RBB Economics

Cost Pass-Through

Theory, Measurement & Potential Policy Implications

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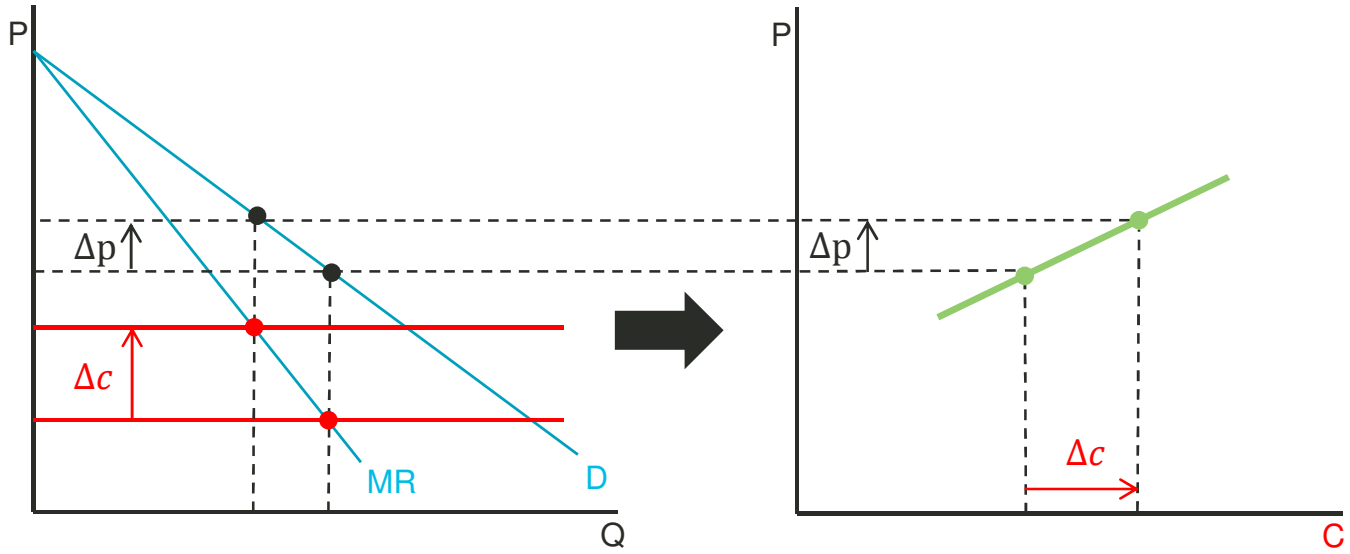
Introduction

- Acknowledgments
- Objective: Understand (likely) price effects of a shift in firm costs
- Review of relevant theoretical and empirical work
- Provide organised view, to facilitate understanding of key insights and intuitions from literature … and recognition of limitations
- Draw out potential policy implications and provide practical guidance
- Only time for a 'flavour' in this presentation

Overview

- At one level, a ‘measurement’ exercise
- Key challenge: What if direct measurement is not feasible?
- Focus shifts to underlying drivers: ‘shape’ of demand; cost structures; nature of competition; …

