Comments on Price Updating in Production Networks
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The Questions

How much of an input cost shock is passed through into the output price of a firm embedded in a production network?

How does horizontal competition in the output market affect cost pass-through?

Does the nature of the cost shock matter? How do common and idiosyncratic shocks differ?

This paper presents a new, non-parametric approach for estimating the impacts of cost shocks and horizontal price competition on output prices of firms in a production network.

The main finding: cost pass through is 44%. This rejects constant markup models of demand, like CES.

Estimating equation for cost pass-through

Consider price-updating by a single-product firm j

$$(1) \quad dlnp_{jt} = \beta_{jt} \sum_i \omega_{ijt} dlnp_{it} + \gamma_{jt} dlnz_{jt} + \delta_{jt} dln\mathcal{P}_{-jt} + u_{jt}$$

where

- p_{it} are the prices of variable inputs (domestic and imported)
- ω_{ijt} are firm j's expenditure share on the bundle of inputs from firm i
- z_{jt} is productivity
- $\mathcal{P}_{-jt}$ is an index of competitors' prices (in the output market)
- all parameters embed the responsiveness of firm j's markup to its own output price
- complete pass-through ($\beta_{jt} = 1$) implies markups are constant (or zero)

Data for estimation

1. Prodcom Survey - 4000 products - monthly sales and quantity
   - firm-level prices for output(s) of firm j: $dlnp_{jt}$
   - firm-level prices of inputs produced by firm i: $dlnp_{it}$
   - index of competitors' prices in the same Prodcom8 digit product as firm j's output: $dln\mathcal{P}_{-jt}$
   - "prices" are annual unit values constructed by aggregating monthly data

2. NBB B2B Transactions - annual sales value of firm i to firm j
   - expenditure shares for domestic inputs: the value is reported but not the product(s) ωijt
   - Question: what price from Prodcom is used for each expenditure share obtained from B2B when input suppliers are multi-product firms?

3. International trade data: Intrastat (EU) and Extrastrat (non-EU) CN08 import and export values and quanitities
   - firm-level prices for imported inputs: firm-product-country-year level net imports (value and quantity) used to construct unit values $dlnp_{it}$
   - firm-level expenditure shares for imported inputs at country-product level ω_{ijt}

Endogeneity of prices in a production network
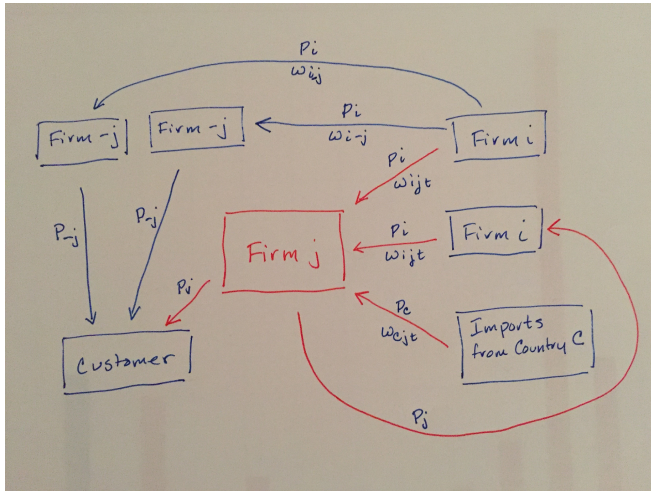
An IV approach to dealing with endogeneity

(2) $\quad dlnp_{jt} = \beta_{jt} \sum_i \omega_{ijt} dlnp_{it} + \gamma_{jt} dlnz_{jt} + \delta_{jt} dln\mathcal{P}_{-jt} + u_{jt}$

1. Instrument for domestic and imported input prices with matched import prices.
   - market-share weighted average of changes in import prices instruments for changes in a domestic input price
   - a similar approach is taken for imported inputs, but it seems similar CN08 products (same CN06?) are used as instruments
   - the change in input prices for firm j is then instrumented with expenditure-weighted average of these average import prices
   - ok, but do we think the nature of the shock matters for pass through? Domestic demand v. foreign supply shock.
2. Instrument for competitors' prices in the output market with corresponding import prices.
3. Instrument for competitors' prices in the output market with their productivity shocks.

Main contributions

- Important first step in understanding how shocks propagate through a production network.
    - Key strength: lots of detailed, disaggregated price data & all firm-to-firm connections.
    - Key weakness: no clearly exogenous shocks to input supply available for studying this propagation.
    - Alternative approach: trade policy shocks (EU GSP, antidumping), large euro appreciations or depreciations to proxy for foreign supply shocks that are exogenous to the Belgian production network?
- Methodological contribution on concording domestic ProdCom and import product categories
- Interesting results on common v. idiosyncratic input price shocks (next slide)
    - Split the estimation sample into 3 bins according to the magnitude of changes in input price bundles relative to the secotr average.
    - Estimate each sample separately to see how large cost reductions, small changes in input costs, and large cost increases are passed through to output prices.

