Supplier Responses to Wal-Mart's Invasion of Mexico

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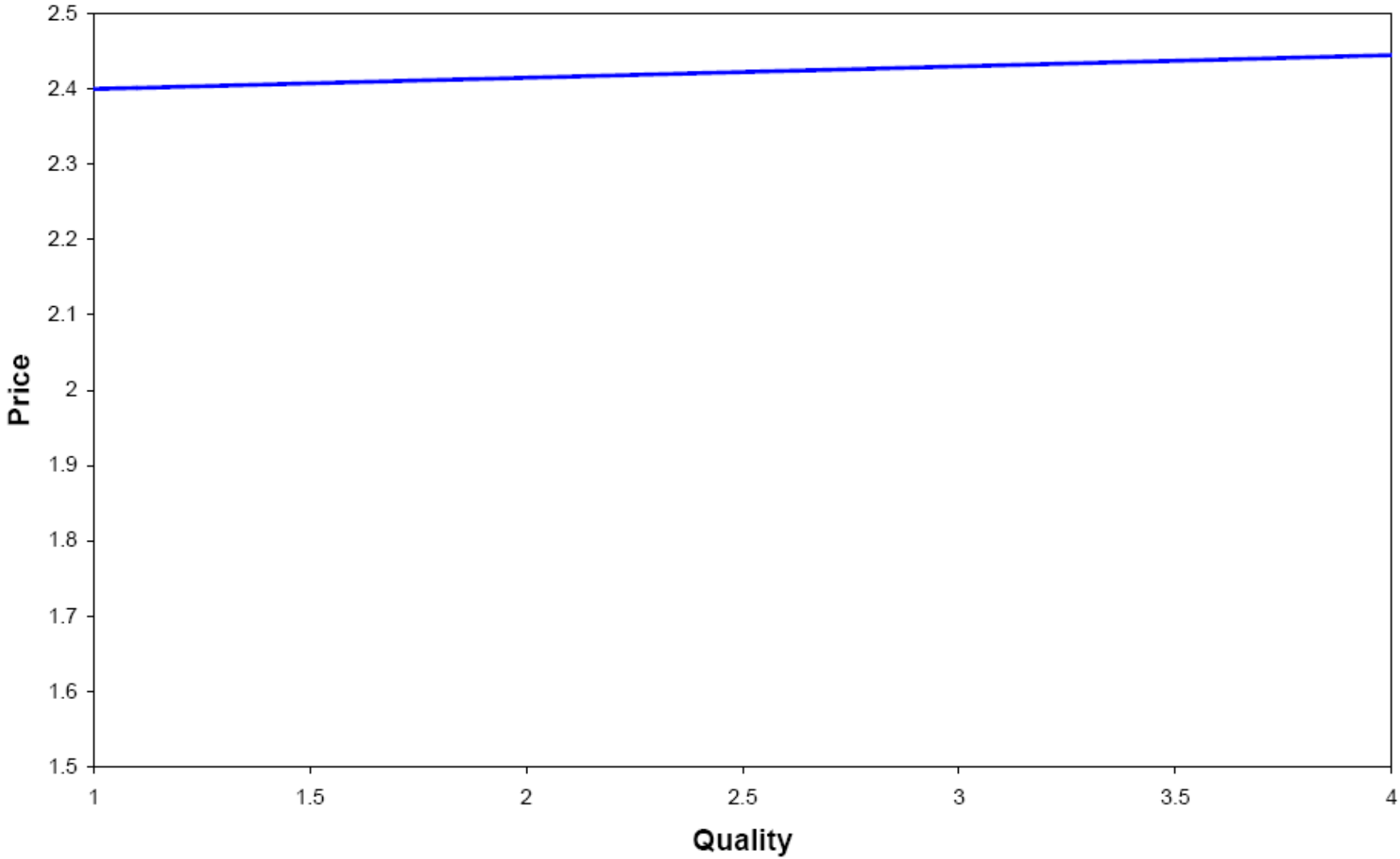
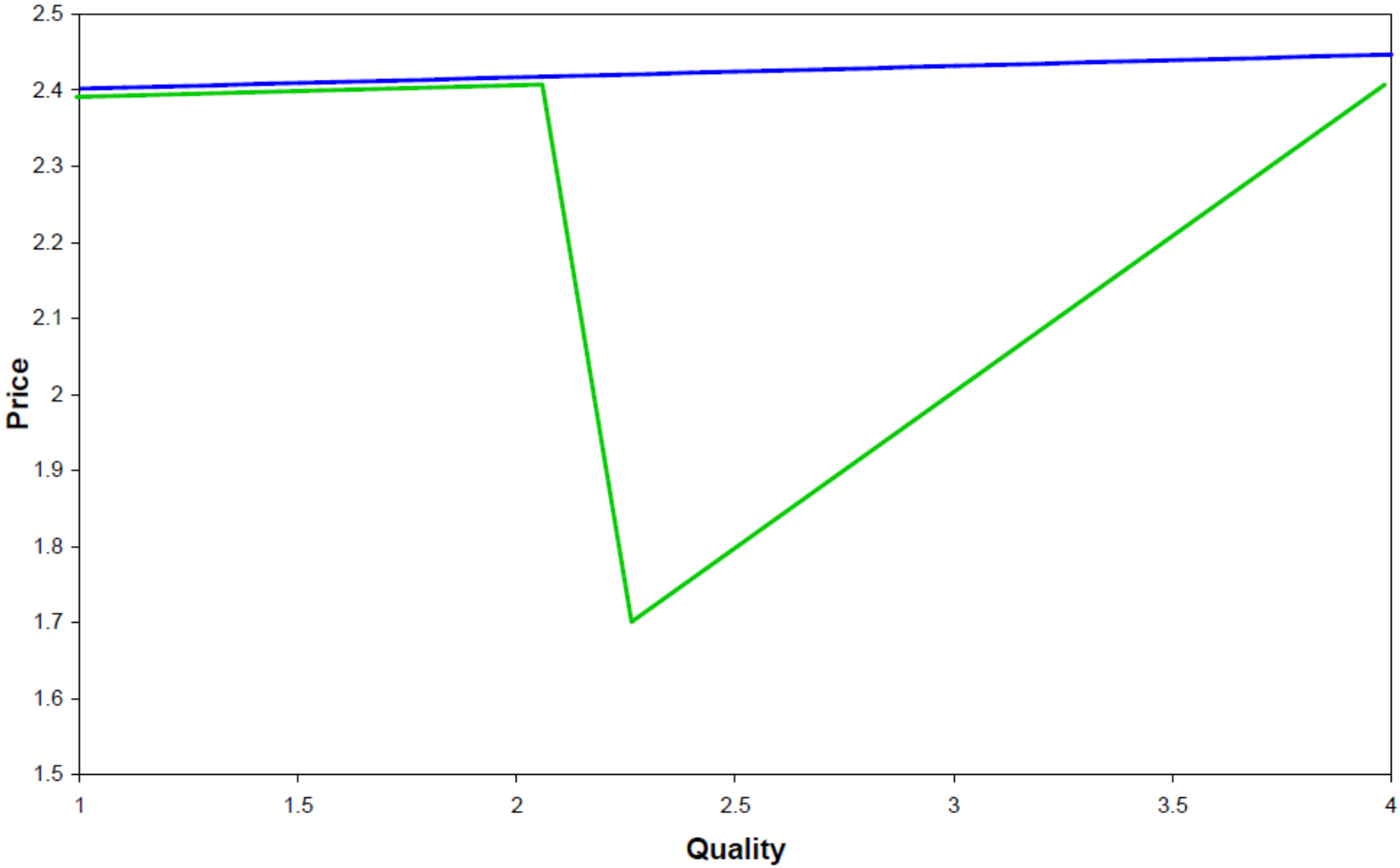
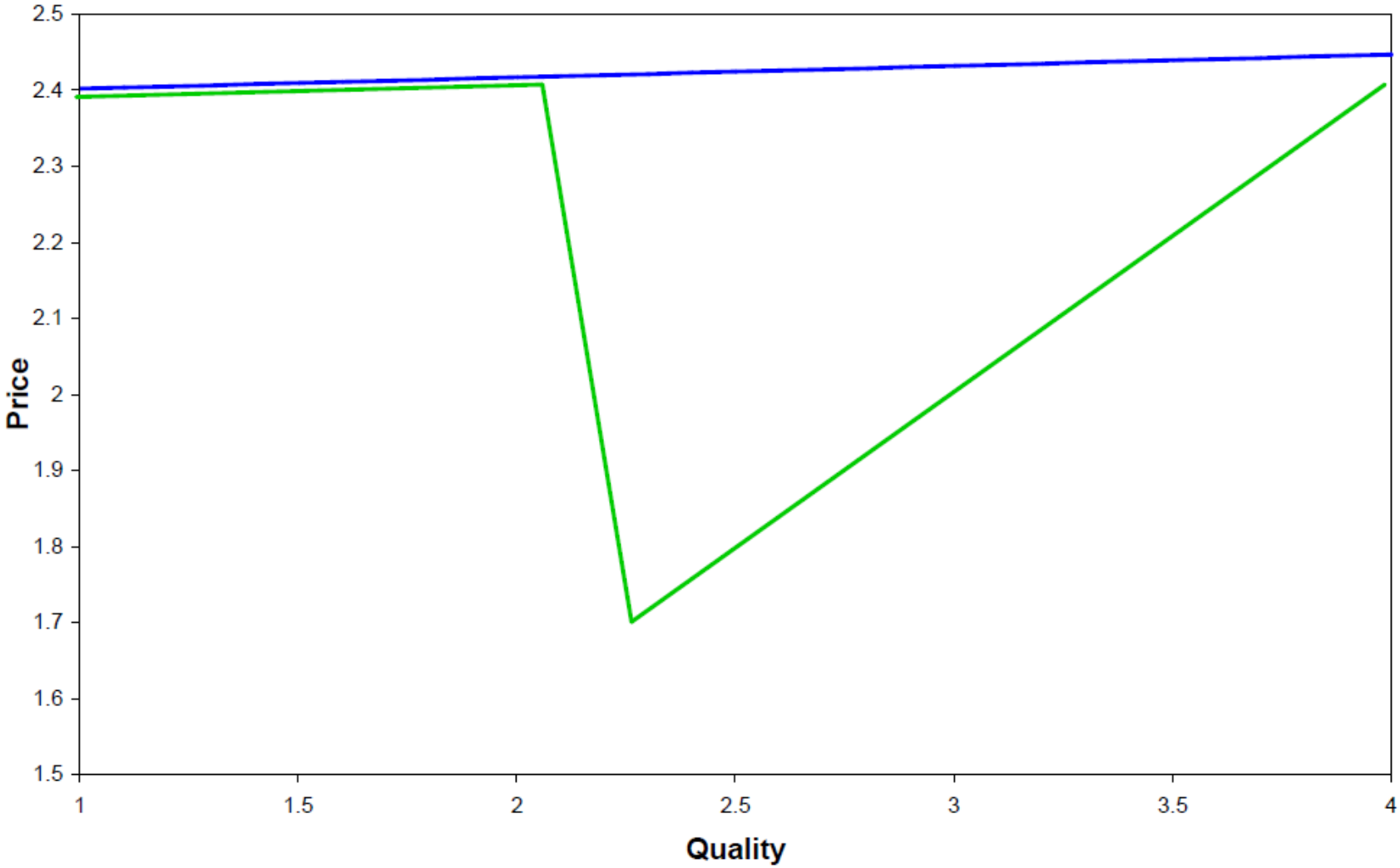
Equilibrium price setting when products differ in quality



Mexico: a globalization shock



Wal-Mart offers its retailing services to Mexican firms



Wal-Mart's Invasion of Mexico: the argument

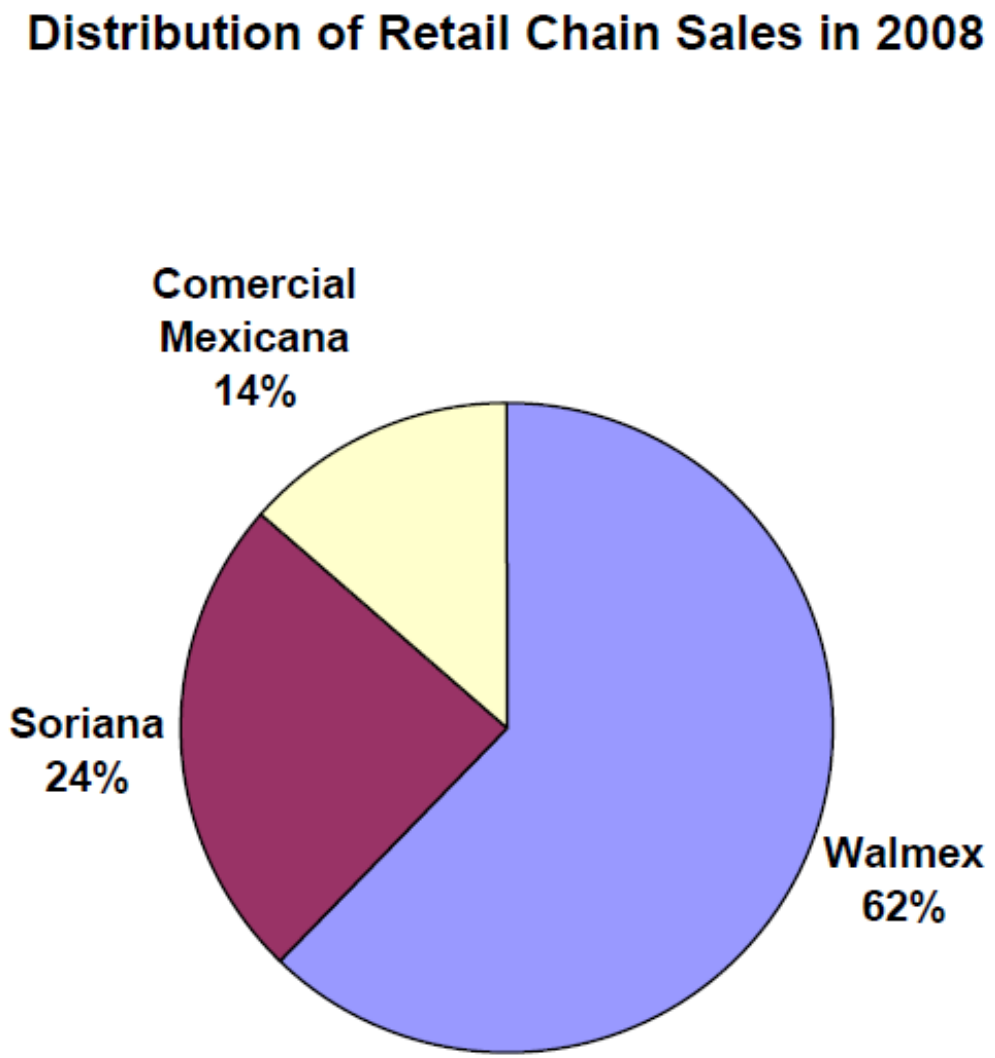
- *Wal-Mart* enters after NAFTA and Mexico's joining the GATT in 1985
- *Wal-Mart* brings its business practices to Mexico
- The FDI triggers massive reshuffling among Mexican producers
  - *Wal-Mart* increases their market size (national distribution)
    - ★ Heterogeneous firms: strong firms gain, weak firms lose
- *Wal-Mart*'s FDI gives incentives to innovate and upgrade
  - Upgrading required to ensure compatibility w/ *Wal-Mart*
    - ★ Heterogeneous firms: strong firms upgrade, weak firms do not

Overview

1. Firm interviews in Mexico as input for modeling the impact of *Wal-Mart* on Mexican suppliers (summarized in Javorcik, Keller, and Tybout 2008)
2. Simulation of sales, upgrading, pricing and other firm responses
3. Regression evidence on the same variables using Mexican micro data

The Invasion

- *Wal-Mart* entered Mexico via joint venture with *Bodegas Aurrera* in 1992
  - Bought controlling interest in 1997 and became *Wal-Mart de México* (*Walmex*)
- *Walmex* is Mexico's largest private employer since 2003



Walmex store formats

Bodega Aurrera — Tiendas de descuento austeras que ofrecen mercancía básica, alimentos y artículos para el hogar al mejor precio.

Propuesta de valor: Precio

M^2 promedio: 3,040

Participación sobre ventas totales: 33.7%

Walmart — Hipermercados que ofrecen el más amplio surtido de mercancía, desde abarrotes y perecederos hasta ropa y mercancías generales.

Propuesta de Valor: Precio y Surtido

M^2 promedio: 8,160

Participación sobre ventas totales: 28.2%

Sam's Club — Club de precios con membresía, enfocado en negocios y consumidores que compran a los mejores precios.

Propuesta de valor: Precio, volumen, mercancía nueva y diferenciada

M^2 promedio: 7,520

Participación sobre ventas totales: 27.0%

Superama — Supermercados ubicados en zonas residenciales.

