Assignment 5

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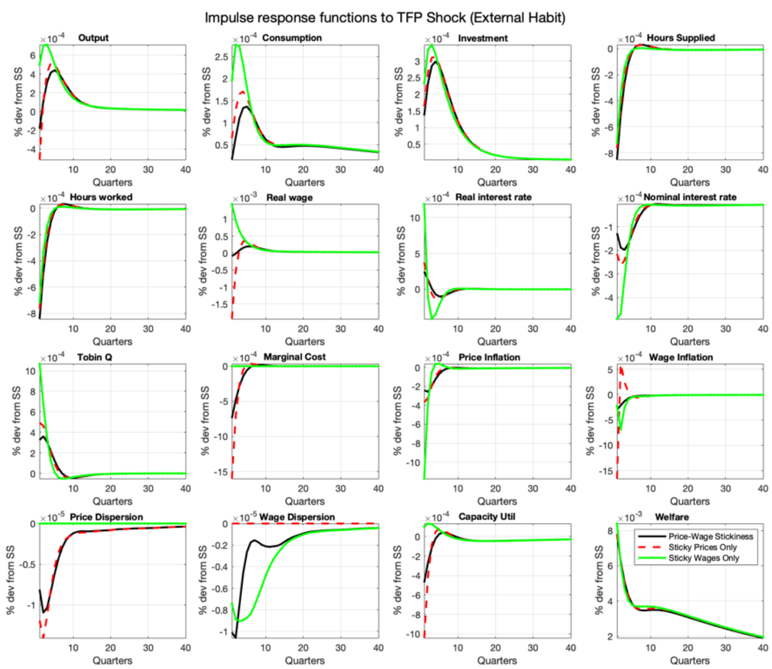
Wage Stickiness and Price Stickiness

Do

- Run 'NK_SW.mod' with the following combinations of parameters
  - $(\xi_p, \xi_w) = \{(0.7,0.7), (0.7, 0.0), (0.0, 0.7)\}$
  - *Revise lines 53-56.*

Results

- *<External-StickinessComparisons-TFP.png>*



- *For Government Expenditure, Capital Quality, Monetary Policy, Price-/Wage-Markup, Risk Premium shocks, see the corresponding png files.*

Discussion

In this figure illustrating a positive TFP shock, I compared varying levels of price stickiness and wage stickiness under the external habit model specification. Using the external habit preferences model corresponds to the "simplified NK workhorse" model, thus making the analysis slightly more comprehensible. In this figure, the three lines represent the case with both price and wage rigidity (black), only price rigidity (red), and only wage rigidity (green). In the presence of a positive TFP shock, we see that output under all three model settings resulted in a positive spike on impact of the shock. This increase in TFP has a stronger effect on the economy with only wage stickiness. The impact from the positive TFP shock is reduced for an economy with only price rigidity, and even more dampened for an economy where both forms of nominal rigidity are present. In an economy with only price rigidity, firms are slow to adjust prices, so when there's a positive TFP shock, they can't immediately drop prices to reflect increased productivity. However, in an economy with only wage rigidity, firms can't adjust wages upward quickly, so they invest more in capital and labor to take advantage of the increased productivity, leading to a larger output increase compared to the price rigid economy. When both rigidities are present, the situation becomes more complex. Price rigidity prevents firms from immediately passing on increased costs to consumers, while wage rigidity limits their ability to adjust labor costs. This dual constraint hampers firms' ability to respond optimally to positive shocks, resulting in a smaller output increase compared to economies with only one type of rigidity. Looking at the consumption impulse response functions, we see a clear correspondence with that of the output... what the economy consumes is what the economy creates. The response of real investments and Tobin's Q both reflect the story of increasing capital investment in the sticky-wages-only economy. Finally, this same point is illustrated in the capital utilization IRF: when wages are slow to adjust, the only channel for economy to reflect the sudden increase in productivity is through capital goods—not just the increase in capital investment (for subsequent periods), but also an increase in contemporaneous capital usage (even though it's costly).

