becomes more muted after introducing a noisy public signal reflects reduced Kalman gain or reduced precision in the estimates of the states
  - fairly general feature of the optimal filtering problem á la Kalman

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- In conclusion, although I am somewhat critical about the way informational imperfections are built into the model, I think this an ambitious and methologically very interesting exercise and, as the authors also suggest, may provide insights into some of the well known puzzles in macro and finance models that rely on the positive response of consumption to aggr prod shocks

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