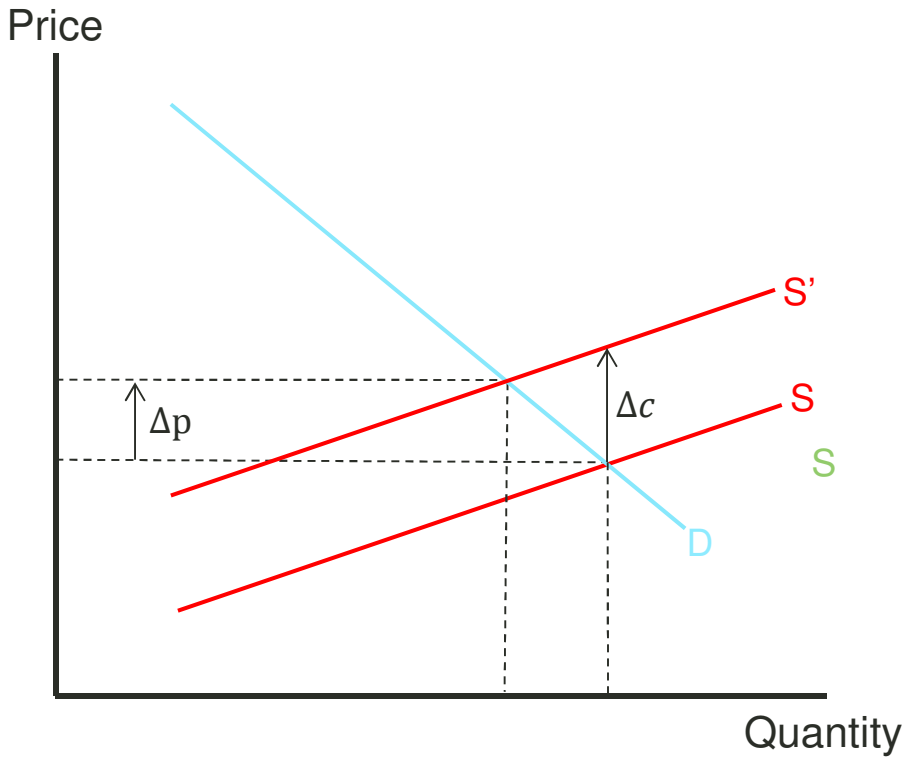


Relevance of cost pass-through

- Incidence of cartel damages
  - Less directly relevant to CMA but major source of wider interest in pass-through
- Likely consumer benefits from cost efficiencies
  - Mergers, JVs, agreements
- Impact of (upstream) policy interventions
- Assessment of input foreclosure
- Unilateral merger effects
  - Common 'first order' predictions of magnitude of price effect of horizontal merger involve explicit or implicit pass-through measure/assumption

A competitive paradigm (cf. classical tax incidence)

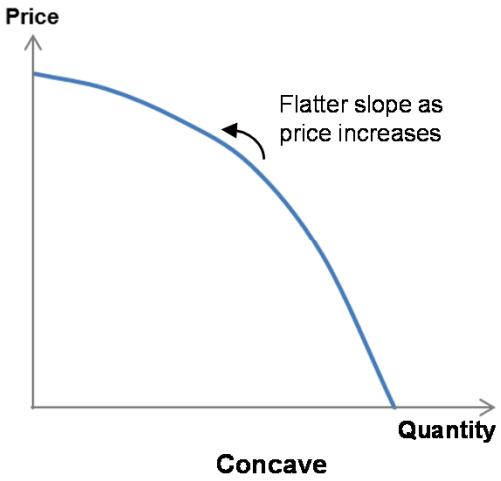
- In competitive scenarios, it is the (relative) slopes of demand and supply that are critical to pass-through of (industry-wide) cost shifts