Pass-through of common v. idiosyncratic shocks

Table 5: Common vs. idiosyncratic input shocks.

	OLS			IV		
	q1	q2	q3	q1	q2	q3
Dep. var.	$d\ln p_{jt}$	$d\ln p_{jt}$	$d\ln p_{jt}$	$d\ln p_{jt}$	$d\ln p_{jt}$	$d\ln p_{jt}$
$d\ln P_{jt}$	0.114**	0.802***	0.269***	0.509***	1.175***	0.342***
	(0.041)	(0.131)	(0.037)	(0.080)	(0.221)	(0.062)
$d\ln z_{jt}$	-0.079***	-0.111***	-0.089***	-0.073***	-0.116***	-0.087***
	(0.011)	(0.015)	(0.012)	(0.012)	(0.015)	(0.012)
$d\ln \mathscr{P}_{-jt}$	0.346***	0.300***	0.320***	0.332***	0.249***	0.257***
	(0.031)	(0.048)	(0.041)	(0.050)	(0.063)	(0.068)
N	7,934	7,719	7,852	6,878	6,882	6,891

Note: Columns (i)-(iii) report OLS estimates, columns (iv)-(vi) reports the second stage of IV estimates employing GMM. q1 refers to the first tercile etc. All regressions are pooled over the years 2004-2014. Significance: $* < 5\%$, $** < 1\%$, $*** < 0.1\%$.

Small input price shocks completely passed through (column IV q2)
Large reductions in input prices passed through by half (column IV q1)
Large increases in input prices pass through by one-third (column IV q3)

Further questions inspired by these findings

- How do the results on large idiosyncratic shocks relate to results in the literature that large firms are different in terms of exchange rate pass-through?

- Exchange rate pass-through literature finds that larger firms are more likely to absorb part of a cost shock rather than pass it on to customers.

- Are these firms with idiosyncratic input price shocks larger on average?

- Does the evidence in this paper about the idiosyncratic nature of some cost shocks tell us something new about why cost pass through for some firms is low?

- Do firms with large idiosyncratic cost shocks produce a more differentiated variety requiring specialized inputs? If yes, what does this imply about output market competition?

- Or is it just that large firms have more idiosyncratic costs?

Comparisons to the exchange rate pass through literature

A standard exchange rate pass-through equation (Goldberg and Knetter, 1997):

$$(3) \quad P_{m,t}^{dest} = \alpha + \gamma e_t^{dest/orig} + \beta mc_t + \delta D_t + u_t$$

- Prices denominated in the destination/local currency of the importer.
- The nominal exchange rate is expressed as destination (importer) currency over origin (exporter) currency.
- If $\gamma = 1$, then complete pass-through of exchange rate movements to import prices.
- If $\gamma < 1$, then incomplete pass-through.
- Exchange rate disconnect puzzle: nominal exchange rates are more volatile than prices and macro fundamentals. $\gamma < 1$.

Insights from the literature on exchange rate pass through

Studies focused on firm characteristics:

- Amiti, Itskhoki, Konings (2014): Belgian firm-level data: Pass through into export prices of 0.20 implies pass through to import prices of 0.8. But pass through is lower (0.64) for firms that import a lot (95th percentile).

- Berman, Martin and Mayer (2012): French firm-level data: Pass through into export prices of 0.08-0.13 implies pass through into import prices of 0.92 - 0.83, but pass through into import prices is lower for firms with higher productivity.

Punchline from this lit: Certain types of firms (large importers, more productive) adjust their markups more to reduce the pass through of exchange rate fluctuations to their customers.

Question: What is the relationship between firm size, productivity, import exposure and the covariance of a firm's input costs with its competitors for firms in the Belgian production network?

More insights from exchange rates

- Corsetti, Crowley, Han and Song (2018): Chinese firm-product data:

  $$p_{ifdt} = \mu_{ifdt} + \mu_{ift} + mc_{ifdt}$$

  Pass through into export (import) prices of 0.32 (0.68) for highly differentiated goods and of 0.19 (0.81) for less differentiated goods.

  Two-thirds (one-quarter) of the export price adjustment (aka incomplete pass through) for highly differentiated (less differentiated) goods is due to a destination-specific ($\approx$ customer-specific) markup adjustment.

Punchline: Firms selling in more differentiated product markets engage in less pass through and more (destination or customer-specific) markup adjustment.

Question: Do Belgian firms operating in output markets with greater product differentiation have similar low pass-through and large markup adjustment to common and/or idiosyncratic shocks?

Conclusions

- Important paper that offers a new, non-parametric approach to evaluating the evolution of prices.
- Parameters have a structural interpretation $\Rightarrow$ we can gain insight into model features that we need to match the data.
- These parameters are essential for modeling propagation of shocks in the production network.
- Opens new questions regarding how to think about the relationship of input prices, competitors' prices and output prices.