Non-CES Models of Monopolistic Competition

ECON245 - Winter 24

Modeling market power

- Workhorse models of heterogeneous firms feature
  1. CES demand
  2. Monopolistic competition
- non-starter: markups are (i) homogeneous and (ii) exogenous

$$p_{it} = \frac{\sigma}{\sigma - 1} mc_{it}$$

- two (immediate) ways out
  1. maintain CES demand, assume oligopoly
  2. non-CES demand, maintain monopolistic competition

Special Features of CES

- income elasticity of each good is one (homotheticity)
- relative demand for any two goods depends only on the ratio of prices of these two goods (independence of irrelevant alternatives)
- EoS btw all pairs of goods are not only constant but also identical
- goods are either gross complements (expenditure share is increasing in the relative price if $\sigma < 1$) or gross substitutes (if $\sigma > 1$)
- either all goods are essential ($p_\omega \to \infty \Rightarrow P \to \infty$, if $\sigma \leq 1$) or inessential
- no choke prices: demand for any good remains strictly positive at all relative prices, no saturation

From Matsuyama 2023

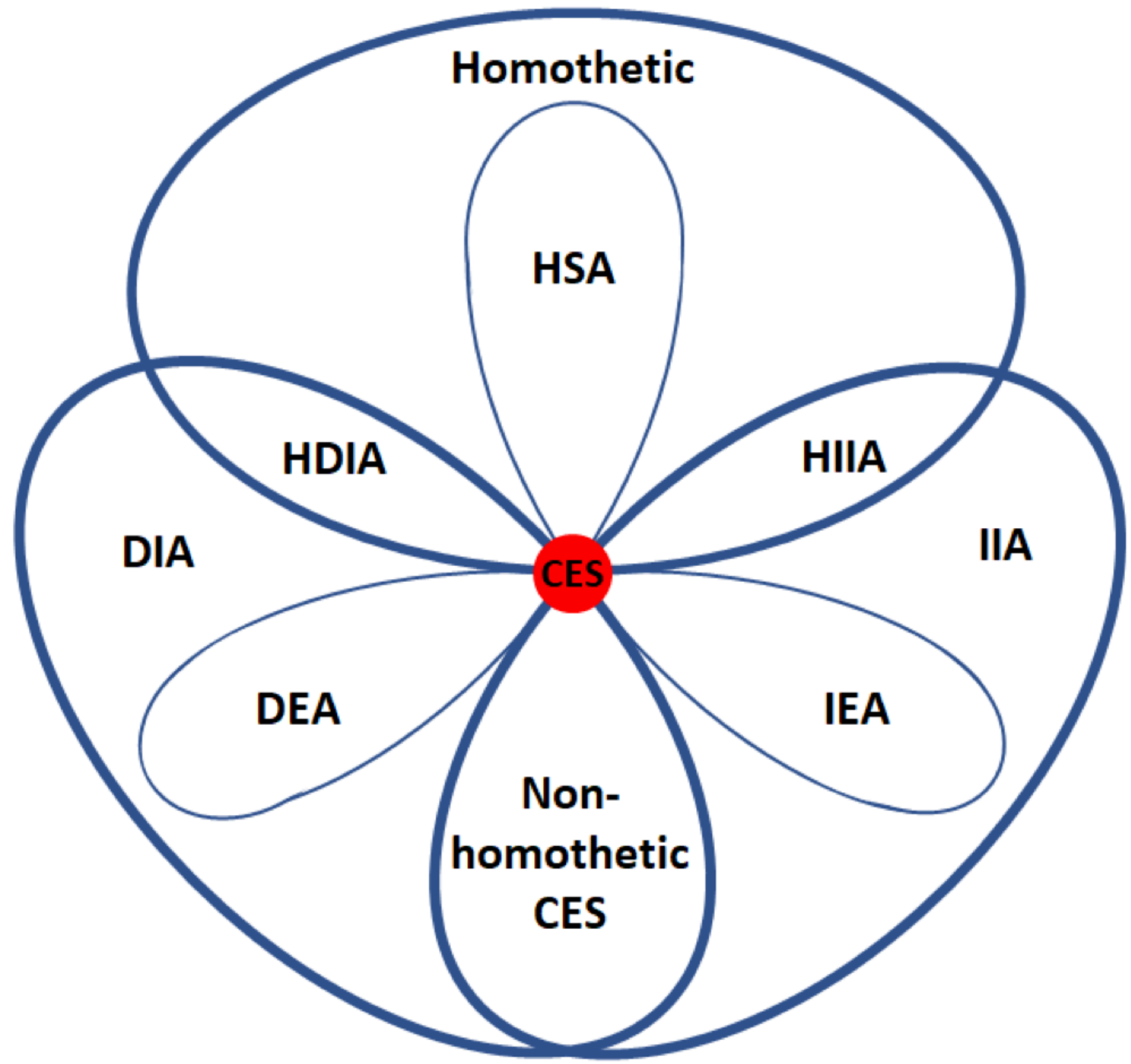
Landscape of non-CES Aggregators

DEA ∩ Homothetic = CES
Known as "Bergson's Law"

DEA ∩ IEA = CES.
Samuelson (1965)

IEA ∩ Homothetic = CES.
Berndt and Christensen (1973)

Departing from CES in the direction of DEA or IEA introduces nonhomotheticity.



DEA

$$U(\boldsymbol{c}) = \sum_{\Omega} u_\omega(c_\omega)$$

- non-nomothetic unless CES, i.e., $u_\omega(x) \equiv a_\omega x^{(\sigma-1)/\sigma}$
- demand:

$$c_\omega = D_\omega(p_\omega/A),\ D_\omega(\cdot) \equiv (u'_\omega)^{-1}(\cdot),\ A \equiv [\sum_{\Omega} u'_\omega(c_\omega)c_\omega d\omega]/E$$

- flexible demand elasticity: $\sigma_\omega(p/A) \equiv -\dfrac{\partial \ln D_\omega(p/A)}{\partial \ln(p/A)}$
- <u>but:</u> MRS btw ω, ω' is independent of any other good:

$$p_\omega/p_{\omega'} = u'_\omega(c_\omega)/u'_{\omega'}(c_{\omega'})$$

- so variable markups stem from non-homotheticity, not from competition

DEA: Examples

$$U(\boldsymbol{c}) = \textstyle\sum_{\Omega} u_{\omega}(c_{\omega})$$

- quasi linear: $U(\boldsymbol{c}) = C_o + \int_{\Omega} u_{\omega}(c_{\omega}) d\omega$
- Stone-Geary: $U(\boldsymbol{c}) = \displaystyle\sum_{i=1}^{N} \beta_i \frac{(x_i - \bar{x}_i)^{(\sigma-1)/\sigma}}{1 - 1/\sigma}$
  - $\bar{x}_i$ is the subsistence level, ladder of development in consumption: relative expenditures on i and j is decreasing in $E \Leftrightarrow \bar{x}_i > \bar{x}_j$
  - but: relative MPC is constant in E
  - asymptotically homothetic, i.e., as income goes to infinity, MRS between any two goods becomes independent of income
- also: Houthakker's addilog (1960), Caron et al (2014) constant ratio of income elasticities

Non-homothetic CES

- by far the most popular function to model non-homotheticity these days: Bohr et al (2021), Comin et al (2021), Cravino-Sotelo 2019, Fujiwara-Matsuyama (2022), Matsuyama (2019), …
- direct utility is implicitly defined

$$\left[\sum_{i=1}^{n} \beta_i(U)^{1/\sigma(U)} \left(\frac{c_i}{U}\right)^{1-\frac{1}{\sigma(U)}}\right]^{\sigma(U)/(\sigma(U)-1)} = 1$$

- price index $P = P(\boldsymbol{p}, U)$ satisfies $PU = E$

$$\left[\sum_{i=1}^{N} \frac{\beta_i(U)}{U^{1-1/\sigma(U)}} \left(\frac{p_i}{P}\right)^{1-\sigma(U)}\right]^{1/(1-\sigma(U))} = 1$$

- non-nomothetic if $\partial\beta_i(U)/\partial U$ depends on i or $\sigma(U)$ depends on U

Isoelastic non-nomothetic CES

- set $\beta_i(U) = \beta_i \times U^{\epsilon_i - \sigma}$. and $\sigma(U) = \sigma$
- require $(\varepsilon_i - \sigma)/(1 - \sigma) > 0$ to be well-behaved
- budget shares:

$$m_i = p_i c_i / E = \beta_i \left(\frac{E}{P}\right)^{\varepsilon_i - 1} \left(\frac{p_i}{P}\right)^{1-\sigma}$$