- Slope of (competitive) supply relevant in oligopoly settings too

Imperfect competition: critical role for demand curvature

- Outside of competitive paradigm, curvature (convexity) of demand is critical



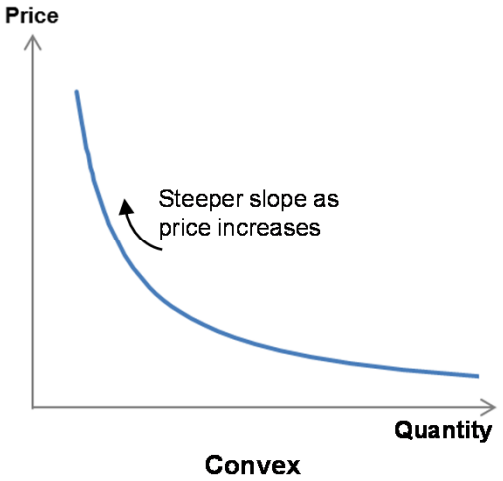
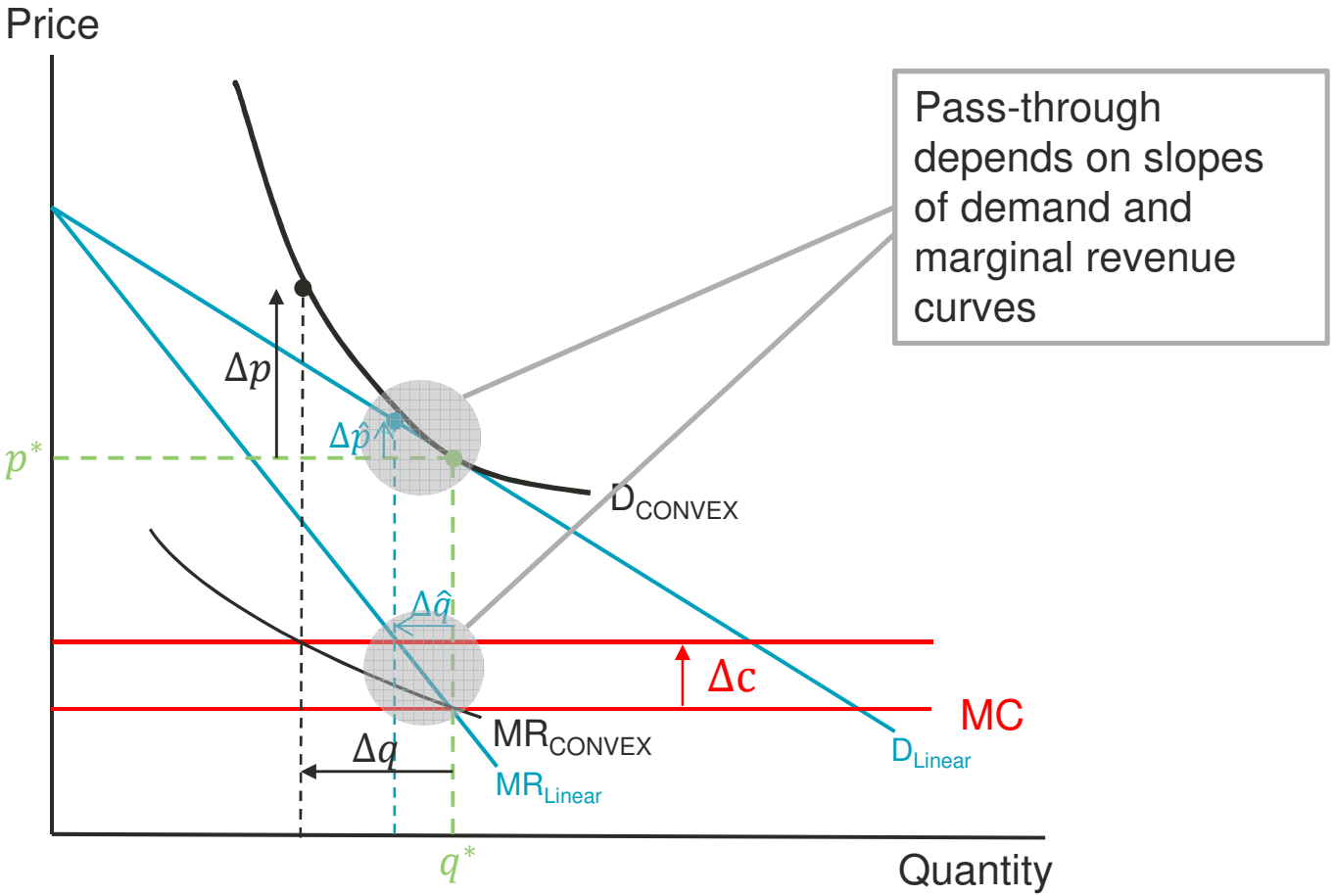


Illustration: Monopoly

- Impact best illustrated in monopoly context



Monopoly: Technical aside

- What's impact of cost shift on price/quantity which maximises profit?
  - How does solution to MR=MC change as MC shifts?

- First order condition: $MR(Q) - MC(Q, c) = 0$

- Implicit function theorem: Q(c) $\rightarrow \frac{\partial MR}{\partial Q} \cdot \frac{dQ}{dc} - \frac{\partial MC}{\partial Q} \cdot \frac{dQ}{dc} - \frac{\partial MC}{\partial c} = 0$

- Thus: $\frac{dQ}{dc} = \frac{1}{\frac{\partial MR}{\partial Q} - \frac{\partial MC}{\partial Q}}$

- Cost pass-through: $\frac{dP}{dc} = p'(Q) \cdot \frac{dQ}{dc}$

Monopoly results

$$Pass-through = \frac{slope\ of\ inverse\ demand}{slope\ of\ marginal\ revenue - slope\ of\ marginal\ cost}$$

$$= \frac{1}{2 + elasticity\ of\ slope\ of\ inverse\ demand - \frac{slope\ of marginal\ cost}{slope\ of\ inverse\ demand}}$$

demand curvature effect

- With constant marginal costs (slope of marginal cost = 0):
  - Linear demand: Pass-through = 50%
  - Concave demand: Pass-through < 50%
  - Convex demand: Pass-through > 50%
  - Convex enough demand: Pass-through > 100%

