Pre-recording:
Monopolistic competition and price stickiness

Rhys Bidder

KBS/QCGBF

Spring, 2024

Disclaimer

The views expressed in this presentation, and all errors and omissions, should be regarded as those solely of the author, and are not necessarily those of the Bank of England or Qatar Central Bank.

Monopolist profit maximization

Monopolist profit maximization

Before we delve into a full NK model, we will analyze one of its building blocks

- In particular, we will analyze a basic monopolist problem
- Monopolist is the only supplier of a good
- The demand curve it faces is the same as the *market* demand curve
- As such, it has **pricing power** (in contrast to a standard 'price taking' perfect competition assumption)
- Choosing price is equivalent to choosing output, as the price combined with the demand curve implies output
  - Or the output combined with the demand curve implies price

Monopolist profit maximization

- Assuming a ‘standard’ demand curve, the monopolist must reduce its price to sell an additional unit on the margin
- This means that unlike in the case of a perfectly competitive price taker, their ‘marginal revenue’ is less than the price
  - A price taker has no effect on price if it produces more, so an additional unit of output earns the (fixed) price

Monopolist profit maximization

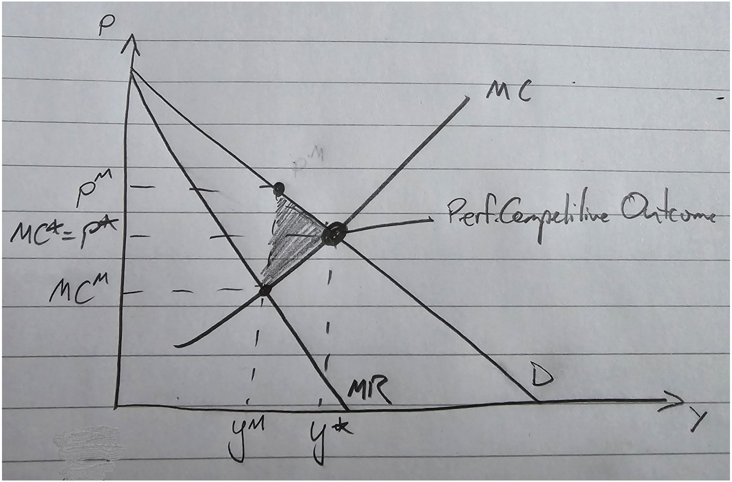
The impact on price leads to the monopolist producing less

- Simplifying - profit maximization occurs when MC=MR i.e. marginal cost = marginal revenue
- Because of pricing power, $MC < P$ and thus the optimal amount produced will be lower than if $MC = P$

This is inefficient as MC will be $< P$ at the profit maximizing scale

- People are willing to pay more for the additional marginal unit than it costs to make (scope for Pareto gain)
- You can see this from the demand curve being above the marginal cost curve up to the point where $MC = P$ (Harberger triangle)
- But, without price discrimination, the monopolist cannot charge people different prices

So we have $y^M < y^*$ and thus a **markup** of price over cost $P^M > MC^M$



P
MC
p^M
$MC^* = p^*$
MC^M
Perf. Competitive Outcome
D
MR
Y
y^M
y^*

Monopolist profit maximization

Imagine that a monopolist faces a demand curve $y = p^{-\epsilon}$ and a differentiable cost function, C

- What is ϵ?

$$\frac{dy}{dp} = -\epsilon p^{-\epsilon-1}$$

so (remember the section on differentiation in the Math note)

$$\frac{dy}{dp}\frac{p}{y} = -\epsilon p^{-\epsilon-1}\frac{P}{P^{\epsilon}} = -\epsilon$$

- Thus, ϵ is the price elasticity of demand - it gives the percentage loss in sales for a percentage change in price
- Large (small) ϵ implies big (small) loss in sales for a price change
- $\epsilon \to \infty$ means no pricing power (limit is perfect competition)

Monopolist profit maximization

A monopolist maximizes profits (which are revenue minus costs)

$$\max_p py - C(y)$$

s.t.