- relative expenditure shares are log-linear in $E/P = U$ and p_i

$$\ln\left(\frac{m_i}{m_j}\right) = \ln\frac{\beta_i}{\beta_j} + (1-\sigma)\ln\frac{p_i}{p_j} + (\varepsilon_i - \varepsilon_j)\ln\frac{E}{P}$$

- advantages over Stone-Geary: not nomothetic in the limit, log-additive expenditure shares (nice for estimation)

Homothetic non-CES

- non-homotheticity is useful in some contexts: structural transformation, development, inequality
- in many (most) other contexts, not giving up homotheticity is important
  - CRS is key for aggregation in macro
  - in nested structures (multi-industry, also multi-region), having non-homotheticities anywhere but at “top” creates problems
- in markup/market power context, effect of non-homotheticities is often hard to separate from the effects of concentration/competition (or sometimes, confused with it see DEA)

Homothetic demand systems

- if $U(\boldsymbol{c})$ is homothetic, then it has a dual representation in the form of an ideal price index, defined as $P = P(\boldsymbol{p}) = \min_{\boldsymbol{c}}\{\boldsymbol{pc} \mid U(\boldsymbol{c}) \geq 1\}$
- $P = P(\boldsymbol{p})$ is also often called the unit cost function
- homotheticity: $P(\boldsymbol{p})$ indep. of U, linear homogeneity: $P(\lambda\boldsymbol{p}) = \lambda P(\boldsymbol{p})$
- demand solves: $c(\boldsymbol{p}) = \arg\min_{\boldsymbol{c}}\{\boldsymbol{pc} \mid U(\boldsymbol{c}) \geq U\}$
- Shephard's lemma I: $\partial E/\partial U = P(\boldsymbol{p})$
- Shephard's lemma II: $c_\omega(\boldsymbol{p}) = \partial E/\partial p_\omega = \frac{\partial P(\boldsymbol{p})}{\partial p_\omega} U$

Homothetic demand systems

- re-arrange $c_\omega(\boldsymbol{p}) = \partial E / \partial p_\omega = \frac{\partial P(\boldsymbol{p})}{\partial p_\omega} U$ and $P(\boldsymbol{p})U = E$ to obtain

$$m_\omega = \frac{p_\omega c_\omega}{E} = \frac{\partial \ln P(\boldsymbol{p})}{\partial \ln p_\omega}$$

- Euler's theorem implies that market shares add to 1

$$\sum_\Omega m_\omega = \sum_\Omega \frac{\partial \ln P(\boldsymbol{p})}{\partial \ln p_\omega} = 1, \text{ or } \int_\Omega m_\omega d\omega = \int_\omega \frac{\partial \ln P(\boldsymbol{p})}{\partial \ln p_\omega} d\omega = 1$$

- hence, *any* homothetic demand system is fully characterized these two equations $P(\boldsymbol{p})$

- the CES case is very special: the second equation directly defines P

$$m_\omega = a_\omega \left(\frac{p_\omega}{P}\right)^{1-\sigma}, a_\omega > 0 \text{ and } \sum_\Omega m_\omega = 1 \Leftrightarrow P^{1-\sigma} = \sum_\Omega a_\omega p_\omega^{1-\sigma}$$

Homothetic with a Single Aggregator (HSA)

- HSA: the market share function *directly* becomes the primitive
- a homothetic $U(\boldsymbol{c})$ is called HSA if a good's market shares m_ω depends only on its price relative to a common aggregator $A(\boldsymbol{p})$ such that

$$m_i = \frac{p_i c_i}{E} = s_\omega\left(\frac{p_\omega}{A(\boldsymbol{p})}\right)$$

$$\int_\Omega s_\omega\left(\frac{p_\omega}{A(\boldsymbol{p})}\right) = 1$$

- $s_\omega(\cdot)$ are the primitives, assumptions: $s'_\omega < 0$ (gross substitutes), $\lim_{z\to\bar{z}} s_\omega(z) = 0$ (if $\bar{z}$ is finite, this is the choke price)
- $A(\boldsymbol{p})$ is a price aggregator: mediates competition/cross-price effects in the demand system
- HSA is new (2017): not much usage yet (see Kimball later), but in my view the most tractable option

