Supplier Responses to Wal-Mart's Invasion of Mexico*

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Abstract

We analyze the effects of Wal-Mart's entry into Mexico on Mexican manufacturers of consumer goods. More precisely, we develop a dynamic model of an upstream consumer-goods industry in which heterogeneous firms decide whether to sell their products through *Walmex* or through traditional retailers. We then use this model to characterize the changes in firms' market shares, pricing, R&D/advertising expenditures, and exit probabilities that *Walmex* might have induced. Finally, using establishment-level panel data, we generate evidence that these predicted changes in producer behavior actually took place in Mexico.

1 Introduction

After joining the GATT in 1986, Mexico adopted a more welcoming stance toward foreign investors and opened its borders to foreign trade. Taking stock of these developments—as well as the NAFTA and the growing purchasing power of Mexico's middle class—Wal-Mart entered into a joint venture with a major Mexican retailer in 1991 (Chavez, 2002). And after six years of explosive growth, it took majority control of its investment, becoming Wal-Mart of Mexico (*Walmex*). By 2001 it controlled nearly half of the Mexican retail market, and by 2003 it had become Mexico's largest private employer, (Chavez, 2002; Case 2004).[1]

Herein we analyze the effects of *Walmex*'s ascendence on Mexico's manufacturers of consumer goods. More precisely, we develop a dynamic model of an upstream consumer-goods industry in which heterogeneous firms decide whether to sell their products through *Walmex* or through traditional retailers. We then use this model to characterize the changes in firms' market shares, pricing, R&D/advertising expenditures, and exit probabilities that *Walmex* might have induced. Finally, we look for evidence that these predicted changes in producer behavior actually took place in Mexico.

Our analysis highlights the advantages and disadvantages of becoming a *Walmex* supplier. The former include access to a larger domestic consumer base, and (less importantly) access to new exporting opportunities. The latter include sub-optimally low prices and continuous pressure to raise the quality/appeal of one's product. Embedding these effects in an industrial evolution model, we show that the arrival of *Walmex* can cause consumer-goods

[1] For details of Wal-Mart's expansion into Mexico see Chavez (2002), Tegel (2003), and Javorcik et al (2008).

producers to self-select into two groups on the basis of their product's popularity. Firms that sell relatively popular products (hereafter "high quality" products) choose to sell through *Walmex*, while the rest continue selling through traditional retailers. And relative to the pre-*Walmex* equilibrium, both groups adjust their behavior in a number of dimensions. The *Walmex* suppliers with the highest quality products invest more in advertising and product upgrading, while all of the other firms (including some less popular *Walmex* suppliers) scale back their investments. In addition, firms that switch to selling through *Walmex* see their prices and mark-ups fall. Finally, high quality *Walmex* suppliers gain market share, while others contract or exit entirely.

The evidence we present regarding these predicted adjustments comes from two sources. First, we conducted interviews with Mexican firm representatives and industry experts. Those interviewed frequently mentioned that *Walmex'* entry had considerably sharpened the distinction of high- versus low-performing firms. They also stated that, among firms choosing to deal with *Walmex,* the productivity effects were often positive.[2] Second, we analyze plant-level panel data on Mexican manufacturers of consumer goods. These data, obtained from the Mexican Statistical Office (INEGI), allow us to examine whether the predicted patterns on industry restructuring, pricing, productivity, and innovation are most striking among producers who should have been most affected: those in regions where *Walmex* established a presence, and those who produce the types of goods sold at Walmex. The results suggest that, at least broadly speaking, this is the case.

[2]We have conducted two series of interviews on which we are drawing, in the years 2005 and 2007; results from the 2005 interviews are summarized in Javorcik, Keller, and Tybout (2008).

Our study contributes to a number of literatures. First and most obviously, it adds to the growing body of evidence on the causes and effects of Wal-Mart's operations.[3] Unlike most of this literature, however, it focuses on Wal-Mart's effects on upstream manufacturers rather than its effects on other retailers.[4] Second, we extend the large literature concerning the impact of foreign direct investment on host country firms.[5] Here, too, our contribution is atypical, since we use a dynamic structural model to describe the nature of the linkages between Wal-Mart and its upstream suppliers, and we characterize firms' behavior in many dimensions, inlcuding sales volumes, pricing, wage payments, investment, technology upgrading, and exit decisions.[6] Third, our work adds to the "heterogenous firm" literature by describing a new way in which changes in the business environment lead to dramatically different responses by firms with different productvity levels or product quality levels.[7] And finally, exploiting the equilibrium concept and computation algorithm developed in Weintraub et al (2007), we contribute a new application to the growing empirical literature on industry dynamics.[8]

The remainder of the paper is as follows. Section 2 provides background on Wal-Mart's

[3] See Basker (2007) for an overview.

[4] Wal-Mart's entry into U.S. regions has been found to be associated with lower retail prices (Basker 2005a), while the evidence on job creation has been mixed mixed (Basker 2005b). Using a model of strategic competition to analyze market share reallocation between two major-Wal-Mart and Kmart– and a fringe of smaller retailers, Jia (2006) finds that Wal-Mart is largely responsible for the demise of small discount retailers. Holmes (2006) examines the dynamic pattern of store openings in the U.S. to estimate Wal-Mart's implied gain from establishing stores near to each other, due perhaps to the sharing infrastructure, distribution centers, and advertising expenditures.

[5] Surveys of the literature include Keller (2007), Lipsey and Sjoholm (2005), as well as Görg and Greenway (2004).

[6] The reduced-form impact of global retail chains on supplying industries is estimated in Javorcik and Li (2008).

[7] In particular, a number of recent papers in the trade literature link product market conditions to joint adjustments in market shares and investments in innovation (Yeaple, 2005; Ederington and McCalman, 2007; Bustos, 2007; Constantini and Melitz, 2008; Atkeson and Burstein, 2007; Verhoogen, 2008.)

[8] Baraji et al (forthcoming) provide a recent survey of this literature.

entry into the Mexican retail market. Section 3 introduces the basic trade-off that suppliers contemplating selling through Wal-Mart face, embeds them in our industrial evolution model, and characterizes their implications for industries that produce consumer goods. Reduced-form regression results are presented in section 4, while section 5 summarizes the results.

2 The Wal-Mart invasion in Mexico

2.1 Changes in business practices

As we have noted elsewhere, *Walmex* acted as a catalyst for two fundamental changes in the Mexican retail sector:

> First, the sector modernized its warehousing, distribution, and inventory management. Second, it changed the way it interacted with its suppliers. The former changes partly reflected the growing availability of information technology. But they also reflected the innovations that Walmex imported from the United States. Walmex not only introduced the system of channeling deliveries from suppliers through centralized warehouses, it also require[d] delivery trucks to have appointments and drivers to carry standard identification cards. Those that missed appointments were subject to fines. Shipments [had to] be on standardized palettes (rentable from *Walmex*), they [had to be] shrink-wrapped with corner protectors, and they [were] subject to third-party quality audits. (Javorcik et al, 2008)

Walmex has maintained two separate distribution systems in Mexico: one for its supermarket chains and one for Sam's chain of wholesale stores.[9] Many producers serve both types of distribution centers. The principle difference between the two is the size of product packaging. All suppliers have the option of delivering their products to a single distribution center, but those with multiple plants around the country are encouraged to deliver to multiple centers. A single truck-load is the usual unit of delivery volume, though three centers are able to receive deliveries of smaller sizes and aggregate them into full truck-loads. Distribution centers specialize in terms of product type: dry goods, clothing, and perishables, including frozen products. Further, only some of the perishables sold in *Walmex* stores are channeled through distribution centers—many perishables are purchased locally. Thus, proximity to Walmex retailers is particularly important for perishable goods suppliers.

Centralized distribution systems, the use of palettes, and other innovations introduced by *Walmex* have diffused to the other major retail chains. According to Tegel (2003), in the early 2000s *Walmex* was "the only Mexican retail chain that [had] its own centralized distribution system. Suppliers thus [could] deliver their goods just once to any of 11 *Walmex* depots scattered across the country, rather than to each individual store." Interviews conducted for this study in 2005 and 2007 revealed that since the time of Tegel's writing, other major retailers have followed suit and introduced centralized warehousing and the use of palettes.

Despite this diffusion of retail practices, *Walmex* has remained a technological leader in Mexico. This is partially because *Walmex* continues to make improvements to its distribution system, and partly because local competitors have not always adopted *Walmex*'s innovations.

[9] Its clothing store chain Suburbia and restaurant chain VIP support separate distribution centers as well.

For example,while all perishables sold by *Walmex* were packaged into carton boxes and wooden crates in 2003, 90 percent of them were packaged in replenishable plastic containers (RPCs) by 2007.[10] The leading Mexican supermarket chain, Soriana, already uses this technology and some others are in the process of introducing it. But Soriana is the only retailer besides *Walmex* that has a cold chain. Similarly, *Walmex* is the only retailer that uses computerized tracking of sales and inventories and is able to provide suppliers with daily sales and inventory figures at the level of individual stores.

The profound changes in the retail sector, initiated by *Walmex* and diffusing somewhat to other retailers, have resulted in a significant decline in distribution costs faced by Mexican suppliers. And critically, the spectacular expansion of Walmex's retail network has allowed its suppliers to reach a larger segment of the Mexican market. Several other factors make Walmex an attractive downstream retailer. First, it pays the agreed upon amount on time, while other supermarket chains are often late with payments or subtract arbitrary fees from the payment.[11] Second, the high creditworthiness of Wal-Mart allows its suppliers to benefit from factoring. Factoring involves selling commercial trade receivables in order to obtain working capital. Thus rather than waiting 30 or 90 days to receive a payment from Wal-Mart, a Wal-Mart supplier may sell for a small fee its account receivables and immediately obtain working capital. In many countries, factoring has become an important source of

[10] RPCs have many advantages over carton boxes and wooden crates. They are more sanitary and better keep the desired temperature. They also reduce the handling costs as they have a standardized weight, are more stable and easier to move, fit exactly on a pallet and can be easily stocked one on top of another. Finally, they are more environmentally friendly.

[11] According to interviews with Mexican entrepreneurs, supermarket chains often match rebates offered to consumers by their competitors. While Wal-Mart will cover the costs of such impromptu rebates, other supermarket chains try to pass on the suppliers of discounted goods.

financing-especially short term working capital-for small and medium-size enterprises.

The benefits of dealing with Walmex come a cost, however. Because it controls such a large share of the retailer market, it has far greater bargaining power than its rivals. This allows it to drive down its suppliers' profit margins, making take-or-leave-it offers. Often it extracts price concessions ranging from 5 to 25 percent below the prices of the same product at other outlets.[12] Further, *Walmex* demands annual wholesale price reductions of those suppliers who do not improve their product from one year to the next. "Those firms that are unable to frequently introduce new goods–and thus avoid establishing a benchmark price–are squeezed relatively more (Fishman 2003). Those suppliers that balk at Wal-Mart's demands are simply discontinued, and new suppliers are brought in." (Javorcik, et al, 2008) In section 3 below, we will develop a model that captures each of these features of the Mexican retail sector in the Walmex era.

