Dynamic Franchising Decisions*

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Abstract

We develop a tractable dynamic oligopoly model for retailing, in which forward-looking firms strategically choose expansion plans taking into account of the costs and revenues of franchising and corporate outlets. We estimate this model in the market for convenience-store industry in Japan. First, we demonstrate noticeable differences in expansion strategies across ownership types. Second, we confirm that franchisee-run outlets generate higher revenues (all else held equal) than their corporate-run counterparts. Finally, our sunk cost estimates reveal that it is more costly to open (and close) corporate-run outlets than franchisee-run outlets. Our results suggest that both revenue and cost considerations are important drivers behind franchising decisions. Despite such benefits of expansion via franchisee-run outlets, our results also show that corporate-based expansion can still be rationalized, as franchisee-run outlets are more sensitive to cannibalization. Furthermore, our counterfactual analysis provides a salient connection between preemptive motives and expansion via corporate-run outlets, despite the inferred revenue and cost-based benefits of franchisee-run expansion. Finally, we show that a sudden increase in the share of corporate-run outlets may precede a threat of entry.

Keywords: Dynamic structural estimation, Encroachment, Entry deterrence, Franchising, Industry dynamics, Firm performance, Market structure, Moral hazard, Ownership structure, Resource scarcity, Retailing.

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1 Introduction

As retailers look to expand into new markets, franchising has become a key (and at times, default) instrument for increasing market coverage.[1] In light of the reliance of franchising in retail, this paper revisits the underlying motives behind decisions about organizational structure. There is vast literature on the drivers behind franchising decisions, which has been studied in organizational economics, strategic management, and marketing. Key motivators behind franchising may stem from a combination of factors related to revenue[2] (e.g., Brickley and Dark, 1987; Fan, Kuhn, and Lafontaine, 2013; Gal-Or, 1995; Kalnins and Lafontaine, 2013; Lafontaine and Slade, 1996; Lafontaine and Slade, 2007; Minkler, 1990), cost[3] (e.g., Combs and Ketchen, 2003; Martin, 1988; Oxenfeldt and Kelly, 1969) or both (e.g., Carney and Gedajlovic, 1991; Maruyama and Yamashita, 2010).[4] In contrast, an important motivator in favor corporate-based retail expansion would be the flexibility to expand without the threat of legal action from violating territorial agreements with franchisees (e.g., Azoulay and Shane, 2001; Barkoff and Garner, 1993; Blair and Lafontaine, 2005); flexibility to grow the brand (at the cost of cannibalizing own-brand sales) may be important to the chain if it faces strong preemptive motives[5] (e.g., Blair and Lafontaine, 2005; Hadfield, 1991; Igami and Yang, 2015; Michael, 2003). As pointed out in Page 220 of Blair and Lafontaine (2005):

> [T]he possibility that other chains might enter the market will affect a franchisor's decision as to the optimal location and density of its stores. Specifically, assuming that there are some sunk costs related to establishing a store in a particular location, it has been shown that one way to prevent entry by a competing chain or independent competitors would be to proliferate the number of outlets in the market or enter earlier than these competitors. Though franchisees also would want their franchisor to be aggressive in preventing entry or expansion by other firms, they are unlikely to agree with their franchisor as to the extent of intra-brand development that this entails.

Such opposing forces are likely to determine the extent of franchising in an industry. A few generic features about the franchise industry (across sectors) are worth noting. First, there

[1] See, for example, "10 Ways to Grow Your Business" (*Entrepreneur*, May 10, 2004).

[2] Revenues may improve with franchising for a few reasons. A commonly used argument is that franchising aligns incentives and helps circumvent agency issues such as moral hazard. It has also been posited that franchisees may have informational advantages about local demand.

[3] Costs may be reduced through franchising. In particular, when the chain faces a shortage in managerial expertise, outsourcing the management of outlets to franchisees may help alleviate this resource scarcity.

[4] We refer the reader to Blair and Lafontaine (2005) for a comprehensive survey of the franchising literature.

[5] Other benefits of rapid expansion may include efficiency gains from organizational learning (e.g., Sorenson and Sørensen, 2001) or development of brand capital (e.g., Meyer and Brown, 1979)

is considerable dynamics in the entry and survival of franchise chain outlets across industries (e.g., Kosova and Lafontaine, 2010).[6] Second, retail chains choose not only the number of outlets to open, but may also (at the same time) choose the mix of corporate-run and franchisee-run outlets (e.g., Lafontaine and Slade, 2007).[7] Finally, the mix of corporate-run and franchisee-run outlets is unlikely to be stable over time (e.g., Lafontaine and Kaufmann, 1994). These industry features motivate us to explore the underlying factors behind franchising from a different perspective by framing our analysis around a structural model that allows forward-looking and strategic firms to flexibly choose the composition of corporate-run and franchisee-run outlets over time as market conditions and structure evolve.

To study these opposing forces and how they impact organizational structure decisions, we introduce a new estimable model that allows forward-looking retail chains to choose how many corporate-run and franchisee-run outlets to open. Estimates from such a model provide insights about the revenue-based and cost-based drivers behind franchising. Evidence that franchisee-run outlets systematically generate higher sales would be consistent with the notion that franchising yields revenue-based benefits. Furthermore, the difference in the sunk costs of expansion between corporate-run and franchisee-run outlets would shed some light about the role of cost-based factors; for example, higher sunk costs for opening corporate-run outlets suggest shortages in capital and labor at the firm-level. Finally, the difference in cannibalization effects among corporate-run and franchisee-run outlets will help quantify the potential costs (accrued by the chain) of breaking territorial agreements in franchisor-franchisee contracts.

A dynamic retail expansion model is appropriate for studying the evolution of organizational form in franchise industries. Although a lot of attention has been placed on the proportion or mix of ownership-types across firms (and industries), we note that this proportion is often a result of an underlying expansion decision that is made across geographic market. That is, the proportion of corporate-run outlets is a result of years of expansion (or contraction) decisions. Furthermore, by focusing on the dynamic expansion decisions (that lead to certain franchising mixes), we can exploit even richer data variation. For example, if we see that 10% of stores are corporate-run, it could be because that 1 out of 10 outlets are corporate-run, or 10 out of 100, or 100 out of 1,000. Because the data generating processes that lead to 1 versus 100 corporate outlets are likely to be different (i.e., cannibalization concerns, market-specific heterogeneity, business-stealing from rivals, expectations about local

[6] There is generally less dynamics observed in terms of contract terms. For example, Lafontaine and Shaw (1999) find evidence of persistence in the royalty rates and franchisee fees.

[7] Past studies have found that adaptation and flexibility is important for the performance and survival of franchisors (e.g., Castrogiovanni, Justis, and Julian, 1993; Szulansk, Jensen, and Lee, 2003; Yin and Zajac, 2004).

market conditions, sunk costs), being able to distinguish between these cases may be important for understanding the demand and supply-side considerations behind retail expansion, and thus, has implications on the role of various factors in franchise decisions. Finally, dynamic expansion models often are set under the context of local geographic markets, which is especially appropriate if cannibalization is a relevant concern (Blair and Lafontaine, 2005).

We estimate the model using a comprehensive data-set from the convenience-store industry in Japan from 1982 to 2001. The data-set we use contains rich information about the number of corporate-run and franchisee-run outlets across geographic markets, as well as revenues generated by each of these ownership types; to the best of our knowledge, this study is the first to make use of such granular data about performance dynamics across different organizational forms. This setting is ideal for studying dynamic strategic motives in franchising decisions. First, the convenience store industry (especially in Japan) has been widely cited as one where firms potentially engage in preemption via market saturation.[8] Second, as the share of corporate-run outlets/sales versus franchisee-run outlets/sales exhibits noticeable variation over time. Furthermore, we see a lot of variation in these shares across markets and time, where some of this variation can be explained by local market conditions such as population, income, property value, minimum wage, and market structure (as demonstrated in our reduced-form policy function approximations). In this industry, the proportion of corporate-run outlets follows a non-monotonic pattern, as it was initially decreasing for several years, but experienced a rapid rise in recent years. The non-monotonic pattern suggests a potential counteracting force that works against revenue-based and cost-based concerns, such as disproportionate cannibalization costs.

Motivated by the rich reduced form patterns in our data, we estimate the model using a combination of techniques introduced by Ellickson and Misra (2012) and Bajari, Benkard, and Levin (2007). The Ellickson and Misra (2012) method allows us to perform revenue regressions that take into account potential selection biases, while the Bajari, Benkard, and Levin (2007) procedure allows us to incorporate forward-looking behavior. The setting we study provides a unique opportunity to look at the joint expansion and franchising decisions, as we are able to observe store counts and revenue across markets broken down based on whether the outlets are corporate-run or franchisee-run. To the best of our knowledge, this study is the first to utilize and analyze such detailed retail chain information. The richness of our data then allow us to estimate the dynamic retail chain expansion model that accounts for heterogeneity across ownership types (i.e., corporate versus franchisee). To further depart from the typical retail entry literature, we model jointly the simultaneous decisions about how many corporate-run and franchisee-run outlets to open.

