Multi-Product Firms at Home and Away: Cost- Versus Quality-Based Competence

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What makes a successful exporting firm?

- Firm Productivity?
  - Evidence of firm selection into exporting
    - Clerides, Lach and Tybout (*QJE* 1998), Bernard and Jensen (*JIE* 1999)
  - Theory: Only the most productive firms can cover the extra costs of exporting
    - Melitz (*Em* 2003)
- Product Quality?
  - Evidence that successful exporters charge higher prices on average

But: Are these two views opposed?

- We show not, by focusing on the "intra-firm extensive margin":
  - Adjustments in the range of goods produced by multi-product firms

Our Contribution

1. We combine quality and multi-product firms
2. This allows us to model endogenous choice between *cost-based* and *quality-based* competition
3. We test this on Mexican data and confirm a key prediction of the model

- Theory: Builds on Eckel and Neary (*REStud* 2010):
  - Multi-product oligopoly with linear demand for differentiated products
  - "Flexible Manufacturing"
  - Extended to investment in quality
- Application: Uses Mexican data from Iacovone-Javorcik (*EJ* 2010):
  - Detailed plant-product-year data for *both* home and export sales
  - ... at the *same* level of disaggregation

Literature Overview

Competition on:	Single-Product Firms	Multi-Product Firms
Cost	Melitz ...	(1)
Quality	(2)	This paper

(1) Models of multi-product firms:

- IO: Products few and/or fixed, competition on scope and/or quality: Brander-Eaton (*AER* 1984), Klemperer (*AER* 1992), Baldwin-Ottaviano (*JIE* 2001), Johnson-Myatt (*AER* 2003)
- Symmetric demand and cost; diseconomies of scope: Ju (*RIE* 2003), Allanson-Montagna (*IJIO* 2005), Feenstra-Ma (2009), Nocke-Yeaple (2006), Dhingra (2009)
- Asymmetric demand: Bernard-Redding-Schott (*AER* 2010; 2009)
- "Flexible Manufacturing": Eckel-Neary (*REStud* 2010), Arkolakis-Muendler (2009), Mayer-Melitz-Ottaviano (2009)

(2) Theoretical and empirical papers with quality:

- Antoniades (2009), Baldwin-Harrigan (2007), Crozet-Head-Mayer (2009), Hallak-Schott (2009), Hallak-Sivadasan (2009), Iacovone-Javorcik (2007), Johnson (2010), Khandelwal (*REStud* 2009), Kugler-Verhoogen (2008), Mandel (2008), Manova-Zhang (2009), Verhoogen (*QJE* 2008)

(3) Models of investment by heterogeneous firms:

- Investment in process and product R&D: Bustos (2010), Constantini-Melitz (2008), Dhingra (2010), Lileeva-Trefler (*QJE* 2010)
- Investment in quality, including market-specific perceived quality: Arkolakis (2007)

Outline of the Talk

Outline of the Talk

Preferences for Quantity and Quality

Sub-utility function of a representative consumer:

- $u = u_1 + \beta u_2$
- $u_1 = a^0 Q - \frac{1}{2} b \left[(1-e) \int_{i \in \tilde{\Omega}} q(i)^2 di + eQ^2 \right]$

$\tilde{\Omega}$: The set of differentiated products
$q(i)$: Consumption of variety i, $Q \equiv \int_{i \in \tilde{\Omega}} q(i) di$
e : Substitution index between goods $(0 \leq e \leq 1)$

- $u_2 = \int_{i \in \tilde{\Omega}} q(i) \tilde{z}(i) di$

$\tilde{z}(i)$: Perceived quality of variety i

Implied market demand functions $[x(i) = Lq(i)]$:

- $p(i) = a(i) - \tilde{b} \left[(1-e) x(i) + eX \right], \qquad i \in \Omega \subset \tilde{\Omega}$

$a(i)$: $a^0 + \beta \tilde{z}(i)$
$\tilde{b}$: b/L
X : $\int_{i \in \Omega} x(i) di$

Cost-Based Competence

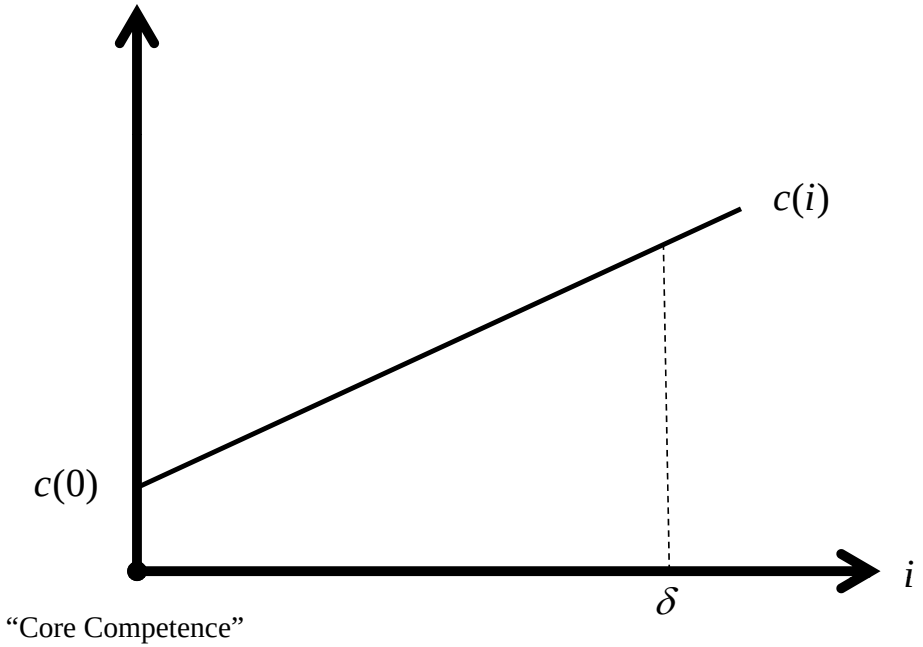
Consider a single monopoly firm, selling in a single market

