

Assignment 4

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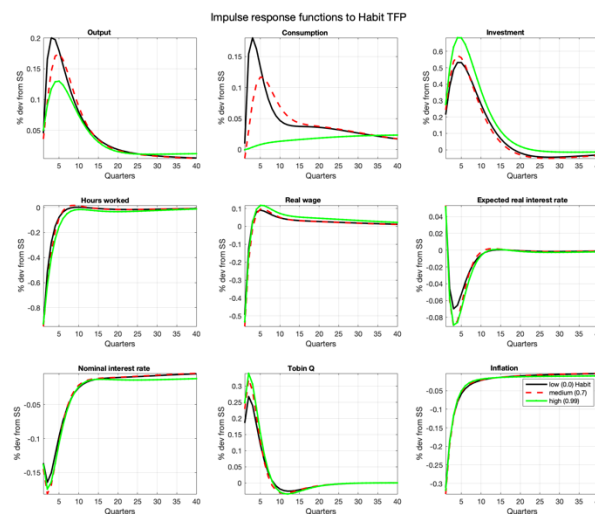
Habitat and Indexing

Do

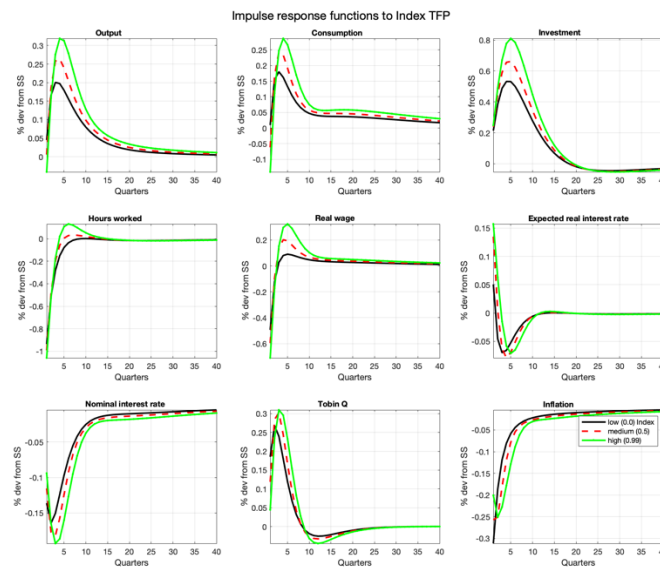
- Run 'NKlinear.mod' with the following combinations of parameters
 - $(\gamma, \chi) = \{0.0, 0.5, 1.0\} \times \{0.7\}$
 - $(\gamma, \chi) = \{0.5\} \times \{0.0, 0.7, 1.0\}$
 - Revise lines 26, 36, 174-184... (not lines 143-147 of mod file)

Results

- <NKlinear_habitTFP>



- <NKlinear_indexingTFP>



- For shocks G -, M -, MS - shocks, see the corresponding png files.

Discussion

[Habit] When the economy is faced with a one-time positive productivity shock, output rises as expected. In the presence of external habit, this output increase is dampened. As depicted in the Consumption panel, with stronger external habit effects, the slower the change in consumption demanded. Thus, because the demand-side is slow to adjust (in the presence of external habit), the boon on the supply-side will be muffled. The effect of the TFP shock on investments are amplified because the productivity shock did increase overall wealth, but the increase in consumption is dampened due to external habits, so the additional wealth are channeled to capital. Because prices are sticky, there will price levels will drop initially, then tapering off to steady state.

[Indexing] The indexing model adjusts prices in the economy by a predetermined rule of past interest rates. Intuitively, this family of models will introduce additional nominal rigidities in the economy as prices are even slower to adjust. The positive TFP shock increases output, as productivity gains mean the economy can produce more with the same inputs. It should be noted that with larger indexing parameters, the output lines are slightly shifted right (meaning slightly lagged responses) and that peaks are higher with larger indexing parameters. With perfectly flexible prices, the shock will pass through to the economy and the investment levels will adjust immediately to the higher TFP (firms invest more due to the expected profitability of new capital in a more productive economy). The presence of price indexing may affect the cost of investment and the reduce rate at which it adjusts, leading to a more sustained positive impact from the TFP shock. Overall, we see that price indexing leads to a more "sustained" response.