[8]See, for example, "Corporate Sardines" (*The Economist*, May 3, 2014).

Our estimated model reveals many differences between corporate-run and franchisee-run outlets. First, we show that the policy functions are different across ownership types. Second, our revenue regressions reveal that franchisee-run outlets systematically generate higher sales than their corporate-run counterparts. Third, our sunk cost estimates show that the cost of expanding via corporate-run outlets is higher than the cost of expanding via franchisee-run outlets. Thus, our results appear to support both the revenue-based and cost-based hypotheses that have been posited in past franchising literature. Furthermore, we show that each franchisee-run outlet are cheaper to open, and at the same time, each franchisee-run outlet generates more sales (all else held equal) than its corporate-run counterpart; such comparisons suggest that cost-based factors may play a slightly larger role than revenue-based factors. Interestingly, simulation analysis using the estimated model suggests that despite these underlying motivators behind franchising, the chain as a whole may be better off in some situations by expanding via corporate-run outlets. Finally, we highlight that preemptive motives may explain why retail chains still expand via corporate-run outlets, even when there are revenue and cost-based benefits of expansion via franchisee-run outlets.

We proceed as follows. First, we conclude this section by providing a brief overview of related literature. In Section 2, we provide more descriptions about the empirical setting we study. Section 3 lays out the model of organizational structure dynamics under the context of retail chain expansion. The estimation procedure is discussed in Section 4. Given the novelty of the model we propose and estimate, we embark on a simple numerical exercise to demonstrate equilibrium existence as well as highlight interesting properties of the equilibrium in Section 5. Our main findings from the estimated model are summarized in Section 6. Finally, we provide concluding remarks in Section 7.

1.1 Related Literature

Comparisons between the performance of corporate-run and franchisee-run establishments is an active area of research, and the cross sectional variation in the mix of these types, or "plural form," has been well-documented in past work (e.g., Bradach, 1997; Thompson, 1994). In general, the results have been mixed in terms of which ownership type performs better in optimizing revenue and minimizing costs. For example, Kosová, Lafontaine and Perrigot (2013) find that corporate-run establishments perform better or at least as well as franchisee-run establishments. But in contrast, Caves and Murphy (1976), Lafontaine (1992), Martin (1988), and Shelton (1967) find the opposite. Furthermore, Novak and Stern (2008) show that vertical integration has a negative relationship with short-run performance. We contribute to this literature by making endogenous the organizational form decision itself, by analyzing this decision under the context of ownership-specific retail expansion across time. Such a model provides further insights into primitives that may be driving one ownership-type choice over another, and ultimately, consequences of such choices. More generally, research that study franchising decisions have focused on static settings absent forward looking incentives (e.g., Blair and Lafontaine, 2005; Dant and Kaufmann, 2003; Lafontaine and Shaw, 2005; Minkler and Park, 1994; Scott, 1995).

Our work also contributes to the growing literature about retail entry and expansion dynamics (e.g., Beresteanu, Ellickson, and Misra, 2010; Blevins, Khwaja, and Yang, 2015; Hollenbeck, 2013; Igami and Yang, 2015; Nishida, 2013a, 2013b; Nishida and Yang, 2015; Suzuki, 2013; Toivanen and Waterson, 2005; Yang, 2013). We depart from this literature by focusing not only on the entry or expansion decision itself, but also the organizational form decision. Being able to distinguish between expansion via corporate-run stores and franchisee-run stores provides us an added layer of richness to study the underlying franchising decisions, especially so given that we also have ownership-specific revenue across markets.

Finally, this paper complements research about retail cannibalization and preemptive motives. For example, prior work has studied cannibalization, encroachment, or own-brand business stealing effects in the convenience store (e.g., Nishida, 2013b), discount retail (e.g., Jia, 2008), fast food (e.g., Igami and Yang, 2015; Pancras, Sriram, and Kumar, 2012; Thomadsen, 2005), hotel (e.g., Jap and Kim, 2015; Kalnins, 2004; Mazzeo, 2002), and luxury fashion (e.g., Ngwe, 2013) retail sectors. With detailed sales data from both corporate-run and franchisee-run outlets, we add to this literature by determining the extent to which encroachment impacts these different ownership types. Being able to identify heterogeneous cannibalization effects across ownership types may help us better understand the discrepancy in perceived optimal number of outlets between franchisees and franchisors; theoretically, it can be shown that franchisors would prefer a larger number of outlets than franchisees (Blair and Lafontaine, 2005). There is considerably less empirical work on preemptive motives in the retail chain industry, largely because of the challenges associated with detecting such incentives when they are not directly observable in data. Much of the work has focused on how firms react (via entry) under the threat of preemption, as proliferation into new markets may become more rapid as the number of potential entrants grows (Bonanno, 1987); some examples of empirical work along this line include Goolsbee and Syverson (2008), Seamans (2012), and West (1981). One notable exception that investigates the underlying motive itself is Igami and Yang (2015), who develop a simple counterfactual that can effectively switch off the preemptive motives. Going beyond Igami and Yang (2015), our objective is not solely the detection of preemptive motives, but whether or not preemptive motives is associated with franchising mix decisions.

2 Empirical Setting

In this section, we describe the data used in our analysis. Furthermore, we illustrate key patterns in the dynamics of expansion and sales across corporate-run and franchisee-run outlets.

2.1 Data Description

For our analysis, we use data from the convenience-store chains in Japan. We define each market as a prefecture. This market definition yields 47 independent geographic markets. This definition is then used to link annual store counts/sales to each geographic market. The store counts/sales data is obtained from annual financial statements of the six largest convenience-store chains, namely, 7-Eleven, LAWSON, Family Mart, circle K, sunkus, and ministop. As for the time periods, we focus on the years 1982 to 2001. Because of inflation, we deflate nominal sales across years by using the annual GDP deflator from the Cabinet Office. Note that our data differs from past research that has studied a similar setting (e.g., Nishida, 2013a, 2013b; Nishida and Yang, 2015), in that our store counts and sales are further dichotomized based on ownership type (i.e., corporate-run, franchisee-run).

The market characteristics we use include population density, income, hourly minimum wages, and property value. The population information is obtained from the Census Bureau at the Ministry of Internal Affairs and Communications. Income data is obtained from the Cabinet Office. Hourly minimum wages are found in the Annual Handbook of Minimum Wage Decisions from the Ministry of Health, Labour and Welfare.[9] Finally, we get the property value data from Ministry of Land, Infrastructure, Transport and Tourism publications.

Table 1 provides a set of summary statistics from this data. In general, the number of franchisee-run outlets exceed the number of corporate-run outlets. Furthermore, we see a similar comparison when we focus on sales. Another way of showing this pattern is by calculating the proportion of corporate-run outlets and sales, which we display in Table 2. This table confirms that in general, there are disproportionately fewer corporate-run outlets, and consequently, they contribute a small percentage of the total sales. A few additional observations are in order. First, the proportion of corporate-run outlets is in general no greater than 9%, which is in line with Lafontaine and Shaw (2005), who document similar proportions across various franchise industries. Second, it is interesting to note that this

[9] See Kawaguchi and Yamada (2007) for more details about the minimum wage data.

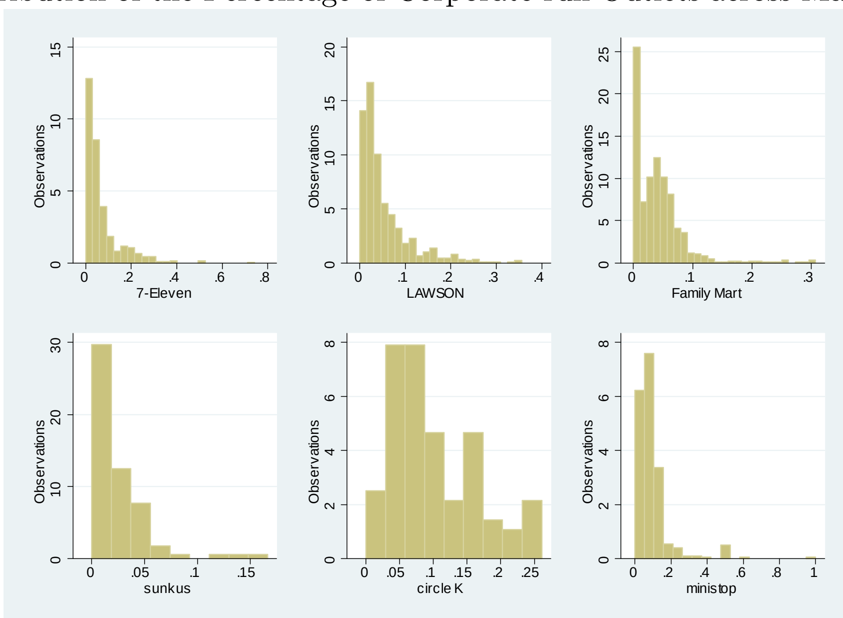
Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Number of corporate-run outlets					
7-Eleven	5.8465	12.4567	0	148	1244
LAWSON	9.6675	30.2635	0	409	800
Family Mart	3.7045	8.9364	0	92	1279
sunkus	0.3179	1.8046	0	23	736
circle K	1.3514	5.4121	0	64	737
ministop	1.7095	4.7802	0	40	1439
Number of franchisee-run outlets					
7-Eleven	110.9703	197.6785	0	1311	1244
LAWSON	113.0063	151.6288	0	877	800
Family Mart	76.3829	144.5553	0	1019	1272
sunkus	12.0584	46.1287	0	410	736
circle K	15.2795	70.765	0	735	737
ministop	18.735	46.5680	0	285	1438
Sales of corporate-run outlets					
7-Eleven	899.6721	2119.4339	0	29668	1244
LAWSON	1653.7938	5265.6630	0	85094	800
Family Mart	512.0128	1344.9574	0	15213	1270
sunkus	45.8534	263.764	0	3335.64	736
circle K	160.1734	681.019	0	8438	737
ministop	236.2888	698.9484	0	5759	1402
Sales of franchisee-run outlets					
7-Eleven	25564.2586	48546.5122	0	332870	1224
LAWSON	18632.8825	26112.3284	0	163090	800
Family Mart	13235.0067	27871.8521	0	212651	1159
sunkus	2112.5925	8525.6606	0	82886	736
circle K	2652.0342	13233.2042	0	149495	737
ministop	2674.5477	7358.3389	0	50602	1386
Market characteristics					
Population density	0.6319	1.0968	0.0654	6.0383	1504
Income	2590.8465	538.3013	1347.643	5232.2506	1363
Land price	170522.4804	210785.0229	28426	2517346	1457
Minimum wage	575.2168	104.9705	358	869	1504