Let's have a look at the price dynamics. Real wages IRFs are drastically different for the three economies. While the real wage rises in the sticky-wages-only economy upon the productivity boon, real wage falls for the sticky-prices-only economy; the economy with both nominal rigidities present represents a middle ground. This response in real wages is straight forward in that because of the productivity shock, firms in the sticky-wages-only economy can quickly increase prices to reflect the increase in productivity, this leads to significant price deflation (see price inflation IRF). With rigid wages, a deflation in commodity prices necessarily results in a spike in real wages. The real wage dynamics for the sticky-prices-only economy follows a slightly different logic. When the TFP shock hits, marginal costs drop significantly. In the process of maximizing profits (with a decrease in marginal costs), firms in the sticky-prices-only economy will want to expand production, achieved by increasing nominal wages. This combined effect of increasing nominal wages and drop in marginal costs yields the real wage dynamics for the sticky-prices-only economy. Finally, as a sanity check, we see that there is no price dispersion under flexible prices (i.e. sticky-wages-only); and there is no wage dispersion under flexible wages (i.e. sticky-prices-only).

Aside: Intuitively, from this figure, we see that when both nominal rigidities are present and Calvo parameters set equally at 0.7 (i.e. 30% probability of optimal price setting), the effect of real wage is 'almost' nullified, closer to the sticky-prices-only model. If we view the economy with both nominal rigidities as a weighted average of the sticky-prices-only economy and sticky-wages-only economy, then the observation mentioned above might signify that sticky prices may have a slightly more dominating impact on the economy. Question: how to find $\min_{\xi_w} \left| \frac{W_t}{P_t} - \frac{\bar{W}}{\bar{P}} \right|_{\mathrm{SPSW}, \xi_p \text{ given}}$?

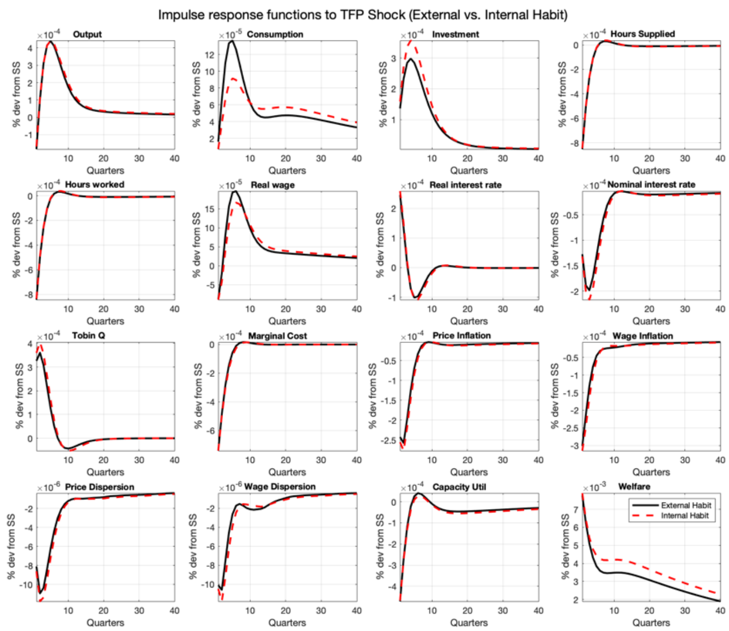
RBC vs NK

Do

1. Run '[NK_SW.mod](NK_SW.mod)' by changing the macro for habit type (external vs. internal)
    - *Revise line 2. ASSUMED presence of both nominal rigidities.*

Results

- <InternalvsExternal-TFP.png>



- *For Government Expenditure, Capital Quality, Monetary Policy, Price-/Wage-Markup, Risk Premium shocks, see the corresponding png files*