2.2 The geography of Walmex' growth

Different suppliers gained access to the option to sell through Walmex at different points in time. Figures 1 through 4 show the growth of Wal-Mart de Mexico in terms of geographic space over the years 1993 to 2007. The figures also highlight some differences to Wal-Mart's evolution in the United States. Among the different Wal-Mart formats, we distinguish *Bodega Aurrera*, which is a lower end grocery chain, *Superama*, which is a basic big box store that does not sell food, and *Walmex Supercenters*, which are "big box" stores that sell groceries.

[12] We base these percentages on studies of Walmart in the United States (Basker (2005a, Business Planning Solutions 2005). For discussion of these studies, see Javorcik et al (2008).

Finally, *Sam's Club* is a bulk version of the *Supercenter*. We also note the location of *Walmex* distribution centers, of which there were nine in 2007.

Figure 1 shows the location of various formats of Wal-Mart shops in the year 1993 across the thirty-two Mexican provinces. Since differences in demand play a key role for Wal-Mart's expansion, we have shaded the provinces in terms of population density. The darker the color, the higher is population density, which in 1993 attains its maximum in the area of the Mexico City (*Distrito Federal*).

Wal-Mart's geographic expansion strategy in Mexico appears to have been driven by population density. In this respect it departs from the expansion strategy it followed in the United States, where it gradually radiated out from Bentonville, Arkansas (Holmes 2006). Although it began in the highly populated central areas, relfecting the existing locations of its venture partner (Aurrera), it quickly planted stores in the far North-West as well as in the South-East of Mexico (Figure 2). At the same time, as Figures 3 and 4 indicate, the concentration of *Walmex* stores remains higher in the central provinces of Mexico throughout the period of 1993 to 2007. Finally, note that the establishment of distribution centers has generally followed the opening of stores.

We will exploit these expansion patterns when we test for the effects of Walmex on consumer goods suppliers in section 4 below. Before we do so, however, we develop an industrial evolution model with retailers that generates our testable predictions.

3 Modeling Upstream Industry Evolution with Walmex

3.1 *Walmex* Effects to be Modeled

Walmex does three things that consumers like. First, it brings together many products that they wish to purchase in convenient locations, thereby decreasing their transactions costs. Second, thanks to its unique computerized inventory and sales tracking system, Wal-Mart is considered to be the only chain that is "never out of stock."[13] Finally, Wal-Mart offers quality merchandise at very competitive prices.

Taken alone, the fact that *Walmex* efficiently move goods to a very large customer base makes it very attractive as a retailer. However, its appeal to upstream suppliers is tempered by the price concessions that *Walmex* demands. The suppliers we interviewed reported being asked for a "logistics discount," effectively compensating Walmex for the lower distribution costs it realizes with its centralized logistics and sourcing system Similarly, Walmex argues that its large consumer base allows its suppliers to reap scale economies, and that this justifies its demands for lower wholesale prices. Finally, as mentioned above, *Walmex* expects annual declines in prices from all of its suppliers who do not improve their products. Even large multinationals can have a hard time resisting price cuts. According to one executive, if *Walmex* does not like the way negotiations are going in Mexico, it will escalate them to the level of US headquarters of both firms.

The ability of *Walmex* to demand quality increases and/or price cuts also stems from the fact that by lowering the distribution costs it has turned many small producers previously

[13] This assertion is based on our interviews with executives.

operating in their local markets into national suppliers, selling under their own brands or *Walmex*'s store brands. While major industry players often own a fleet of truck which they use to distribute their products nationwide, smaller producers are usually unable to bear the cost of product distributing beyond their locality. By allowing small producers to deliver their products locally and have them distributed nationwide, Wal-Mart turned small producers into viable competitors of the large players.

Producers weigh the market enlargement effects against the price concessions they must accept when deciding whether to use *Walmex* as a retailer. Of course, suppliers' decisions are affected by the decisions of their competitors. It is possible that when the option to retail through *Walmex* first appears, only a few firms at the high end of the quality/popularity spectrum find it profitable to reduce their prices and become *Walmex* suppliers. But once they have done so, the menu of prices faced by consumers is perturbed, and non-*Walmex* suppliers will be induced to adjust their prices downward in response. And since they have already suffered a reduction in profit margins and sales volumes, they may find they too do better by following the popular brand firms and switching to *Walmex*. In short, it is possible that a snowballing could occur once *Walmex* successfully woos a critical mass of firms, many others find it optimal to switch as well.

In addition to pricing decisions, the presence of *Walmex* affects suppliers' incentives to engage in process or product innovation. Anecdotal evidence and interviews suggest that making product improvements allows suppliers to escape the mandatory price cuts. Similarly, suppliers can obtain higher prices by introducing new product varieties. Interviewees in Mexico repeatedly reported that *Walmex* wants to source products that are different from

those supplied to the competing supermarket chains. Finally, the usual Schumpeterian forces are at play when *Walmex* increases the size of the customer base, and thereby increases the number of units over which one can reaps the benefits of a cost-reducing innovation.

3.2 The Industrial Evolution Model

Drawing on Pakes and McGuire (1994), Pakes and Ericson (1995), and Weintraub, Benkard and van Roy (2007), we now develop an industrial evolution model that captures these main consequences of *Walmex*'s presence. The model characterizes supplying firms' pricing decisions, retailer choices, investments in product quality improvements, and entry/exit decisions.

The structure of our model is similar to Weintraub et al's (2007), with the twist that firms choose how to retail their products. Specifically, forward-looking, risk-neutral firms make optimal decisions as they compete against each other in an infinite-horizon dynamic game. Time is measured in discrete increments, and within each period the following sequence of events occurs:

1. Taking into consideration its scrap value, its current product quality, and other firms' product qualities, each incumbent firm decides whether to continue operating or shut down. Those that do not shut down also decide how much to invest in quality improvement.

2. Each potential entrant calculates the present value of the profit stream from a new firm, takes stock of sunk entry costs, and decides whether to become a producer next

period.

3. Taking stock of Walmex's take-it-or-leave-it price offer and minimum quality requirements, each incumbent firm decides whether to use Walmex as its retailer or deal with traditional retailers.

4. Incumbent firms compete in the spot market and generate their current period operating profits. Those that are selling through Walmex must offer their goods at Walmex's dictated prices; others choose their own price using a pure Bertrand-Nash strategy.

5. The outcomes of firms' investments in quality improvements are realized, and the industry takes on a new state.

6. The next period begins.

3.2.1 The profit function

To develop firms' profit functions, we begin with a logit demand system that allows for a retailer effect. Let $\mathbf{I}_t$ denote the set of incumbent firms in period t, each of which produces a single, differentiated project. Also let firm j's product have "popularity" or "quality" level ξ_{jt} relative to goods outside the industry of interest, and (suppressing time subscripts) express the net indirect utility of product j for the i^{th} consumer as:

$$\begin{aligned} U_{ij} &= \theta_1 \ln(\xi_j) + \beta_w w_j + \theta_2 \ln(Y - P_j) + \epsilon_{ij} \\ &\stackrel{def}{=} \overline{U}_{ij} + \epsilon_{ij}. \end{aligned} \tag{1}$$

Here $\beta_w > 0$ measures the extra appeal of product j when it is available at Walmex, w_j is a dummy variable that takes a value of unity if producer j sells through *Walmex*, Y is the (exogenous) expenditure level of a typical household, and ϵ_{ij} is a Type I extreme value disturbance that picks up unobserved idiosyncratic features of consumer i. The parameter β_w is positive because, when a product is available at Walmex, it becomes more accessible to the average consumer.[14]

Assuming that each consumer purchases a single unit of the product that gives her the highest indirect utility, and letting the mass of consumers be measured by M, it is well known that (1) implies the total demand for product j is

$$Q_j^D = h_j \cdot M$$

where:

$$h_j = h(j|\mathbf{w}, \mathbf{P}, \boldsymbol{\xi}) = \frac{\exp\left[\overline{U}_{ij}\right]}{\sum_\ell \exp\left[\overline{U}_{i\ell}\right] + 1}, \tag{2}$$

$\mathbf{w} = \{w_j | j \in \mathbf{I}\}$, $\mathbf{P} = \{P_j | j \in \mathbf{I}\}$, and $\boldsymbol{\xi} = \{\xi_j | j \in \mathbf{I}\}$. Further, if all firms sell all of their output through traditional retailers (i.e., $w_j = 0 \; \forall \; j \in I$), the set of pure strategy Bertrand-Nash prices satisfies (2), (1) and:

$$P_j = C_j + \frac{Y + \theta_2 C_j (1 - h_j)}{1 + \theta_2}, \; j \in \mathbf{I} \tag{3}$$

[14] Holmes (2007) also uses a logit specification, but makes the opposite assumption that consumers lose satisfication by shopping at Walmart rather than other retailers.

where C_j is the marginal cost of production for firm j (Berry 1994).

We make several assumptions at this point. First, firms differ in terms of their product quality, but not their marginal costs. Thus, we hereafter drop the j subscript on C. Second, each supplier either sells through traditional retailers or through *Walmex*, but not both. While this is not entirely realistic, it will be close to the truth in markets where local retailers and *Walmex* are both present, since the latter will underprice the former and capture most of the market. Third, Walmex's take-it-or-leave-it price offer to any supplier j—hereafter denoted $\overline{P}_j$—depends upon ξ_j according to:

$$\overline{P}_j = P_0 + \theta_3 \ln(\xi_j),\ \theta_3 > 0. \tag{4}$$

$\mathbf{w} = \{w_j | j \in \mathbf{I}\}$ and $\boldsymbol{\xi} = \left\{\xi_j | j \in \mathbf{I}\right\}$. This specification not only makes the return to investments in product quality positive for *Walmex* suppliers, it implies that when firms experience quality declines relative to the outside good they will be forced to cut their prices as discussed in section 2 above. Finally, in addition to the pricing constraint (4), we assume that Walmex imposes a minimum quality standard on all its suppliers: $\xi_j \geq \overline{\xi}\ \forall j \in \mathbf{W}^1$, where $\mathbf{W}^1 = \{j | w_j = 1, j \in \mathbf{I}\}$ is the set of suppliers who do business with Walmex.

