Comments on: Evidence from Micro Producer Data

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I feel like a kid in a candy store. Studies of pricing behaviour at the individual level have always been hampered by lack of data. This is no longer a problem and IPN deserves the credit.

Plan of the Discussion.

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1. Why study PPI?

- Extensive consumer price data, so far very few producer price data sets;

- Unique price information;

- Industrial pricing is much more heterogeneous than consumer pricing and so patterns of consumer price changes are likely to differ from patterns of producer price changes, the latter are also more varied;

- Monetary policy channels may differ for producer prices, especially if retail sector uses simple pricing rules.

2. Issues.

2.1 Issues arising from the differences between producer and consumer prices:

(a) Industrial pricing differs from consumer pricing due to:

- Closer links between suppliers and customers:

Unlike with consumer pricing, where I can be shopping for groceries in the same store for years without being known to the seller, in industrial pricing the relationships very often are not anonymous.

- Long-term relationships:

These non-anonymous relationships between supplier and customer are often long-term; hence price behaviour is often based on explicit contracts; also, implicit price contracts are probably more important;

- Stronger customer resistance (Rotemberg, 2002) – due to non-anonymous relationships;

- Collusion (Rotemberg and Saloner, 1997) – more likely for producer prices.

2. Issues

- (Blinder, 1991): delivery lags, explicit contracts, hierarchies – important for producer but not consumer prices,

- Price adjustment costs may be smaller for producer prices

but Zbaracki, Ritson, Levy, Dutta and Bergen (2004) document that 70% of price adjustment costs are the cost of negotiating with customers.

(b) PPI data sets consist of list, not transactions prices:

- makes the information on the frequency, duration and size of price changes problematic,
- need a model of price adjustment in which the list price is the basis for negotiation of transaction price;

(c) Industrial products are much more heterogeneous than consumer products; hence the analysis, in particular classification into general categories of goods, needs to be more detailed.

2. Issues

2.2. General Issues:

(d) Probability or duration?

Calculating probability of price changes as the ratio of the number of changes to the number of two consecutive observations provides an adequate measure of the frequency of price changes. On the other hand, calculations of the duration of prices are fatally flawed by missing or interrupted observations. There is no reasonable way around the problem and so duration data provide limited additional information on price behaviour.

The difference between averaged duration obtained directly and obtained from frequency data shows the dispersion of duration across products or product aggregates (due to Jensen's inequality). The dispersion can be accounted for by reporting frequencies for smaller aggregates.

(e) To censor or not to censor: Is data volume an issue?

As many price spells are incomplete (interrupted by the beginning or end of data series), researchers face choice between data quality and data volume. In several studies, some statistics are computed using all price information. The rationale is that incomplete price spells (interrupted by the beginning or the end of the data series) provide additional information.

2. Issues

The importance of this additional information cannot be assessed without strong distributional assumptions on the duration of prices. Current knowledge does not provide sufficient guidance for such assumptions. Hence price information using all data may be misleading.

Thanks to the amazing effort of IPN participants, the volume of available data is sufficient to extract patterns of price changes even if only censored data are used. Hence the choice between data quality and volume should be decided in favour of the former.

(f) Is a missing observation a sign of flexibility or of rigidity?

There is a temptation to treat missing observations, or changes in product characteristics, as equivalent to price changes. This makes more sense for PPI than for CPI since product characteristics influence the effective price. But changes in product characteristics are how a firm may deal with the inability to adjust the nominal price, hence they may be a sign of nominal rigidity.

The choice between these two interpretations is difficult, and so data on missing observations or changes in characteristics should be reported separately from price changes.

3. Empirical Results.

I divide the empirical results in the four papers into the obvious, the not-so-obvious and the surprising.

3.1. The Obvious:

I classify empirical results as obvious if:

- they are known from consumer price studies,
- there is no reason to expect different behaviour for
  producer prices.

(a) Heterogeneity in the frequency of price changes:

This is a well known fact from earlier studies of consumer prices; for example:

- Cecchetti (1986)
- Kashyap (1995)
- Levy and Young (2003)

In the last study the price did not change for over 70 years!

This can be contrasted with prices of some energy products and fresh foods, which may change multiple times in a month.

3. Empirical Results

(b) High frequency of price changes for energy products.