Link between P and A

- $A(\boldsymbol{p})$ captures cross-price in the demand system

$$\int_\Omega s_\omega\left(\frac{p_\omega}{A(\boldsymbol{p})}\right) = 1$$

- $P(\boldsymbol{p})$ captures welfare effects of prices
- $A(\boldsymbol{p})$ is related to the ideal price $P(\boldsymbol{p})$ index via (M&U 2017 for proof)

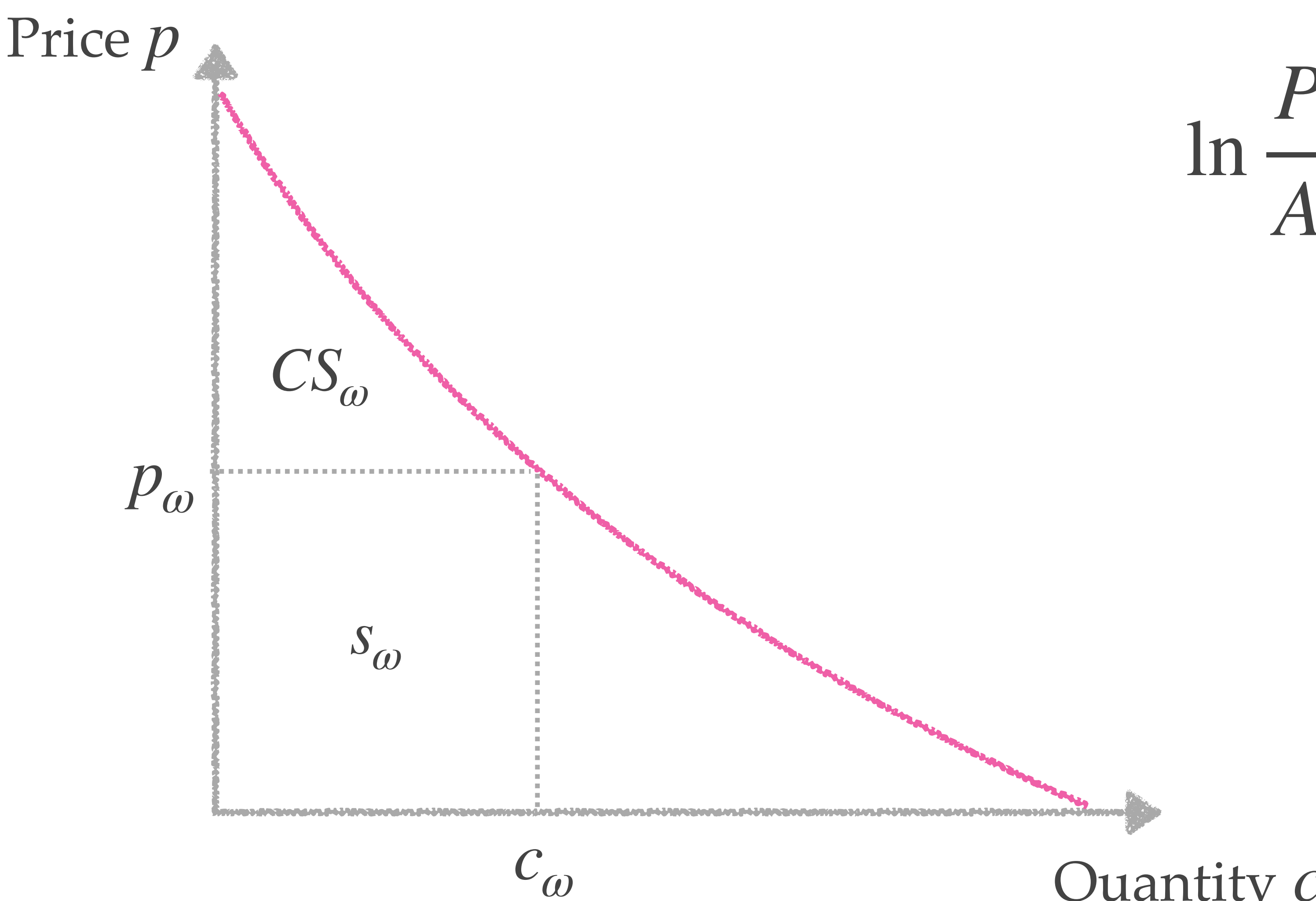
$$\ln \frac{P(\boldsymbol{p})}{A(\boldsymbol{p})} = c_1 - \int_\Omega \left[\int_{p_\omega/P}^{\infty} \frac{s_\omega(\zeta)}{\zeta} d\zeta\right] d\omega$$