Since there are no sunk costs associated with starting or stopping a *Walmex* relationship, suppliers choose their retailers period by period, without worrying about the implications of their current choices for their future retailing options. When the subset $\mathbf{W}^1$ of incumbent firms chooses to use *Walmex* as their retailer, and the remaining incumbent firms $\mathbf{W}^0 = \{j | w_j = 0, j \in \mathbf{I}\}$ compete pure Bertrand-Nash in prices, the set of prices for these non-

Walmex firms—hereafter denoted $\mathbf{P}^0 = \{P_j | j \in \mathbf{W}^0\}$—solves (1), (2) and (3), given that *Walmex* suppliers' prices are fixed at $\overline{\mathbf{P}}^1 = \left\{\overline{P}_j | j \in \mathbf{W}^1\right\}$. The associated profits for the j^{th} non-*Walmex* firm are

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

where h_j is given by the share equation (2) evaluated at $\mathbf{P} = \overline{\mathbf{P}}^1 \cup \mathbf{P}^0$, $\boldsymbol{\xi}$, and $\mathbf{w}$, and the vector $\mathbf{w}_{-j} = (w_1, w_2, ..., w_{j-1}, w_{j+1,}.., w_N)$ collects the retailing decisions of all firms *except* firm j. Analogously, if firm j were to switch from traditional retailers to *Walmex*, and all other firms were to stick with their initial retailing choices, j would earn operating profits:

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

where h_j is given by (2) evaluated at the same $\mathbf{w}_{-j}$ and $\boldsymbol{\xi}$ but at the new equilibrium price vector. Firms' retailer choices are Nash equilibria so, given the choices of other supplier firms, no firm will wish to adjust its choice of retailer. Thus in all equilibria:

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

While multiple equilibria may exist, we limit our attention to equilibria in which all firms above some quality threshold sell their product through *Walmex*, and all firms below that

threshold sell their product through traditional retailers. Doing so allows us to establish a mapping from $\boldsymbol{\xi}$ to $\mathbf{w}$, and to thereby express the profits of all incumbent firms as a function of the vector $\boldsymbol{\xi}$ alone. Hereafter we will express the profits for firm j when the industry is in state $\boldsymbol{\xi}$ as $\pi^*\left(\xi_j, \boldsymbol{\xi}_{-j}\right)$,where $\boldsymbol{\xi}_{-j}$ gives the product quality/appeal levels for all incumbent firms except $j's$. (Thus $\boldsymbol{\xi}$ =$\xi_j \cup \boldsymbol{\xi}_{-j}$.)

3.2.2 The dynamic problem

Although current period retailing decisions do not affect future period earnings, there are two features of our model that make it forward-looking. First, entry and exit are not frictionless. When entrerpreneurs create new firms, they incur sunk start-up costs (hereafter ϕ_e), and when they shut down their firms they receive its scrap value (hereafter $\phi_s < \phi_e$). Their entry and exit decisions thus involve comparisions of expected future profit streams with entry costs and scrap values, respectively. Second, each firm's product appeal/quality (ξ) evolves over time, and the processes that these appeal/quality indices follow are dependent upon firms' R&D expenditures and advertising.

Define r_j to be the current level of R&D/advertising undertaken by the j^{th} producer in order to influence its product appeal next period, hereafter denoted ξ_j'. Further, assume that for any firm j, all realizations on ξ_j s are elements of a discrete ordered set $\left\{\xi^1, ..., \xi^K\right\}$, $\xi^i < \xi^{i+1}\ \forall i \in I^+$, that ξ_j moves at most one position in the ordered set per period, and that ξ_j is measured relative to the appeal of goods outside the industry. Then, if R&D efforts are successful with probability $\frac{ar_j}{1+ar_j}$, and if outside goods improve one step in quality with exogenous probability δ, firm j's product quality evolves according to:

$$\begin{aligned}
\Pr\left[\xi_j' = \xi^{i+1} | \xi_j = \xi^i\right] &= \tfrac{ar_j}{1+ar_j} \cdot (1-\delta) \\
\Pr\left[\xi_j' = \xi^{i} | \xi_j = \xi^i\right] &= \left(1 - \tfrac{ar_j}{1+ar_j}\right)(1-\delta) + \tfrac{ar_j}{1+ar_j}\delta \\
\Pr\left[\xi_j' = \xi^{i-1} | \xi_j = \xi^i\right] &= \left(1 - \tfrac{ar_j}{1+ar_j}\right)\delta
\end{aligned} \tag{5}$$

We now summarize the dynamic optimization problem that firms solve. At the beginning of each period, each incumbent firm takes stock of its current product quality and the product quality of all of its rivals. It then decides whether to continue operating or shut down. If it does continue operating, it also chooses an R&D level, r, and a retailing strategy, w. To characterize these decisions, let the state of the industry be summarized by $\mathbf{s} = (s_1, s_2, ..., s_K)$, where s_i is the number of firms that are currently at the i^{th} quality level level Similarly, let $\mathbf{s}_{-j}$ be the same vector, except in that it leaves firm j out of the count.[15] Then firm j chooses its R&D level to solve:

$$V\left(\xi_{j,}, \mathbf{s}_{-j}\right) = \max\left[\phi_s, \max_{r_j}\left\{\pi^*\left(\xi_{j,}, \mathbf{s}_{-j}\right) - c_r \cdot r + \beta E_{\Omega_j}\left[V.\left(\xi_{j,}', \mathbf{s}_{-j}'\right)\right]\right\}\right] \tag{6}$$

Here c_r is the unit cost of R&D, β is the one period discount factor, and the expectation operator is based on firm j's beliefs about the transition density for the industry state, excluding itself: $\Omega_j\left(\mathbf{s}_{-j}' | \mathbf{s}_{-j}\right)$. This perceived transition density in turn reflects firm j's perceptions of the policy functions that other firms in the industry use to make their exit or entry decisions and to choose their R&D spending levels.

Finally, there is a large pool of potential entrants who stand ready to create new firms.

[15] This vector contains the same information as $\boldsymbol{\xi}_{-j}$, but it is smaller dimension, and it does not track individual firms through time. Since firms need only keep track of the state of the industry, and not of the individual shocks to their various competitiors, it is better suited for analysis of the dynamic equilibrium.

They do so when the expected profit stream covers their entry costs, ϕ_e, so the mass of entrants each period is just large enough to drive the net expected profit stream for the marginal entrant to zero, except in the corner case where even a single entrant expects negative net returns. New entrants start with some relatively modest product appeal, ξ_e.

3.2.3 Equilibrium

The industry is in dynamic equilibrium when all firms correctly solve their optimization problems and their beliefs about industrial evolution patterns (as characterized by $\Omega(\cdot)$) are consistent with the realized Markov process for industry states. Several methods for identifying this kind of equilibrium have been developed; we rely on the approach developed by Weintraub et al. (2007).[16]

The basic idea is the following. So long as the number of incumbent firms is fairly large, the industry state is insensitive to the idiosyncratic outcomes of R&D investments and advertising by individual firms. And since there is no other source of noise in the model, each firm's optimal behavior is approximated by its behavior under the assumption that $\mathbf{s}_{-j}$ is time-invariant. (That is, $\Omega_j\left(\mathbf{s}'_{-j}|\mathbf{s}_{-j}\right)$ is a degenerate distribution.) The associated equilibrium concept is dubbed an "oblivous equilbrium" by Weintraub et al (2007) to highlight their assumption that firms ignore the variations in $\mathbf{s}_{-j}$ due to idiosyncratic product appeal shocks. Our simulations are based on the Matlab code Weintraub has provided on his web site, edited to allow for endogenous retailer choice as discussed above. Details on the solution

[16] The main challenge is to deal with the fact that the number of possible industry states s is very large, and number of transition probabilities summarized by $\Omega_j\left(\mathbf{s}'_{-j}|\mathbf{s}_{-j}\right)$ is the square of this very large number. Ackerberg et al. (forthcoming) provide a useful discussion of solution techniques in the context of dynamic model estimation.

algorithm can be found in Weintraub et al. (2007).

3.3 Model Simulations

To demonstrate the main implications of our model, we simulate our model at parameter values that generate plausible size distributions of suppliers, entry/exit patterns, R&D patterns, and mark-ups. Then we shut down the option to sell through Walmex and examine the associated adjustments in behavior. The key parameter values for these simulations are as follows:

Parameter	Without *Walmex*	With a *Walmex* option
C	1.5	1.5
β_w	1.0	1.0
$\overline{\xi}$	–	2.0
θ_3	–	0.4

Figure 5 presents the simulation results. The first (upper-left) panel of Figure 5 shows that in the absence of *Walmex*, all firms have substantial mark-ups, and price increases slightly with product quality (the smooth line at a price of about 2.4).[17] When the option to sell through *Walmex* is offered to firms, the lower quality firms decline to do so, even some with quality above the minimum acceptable to *Walmex*. Accordingly, these firms continue to price around 2.4, maintaining a large mark-up over their marginal cost of 1.5. On the other hand, those with quality of roughly 2.2 find it worth their while to sell through *Walmex* and

[17]The lack of price sensitivity to quality reflects the fact that even high-quality firms have small market shares, so changes in its product appeal does not lead to large changes in their market power.

take a major price cut because they gain access to a much larger consumer base. The higher the firm's quality, the more attractive *Walmex* is, since their market share increases almost in proportion to their size, and since *Walmex* is willing to let high quality firms charge higher prices.

It is noteworthy that the firms with quality just high enough to induce them to use *Walmex* are not better off in the *Walmex* equilibrium than in the no-*Walmex* equilbrium. To the contrary, they would have preferred that *Walmex* had never become an option for anyone. However, once the option is there, competition from suppliers who use it causes these firms do worse if they rely on traditional retailers than if they cut their prices and tap into *Walmex*'s large consumer base.

The top-right panel of Figure 5 shows that the lowest quality firms that sell through *Walmex* invest less in innovation—and thus innovate less frequently—than they would have if they had not had a *Walmex* option (the *Walmex* case has a higher maximum innovation, for the highest-quality firms). This is also true of those firms that opt to remain with traditional retailers. The reason is that these firms lose market share (and profit margin) relative to the high quality firms when *Walmex* becomes a retailing option. Accordingly, the returns to successful innovation for these firms become smaller. We find a similar pattern for capital investment (Figure 5, lower left).

The final panel of Figure 5 shows that, although *Walmex* increases industry-wide sales by making products more accessible and lowering their prices, it strongly reduces the number of suppliers. This is a simple consequence of the fact that firms at all but the highest quality levels experience a reduction in operating profits when *Walmex* shows up. So, against the

positive welfare effects of *Walmex* for consumers who are able to consume their favorite brands at a more convenient location and a lower price, one must weigh the capital losses imposed on entrpreneurs whose profitability is reduced, sometimes to the point of exit, and the welfare losses of consumers who preferred the brands that are driven from the market.

We now turn to the question of whether our model's characterization of supplier reactions to *Walmex* is consistent with evidence from Mexican manufacturing establishments.

