Supplier Responses to WalMart’s Invasion of Mexico

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Two decades ago, Mexico committed itself to greater integration with the global economy:

- joined the GATT in 1985 (lower tariffs on consumer goods)
- Signed NAFTA in 1992 (national treatment to foreign investors)

At the same time, the Mexican economy was becoming more attractive to foreign retailers for other reasons:

- Big, with a growing middle class
- Increasingly urbanized population
Walmart (and other foreign chains) invested in Mexico

- Bought controlling interest in Aurrera in 1997 and became Wal-Mart de México (Walmex).

By 2001, “only 4 chains dominated the market" (Chavez, 2002):

- Wal-Mart de México with almost half (45.6 percent),
- Comercial Mexicana with a little over a fifth (20.6 percent),
- Gigante (15.5 percent) and
- Soriana (14 percent)".

By 2002, Walmex’s total sales had grown to $10.9 billion (Tegel, 2003), and by 2007 to $20.6 billion (Wal-Mart, 2008).
Stores and Distribution Centers

- A variety of retailers now operate under the Walmex umbrella
  - **Bodega Aurrera** (lower end grocery chain)
  - **Superama** (basic big box store)
  - **Walmex Supercenters** (big box store, plus grocery store)
  - **Sam’s Club** (bulk version of Supercenter)
  - **VIPs** (restaurants)
  - **Suburbia** (clothing)

- These stores are supplied by regional distribution centers (CEDIS), as well as direct deliveries from producers.
  - 30 percent of perishable goods are bought locally by supermarkets directly from suppliers.
  - CEDIS are specialized by commodity type: dry goods, perishables, clothes.
  - Supplying a single CEDIS gives a producer access to the entire network
Unlike in the United States (Holmes, 2011), Wal-Mart began in the most populated areas (partly because Aurrera was already there).

It added stores throughout Mexico as it expanded, rather than gradually radiating out from the center.

It planted several distribution centers in areas where its store concentration was highest.
Walmart business practices

- Innovative warehousing, distribution, and inventory management.
  - Modernized system of channeling deliveries from suppliers through centralized warehouses
  - Requires delivery trucks to have appointments and drivers to carry standard identification cards.
  - Shipments must be on standardized pallets (rentable from Walmex), shrink-wrapped with corner protectors, subject to third-party quality audits.

- Wal-Mart keeps negotiations with its suppliers as stark as possible—both the bargaining environment and the number of negotiable contract features (price, quality, quantity).
  - Often makes a take-or-leave-it offer.
  - Expects product innovation or annual price concessions.
  - Uses store brands to create competition.
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The cost of Walmex: mandatory low prices, tied to quality relative to "outside" goods.

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Walmex and Upstream Industrial Evolution

A simple model: Intra-period timing

1. Given industry state, own scrap value, and own product quality each incumbent firms decides
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5. Profits accrue, product improvements are realized, and the period ends.
Indirect utility from a unit of product $j$ for consumer $i$:

$$U_{ij} = \theta_1 \ln(\xi_j) + \beta_w w_j + \theta_2 \ln(Y - P_j) + \epsilon_{ij}$$

$$\text{def} \quad \overline{U_j} + \epsilon_{ij}.$$

Definitions

- $\xi_j$: Quality/popularity of good supplied by firm $j$, relative to "outside" good $\xi_j \in \{\xi^1, ..., \xi^K\}$
- $P_j$: Price of good $j$
- $Y$: Income of representative consumer
- $w_j$: 1 if $j$ retails through Walmex, 0 otherwise
- $\epsilon_{ij}$: Type 1 extreme value, iid across consumers and goods

If firm $j$ sells through Walmex, it makes its product more accessible to consumers, so more consumers choose it.
Walmex and Upstream Industrial Evolution

A simple model: pricing

- Firms selling through Walmex must meet a minimum quality/popularity level and price at:

$$\bar{P}_j = P_0 + \theta_3 \ln(\xi_j), \quad \theta_3 > 0$$

- Constrained Bertrand competition:

$$P_j = \begin{cases} 
\frac{Y + \theta_2 C_j(1-h_j)}{1 + \theta_2 (1-h_j)} & w_j = 0 \\
\min \left[ \bar{P}_j, \frac{Y + \theta_2 C_j(1-h_j)}{1 + \theta_2 (1-h_j)} \right] & w_j = 1
\end{cases}$$

where

$$h_j = h(j|w, P, \xi) = \frac{\exp[\bar{U}_j]}{\sum_{\ell} \exp[\bar{U}_\ell] + 1}$$

$$\xi = \{\xi_1, \ldots, \xi_n\}$$

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Walmex and Upstream Industrial Evolution
A simple model: retail choices