(c) High frequency of price changes for unprocessed food.

(d) Time-contingent elements, in particular many durations of 12, 24 and 36 months.

Casual observation, as well as consumer price information, indicate preference for certain dates in price changing, in particular the beginning of the year or quarter or month.

This need not be a problem for Calvo, as the economy could consist of various types of firms, some of which can change prices monthly, some yearly etc..

(e) State-contingent elements.

(f) Little rigidity at the individual level – many price decreases:

at low levels of inflation few prices are rigid downwards.

3. Empirical Results

3.2. The Not-So-Obvious:

(a) Regularities across categories of goods:

Table 1

Frequency of price changes - higher for food and intermediate products than for capital, non-food consumer goods

| | Average* | | | | | | |
| | 5 | 3 | | | | | |
	countries		Germany	France	Italy	Spain	Portugal
Food	*0.21*	*0.24*	**0.14**	*0.21*	*0.27*	*0.24*	*0.21*
Non durable	**0.10**	**0.08**	**0.14**	**0.11**	**0.10**	**0.10**	**0.05**
Durable	**0.11**	**0.12**	**0.10**	**0.12**	**0.07**	**0.10**	*0.18*
Intermediate	*0.20*	*0.19*	*0.23*	*0.20*	*0.18*	*0.28*	**0.12**
Capital	**0.09**	**0.07**	**0.11**	**0.12**	**0.05**	**0.08**	--
Energy	0.50	0.52	0.39	0.56	--	0.38	0.66
ALL	0.19	0.20	0.17	0.17	0.15	0.21	0.23

Notes: **Bold: low frequency,** *italic: high frequency*

*unweighted averages; 3 countries: Italy, Spain, Portugal

Prices of capital and non-food consumer goods are changed, on the average, once a year; the frequency for food and intermediate products is twice higher

3. Empirical Results

(b) Duration of some industrial prices (non-durable consumer, capital goods):

Portugal: median of 36 months for manufacture of rubber and plastic, other non-metallic and fabricated metal product.

This is an astonishing degree of price rigidity (but perhaps only of list price rigidity).

(c) German firms condition their price changes on the behaviour of competitors.

(d) German firms react more strongly to cost increases than to price decreases – Pelzman (2000).

(e) Proportion of price decreases – inversely related to the frequency of price changes.

3. Empirical Results

3.3. The Surprising:

(a) Large proportion of price decreases – for list prices!

Given that the supplier can change the characteristics of the good (delivery lags etc.) it is not obvious why price decreases are so common.

(b) Differences across countries, inflation rates, industries – much greater for probability of adjustment than for size.

Table 2

Size of price changes varies less than probability

	Italy		Spain		Portugal	
	Prob	Size	Prob	Size	Prob	Size
Food	0.14	0.05	0.14	0.06	0.12	0.07
Non durable	0.06	0.05	0.07	0.05	0.04	0.05
Durable	0.05	0.03	0.09	0.04	0.10	0.04
Intermediate	0.10	0.04	0.16	0.05	0.07	0.05
Capital	0.03	0.04	0.06	0.05		
Energy			0.21	0.04	0.38	0.12
ALL	0.09	0.04	0.13	0.05	0.14	0.07

Note: data for price increases

3. Empirical Results

(c) Similar size of price changes for increases, decreases.

(d) Changes in the rate of inflation – have little effect on the overall frequency of price changes, but they affect the shares of price increases and decreases.

To summarize: the overall surprising picture is that list prices are reduced often, firms react to changes in inflation by varying the ratio of price increases and decreases and the frequency of price changes is much more heterogeneous than the size of price changes.

The last observation is a problem for Calvo (1983); perhaps also for Sheshinski and Weiss (1977).

4. Comparison with Consumer Prices.

My intuition, before reading the papers, was that:

-   producer prices should be changed less often since other good characteristics (delivery lags etc.) can be adjusted instead;

-   producer price changes should be smaller, since a typical industrial firm sells fewer products than a typical retail establishment and so can less afford variations in its real revenue;

-   producer price decreases should be less frequent, as these are list prices and discounts can be used; also, other good characteristics can be improved instead.

4.1. Are Producer Prices Changed Less Often?

Portugal – yes.