Discussion

This figure shows the IRF to TFP shock for economies with external- and internal-habit preferences. Just looking at the set of IRFs, we see that the two models yield identical qualitative inferences. The only difference lies with Consumption and Welfare. There are two striking observations: 1) output dynamics in the two economies are mostly identical while consumption dynamics differ; 2) the internal habit preferences seems to imply greater welfare gains from the same TFP shock. The first observation can be split into two parts: equal output and unequal consumption. Equal output is necessary because the production side of the economy is identical. Consumption levels differ solely because of the differences in preference set up: external habit preferences use aggregate per capita consumption (homogenous value), while internal habit preferences use the idiosyncratic household consumption of the previous period. This implies that even when evaluated at the symmetric equilibrium ($C_t^j = C_t$), the marginal utility from consumption for internal habitat is lower by a fixed amount: $-\beta\chi(1-\varrho)\mathbb{E}_t\left[U_{c,t+1}^{\text{ext.hab}}\right] = -\beta\chi(1-\varrho)\mathbb{E}_t\left[\left(C_{t+1}^j - \chi C_t^j\right)^{(1-\varrho)(1-\sigma_c)-1}\left(1-H_{t+1}^j\right)^{\varrho(1-\sigma_c)}\right]$. That is, if the household expects next period consumption to be higher than this period consumption, then the

MUC is lower this period (compared to the external habit case). Out of a consumption smoothing incentive, these households would consume a little less this period (compared to the external habit case). Before the unexpected TFP shock hits, the two economies are identical, but when the economy observes the shock, the aforementioned process kicks in. The reduced consumption is then converted into capital investment. Another way to understand the internal habit preferences is that consumption smoothing of the household is of greater ‘importance.’ As such, even when there is a productivity increase, these households with internal habit is willing to give up consuming more for a smoother change in consumption behavior. Because of this, there will be more investment in this economy, and thereby a more sustained welfare gain from the TFP shock.

Capital Utilization

Do

1. Create new file 'NK_SW_noUtilization.mod'
    - Remove utilization variable u *(line 9)*
        - Remove capital rental condition with capital utilization cost *(line 132)*
    - Set a(u)=0 *(line 155)*
    - Set u=1 for everywhere it appears (equations displayed are non-detrended versions)
        - *[Tobin's Q, line 138]*

$$Q_t = \mathbb{E}_t\left[\Lambda_{t,t+1}[(r_{t+1}^K * u_{t+1} - a(u_{t+1}))] + (1-\delta)Q_{t+1}\right]$$

        - *[Production, line 182]*

$$Y_t^W = \left(AH_t^d\right)^\alpha (u_t K_{t-1})^{1-\alpha}$$

        - *[Firm FOC K, line 189]*

$$r_t^K = (1-\alpha)\frac{P_t^W}{P_t} * \frac{Y_t^W}{u_t K_{t-1}}$$

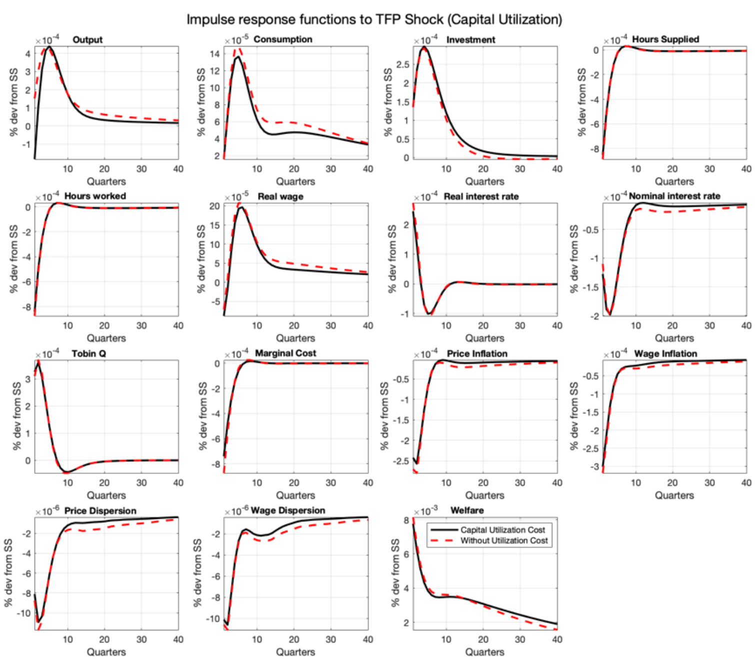
        - *[Gross Return on K, line 226]*