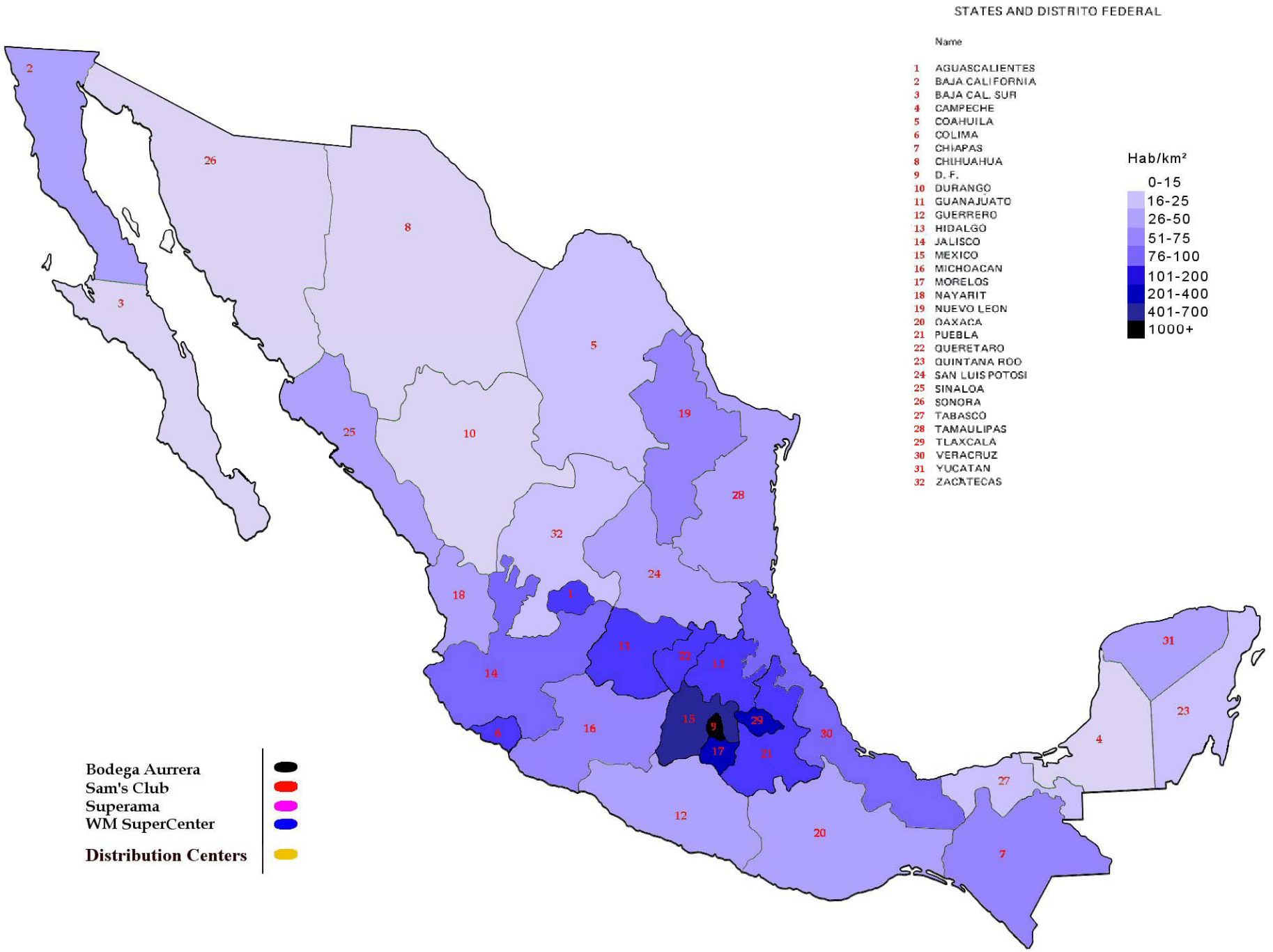
Propuesta de valor: Calidad, conveniencia y servicio