- Extension to oligopoly with many firms and markets is straightforward

Begin with the technology side only, so ignore quality [set $\beta = 0$]

- "Flexible Manufacturing" technology, as in Eckel-Neary (2010)
- Marginal production costs are independent of output but differ across products: $c(i)$
- Firm has a "core competence" product which it produces at lowest cost: $c(0) = c^0$
- Adding more products incurs adaptation costs: $c'(i) > 0$

Flexible Manufacturing



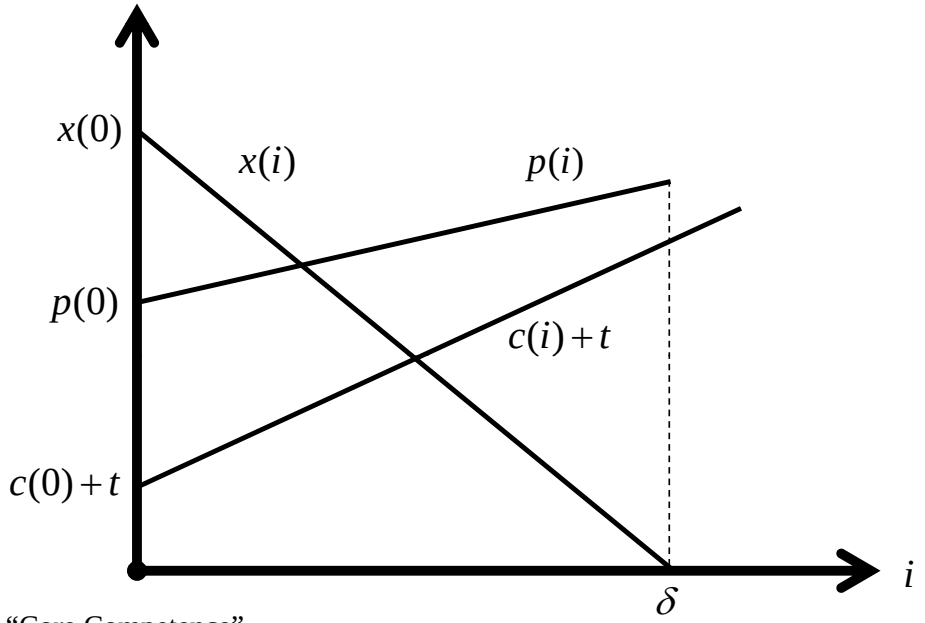
Ignoring quality, firm wants to maximise operating profits:

$$\pi = \int_{i \in \Omega} [p(i) - c(i) - t]\, x(i) di$$

$\Rightarrow$ First-order conditions for scale $x(i)$ and scope δ: $\Omega = [0, \delta]$

- ▸ Details

Price and Sales Profiles with Cost-Based Competence



"Core Competence"

$$x(i) = \frac{a^0 - c(i) - t - 2\tilde{b}eX}{2\tilde{b}(1-e)} \qquad i \in [0, \delta]; \qquad x(\delta) = 0.$$

$$p(i) = \frac{1}{2}\left[a^0 + c(i) + t\right]$$

Quality-Based Competence

- Recall: $u = u_1 + \beta u_2$, $u_2 = \int_{i \in \tilde{\Omega}} q(i)\tilde{z}(i)di$
- Now: $\beta > 0$
- Perceived quality of variety i: $\tilde{z}(i) = (1-e)z(i) + e\bar{Z}$

  $z(i)$: Variety-specific perceived quality

  $\bar{Z}$: Perceived quality of the firm's brand; $\bar{Z} \neq \int_{i \in \Omega} z(i)di$
- Firm invests in quality of both its individual varieties and its brand:

$$z(i) = 2\theta k(i)^{0.5}, \quad \bar{Z} = 2\Theta \bar{K}^{0.5}$$

- Firm wants to maximise total profits net of investment costs:

$$\Pi = \int_0^{\delta} \left[\{p(i) - c(i) - t\} x(i) - \gamma k(i) \right] di - \Gamma \bar{K}$$

  - FOCs for scale $\{x(i)\}$ and scope δ unchanged
  - FOCs for investment:

$$\text{(i) } \gamma k(i)^{0.5} = \beta(1-e)\theta x(i), \quad i \in [0, \delta]; \qquad \text{(ii) } \Gamma \bar{K}^{0.5} = \beta e \Theta X$$

Implications for Output Profile

- Output profile with endogenous investment in quality:

$$x(i) = \frac{a^0 - c(i) - t - 2(\tilde{b} - \bar{\eta}e)eX}{2[\tilde{b} - \eta(1-e)](1-e)}, \quad i \in [0, \delta] \quad \eta \equiv \frac{\beta^2\theta^2}{\gamma} \quad \bar{\eta} \equiv \frac{\beta^2\Theta^2}{\Gamma}$$