- With increasing (decreasing) marginal costs (slope of marginal cost > (<) 0):
  - Pass-through rate reduced (increased)

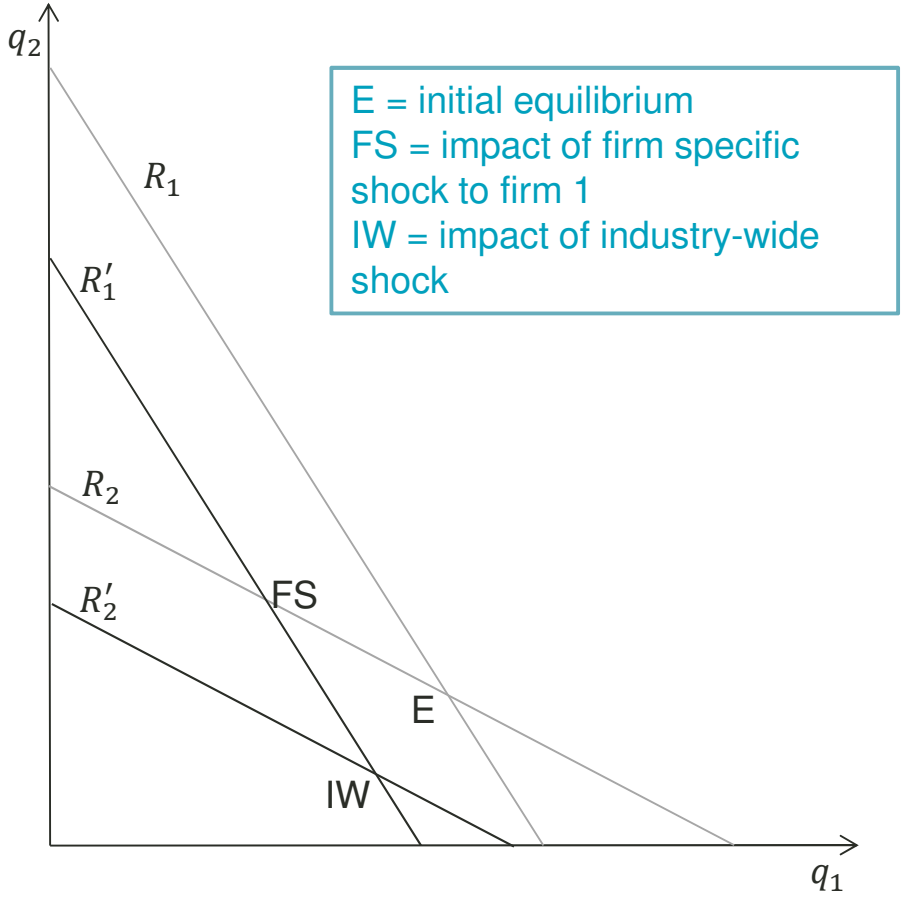
- **Policy: (Marginal) cost efficiencies passed through even in monopoly**

Oligopoly and vertical settings

- Some highlights:
  - Relationship between pass-through of firm-specific versus industry-wide cost shocks
  - Does more competition lead to higher pass-through?
  - Wholesale versus retail pass-through and implications for bargaining strength
  - IPRs and GUPPI: assuming pass-through (via assumed demand) versus estimating pass-through