Table 2: Proportion of Corporate-run Outlets or Sales

	Outlets	Sales
7-Eleven	0.053	0.038
LAWSON	0.079	0.081
Family Mart	0.045	0.04
sunkus	0.025	0.021
circle K	0.08	0.056
ministop	0.087	0.081

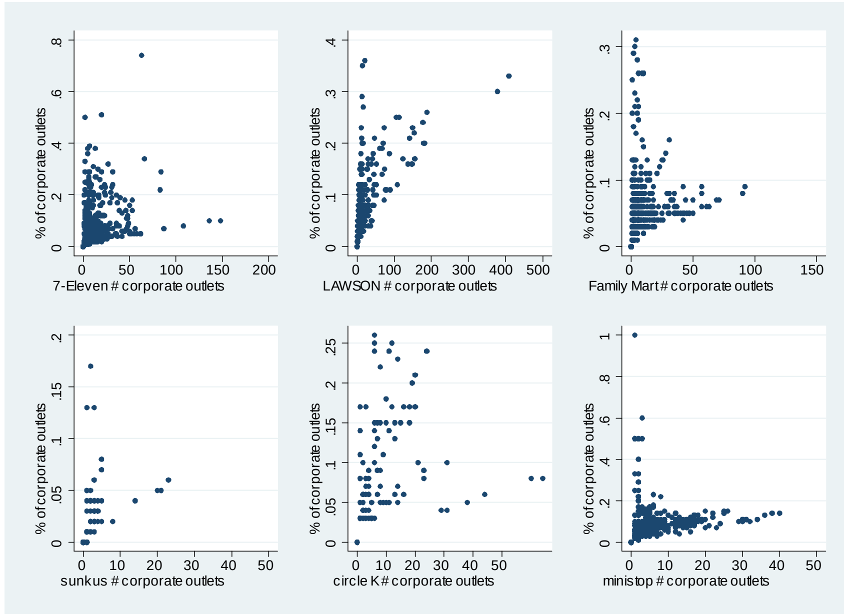
Figure 1: Distribution of the Percentage of Corporate-run Outlets across Markets and Time



proportion does not vary drastically across chains, which suggests that their franchising contracts (i.e., royalty rates, terms and conditions) are fairly uniform and likely follow an industry standard.

In Figure 1, we display a set of histograms for the percentage of corporate-run outlets. From these histograms, it is apparent that the percentage is skewed towards smaller values, which should not be surprising given our earlier summary statistics. The distributions for these proportions also look qualitatively similar across the chains, with the exception of circle K. Despite the skewness in these distributions, we do see observations in which the proportion of corporate-run outlets exceeds 9%. In fact, this proportion can potentially be as high as 75% in some market-time observations. This diagram highlights rich variation in our data across markets, and across time. Our subsequent analysis will summarize some of the general patterns in the dynamics in franchising.

Figure 2: Variation in Number of Corporate-run Outlets Across Franchising Mixes



Next, we demonstrate the additional richness in variation if one focuses on the expansion and contraction patterns, as opposed to a measure like the franchising mix. Figure 2 provides a scatter plot where the horizontal axis represents the number of corporate-run outlets, while the vertical axis represents the proportion of corporate-run outlets. These scatter plots demonstrate that conditional on franchising mix, there is enormous variation in the number of corporate-run outlets. For example, in markets where 7-Eleven operates about 5% corporate-run outlets, the number of corporate-run outlets can range from 1 up to 150.

2.2 Dynamics of Expansion and Franchising Decisions

In this section, we illustrate some basic patterns of dynamics found in the data. First, we summarize the dynamics seen in aggregate expansion and sales numbers. Figure 3 provides the evolution of store count, while Figure 4 presents the evolution of sales. These figures illustrate that overall, the number of outlets and total sales have been steadily increasing over time.

Next, we investigate how the share of corporate-run outlets changes over time. Figure 5 summarizes these patterns. The graph demonstrates considerable time-series variation in the proportion of corporate-run outlets. For some chains such as 7-Eleven, LAWSON, and Family Mart, the proportion of corporate-run outlets diminishes over time, but at some point, this proportion increases. In contrast, the proportion of corporate-run outlets appears to have an upward trajectory for sunkus and circle K. For ministop, the overall trend over