  - η, $\bar{\eta}$: the "marginal effectiveness of investment" in the quality of individual varieties and of the firm's brand respectively.
    - d'Aspremont and Jacquemin (*AER* 1988), Leahy and Neary (*AER* 1997), Antoniades (2009), Bustos (*AER* 2010), Dhingra (2009).
    - Second-order conditions: $\tilde{b} - \eta(1-e) > 0$ and $\tilde{b} - \bar{\eta}e > 0$
  - Implication: Output profile is steeper the higher is η

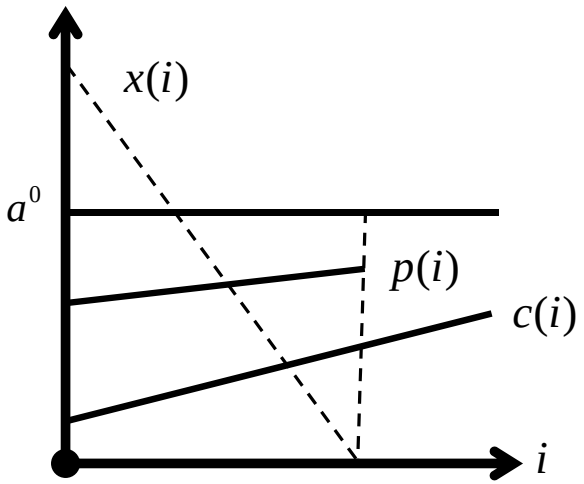
Implications for Price Profile

- Price profile with endogenous investment in quality:
  - Recall: $p(i) = \frac{1}{2}[a(i) + c(i) + t]$
- As the firm moves away from its core competence:
  - Costs rise, encouraging a higher price
  - But: markups fall, encouraging less investment in quality, hence a lower $a(i)$, hence a lower price
- The net outcome is ambiguous:

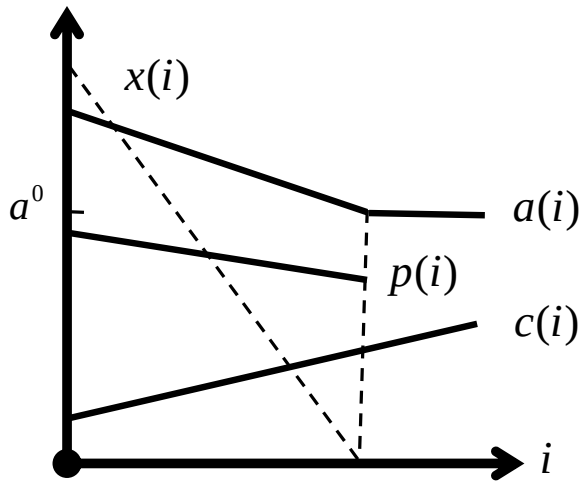
$$\frac{dp(i)}{di} = \frac{\tilde{b} - 2\eta(1-e)}{2[\tilde{b} - \eta(1-e)]} \frac{dc(i)}{di}$$

  - $\tilde{b} > 2\eta(1-e)$: Cost-based competence dominates, price rises with i
    - Benchmark case of $\eta = 0$: $\frac{dp(i)}{di} = \frac{1}{2}\frac{dc(i)}{di}$
  - $\tilde{b} < 2\eta(1-e)$: Quality-based competence dominates, price falls with i

Price and Sales Profiles with Cost- and Quality-Based Competence



$$\frac{b}{L} > 2\eta(1-e)$$



$$\frac{b}{L} < 2\eta(1-e)$$

- Quality-based competence more likely:
  - When investment in quality is more effective: η is larger
  - When market size L is larger
  - When products are more differentiated: e is smaller
- Though in all cases, production costs are primitive

▸ Details

Outline of the Talk

The Data

Mexican survey giving plant-product-level data:

- *Encuesta Industrial Mensual* (EIM): home and foreign sales
- Monthly survey, aggregated to annual observations 1994-2004
- Coverage: c. 85% of Mexican industrial output (exc. "maquiladoras")
- From 6,291 (1994) to 4,424 (2004) plants
- ... of which, 1,579 to 2,137 engaged in exporting
- Information on 3,183 unique products, in 205 *clases*
  - Similar to 6-digit Harmonized System ▸ Examples
- Detailed plant-product-year data for home and export sales
- ... consistently concorded at the same level of disaggregation

Number of Plants and Products

Year	Number of plants					Number of products	
	Total	Owned by MPFs[1]	Other	Exporters		Produced	Exported
				Total	Adjusted[2]		
1994	6,291	1,259	5,032	1,582	1,579	19,154	2,844
1995	6,011	1,245	4,766	1,844	1,842	18,568	3,406
1996	5,747	1,256	4,491	2,024	2,023	17,662	3,881
1997	5,538	1,256	4,282	2,138	2,137	16,938	4,092
1998	5,380	1,268	4,112	2,095	2,094	16,419	4,193
1999	5,230	1,279	3,951	1,951	1,950	15,885	3,889
2000	5,100	1,280	3,820	1,901	1,899	15,279	3,737
2001	4,927	1,258	3,669	1,770	1,766	14,714	3,509
2002	4,765	1,237	3,528	1,686	1,684	14,182	3,321
2003	4,603	1,193	3,410	1,678	1,675	13,507	3,282
2004	4,424	1,159	3,265	1,602	1,599	12,887	3,118
Total	58,016	13,690	44,326	20,271	20,248	175,195	39,272

(1) MPFs: Multi-plant firms; information on the number of plants owned by a single firm is available for 2003 only.
(2) The adjusted data exclude plants not reporting production in the year in question.