$$y = p^{-\epsilon}$$

So our first order condition is $(MR - MC = 0)$

$$(1-\epsilon)p^{-\epsilon} - C'(y)\frac{dy}{dp} = 0$$

or

$$(1-\epsilon)p^{-\epsilon} + C'(y)\epsilon p^{-\epsilon-1} = 0$$

or

$$p = \frac{\epsilon}{\epsilon - 1}C'(y) \equiv \mathcal{M}C'(y)$$

Monopolist profit maximization

The pricing condition is

$$p = \mathcal{M} \times C'(y)$$

where

$$\mathcal{M} \equiv \frac{\epsilon}{\epsilon - 1}$$

Price is set as a constant markup ($\mathcal{M}$) over marginal cost

- Note we recover $P = MC$ in the $\epsilon \to \infty$ (perfect competition case)
- Lower (higher) $\epsilon \Rightarrow$ higher (lower) markup

Monopolist profit maximization

In the NK framework we assume there are 'lots' (uncountably many) of goods

- The households' preferences will imply a demand curve for each that looks like the demand curve we assumed above
- It is assumed that a single firm (a monopolist) supplied each good
- The degree of market power they each have is determined by the willingness of the household to substitute between the different types of goods
- ϵ will reflect that substitutability - as it limits how quickly the household will substitute away (and thus it limits market power)

This setup is known as 'monopolistic competition'

Monopolist profit maximization

So, does that mean firms in the NK model set $P = \mathcal{M} \times C'(y)$?

- Not quite
- They face 'price stickiness' and are assumed not always to be able to set their prices freely
- Commonly modeled in a (very) reduced form way...

Price stickiness

Price stickiness

We will follow Calvo (1993) in asserting a simple form of price stickiness

- Each period, only a fraction $(1 - \theta)$ of firms can reset prices (for $\theta \in [0, 1]$)
- Completely random *which* firms - so each firm has probability θ of *not* being able to re-optimize their price in a given period
- As such, when they do re-optimize their price in t, there is the probability θ^k that the price will be fixed until $t + k$ (and thus will apply in t, $t + 1$, $\ldots t + k$)
- The time to next optimization is a random variable, with mean $\frac{1}{1-\theta}$ (which is increasing in θ, as is intuitive)

Price stickiness

Because their price might last for several periods into the future, **when the firm can reset the price, they have to imagine how profits in future periods will be affected by it**

- The firm will maximize a discounted sum of future profits
- Will only consider future contingencies in which the price set is *still* prevailing
- They weight the future contingencies in $t + k$ by:
  - the probability of reaching it (θ^k)
  - time discount (β^k)

Price stickiness

In every period the distribution of prices across firms is a mixture of

- The price of the $1-\theta$ of firms who get to reoptimize
  - All set the same price since they face the same optimization problem
- The prices of the θ fraction of firms whose prices were reoptimized before t but are now fixed
  - Among these prices, a fraction $1-\theta$ were reoptimized in $t-1$ and a fraction θ were reoptimized before $t-1$
  - Among those prices reoptimized before $t-1$, a fraction $1-\theta$ were reoptimized in $t-2$ and a fraction θ were reoptimized before $t-2$
  - Continue the logic...

Price stickiness

In t we have prices prevailing that were reoptimized in the current period *and all previous periods*

- The fraction of prices in t that were set in $t - j$ is declining (to zero) as $j \to \infty$

When firms set their prices they do so acknowledging that...

- There is a distribution of prevailing prices now and in the future
- Their own price will prevail for a random length of time into the future

The problem is thus very different from standard 'static' monopolistic competition that implied

$$P = \mathcal{M} \times C'(y)$$

but it is related

Price stickiness

Let us consider a couple of punchlines:

- With price stickiness, we can see an avenue to monetary non neutrality
  - Remember quantity equation and Fisher equation
- If we are to discuss price stickiness, we need to introduce price *setting* and, thus, market power
  - With perfect competition there is no price setting, only *price taking*
  - How can we model prices *not* being changed (stickiness), given that there is never a decision to set prices in the first place!?
- Imperfect competition introduces 'market failure' efficiency losses
  - This **provides a reason why monetary policy interventions might be justified**
  - Contrast with RBC models