M^2 promedio: 1,650

Participación sobre ventas totales: 5.1%

Regional Distribution Centers

- Walmex stores are supplied by regional distribution centers (CEDIS), as well as direct deliveries from producers
- 30 percent of perishable goods are bought locally directly from suppliers
- Supplying a single CEDIS gives a producer access to the entire network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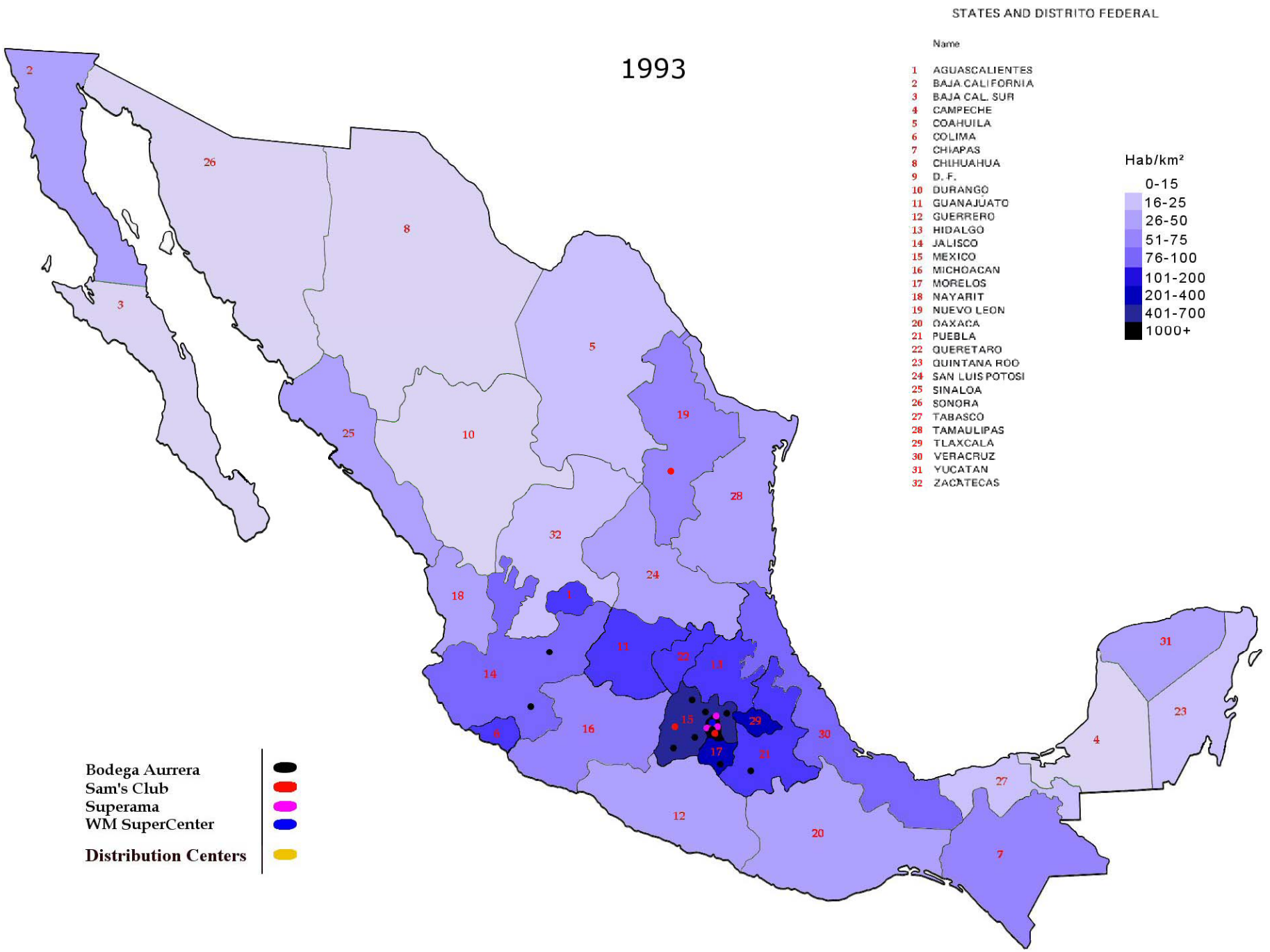
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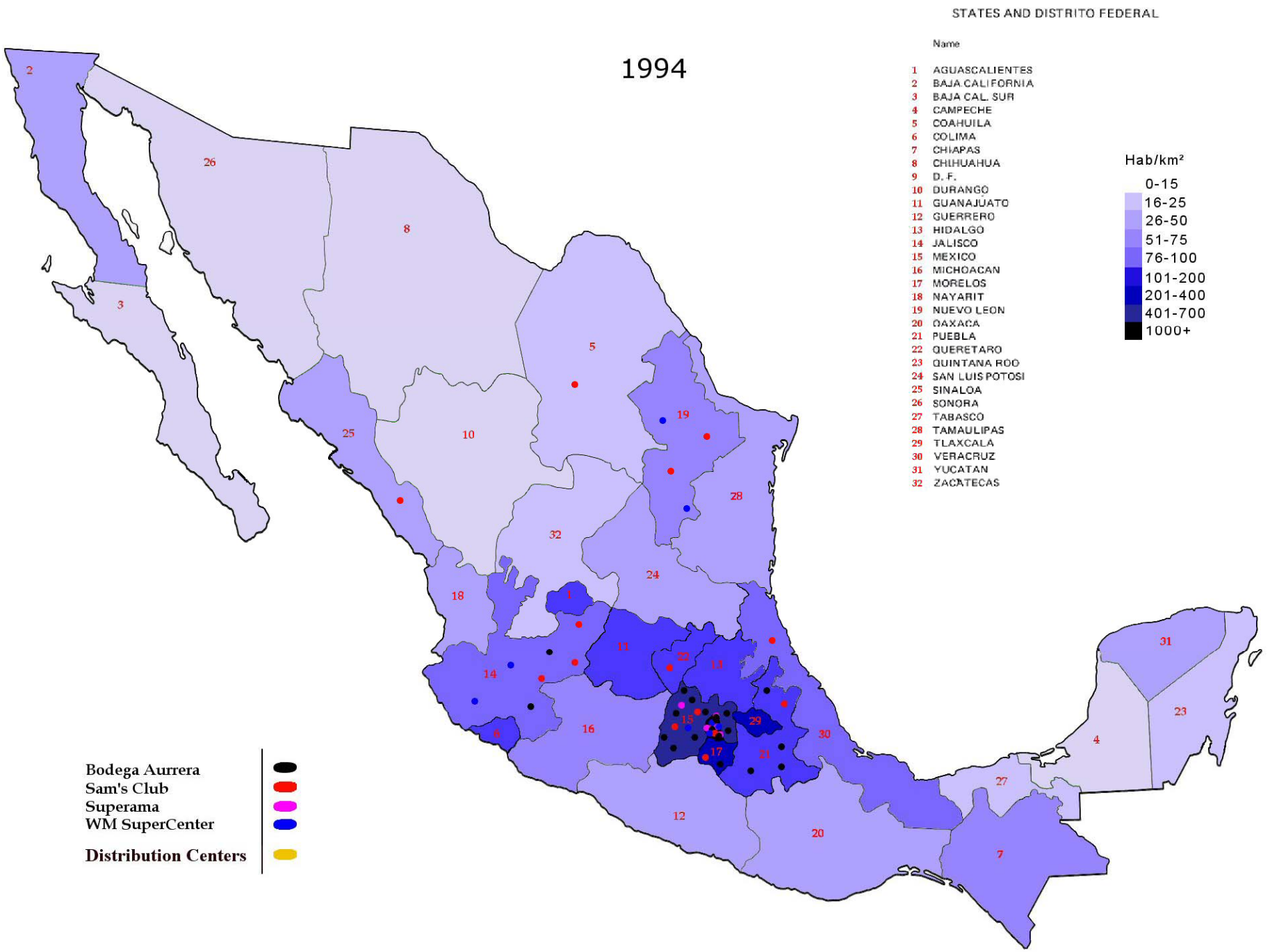
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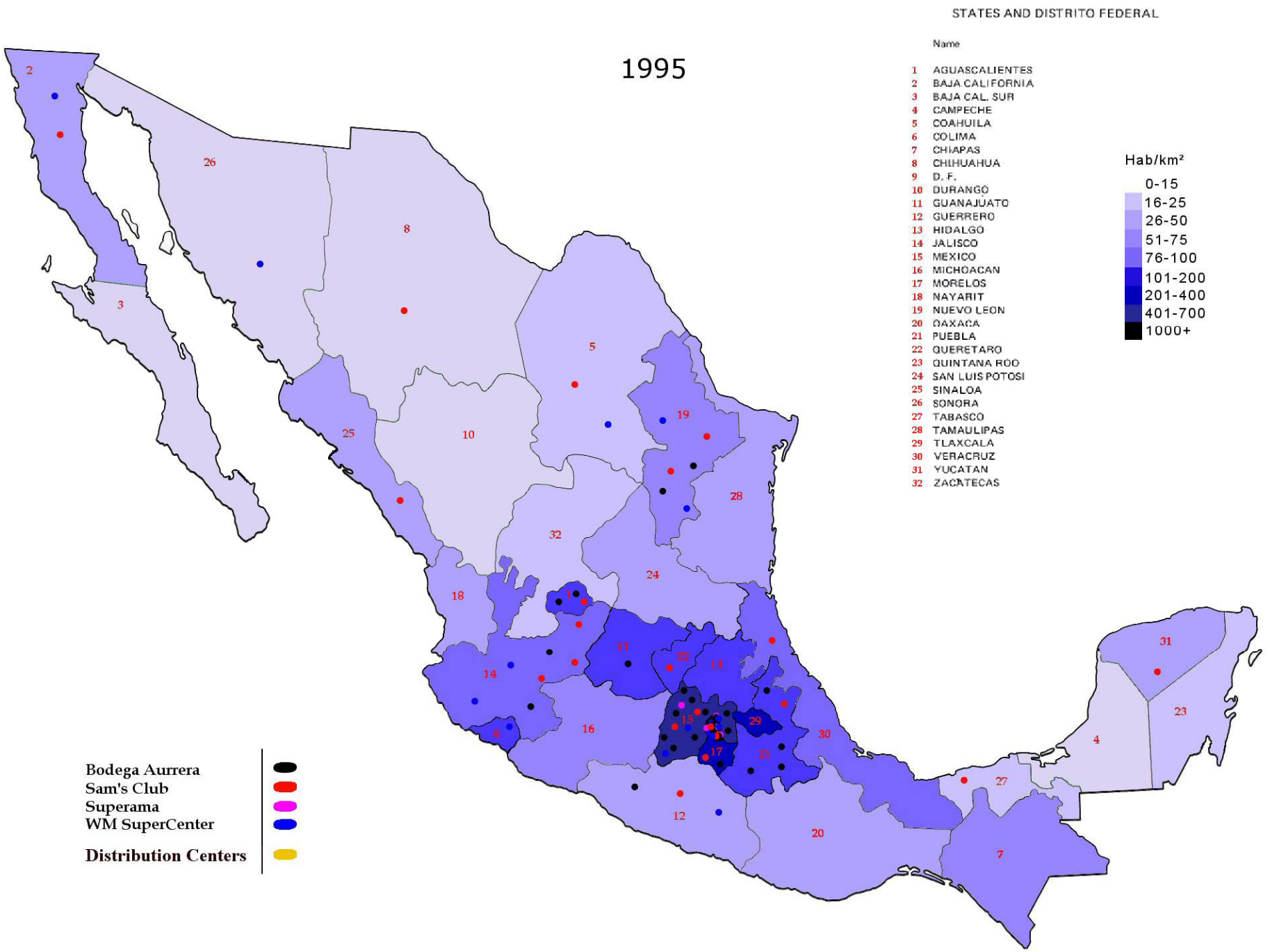
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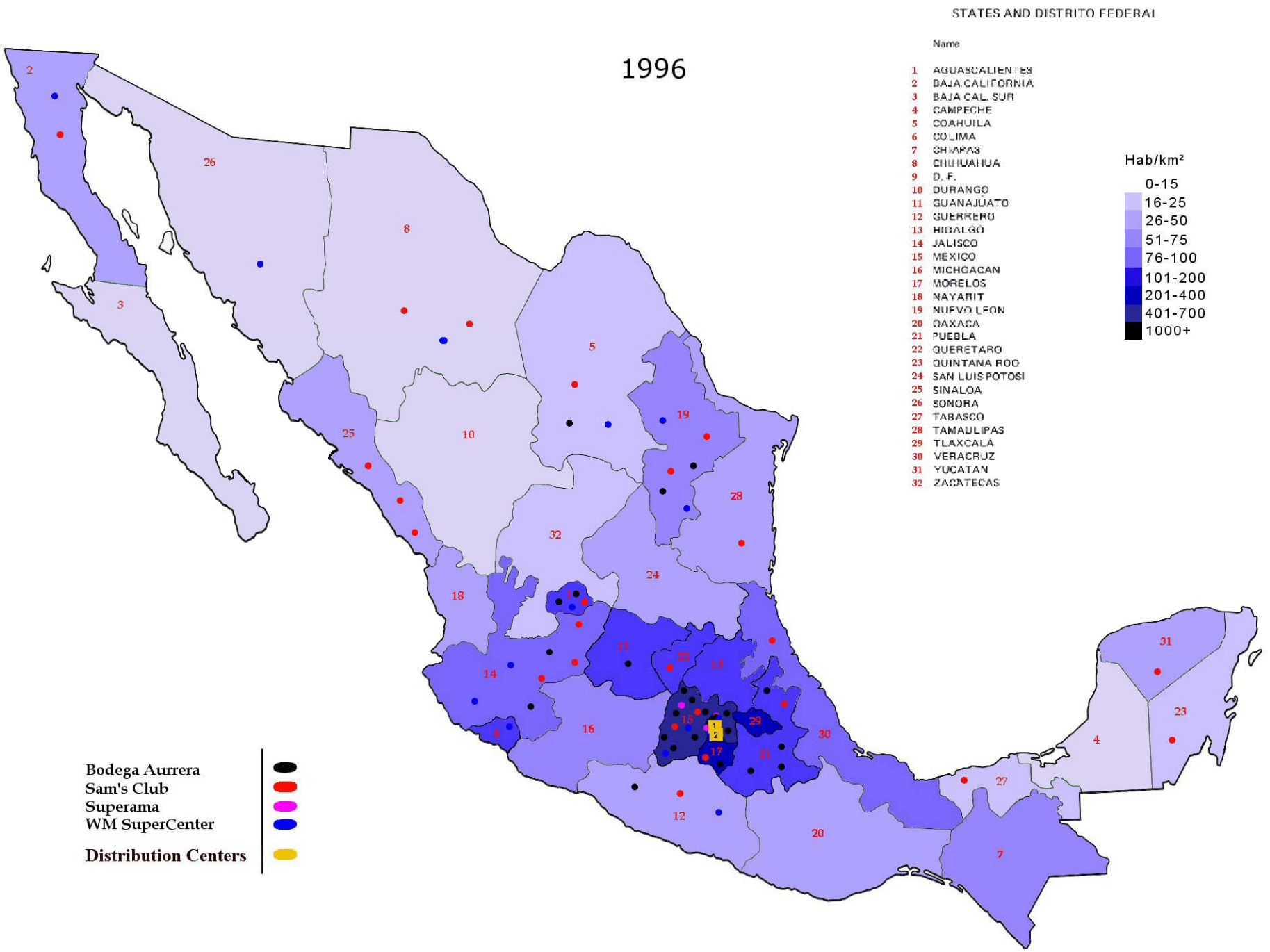
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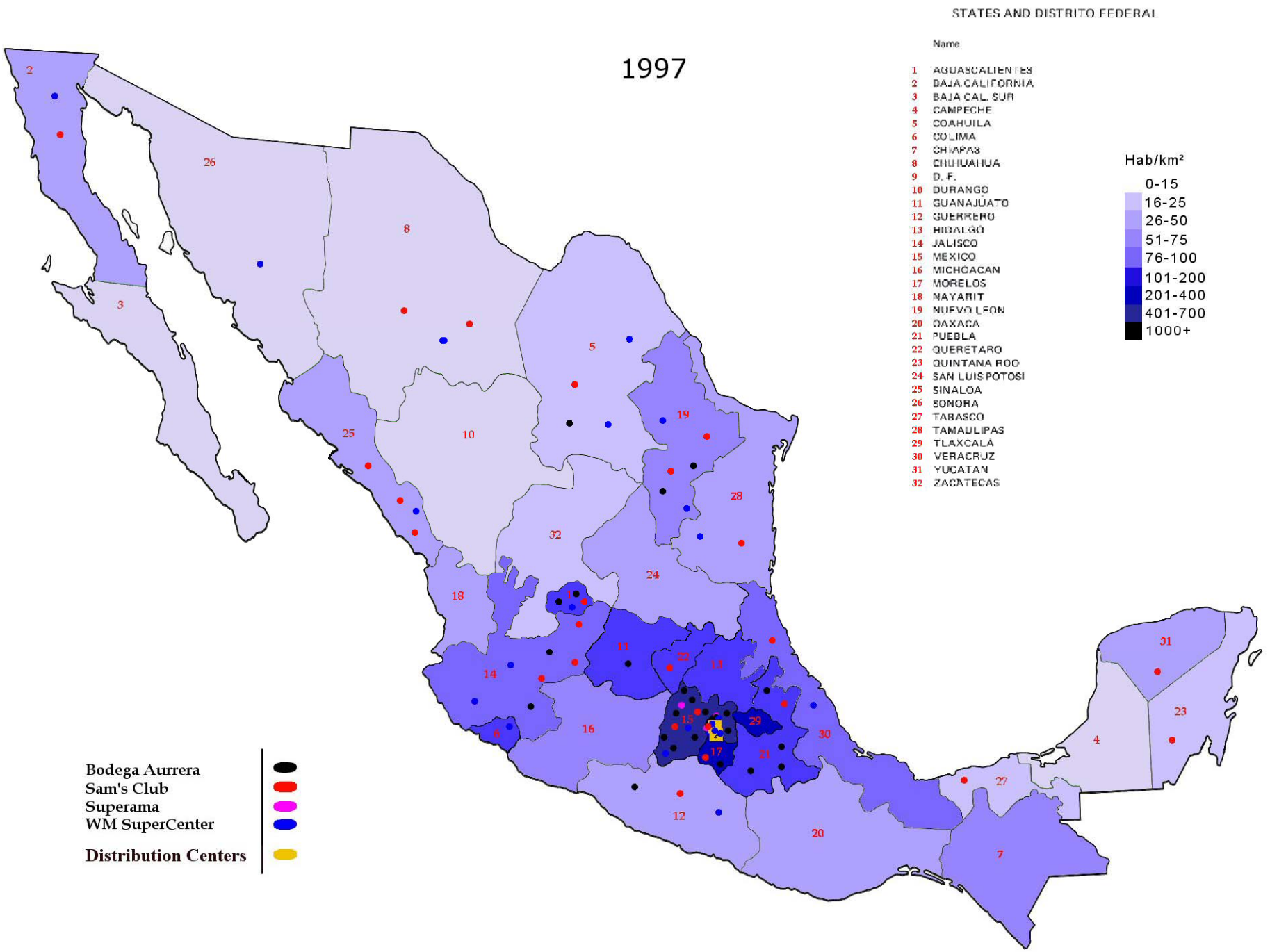
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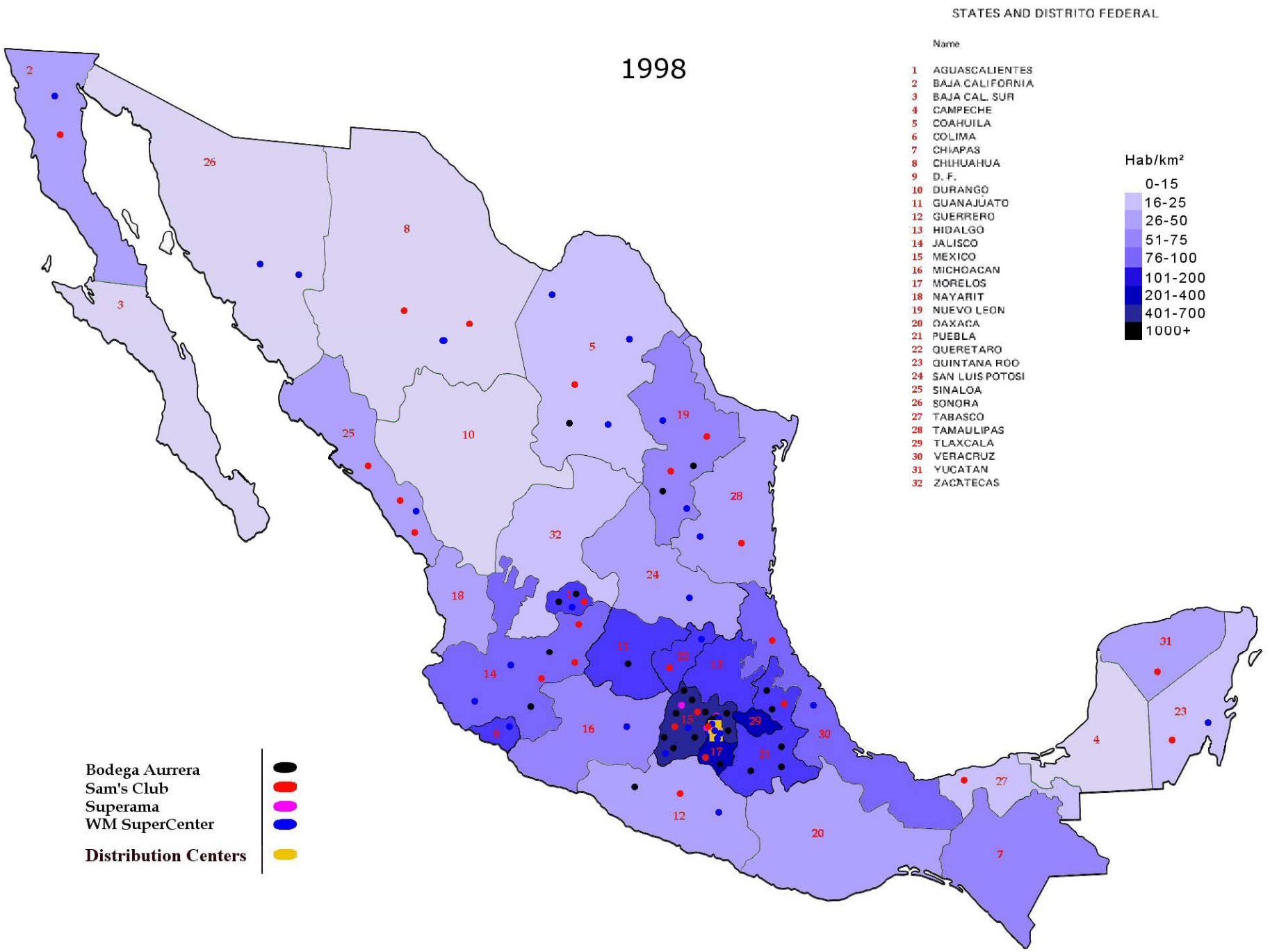