Sales Profiles

Evidence on sales profiles:

- Exporting plants are larger
- Larger plants produce more products
- Profile of sales across products is highly non-uniform
- Similar ranking of products by sales in home and foreign markets
- Plants sell more products at home
- Most exported products are also sold at home

All broadly in line with other studies

Outline of the Talk

Empirical Strategy

- Theoretical prediction:
  - Quality-based competence (prices *fall* with distance from core competence) prevails in destination market d when: $\frac{b}{L_d} < 2\eta_d (1 - e_d)$
  - In particular, more likely if products are more differentiated (lower e_d).

▸ Recap on Theory

- How to measure distance from core competence?
  - Sales volume?
  - BUT: different units of measurement in the data?
  - We use sales value instead: $s(i) = p(i)x(i)$
  - $\frac{ds(i)}{di} = p(i)\frac{dx(i)}{di} + x(i)\frac{dp(i)}{di} < 0$

Empirical Strategy (cont.)

- In our theoretical model, all goods are symmetrically differentiated and hence directly comparable in terms of prices and of quantities
- In real-world data, different products are measured in different units which are not directly comparable
- To deal with these problems, we distinguish between the true price p_{ijt} and the observed price P_{ijt} where $P_{ijt} \equiv \zeta_{it} p_{ijt}$
- When we take logs of this identity, the conversion factor ζ_{it} appears as a product-year fixed effect
- Sales are not affected by units of measurement

$$P_{ijt} \equiv \zeta_{it} p_{ijt}, \quad X_{ijt} \equiv x_{ijt}/\zeta_{it} \quad \Rightarrow \quad s_{ijt} \equiv p_{ijt} x_{ijt} = P_{ijt} X_{ijt} \tag{1}$$

Empirical Strategy (cont.)

- Estimating equation:

$$\ln P_{ijt} = \beta_0 + \sum_{r=1}^{\delta_{jt}} \beta_r D_{ijt}^r + \omega_{it} + \nu_{jt} + \varepsilon_{ijt}$$

D_{ijt}^r : $= 1$ if product i is ranked r in the sales/exports of plant j in year t

$\omega_{it} \equiv \ln \zeta_{it}$

- How do we measure product differentiation?
  - We use the Rauch (*JIE* 1999) classification.
  - Group *clases* by whether they correspond to differentiated or non-differentiated products:
    - "Undifferentiated": "Traded on organised exchanges" plus "reference priced"
    - We use Rauch's "liberal" classification: when in doubt, undifferentiated
    - Examples: ▸ here

Price Profiles for Plants with At Least Two Products

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product	0.039^{***}					
	(0.006)					
R^2	0.976					
N	$124,204$					

Price Profiles for Plants with At Least Two Products

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product	0.039^{***}	0.040^{***}	0.038^{***}			
	(0.006)	(0.008)	(0.007)			
R^2	0.976	0.973	0.984			
N	124,204	82,506	41,698			

Conclusions:

- Home market: Prices fall with distance from core competence
  - i.e., strong evidence of quality-based competence
  - Holds for both differentiated and non-differentiated products
  - Differentiated coefficient is significantly larger - as predicted by theory

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	(0.006)	(0.008)	(0.007)	(0.024)		
R^2	0.976	0.973	0.984	0.988		
N	124,204	82,506	41,698	22,329		

Conclusions:

- Home market: Prices fall with distance from core competence
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- Export market: Same holds in aggregate

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Top Product	0.039^{***} (0.006)	0.040^{***} (0.008)	0.038^{***} (0.007)	0.053^{**} (0.024)	0.082^{**} (0.031)	-0.018 (0.030)
R^2	0.976	0.973	0.984	0.988	0.985	0.994
N	124,204	82,506	41,698	22,329	14,975	7,354

Conclusions:

- Home market: Prices fall with distance from core competence
  - i.e., strong evidence of quality-based competence
  - Holds for both differentiated and non-differentiated products
  - Differentiated coefficient is significantly larger - as predicted by theory
- Export market: Same holds in aggregate
- BUT: Not for non-differentiated products
  - evidence against quality-based competence
  - suggestive of cost-based competence

Price Profiles for Plants with More than Two Products

- Similar results hold for plants with more than two products
  - Loss of degrees of freedom as we consider plants with more products
  - Nevertheless the results are qualitatively identical Skip details

Price Profiles at Home

Table : Home Sales: All Products

Plants with	2+ products	3+ products	4+ products	5+ products
Top Product	0.039***	0.057***	0.073***	0.091***
	[0.006]	[0.007]	[0.008]	[0.010]
Top 2nd		0.039***	0.056***	0.072***
		[0.007]	[0.008]	[0.009]
Top 3rd			0.046***	0.064***
			[0.007]	[0.009]
Top 4th				0.058***
				[0.009]
R^2	0.976	0.974	0.973	0.972
N	124,204	106,560	88,879	73,154

Conclusion: Prices fall with distance from core competence; strong evidence of quality-based competence.

This holds for both differentiated and (to a lesser extent) non-differentiated products.