4 The upstream impact of Walmex: regression evidence

4.1 Data

Our analysis is based on establishment-level data from the *Encuesta Industrial Anual* (EIA) and the *Encuesta Industrial Mensual* (EIM) administered by the *Instituto Nacional de Estadísstica Geografía e Informática* (INEGI) in Mexico. The Encuesta Industrial Anual is an annual industrial survey that covers about 85 percent of Mexican industrial output, with the exception of "maquiladoras." The EIA was started in 1963 and then expanded in subsequent years, with the last expansion taking place in 1994 after the 1993 census. In our analysis, we use the information for the 1993-2002 period. The unit of observation is a plant described as *"the manufacturing establishment where the production takes place."* Each plant is classified by industry (*clase*) on the basis of its principal product. The industry classification is equivalent to the 6-digit level Mexican System of Classification for Productive Activities

(CMAP).

Our sample includes 6,867 plants spread across 205 classes of activity. The sampling framework is based on the 1993 industrial census. In each of the selected 205 *clases* the survey samples the largest firms until the coverages reaches 85% of the sectoral output. In sectors with fewer than 20 plants, all entities are surveyed. Moreover, all plants with more than 100 employees are automatically included in the sample. In addition to standard plant-level data, the EIA survey includes details of plant-level activities associated with production upgrading, such as investment in physical assets, R&D expenditure and technology purchases. This feature of the dataset makes it particularly suitable to examine the question at hand.

The *Encuesta Industrial Mensual* is a monthly survey that is collected by INEGI to monitor short-term trends and dynamics. The survey has been run in parallel with the EIA and has covered the same plants. The EIM panel is available for the period 1994-2004 covering 205 *clases*. The principal difference with EIA is its periodicity (being this monthly instead of yearly), its data content (it includes the quantity and value of domestic sales, which allows for calculation of unit values) as well as the level of aggregation (plant-product rather than plant level).We aggregate monthly EIM data into annual observations.

The EIM contains information on 3,396 unique products. Each *clase* contains a list of products, which was developed in 1993 and remained unchanged during the entire period under observation. For instance, the *clase* of *distilled alcoholic beverages* (identified by the CMAP code 313014) lists 13 products: gin, vodka, whisky, liquors, coffee liquors, liquor "habanero", "rompope", prepared cocktails, prepared from agave, brandy, rum, table wine, alcohol extract for liquor preparation. The *clase* of *small electrical appliances* contains 29

products, including vacuum cleaners, coffee makers, toasters, toaster oven, 110 volt heaters and 220 volt heaters (within each group of heaters the classification distinguishes between heaters of different sizes: less than 25 liters, 25-60 liters, 60-120 liters, more than 60 liters). These examples illustrate the narrowness of product definitions and the richness of micro-level information available in our dataset.

4.2 Empirical strategy

To shed some light on whether our model's characterization of supplier reactions to *Walmex* is consistent with evidence from Mexico, we estimate a series of reduced form regressions. These regressions examine the relationship between establishment-level outcomes and the presence of *Walmex* stores in the establishment's state of operation. Thus our key identifying assumption is that establishments located in proximity to *Walmex* should be affected to a larger extent than those located farther away. In our view, this assumption is quite plausible for three reasons. First, producers located close to a *Walmex* stores may be better informed about the type of products sold by *Walmex*, their characteristics and pricing. Second, information collected during interviews with *Walmex* executives, Mexican firms and industry experts suggests that *Walmex* makes an effort to source from producers located in the region of *Walmex* operations. This effort is made in order to appeal to the tastes of local consumers, cut down on transportation costs and build goodwill in local communities. And finally, *Walmex* sources many of its perishable goods locally.

Our estimation equation takes the following form:

$$
\begin{aligned}
Y_{it} \;=\; & \alpha + \beta_1 ln(Walmexshops)_{it} + \beta_2 WalmexProduct_i + \beta_3 Topplant_{it-1} \\
& + \beta_4 ln(Walmexshops)_{it} \cdot WalmexProduct_i \\
& + \beta_5 ln(Walmexshops)_{it} \cdot Topplant_{it-1} + \beta_6 WalmexProduct_i \cdot Topplant_{it-1} \\
& + \beta_7 ln(Walmexshops)_{it} \cdot WalmexProduct_i \cdot Topplant_{it-1} \\
& + \alpha_r + \alpha_j + \alpha_t + \varepsilon_{it}
\end{aligned}
$$

Here Y_{it} is the outcome variable for establishment i operating at time t. The variable $Walmexshops_{it}$ is defined as the sum of the number of *Walmex* supercenters, Bodega shops, Sam's and Superamas operating in the i^{th} establishment's state at time t. Recall that while the first three store types sell groceries and other consumer products, Superama is a grocery store. The variable The dummy $WalmexProduct_{it}$ identifies those manufacturing establishments that produce categories of goods carried by *Walmex*.[18] The dummy $Topplant_{it-1}$ is equal to one if the establishment was in the top quartile of the size distribution within its 4-digit industry last year, and zero otherwise. Finally, the regression model controls for industry[19], region[20] and year fixed effects.

Interaction terms involving $Topplant_{it-1}$ capture our model's prediction that *Walmex* should affect high quality producers differently from others. (Recall that in our model,

[18] The list was drawn based on information available on Wal-Mex website, store visits and detailed industry descriptions.

[19] At a disaggregation equivalent to four digits we can separately identify fifty sectors.

[20] Seven different regions are identified: *Northern Frontier, North, North-East, Center-North, Center-South, South, Mexico City Region.*

quality is monotonically related to sales.) The interaction between $Walmexshops$ and the dummy $WalmexProduct$ identfies the average impact of *Walmex* on potential suppliers in the bottom 75 percent of the size distribution, and the triple interaction between these two variables and $Topplant_{t-1}$ identifies the differential effect that Walmex has on those establishments with the most popular products.

Our full sample of establishments includes producers of intermediate inputs and other goods not typically purchased by households.[21] To explore the robustness of our results we also report estimates for the subsample of consumer goods and the subsample of food products. Food products are singled out because, as noted above, *Walmex* sources many perishable items locally, by-passing its distribution centers. Producers of these goods should therefore be particularly sensitive to the proximity of *Walmex* stores.Finally, in addition to OLS estimates, we report results obtained with plant-level fixed effects. The latter control for unobserved plant characteristics that are constant over the sample period, which could well be important for avoiding spurious correlation. At the same time, this within-estimator highlights short-run variation in the data, and exacerbates any measurement error bias that might be present. At this point, we do not strictly prefer one of the estimators.

Sales The results for the first outcome of interest, domestic sales expressed in real terms, are presented in Table 1. The theory predicts that the best firms are more likely to accept a deal with *Walmex*, which allows them to enjoy higher market shares and expand their sales, while the firms choosing not to sell to *Walmex* see their sales squeezed down. The data

[21] The list was drawn based on information available on Wal-Mex website, store visits and detailed industry descriptions.

support this conclusion. The average impact of increasing the number of *Walmex* stores in the state is indeed negative for potential suppliers, but, as expected, it is positive for top firms, which are best positioned to do business with *Walmex* and in this way reach a larger number of consumers. This effect is present in all three OLS regressions, and it is particularly strong for food producers. In specifications with plant fixed effects, the coefficient on the triple interaction, representing the effect of *Walmex* presence on top suppliers, is positive in all three specifications but reaches conventional signficance levels only in the case of food.

Innovative activity Next we consider outcomes related to innovative activity. We focus on two different measures of innovative activities: R&D spending and outlays on technology acquisition (both expressed in real terms), as these are most likely to capture alternative strategies to innovate. Not surprisingly, Table 2 shows that top establishments tend to have higher log R&D spending levels in general. While the expansion in the number of *Walmex* stores in the state does not spur any additional innovative effort on the part of the suppliers below the 75^{th} size percentile, this situation is different in the case of top producers. The top plants producing *Walmex*-type products tend to increase their R&D spendings as the number of *Walmex* shops in their state goes up. This effect is statistically significant in OLS regressions on the full sample and the subsample of consumer goods. The results for other specifications may by insignificant because there is less room for innovation in the case of food products, and because plant fixed effects absorb much of the relevant variation in innovative activity.

Our OLS findings for technology acquisition are similar (see Table 3). The top plants

producing *Walmex*-type goods tend to increase their outlays on technology acquisition as the the number of *Walmex* stores in their state increases. Again, this pattern is present in the full sample and the subsample of consumer goods. A 10 percent increase in the number of *Walmex* stores in the state is associated with a 1.4 percent and a 2.8 increase in R&D and technology acquisition expenditure, respectively. Using the fixed effects estimator, we find less support: in fact, for the average good, technology outlays of top plants may be lower than for the average plant (significant at the 10 percent level).

Performance outcomes Innovating activity is likely to translate into different performance outcomes. Thus next we consider three other aspects of producer behavior: labor productivity, average wage and probability of becoming an exporter. The results for labor productivity are presented in Table 4 and suggest that the entry of *Walmex* tends to have a negative impact on the productivity of establishments below 75^{th} size percentile producing *Walmex*-type products. This effect is stastically significant almost across the board (in four of six specifications). However, this effect is not present in the case of establishments with highly popular products, as in the full sample the coefficient on the triple interaction term is positive and statistically significant. The latter pattern is consistent with the theoretical predictions. Of course, since output is measured as deflated revenue, labor productivity may be picking up variation in mark-ups as well as physical productivity.

When we focus our attention on the wages (Table 5), another potential measure of improved performance at the plant-level, the observed pattern is also in line with the theory. In the full sample and in the subsample of consumer goods, we find that the entry of *Walmex*

is associated with an increase in the average wage in the top establishment. We cannot distinguish whether this reflects the sharing of *Walmex*-induced rents at the top firms or the hiring of relatively high quality workers to maintain/improve product quality.

Innovation and upgrading product quality might make it easier for *Walmex* suppliers to become exporters. It is also possible that *Walmex* may offer its suppliers contracts for sales to its US stores. The results of linear probability models, presented in Table 6, are in line with this scenario. We find that while top producers are more likely to export, the probability of exporting goes up for top producers of *Walmex*-style goods with the increase in the presence of *Walmex* in the state. The effect is present in the full sample and the subsample of consumer goods.

Pricing behavior The next outcome of interest is the pricing behavior. We use a price index compiled using the information on unit values of products sold in Mexico by a given establishment. The price index for each producer is normalized to 100 for 1993, and growth rates in prices are thereafter constructed using the products that were sold both at time t and $t-1$. Changes in prices are weighted by the share of the product sales in the establishment's total sales.

Our model predicts that conditional on product quality, the entry of *Walmex* leads to a relative decline in the price of firms that sell through *Walmex* (see Figure 5, upper-left panel). Interestingly, the fixed effects results of Table 7 suggest that the average plant producing a *Walmex* product tends to charge a higher price when *Walmex* has a large local presence; this may be in part due to state-specific trends. At the same time, the price charged by top

plants typically declines relative to those at plants below the 75^{th} size percentile, which is consistent with the prediction of our model.

Investment The final outcome considered is log investment in physical capital. Not surprisingly, we find that top producers tend to invest more than other establishments. Further, the results in Table 8 suggest that an increase in the number of *Walmex* stores is negatively correlated with investment among potential suppliers in the state. While there is some tentative evidence that the top 25 percent suppliers cut their investment less strongly, the difference is not significant at standard levels.