Dias, Dias and Neves, Figure 15

Spain – no, but close.

4. Comparison with Consumer Prices

4.2. Are PPI Price Changes Smaller?

Portugal, Spain, Italy – yes.

Dias, Dias and Neves, Figure 18

4.3. Are PPI Price Reductions Less Frequent?

Portugal, Italy, Spain - no

Overall – a clear but unexpected picture.

It may be the case that my intuition was simply wrong. In any case, the explanation of these differences is a task for future research.

5. Explaining Frequency and Size of Price Changes.

IPN studies presented in this conferences (both PPI and CPI) provide a rich set of facts on the frequency and size of price changes at the individual level. These facts will be used to construct aggregate models. But, as has been stressed many times here, the frequency of price adjustment varies a lot over goods, locations and countries. So I guess the most important task is to explain the factors that determine the size and frequency of adjustment.

Several presenters mentioned that the frequency of price changes depends on the elasticity of demand or on the size of the firm. My previous research, joint with Andrzej Skrzypacz (2004) indicates, however, that what matters is the concavity of the profit function. This approach provides an explanation of some of the observed patterns, but also a new question.

Across goods heterogeneity in price changes.

Concavity of the profit function affects in an unambiguous way the frequency and size of price changes;.

Furthermore, it explains why the following three features of price adjustment coincide:

5. Explaining Frequency and Size of Price Changes

- frequent adjustment and small price changes;
- low proportion of pricing points (both attractive and round prices);
- staggering of price changes.

In Alvarez, Buriel and Hernando the probability of price changes is smaller, and the size of changes is larger, if the preceding price is a pricing point (see tables 4, 9).

In Sabbatini, Fabiani, Gattulli and Veronese the frequency of price changes is positively, and the size of price changes is negatively, related to the staggering of price changes (see tables 8-10)

Proposed explanation: consider a model with the two crucial elements:

- identical menu costs,
- heterogeneous concavity of the profit function across firms.

Assume no discounting and nonstochastic inflation. In the presence of menu costs, the firm chooses two price bounds, *s, S*. The nominal price is being kept constant until inflation erodes the real price to *s*; then the nominal price is raised so as to make the new real price equal to *S*.

5. Explaining Frequency and Size of Price Changes

The optimal condition which determines the price bounds and, for a given inflation rate, the frequency of price changes, is:

$$\pi(s) = \pi(S) = \frac{1}{T}\left[\int_0^T \pi(Se^{-gt})dt - C\right]$$

where π is the profit function, g is the (constant) inflation rate and C is the menu cost.

i.e. (disregarding the nonlinear formula for the average) the values of profits at the price bounds are equal to average profits per unit of time over the pricing interval, net of adjustment costs.