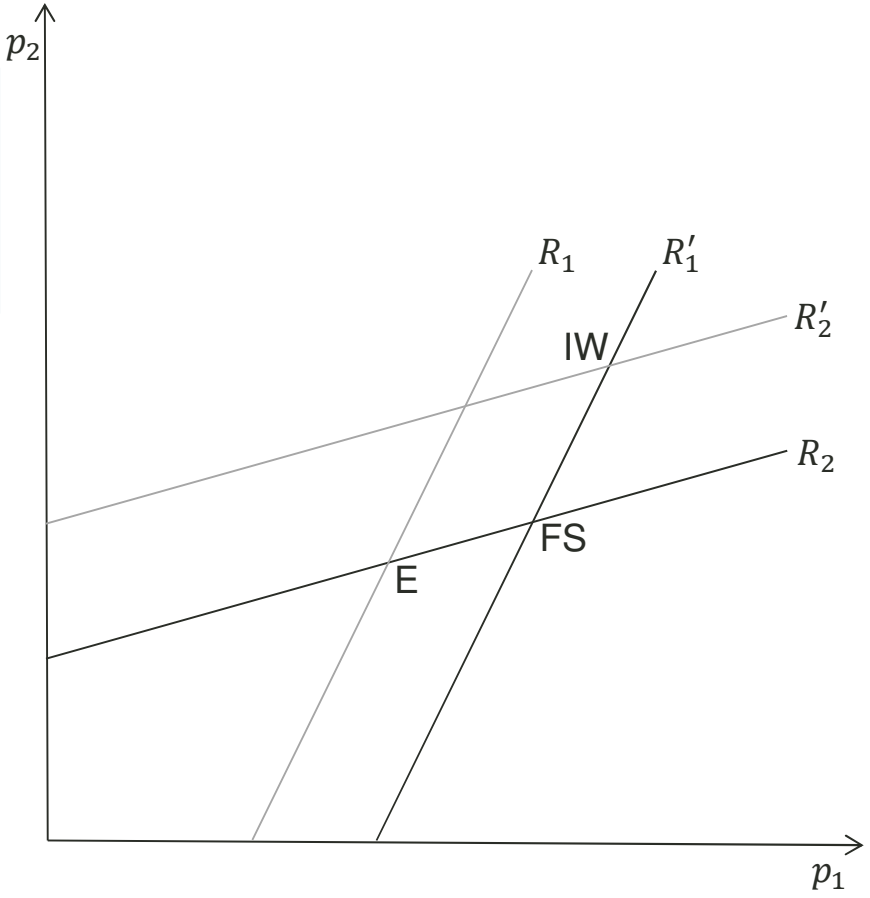
Impact of strategic interaction in standard cases

‘Cournot’ – strategic substitutes



E = initial equilibrium
FS = impact of firm specific shock to firm 1
IW = impact of industry-wide shock

‘Bertrand’ – strategic complements



Policy: Pass-through of firm-specific shocks is less than industry-wide shocks

Oligopoly results: 'Cournot' competition with homogeneous goods

- With constant marginal costs:

$$industry\ wide\ cost\ pass\ through = \frac{n}{n + 1 + \varepsilon_{SID}}$$

$$firm\ specific\ cost\ pass\ through = \frac{1}{n + 1 + \varepsilon_{SID}}$$

- Industry-wide pass-through depends on the number of firms (n) and the elasticity of slope of inverse demand (ε_{SID})
- Firm-specific pass-through rate is $^1/_n$ industry pass-through rate
- Industry-wide and firm-specific pass-through rates diverge as *n* increases
- **Policy: Pass-through of firm-specific cost efficiencies decreases with intensity of competition (as measured by n)**

Industry-wide cost pass-through and the intensity of competition

- General formulation for industry-wide cost pass-through (with constant marginal cost):

$$industry - wide\ cost\ pass - through = \frac{1}{1 + \theta(1 + \varepsilon_{SID})}$$

- θ is a conduct parameter: smaller θ corresponds to more intense competition
  - $\theta = 1$: monopoly; $\theta = {}^{1}/_{n}$: n-firm Cournot; $\theta = 0$: perfect competition; …

- Formula also nests symmetric differentiated Bertrand (cf. Anderson et al.), when $\theta = (1 - D)$, where D is the aggregate diversion ratio:
  - Competition increases as D increases; as does pass-through (if $\varepsilon_{SID} > -1$)

- **Policy: Industry-wide cost pass-through increases as the degree of competition increases, *provided that* inverse demand is not too convex (i.e. $\varepsilon_{SID} > -1$)**

- Weyl and Fabinger: *General expression* for industry-wide cost pass-through with symmetric firms (which allows for non-constant marginal cost and changes in the conduct parameter).
  - Also addresses integrating up of small cost changes.

Firm-specific cost pass-through and the intensity of competition

EC Guidelines on Article 101(3) TFEU:

The greater the degree of residual competition the more likely it is that individual undertakings will try to increase their sales by passing on cost efficiencies.

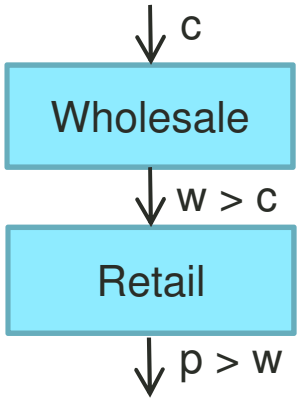
- Not true in homogenous product Cournot.