Price Profiles at Home

Table : Home Sales: **Differentiated Products**

Plants with	2+ products	3+ products	4+ products	5+ products
Top Product	0.040***	0.072***	0.091***	0.109***
	[0.008]	[0.010]	[0.011]	[0.013]
Top 2nd		0.059***	0.076***	0.097***
		[0.009]	[0.010]	[0.012]
Top 3rd			0.055***	0.077***
			[0.010]	[0.011]
Top 4th				0.069***
				[0.011]
R^2	0.973	0.971	0.97	0.97
N	82,506	72,682	62,218	52,878

Price Profiles at Home

Table : Home Sales: **Non-Differentiated Products**

Plants with	2+ products	3+ products	4+ products	5+ products
Top Product	0.038***	0.024**	0.023**	0.031**
	[0.007]	[0.008]	[0.010]	[0.012]
Top 2nd		0.001	0.006	0.001
		[0.007]	[0.009]	[0.010]
Top 3rd			0.019**	0.021**
			[0.008]	[0.010]
Top 4th				0.024**
				[0.009]
R^2	0.984	0.979	0.978	0.976
N	41,698	33,878	26,661	20,276

Price Profiles Away

Table : Exports: **Differentiated Products**

Plants with	2+ products	3+ products	4+ products	5+ products
Top Product	0.082**	0.123**	0.177**	0.205**
	[0.031]	[0.044]	[0.055]	[0.063]
Top 2nd		0.061	0.142**	0.223**
		[0.043]	[0.059]	[0.074]
Top 3rd			0.171***	0.237***
			[0.050]	[0.059]
Top 4th				0.076
				[0.062]
R^2	0.985	0.982	0.979	0.976
N	14,975	11,528	8,812	6,720

Conclusion: Prices fall with distance from core competence;
strong evidence of quality-based competence.

Price Profiles Away

Table : Exports: **Non-Differentiated Products**

Plants with	2+ products	3+ products	4+ products	5+ products
Top Product	-0.018	-0.001	-0.049	-0.138*
	[0.030]	[0.037]	[0.052]	[0.071]
Top 2nd		0.032	0.009	-0.072
		[0.033]	[0.046]	[0.062]
Top 3rd			-0.016	-0.132**
			[0.040]	[0.059]
Top 4th				-0.100*
				[0.054]
R^2	0.994	0.993	0.991	0.99
N	7,354	5,131	3,365	2,212

Conclusion: Prices *rise* with distance from core competence;
strong evidence against quality-based competence;
suggestive of cost-based competence.

Robustness Checks

1. Sample sizes at home and away are different
   - We reestimate for varieties that are *both* sold at home and exported:
   - Results turn out to be robust ▸ Details
2. Results might just reflect differences between home-market- and export-oriented plants
   - We reestimate for home sales of exporting plants:
   - Again, results are robust ▸ Details
3. Correct for plant ownership:
   - Theory relates to firms, data to plants
   - Data on plant ownership available for 2003 only
   - We reestimate for single-plant firms only (as of 2003) in all years
   - Again, results are robust ▸ Details
4. Check that results hold year-by-year ▸ Details
5. Check that results hold for domestically-owned plants only ▸ Details

Outline of the Talk

Summary and Conclusion

- Theory:
  - Integrate flexible manufacturing with investment in quality
- Mexican data set:
  - Highly disaggregated data on both home and foreign sales
- Empirical results on price profiles:
  - Evidence for quality selection within firms
  - Competence based more on quality when products are more differentiated, especially for exports
- Broader implications: What makes a successful exporter?
  - Size matters: Larger firms produce more products and are more likely to export
  - But higher productivity manifests itself differently in different sectors and markets
  - Only differentiated-product firms compete in export markets on quality
- Policy implications: What should export promotion focus on?
  - Differentiated product sectors: Improving perceived product quality
  - Non-differentiated good sectors: Helping lower production costs

