A Possible Explanation of the Missing Deflation Puzzle

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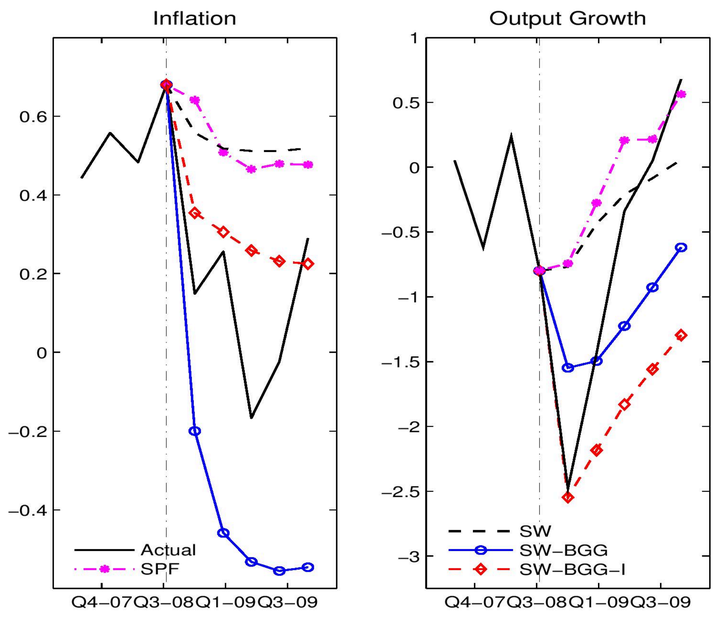
Missing Deflation Puzzle

- Hall (2011) and Ball & Mazumder (2011): **NKPC fails to explain positive inflation during the Great Recession.**
- Del Negro, Giannoni and Schorheide (2015) (NGS) show that the Smets & Wouters (2007) (SW) model with financial frictions mechanism of BGG (1999) can forecast Great Recession but requires large price rigidities (i.e. flatter NKPC).
- Micro data on prices does not support large price rigidities as estimated in SW and NGS (Klenow and Malin (2011)).
- We provide an **alternate explanation: Inflation did not fall much because real intermediate input prices were increasing.**

Figure 1: Out-of-Sample Forecasts



Note: SW is the Smets & Wouters (2007) model; SW-BGG is SW model with financial frictions; SW-BGG-I is SW-BGG model with intermediate input prices; and SPF is Survey of Professional Forecasters. Average age of the price contract is 2.5 quarters in both SW-BGG and SW-BGG-I

- The new model (**i.e. SW-BGG-I**) successfully predicts the Great Recession **with micro-consistent price rigidities.**

This Paper

- Extends Smets & Wouters (2007) (SW) model with BGG-type financial frictions to **allow for changes in Intermediate Input prices. Structure: Two sectors**
  - Sector s: finished consumption goods are produced.
  - Sector m: Intermediate input sector (consumption+input for sector s).
  - Prices are sticky in both sectors and follow Calvo mechanism.
- Estimates the model with data up to 2008-Q3.
- Focuses on out-of sample inflation and output forecasts after 2008-Q3.
  - conditional on 2008-Q4 spread and interest rate data.

Model Structure

- Divide the contimuum of firms ($f \in [0,1]$) into two sub-intervals representing each sector: finished goods sector (s) and intermediate input sector (m):
  - Sector s: finished consumption goods are produced.

$$Y_t^s(f) = Y_t^m(f)^{\alpha^m}\left(A_t K_t^s(f)^{\alpha}\left[\gamma^t L_t^s(f)\right]^{1-\alpha}\right)^{(1-\alpha^m)} - \gamma^t \Phi \tag{1}$$

  - Sector m: intermediate inputs are produced.

$$Y_t^m = A_t (K_t^m)^{\alpha}(\gamma^t L_t^m)^{1-\alpha} - \gamma^t \Phi \tag{2}$$

  - **Prices are sticky in both sectors and follow Calvo mechanism.** NKPCs for finished goods and intermediate input sectors are:

$$\pi_t^s = \beta\gamma^{1-\sigma_c}\pi_{t+1}^s + \kappa^s(\bar{mc}_t^s - \bar{p}_t^s) \tag{3}$$

and

$$\pi_t^m = \beta\gamma^{1-\sigma_c}\pi_{t+1}^m + \kappa^m(\bar{mc}_t^m - \bar{p}_t^m) + a_t^f \tag{4}$$

respectively. ***κ^i is the slope coefficient and is an inverse function of ζ_p^i (i.e. degree of price stickiness) where $i = s, m$.*** *α_m is the share of intermediate inputs in finished goods production.*