Exit In Table 9, we present results on how the probability of exit might be related to Walmex entry. Recall that our model simulations suggest that fewer firms survive when Walmex is present. We find that the probability of exit increases with the number of Walmex shops in the state, and that the probability of exit is generally lower for top quality plants. Both of these results are plausible. However, the results also suggest that the arrival of Walmex lowers the probability of exit for establishments below the 75^{th} size percentile that are producing a Walmex product, and this effect might be somewhat lower for top-quality plants. While our model simulations indicate that there may not be a strong difference between the exit pattern of low- and high-quality plants (see Figure 5, lower-right panel), this finding may indicate that the arrival of Walmex also goes hand in hand with general survival enhancing changes in the Mexican economy, such as infrastructure or education improvements. In future work we plan to investigate this further.

4.3 Additional Robustness checks

We performed two additional robustness checks. First, we redefined the dummy for top firms based on the *initial* sales (i.e., sales in 1993, the first year of the sample) rather than sales at time $t-1$. The results obtained are very similar to those discussed above, so to save space we do not include them in the paper. Second, we also analyzed the impact of *Walmex* entry over a larger time horizon. This specification is an alternative to the fixed-effect estimation and has the advantage of eliminating the noise due to short-term fluctuations in our variables of interests.Rather than using triple interactions, we split the sample into subsamples of *Walmex*-type and other products. We further distinguished between food products, perishables and non-food products. As using the definition of a top establishment based on lagged sales is harder to interpret in this context, we focused on initial sales instead. The patterns found are broadly consistent with our conclusions.

5 Summary

This paper analyzes the effects of Wal-Mart's entry into Mexico on upstream suppliers of merchanise and food. Testable predictions are developed using a dynamic industry model in which (non-exiting) firms choose how much to invest in innovation and whether to sell their products through *Walmex.* In making the latter decision, they weigh the benefits of increased access to consumers against the constraints that *Walmex* places on their pricing and product quality. Simulations of the model show that firms with popular products should react differently from others to the arrival of *Walmex.* At the industry-level, the model

predicts that sales, productivity and the rate of innovation should all increase among firms with popular products, and should decrease among others. These simulations generally accord well with results of firm interviews conducted in Mexico and with the results of reduced-form regression based on Mexican plant-level data.

References

[1] Ackerberg, D., L. Benkard, S. Berry, and A. Pakes (forthcoming), "Econometric Tools for Analyzing Market Outcomes", Handbook of Econometrics, Vol. 6, North-Holland.

[2] Basker, E. (2007), "The Causes and Consequences of Wal-Mart's Growth", *Journal of Economic Perspectives* 21, Summer: 177-198.

[3] Basker, E. (2005a), "Selling a Cheaper Mousetrap: Wal-Mart's Effect on Retail Prices", *Journal of Urban Economics* 58: 203-229.

[4] Basker, E. (2005b), "Job Creation or Destruction? Labor Market Effects of Wal-Mart's Expansion", *Review of Economics and Statistics* 87(1): 174-183.

[5] Berry, S. (1994), "Estimating Discrete-Choice Models of Product Differentiation," *RAND Journal of Economics*, vol. 25(2), pages 242-262.

[6] Business Planning Solutions (2005), *The Economic Impact of Wal-Mart*, Washington, D.C.

[7] Bustos, P. (2007), "The Impact of Trade on Technology and Skill Upgrading: Evidence from Argentina", working paper, Universitat Pompeu Fabra, Barcelona.

[8] Case, B. (2004), "Welcoming Wal-Mart to Mexico", Dallas Morning News, November 9, 2004.

[9] Chavez, M. (2002),"The Transformation of Mexican Retailing with NAFTA," Development Policy Review 20(4), pp 503-13.

[10] Costantini, J., and M. Melitz (2007), "The Dynamics of Firm-Level Adjustment to Trade Liberalization", working paper, Princeton University.

[11] DeLoeker, J. (2006), "Do Exports Generate Higher Productivity? Evidence from Slovenia", Journal of International Economics 73: 69-98.

[12] Ericson, R. and A. Pakes (1995) "Markov-Perfect Industry Dynamics: A Framework for Empirical Work," Review of Economic Studies, 62, 53-82.

[13] Durand, C. (2007), "Externalities from foreign direct investment in the Mexican retailing sector", *Cambridge Journal of Economics*, February, 1-19.

[14] Ederington, J. , and P. McCalman (2008), "Endogenous Firm Heterogeneity and the Dynamics of Trade Liberalization", *Journal of International Economics* 74: 422-440.

[15] Fishman, Charles (2003). "The Wal-Mart You Don't Know," Fast Company (December) 77. Downloaded February 15, 2006 from http://pf.fastcompany.com/magazine/77/walmart.html.

[16] Görg, H., and D. Greenaway (2004), "Much ado about nothing? Do domestic firms really benefit from foreign direct investment?", *World Bank Research Observer* 19.

[17] Holmes, Tom (2007), "Diffusion of Wal-Mart and Economies of Density", University of Minnesota working paper, April.

[18] Javorcik, Beata (2004), "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages", *American Economic Review*.

[19] Javorcik, B., W. Keller, and J. Tybout (2008), "Openness and Industrial Responses in a Wal-Mart World: A Case Study of Mexican Soaps, Detergents and Surfactant Producers", *World Economy*, December.

[20] Javorcik, B. and Y. Li (2008), Do the Biggest Aisles Serve a Brighter Future? Global Retail Chains and Their Implications for Romania", World Bank Policy Research Working Paper # 4650.

[21] Jia, Panle (2006), "What Happens when Wal-Mart comes to Town? An Empirical Analysis of the Discount Retailing Industry", MIT working paper.

[22] Keller, W. (2007), "Transfer of Technology", *New Palgrave Dictionary of Economics*, 2nd edition, edited by L. Blume and S. Durlauf, MacMillan.

[23] Keller, W., and Stephen R. Yeaple (2008), "Multinational Enterprises, International Trade, and Productivity Growth: Firm-level Evidence from the United States", forthcoming, *Review of Economics and Statistics*.

[24] Lipsey, R., and F. Sjoholm (2005), "The Impact of Inward FDI on Host Countries: Why so Different Answers?", in *Does FDI Promote Development*? (eds. T. Moran, E. Graham, and M. Blomstrom), Institute of International Economics, Washington, DC.

[25] McKinsey (2003), *New Horizons: Multinational Company Investment in Developing Countries*, McKinsey Global Institute, Washington, DC.

[26] Melitz, M. (2003), "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica*, Vol. 71, November 2003, pp. 1695-1725.

[27] Pavcnik, N. (2002), "Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants", *Review of Economic Studies*.

[28] Pakes, A., and P. McGuire (1994), "Computing Markov-Perfect Nash Equilibria: Numerical Implications of a Dynamic Differentiated Product Model," RAND Journal of Economics vol. 25(4), pages 555-589, Winter.

[29] Sjöholm, F., and R. Lipsey (2006), "Foreign Firms and Indonesian Manufacturing Wages: An Analysis with Panel Data", *Economic Development and Cultural Change* 55: 201-221.

[30] Tegel, S. (2003), "Every Day Higher Sales: Mal-Mart Wunderkind Walmex shows them how it's done in a down economy: The Giant 24," Latin Trade (August). Downloaded February 15, 2006 from http://www.findarticles.com/p/articles/mi_m0BEK/is_8_11/ai_106860473

[31] Verhoogen, E. (2008), "Trade, Quality Upgrading and Wage Inequality in the Mexican Manufacturing Sector", *Quarterly Journal of Economics*, May.

[32] Wal-Mart de Mexico (2006), Annual Report 2006, accessed on the Internet in 2007.

[33] Weintraub, G. L. Benkard, and B. Van Roy (forthcoming), "Markov Perfect Industry Dynamics with Many Firms", *Econometrica*.

[34] Weintraub, G., C. L. Benkard, and B. Van Roy. (2007) "Computational Methods for Oblivious Equilibrium," Working Paper, Stanford University, Department of Economics.

[35] Yeaple, S. (2005), "Firm Heterogeneity, International Trade, and Wages", *Journal of International Economics* 65 (1): 1-20.

Table 1: Domestic Sales

	All goods		Consumer goods		Food	
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
Log GDP State	-0.101**	1.365***	0.092	1.316**	-0.398***	-0.272
	[0.040]	[0.415]	[0.067]	[0.665]	[0.077]	[0.865]
Log No. of WM Shops in state	0.074**	-0.194**	0.056	-0.219	0.749***	0.022
	[0.030]	[0.081]	[0.053]	[0.138]	[0.110]	[0.361]
Dummy WM Product	1.424***		1.993***		3.341***	
	[0.139]		[0.189]		[0.271]	
Top quartile lag	3.756***	0.751***	3.604***	0.635**	4.883***	2.153**
	[0.054]	[0.153]	[0.105]	[0.310]	[0.309]	[0.987]
Log No. of WM Shops in state X Top quartile lag	0	0.231***	0	0.261***	-0.580***	-0.322
	[0.018]	[0.053]	[0.032]	[0.097]	[0.138]	[0.329]
Dummy WM Product X Top quartile lag	-0.509***	-0.301	-0.248	-0.232	-1.754***	-1.72
	[0.111]	[0.361]	[0.161]	[0.513]	[0.325]	[1.045]
Log No. of WM Shops in state X Dummy WM Product	-0.070**	0.161	-0.215***	0.453***	-0.505***	-0.217
	[0.035]	[0.131]	[0.044]	[0.170]	[0.103]	[0.358]
Log No. of WM Shops in state X Dummy WM Product X Top quartile lag	0.113**	0.167	0.130**	0.107	0.751***	0.751**
	[0.044]	[0.166]	[0.058]	[0.227]	[0.145]	[0.376]
N	53909	53909	20040	20040	9657	9657
r2	0.297	0.08	0.322	0.085	0.292	0.06

Table 2: R&D Expenditures

	All goods		Consumer goods		Food	
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
Log GDP State	-0.075***	0.152	-0.126***	-0.394	-0.121***	-0.457
	[0.021]	[0.281]	[0.031]	[0.427]	[0.044]	[0.542]
Log No. of WM Shops in state	0.033**	0.016	0.071***	0.125	0.106***	0.433***
	[0.016]	[0.053]	[0.024]	[0.097]	[0.037]	[0.135]
Dummy WM Product	0.02		0.199**		0.067	
	[0.064]		[0.085]		[0.075]	
Top quartile lag	0.878***	-0.005	0.577***	-0.129	0.359**	0.477**
	[0.051]	[0.081]	[0.092]	[0.129]	[0.153]	[0.217]
Log No. of WM Shops in state X Top quartile lag	-0.049***	0.034	-0.009	0.068	0.01	-0.132
	[0.017]	[0.028]	[0.027]	[0.046]	[0.082]	[0.108]
Dummy WM Product X Top quartile lag	-0.453***	0.07	-0.620***	0.078	0.103	-0.41
	[0.116]	[0.180]	[0.150]	[0.230]	[0.187]	[0.271]
Log No. of WM Shops in state X Dummy WM Product	0.019	-0.033	0.018	-0.067	-0.01	-0.342***
	[0.015]	[0.080]	[0.019]	[0.117]	[0.027]	[0.132]
Log No. of WM Shops in state X Dummy WM Product X Top quartile lag	0.138***	-0.022	0.261***	-0.077	0.052	0.142
	[0.044]	[0.084]	[0.057]	[0.108]	[0.093]	[0.139]
N	53909	53909	20040	20040	9657	9657
r2	0.098	0.003	0.119	0.004	0.039	0.006