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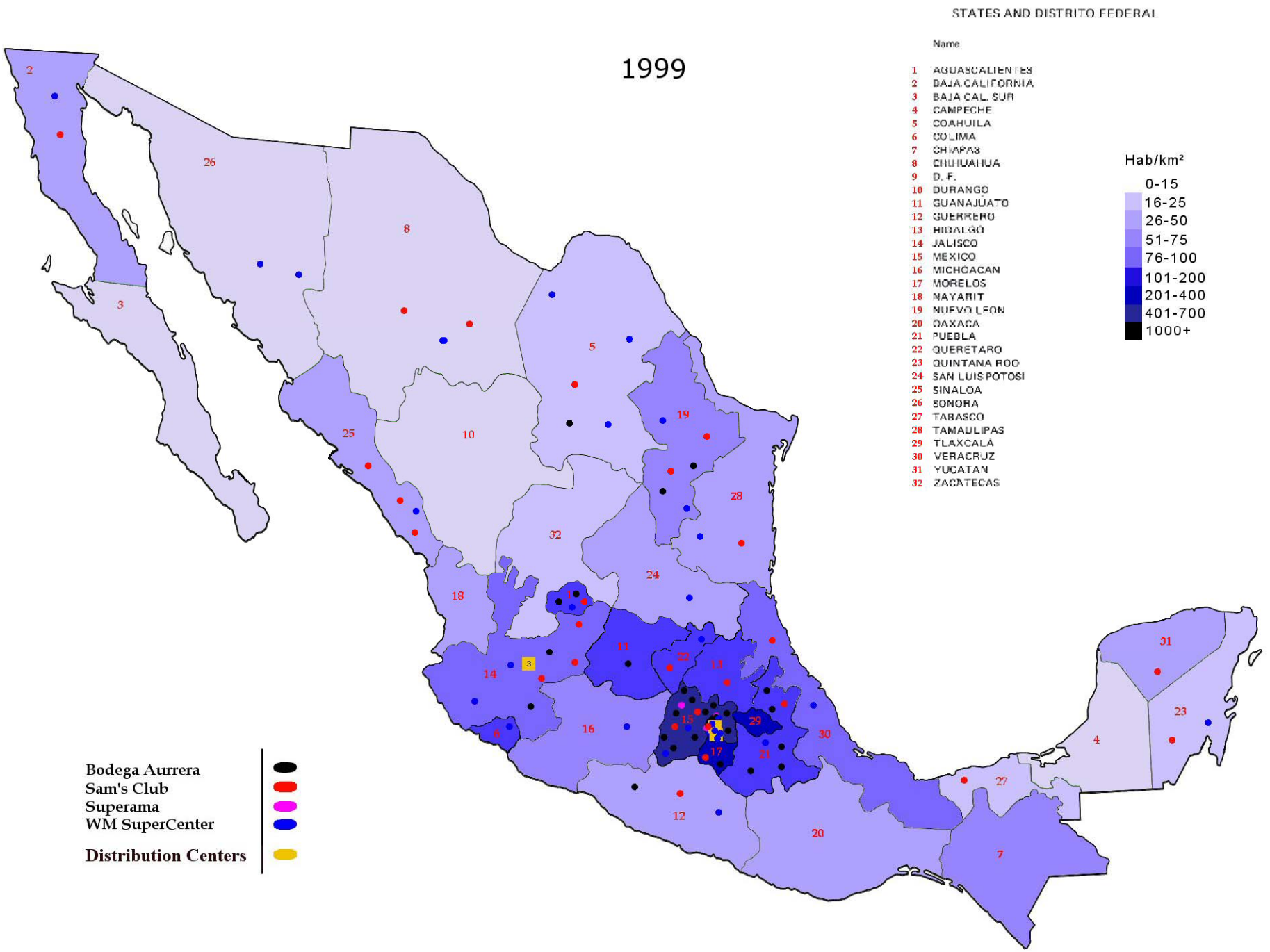
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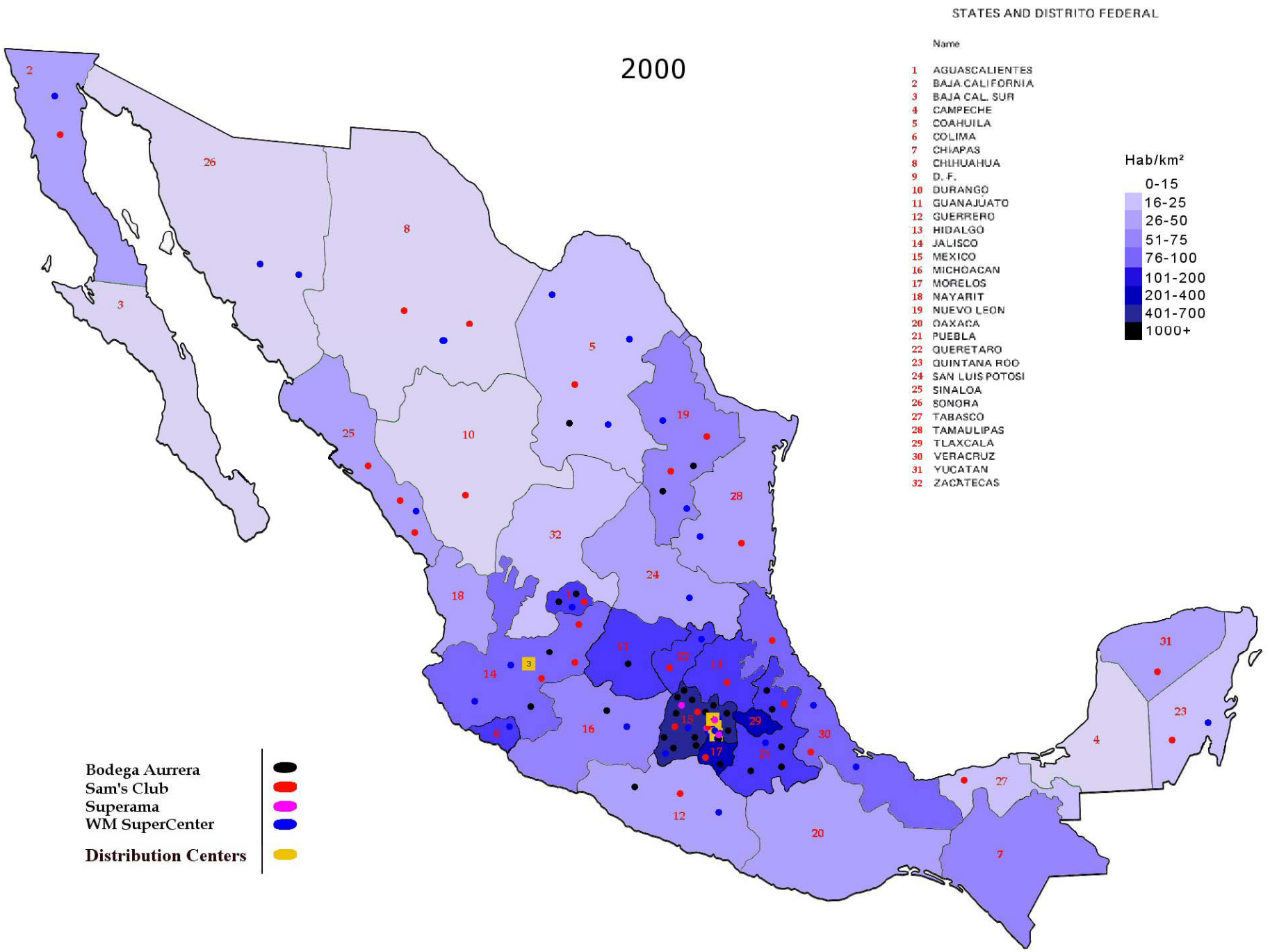
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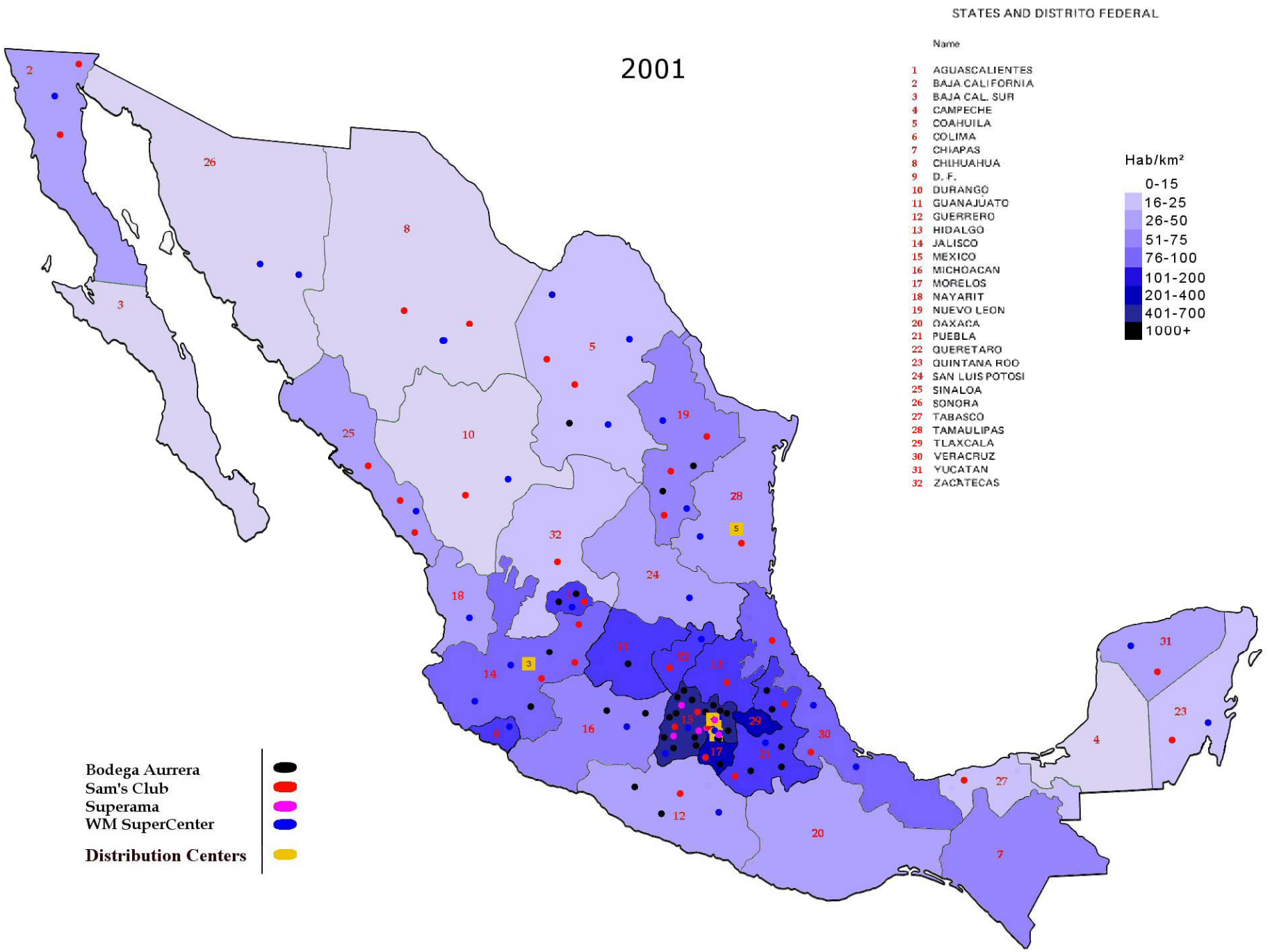
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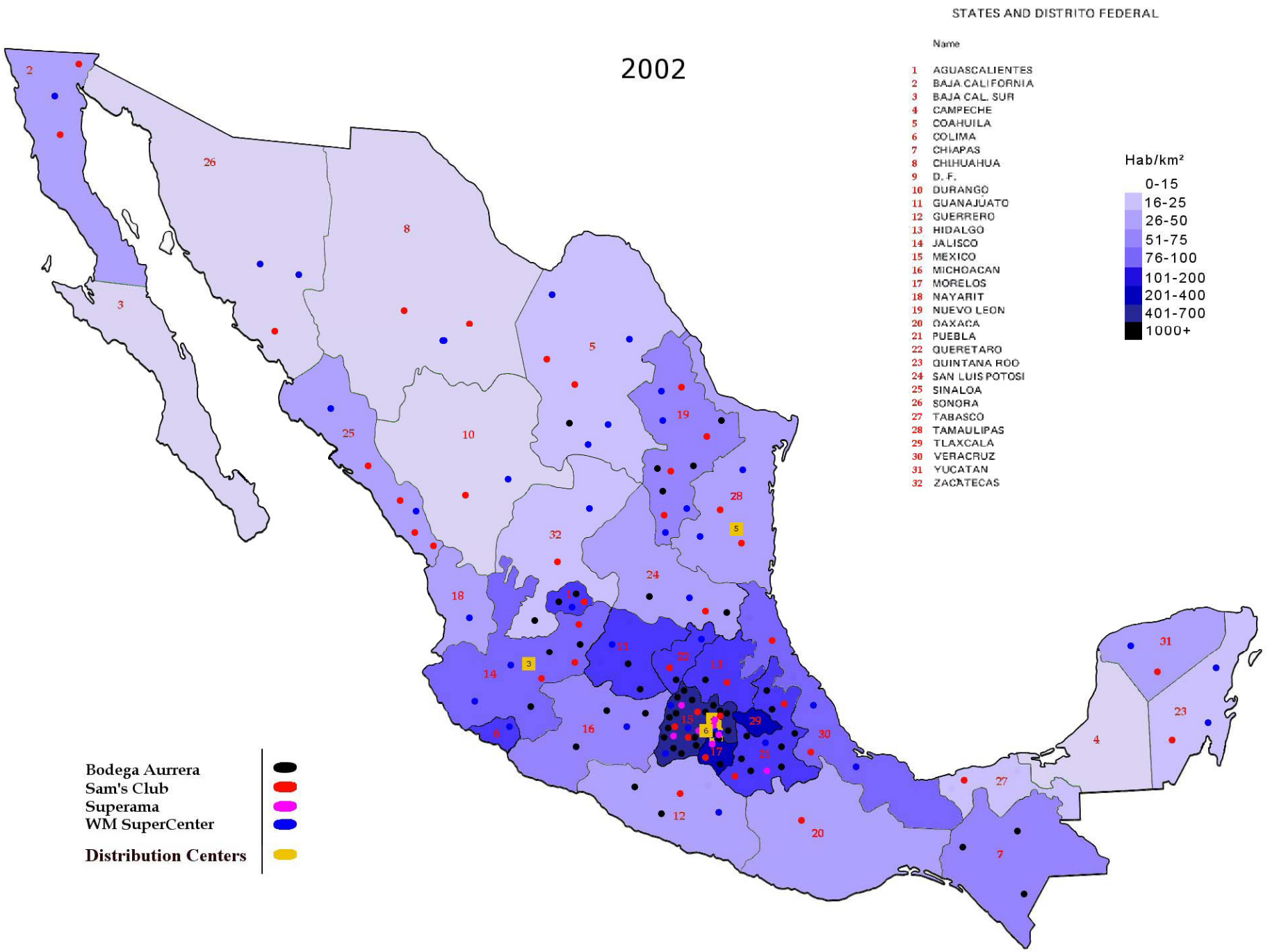
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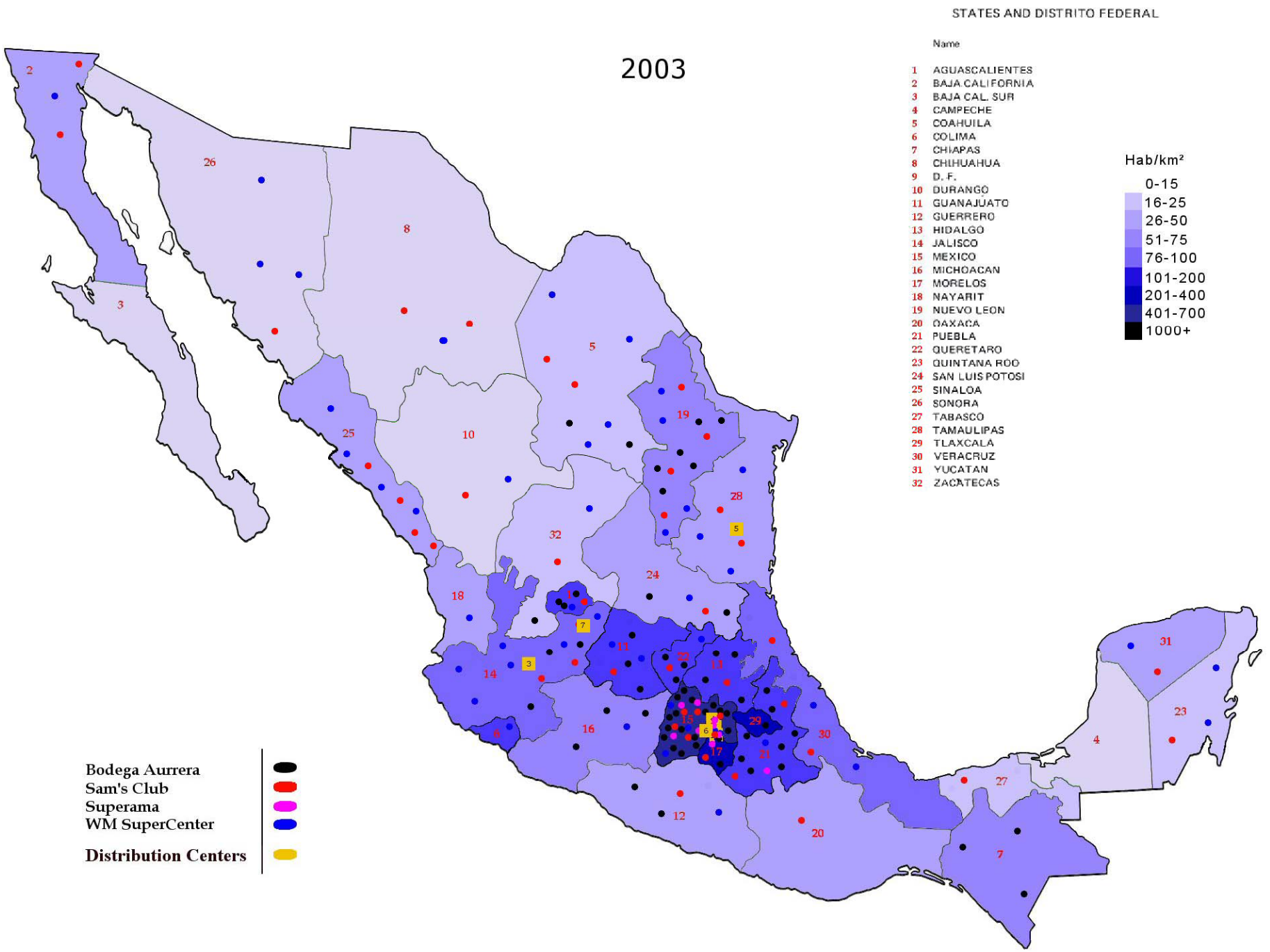
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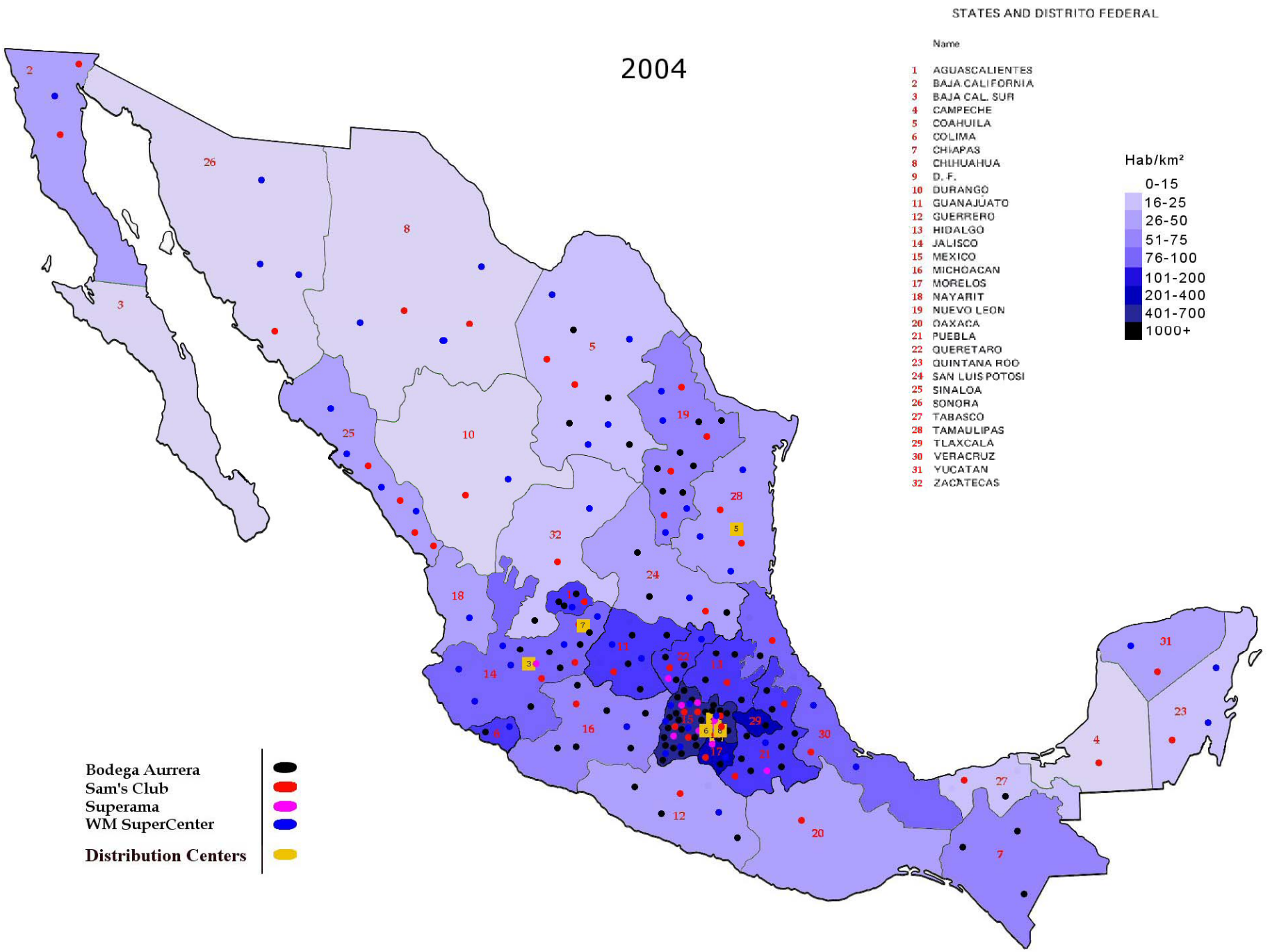
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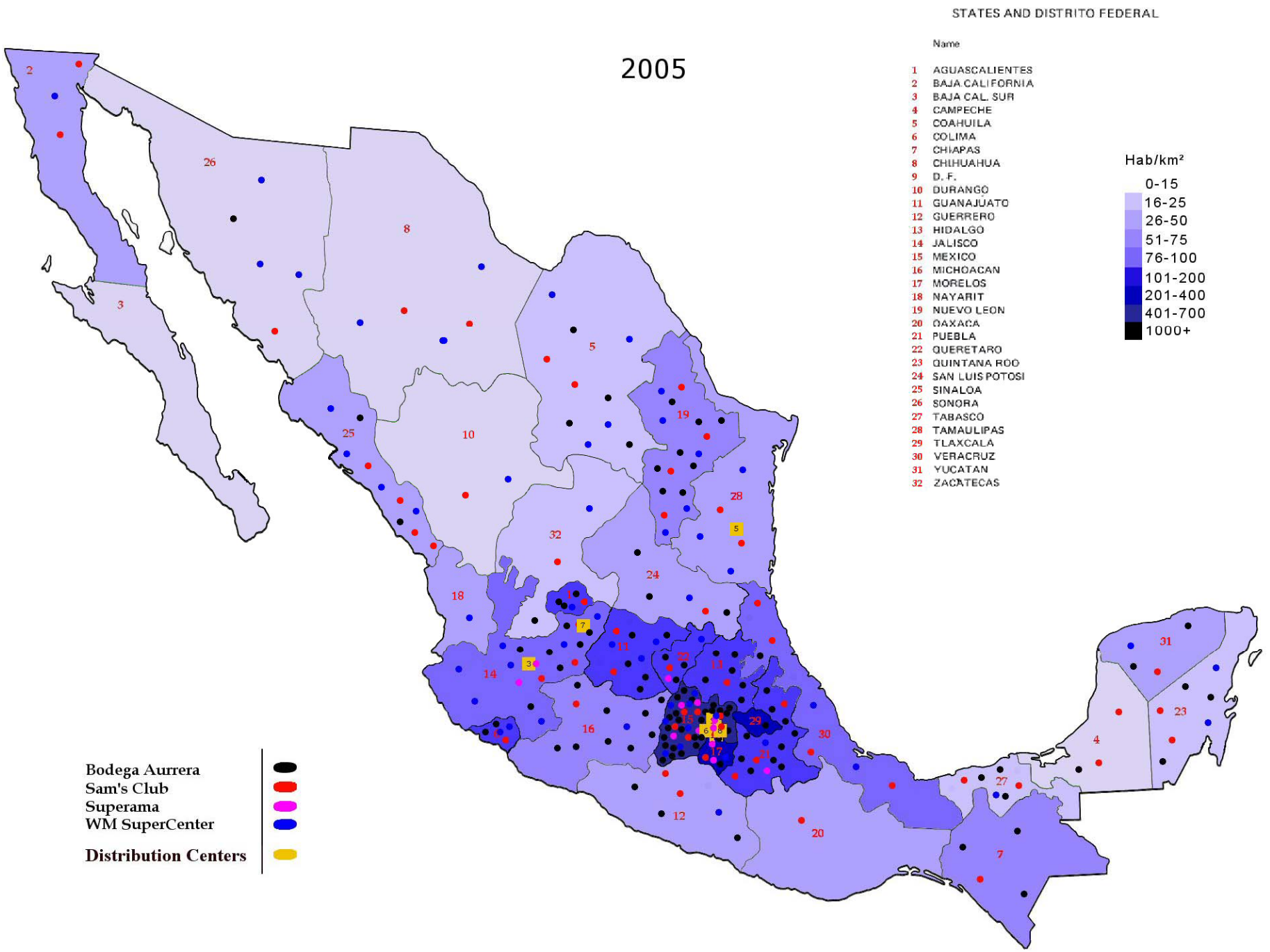
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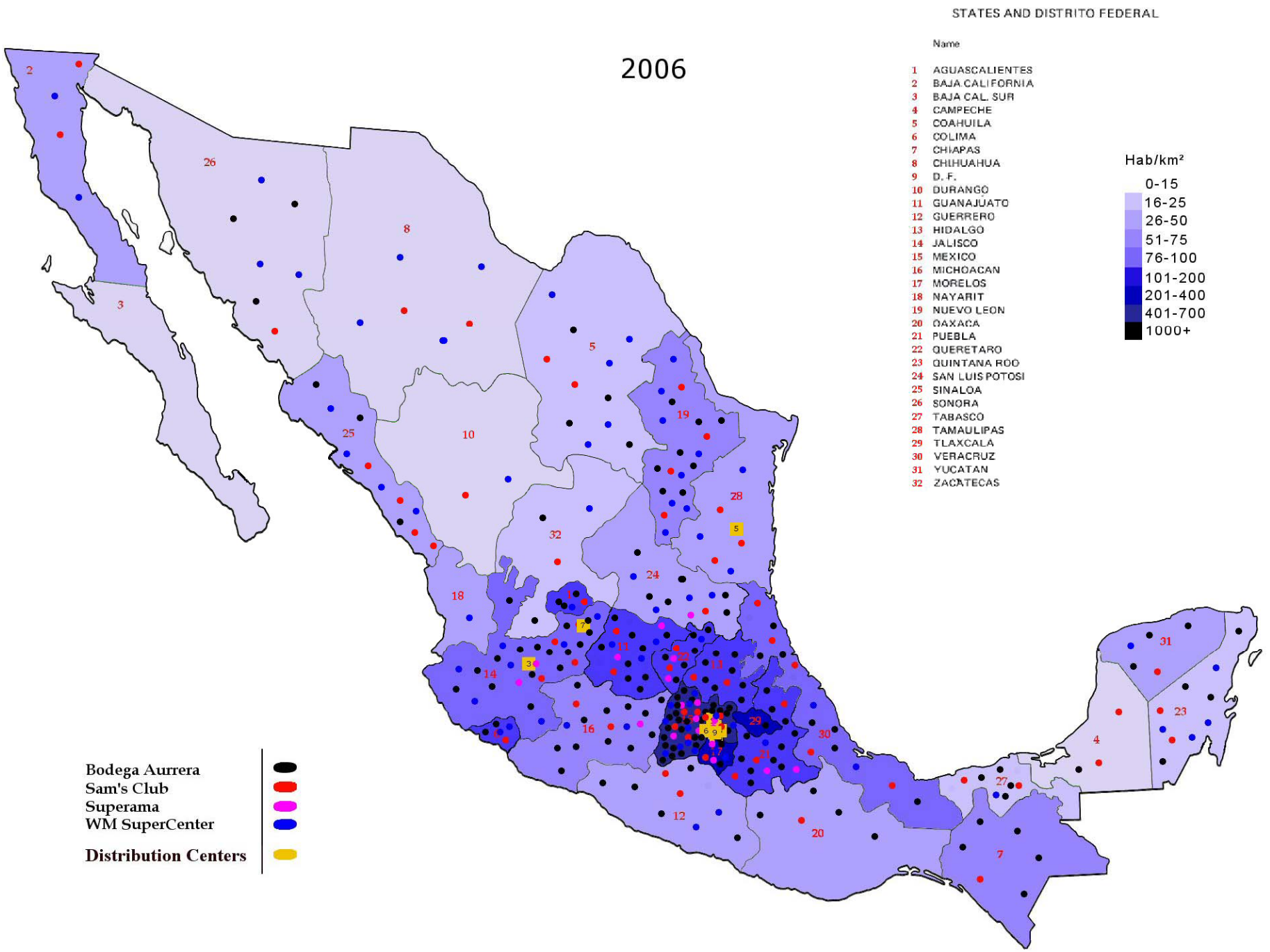
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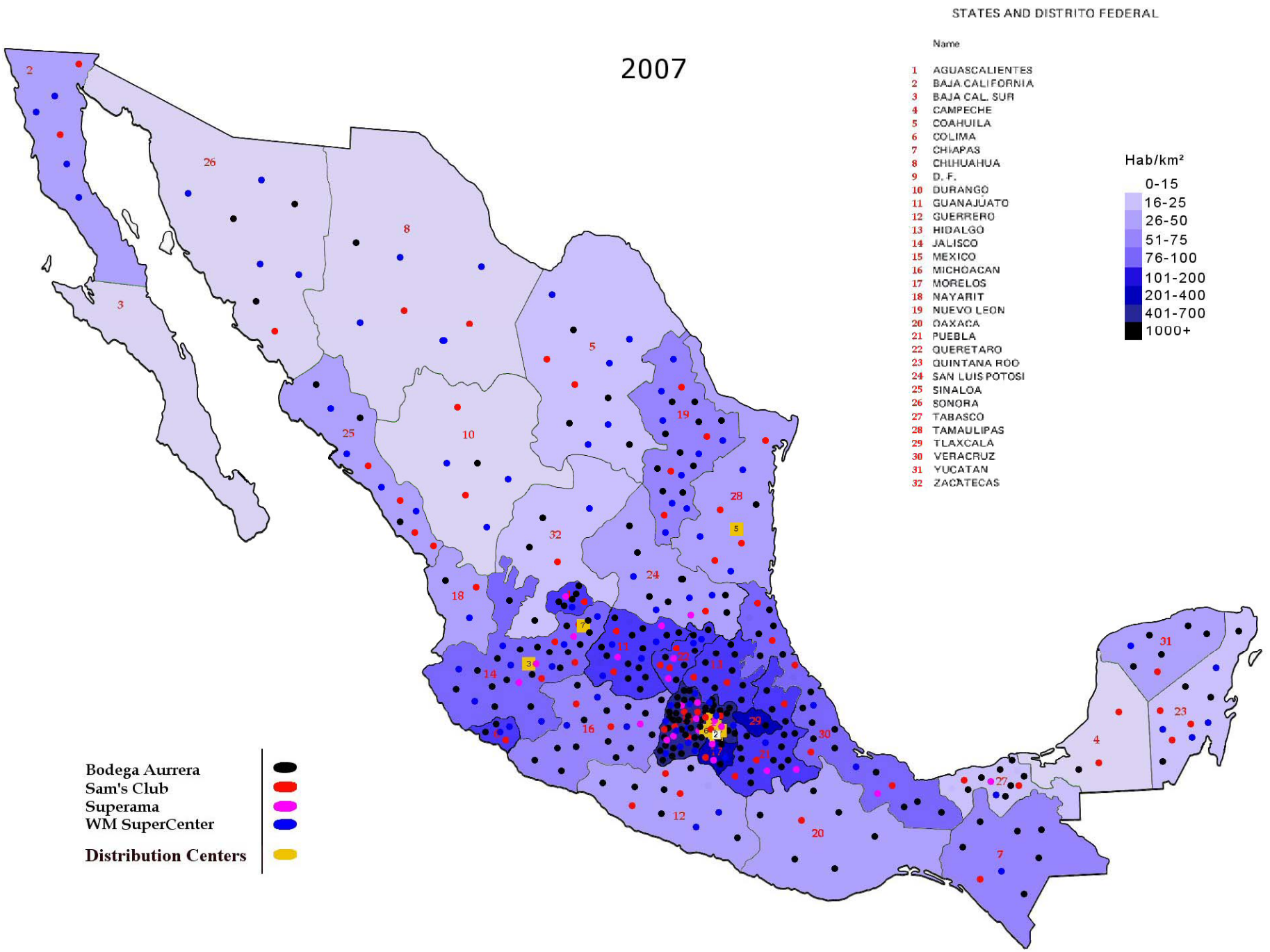
401-700
1000+
Bodega Aurrera
Sam's Club
Superama
WM SuperCenter
Distribution Centers