- **Walmex choices:**
  - Firms anticipate second stage equilibrium prices for each \((w, \xi)\).
  - Given the decisions of their competitors, make the profit-maximizing choice concerning Walmex, comparing.

\[
\pi(\xi_j, w_j = 0|w_{-j}, \xi) = \left(P_j^0 - C\right) \cdot h_j^0 \cdot M \\
\text{and}
\pi(\xi_j, w_j = 1|w_{-j}, \xi) = \left(P_j^1 - C\right) \cdot h_j^1 \cdot M
\]

- Equilibria in retailing choices obtain when no one has an incentive to switch retailer:

\[
\left[\pi(\xi_j, w_j = 1|w_{-j}, \xi) - \pi(\xi_j, w_j = 0|w_{-j}, \xi)\right] \cdot w_j \\
+ \left[\pi(\xi_j, w_j = 0|w_{-j}, \xi) - \pi(\xi_j, w_j = 1|w_{-j}, \xi)\right] \cdot (1 - w_j) \geq 0 \quad \forall j
\]
Walmex and Upstream Industrial Evolution

A simple model: investment in innovation

- When a firm exerts effort level $r$ to improve it’s products popularity/quality, it incurs cost $r \cdot c_r$.
- For a given firm, $\xi$ moves at most one position in the ordered set $\xi$ per period.
- Successful innovation occurs with probability $\frac{ar}{1+ar}$.
- Negative quality/popularity shocks occur with exogenous probability $\delta$.

\[
\begin{align*}
\Pr \left[ \xi_j' = \xi^{i+1} | \xi_j = \xi^i \right] &= \frac{ar_j}{1+ar_j} \cdot (1 - \delta) \\
\Pr \left[ \xi_j' = \xi^i | \xi_j = \xi^i \right] &= \left(1 - \frac{ar_j}{1+ar_j}\right) (1 - \delta) + \frac{ar_j}{1+ar_j} \delta \\
\Pr \left[ \xi_j' = \xi^{i-1} | \xi_j = \xi^i \right] &= \left(1 - \frac{ar_j}{1+ar_j}\right) \delta
\end{align*}
\]
Walmex and Upstream Industrial Evolution
A simple model: continuation and innovation

- Let the $i^{th}$ element of $\mathbf{s} = (s_1, s_2, \ldots, s_K)$ be the number of firms in the industry at quality level $\xi^i$.
- Let $\mathbf{s}_{-j}$ be the same vector, except in that it leaves firm $j$ out of the count.
- Let $\pi^* (\xi^j, \mathbf{s}_{-j})$ be the equilibrium current profits of firm $j$ when it is at quality $\xi^j$, and the remainder of the industry is at $\mathbf{s}_{-j}$.
- Investments in quality/popularity and entry/exit decisions are characterized by Bellman equation:

$$
V (\xi^j, \mathbf{s}_{-j}) = \max \left[ \phi_s, \max_{r_j} \left\{ \pi^* (\xi^j, \mathbf{s}_{-j}) - c_r \cdot r + \beta E_{\Omega_j} \left[ V (\xi^{j'}, \mathbf{s}'_{-j}) \right] \right\} \right]
$$
In equilibrium

- The expected value of entry is less than or equal to entry costs.
- The scrap value of each continuing firm is no larger than the continuation value.
- The transition density for the industry states is correctly understood by all agents.
- Spot markets clear at optimal $P, w$ choices.
- Optimal investments are made

Given parameters, one can solve for the “oblivious” equilibrium numerically, using algorithm developed by Weintraub, Benkard and Roy (2007).
### Walmex and Upstream Industrial Evolution

