On the Significance of Quality-of-Capital News Shocks

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Motivation

- This paper builds on the expectation-driven business cycle hypothesis (Pigou, 1927)
- Beaudry and Portier (2006) provide empirical evidence that strongly supports this hypothesis.
- Using a VAR approach, Beaudry and Portier (2006) show that shocks impacting the financial market (stock prices) are closely correlated to shocks anticipating future movements in TFP

Motivation

- Since then, both VAR and DSGE methodologies have focused on TFP news shocks (Barsky and Sims, 2011; Fujiwara et al., 2011; Görtz and Tsoukalas, 2017; Görtz et al., 2021; and others)

- **Novel approach**: We consider quality-of-capital (QoC) news shocks in the medium-scale DSGE model of Smets and Wouters (2007) augmented with financial frictions à la Gertler and Karadi (2011)

- QoC shocks represent qualitative appreciations (depreciations) of physical capital which trigger an exogenous change in the productivity of capital and also directly affect the balance sheet of financial intermediaries whose assets are collateralized by that capital

- This clear interpretation of QoC news shocks (relative to TFP news shocks) enables them to be connected with financial markets through the credit and expectation channels
- The fundamental difference between QoC and TFP news shocks lies in the direct effects on financial variables induced by the former, which are amplified through the expectation and credit channels
- By estimating alternative model specifications, we assess the relative contribution of QoC and TFP news shocks in explaining aggregate fluctuations

Production channel:

$$Y_t = TFP_t \left[\left(QoC_t \right) K_{t-1} U_t \right]^{\alpha} L_t - \phi_p$$

Financial channel: The optimal decision of capital services firms means that the price of assets (capital) depends *directly* on QoC shocks:

$$Q_t = \frac{r_{t+1}^k U_{t+1} - a \left(U_{t+1} \right) + (1-\delta) Q_{t+1}}{R_{t+1}^k} \left(QoC_{t+1} \right)$$

The formulation of news shocks follows the seminal paper by Schmitt-Grohé and Uribe (2012):

$$\epsilon_t^z = \rho^z \epsilon_{t-1}^z + \sum_i \eta_{t,t-i}^z,$$

where $z = \mathit{TFP}, \mathit{QoC}$; and $i = 0, 1, 4, 8, 12$. Therefore, $\eta_{t,t-i}^z$ is a z news shock which is expected to realize at time t but is forecast i periods before (i.e. at period $t - i$).

Agents forecast future values of ϵ_{t+k}^{z} as follows:

$$E_t \epsilon_{t+k}^{z} = (\rho^z)^k \, \epsilon_t^z + \begin{cases} \eta_{t+k,t}^{z} + \eta_{t+k,t-1}^{z} + \eta_{t+k,t-4}^{z} + \eta_{t+k,t-8}^{z} + \eta_{t+k,t-12}^{z}, & \text{for } k = 0, \\ \eta_{t+k,t-1}^{z} + \eta_{t+k,t-4}^{z} + \eta_{t+k,t-8}^{z} + \eta_{t+k,t-12}^{z}, & \text{for } k = 1, \\ \eta_{t+k,t-4}^{z} + \eta_{t+k,t-8}^{z} + \eta_{t+k,t-12}^{z}, & \text{for } 1 < k \leq 4, \\ \eta_{t+k,t-8}^{z} + \eta_{t+k,t-12}^{z}, & \text{for } 4 < k \leq 8, \\ \eta_{t+k,t-12}^{z}, & \text{for } 8 < k \leq 12 \\ 0, & \text{for } k > 12. \end{cases}$$

Table: Model fit assessment

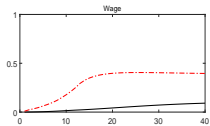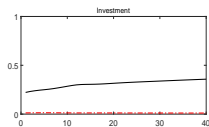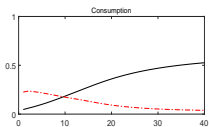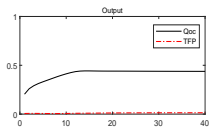| Marginal Data Density	TFP -1051.70	QoC -996.05						
	RMSE			RMSE to SPF		Standard deviation		
	TFP	QoC	SPF	TFP	QoC	Actual	TFP	QoC
Output growth	0.58	0.56	0.50	0.19	0.09	0.59	1.08	0.99
Consumption growth	0.57	0.52	0.50	0.79	0.79	0.56	0.97	0.57
Investment growth	1.67	1.48	1.44	0.19	0.09	1.84	3.87	3.40
Hours	0.54	0.42	-	-	-	4.30	4.30	3.20
Wage growth	0.87	0.86	-	-	-	0.86	1.14	0.92
Inflation	0.23	0.19	0.19	0.03	0.02	0.24	0.42	0.33
Spread	0.17	0.16	-	-	-	0.25	0.56	0.43
Interest rate	0.09	0.09	-	-	-	0.79	0.61	0.52
Net worth growth	2.10	2.20	-	-	-	1.53	8.52	6.36
	Autocorrelation					Correl. with output growth		
	Actual	TFP	QoC			Actual	TFP	QoC
Output growth	0.29	0.63	0.38			1	1	1
Consumption growth	0.33	0.74	0.34			0.66	0.67	0.51
Investment growth	0.68	0.64	0.60			0.66	0.66	0.71
Hours	0.99	0.98	0.97			0.21	0.46	0.18
Wage growth	-0.15	0.28	0.14			-0.04	0.41	0.19
Inflation	0.62	0.74	0.71			0.05	0.25	-0.08
Spread	0.89	0.80	0.81			-0.57	-0.43	-0.36
Interest rate	0.98	0.98	0.97			0.13	0.40	0.20
Net worth growth	0.22	-0.05	0.02			0.04	0.30	0.35