- c_1 is an inconsequential constant (depends on normalization)
- the difference between P and A is consumer surplus: the value of having varieties available at a given relative price vector $\boldsymbol{p}/P$

Consumer surplus

$$\delta_\omega(\frac{p_\omega}{A}) \equiv 1 + \int_{p_\omega/P}^{\infty} \frac{s_\omega(\zeta)}{\zeta} d\zeta = \frac{\int_{p_\omega}^{\infty} c_\omega(p)dp}{s_\omega(\frac{p_\omega}{P})} \geq 1$$

- hence, can express the difference between A and P as a sales-weighted average of the ratios of consumer surplus to sales across all goods



$$\ln \frac{P(\boldsymbol{p})}{A(\boldsymbol{p})} = c_1 + \int_\Omega s_\omega \left[\frac{CS_\omega}{s_\omega} \right] d\omega$$

CES as a special case

- HSA is CES if $\forall \omega, s_\omega(z) = a_\omega z^{1-\sigma}$, $A(\boldsymbol{p})$ captures cross-price effects in demand:

$$\int_\Omega a_\omega \left(\frac{p_\omega}{A(\boldsymbol{p})}\right)^{1-\sigma} d\omega = 1 \Leftrightarrow A(\boldsymbol{p})^{1-\sigma} = \int_\Omega a_\omega p_\omega^{1-\sigma} d\omega$$

- $A(\boldsymbol{p})$ comoves one-to-one with the ideal price index $P(\boldsymbol{p})$

$$\frac{P(\boldsymbol{p})}{A(\boldsymbol{p})} = c_1 \times \frac{1}{\sigma - 1} \Leftrightarrow P(\boldsymbol{p}) = \text{constant} \times A(\boldsymbol{p})$$

- hence: for CES, the common aggregator and the ideal price index coincide!
- reason: for all goods, consumer surplus to sales ratio is constant, exogenous and equal to the sales to variable costs = variable profit ratio $1/(\sigma - 1)$
- under general HSA: consumer surplus is variable, endogenous and may be higher or lower than the private surplus (i.e., the markup)

Markups under HSA

- under HSA, demand elasticity is variable, even if producer ω takes aggregates, i.e., the common aggregator A as given

$$\sigma_\omega = \sigma_\omega\left(\frac{p}{A}\right) = 1 - \frac{\partial \ln s_\omega(p/A)}{\partial \ln(p/A)}$$

- by choosing $s_\omega(\cdot)$, can match any shape of (downward-sloping) residual demand curve - hence, can match a lot (!) of patterns for the markup μ_ω

$$\mu_\omega = \mu_\omega(\frac{p}{A}) = \frac{\sigma_\omega(\frac{p}{A})}{\sigma_\omega(\frac{p}{A}) - 1}$$

- markups vary by relative price and may vary by ω (conditional on relative price, e.g., quality may matter differentially from productivity)
- markups may be decreasing in relative price (as in Atkeson-Burstein), increasing in relative price, or display a non-linear relationship with price

HSA: Functional form examples

- perturbed CES with monotonicity: $\sigma(z) = \sigma + a(\sigma - 1)g(z)$,
  - here: $g' > 0$, $g(0) = 0$, $g(\infty) = 1$, and σ, a are constants
  - gives markup - sales relationship as Atkeson-Burstein if $a < 0$ perturbed CES: $\sigma(z) = \sigma + a(\sigma - 1)g(z)$, where $g' > 0$, $g(0) = 0$, $g(\infty) = 1$
- perturbed CES w/o monotonicity: $\sigma(z) = 1 + (\sigma - 1)\frac{\delta z g'(z)}{1 + \delta(\sigma - 1)g(z)}$
  - here, $g(0) = 0$, $g(\infty) = 0$
  - δ can be positive or negative: allows non-linear markup-sales patterns
- generalized translog: $\sigma(z) = 1 + \eta/[\ln(\bar{z}/z)]$ for $z < \bar{z}$
  - introduced to the trade literature by Feenstra 2003
  - famous for the choke price