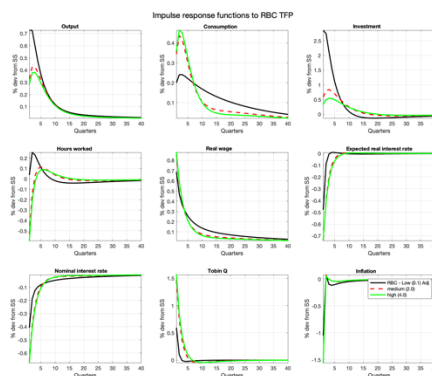
RBC vs NK

Do

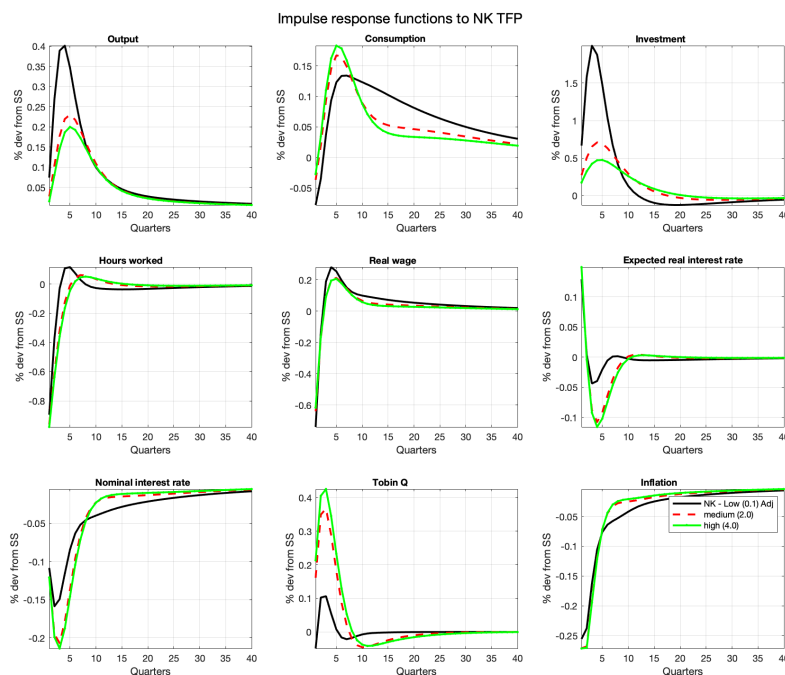
1. ["RBC"] Run '**NK.mod**' with *flexi=1* (line 39)
 - Set $\phi_X = \{0.1, 2.0, 4.0\}$
2. [NK] Run '**NK.mod**' with *flexi=0*
 - Set $\phi_X = \{0.1, 2.0, 4.0\}$

Results

- <RBC_TFP.png>



- <NK_TFP.png>



- For RBC-G/M/MS and NK-G/M/MS see corresponding png files.

Discussion

[RBC with Adj Costs] The response of output to the TFP shock is positive across all levels of adjustment cost, as expected in an RBC model. Higher adjustment costs slightly dampen the peak of the output response, since firms face greater costs when adjusting their capital stocks to the new productivity level. Consumption initially rises in response to the positive TFP shock but shows a bit of overshooting before converging back to the steady state. The presence of higher adjustment costs seems to delay the peak response of consumption slightly, indicating that households may be more cautious with consumption when it's costly for firms to adjust capital. The investment response is notably more sensitive to adjustment costs. Higher adjustment costs lead to a more muted and delayed peak response, as firms are slower to adjust their capital stock in response to the TFP shock. Higher productivity encourages more labor input. However, the presence of high adjustment costs may dampen the response slightly, as the full benefits of increased productivity are not immediately realized due to capital stock inflexibility. There's a sharp decline in the expected real interest rate following the TFP shock, which may reflect an immediate increase in savings as households anticipate future income from higher productivity. Higher adjustment costs do not significantly alter the qualitative response but may affect the quantitative magnitude slightly. The inflation response is interesting, showing a brief deflationary effect following the TFP shock. This could be due to an increase in the supply of goods that outpaces demand or a drop in the nominal interest rate. Higher adjustment costs accentuate the deflationary pressure slightly, potentially because slower investment adjustments lead to a lag in

capital stock expansion, affecting price levels. Overall, higher adjustment costs generally lead to a more muted and delayed response, as firms and households gradually adjust to the new productivity level.

