Monopolistic Competition when Income Matters

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Purpose

We propose an alternative microfoundation to models of imperfect competition and product differentiation with and without endogenous entry.
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- Separable utility à la Dixit-Stiglitz is widely applied in trade (Krugman, 1980; Melitz, 2003) and macroeconomics (New-Keynesian models, Endogenous entry models) under CES preferences.
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- We propose an alternative microfoundation to models of imperfect competition and product differentiation with and without endogenous entry.
- Separable utility à la Dixit-Stiglitz is widely applied in trade (Krugman, 1980; Melitz, 2003) and macroeconomics (New-Keynesian models, Endogenous entry models) under CES preferences.
- It is also useful to study Cournot competition with product differentiation.
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\[ U = \sum_{j=1}^{n} u(x_j) \]
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- Direct additivity implies that the Marginal Rate of Substitution \( \frac{u(x_i)}{u(x_j)} \) between any two varieties does not depend on the consumption of other varieties \( x_k \).
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- Most applications focus on CES preferences with \( \theta \in (1, \infty) \):
  \[ U = \sum_{j=1}^{n} x_j^{\frac{\theta-1}{\theta}} \]
Monopolistic competition à la Dixit-Stiglitz

- Equilibrium in the CES case:

\[ p = \frac{\theta c}{\theta - 1}, \quad n = \frac{EL}{\theta F}, \quad q = \frac{(\theta - 1)F}{c} \]

where \( p \) = price, \( n \) = number of firms and \( q = xL \) = firm production, \( E \) = income, \( L \) = population, \( c \) = marginal cost and \( F \) = fixed cost. A double marke size (number of consumers) generates double number of goods, with same price (and quantity per firm), but only with CES. Income does not affect price and quantity, not just with CES.
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p = \frac{\theta(x) c}{\theta(x) - 1}, \quad n = \frac{EL}{\theta(x) F}, \quad q = \frac{(\theta(x) - 1) F}{c}
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where \( \theta(x) = -u'(x)/xu''(x) \).
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where \( \theta(x) = -u'(x) / xu''(x) \).

- With Cournot or Bertrand competition and CES, an additional competition effect for trade (Etro, 2013, Scand.J.E.) and RBC (Etro-Colciago, 2010, Econ.Journ.)
The Model

- We consider a different microfoundation, based on different preferences

\[ V = \sum_{j=1}^{n} v_j p_j E \]

with \( v > 0, v_0 < 0 \) and \( v_{00} > 0 \) and some regularity conditions. 

By Hicks (1969) and Samuelson (1969) we know that direct additivity and indirect additivity represent two distinct classes of well-behaved preferences with only one case in common: CES.
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Direct demand function

- Indirect additivity \((\sum_{j=1}^{n} = \int_{0}^{n} \text{if you like})\):

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- The Roy identity generates the direct demand function of each consumer:

$$x_i = \frac{\partial V / \partial p_i}{-\partial V / \partial E} = \frac{v' \left( \frac{p_i}{E} \right)}{\sum v' \left( \frac{p_j}{E} \right) \frac{p_j}{E}}$$
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Direct demand function

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V = \sum \nu \left( \frac{p_j}{E} \right)
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x_i = \frac{\partial V / \partial p_i}{-\partial V / \partial E} = \frac{\nu' \left( \frac{p_i}{E} \right)}{\sum \nu' \left( \frac{p_j}{E} \right) \frac{p_j}{E}}
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- Indirect additivity implies that the relative demand of two varieties \(x_i / x_j\) does not depend on the price of other varieties \(p_k\).

- The denominator \(\mu = \sum \nu' \left( \frac{p_j}{E} \right) \frac{p_j}{E} < 0\) is taken as given in monopolistic competition.
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- Market demand is given by $q_i = x_i L$ where $L$ is number of consumers (market size)
Some examples of direct demands

- CES: \( v(p) = p^{1-\theta} \) delivers:

\[
q_i = \frac{p_i^{-\theta} EL}{\sum p_j^{1-\theta}}
\]
Some examples of direct demands

- **CES**: $v(p) = p^{1-\theta}$ delivers:

  $$q_i = \frac{p_i^{-\theta} EL}{\sum p_j^{1-\theta}}$$

- **EXPONENTIAL**: $v(p) = e^{-\tau p}$ delivers log-linear demand:

  $$q_i = \frac{e^{-\frac{\tau p_i}{\varepsilon}} EL}{\sum e^{-\frac{\tau p_j}{\varepsilon}} \cdot p_j}$$