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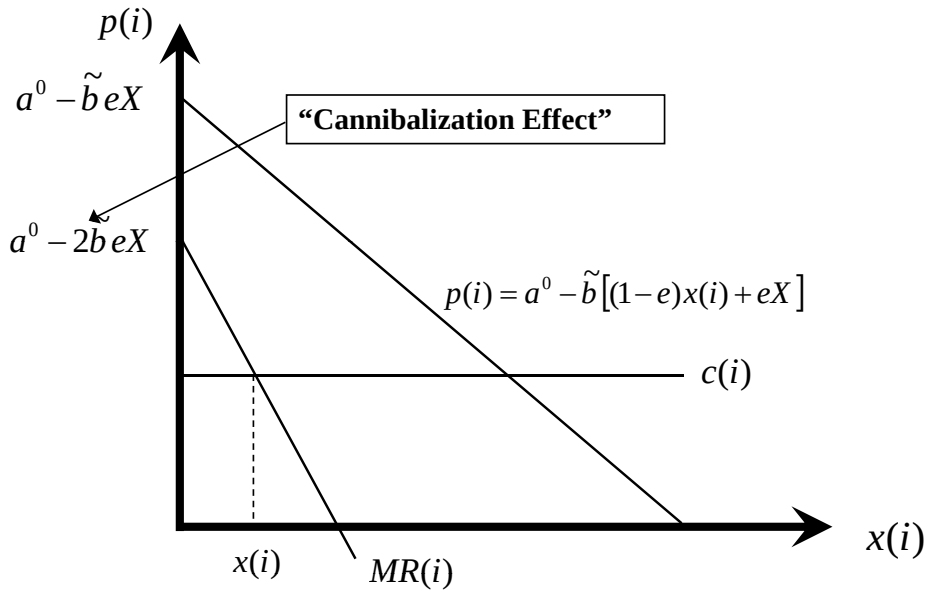
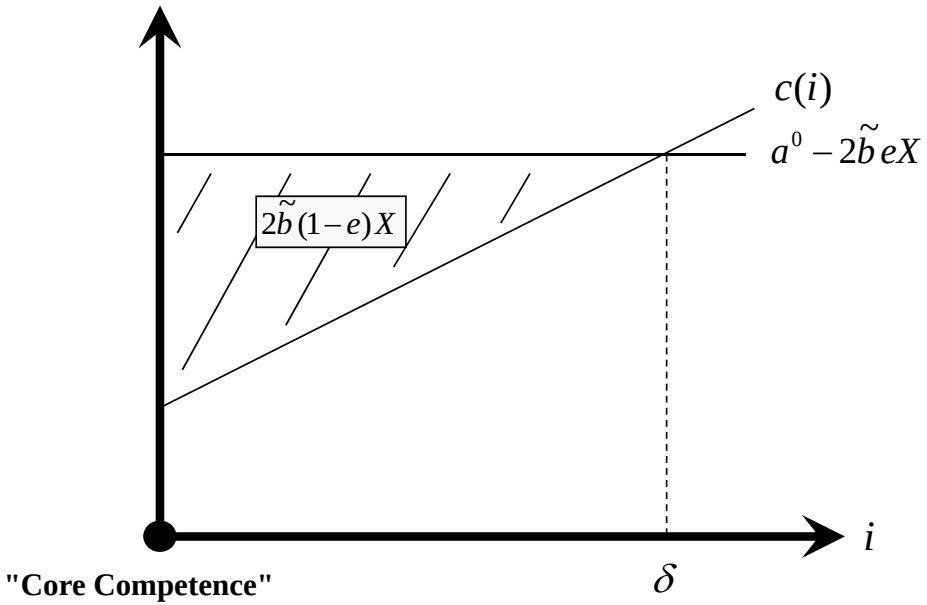
First-Order Condition for Scale



- Cannibalisation effect shifts the MR curve downwards
- Produce where MC=MR
- ▸ Back

First-Order Condition for Scope



- Produce a positive amount of a variety as long as its marginal cost ...
- ... $\leq$ the marginal revenue of the first unit consumed: $a^0 - 2\tilde{b}eX$
- ▸ Back

Full Marginal Costs

- Core competence always derives from production costs ▸ Back
- We can also consider "full" marginal costs:

$$c(i) + \gamma \frac{k(i)}{x(i)} = \frac{2\tilde{b} - 3\eta(1-e)}{2[\tilde{b} - \eta(1-e)]} c(i) + \frac{\eta(1-e)}{2[\tilde{b} - \eta(1-e)]} c(\delta)$$

- Neither production costs nor full marginal costs predict the profile of prices across varieties:
  - **(i)** $\eta(1-e) < \frac{1}{2}\tilde{b}$: Cost-based competence dominates; both prices and full marginal costs rise with i.
  - **(ii)** $\frac{1}{2}\tilde{b} < \eta(1-e) < \frac{2}{3}\tilde{b}$: Quality-based competence dominates, but mildly; prices fall with i but full marginal costs rise with i.
  - **(iii)** $\frac{2}{3}\tilde{b} < \eta(1-e) < \tilde{b}$: Quality-based competence strongly dominates; *both* prices and full marginal costs fall with i.

Note that in (ii), both measures of cost rise with i, despite which prices fall with i.

Examples of Product Classification into Clases

- 313014: "Distilled Alcoholic Beverages" :
  - Gin
  - Vodka
  - Whisky
  - Other distilled alcoholic beverages
  - Coffee liqueurs
  - "Habanero" liqueurs
  - "Rompope"
  - Prepared cocktails
  - Hydroalcoholic extract
  - Other alcoholic beverages prepared from agave,
  - or brandy,
  - or rum,
  - or table wine

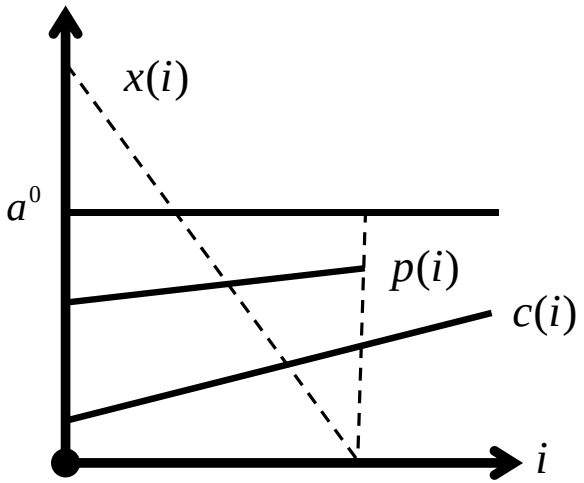
Back

Examples of Classification into Clases (cont.)