[New Keynesian] The TFP shock positively influences output, but the extent of the peak and the speed of the return to steady state are influenced by the level of adjustment costs. In comparison to the RBC model, the output response in the NK model is more subdued due to price stickiness, which slows down the adjustment process. Consumption increases in response to the TFP shock, with higher adjustment costs causing a delayed peak. The NK model typically shows more gradual adjustments in consumption due to forward-looking behavior and the presence of price stickiness, unlike the RBC model, where consumption might adjust more rapidly due to the absence of such frictions. Like the RBC model, the NK model shows that investment responds positively to the TFP shock but is dampened by higher adjustment costs. The magnitude of the investment spike in the NK model may be smaller due to the role of monetary policy, which can influence the cost of capital through interest rate adjustments. The nominal interest rate decreases initially and then recovers, reflecting the central bank's policy actions to stabilize prices and output. This is a distinct feature of the NK model, as the RBC model does not include an active monetary policy rule. Overall, the qualitative effects of a positive productivity shock is very similar in both RBC and NK models. But NK introduces additional dynamics due to price stickiness and monetary policy. These factors tend to moderate and smooth the responses of economic variables, resulting in less volatility compared to the RBC model. Adjustment costs in both models create lags and dampening effects, but these are compounded in the NK framework by the additional frictions and policy responses it includes.

Monetary Policy Rules

Do

1. [“Implementable”] Run ‘**NKlinear.mod**’ with *flexi=1* (line 39)

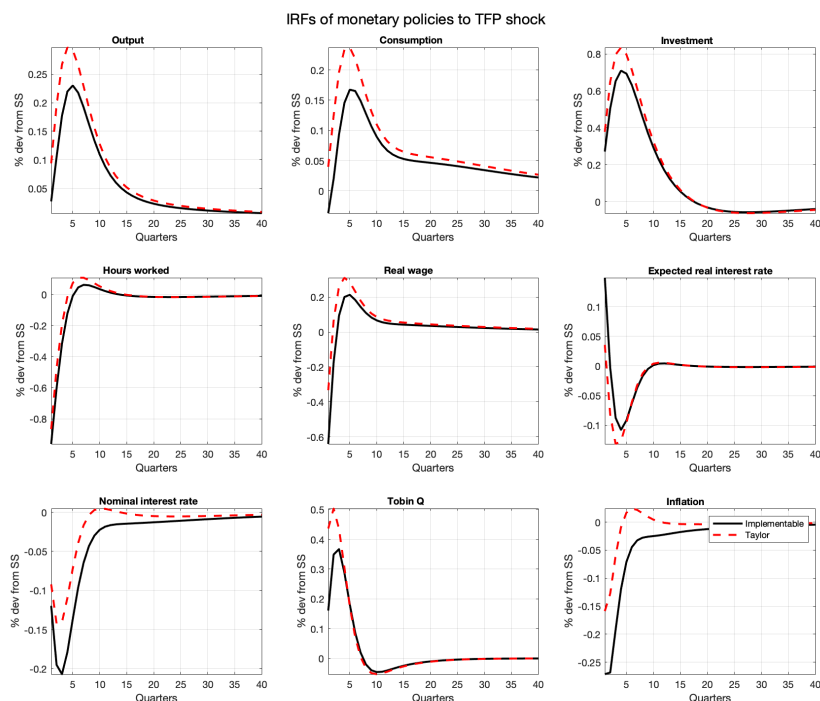
- Set $\phi_X = \{0.1, 2.0, 4.0\}$

2. [Taylor Rule] Run ‘**NKlinear.mod**’ with *flexi=0*

- Set $\phi_X = \{0.1, 2.0, 4.0\}$

Results

- <rules_TFP.png>



- For Rules-G/M/MS corresponding png files.

