Could Intra-Firm Misalignment Explain Price-Setting Patterns?

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Motivation

- The literature on price-setting is based, mainly, on two frictions:
  - Physical Cost Friction - Menu Cost
  - Information Friction - Rational Inattention and Sticky Information

- However, both strands overlook managerial decisions and firms’ structure even though papers had already cited its relevance as:
  - Zbaracki et al (2004):
    "The evidence suggests that the internal structure of the organization plays an important role in shaping the outcomes of pricing interventions."

- Thus, we try to fill this gap looking to:
  - Firms’ incentives and their within communication

- Then, a question comes up, what happens when we look to information, structure and incentives within the firm in a macro model?
Theoretical Contribution

- We derive a newly multi-sector NK DSGE model, under incomplete information, due misalignment intra-firm.
- Show that within-firm misalignment in the communication generates price stickiness and non-neutrality of money.
- Elucidate how it also matters to find price-setting behavior, optimal policy and welfare of the economy.
- Derive a new Phillips curve where the misalignment of incentives and the number of divisions of a given firm drive their slope.
Combining our intra-firm communication mechanism with a proprietary scraped price database we fit the price behavior and its stylized facts, as:

- Small changes in prices;
- Heterogeneity on price-setting;
- Reference/Sales price behavior;
- Gathering information-misalignment;

On the macro side, our New Keynesian model highlights the relevance of within firm incentives on optimal monetary policy and welfare:

- Generating non-neutrality of money;
- Reducing power of monetary policy according to the number of sectors;
- Creates a negative relationship between intra-firm misalignment and welfare.
This intuition can be illustrated by the following representation:

\[
\text{Boss } (M^i_{at}, M^t_{bt})
\]

Department A: \((M^i_{at} | \mu^i_{at})\)  
Department B: \((M^t_{bt} | \mu^t_{bt})\)

Where:

- \(M^i_{at}\) = Message sent by micro department to the boss
- \(M^t_{bt}\) = Message sent by macro department to the boss
- \(\mu^i_{at}\) = Private Belief of micro department
- \(\mu^t_{bt}\) = Private Belief of macro department
Then, the profit problem of the boss incorporates the message received by each department:

$$\max_{t=0}^{\infty} \sum_{t=0}^{\infty} \beta^t \pi(P_{it}, P_t, Y_t, Z_{it} | M_i, M_j)$$

It is important to highlight that one way to understand the misalignment is the private information, $\mu_j, \mu_i$, be different than the message sent, $M_i$ and $M_j$. 
Partial Equilibrium Model

- Then, optimal price set by the firm under symmetric equilibrium is given by:

\[ p_{it} = p_t + \frac{\pi_{13}}{|\pi_{11}|} (1 + t_i)(1 + h)^{t_i} + \frac{\pi_{14}}{|\pi_{11}|} (1 + t)(1 + k)^t \]  

(1)

- Following Ball and Romer (1990) higher the misalignment of each margin greater should be the importance of the respective margin to explain variation in prices.
Partial Equilibrium Model

- Using the previous setup we engage the players in a sender-receiver game, where their payoffs are given by:

\[
L^{boss} = \left[ p_{it} - \left( p_t + \frac{\pi_{13}}{|\pi_{11}|} y_t + \frac{\pi_{14}}{|\pi_{11}|} z_{it} \right) \right]^2
\]

\[
L^{micro} = \left[ p_{it} - \left( p_t + \frac{\pi_{13}^{micro}}{|\pi_{11}|} y_t + \frac{\pi_{14}^{micro}}{|\pi_{11}|} z_{it} \right) \right]^2
\]

\[
L^{macro} = \left[ p_{it} - \left( p_t + \frac{\pi_{13}^{macro}}{|\pi_{11}|} y_t + \frac{\pi_{14}}{|\pi_{11}|} z_{it} \right) \right]^2
\]

- Then, this environment guarantees that such information revelation game is partitioned.
Lemma

If the optimal actions chosen from the micro research department and the boss are different, for every realization of $z_{it}$, then $\exists \epsilon: \forall u, v, |u - v| \geq \epsilon$, where $u$ and $v$ are actions induced in equilibrium. Further, the set of actions induced in equilibrium is finite.
The Dynamic Phillips Curve

- Our sectoral Phillips curve is given by:

\[ \pi_{kt}^* = \alpha_j \pi_t - (1 - \alpha_j) E_t \pi_{t+1} + \gamma_j \Delta E_t y_{t+1} + \chi_j \pi_{kt} + E_t (\pi_{k,t+1}^* - \pi_{t+1}) \tag{2} \]

Where: \( \alpha = \frac{\Pi_{12}}{|\Pi_{11}|}, \gamma = \frac{\Pi_{13}}{|\Pi_{11}|}, \chi = \frac{\Pi_{15}}{|\Pi_{11}|} \).

- To get the aggregate Phillips curve we consider the following aggregation:

\[ \pi_t^* = \sum_{i=1}^{K} \mu_i \pi_{kt}^* \tag{3} \]

- Then, our Phillips curve elucidates two new results:
  - Misalignment of incentives and the number of divisions of a given firm drive the slope of the Phillips curve.
  - Communication within the firm affects directly the sectoral inflation and the persistence of monetary policy.
Database

- Daily price data collected from online and offline retailers (mainly supermarkets) to Brazil;
- From July first of 2018 until August first of 2021, with more than 6 millions of observations per supermarket;
- Classified in four levels:
  - Supermarket
  - Sector
  - Category
  - Individual
Figure: Misalignment x Partition
Do Retailers Match our Optimal Prices?

**Figure:** Examples of Optimal Price Simulation

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