- No general result for firm-specific cost pass-through in Bertrand setting
  - It may fall with the number of firms, e.g. $q_i = \alpha - p_i - \varphi\left(p_i - \frac{1}{n}\sum_{j=1}^{n} p_j\right)$
  - It may rise (logit demand, symmetric inside goods prior to firm-specific shock)

- **<u>Policy:</u> Should not presume that greater market share implies lower pass-through of efficiency gains.**

Verticals (1): Pass-through and double marginalisation

- Well understood that successive monopolies can give rise to double marginalisation problem. Extends to oligopoly settings.



Upstream (wholesale) pass-through

Downstream (retail) pass-through

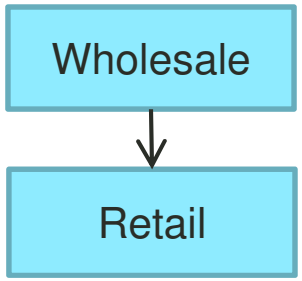
- Pricing behaviour linked to pass-through rates
  - Wholesale price rise reduces volumes more as retail pass through increases
  - Greater downstream pass-through means reduced incentive to mark up wholesale price

- **Policy: Scope for strategic effects?**
  - **Wholesalers with market power might seek to dampen retail pass-through? But retailers might want to resist this…**

Verticals (2): Pass-through and bargaining terms

- Compare negotiation between wholesaler and retailer under 3 scenarios:

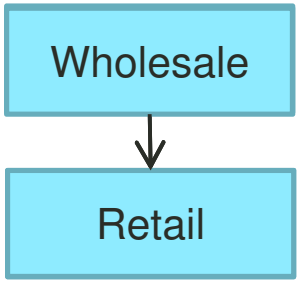
Two-part tariffs



Wholesale price set equal to marginal cost

Wholesale pass-through rate = 100%
Downstream pass-through rate = ρ_D

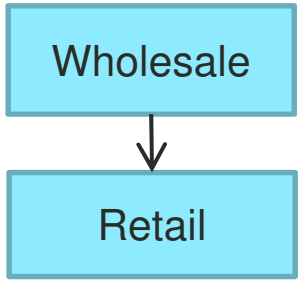
Negotiation over wholesale price and retail price



$$\frac{(p-w)}{(w-c)} = \frac{\alpha}{(1-\alpha)}$$

Wholesale pass-through = $\alpha \cdot 100\% + (1-\alpha)\rho_D$

Negotiation over wholesale price only



$$\frac{(p-w)}{(w-c)} = \frac{\alpha}{(1-\alpha)} + \frac{\partial p}{\partial w}$$

Higher retail pass-through rate = *stronger* retailer negotiating position

Policy application: Unilateral effects of horizontal mergers

- Unilateral effect: merger creates cannibalisation cost to winning new sales
  - Simultaneous cost shock for each of merging parties
- Predicted price rise depends on extent to which these cost shocks passed through
  - As well as impact of merger-specific efficiencies
- Pass-through critical to popular 'first order' approximations of merger effect
  - Assumed (via demand shape) in IPR formula; required input in GUPPI x pass-through approach
- Choice of pass-through rate not innocuous but true value(s) typically unobservable
- Alternatives may be misleading
  - Industry-wide cost shocks often very different (*over-stating* firm specific)
  - Assuming 100% pass-through potentially far from reality but hard to give a feel for what firm-specific rate should be (without detailed estimation)
- **Policy? Pre-merger pass-through rates may give superior results than mis-specified demand (Miller et al). *But* still need to obtain reliable estimates of pre-merger pass through…**

Empirical agenda: Relevant issues

- How can we obtain practically useful estimates of pass-through rates?
- What data are required to obtain these estimates?
- What are the limitations associated with particular approaches?
- What factors affect pass-through rate?
- Do any reliable quantitative rules of thumb emerge from the empirical literature?

Different measures of cost pass-through

- **Absolute pass-through**
  - If a £1 unit cost increase causes a £1 price increase, then absolute pass-through = 1

- **Pass-through elasticity**
  - If a 20% unit cost increase causes a 10% price increase, then pass-through elasticity = 0.5

- Converting absolute pass-through to pass-through elasticity, and vice versa
  - Simple rule: **Pass-through / Pass-through elasticity = Price / Unit cost**

  - E.g. unit cost increased from £5 to £6 and price increased from £10 to £11
    - Absolute pass-through = £1 / £1 = 1
    - Pass-through elasticity = 10% / 20% = 0.5
    - Pass-through / Pass-through elasticity = 2 = Price / Unit cost = £10 / £5