$$R_t^K = \frac{r_t^K u_t - a(u_t) + (1-\delta)Q_t}{Q_{t-1}}$$

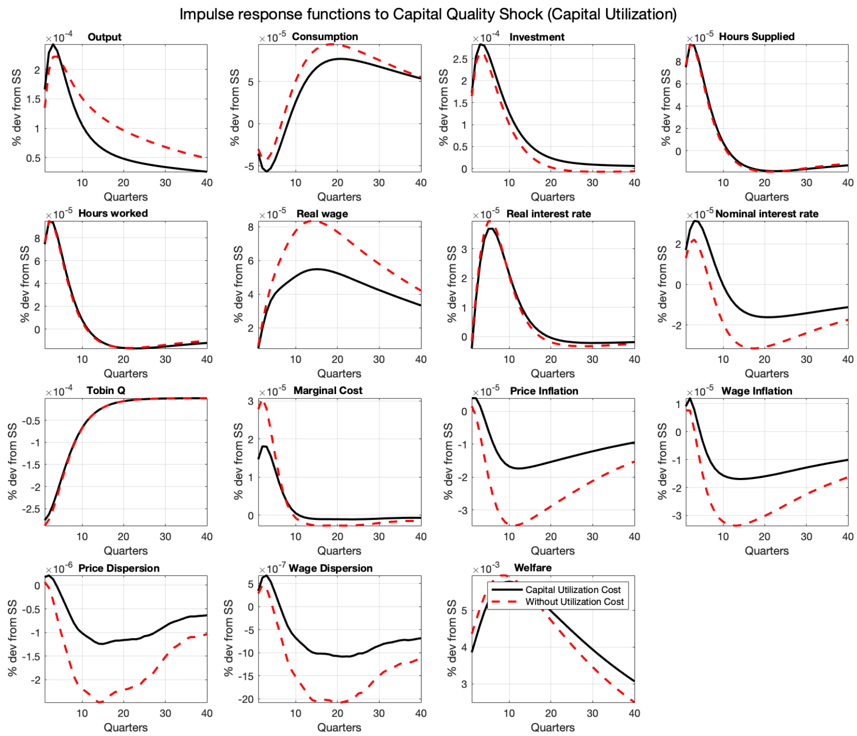
    - Set adash = $a'(u) = \gamma_1$ (to clear steady state model, *line 159*)

Results

- <UtilizationCost-TFP.png>



- < UtilizationCost-CapQuality.png >



- *For Government Expenditure, Monetary Policy, Price-/Wage- Markup, Risk Premium shocks, see the corresponding png files*

Discussion

With a positive TFP shock, things look very similar, regardless of the presence of capital utilization costs. Yet when there is a positive capital quality shock, things become much more interesting. Following an increase in capital productivity, the economy without variable utilization is stuck with the amount of capital stock it inherited from the previous period. Then, this productivity increase will be reflected in a price deflation. Yet, when utilization is variable, the economy can choose to incur a bit of a utilization cost and increase production by increasing capital utilization rates. This reduces the deflationary pressures. Furthermore, because the firms in the economy with variable utilization has more options in the face of external shocks (by adjusting utilization rates subject to an utilization cost), its IRFs are slightly less volatile.

Question, IF I allow $r_t^K = a'(u_t)$, and comment away the firm's FOC for capital, I can ALSO get a error-free Dynare IRF figure, but it looks very incorrect. I think this is a good lesson that Dynare will return an IRF if steady-state and BK conditions hold. But it does not guarantee it's the "correct" model it's solving.