2007
STATES AND DISTRITO FEDERAL
Name
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Walmex' geographic expansion patterns: summary

- *Walmex* started out in the most populated area–partly because *Aurrera* was already there
- *Walmex* expanded by adding stores throughout Mexico, rather than gradually radiating out from the center
  - In contrast to *Wal-Mart*'s strategy in the United States (Holmes 2007)
- Distribution centers followed stores, so suppliers' proximity to stores means they have good access to *Walmex*

Becoming a Walmex supplier: the pros

- Substantial increase in market size

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- Getting ready for *Wal-Mart*
  - is like "getting into a company version of basic training with an implacable Army drill sergeant"
  - "helps everything: customer focus, inventory management, speed to market" (Fishman 2003)

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- For a supplier to complain about *Wal-Mart*'s approach
  - "would be committing suicide. If *Wal-Mart* takes something the wrong way, it's like Saddam Hussein. You just don't want to p____ them off" (Paul Kelly, business consultant; Javorcik, Keller, and Tybout 2008)

A simple model of Walmex' upstream industry

- Indirect utility from a unit of product j for consumer i:

$$\begin{aligned} U_{ij} &= \theta_1 \ln(\xi_j) + \beta_w w_j + \theta_2 \ln(Y - P_j) + \epsilon_{ij} \\ &\stackrel{def}{=} \overline{U}_{ij} + \epsilon_{ij}. \end{aligned}$$

ξ_j : Quality of good supplied by firm j
P_j : Price of good j
Y : Income of representative consumer
w_j : $= 1$ if j retails through *Walmex*, 0 otherwise
ϵ_{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

Static and dynamic firm heterogeneity

- Firms' products differ in terms of their current quality, ξ_j
- At the beginning each period, each type of firm decides whether to exit for scrap value or continue operating
- Potential entrants decide whether to create new firms
- Those that continue choose a level of investment in innovation
  - Investment increases the probability of quality improvement

The choice of retailing

- Each incumbent firm decides whether to sell through *Walmex* ($w_j = 1$ or $w_j = 0$)
  - The benefit: Access to *Walmex* consumer base
  - The cost: *Walmex* dictates a low price
- Pure Bertrand product market competition for firms not selling through *Walmex*

Nash Equilibrium

- In equilibrium
  - The transition density for the industry states is correctly understood by all agents
  - Spot markets clear at optimal price (P_j) and retail (w_j) choices
  - Optimal investments towards quality improvements are made
- Given parameters, we solve for the *oblivious* equilibrium numerically
  - Oblivious equilibrium: approximation technique introduced by Weintraub, Benkard and Roy (2007)

Optimal price setting

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

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

- The remaining firms do best to price at:

$$P_j = \frac{Y + \theta_2 C_j (1 - h_j)}{1 + \theta_2 (1 - h_j)},\ j \in \mathbf{I}$$

where

$$h_j = h(j|\mathbf{w}, \mathbf{P}, \boldsymbol{\xi}) = \frac{\exp\left[\overline{U}_{ij}\right]}{\sum_\ell \exp\left[\overline{U}_{i\ell}\right] + 1}$$

Equilibrium retailing choice

- Firms anticipate second stage equilibrium prices for each quality level
- Given the decisions of their competitors ($\mathbf{w}_{-j}$), they make the profit-maximizing *Walmex* choice by comparing

$$\pi_j = \pi(j, w_j = 0 | \mathbf{w}_{-j}, \boldsymbol{\xi}) = (P_j - C) \cdot h_j \cdot M$$

and

$$\pi_j = \pi(j, w_j = 1 | \mathbf{w}_{-j}, \boldsymbol{\xi}) = \left(\overline{P}_j - C\right) \cdot h_j \cdot M$$

- Equilibria in retailing choices obtain when:

$$\begin{aligned} [\pi_j(j, w_j &= 1 | \mathbf{w}_{-j}, \boldsymbol{\xi}) - \pi_j(j, w_j = 0 | \mathbf{w}_{-j}, \boldsymbol{\xi})] \cdot w_j \\ +[\pi_j(j, w_j &= 0 | \mathbf{w}_{-j}, \boldsymbol{\xi}) - \pi_j(j, w_j = 1 | \mathbf{w}_{-j}, \boldsymbol{\xi})] \cdot (1 - w_j) \geq 0 \ \ \forall\, j. \end{aligned}$$

Product quality investments

- r_j is the current level of R&D of the j^{th} producer in order to influence its product quality next period, hereafter denoted ξ_j'
- Product quality realizations are elements of a discrete ordered set
- Quality moves at most one position for each firm per period

The evolution of product quality over time

- With R&D effort r, a firm's probability of success is $\frac{ar}{1+ar}$
- Firms lose a quality step with exogenous probability δ
- The quality transition probabilities are

Up	:	$\Pr\left[\xi_j' = \xi^{i+1} \mid \xi_j = \xi^i\right] = \frac{ar_j}{1+ar_j}(1-\delta)$
Constant	:	$\Pr\left[\xi_j' = \xi^{i} \mid \xi_j = \xi^i\right] = \left(1 - \frac{ar_j}{1+ar_j}\right)(1-\delta) + \frac{ar_j}{1+ar_j}\delta$
Down	:	$\Pr\left[\xi_j' = \xi^{i-1} \mid \xi_j = \xi^i\right] = \left(1 - \frac{ar_j}{1+ar_j}\right)\delta$