Table 3: Technology acquisition outlays

	All goods		Consumer goods		Food	
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
Log GDP State	-0.222***	0.341	-0.355***	0.893*	-0.344***	-0.108
	[0.030]	[0.322]	[0.047]	[0.504]	[0.059]	[0.589]
Log No. of WM Shops in state	0.152***	-0.083	0.328***	-0.029	0.284***	0.155
	[0.022]	[0.059]	[0.035]	[0.103]	[0.054]	[0.147]
Dummy WM Product	0.338***		0.346***		0.298***	
	[0.090]		[0.125]		[0.115]	
Top quartile lag	1.588***	0.334***	1.503***	0.031	-0.225	0.242
	[0.071]	[0.099]	[0.147]	[0.172]	[0.184]	[0.147]
Log No. of WM Shops in state X Top quartile lag	0.076***	0.009	0.119***	0.131**	0.198	-0.120*
	[0.024]	[0.036]	[0.045]	[0.063]	[0.126]	[0.066]
Dummy WM Product X Top quartile lag	-1.179***	0.093	-1.131***	0.289	0.869***	0.156
	[0.161]	[0.257]	[0.226]	[0.358]	[0.237]	[0.279]
Log No. of WM Shops in state X Dummy WM Product	0	-0.019	-0.093***	-0.154	-0.054	-0.194
	[0.021]	[0.091]	[0.027]	[0.127]	[0.043]	[0.139]
Log No. of WM Shops in state X Dummy WM Product X Top quartile lag	0.277***	-0.191*	0.285***	-0.269**	0.005	-0.071
	[0.064]	[0.101]	[0.084]	[0.133]	[0.141]	[0.115]
N	53909	53909	20040	20040	9657	9657
r2	0.162	0.005	0.191	0.006	0.073	0.005

Table 4: Labor productivity

	All goods		Consumer goods		Food	
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
Log GDP State	0.007	0.064	-0.055***	-0.053	0.005	-0.620**
	[0.013]	[0.132]	[0.020]	[0.209]	[0.028]	[0.309]
Log No. of WM Shops in state	0.016	0.035	0.129***	-0.005	-0.007	0.289**
	[0.010]	[0.025]	[0.016]	[0.042]	[0.039]	[0.140]
Dummy WM Product	-0.002		0.145**		-0.266***	
	[0.047]		[0.067]		[0.093]	
Top quartile lag	1.020***	0.177***	0.647***	0.152**	0.868***	0.269
	[0.023]	[0.038]	[0.039]	[0.077]	[0.122]	[0.239]
Log No. of WM Shops in state X Top quartile lag	-0.041***	0.025*	0.045***	0.03	0.034	-0.028
	[0.008]	[0.013]	[0.013]	[0.024]	[0.056]	[0.088]
Dummy WM Product X Top quartile lag	-0.051	-0.048	0.300***	-0.093	0.068	-0.16
	[0.054]	[0.085]	[0.074]	[0.113]	[0.133]	[0.252]
Log No. of WM Shops in state X Dummy WM Product	-0.017	-0.076*	-0.061***	-0.093*	-0.01	-0.332**
	[0.011]	[0.043]	[0.013]	[0.054]	[0.036]	[0.139]
Log No. of WM Shops in state X Dummy WM Product X Top quartile lag	0.128***	0.017	0.031	0.026	0.073	0.092
	[0.022]	[0.039]	[0.029]	[0.047]	[0.062]	[0.098]
N	48726	48726	18285	18285	8558	8558
r2	0.287	0.054	0.323	0.057	0.26	0.072

Table 5: Average wage

	All goods		Consumer goods		Food	
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
Log GDP State	-0.001	0.413***	-0.028**	0.424***	-0.011	0.209*
	[0.007]	[0.059]	[0.011]	[0.098]	[0.014]	[0.110]
Log No. of WM Shops in state	0.032***	0.004	0.088***	-0.025	0.083***	-0.04
	[0.006]	[0.011]	[0.009]	[0.019]	[0.019]	[0.037]
Dummy WM Product	-0.145***		-0.084**		-0.029	
	[0.025]		[0.035]		[0.047]	
Top quartile lag	0.523***	0.022	0.300***	-0.011	0.043	-0.016
	[0.012]	[0.018]	[0.023]	[0.037]	[0.057]	[0.055]
Log No. of WM Shops in state X Top quartile lag	-0.006	0.014**	0.034***	0.022*	0.083***	0.054*
	[0.004]	[0.006]	[0.007]	[0.011]	[0.031]	[0.031]
Dummy WM Product X Top quartile lag	-0.135***	-0.011	0.011	0.009	0.348***	0.015
	[0.025]	[0.035]	[0.037]	[0.054]	[0.061]	[0.062]
Log No. of WM Shops in state X Dummy WM Product	0.022***	0.080***	-0.024***	0.073***	-0.018	0.054
	[0.006]	[0.017]	[0.008]	[0.023]	[0.018]	[0.037]
Log No. of WM Shops in state X Dummy WM Product X Top quartile lag	0.052***	-0.019	0.030**	-0.021	-0.047	-0.046
	[0.010]	[0.014]	[0.014]	[0.019]	[0.032]	[0.034]
N	49633	49633	18515	18515	9046	9046
r2	0.353	0.191	0.404	0.195	0.285	0.143

Table 6: Probability of exporting

	All goods		Consumer goods		Food	
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
Log GDP State	0.028***	-0.001	0.008	-0.005	0.068***	-0.068
	[0.006]	[0.060]	[0.009]	[0.089]	[0.011]	[0.112]
Log No. of WM Shops in state	-0.035***	-0.013	-0.022***	-0.041**	-0.038***	0.012
	[0.004]	[0.010]	[0.007]	[0.019]	[0.012]	[0.021]
Dummy WM Product	-0.052***		-0.234***		-0.129***	
	[0.017]		[0.024]		[0.026]	
Top quartile lag	0.278***	-0.003	0.267***	0.01	-0.057*	0.021
	[0.011]	[0.019]	[0.024]	[0.046]	[0.032]	[0.044]
Log No. of WM Shops in state X Top quartile lag	-0.005	0.022***	0	0.018	0.042***	-0.004
	[0.004]	[0.007]	[0.007]	[0.014]	[0.016]	[0.018]
Dummy WM Product X Top quartile lag	-0.207***	-0.027	-0.185***	-0.037	0.161***	-0.044
	[0.024]	[0.037]	[0.034]	[0.056]	[0.039]	[0.055]
Log No. of WM Shops in state X Dummy WM Product	-0.020***	0.016	-0.006	0.028	-0.045***	0.013
	[0.004]	[0.017]	[0.005]	[0.022]	[0.010]	[0.022]
Log No. of WM Shops in state X Dummy WM Product X Top quartile lag	0.042***	0.011	0.024**	0.012	-0.030*	0.03
	[0.009]	[0.015]	[0.012]	[0.019]	[0.018]	[0.023]
N	53909	53909	20040	20040	9657	9657
r2	0.183	0.017	0.187	0.018	0.205	0.009

Table 7: Prices

	All goods		Consumer goods		Food	
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
Log GDP State	-0.008*	0.064	0.006	0.101	-0.021***	0.109
	[0.004]	[0.063]	[0.007]	[0.098]	[0.007]	[0.099]
Log No. of WM Shops in state	-0.006*	-0.01	-0.010*	-0.053**	-0.002	-0.066**
	[0.003]	[0.011]	[0.005]	[0.021]	[0.008]	[0.029]
Dummy WM Product	0.036***		0.037**		0.013	
	[0.013]		[0.019]		[0.021]	
Top quartile lag	0.061***	0.008	0.002	0.014	0.069***	0.031
	[0.007]	[0.014]	[0.015]	[0.029]	[0.024]	[0.043]
Log No. of WM Shops in state X Top quartile lag	0.011***	0.004	0.024***	0	-0.018	-0.01
	[0.003]	[0.005]	[0.005]	[0.009]	[0.012]	[0.021]
Dummy WM Product X Top quartile lag	-0.047***	0.008	0.018	0.02	-0.050*	-0.02
	[0.014]	[0.030]	[0.020]	[0.042]	[0.026]	[0.050]
Log No. of WM Shops in state X Dummy WM Product	0.016***	0.130***	-0.004	0.148***	0.020***	0.096***
	[0.003]	[0.016]	[0.004]	[0.024]	[0.007]	[0.029]
Log No. of WM Shops in state X Dummy WM Product X Top quartile lag	0.004	-0.002	-0.001	0.001	0.026**	0.019
	[0.005]	[0.012]	[0.007]	[0.017]	[0.012]	[0.024]
N	40627	40627	15621	15621	7606	7606
r2	0.506	0.69	0.557	0.727	0.653	0.797