Figure 3: Evolution of the Total Number of Outlets

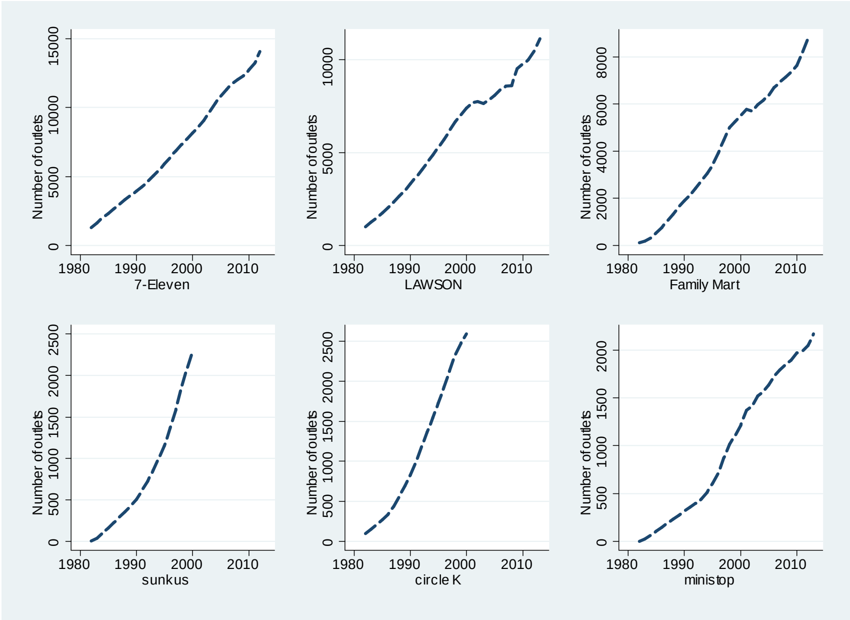


Figure 4: Evolution of Total Sales

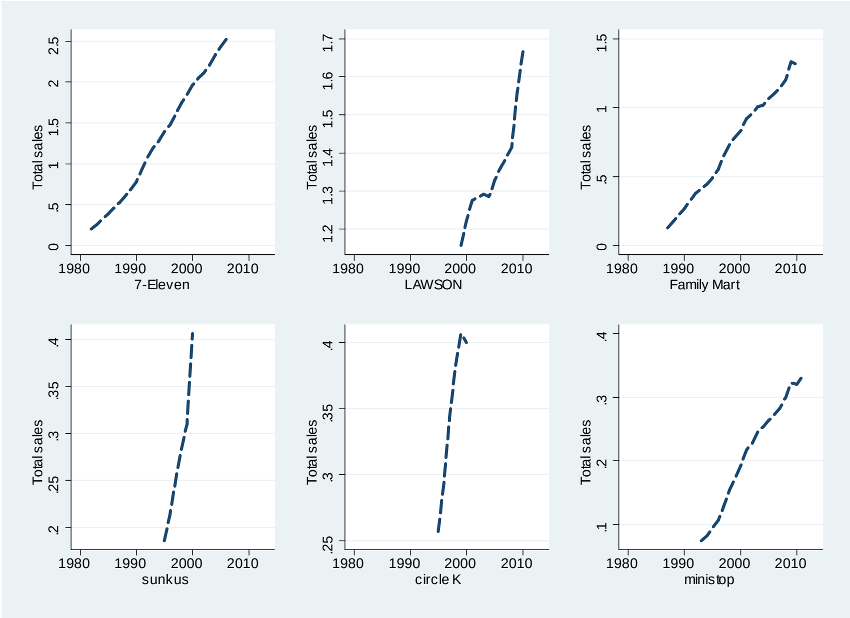
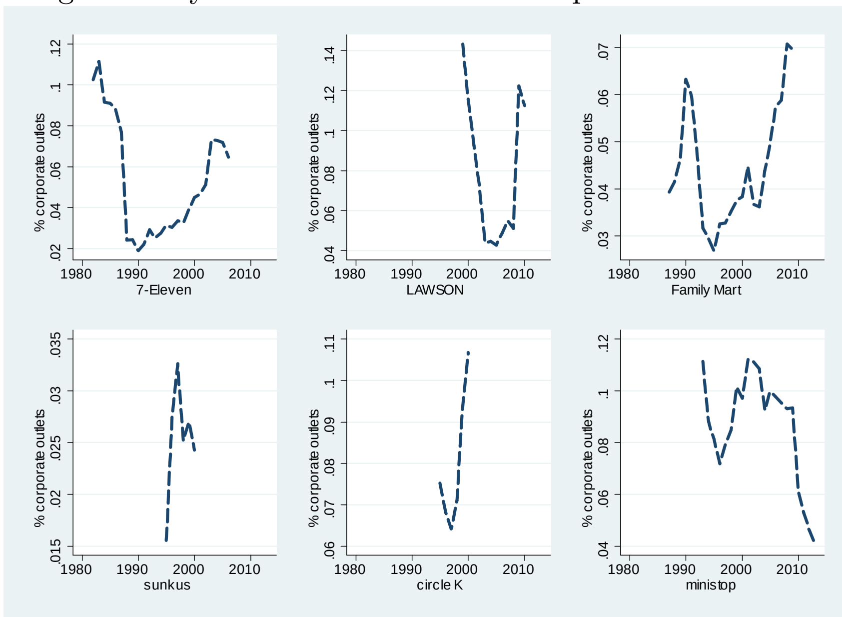


Figure 5: Dynamics in the Share of Corporate-run Outlets



time is a decreasing share of corporate-run outlets. Furthermore, the changes in this share is quite drastic, and in some cases, the share can decrease by as much as 10%.

Similarly, we explore the dynamics in the share of sales from corporate-run outlets in Figure 6. In general, these sales patterns are similar (but not identical) to those exhibited in the share of corporate-run outlets. As in the share of corporate-run outlets, we see the minimum reached in 1990, 2005, and 1995 for 7-Eleven, LAWSON, and Family Mart, respectively. At their lowest points, the shares of corporate-run sales can be as low as 2%, 4%, and 2.5% for 7-Eleven, LAWSON, and Family Mart, respectively.

Finally, we investigate whether or not the amount of market power varies across ownership types. Figure 7 plots the Herfindahl-Hirschman Index (HHI) over time constructed using various measures. The first measure (solid line) is calculated using the HHI based only on corporate-run sales, while the second measure (dashed line) is calculated using the HHI based only on franchisee-run sales. This diagram shows that the corporate-based and franchisee-based HHI measures follow similar overall trends over time; however, there are clear differences in the HHI measures during certain periods. For example, the corporate-based HHI trajectory lies below the franchisee-based HHI trajectory prior to 2000, and after 2000, both trajectories exhibit a lot of overlap. This pattern suggests that for a period of time, sales from franchisee-run outlets are concentrated towards a small set of chains with market power, while corporate-run outlets appear to operate in more competitive local markets.

These raw data patterns provide us evidence that the proportion of corporate-run outlets

Figure 6: Dynamics in the Share of Corporate-run Sales

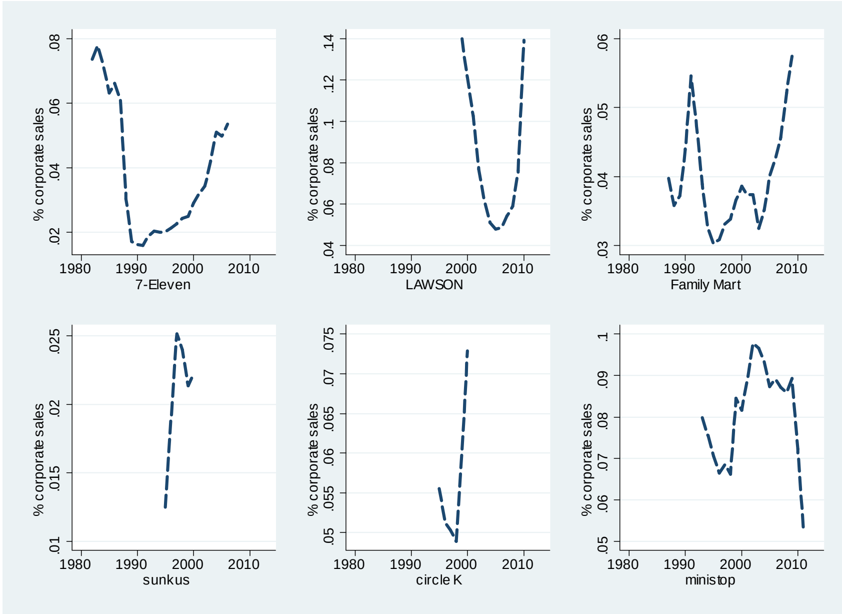
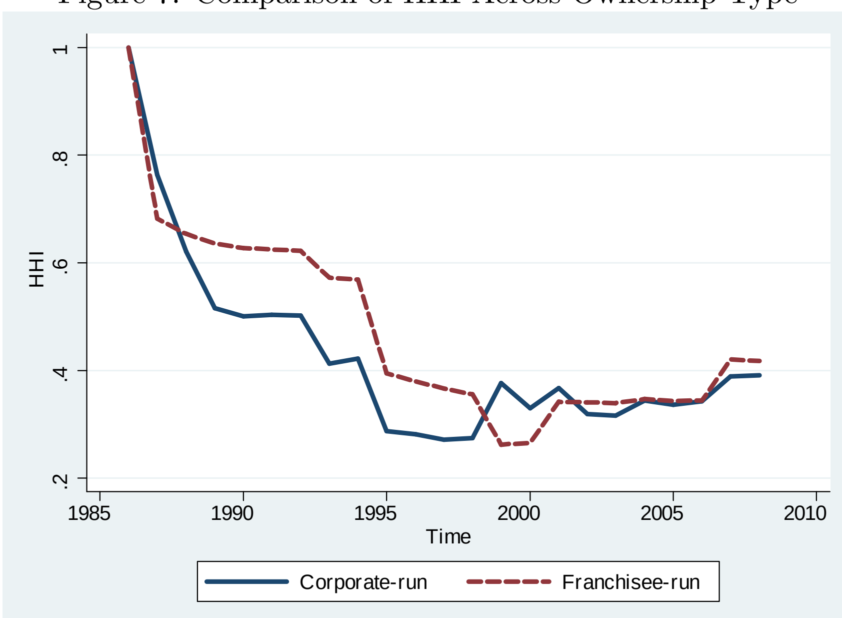


Figure 7: Comparison of HHI Across Ownership Type



and sales exhibit noticeable intertemporal variation. Furthermore, this intertemporal variation ultimately translates into different evolutions of market power depending on ownership type. Such patterns warrant a closer look at franchising decisions, from a perspective that takes into account dynamic oligopolist behavior.

3 Model

This section describes the model of retail expansion that will be estimated. Our model extends the retail expansion models used in Blevins, Khwaja, and Yang (2015) and Nishida and Yang (2015) by disaggregating the expansion decision into simultaneous choices about the number of corporate-run outlets to open (or close) and the number of franchisee-run outlets to open (or close).

3.1 Basic Setting

We consider a model with I forward looking firms in a retail industry. At the beginning of each time period t, each firm i decides how many new stores to add or subtract in market m. The type of outlet is denoted as $k \in \{C, F\}$, since a store is run by either the corporation (C), or franchisee (F). The firm simultaneously chooses both the number of corporate-owned outlets ($n^C_{imt} \in A$), and franchised outlets ($n^F_{imt} \in A$) that will be opened or closed in market m and time t, where $\mathcal{A} = \{-A, ..., -1, 0, 1, ..., A\}$ is the set of all feasible actions the firms can take.