Pass-throughs under HSA

- let $p_\omega = \mu_\omega \times \text{mc}_\omega$
- price-cost pass-through ρ_ω depends (intuitively) on the elasticity of the markup function

$$\rho_\omega(\frac{p}{A}) \equiv \frac{\partial \log p_\omega}{\partial \log \text{mc}_\omega} = \frac{1}{1 - \frac{\frac{p}{P}\mu'_\omega(\frac{p}{P})}{\mu_\omega(\frac{p}{P})}}$$

- $\rho_\omega = 1$ whenever a firm ω has a constant markup
- else, $\rho_\omega \in [0,1]$ can be guaranteed if $\mu'_\omega < 0$, i.e., if each firm's markup share is decreasing in it's sales share

Micro-foundation: The role of IIA

- similar to the CES demand system, the HSA demand system can be derived from a logit discrete choice model (Trottner 2023)
- however, in contrast to standard logit, choices will violate independence of irrelevant alternatives, i.e.: the differentiation between goods will depend on the overall competitiveness of the market
- IIA + infinitely many firms: no complementarities in pricing behavior
- IIA + finitely many firms: direct strategic complementarities between each pair of firms
- HSA + infinitely many firms: indirect strategic complementarities between any firm and all other firms

HSA in Action: Melitz revisited

- consider a closed-economy, with mass of L consumers
- normalize $w = 1$
- symmetric HSA, so total demand for each firm is $Ls(\frac{p_\omega}{A})$, CES case is

$$s^{CES}(\frac{p_\omega}{A}) = \left(\frac{p_\omega}{A}\right)^{1-\sigma}$$

- firms with productivity φ behave symmetrically, index firms by φ
- technology: A firm with productivity φ can produce q using l units of labor according to

$$l(\varphi) = f_d + \frac{q(\omega)}{\varphi(\omega)}$$

- entry cost f_d, overhead cost f_o

HSA Melitz: pricing and profits

- HSA price

$$p_\varphi = \mu_\omega(\frac{p_\omega}{A})/\varphi$$

- CES price:

$$p_\varphi = \mu/\varphi$$

- HSA operating profits under HSA

$$\pi_\varphi = L(1 - \frac{1}{\mu_\varphi})s_\varphi - f_o$$

- CES operating profits

$$\pi_\varphi = L(1 - \frac{1}{\mu})s_\varphi^{CES} - f_o$$

Zero Profit Condition

- exit cutoff φ^* under HSA

$$L(1-\frac{1}{\mu_{\varphi^*}})s_{\varphi^*}=f_o$$

- exit cutoff under CES

$$L(1-\frac{1}{\mu})s_{\varphi^*}^{CES}=f_o$$

- difference: curvature of the markup function matters

Free Entry

- Free entry condition under HSA

$$\int_{\varphi^*}^{\infty}\left[L(1-\frac{1}{\mu_\varphi})s_\varphi - f_o\right]dG(\varphi) = f_e$$

- exit cutoff under CES

$$\int_{\varphi^*_{CES}}^{\infty}\left[L(1-\frac{1}{\mu})s_\varphi^{CES} - f_o\right]dG(\varphi) = f_e$$

Equilibrium: M, A, φ^* s.t.

- goods market clear, exit and entry are optimal

(market clearing) $$M \int_{\varphi^*}^{\infty} s\left(\frac{p_\omega}{A(\boldsymbol{p})}\right) dG(\omega) = 1$$

(ZPC) $$L\left(1 - \frac{1}{\mu_{\varphi^*}}\right) s_{\varphi^*} = f_o$$

(Free entry) $$\int_{\varphi^*}^{\infty} \left[L\left(1 - \frac{1}{\mu_\varphi}\right) s_\varphi - f_o \right] dG(\varphi) = f_e$$

where $\mu_\varphi = \frac{\sigma_\varphi(\frac{p}{A})}{\sigma(\frac{p}{A}) - 1}$, $s_\varphi = s\left(\frac{p_\varphi}{A}\right), p_\varphi = \mu_\varphi / \varphi$

- guess A, solve for prices, markups and sales shares
- then solve for φ^* using ZPC and M using market clearing
- given all the above, solve for A using free entry, compare, update…

Equilibrium: Efficiency

(market clearing) $$M\int_{\varphi*}^{\infty} s(\frac{p_\omega}{A(\boldsymbol{p})})dG(\omega) = 1$$