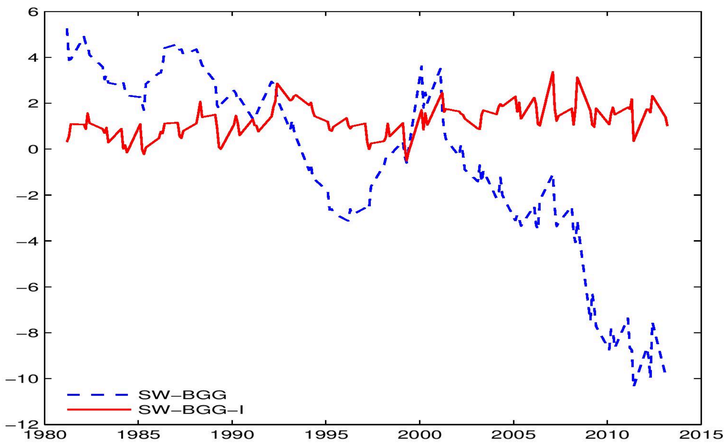
Table 1: Estimates for Key Parameters

		Prior Distribution		Posterior Distribution	
	type	Mean	st. dev.	Mean	st. dev
ζ_p^s	Beta	0.75	0.10	0.59	0.002
ζ_p^m	Beta	0.40	0.10	0.46	0.006
Intermediate Price shock (a_t^f)					
ρ_{a^f}	Beta	0.500	0.200	0.616	0.002
σ_{a^f}	Inv.G.	1.000	2.000	1.473	0.064

Transmission Channel

- Despite the fall in output, **marginal cost did not fall much.**

Figure 2: Smoothed Marginal Cost



- **Why?** MC depends on real intermediate input prices, $\bar{p}_t^m$, **(see eq. 5) which were increasing during the Great Recession:**

$$\bar{mc}_t^s = (1-\alpha^m)\bar{mc}_t^{sw} + (\alpha^m)\bar{p}_t^m \tag{5}$$

where $\bar{mc}_t^{sw}$ is similar to real marginal cost in the SW and NGS model:

$$\bar{mc}_t^{sw} = \alpha r_t^k + (1-\alpha)w_t - a_t \tag{6}$$

- **Since MC in the model is relatively higher, the model does not require large price rigidites (i.e. a flatter Phillips curve)** to match relatively stable inflation dynamics.

Financial Mechanism and the Role of Risk

- Banks protect themselves by charging over the deposit rate, R_t:

$$E_t[\tilde{R}_{t+1}^k - R_t] = b_t + \zeta_{sp,b}(q_t^k + \bar{k}_t - n_t) + \tilde{\sigma}_{\omega,t} \tag{7}$$

where $\tilde{\sigma}_{\omega,t}$ is idiosyncratic risk; n_t is endogenous networth variable; q_t^k is the price of capital; and, $\bar{k}_t$ is the capital stock.

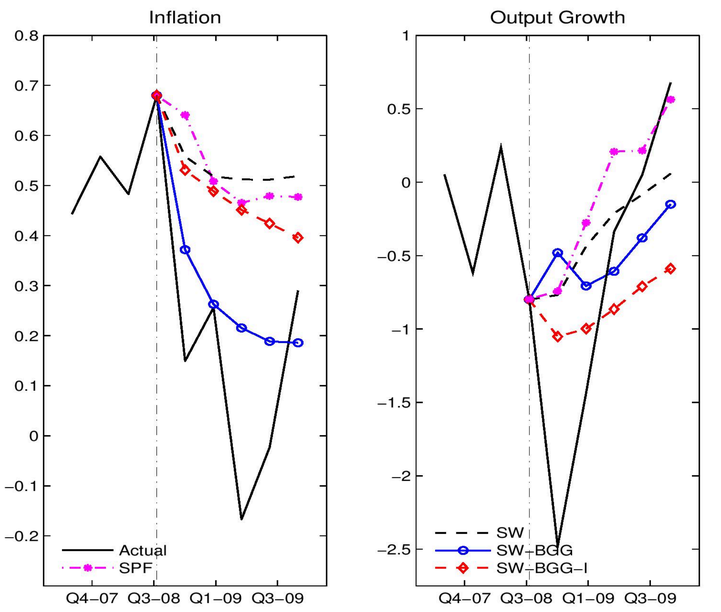
- We adopt the following structure for idiosyncratic risk:

$$\tilde{\sigma}_{\omega,t+i} = \rho_{\tilde{\sigma}}\tilde{\sigma}_{\omega,t+i-1} + \rho_{\tilde{\sigma},n}^i \boldsymbol{\epsilon_{\tilde{\sigma},t}} + \rho_{\tilde{\sigma},n}^i \sum_{j=1}^{\infty} \rho_{\tilde{\sigma},n}^j \epsilon_{t-j} \tag{8}$$

where $0 < \rho_{\tilde{\sigma}}, \rho_{\tilde{\sigma},n} < 1$. Eq. (8) mimics the effect of the Lehman shock.

- $\boldsymbol{\epsilon_{\tilde{\sigma},t}}$ affects the economy in period 't' via two channels:
  - **Direct**: A shock in period 't' affects risk in period 't' ($\tilde{\sigma}_{\omega,t}$)
  - **Anticipated**: A shock in period 't' also affects future risk ($\tilde{\sigma}_{\omega,t+i}$) and thus the current state of the economy.
- Allowing current shocks as signals for future risk improves the forecast performance for inflation and output growth.

Figure 3: Forecasts without the Anticipated Risk Channel



Conclusion

- **Introduced firm level heterogeneity** to account for the changes in intermediate input prices.
- The model **matches the evolution of key macroeconomic variables during the Great Recession** in a way that is consistent with the micro evidence on prices.
- **Marginal cost has been a poor proxy for output gap** over the last dacade.

**Poster template credits: Gerlinde Kettl and Matthias Weiser (tex@kettl.de)*