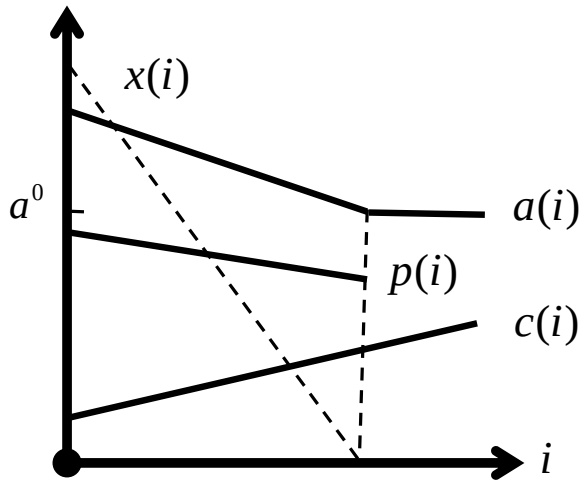
- 313011: "Produccion De Tequila Y Mezcal":
  - Tequila
  - Mezcal
  - Sangrita
  - Otras Bebidas Preparadas (Especificar) [Other Prepared Beverages (to be Specified)]
  - Otras Bebidas Alcoholicas (Especificar) [Other Alcoholic Beverages (to be Specified)]
  - Otros Desechos Y Subproductos [Other Subproducts and Waste]
  - Otros Productos No Genericos [Other Non-Generic Products]

Back

Recap: Price and Sales Profiles with Cost- and Quality-Based Competence



$$\frac{b}{L} > 2\eta(1-e)$$



$$\frac{b}{L} < 2\eta(1-e)$$

- Quality-based competence more likely:
  - When investment in quality is more effective: η is larger
  - When market size L is larger
  - When products are more differentiated: e is smaller
  - ▸ Back to empirical strategy

Examples of Differentiated vs. Non-Differentiated Clases

Back

- Differentiated:
  - 311901: Produccion de chocolate y golosinas a partir de cocoa o chocolate
    - Production of chocolate and candy from cocoa or chocolate
  - 323003: Produccion de maletas, bolsas de mano y similares
    - Production of suitcases, handbags and similar
  - 322005: Confeccion de camisas
    - Ready-to-wear shirts
- Non-Differentiated:
  - 311201: Pasteurizacion de leche
    - Pasteurization of milk
  - 311404: Produccion de harina de trigo
    - Production of wheat flour
  - 341021: Produccion de papel
    - Production of paper

Observations on Varieties Sold Both At Home and Away Only

A. Price Profiles for Plants with Two or More Products

Back

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product:	0.049**	0.063**	0.017	0.054**	0.082**	-0.019
	[0.024]	[0.031]	[0.035]	[0.025]	[0.031]	[0.033]
R^2	0.989	0.988	0.994	0.988	0.985	0.995
N	20,935	14,150	6,785	20,981	14,179	6,802

B. For Reference: Including all observations in each category

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product:	0.039***	0.040***	0.038***	0.053**	0.082**	-0.018
	[0.006]	[0.008]	[0.007]	[0.024]	[0.031]	[0.030]
R^2	0.976	0.973	0.984	0.988	0.985	0.994
N	124,204	82,506	41,698	22,329	14,975	7,354

Price Profiles for Plants with Five or More Products

A. Including only observations on goods both exported and sold at home

Back

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product:	0.200***	0.229***	-0.010	0.179**	0.215***	-0.138*
	[0.060]	[0.066]	[0.085]	[0.061]	[0.065]	[0.079]
Top 2nd:	0.153**	0.178**	-0.025	0.196**	0.222**	-0.032
	[0.060]	[0.066]	[0.081]	[0.068]	[0.075]	[0.081]
Top 3rd:	0.196***	0.225***	-0.005	0.186***	0.224***	-0.096
	[0.054]	[0.059]	[0.084]	[0.055]	[0.059]	[0.074]
Top 4th:	0.02	0.025	-0.059	0.06	0.075	-0.109
	[0.057]	[0.063]	[0.060]	[0.057]	[0.063]	[0.066]
R^2	0.982	0.981	0.992	0.977	0.975	0.991
N	8,279	6,338	1,941	8,285	6,342	1,943

Price Profiles for Plants with Five or More Products

B. For Reference: Including all observations in each category

Back

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product:	0.091***	0.109***	0.031**	0.162**	0.205**	-0.138*
	[0.010]	[0.013]	[0.012]	[0.058]	[0.063]	[0.071]
Top 2nd:	0.072***	0.097***	0.001	0.179**	0.223**	-0.072
	[0.009]	[0.012]	[0.010]	[0.063]	[0.074]	[0.062]
Top 3rd:	0.064***	0.077***	0.021**	0.178***	0.237***	-0.132**
	[0.009]	[0.011]	[0.010]	[0.052]	[0.059]	[0.059]
Top 4th:	0.058***	0.069***	0.024**	0.059	0.076	-0.100*
	[0.009]	[0.011]	[0.009]	[0.053]	[0.062]	[0.054]
R^2	0.972	0.97	0.976	0.978	0.976	0.99
N	73,154	52,878	20,276	8932	6,720	2,212