**A simple model**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>base case</th>
<th>no Walmex</th>
<th>low boost</th>
<th>low quality premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C$ Marginal costs</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>$m$ Market size</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>$Y$ Consumer income</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>$\beta_w$ customer base effect</td>
<td>1.0</td>
<td><strong>0.0</strong></td>
<td><strong>0.5</strong></td>
<td>1.0</td>
</tr>
<tr>
<td>$\xi$ Minimum Walmex appeal</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>$\theta_1$ Quality coefficient</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>$\theta_2$ Price coefficient</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>$\theta_3$ appeal-price relation</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td><strong>0.3</strong></td>
</tr>
<tr>
<td>$a$ Investment f’n. parameter</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>$\delta$ Innov. prob., outside good</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>$\kappa$ Entry cost</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>$E(\phi_s)$ Average scrap value</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Iacovone et al (World Bank, etc.) Walmex invasion 04/11 19 / 29
Walmex and Upstream Industrial Evolution

Simulation results: Walmex market size effects

![Graphs showing the effects of Walmex market size on prices, quality, firm frequency, firm size, and investment in innovation and quality.](image)
Walmex and Upstream Industrial Evolution
Simulation results: Walmex price ceiling effects

prices and quality

firm frequency and quality

firm size and quality

investment in innovation and quality
Walmex and Upstream Industrial Evolution

  - Standard information on inputs, outputs, investments, for 6,867 plants spread across 205 classes of activity.
  - Classes the survey samples the largest firms until the coverage reaches 85% of the sectoral output.

- **Monthly Survey of Industry (EIM)**, also collected by INEGI 1994-2002
  - Covers same plants as annual industry survey.
  - Records the physical quantity and value of domestic sales, which allows for calculation of unit values and plant-level price indices.
  - Plant-product rather than plant level. We aggregate monthly EIM data into annual observations.

- **National Association of Self-Service and Department Stores (ANTAD)** and Walmex, 1992-2002
  - Walmex floorspace, by region, through time.
  - Total retail floorspace, by region, through time.
Dependent variables \((Y)\) are observed annually at the plant level; expressed as deviations from 6-digit product-year means

- **Domestic prices** Log of price index where 1994 = 100 (Firm-specific Tornqvist index)
- **Domestic sales** Log of value of sales deflated using 6-digit product index
- **R&D** Deflated log of expenditures on R&D
- **Wage** Deflated log of total wage bill
- **TFP** constructed using producer-specific price deflators; all TFP indices normalized to unity in the base year.

Variables observed annually at the state level

- \(s_{jt}\) **WM share** Sams, Bodega, WM Supercenter, and Superama floorspace as a share of state-wide retail floorspace.
- **GDP\(_{jt}\)** **Log GDP State** Log of real GDP (constant 1993 pesos)
Can’t see:
- retailing choices of individual firms directly, or
- firms’ product appeal

Can see:
- size, which is monotonically related to product appeal in equilibrium.
- Walmex presence in geographic region of producer

What we look for
- Relative to large, high-appeal producers, a Walmex option should cause small, low appeal producers to shrink, back off investment, price higher than moderately big firms.
- This should matter only among producers of goods that are affected by a local Walmex presence (especially perishables).
Walmex and Upstream Industrial Evolution

A reduced-form regression

- The equation of interest

\[ Y_{jt} = \beta_1^g PG^i + \beta_2^g [PG^i \times s_{jt}] + \beta_3^g s_{jt} + \beta_4^g TUS_t + \beta_5^g TMEX_t + \beta_6^g GDP_{jt} + \beta_7^g [PG^i \times GDP_{jt}] + \alpha_t + \mu_j + \varepsilon_{jt}. \quad g = 1, 4 \]

- Dealing with endogenous floorspace shares \((s_{jt})\): a VAR

\[ FW_{jt} = \gamma_1 FW_{jt-1} + \gamma_2 FNW_{jt-1} + \gamma_3 GDP_{jt-1} + \gamma_4 GDP_{jt-2} + \zeta_t + \omega_{jt} \]
\[ FNW_{jt} = \delta_1 FW_{jt-1} + \delta_2 FNW_{jt-1} + \delta_3 GDP_{jt-1} + \delta_4 GDP_{jt-2} + \tilde{\zeta}_t + \tilde{\omega}_{jt} \]