(ZPC) $$L(1-\frac{1}{\mu_{\varphi*}})s_{\varphi*} = f_o$$

(Free entry) $$\int_{\varphi*}^{\infty}\left[L(1-\frac{1}{\mu_\varphi})s_\varphi - f_o\right]dG(\varphi) = f_e$$

where $\mu_\varphi = \frac{\sigma_\varphi(\frac{p}{A})}{\sigma(\frac{p}{A})-1}$, $s_\varphi = s(\frac{p_\varphi}{A}), p_\varphi = \mu_\varphi/\varphi$

- note that P does not appear in these equilibrium conditions
- intuitively: market mechanism incentivizes competition, A, through private profits, μ_φ, but not welfare, P, which depends on “social profits”
- A and P coincide only in the CES case
- hence: the equilibrium will be efficient if and only if markups are constant

Local margins of inefficiency

- cross-sectional distortion: φ too small compared to φ' iff

$$\mu_\varphi > \mu_{\varphi'}$$

- entry distortion: M is excessive (else, insufficient) iff

$$\bar{\mu} = \left(\int_{\varphi*}^{\infty} s_\varphi (1/\mu_\varphi)^{-1} dG(\varphi) \right)^{-1} > \left(\int_{\varphi*}^{\infty} s_\varphi \delta_\varphi dG(\varphi) \right) = \bar{\delta}$$

- selection distortion: $\varphi*$ is too high (else, too low) iff

$$\bar{\delta} > \delta_{\varphi*}$$

- see also Baqaee Fahri 2023, Edmond Midrigan Xu 2023
- "sufficient statistics": also when underlying heterogeneity goes beyond productivity

Global Welfare Change: Ex-Post statistics

$$d \ln \frac{1}{P} = (\bar{\delta} - 1) d \ln M + (\delta_{\varphi^*} - \bar{\delta}) \frac{g(\varphi)}{1 - G(\varphi} d\varphi^* + \mathbb{E}_s \left[d \ln \mu_\varphi \right]$$

- three margins of welfare gains
  1. $d \ln M$: entry
  2. $d\varphi^*$: selection
  3. $d \ln \mu_\varphi$: markups
- CES-baseline: all welfare effects from entry $d \ln \frac{1}{P} = (\mu - 1) d \ln M$
  - markups exogenous $\mu_\varphi = \mu$,
  - all varieties provide the same surplus $\delta_\omega = \delta_{\omega'} = \mu$
- variable, heterogeneous markups
  - all margins active

Gains from Market Size in Krugman

- Krugman: homogeneous firms, no selection +cross-sectional distortions

market clearing: $Ms(\frac{p}{A(\boldsymbol{p})}) = 1,$ (FE) $L\left[1 - \frac{1}{\mu(p/A)}\right] s\left(\frac{p}{A}\right) = f_e$

$$-\ln P/A = M\int_{p/A}^{\infty} \frac{s(\xi)}{\xi} d\xi = M(\delta - 1)$$

$$\mu(p/A) = \frac{\sigma(\frac{p}{A})}{\sigma(\frac{p}{A}) - 1}, p = \mu$$

- can show that welfare effect of market size $d\ln L$ equals

$$d\ln\frac{1}{P} = (\delta - 1)d\ln L + \left(1 - \frac{\delta}{\mu}\right)\sigma(1 - \rho)d\ln L$$

- Δ technical efficiency "love-for-variety" + Δ allocative efficiency

Gains from Market Size: Krugman

$$-\ln P/A = M\int_{p/A}^{\infty}\frac{s(\xi)}{\xi}d\xi = M(\delta-1)$$

- welfare effect of market size $d\ln L$ equals

$$d\ln\frac{1}{P} = (\delta-1)d\ln L + \left(1-\frac{\delta}{\mu}\right)\sigma(1-\rho)d\ln L$$

- Δ technical efficiency "love-for-variety" + Δ allocative efficiency
- when demand is CES, then $\delta = \mu, \rho = 1$, so only technical gains
  - gains reflect pure increase in variety M, which consumers "love"
- else, increase in M can "on the margin" improve allocative efficiency if:
  - competition lowers the markup $1-\rho > 0$ and entry was excessive $\mu > \delta$
  - competition raises markup $1-\rho < 0$ and entry was insufficient $\mu < \delta$