Discussion

In the presence of a positive productivity shock, both rules lead to an increase in output, but the Taylor rule appears to produce a slightly less pronounced initial response, which could suggest that the Taylor rule is less aggressive in responding to a TFP shock (due to targeting output gap). Investment spikes in response to the TFP shock under both rules but recovers more smoothly under the implementable rule. This could indicate that the implementable rule may involve more aggressive or nuanced adjustments to stabilize investment fluctuations. Hours worked decrease similarly under both rules. This uniform response suggests that the differences in monetary policy do not significantly influence the labor response to a TFP shock in the short term. The expected real interest rate initially decreases under both rules but recovers faster under the Taylor rule. This suggests that the Taylor rule may lead to a quicker normalization of policy rates after a shock. Overall, the differences between the two rules highlight the trade-offs inherent in monetary policy: the Taylor rule's predictability and responsiveness to inflation and output versus the potentially more complex and tailored approach of an implementable rule that could consider a wider range of economic indicators.

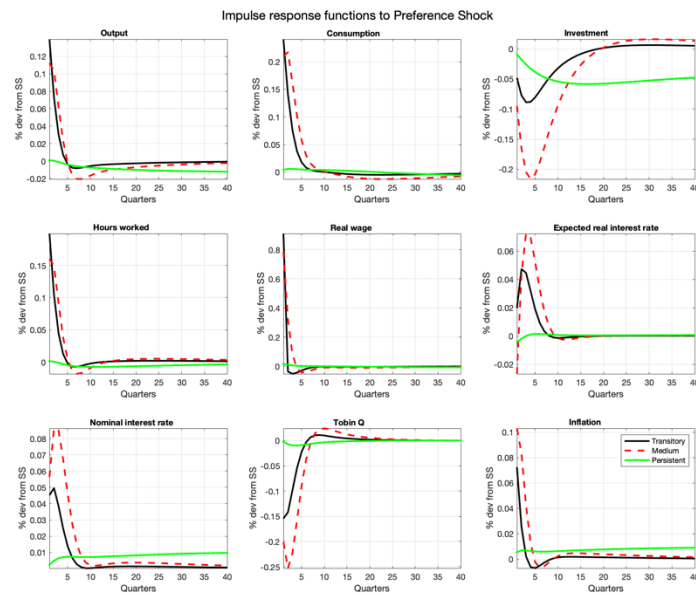
More Shocks

Do

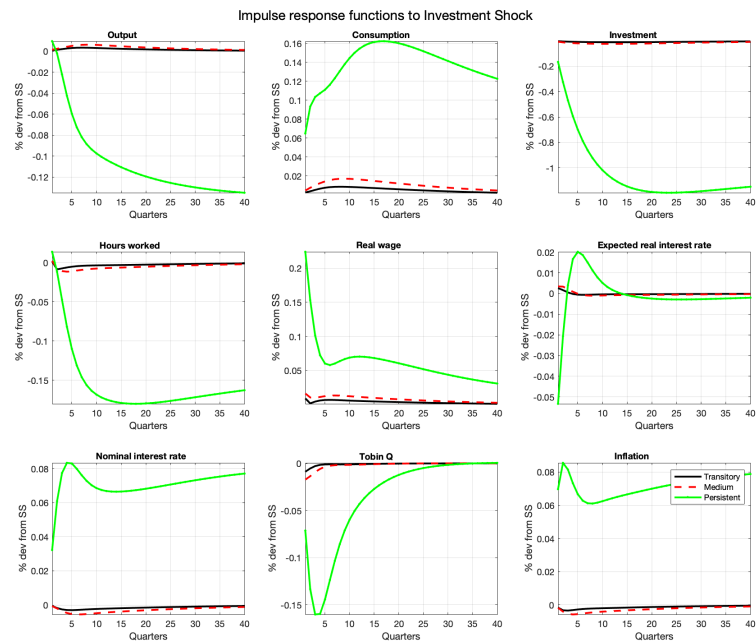
1. Define endogenous variables PS and IS;
2. Define persistence and variance parameters;
3. Set parameter values and steady state values for PS and IS;
4. Revise model equations (multiplicative);
5. Revise steady state equations (no change).

Results

- <moreShocks_PreferenceShock.png>



- <moreShocks_InvestmentShock.png>



Explanation.

The figures show the multiplicative preference shock and investment shock. The persistence of the preference shocks are set at 0.001, 0.500, and 0.999, indicating various levels of persistence in the respective shocks.