Given these decisions, the total number of active corporate-owned and franchised outlets evolve according to $N^C_{imt} = N^C_{imt-1} + n^C_{imt} \leq \bar{N}$ and $N^F_{imt} = N^F_{imt-1} + n^F_{imt} \leq \bar{N}$ respectively. Here, denote the total number of outlets as $N_{imt} = N^C_{imt} + N^F_{imt}$, and the current period's market structure as $N_{mt} = \{N_{imt}\}_i$. Since firms are forward looking, they will be maximizing the discounted profit stream $\sum_s \rho^s \Pi_{imt+s}$, where Π_{imt+s} is the one-shot payoff as defined by

$$\Pi_{imt} = R(n_{imt}, n_{-imt}, N_{imt-1}, N_{-imt-1}, Z_{imt}) - C(n_{imt}, N_{imt-1}, N_{-imt-1}, Z_{imt}).$$

In the one-shot payoff, $R(\cdot) = \sum_{k \in \{C,F\}} R^k(\cdot)$ is the total revenue that the firm receives from operating N_{imt} outlets, while $C(\cdot)$ are the sunk costs associated with adding or subtracting n_{imt} outlets. Furthermore, payoff relevant state variables are captured by the vector Z_{imt}. Note that the revenue function can be written as,

$$R^k(\cdot) = N^k_{imt} r^k_{imt}(Z_{imt}, N^C_{imt}, N^F_{imt}, N_{-imt}) + \omega^k_m + \varsigma^k_{1imt} + \xi^k_{1imt},$$

where $r^k_{imt}(\cdot)$ is the per-store revenue represented by the following

$$r^k_{imt}(\cdot) = \alpha^k_1 + \alpha^k_2 Z_{imt} + \alpha^k_3 N^C_{imt} + \alpha^k_4 N^F_{imt} + \alpha_5 N_{-imt}.$$

Based on this specification of revenue, we see that total sales is a function of the total number of outlets multiplied by the average per-store profits (in the brackets). A few observations are in order. First, we allow the cannibalization effects (α^k_3 and α^k_4), which depend on whether they are related to corporate or franchisee run outlets. Second, our specification for the revenue process allows for both private information (ς^k_{1imt}) and optimization error (ξ^k_{1imt}), as in Ellickson and Misra (2012). We assume that these shocks are i.i.d. and drawn from a Type I Extreme Value distribution. Finally, we allow for market-specific fixed effects (ω^k_m) in the revenue equation.

The sunk costs can be written as

$$\begin{aligned} C(\cdot) &= \beta_1 Z_{imt} + \beta_2 \cdot 1\{N_{imt-1} = 0, n_{imt} > 0\} \\ +\beta^C_3 \cdot 1\{n^C_{imt} &> 0\}n^C_{imt} + \beta^F_3 \cdot 1\{n^F_{imt} > 0\}n^F_{imt} \\ +\beta^C_4 \cdot 1\{n^C_{imt} &< 0\}n^C_{imt} + \beta^F_4 \cdot 1\{n^F_{imt} < 0\}n^F_{imt} + \beta^C_5 \cdot N^C_{imt} + \beta^F_5 N^F_{imt} + \varsigma^k_{2imt} + \xi^k_{2imt}. \end{aligned}$$

Key components of the sunk cost include the following. We allow cost-specific state variables to have an impact on costs (β_1). Ideally, these state variables will be different from the state variables in the revenue equation. The costs of entering are captured by β_2; such costs may include the cost of setting up a distribution network. Similarly, the expansion costs for corporate-owned and franchised outlets are represented by β^C_3 and β^F_3 respectively, while the contraction costs are β^C_4 and β^F_4. Furthermore, we allow for variable costs at the store level via β^C_5 and β^F_5. Finally, as in the revenue equation, we allow for both private information (ς^k_{2imt}) and optimization error (ξ^k_{2imt}).

In latter sections, we will summarize the set of model parameters as

$$\theta = (\alpha^k_1, \alpha^k_2, \alpha^k_3, \alpha^k_4, \alpha_5, \beta_1, \beta_2, \beta^k_3, \beta^k_4, \beta^k_5).$$

3.2 Equilibrium

We now define the Markov strategies that are used by the firms. Before describing these strategies, we note first that the pay-off relevant states are $S = (Z_{mt}, N_{mt-1})$. These strategies are $\sigma_i = (\sigma^C_i, \sigma^F_i)$, which consist of the corporate-run outlet strategy $\sigma^C_i : S \to \mathcal{A}$, and the franchise-run outlet strategy $\sigma^F_i : S \to \mathcal{A}$. Furthermore, n_i can be described as mappings from pay-off relevant states (S) to strategies (σ_i). Let $\sigma = \{\sigma_i\}_i$ be a Markov strategy profile. Assuming that the firms follow a Markov Perfect Equilibrium,[10] we know that they will choose a strategy profile σ^* such that for all i,

$$V_i(S;\sigma^C,\sigma^F|\sigma_i^*,\sigma_{-i}^*) \geq V(S;\sigma^C,\sigma^F|\sigma_i,\sigma_{-i}^*)$$

for all σ_i, where $V_i(\cdot)$ is the Bellman equation defined as:

$$V_i(S;\sigma^C,\sigma^F) = E[\Pi_i(S;\sigma^C(S),\sigma^F(S)) + \rho E(V_i(S';\sigma^C,\sigma^F)|S,n^C=\sigma^C,n^F=\sigma^F)|S]$$

Doraszelski and Satterthwaite (2010) lay out the key assumptions needed for existence of a MPE. At first glance, it is clear that our model satisfies most of the conditions. First, the state space in our model is bounded. That is, we restrict the total number of outlets a given market can have for a particular chain and ownership type to be $\bar{N}$. Furthermore, the observed market characteristics can be bounded if we make them discrete. Also, optimization and private information shocks are drawn from distributions with positive densities and connected support. Finally, there needs to exist a maximizer to the Bellman equation for any set of value functions. It is this last condition that we explore further in numerical analysis, as our model involves the joint decision of selecting how many corporate-run and franchisee-run outlets will be added.[11]

4 Estimation

To estimate the model, we proceed in three main steps. In the first step, we propose a flexible parametric estimator that approximates the corporate-run and franchisee-run expansion strategies across the firms. In the next step, we estimate revenue regressions that allow for potential selection biases using the method proposed by Ellickson and Misra (2012). Finally, using the approximated policy functions along with the estimated revenue equation, we estimate the sunk cost parameters via Bajari, Benkard, and Levin's (2007) forward simulation approach. Note that the standard errors are obtained using bootstrapping procedures.

[10] Refer to Ericson and Pakes (1995) for the general framework.

[11] Note that the assumption we make about the shocks suggest that the best response function is well defined and continuous in the set of choice probabilities, and by Brower's fixed point theorem, there should exist at least one equilibrium (Aguirregabiria and Mira, 2007).

4.1 Policy Function Approximation

In this section, we discuss the flexible parametric approach we use to approximate the policy functions. The main objects we are interested in are $P(\sigma_i^C|S)$ and $P(\sigma_i^F|S)$. We use a flexible sieve estimator to obtain $\hat{P}(\sigma_i^C|S)$ and $\hat{P}(\sigma_i^F|S)$. To obtain these choice probabilities, we evaluate the likelihood function of a flexible ordered probit model that approximates the reduced form policy function.

In particular, we estimate an ordered probit model where the discrete choice set is $\mathcal{D} = \{d_1, d_2, \ldots, d_D\} \subset \mathcal{A}$ with $d_1 < d_2 < \cdots < d_D$. These values may range from negative to positive, representing expansion and contraction decisions by firms. Each firm's decision depends on the value of a latent index, y_{imt}^k, which can be flexibly specified to depend on the relevant state variables. Let W_{mt} denote the vector of endogenous and exogenous state variables Z_{mt}, along with all distinct pair-wise interactions and squares. Furthermore, we include as part of the state variables market fixed-effects, as in Suzuki (2013). We use the following simple, but flexible linear specification for y_{imt}^k that includes higher-order terms and interactions:

$$y_{imt}^k = \phi \cdot W_{mt}^k + \nu_{imt}^k.$$

The final term, ν_{imt}^k, is an independent and normally distributed error term with mean zero and unit variance.[12] Decisions are related to the latent variable by a collection of threshold-crossing conditions:

$$n_{imt}^k = \begin{cases} d_1 & \text{if } y_{imt}^k \leq \vartheta_1 \\ d_2 & \text{if } \vartheta_1 \leq y_{imt}^k \leq \vartheta_2 \\ \vdots & \vdots \\ d_D & \text{if } \vartheta_{D-1} \leq y_{imt}^k \leq \vartheta_D \end{cases}.$$

The values $\vartheta_1, \ldots, \vartheta_D$ are the D cutoff parameters corresponding to each outcome. These cutoffs are estimated using sieve maximum likelihood along with the index coefficients. Let ϕ denote the vector of all first-stage parameters. Given data $\{n_{mt}, Z_{mt}\}_{t=0}^T$ for the entire sample of $m = 1, \ldots, M$ markets, consistent estimates of ϕ can be obtained by maximizing

[12] We normalize the variance of the error term to one because the coefficients in the payoff function are only identified up to scale.

the following likelihood function,

$$
\begin{aligned}
L_M(\phi) &= \prod_{m=1}^{M} \prod_{t=1}^{T} L_m(n_{mt} \mid Z_{mt}, \phi) \\
&= \prod_{m=1}^{M} \prod_{t=1}^{T} l_m(n_{mt}^C \mid Z_{mt}, \phi)\, l_m(n_{mt}^F \mid Z_{mt}, \phi).
\end{aligned}
$$

Note here that this likelihood is derived using the fact that the shocks $(\varsigma_{1imt}^C, \xi_{1imt}^C)$ and $(\varsigma_{1imt}^F, \xi_{1imt}^F)$ are not correlated with each other, which holds under the i.i.d. assumption that we impose on the private information and optimization error shocks. We do, however, allow for the potential impact that N_{imt}^F may have on n_{imt}^C, and N_{imt}^C may have on n_{imt}^F, and $(N_{imt}^C, N_{imt}^F) \subset Z_{mt}$.