Concavity of the profit function affects:
- losses from suboptimal adjustment and, as a consequence
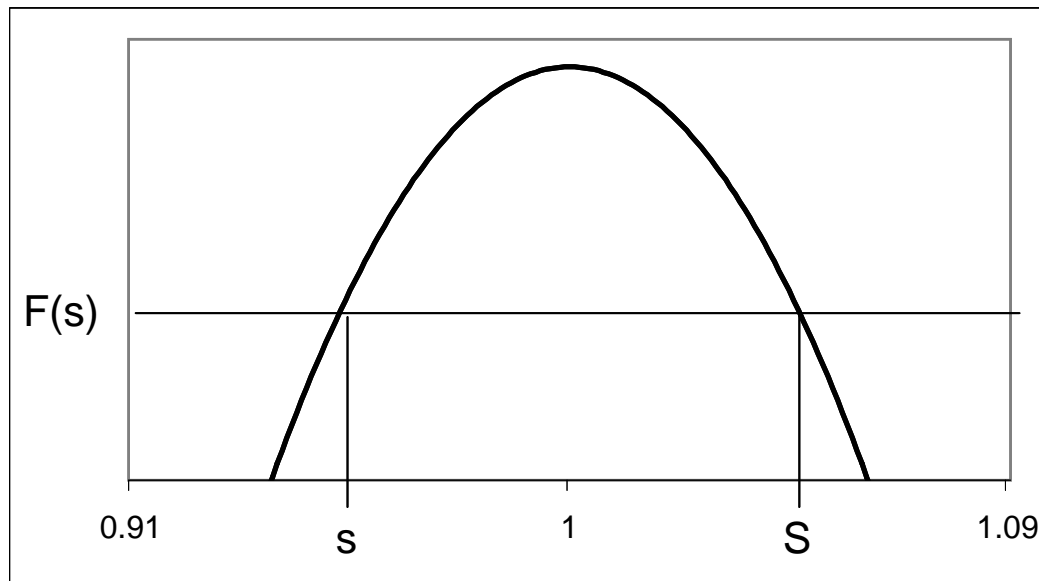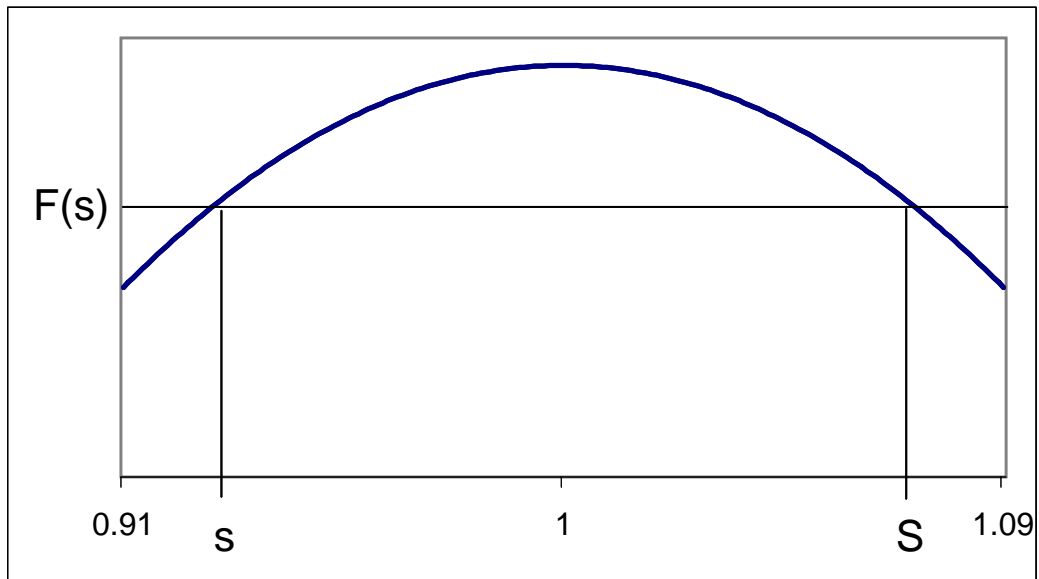- the frequency of price changes.

The more concave is the profit function, the more frequent and (for a given inflation rate) the smaller are price changes (see figure 1 below).

If the profit function is strongly concave (as in the lower panel of figure 1), the precise timing of adjustment is crucial and so the attractiveness of pricing points or time-contingent considerations is small.

5. Explaining Frequency and Size of Price Changes

Figure 1

Concavity of the profit function
and the size and frequency of price changes

F(s)

0.91   s   1   S   1.09

F(s)

0.91   s   1   S   1.09

5. Explaining Frequency and Size of Price Changes

Conclusion: if the reason for heterogeneity is the difference in the concavity of the profit function, then:

- For frequently adjusting firms calendar and pricing points do not matter;
- For infrequently adjusting firms calendar and pricing points are important.

What affects concavity of the profit function?

Konieczny and Skrzypacz (2004): the more intensive is the search for the best price, the more concave is the profit function.

Our calibrated model shows much stronger response of frequency than size of changes to inflation. With entry, the size of changes is not affected by inflation; all adjustment is in the frequency. This is consistent with some of the stylized facts outlined above.

Search - relevant for consumer markets; not obvious for producer markets.

Question: what affects profit function concavity in producer markets?

6. Relevance for Monetary Policy.

1. Producer price behaviour not that much different from consumer price behaviour.

2. More research needed since the nature of producer and consumer pricing policies is different, and so the similarity is surprising.

3. Given the large differences in the frequency of price changes between good types, it is important to take into account not only averages but also the distribution of the probability of price changes.

4. In particular, capital goods pricing appears to be very rigid.

This means that monetary policy may have significant output effects in capital goods industries – certainly an interesting prospect.