  (notice the difference from the Logit, which has no income effects)
Some examples of direct demands

- ADDILOG: \( \nu(p) = (a - p)^{1+\gamma} \) delivers the linear perceived demand when \( \gamma = 1 \):

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- **DISPLACED CES:** \( v(p) = (p + b)^{1-\vartheta} \) delivers:
  \[
  q_i = \frac{(\frac{p_i}{E} + b)^{-\vartheta} \cdot EL}{\sum (\frac{p_i}{E} + b)^{-\vartheta} \cdot p_j}
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Monopolistic Competition (Dual)

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- Profit can be written as:

$$\pi_i = \frac{(p_i - c) v'(p_i/E) L}{\mu} - F$$

where $c > 0$ and $F > 0$ are respectively marginal and fixed costs.
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where $c > 0$ and $F > 0$ are respectively marginal and fixed costs.

The demand elasticity is $\theta(p_i/E) \equiv -\frac{v''p_i}{v'E} > 0$: it depends on $p_i/E$, not on $\mu$ and $L$. 
Pricing

- The FOC is:

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\frac{p^e - c}{p^e} = \frac{1}{\theta \left( \frac{p^e}{E} \right)}
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- Rationale for *procyclical markups* in macro, for *pricing to market* in trade
Endogenous Entry Equilibrium

- Dual:

\[
\frac{p^e - c}{p^e} = \frac{1}{\theta \left(\frac{p^e}{E}\right)}, \quad n^e = \frac{EL}{F\theta \left(\frac{p^e}{E}\right)}, \quad q^e = F\frac{\theta \left(\frac{p^e}{E}\right) - 1}{c}
\]

Notice that \(\epsilon_{pL} = \epsilon_{qL} = 0\) and \(\epsilon_{nL} = 1\) which generalizes the classical result by Krugman (1980) concerning market size with CES preferences: pure gains from variety without any competitive effect on prices and firm size.

Other results (pricing to market and undershifting):

\(\epsilon_{pE} \leq 0\) and \(\epsilon_{nE} \leq 1\) if \(\theta > 0\) \(\left(\frac{p^e}{E}\right) \leq 0\) and \(\epsilon_{pc} \geq 1\) and \(\epsilon_{nc} \geq 0\) if \(\theta > 0\) \(\left(\frac{p^e}{E}\right) \geq 0\)
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\epsilon_{pE} \geq 0 \quad \text{and} \quad \epsilon_{nE} \geq 1 \quad \text{iff} \quad \theta' \left( \frac{p^e}{E} \right) \geq 0
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Two new examples with closed form solutions

- The (negative) exponential demand $q_i = e^{-\frac{\tau p_i}{E}} L / \mu$ delivers:

  \[ p^e = c + \frac{E}{\tau}, \quad n^e = \frac{E^2 L}{F(c\tau + E)}, \quad q^e = \frac{F\tau}{E} \]
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- The linear demand case \( q_i = \left( a - \frac{p_i}{E} \right) L/\mu \) delivers:

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Direct Utility Functions

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\[ U = \sum x_i \cdot \exp \left( -\frac{\tau + \sum_{j=1}^{n} x_j \ln x_j}{\sum_{j=1}^{n} x_j} \right) \]
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Social Optimum and inefficient entry

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FOCs deliver:

$$\frac{p^* - c}{p^*} = \frac{1}{1 + \eta \left( \frac{p^*}{E} \right)}$$

$$n^* = \frac{EL}{F \left[ 1 + \eta \left( \frac{p^*}{E} \right) \right]}$$

where $\eta(p/E) \equiv -\frac{v'(p)}{v(E)} > 0$ is the elasticity of $v(\cdot)$. 
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- Excess entry arises if and only if $\eta' > 0$, as in the exponential and linear examples (CES delivers the optimal equilibrium)
Bertrand competition and endogenous entry

- Suppose that the number of firms is limited and strategic interactions play a role
Bertrand competition and endogenous entry

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- In a Bertrand setting, considering the actual demand, each firm $i$ chooses its price $p_i$ to maximize:

$$
\pi_i = \frac{(p_i - c) v' \left( \frac{p_i}{E} \right) L}{\sum_{j=1}^{n} v' \left( \frac{p_j}{E} \right) \frac{p_j}{E}} - F
$$

where the denominator is not taken as given.