4.2 Revenue Regressions

In a similar manner as Nishida and Yang (2014), our analysis makes use of the fact that we observe firm-specific revenues for corporate-run and franchisee-run outlets. Because of the potential selection bias in observed revenues that is induced by the underlying dynamic game of expansion, we make use of a propensity-based method by Ellickson and Misra (2012). More specifically, we run revenue regressions, with the inclusion of a control function $\Lambda(\hat{n}_{imt})$. Here, $\hat{n}_{imt} = (\hat{n}_{imt}^C, \hat{n}_{imt}^F)$ is the predicted number of opened/closed corporate-run and franchisee-run outlets as determined using the first stage policy approximation. For the control function, we make it a flexible function of $\hat{n}_{imt}$, which is approximated using high order polynomials. The set of revenue regressions $(R^C(\cdot), R^F(\cdot))$ for corporate-run and franchisee-run outlets are defined as:

$$
R^k(\cdot) = N_{imt}^k r_{imt}^k(Z_{imt}, N_{imt}^C, N_{imt}^F, N_{-imt}) + \Lambda(\hat{n}_{imt}^k) + \tilde{\omega}_{imt}^k
$$

where $\tilde{\omega}_{imt}^k = \tilde{\varsigma}_{1imt}^k + \tilde{\xi}_{1imt}^k$. To obtain $\hat{n}_{imt}$, we take the average number of outlets across simulations for a given market and time. Note that the private information assumption regarding ζ_{imt} helps simplify the problem, as this assumption allows us to decompose the joint selectivity problem into a collection of individual (firm-specific) selectivity problems.

As in Nishida and Yang (2014), we do not run revenue regressions for each possible alternative of n_{imt}, but instead use the predicted number $\hat{n}_{imt}$ via forward simulations as a sufficient statistic. Using $\hat{n}_{imt}$ reduces the dimensionality of our problem significantly. For example, if there are 10 expansion/contraction options a firm can make as to how many stores to subtract or add, and if we used a second order polynomial approximation for the control function, we would have to estimate 40 parameters alone for the selectivity correction component alone. This dimensionality problem in parameter space becomes worse if we wish to estimate firm-specific heterogeneity.

4.3 Forward Simulations

The final stage of our estimation proceeds using Bajari, Benkard, and Levin's (2007) forward simulation approach, which allows us to recover the structural parameters given the estimated first stage parameters ϕ. The estimated first stage parameters allow us to forward simulate the policies, exogenous state variables, and serially correlated unobserved states. To proceed with the inference, we assume that the data is generated by a single MPE strategy, which is a typical assumption when using two-step estimation methods. Unlike nested fixed-point estimation methods, this assumption does not require us to say anything about the particular equilibrium selection; we are only assuming that the equilibrium selection is the same across markets.

For any given initial state $S_1 = (N_0, Z_1)$, we can then forward simulate the following:

$$\begin{aligned}\bar{V}_{i,m}(S_1; \sigma^C, \sigma^F, \theta) &= \mathbb{E}\left[\sum_{\tau=1}^{\infty} \rho^{\tau-1} \Pi_{i,m}(\sigma^C(S_\tau, \varsigma_\tau), \sigma^F(S_\tau, \varsigma_\tau), S_\tau, \varsigma_{i\tau}; \alpha) \mid S_1, \sigma\right] \\ &\simeq \frac{1}{\bar{S}} \sum_{s=1}^{\bar{S}} \sum_{\tau=1}^{T} \rho^{\tau-1} \Pi_{i,m}(\sigma^C(S_\tau^s, \varsigma_\tau^s), \sigma^F(S_\tau^s, \varsigma_\tau^s), S_\tau^s, \varsigma_{i\tau}^s; \theta).\end{aligned}$$

Subscript s represents each simulation, where $\bar{S}$ paths of length T are simulated in the second stage. The term $\sigma(S_\tau^s, \varsigma_\tau^s)$ denotes a vector of simulated actions based on the policy profile σ. With this construction of forward simulated actions and payoffs, we can then consider perturbations of the policy function to generate B alternative policies. With each alternative policy, we can obtain the forward simulated profit stream using the previous two steps. We let b index the individual inequalities, with each inequality consisting of an initial market structure and state $S_1^b = (N_0^b, Z_1^b)$, an index for the deviating firm i, and an alternative policy $\tilde{\sigma}_i$ for firm i. The difference in valuations for firm i in market m using inequality b is denoted by

$$g_{i,b,m}(\hat{\sigma}, \theta) = \bar{V}_{i,m}(S_1^b; \hat{\sigma}, \theta) - \bar{V}_{i,m}(S_1^b; \tilde{\sigma}_i, \hat{\sigma}_{-i}, \theta),$$

where $\hat{\sigma} = (\hat{\sigma}^C, \hat{\sigma}^F)$. This difference should be positive in equilibrium, since off-equilibrium values should be lower than discounted profits under equilibrium play. Therefore, this criterion listed below identifies a $\hat{\theta}$ to minimize the violations of the equilibrium requirement:

$$Q(\theta) = \frac{1}{B} \sum_m \sum_i \sum_{b=1}^{B} (\min\{g_{i,b,m}(\hat{\sigma}, \theta), 0\})^2.$$

4.4 Identification

In order to assess the roles of revenue-based and cost-based factors, the model we estimate needs to be identified. We outline key sources of variation in our data that help identify the key model primitives.

The first components that we need to identify are the revenue functions for corporate-run outlets and franchisee-run outlets. We are especially interested in the ownership-specific fixed effects in the revenue regressions (i.e., intercepts). Identification of the revenue function follows from the fact that we observe the exact revenues (across markets) for corporate-run outlets as well as franchisee-run outlets. Furthermore, as we can control for market specific heterogeneity via observed controls and market fixed effects, the intercept terms will be identified through the regression. There is of course issues of selection, in that we only observe revenues for cases in which a chain has at least one outlet. For this reason, we use the selectivity corrections based on propensity scores, as proposed by Ellickson and Misra (2012).

There may potentially be omitted variables in the profitability of corporate-run and franchisee-run stores. To address such concerns, we ensure that our flexible policy function approximations incorporate market heterogeneity in the form of market fixed effects, as also done in Suzuki (2013). Furthermore, we allow these market fixed effects to vary depending on whether the policy function approximation is for corporate-run or franchisee-run expansion strategies. Because the policy functions are used to address selection biases in revenue, market specific unobserved heterogeneity is also controlled for in the revenue regressions.

Furthermore, we follow similar arguments for identifying strategic interactions. In particular, we rely on the exclusion restriction generated by entry, expansion, and contraction costs. The sunk costs are a function of a chain's past presence in the market, but not a function of its rivals' past presence. Therefore, a component of the profits is not universally relevant for all of the players.

Finally, we need to identify the sunk costs of entry, expansion, and contraction. In general, sunk costs are identified by variation in entry, expansion, and contraction that cannot already be explained by the fitted revenues. As an additional identification argument, we note that our specification includes market characteristics that are included in costs (i.e., land rent, minimum wage), but not revenue. Unlike past work that studies retail expansion, we wish to further dichotomize these costs based on ownership type. To separately identify corporate-specific and franchisee-specific sunk costs, we rely on variation in the relative number of corporate-run and franchisee-run outlets. In particular, we need this variation to be at the market and time level. Our earlier descriptive analysis confirms that such variation is present in our data.

5 Main Findings

5.1 Summary of Estimates

Table 3 shows the estimation results for the policy function. In our specification, we allow the policy functions to be heterogeneous across ownership type. The estimated policy functions reveal that expansion strategies are noticeably different across ownership type. First, the cross-ownership effects appear to be different across corporate-run and franchisee-run outlets, as corporate-run outlets react differently to the number of existing franchisee-run outlets, and vice versa. Furthermore, sensitivity to competition varies between corporate-run and franchisee-run outlets, as franchisee-run outlets appear to be especially deterred by the number of existing rival outlets; the fact that competitive conditions have an impact on corporate-run and franchisee-run expansion decisions further motivates the notion that these decisions are strategic in nature. Finally, we see that some of the observable market characteristics have differential effects on the expansion of corporate-run and franchisee-run outlets; in particular, minimum wage and distance to headquarters appear to have a negative impact on corporate-run expansion. The differential impact of distance to headquarters appears to be consistent with standard intuition from franchising; that is, corporate-run outlets need to be placed closer to headquarters because of revenue-based concerns, while franchisee-run outlets can be placed further away as the chain faces less pressure to monitor franchisees, whose incentives should be aligned with the firm. There are, however, some similarities between corporate-run and franchisee-run outlets, namely, population density and income have similar signed effects on expansion (albeit at different magnitudes).