Some basic practical insights

- **Constant margin**
  - If $p - c = (p + \Delta p) - (c + \Delta c)$, then absolute pass-through = 1
  - If $\frac{p-c}{p} = \frac{p+\Delta p-(c+\Delta c)}{(p+\Delta p)}$, then pass-through elasticity = 1
    - Use the price / cost ratio to back out absolute pass-through

- **A large change in input cost and a small change in price**
  - Price only increased by 2% while factor price of one input went up by 20%. Evidence of low pass-through?
    - Depends on the proportion of this specific factor in total cost
      - If the input represents 20% of total cost, the implied change in cost is 4%, and the pass-through elasticity is 0.5
      - Recover absolute pass through using price / cost ratio

Practical issues: measurement

- Which relevant cost measures?
  - Proxy for marginal cost = average variable cost?
  - Accounting data may not provide economically-meaningful measures
  - Time frames often critical

- Firm-specific vs industry wide cost changes
  - Important to control for industry-wide cost shocks

- Delayed pass-through
  - No contemporaneous effect? Account for potential lags in true relationship
  - Distinguish short-run and long-run effects?

Three empirical approaches

- ‘Qualitative’ approaches
  - Use event studies, documentary evidence, etc. to build qualitative estimates/measures of likely price response to cost changes
  - Find reliable benchmarks from comparable settings
- Non-structural (reduced-form) econometric methods
  - Estimate statistical relationship between cost variation and price variation
- Structural econometric models
  - Estimate underlying market parameters (demand system) and develop counterfactual simulations of impact of cost change on equilibrium price

Practical issue: role of functional form

- Reduced form approach
  - Linear relationship between price and cost implies:
    - **Constant absolute pass-through** (regardless of cost change)
  - Log-log relationship between price and cost implies:
    - **Constant pass-through elasticity but not constant absolute pass-through**
  - Functional form matters!

- Structural model: shape of demand function is a key factor
  - Standard functional form (linear, logit, AIDS, isoelastic) imposes pass-through rate (e.g. illustrative price rise or merger simulation)
  - Recent studies have employed Random Coefficient Logit model (Berry, Levinsohn & Pakes (1995))
    - The shape of the demand curve is estimated
  - Estimation of super-elasticity $(\eta) = \frac{\%\ change\ in\ price\ elasticity\ of\ demand}{\%\ change\ in\ price}$
  - Pass-through and super-elasticity (Bulow & Pfleiderer (1983)): $\frac{dp}{dc} = \frac{\epsilon}{\epsilon - 1 + \eta}$

Insights from the empirical literature

- Limited existing literature that's directly relevant to competition policy situations
  - Empirical I/O literature is still developing
- Wide range of pass-through estimates obtained in practice
  - Low (20%) and high (over 100%) absolute pass-through
  - Variety of different pass-through relationships estimated: Absolute pass-through; pass-through elasticities; elasticities in relation to particular inputs
- Few studies test impact of firm-specific vs industry-wide cost shock on price
- Some limited evidence of industry-wide cost pass-through increasing with intensity of competition
- Evidence of short-term dynamic asymmetries in response to cost increments and decrements

Concluding remarks (1)

- Pass-through relevant to a range of competition policy (and non competition policy) settings
  - Scope for useful insight from a variety of situations
  - New perspectives on old problems

- Often significant misunderstandings/generalisations in practice
  - "Pass-through is dependent on competition"
  - "Pass-through varies with elasticity of demand"

- RBB report seeks to distil and organise results
  - Establish issues and concepts
  - Identify relationships and intuitions from theory
  - Probe insights of empirical work (implications of different measures, etc.)
  - Draw out potential implications for competition policy
  - Recognise limitations

Concluding remarks (2): Some policy messages

- Pass-through (e.g. of cost efficiencies) can be significant, even when competition is limited
- Curvature of demand has a critical impact in monopoly/oligopoly settings
  - Need an empirical strategy that responds to this
- Industry-wide and firm-specific pass-through effects are often quite different
  - Different in levels; different in relationship with competition
  - Need to be very clear about distinction when gathering and appraising evidence
- Broad range of firm-specific pass-through outcomes possible
  - Sensitive to context, so assessment must be context-specific too
- Wide range of pass-through estimates obtained in practice
- Vertical effects sensitive to cumulative pass-through
  - Influenced by and influence on strategic interaction

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