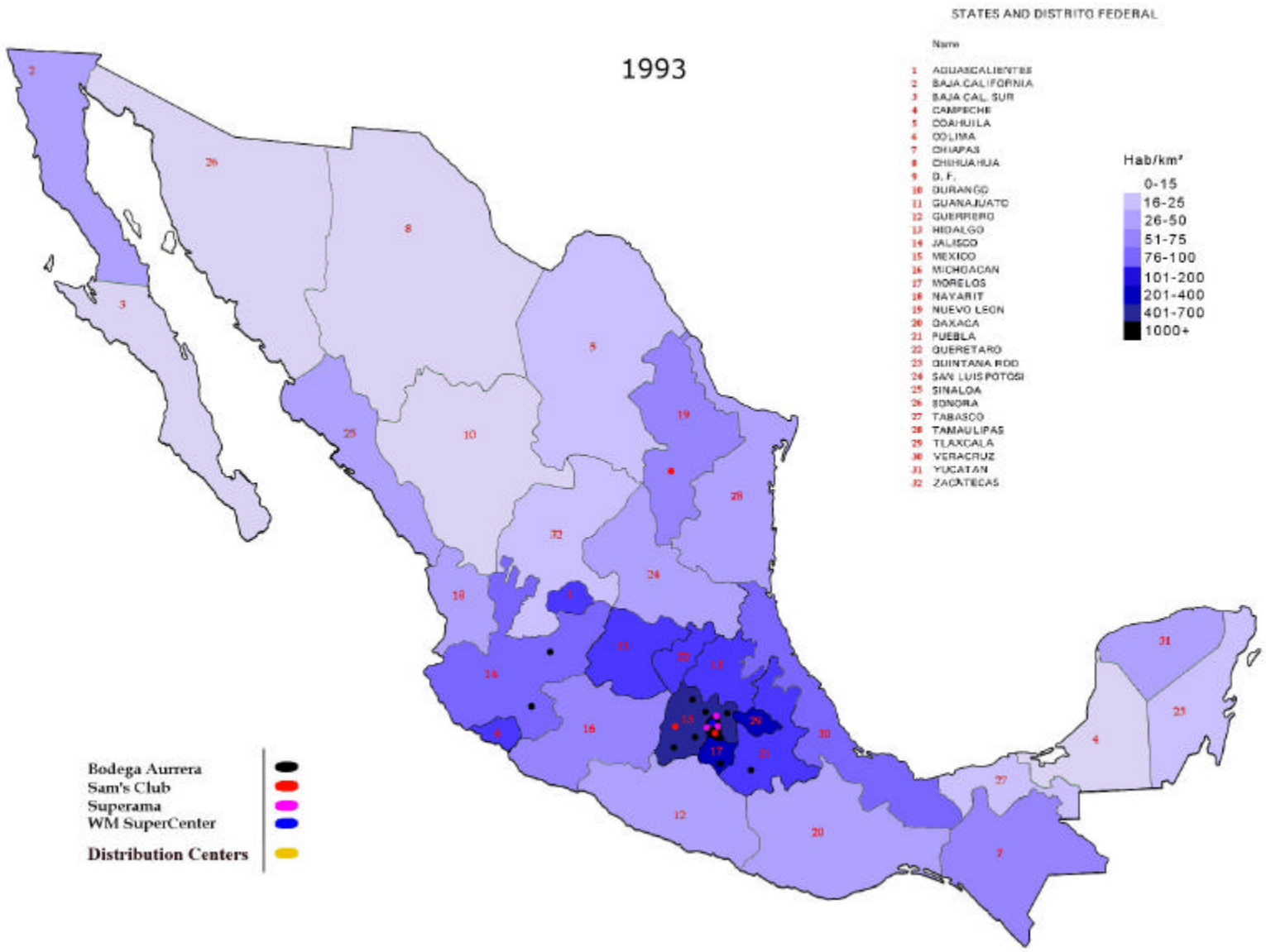
Table 8: Capital investment

	All goods		Consumer goods		Food	
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
Log GDP State	-0.234***	-0.191	-0.261***	0.04	-0.186**	-0.624
	[0.042]	[0.465]	[0.068]	[0.766]	[0.090]	[1.017]
Log No. of WM Shops in state	0.091***	0.003	0.090*	0.264	0.239**	0.710**
	[0.032]	[0.090]	[0.053]	[0.168]	[0.098]	[0.295]
Dummy WM Product	0.865***		1.155***		1.741***	
	[0.134]		[0.190]		[0.222]	
Top quartile lag	2.568***	0.951***	1.887***	0.915***	2.025***	1.578**
	[0.084]	[0.146]	[0.169]	[0.309]	[0.368]	[0.639]
Log No. of WM Shops in state X Top quartile lag	-0.026	-0.145***	0.150***	-0.088	-0.187	-0.521**
	[0.028]	[0.051]	[0.050]	[0.097]	[0.183]	[0.234]
Dummy WM Product X Top quartile lag	-0.398**	-0.354	0.323	-0.042	0.182	-1.026
	[0.185]	[0.363]	[0.271]	[0.535]	[0.406]	[0.725]
Log No. of WM Shops in state X Dummy WM Product	-0.092***	-0.612***	-0.103**	-0.781***	-0.228***	-0.933***
	[0.034]	[0.143]	[0.043]	[0.206]	[0.084]	[0.289]
Log No. of WM Shops in state X Dummy WM Product X Top quartile lag	0.039	0.024	-0.15	-0.186	0.198	0.416
	[0.071]	[0.151]	[0.096]	[0.213]	[0.196]	[0.283]
N	49655	49655	18565	18565	8928	8928
r2	0.231	0.137	0.234	0.128	0.192	0.15

Table 9: Exit

	All goods		Consumer goods		Food	
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
Log GDP State	-0.002	-0.048*	-0.003	-0.095**	0.001	0.025
	[0.003]	[0.027]	[0.005]	[0.044]	[0.005]	[0.049]
Log No. of WM Shops in state	0.004*	-0.001	0.009**	-0.005	-0.006	0
	[0.002]	[0.006]	[0.004]	[0.010]	[0.008]	[0.019]
Dummy WM Product	-0.008		0.006		-0.017	
	[0.008]		[0.011]		[0.018]	
Top quartile lag	-0.039***	-0.008	-0.022**	0.014	-0.034*	-0.023
	[0.004]	[0.009]	[0.009]	[0.021]	[0.021]	[0.030]
Log No. of WM Shops in state X Top quartile lag	0.002	-0.009***	-0.006**	-0.019***	-0.001	-0.001
	[0.001]	[0.003]	[0.003]	[0.007]	[0.009]	[0.010]
Dummy WM Product X Top quartile lag	0.002	-0.004	-0.011	-0.039	-0.005	0.011
	[0.007]	[0.016]	[0.012]	[0.028]	[0.022]	[0.033]
Log No. of WM Shops in state X Dummy WM Product	-0.002	-0.026***	-0.006**	-0.033***	0.005	-0.011
	[0.002]	[0.008]	[0.003]	[0.012]	[0.008]	[0.019]
Log No. of WM Shops in state X Dummy WM Product X Top quartile lag	0.004	0.011*	0.012***	0.029***	0.007	0.001
	[0.003]	[0.006]	[0.004]	[0.010]	[0.009]	[0.012]
N	47683	47683	17765	17765	8825	8825
r2	0.012	0.039	0.017	0.045	0.012	0.031

FIGURE 1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6 COLIMA
7 CHIAPAS
8 CHIHUAHUA
9 D. F.
10 DURANGO
11 GUANAJUATO
12 GUERRERO
13 HIDALGO
14 JALISCO
15 MEXICO
16 MICHOACAN
17 MORELOS
18 NAYARIT
19 NUEVO LEON
20 OAXACA
21 PUEBLA
22 QUERETARO
23 QUINTANA ROO
24 SAN LUIS POTOSI
25 SINALOA
26 SONORA
27 TABASCO
28 TAMAULIPAS
29 TLAXCALA
30 VERACRUZ
31 YUCATAN
32 ZACATECAS
Hab/km²
0-15
16-25
26-50
51-75
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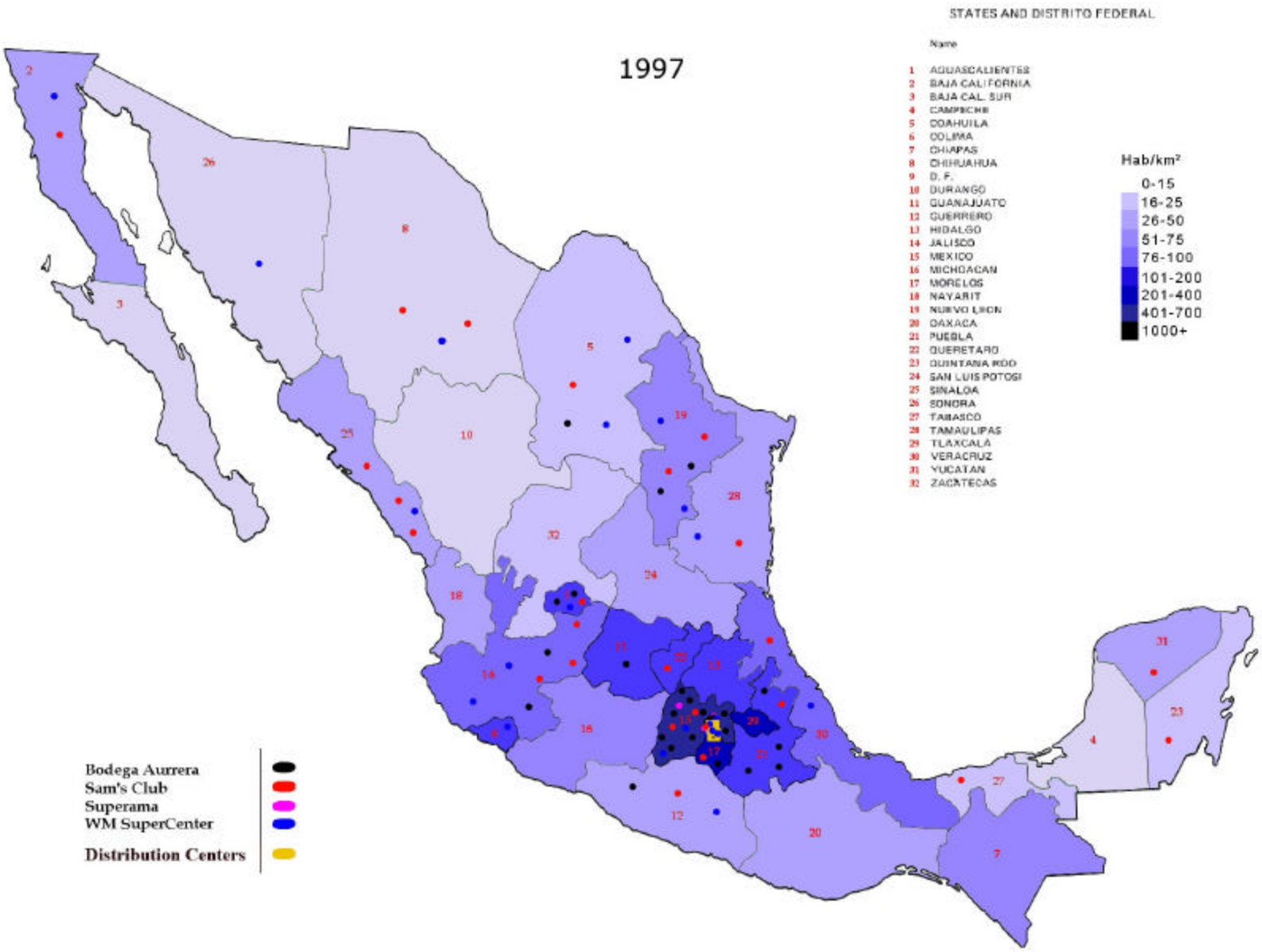
101-200
201-400
401-700
1000+
Bodega Aurrera
Sam's Club
Superama
WM SuperCenter
Distribution Centers