More generally, the first-stage policy function approximation confirms that the expansion decisions depend largely on local market conditions, such as observable market characteristics and market structure. As the number of corporate-run and franchisee-run outlets are used to construct the often used franchising mix measures, we demonstrate here the importance of such granular data when studying drivers behind franchising decisions.

Table 4 reports the estimation results from the selectivity-corrected revenue regressions. As in the first-stage policy function estimation step, we allow for heterogeneity based on

Table 3: First-Stage Policy Function Approximation

	Corporate-run		Franchisee-run	
	Estimate	Std.Error	Estimate	Std.Error
Number of corporate-run outlets	-0.0837	0.0068	0.1068	0.0118
Number of franchisee-run outlets	0.0093	0.0005	0.0238	0.0011
Number of rival outlets	0.0011	0.0002	-0.0022	0.0005
Number of corporate-run outlets (squared)	2.9769	1.1652	-19.3281	2.8906
Number of franchisee-run outlets (squared)	-0.1640	0.0128	-0.6030	0.0343
Number of rival outlets (squared)	-0.0064	0.0011	0.0089	0.0041
Number of corporate-run outlets (cubed)	0.1130	0.5673	7.4144	1.2999
Number of franchisee-run outlets (cubed)	0.0118	0.0012	0.0409	0.0029
Number of rival outlets (cubed)	0.0001	0.0000	-0.0002	0.0001
Income	0.0281	0.0117	0.0970	0.0273
Population density	-2.0180	0.0940	-4.5577	0.9803
Minimum wage	-0.0004	0.0001	0.0009	0.0002
Land price	0.0018	0.0003	0.0042	0.0012
Distance to headquarters	-0.5203	0.1728	0.7515	0.2394

ownership type. The regression results highlight some key differences between corporate-run and franchisee-run outlets. First, the intercept term is markedly higher for franchise-run outlets (i.e., nearly double in size) as compared with corporate-run outlets. This result suggests that franchisee-run outlets are capable of generating more revenue than corporate-run outlets, which is consistent with the notion that franchising helps mitigate revenue-based issues in chain store management. Second, revenues at franchisee-run outlets are negatively impacted by the number of corporate-run outlets; this finding is consistent with what past work has uncovered under different industry settings (e.g., Kalnins, 2004). In contrast, the presence of other corporate-run and franchisee-run outlets has a positive effect on sales at corporate-run outlets, which suggests potential positive effects from encroachment; one may conjecture that the presence of other outlets belonging to the same chain increases brand awareness through quality investments and advertising efforts made by the company and franchisees (e.g., Blair and Lafontaine, 2005).[13] Finally, revenues at franchisee-run outlets are negatively impacted by the number of rival outlets.

As an aside, we would like to point out that income has a disproportionately larger effect on both the expansion and sales of franchisee-run outlets relative to corporate-run outlets. As income is likely correlated with housing wealth, we view these results as being consistent with Fan, Kuhn, and Lafontaine (2013), where they show that housing wealth (that can be collateralized) speeds up the growth of franchisee-run outlets.

Table 5 reports the cost function. As in the first-stage policy functions, and revenue

[13] A positive spillover from past size or experience is also consistent with Blevins, Khwaja, and Yang (2015), and Darr, Argote, and Epple (1995).

Table 4: Revenue Function

	Corporate-run		Franchisee-run	
	Estimate	Std.Error	Estimate	Std.Error
Intercept	126.7851	9.1781	173.1091	12.9051
Population density	-7.6864	1.2037	-7.4843	1.1254
Income	-0.0082	0.0039	0.0050	0.0048
Number of corporate-run outlets	0.0470	0.0249	-0.3946	0.0368
Number of franchisee-run outlets	0.0724	0.0048	0.1325	0.0069
Number of rival outlets	0.0249	0.0028	-0.0096	0.0031
n	-0.7499	0.7853	-490.8373	161.7552
n^2	4.8517	5.2339	25.1188	17.7087
n^3	-0.2107	0.2395	-0.3233	0.3534

Table 5: Sunk Cost Function

	Estimate	Std.Error
Entry cost	-53.2628	58.5539
Expansion cost (Corporate-run)	2.2544	0.8996
Contraction cost (Corporate-run)	-0.1354	0.9040
Expansion cost (Franchisee-run)	68.0086	87.1446
Contraction cost (Franchisee-run)	60.1827	56.1484
Minimum wage	-0.2723	0.0575
Land price	-0.2331	0.0356
Distance to HQ	-1.3985	1.8435
Variable cost (Corporate-run)	3.2885	0.9788
Variable cost (Franchise-run)	-5.9678	8.1470

estimates, there is considerable heterogeneity between corporate-run and franchisee-run outlets. In particular, the expansion cost for corporate-run outlets is noticeably higher than the expansion cost for franchisee-run outlets. This finding fits with the cost-based argument as posited in previous literature about franchising. Furthermore, we see similar patterns when we compare the contraction costs across ownership types. We conjecture that such a finding will emerge if franchisee-run outlets are often operated on real estate that is owned by the chain (e.g., Love, 1995); therefore, closing an outlet may have a higher scrap value due to real estate resale opportunities.

In summary, our results support both the revenue-based and cost-based hypotheses that have been proposed in past work. Because the model we estimate simultaneously captures both of these components, we can provide further insight into the relative roles of revenue-based and cost-based factors. For example, one can compare the corporate-run and franchisee-run intercept terms from the revenue equation. By comparing these intercepts, we

Table 6: Decomposition of Annual Sales in Scenario with Franchisee-run (Corporate-run) Outlets Being Switched to Corporate-run (Franchisee-run) Outlets

	Equilibrium	↑ corporate	Δ	↑ franchisee	Δ
Corporate sales	3692454.64	3856257.79	163803.15	3690943.79	-1510.85
Franchisee sales	14396323.39	14389613.86	-6709.53	14609394.92	213071.54
Total sales	18088778.03	18245871.65	157093.62	18300338.71	211560.68
Spillovers net cannibalization	6981667.32	7531614.52	549947.20	7084984.18	103316.86

see that all else held equal, franchisee-run outlets generate more revenue than corporate-run outlets. In contrast, the comparison of expansion costs reveal that each corporate-run outlet is more expensive to open relative to a franchisee-run outlet; we see similar patterns with respect to variable costs.

5.2 Evaluation of Franchising Performance

In this section, we explore further the underlying drivers behind franchising. The estimates themselves suggest that both revenue-based and cost-based considerations may play important roles in favor of franchising, while cannibalization concerns may dissuade chains from relying solely on franchisee-based expansion. To proceed, we use the estimated model to perform counterfactual analysis. The first hypothetical scenario we consider is one in which all the chains suddenly switch 10 of their franchisee-run outlets into corporate-run outlets in the initial period. Analogously, the second scenario considers a case when all of the chains switch 10 of their corporate-run outlets into franchisee-run outlets. We then forward simulate the industry dynamics as in Benkard, Bodoh-Creed, and Lazarev (2010) and evaluate how key performance measures, such as industry-wide sales, are affected by this hypothetical change in initial conditions.

Table 6 provides our findings from the counterfactual simulations. The simulations confirm that if the chains initially switch some of their franchisee-run outlets into corporate-run outlets in the first year, the average revenue per year from corporate-run outlets does indeed increase, as one would expect. At the same time, we see that revenues from franchisee-run outlets drop. Furthermore, we see converse effects when there are 10 additional franchisee-run outlets.

There are some differences in the effect that an influx of corporate-run or franchisee-run outlets has on revenues. Total sales appear to increase the most in the hypothetical scenario with additional corporate-run outlets in the initial period, as opposed to additional franchisee-run outlets. That is, despite the potential benefits of franchising as a way to mitigate revenue-based issues (i.e., higher intercept in revenue function for franchisee-run outlets), expansion via corporate-run outlets may actually leave the chain better off in terms of sales than the case in which expansion is relying solely on franchisee-run outlets. A larger portfolio of corporate-run outlets allows the chain to avoid additional legal or internalized costs associated with encroachment of pre-existing franchisees. Recall that it is only franchisee-run outlets that experience strong cannibalization effects from the presence of corporate-run outlets. To build on this conjecture, we compare the spillovers (from existing stores of the same brand) net of the negative cannibalization costs across the scenarios. This comparison demonstrates that the monetary value of spillovers net cannibalization is largest when corporate-run outlets are added as opposed to when franchisee-run outlets are added. Furthermore, these net positive spillovers explain a larger percentage of the increase in total sales (i.e., 20% when corporate-run outlets added versus 5% when franchisee-run outlets added).

5.3 Rationalizing Corporate-based Expansion

Our findings thus far have uncovered revenue and cost-based advantages of expansion via franchisee-run outlets. However, despite the benefits of franchisee-run expansion, we still see a sizeable proportion of outlets being run by the corporation. This section will propose one mechanism that may explain the presence of corporate-run outlets, despite the obvious benefits of franchisee-run stores.