Bellman equation

- Let the i^{th} element of $\mathbf{s} = (s_1, s_2, ..., s_K)$ be the number of firms in the industry at quality level ξ^i
- Let $\mathbf{s}_{-j}$ be the same vector, *except* in that it leaves firm j out of the count
- Let $\pi^* \left(\xi_{j,}, \mathbf{s}_{-j}\right)$ be the profits of firm j when it is at quality $\xi_{j,}$ and the remainder of the industry is at $\mathbf{s}_{-j}$
- Then optimal decisions are characterized by:

$$\begin{aligned} & V\left(\xi_{j,}, \mathbf{s}_{-j}\right) \\ = \quad & \max\left[\phi_s, \max_{r_j}\left\{\pi^*\left(\xi_{j,}, \mathbf{s}_{-j}\right) - c_r \cdot r + \beta E_{\Omega_j}\left[V.\left(\xi'_{j,}, \mathbf{s}'_{-j}\right)\right]\right\}\right] \end{aligned}$$

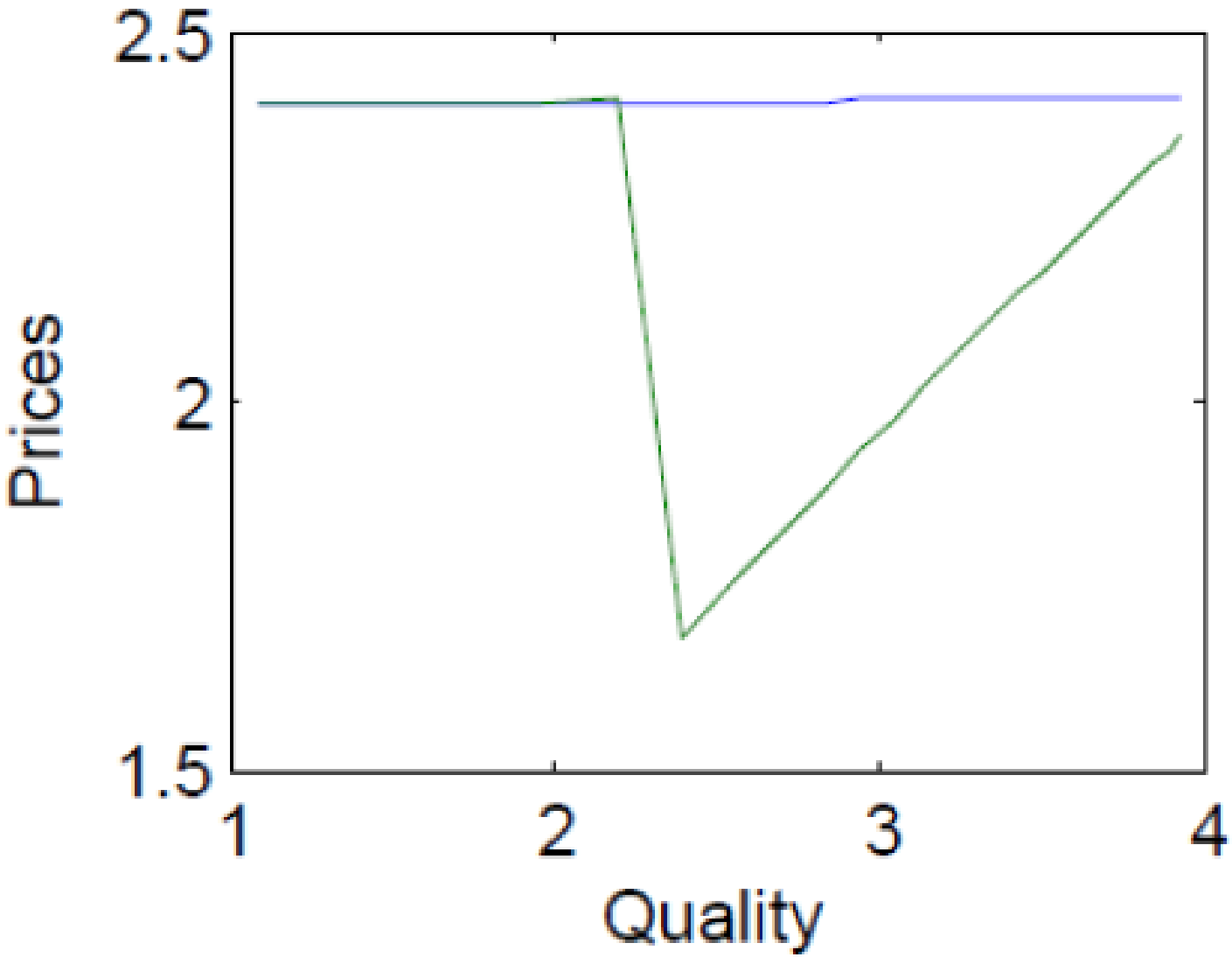
Entry and exit

- Firms enter at some common initial quality level when the expected profits exceeds the (exogenous) cost of creating a new firm
- Firms exit when the scrap value ϕ_s exceeds its continuation value

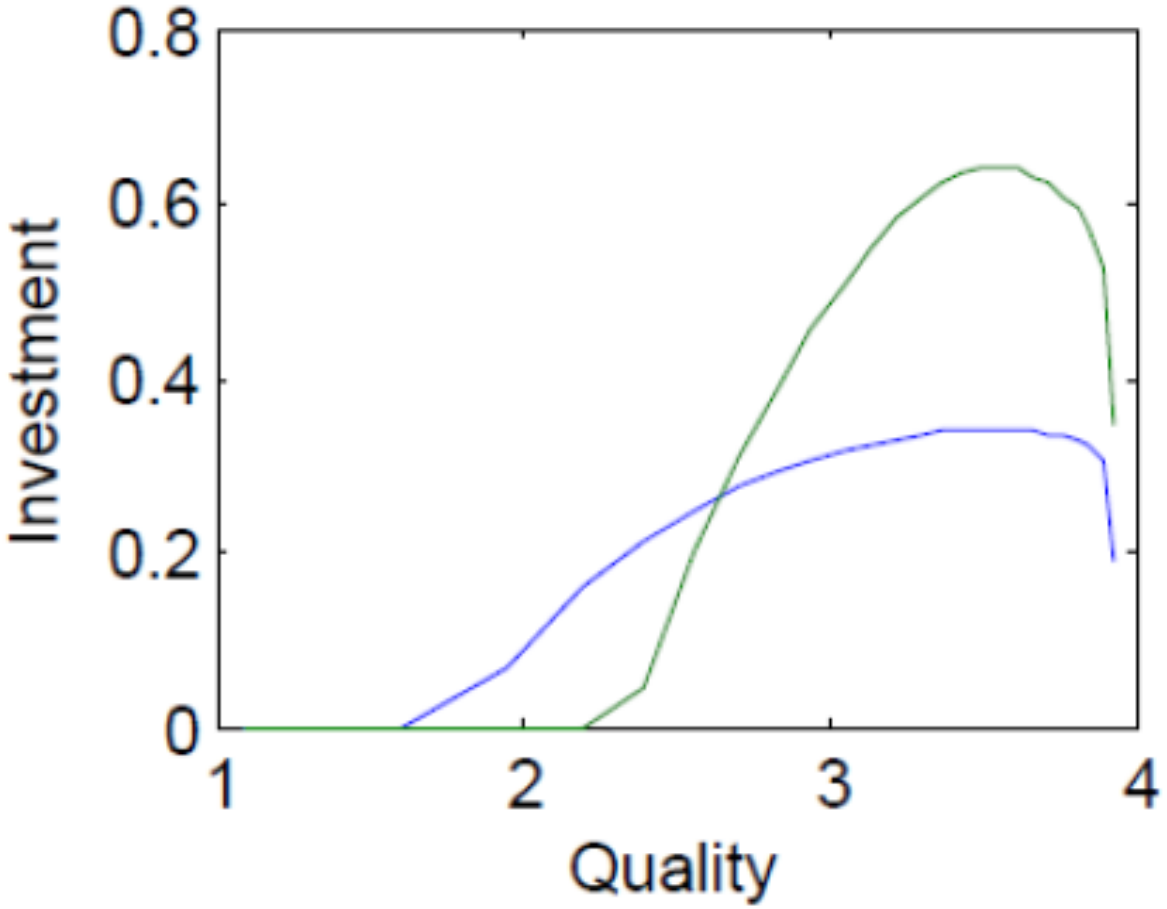
Simulations: main parameters

			Without *Walmex*	With *Walmex* option
C	:	Marginal costs	1.5	1.5
β_w	:	Walmex boost	1.0	1.0
$\bar{\xi}$	:	Min. Walmex quality	n.a.	2.0
θ_3	:	Quality-price rel'n	n.a.	0.4

Price setting in the Walmex world



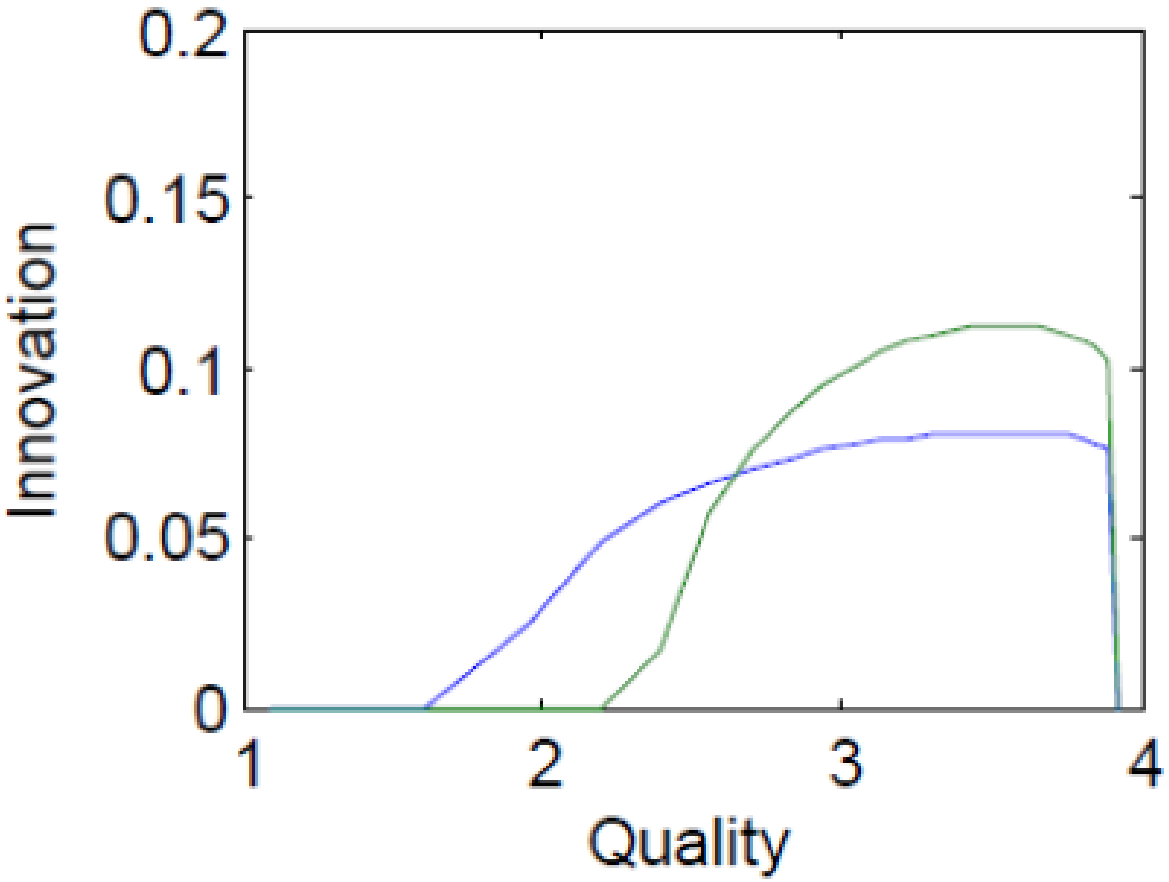
R&D investment



Blue line: No *Walmex*

Green line: *Walmex* is present

Product quality upgrading



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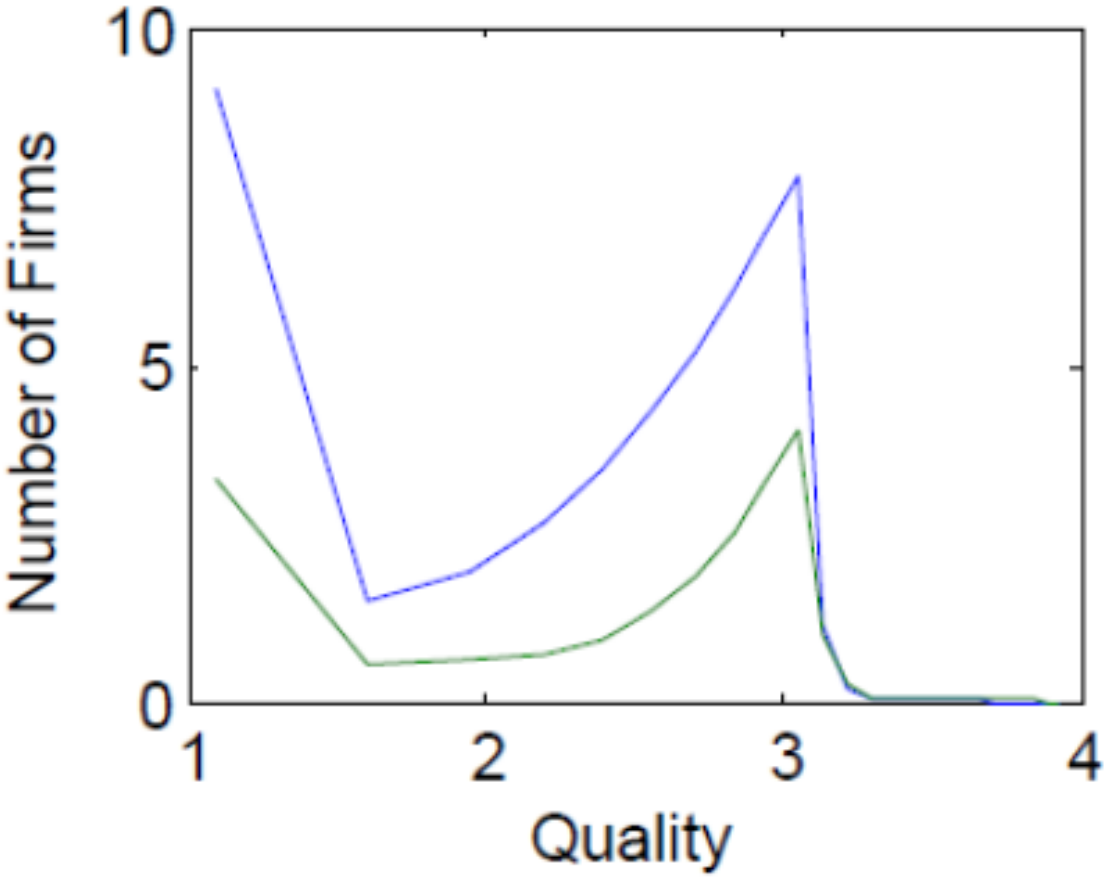
The number of firms



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Key model implication

- Both static and dynamic responses to *Walmex* vary across the quality distribution:

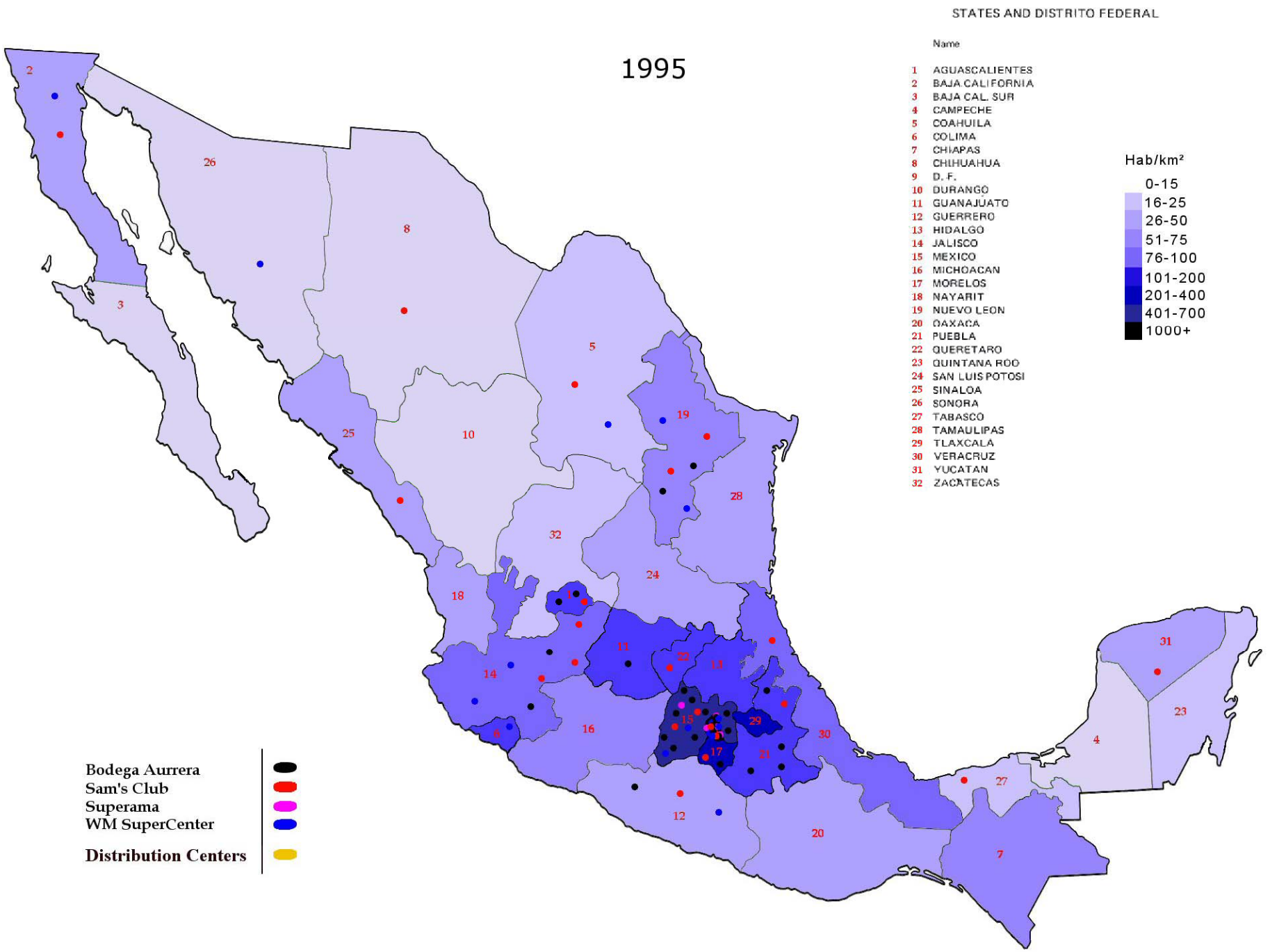
	Low	Medium	High
Sales	$\Downarrow\Downarrow$	$\Downarrow$	$\Uparrow$
Innovation & Upgrading	$\Downarrow\Downarrow$	$\Downarrow$	$\Uparrow$
Price	–	$\Downarrow$	–

Simulations: specific results

1. Net exit occurs (39 firms $\longrightarrow$ 20 firms)
2. Operating profits increase by 23%
3. Exit and entry rates fall (3.5% $\longrightarrow$ 1.8%)
4. Consumer surplus rises by 2%

Regression evidence: key data

- Panel data on Mexican manufacturing establishments (1993 to 2002)
  - Almost 7,000 establishments (= plants) across 205 industry groups
  - Source: INEGI
- Number of *Walmex* stores, by state and over time
- Information on whether products are carried by *Walmex*, or not
- Control variables: State GDPs, US and Mexican tariff levels, and fixed effects


1995
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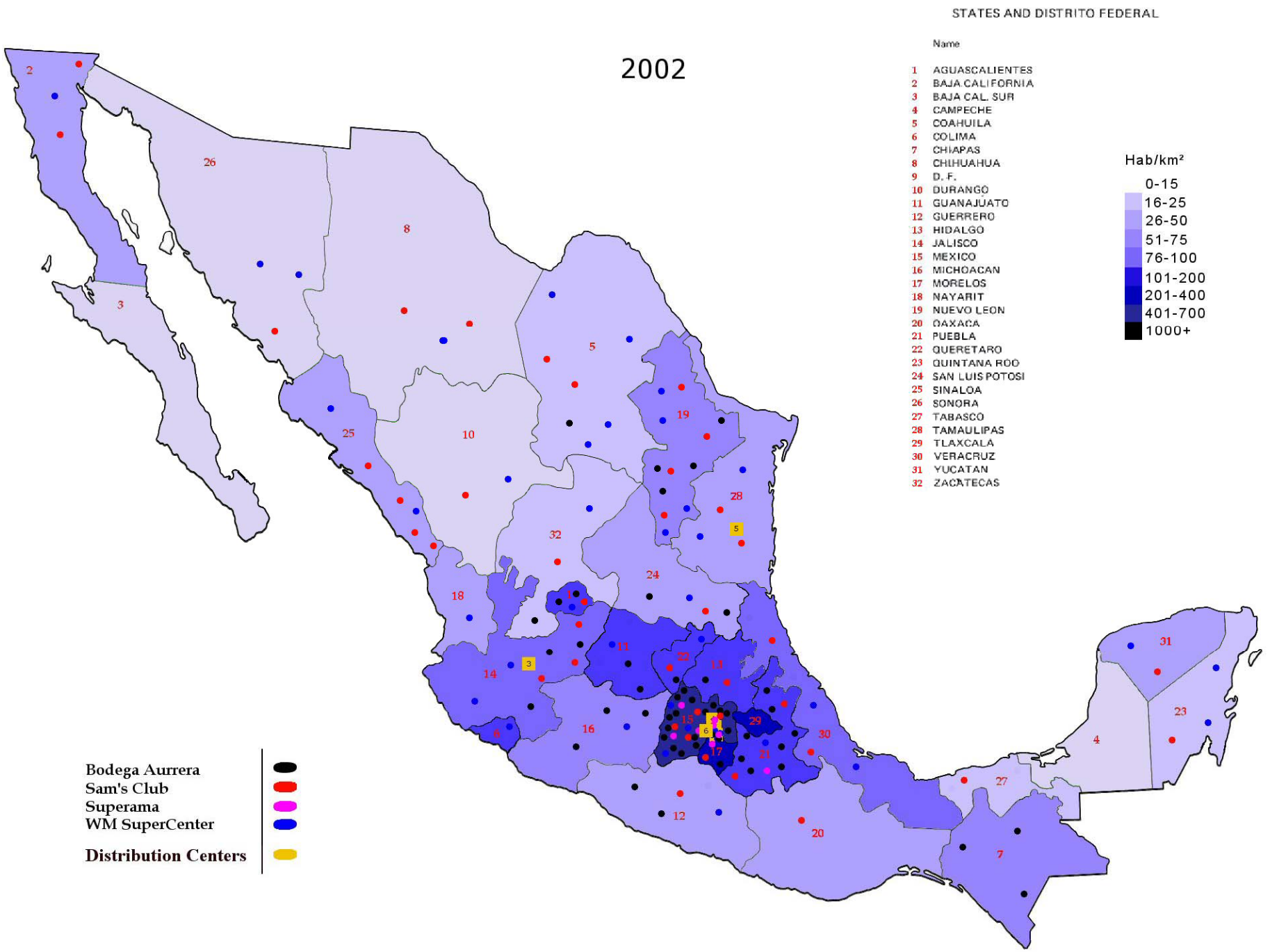
2002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Estimation

- Identification: *Are establishments that sell a Walmex-type product affected differently when Walmex' regional presence increases, compared to establishments that do not sell Walmex-type products?*
- Use simultaneous quintile regressions:

$$\begin{aligned}(Y_{it} - \overline{Y}_{jt}) \quad = \quad & \beta_1^q \ln(N_{st}) + \beta_2^q WMX_j + \beta_3^q \ln(N_{st}) \times WMX_j \\ & + \beta_4^q \ln(GDP_{st}) + \beta_5^q \ln(GDP_{st}) \times WMX_j \\ & + \beta_6^q TAR_{jt}^{MEX} + \beta_7^q TAR_{jt}^{US} + \alpha_t^q + \varepsilon_{it}^q,\end{aligned}$$

  where $i \in$ state s, industry j; e.g., in the first results, dependent variable Y_{it} is domestic sales of establishment i in year t

- q is the quintile of the sales distribution (generally, the Y_{it} variable dist'n)

Summary statistics

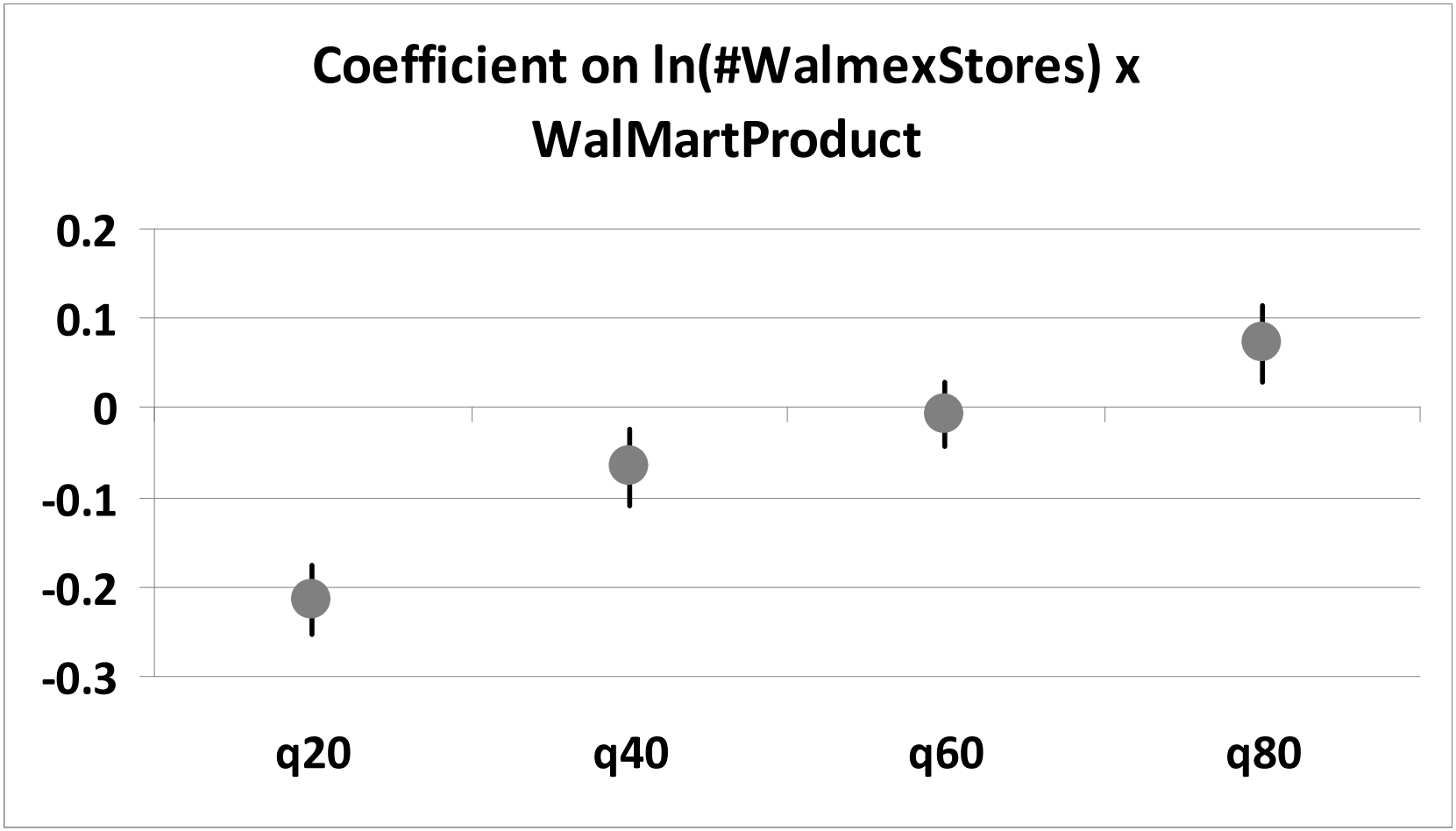
		Innovation & Upgrading						
	Sales	**R&D Expend.**	**Skill Inten-sity**	**Imported Interm. Inputs**	**Av. Wage**	**Capital Invest-ment**	**Labor Pro-duct'y**	**Price**
Mean	9.55	0.51	0.31	0.19	3.12	3.58	4.23	5.12
S.D.	1.73	1.61	0.20	0.29	0.64	3.43	1.07	0.44
N	52861	57495	48896	52586	54552	52795	53672	40073

Walmex and changes in sales for small versus large firms

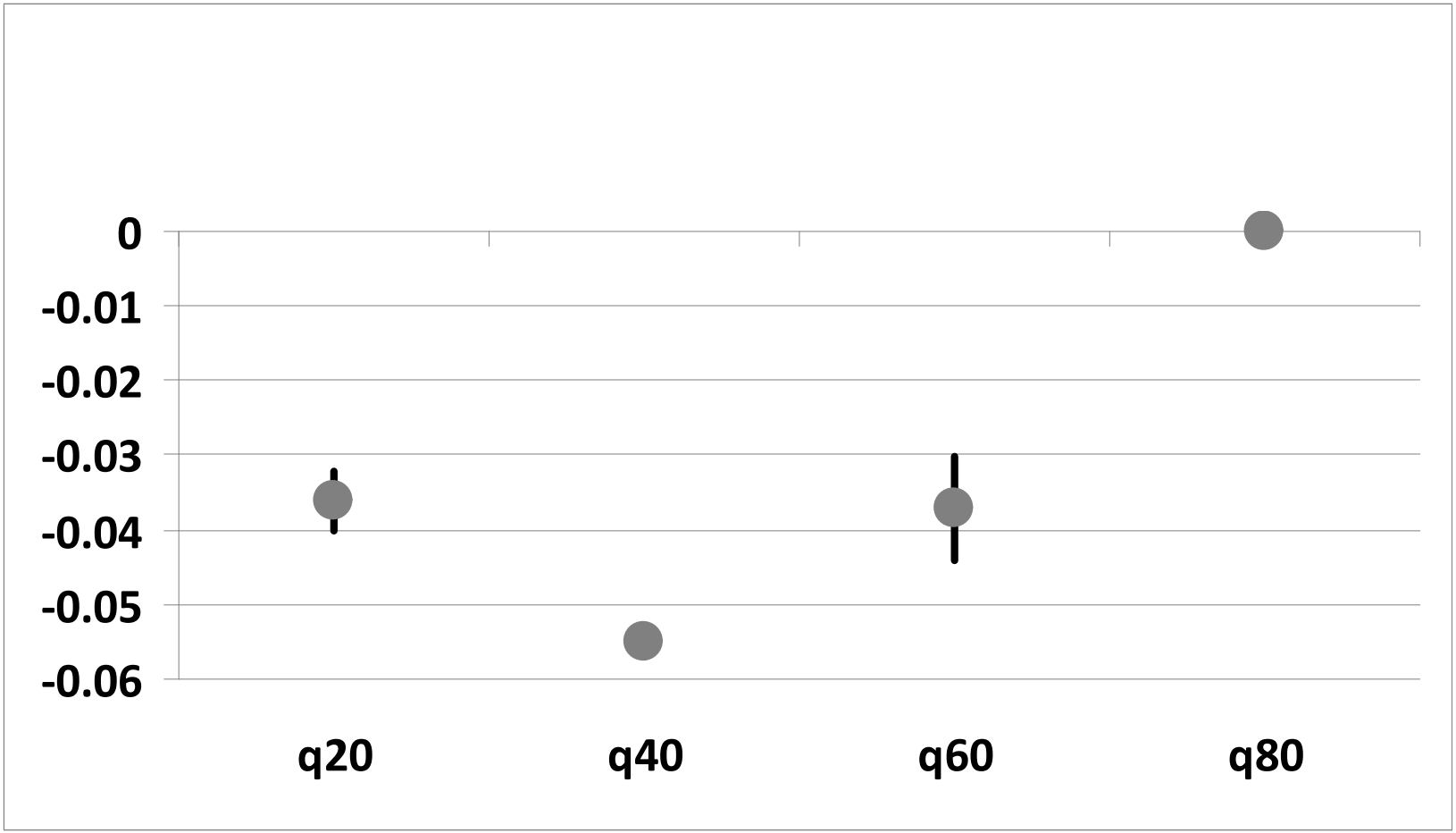
	20th percentile	80th percentile
ln(#WalMartStores)	0.159^{***} (0.014)	0.089^{***} (0.015)
WalMartProduct	-5.264^{***} (0.871)	-1.122 (0.968)
ln (#WalMartStores)× WalMartProduct	-0.214^{***} (0.038)	0.072^{*} (0.042)
ln(StateGDP)	-0.247^{***} (0.020)	-0.100^{***} (0.023)
ln(StateGDP)× WalMartProduct	0.316^{***} (0.053)	0.059 (0.059)

Number of obs: 52,861; regression also includes constant, tariff levels, and time fixed effects; bootstrapped standard errors in parentheses