Home Sales of Exporting Plants Only

Back

Market:	Home				Home			
Varieties:	Diff.	Diff.	Diff.	Diff.	Non-Diff.	Non-Diff.	Non-Diff.	Non-Diff.
Top Product:	0.033**	0.068***	0.104***	0.131***	0.017	0.000	-0.011	-0.018
	[0.014]	[0.017]	[0.020]	[0.023]	[0.014]	[0.018]	[0.022]	[0.026]
Top 2nd:		0.054***	0.078***	0.118***		0.024	0.03	-0.007
		[0.016]	[0.019]	[0.022]		[0.019]	[0.022]	[0.025]
Top 3rd:			0.085***	0.111***			0.011	-0.016
			[0.018]	[0.021]			[0.019]	[0.023]
Top 4th:				0.105***				-0.001
				[0.023]				[0.024]
R^2	0.976	0.974	0.972	0.971	0.986	0.982	0.983	0.982
N	40,068	34,869	29,812	25,168	18,924	14,627	10936	7769

Observations on Single-Plant Firms Only

A. Plants with two or more products Back

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product:	0.048***	0.053***	0.035***	0.059	0.074	0.007
	[0.007]	[0.009]	[0.009]	[0.044]	[0.053]	[0.064]
R^2	0.978	0.975	0.986	0.991	0.989	0.996
N	92,453	65,390	27,063	13,973	9,896	4,077

B. Plants with five or more products

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product:	0.103***	0.116***	0.049**	0.191**	0.210**	-0.042
	[0.012]	[0.015]	[0.015]	[0.087]	[0.090]	[0.132]
Top 2nd:	0.077***	0.095***	0.015	0.236**	0.281**	-0.105
	[0.011]	[0.013]	[0.013]	[0.097]	[0.105]	[0.108]
Top 3rd:	0.076***	0.086***	0.037**	0.192**	0.232**	-0.147
	[0.010]	[0.013]	[0.013]	[0.077]	[0.081]	[0.109]
Top 4th:	0.066***	0.076***	0.030**	0.083	0.092	-0.035
	[0.010]	[0.012]	[0.012]	[0.076]	[0.081]	[0.109]

Market:	Home		Export	
Varieties:	Diff.	Non-Diff.	Diff.	Non-Diff.
1994	0.031	0.067**	0.085	-0.030
	[0.026]	[0.022]	[0.123]	[0.116]
1995	0.053**	0.067**	0.109	0.031
	[0.024]	[0.022]	[0.115]	[0.076]
1996	0.063**	0.044*	0.111	-0.004
	[0.024]	[0.023]	[0.107]	[0.088]
1997	0.074**	0.058**	0.135	0.018
	[0.024]	[0.021]	[0.088]	[0.077]
1998	0.047*	0.047**	0.101	0.036
	[0.025]	[0.023]	[0.093]	[0.076]
1999	0.042*	0.016	0.013	0.054
	[0.025]	[0.021]	[0.103]	[0.098]
2000	0.025	0.007	0.007	-0.077
	[0.026]	[0.021]	[0.105]	[0.071]
2001	0.021	0.003	0.066	-0.150
	[0.027]	[0.022]	[0.094]	[0.104]
2002	0.038	0.016	0.075	-0.111
	[0.029]	[0.024]	[0.094]	[0.124]
2003	0.006	0.047*	0.133	-0.064
	[0.028]	[0.026]	[0.099]	[0.136]
2004	0.019	0.036	0.059	0.016
	[0.029]	[0.024]	[0.084]	[0.132]

Observations on Domestically-Owned Plants Only

A. Plants with two or more products Back

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product:	0.043***	0.047***	0.033***	0.012	0.043	-0.037
	[0.006]	[0.009]	[0.007]	[0.036]	[0.054]	[0.040]
R^2	0.98	0.976	0.986	0.994	0.993	0.995
N	89,426	58,080	31,346	12,337	7,661	4,676

B. Plants with five or more products

Market:	Home			Export		
Varieties:	All	Diff.	Non-Diff.	All	Diff.	Non-Diff.
Top Product:	0.087***	0.109***	0.025**	-0.032	-0.016	-0.094
	[0.011]	[0.015]	[0.012]	[0.125]	[0.151]	[0.128]
Top 2nd:	0.057***	0.079***	0.002	0.011	0.013	-0.031
	[0.010]	[0.014]	[0.011]	[0.098]	[0.128]	[0.106]
Top 3rd:	0.053***	0.066***	0.018*	0.076	0.151	-0.142
	[0.010]	[0.013]	[0.011]	[0.083]	[0.100]	[0.093]
Top 4th:	0.053***	0.062***	0.027**	-0.02	0.007	-0.106
	[0.009]	[0.012]	[0.010]	[0.088]	[0.108]	[0.096]

Comparative Statics

- Recall: $x(i) = \frac{a^0 - c(i) - t - 2(\tilde{b} - \bar{\eta}e)eX}{2[\tilde{b} - \eta(1-e)](1-e)}$ - Solve for two equations in X and δ:
  1. Evaluate at $i = \delta$: $x(\delta) = 0 \rightarrow c(\delta) = a^0 - t - 2(\tilde{b} - \bar{\eta}e)eX$
  2. Integrate $x(i) - x(\delta)$ over i: $X = \frac{\int_0^\delta [c(\delta) - c(i)]di}{2[\tilde{b} - \eta(1-e)](1-e)}$

Increase in:	$\bar{\eta}$	η	t	L
X	$+$	$+$	$-$	$+$
$x(0)$	$+$	$+$	$-$	$+$
$\delta, x(\delta)$	$+$	$-$	$-$	$+/-$

$$*\frac{d\delta}{dL} \propto \bar{\eta}e - \eta(1-e)$$

- More varieties sold in a larger market: (i) the less products are differentiated, and (ii) the more important is investment in brand quality.