Gains from Market Size: Melitz

- get two additional allocative effects
  - cross-sectional distortions: conditional on markups, high-markup firms are more shielded from competition, so entry (i.e., competition) reallocates towards them, which improves efficiency (Baqaee Fahri 23: Darwinian effect)

$$d \ln c_\varphi = -\sigma_\varphi d \ln \frac{\mu_\varphi}{A} - d \ln A$$

  - selection distortion: depends on whether selection was initially too high/low and whether competition induces more or less entry
- key lesson: returns-to-scale are endogenous when markups are variable
- (local) returns-to-scale are the single-most important statistic in growth (i.e., Romer) and spatial (i.e., place-based policies)

Another homothetic non-CES demand system

- Kimball (HDIA in Matsuyama's classification): defined implicitly

$$\int_\Omega \phi_\omega\left(\frac{c_\omega}{C(\boldsymbol{\omega})}\right) = 1$$

- demand system requires two aggregators, $P(\boldsymbol{p})$ and $B(\boldsymbol{p})$

$$\frac{c_i p_i}{E} = \frac{\partial \ln P(\boldsymbol{p})}{\partial \ln p_\omega} = \frac{p_\omega}{P(\boldsymbol{p})}(\phi'_\omega)^{-1}\left(\frac{p_\omega}{B(\boldsymbol{p})}\right)$$

$$\int_\omega \phi_\omega\left((\phi'_\omega)^{-1}\left(\frac{p_\omega}{B(\boldsymbol{p})}\right)\right) d\omega = 1$$

$$P(\boldsymbol{p}) = \int p_\omega (\phi'_\omega)^{-1}\left(\frac{p_\omega}{B(\boldsymbol{p})}\right) d\omega$$

- $B(\boldsymbol{p})$ is a competition index (similar role to A in HSA)
- similarly flexible to HSA, CES is special case if $\phi_\omega(x) = x^{(\sigma-1)/\sigma}$
- two aggregators can be cumbersome, but its not too bad, Kimball has seen a LOT of usage in short-run macro

Klenow-Willis functional form

- Klenow-Willis 2016 proposed the by far most popular functional form for Kimball's 1995 aggregator

$$\phi(x) = (\bar{\sigma} - 1)\exp(\frac{1}{\epsilon})\epsilon^{\frac{\bar{\sigma}}{\epsilon}-1}\left[\Gamma(\frac{\bar{\sigma}}{\epsilon},0) - \Gamma(\frac{\bar{\sigma}}{\epsilon}, x^{\frac{\bar{\sigma}}{\epsilon}}/\epsilon)\right]$$

- $\Gamma(\cdot,\cdot)$ is the incomplete Gamma function, $\bar{\sigma} > 1, \varepsilon > 0$
- implied elasticity: $-\frac{\partial \ln c(\frac{p_\omega}{B})}{\partial \ln(\frac{p_\omega}{B})} = \sigma(\frac{p_\omega}{P}) = \frac{\bar{\sigma}}{1 - \epsilon \log(\frac{\sigma-1}{\sigma}\frac{p_\omega}{B})}$
- super-elasticity: $-\frac{\partial \ln \sigma(\frac{p_\omega}{B})}{\partial \ln(\frac{p_\omega}{B})} = \frac{\epsilon}{1 - \epsilon \log(\frac{\sigma-1}{\sigma}\frac{p_\omega}{B})}$
- relationship between share of variable cost in sales and markups:

$$\ln \frac{1}{\mu_\omega} + \ln(1 - \frac{1}{\mu_\omega} = \text{constant} + \frac{\epsilon}{\sigma} \ln s_\omega$$

Kimball in the Literature

- Edmund, Midrigan, Xu: How costly are Markups?, JPE, 23
- Baqaee, Farhi, Sangani: The supply-side effects of MP, JPE 23
- Santiago Franco, Output Market Power and Spatial Misallocation 24 JMP
- Werning, Wang: Dynamic Oligopoly, AER 22
- Edmund, Midrigan, Xu: Competition, Markups, and Gains from International Trade, AER 2015
- Gopinath, Itskhoki: Currency Choice and Exchange Rate Pass-through, AER 10
- …

Summary

- Non-CES MC is a highly tractable way to account for variable markups with free entry
- cost: does not speak to the highly concentrated nature of many markets as firms are still atomistic
- homothetic non-CES aggregators imply that the value of having goods available at a certain set of prices to consumers depends on market-wide price statistic(s)
- comparison: in search, reservation price is a function of the distribution of prices
- if price distributions can be characterized by a handful of statistics (i.e., mean, variance), could we perhaps map non-CES demand systems into those arising in search settings?