In a symmetric Bertrand equilibrium:

$$
\pi_B = \left( \frac{p_B}{E} \right)^{\frac{\theta(p_B/E)}{1 + \theta(p_B/E)}}
$$

In $B > n$ and thus excess entry is more likely in Bertrand than in monopolistic competition. The competitive effect is restored.
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$$n^B = \frac{EL - F}{F\theta\left(\frac{p^B}{E}\right)} + 1$$

- $n^B > n^e$ and thus excess entry is more likely in Bertrand than in monopolistic competition. The competitive effect of $L$ is restored.
Aggressive Leaders and implications for Competition Policy

- The model belongs to the class of "aggregative" games with endogenous entry (Etro, 2006, Rand; 2008, EJ): neutrality of the price/commitments of Stackelberg leaders on $\mu$ and the strategy of followers.

- Applications to competition policy: vertical contracts with low wholesale price below the marginal cost, bundling to strengthen price competition in the secondary market, other incentive contracts increase CS with $\eta > 0$, mergers to increase prices reduce CS with $\eta < 0$. 
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- This is neutral on consumer welfare with CES preferences (Etro, 2008; Anderson et al., 2012), but raises (decreases) consumers welfare if $\eta' > (<) 0$. 

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- This is neutral on consumer welfare with CES preferences (Etro, 2008; Anderson *et al.*, 2012), but raises (decreases) consumers welfare if $\eta' > (<) 0$.

- Applications to competition policy: *vertical contracts* with low wholesale price below the marginal cost, *bundling* to strengthen price competition in the secondary market, other *incentive contracts* increase CS with $\eta' > 0$, *mergers* to increase prices reduce CS with $\eta' > 0$.
Extensions and applications

1. Outside good à la D-S:

\[ V = \left( \frac{E}{p^0} \right)^\gamma \left( \sum v \left( \frac{p_j}{E} \right) \right)^{1-\gamma} \]
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- The first best requires marginal cost pricing.
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1. *Heterogenous consumers:*

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\[ \frac{p^e - c}{p^e} = \frac{1}{\tilde{\theta}(p^e, C)} \quad \text{with} \quad \tilde{\theta}(p, C) \equiv \int_h \theta_h \left( \frac{p}{E_h} \right) \omega_h dC(h) \]
Extensions and applications

1. **Heterogenous consumers**: 

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► a) market size is neutral
b) if \( \theta' > 0 \), a change of the distribution according to the *likelihood-ratio dominance* raises prices and number of firms more than with respect to the increase of the average income
c) a *mean preserving spread* of the income distribution decreases (raises) prices and the mass of active firms if the demand elasticity is convex (concave) in the price.
Extensions and applications

1. *Heterogenous costs* à la Melitz: market size is neutral, but changes in income induce selection effects.
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- $c$ is distributed according to $G(c)$. Entry cost $F_e$
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  \[
  \int_{\underline{c}}^{\hat{c}} [\pi_v(c) - F] dG(c) = F_e
  \]
- market size is neutral but higher income increases all prices and makes less productive firms able to survive (an anti-selection effect) if $\theta' > 0$
Extensions and applications

1. *Two-country model* à la Krugman (assume $\theta' > 0$)
   First case: no transport costs, different countries

   - Firms adopt a higher price in the richer country, and international trade reduces the mass and increases the size of firms in the richer country.
   - Trade opening reduces the markup on the exported goods and the mass of firms in each country relative to autarky.
   - A reduction in transport costs reduces the price of exports but increases their markups, and therefore induces the creation of new traded goods.

   - Richer countries trade between themselves more than poorer countries.
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1. *New-Keynesian macroeconomics* à la Blanchard-Kyotaki: nominal rigidities are amplified with Bertrand competition
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3. *Generalized EMS* under any symmetric non-separable preferences
Conclusions

- The dual assumption of *Indirect Additivity* introduces a new setting into monopolistic competition. Its results generalize properties of the CES case concerning the impact of the market size. The neutrality of income disappears and a rationale for pricing to market emerges. New simple models of price competition with and without free entry can be derived from indirectly additive preferences (*exponential and linear demand*).