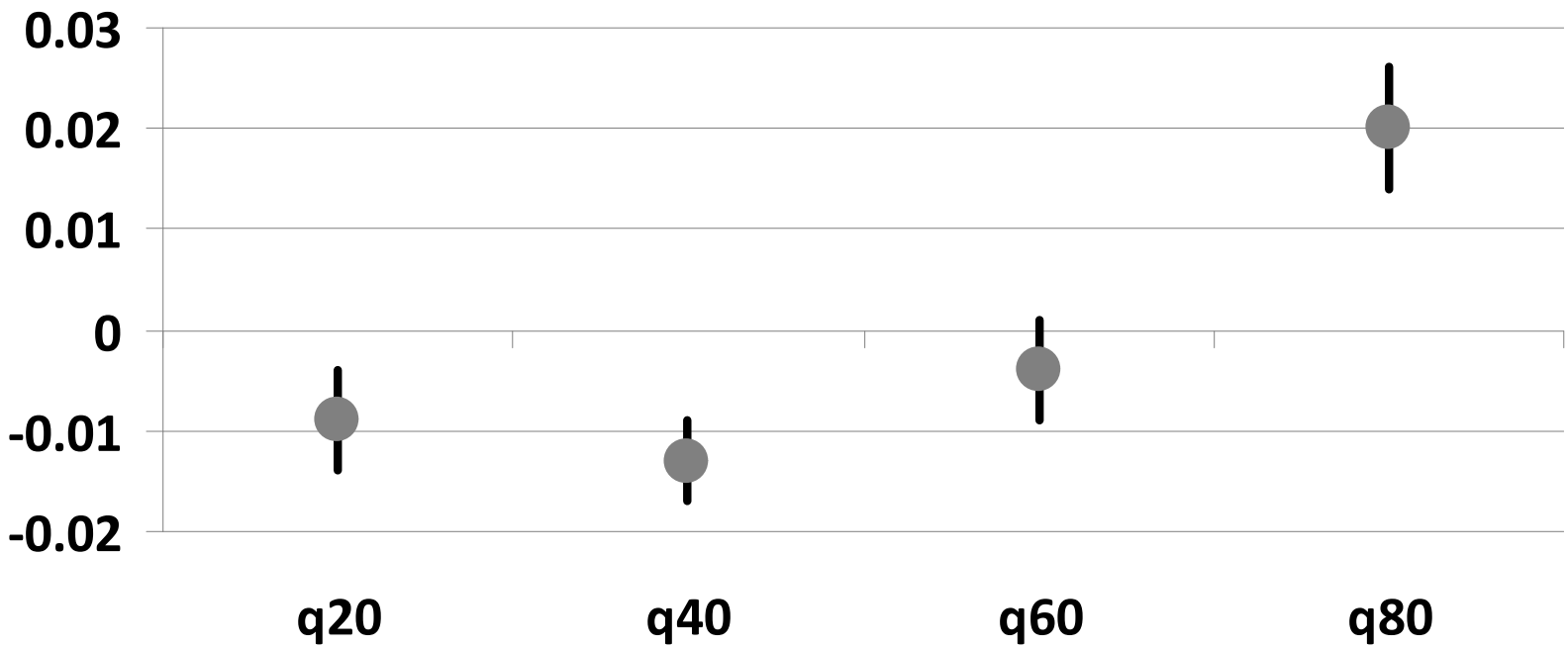
Changes in sales across quintiles



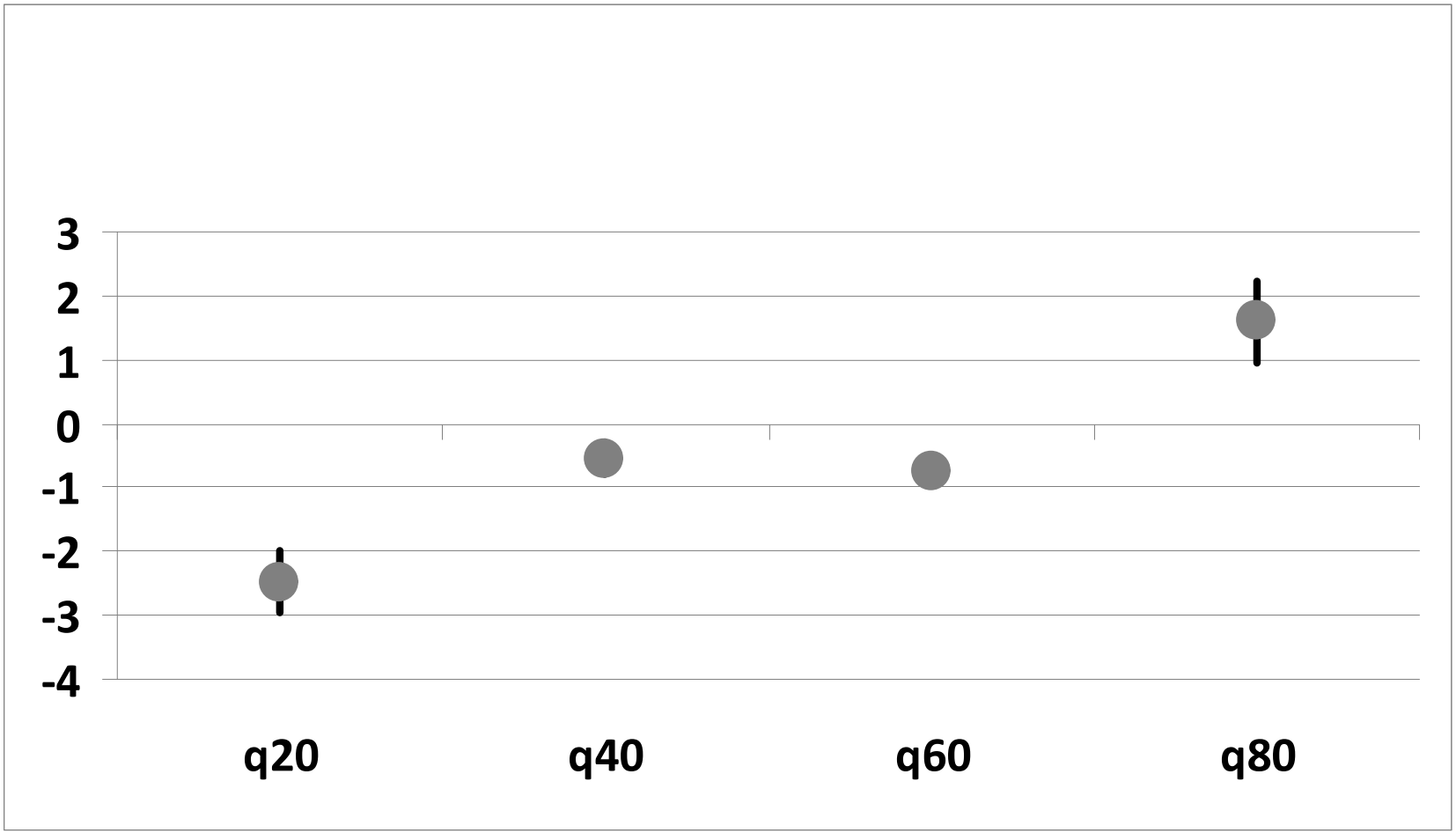
Changes in R&D spending across firms



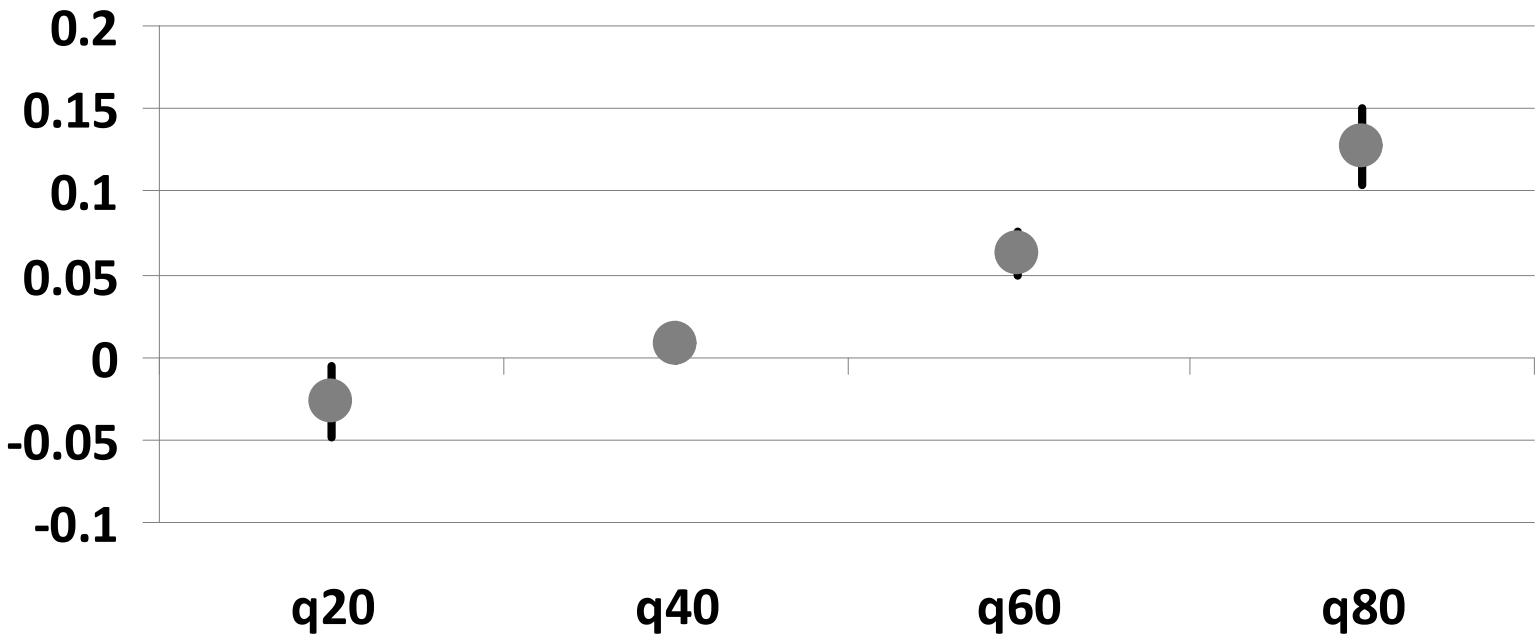
Skill composition as another indicator of upgrading



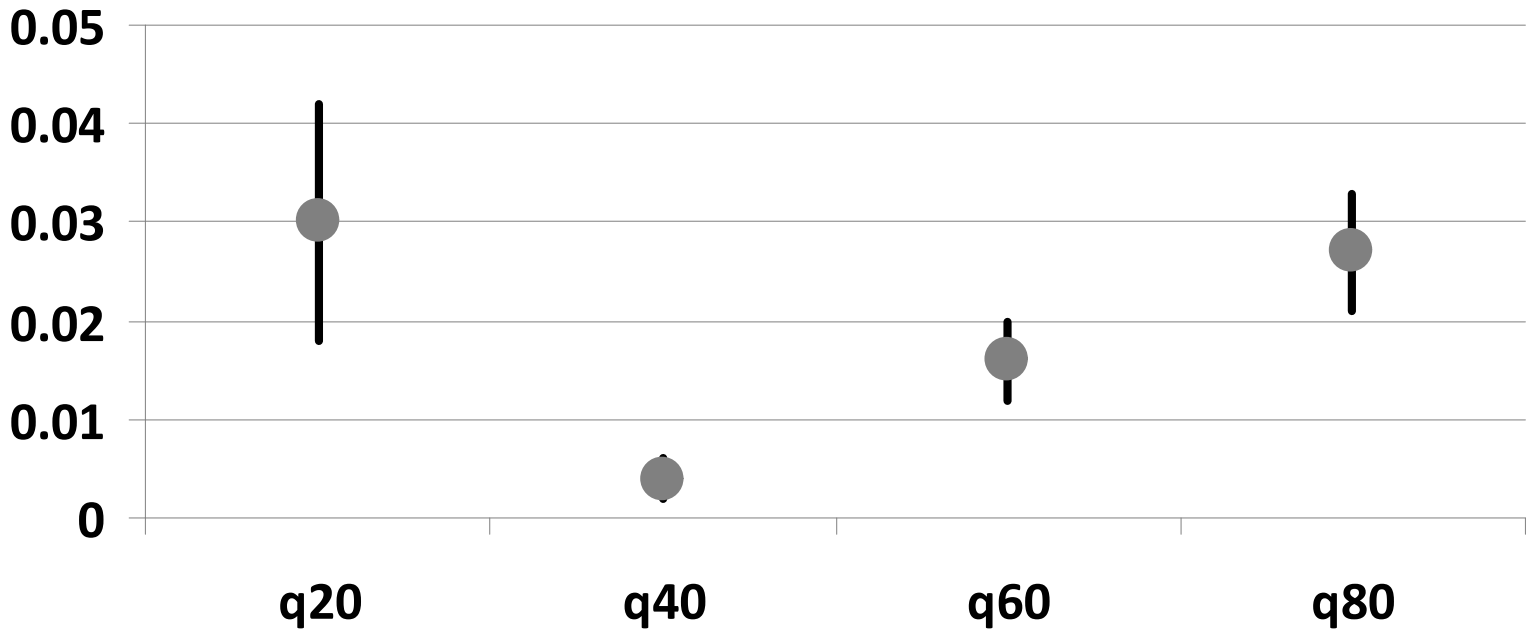
Importing intermediate inputs from abroad



Walmex and labor productivity changes



The change in prices charged across firms



Establishment-level prices incorporate product-level information; index = 100 in 1994, no time fixed effects

Supplier response: Model versus data

- Sales

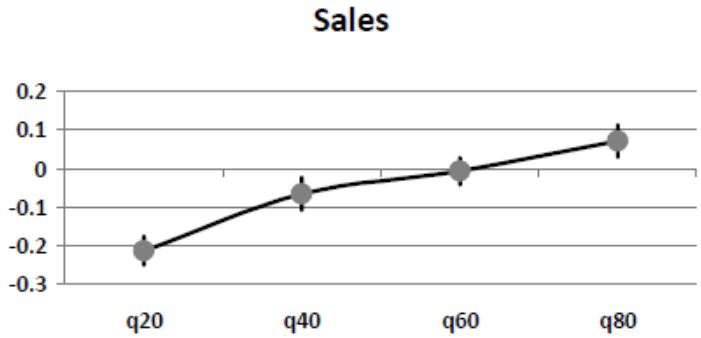
Low quality	Medium quality	High quality
⇓⇓	⇓	⇑

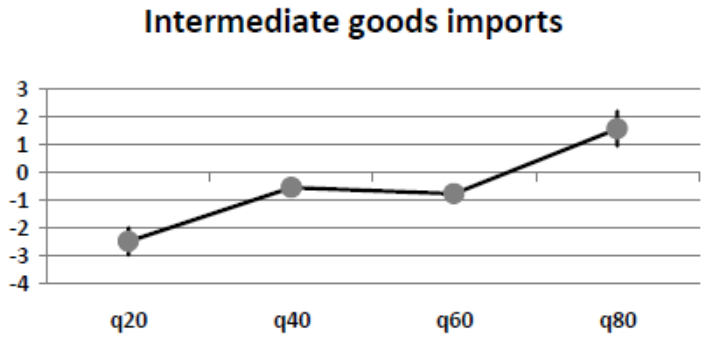
- Upgrading

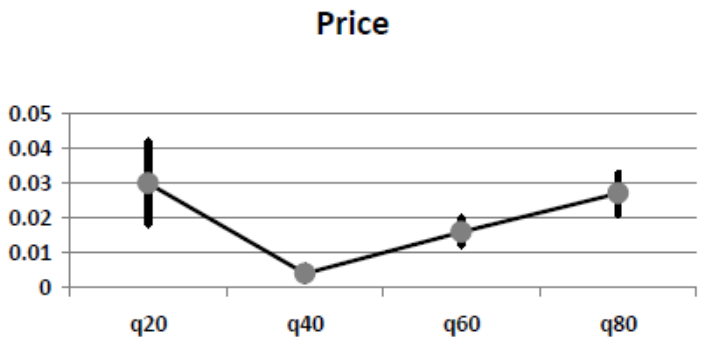
Low quality	Medium quality	High quality
⇓⇓	⇓	⇑

- Price

Low quality	Medium quality	High quality
—	⇓	—







Summary

- *Wal-Mart*'s entry had a major impact on Mexico's manufacturing industry
- We find static reallocation (between-firm) and dynamic (within-firm) effects
- The industry evolution model matches the interview and quantitative evidence well

Implications

- Empirical analysis ought to bring possible heterogeneous responses more into focus
  - Market share gains versus losses
  - More technology spending versus less
  - Firm- and labor force upgrading versus downgrading
- Upstream-downstream relations appear to be important for assessing the impact of trade and FDI liberalization on market size, technological change, and welfare