Structural parameter estimates are rather robust across the two specifications, but there are a few noticeable differences:

- Habit formation and the response of the nominal interest rate to output are estimated as larger under the specification that includes QoC news shocks
- The elasticity of capital utilization adjustment cost and the persistence of TFP shocks decrease greatly in the specification with QoC news shocks
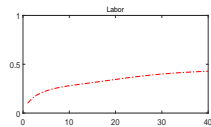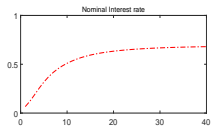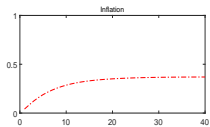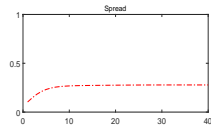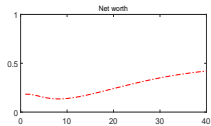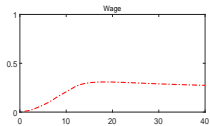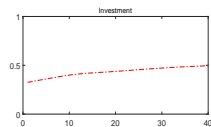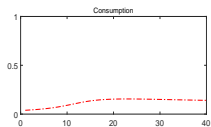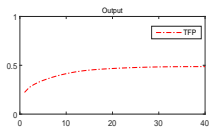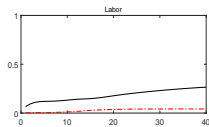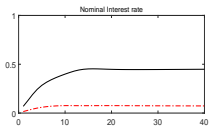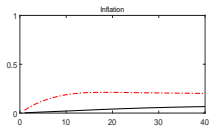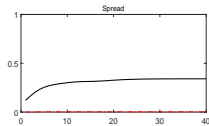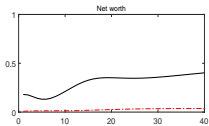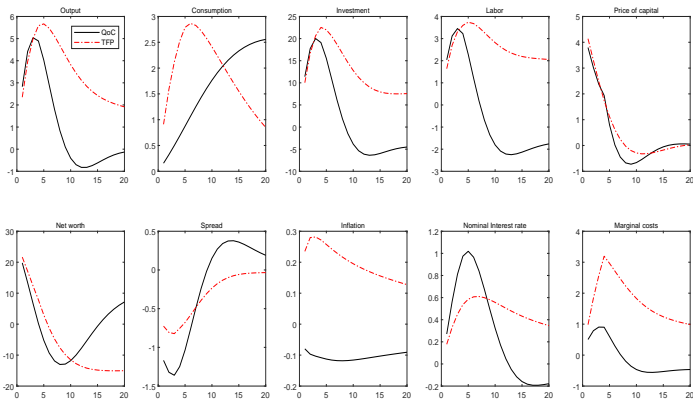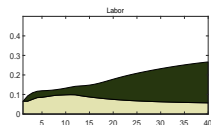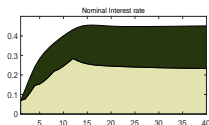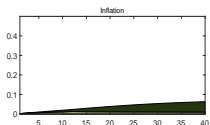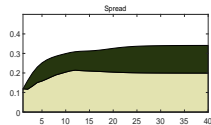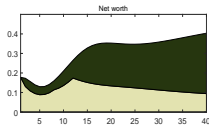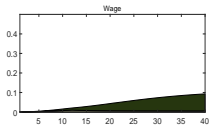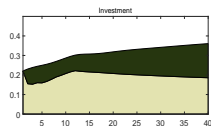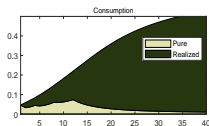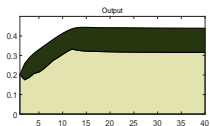
- QoC news closely links the credit channel and the macroeconomy
- Model fit to macroeconomic data greatly improves when QoC news shocks are considered
- QoC news largely displaces TFP news in explaining aggregate fluctuations
- QoC news helps to improve agents expectations
- The signicance of pure (rather than realized) news underscores the expectation channel