FIGURE 2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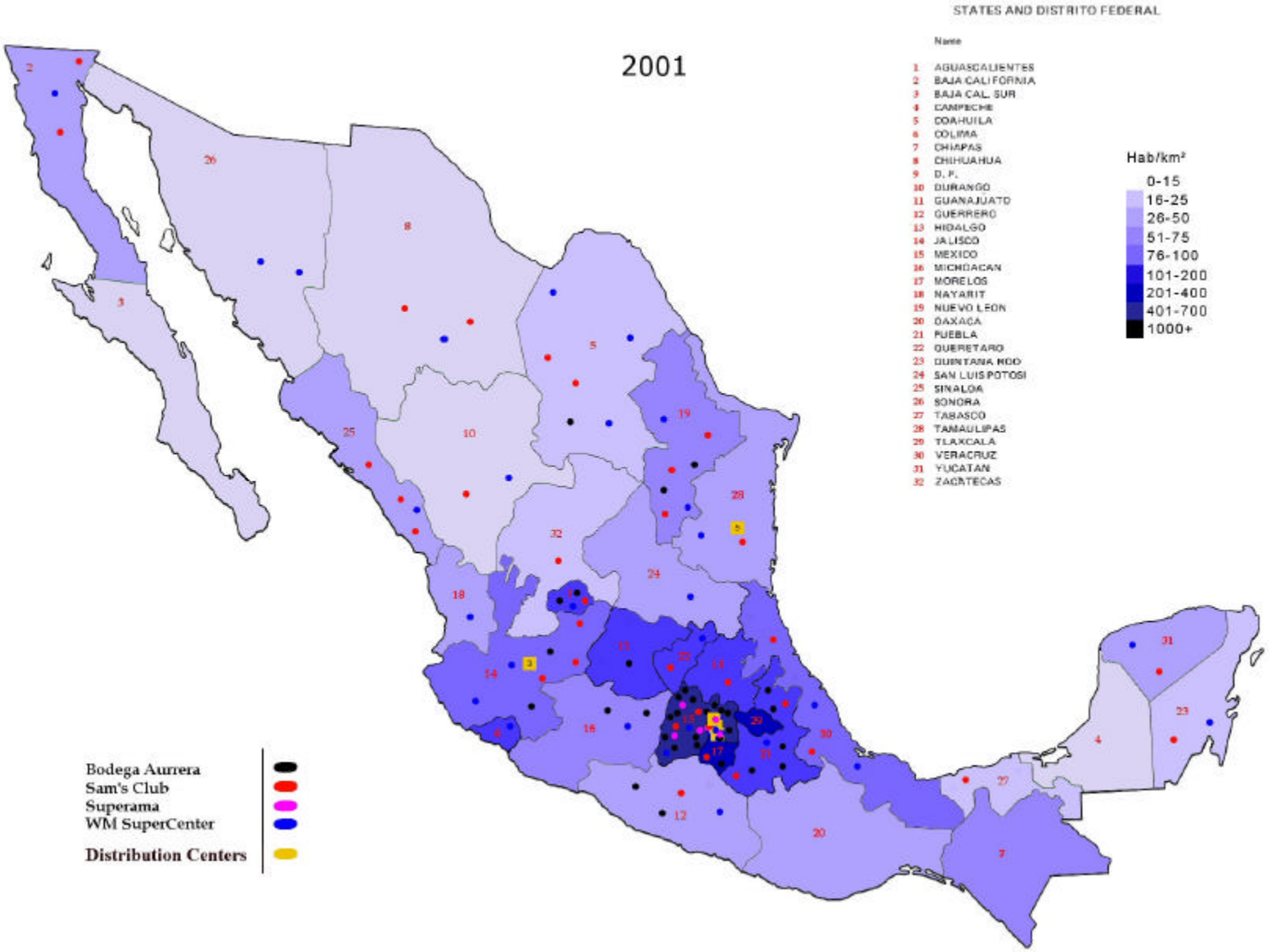
Hab/km²
0-15
16-25
26-50
51-75
76-100
101-200
201-400
401-700
1000+
Bodega Aurrera
Sam's Club
Superama
WM SuperCenter
Distribution Centers

FIGURE 3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29 TLAXCALA
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31 YUCATAN
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Hab/km²
0-15
16-25
26-50
51-75
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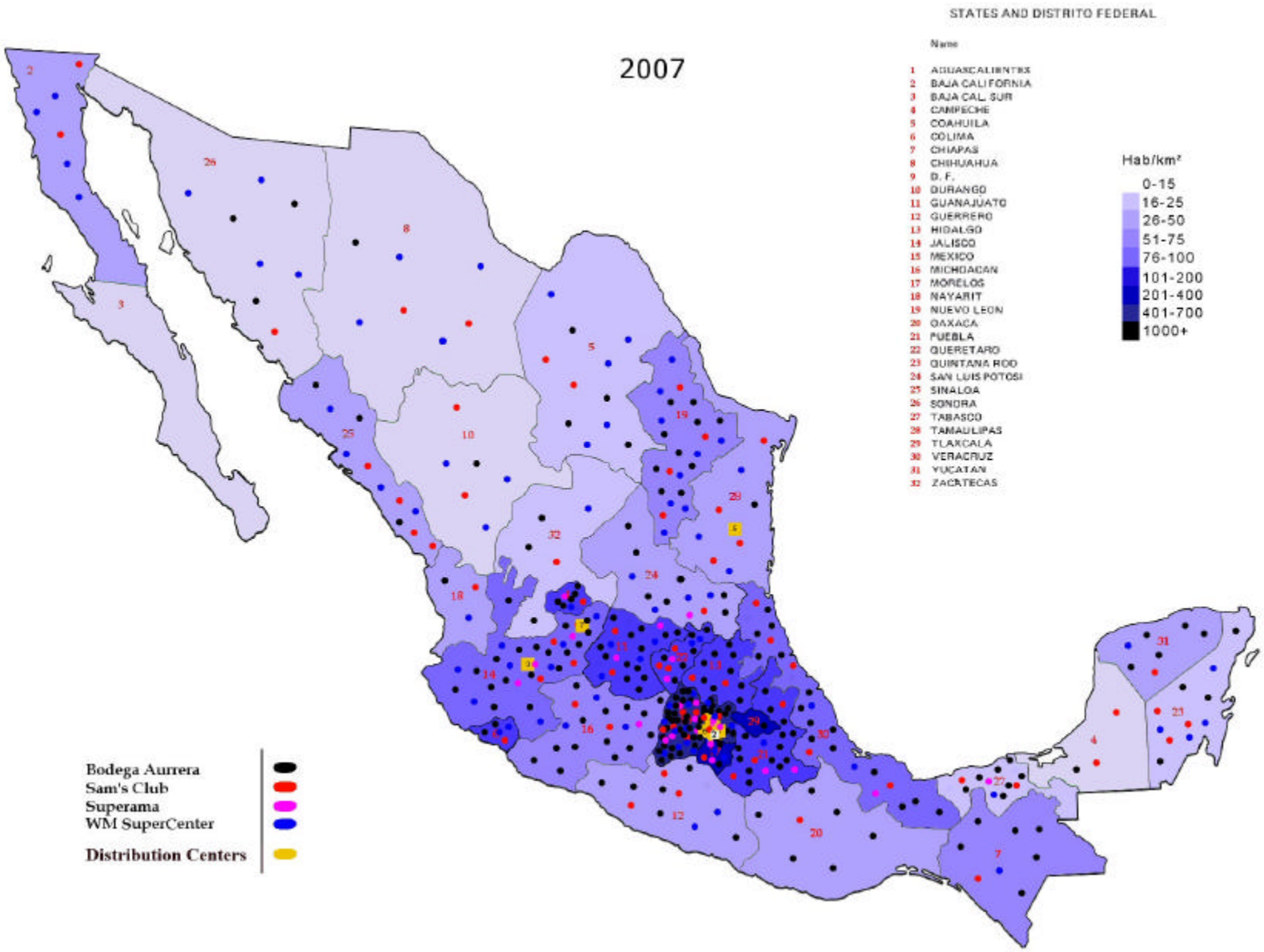
101-200
201-400
401-700
1000+
Bodega Aurrera
Sam's Club
Superama
WM SuperCenter
Distribution Centers

FIGURE 4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Hab/km²
0-15
16-25
26-50
51-75
76-100
101-200
201-400
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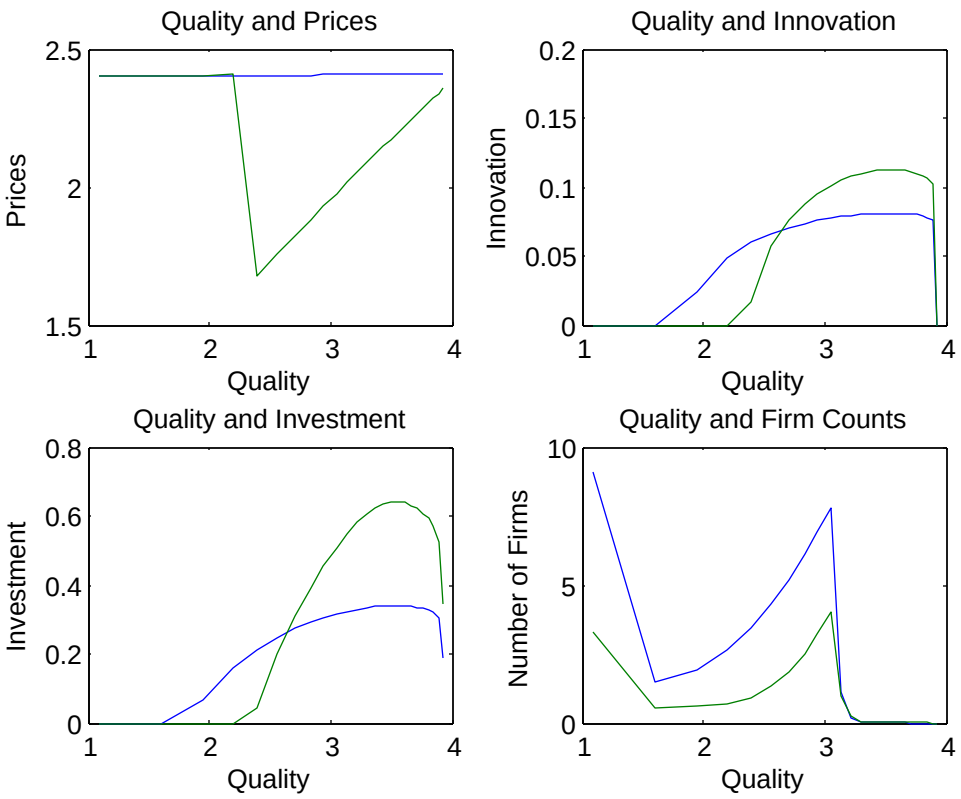
1000+
Bodega Aurrera
Sam's Club
Superama
WM SuperCenter
Distribution Centers

Figure 5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1.5
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Quality
Quality and Innovation
Innovation
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0.05
0
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2
3
4
Quality
Quality and Investment
Investment
0.8
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3
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Quality
Quality and Firm Counts
Number of Firms
10
5
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1
2
3
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Quality