\[ \hat{s}_{jt} = \frac{\exp(FW_{jt})}{\exp(FW_{jt}) + \exp(FNW_{jt})}, \]
<table>
<thead>
<tr>
<th></th>
<th>Fixed Sales</th>
<th>Fixed R&amp;D</th>
<th>Fixed Investment</th>
<th>Fixed Wages</th>
<th>Fixed Prices</th>
<th>Fixed TFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>-8.204***</td>
<td>-1.083</td>
<td>-5.087**</td>
<td>-1.182**</td>
<td>-0.696**</td>
<td>-2.463**</td>
</tr>
<tr>
<td></td>
<td>[1.273]</td>
<td>[0.927]</td>
<td>[2.467]</td>
<td>[0.490]</td>
<td>[0.342]</td>
<td>[1.000]</td>
</tr>
<tr>
<td>Midsmall</td>
<td>0.721</td>
<td>-0.869</td>
<td>-0.509</td>
<td>0.595*</td>
<td>0.800**</td>
<td>0.514</td>
</tr>
<tr>
<td></td>
<td>[0.705]</td>
<td>[1.146]</td>
<td>[1.858]</td>
<td>[0.337]</td>
<td>[0.253]</td>
<td>[0.594]</td>
</tr>
<tr>
<td>Midlarge</td>
<td>-0.456</td>
<td>1.541</td>
<td>2.444</td>
<td>-0.339</td>
<td>-0.346</td>
<td>-0.571</td>
</tr>
<tr>
<td></td>
<td>[0.639]</td>
<td>[1.040]</td>
<td>[2.099]</td>
<td>[0.310]</td>
<td>[0.221]</td>
<td>[0.506]</td>
</tr>
<tr>
<td>Large</td>
<td>0.025</td>
<td>1.662</td>
<td>-1.248</td>
<td>1.103***</td>
<td>-0.033</td>
<td>0.503</td>
</tr>
<tr>
<td></td>
<td>[0.750]</td>
<td>[1.583]</td>
<td>[2.573]</td>
<td>[0.330]</td>
<td>[0.123]</td>
<td>[0.621]</td>
</tr>
</tbody>
</table>

Iacovone et al (World Bank, etc.)

Walmex invasion

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Log quality and estimated effects of Walmex presence

State fixed effects
Table 4: Walmex Effects on Producer Characteristics ($\hat{\beta}_2$) by Initial Plant Size - Plant Fixed Effects

<table>
<thead>
<tr>
<th></th>
<th>Sales</th>
<th>R&amp;D</th>
<th>Investment</th>
<th>TFP</th>
<th>Wages</th>
<th>Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>-0.467</td>
<td>0.470</td>
<td>-9.988*</td>
<td>0.514</td>
<td>0.260</td>
<td>0.239</td>
</tr>
<tr>
<td></td>
<td>[1.688]</td>
<td>[2.004]</td>
<td>[5.167]</td>
<td>[1.843]</td>
<td>[0.609]</td>
<td>[0.456]</td>
</tr>
<tr>
<td>Midsmall</td>
<td>0.487</td>
<td>1.793</td>
<td>-7.661</td>
<td>0.826</td>
<td>-0.029</td>
<td>-0.408</td>
</tr>
<tr>
<td></td>
<td>[1.188]</td>
<td>[2.062]</td>
<td>[5.104]</td>
<td>[1.436]</td>
<td>[0.550]</td>
<td>[0.350]</td>
</tr>
<tr>
<td>Midlarge</td>
<td>2.341**</td>
<td>-3.301</td>
<td>1.471</td>
<td>-0.794</td>
<td>0.109</td>
<td>0.330</td>
</tr>
<tr>
<td></td>
<td>[1.018]</td>
<td>[2.665]</td>
<td>[5.376]</td>
<td>[1.225]</td>
<td>[0.501]</td>
<td>[0.313]</td>
</tr>
<tr>
<td>Large</td>
<td>1.515</td>
<td>10.365**</td>
<td>-2.313</td>
<td>1.283</td>
<td>0.572</td>
<td>-0.378</td>
</tr>
<tr>
<td></td>
<td>[1.280]</td>
<td>[4.491]</td>
<td>[8.231]</td>
<td>[1.686]</td>
<td>[0.605]</td>
<td>[0.371]</td>
</tr>
</tbody>
</table>
Log quality and estimated effects of Walmex presence
State and plant fixed effects

![Graphs of Sales, Investment, R&D, and TFP](Image)

Iacovone et al (World Bank, etc.)