One aspect of the organizational form decision that we have not fully explored is the potential trade-off between encroachment and preemption. That is, one source of friction that may prevent a chain from expanding without bounds may come from attrition in sales experienced by franchisee-run outlets when they are exposed to other stores of the same brand. Despite this potential friction, recall that it has been suggested by Blair and Lafontaine (2005) that franchisors have a strong incentive to expand quickly into markets as a means to deter competing brands from entering. Uncovering this preemptive motive along is difficult, let along demonstrating that such incentives explain the existence of corporate-run outlets.

To proceed, we adapt a recent strategy originally developed by Igami and Yang (2015). In their analysis of fast food chain expansion, they first estimate a fully dynamic game of retail expansion (and contraction). With the estimated model, they then highlight preemptive motives by considering a hypothetical scenario in which the incentive to preempt is shut down. To implement this hypothetical scenario, they consider a case in which the focal chain competes against rivals who form their strategies conditional only on their own size, and exogenous states, such as market size and own-brand presence; in other words, the rivals become non-strategic (from the perspective of the focal chain) as the number of focal chain's outlets are integrated out to form the conditional distribution of rival outlets. For our simulation analysis, we follow a similar approach, except our focus will be on how the mix of corporate and franchisee-run outlets changes when preemptive motives are eliminated. Another way to describe this counterfactual would be to draw on the conceptual framework from the literature about cognitive hierarchy (e.g., Camerer, 2003; Camerer, Ho, and Chong, 2004; Goldfarb and Xiao, 2011; Goldfarb and Yang, 2009), in which firms would be described as being type-0, type-1, type-2, and so on. A type-0 firm would act as though it is the only player in the market, a type-1 firm believes that its competitors act as though they are the only players in the market, and a type-2 firm acts as if its competitors are either type-0 or type-1. Specific to our counterfactual setting, one could interpret the focal chain as being type-1, while its non-strategic rival would be type-0.

5.3.1 Simulation Results

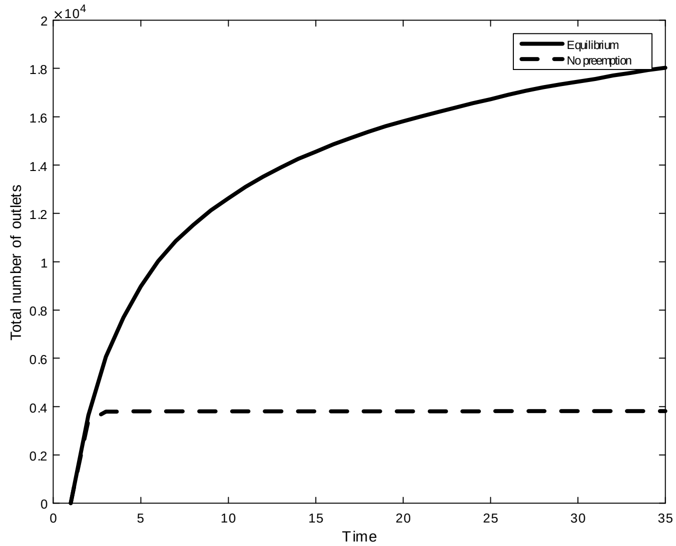
For the simulation analysis, we consider a calibrated version of the model presented. We consider a scenario in which there are two firms, who make decisions about how many corporate-run and franchisee-run outlets will be added or subtracted. In our data, such a setting would accurately depict a few actual markets, such as Niigata and Yamaguchi. Furthermore, we assume that the private information shocks are i.i.d. and follow a Type I Extreme Value distribution. Finally, we calibrate the parameters using the estimates obtained from structural estimation.

To find an equilibrium, we adopt the Pakes and McGuire (1994) iterative approach that stops once the conditional choice probabilities and value functions have converged. That is, we begin with an initial guess $x^0 = (V^0, P^0)$, and then apply the following iteration b for all states S,

$$x^{b+1} = G(x^b),$$

where $G(x^b)$ is a collection of best responses by firm 1 and 2 against strategies P^{b-1} and simulated value functions V^{b-1} based on those strategies. Other information we need to simulate the value functions include the transition probabilities for market characteristics. In this numerical example, we use population and income, that follow a similar Markovian process as in the Niigata and Yamaguchi prefectures. We then interpret convergence of this algorithm as suggestive evidence of equilibrium existence under the parametric assumptions

Figure 8: Dynamics of the Total Number of Outlets



we make about the model.[14]

Our iterative algorithm converges in fewer than 4 iterations. The fact that our algorithm converges suggests that we are able to locate one *ex ante* maximizer (i.e., strategies in probability space) of the Bellman equation for a given set of value functions generated based on our calibrated model. We first demonstrate the evidence of preemptive motives by comparing the trajectory of total outlets for the focal chain. Figure 8 plots this trajectory, and it is clear in this picture that eliminating the preemptive motive leads to considerably dampened retail outlet growth.

Figure 9 highlights a key finding from this counterfactual analysis. Here, we plot the proportion of outlets that are run by franchisees over time. In general, corporate-run outlets constitute a greater proportion of the total store count throughout the industry's evolution. The main pattern we see from the figure is that the proportion of corporate-run outlets to decline over time, which is consistent with the dynamics we see in other industries (e.g., Shane, Shankar, and Aravindakshan, 2006; Thompson, 1994). We attribute this pattern to the fact that corporate-run outlets face higher expansion costs. Furthermore, franchisee-run outlets can achieve higher revenues (as reflected through the higher intercept term). Most importantly, the comparison between the equilibrium and counterfactual proportion of corporate-run outlets highlights preemption as one plausible driver of corporate-based expansion, as we see markedly fewer corporate-run outlets (relative to franchisee-run outlets) when preemptive motives are muted.

We now look more closely at the implications for the timing of corporate-based expansion

[14] We use a tight convergence criterion of 10^{-8}.

Figure 9: Dynamics of the Proportion of Corporate-run Outlets

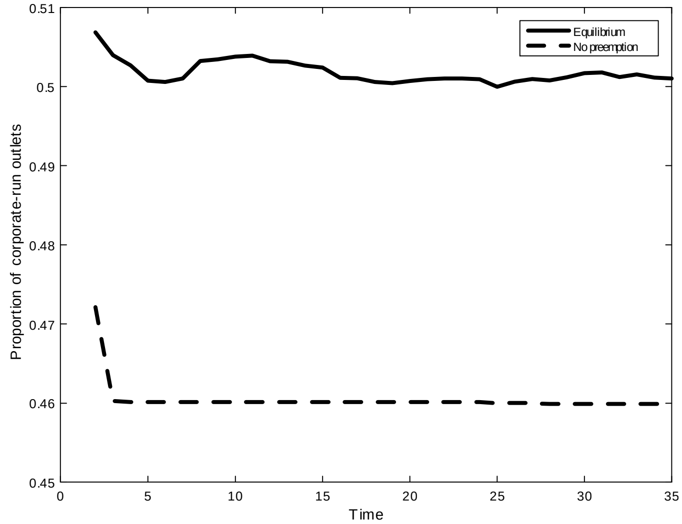
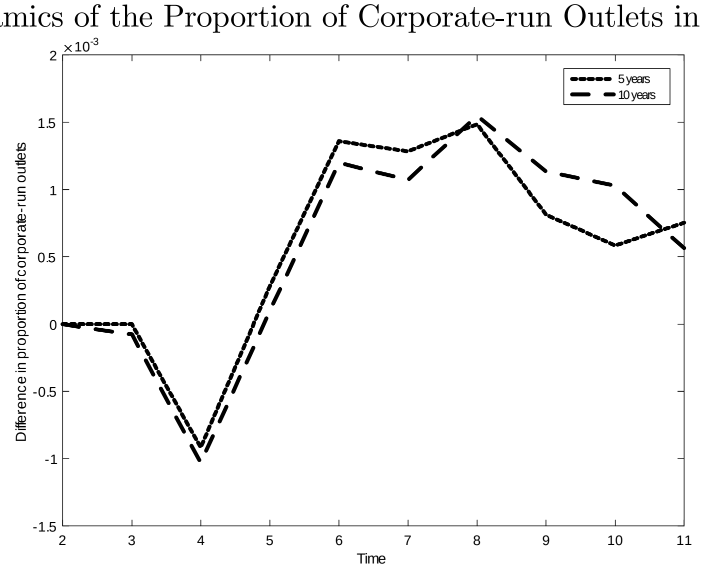


Figure 10: Dynamics of the Proportion of Corporate-run Outlets in First Ten Years



under the presence of preemptive motives. To explore these implications, we consider and compare three different scenarios. As in our previous exercise, we have a focal chain, which we leave unchanged in terms of its underlying model primitives. In contrast, the rival chain may feasibly be a potential entrant after 5 or 10 years. By varying the timing when the threat of entry materializes, we will also be changing the focal chain's underlying incentive to preempt the markets, as past theoretical and empirical work have demonstrated that firms may react preemptively under such threats (e.g., Bonanno, 1987; Goolsbee and Syverson, 2008; Seamans, 2012; West, 1981). Figure 10 summarizes the trajectory for the difference in proportion of corporate-run outlets (relative to the equilibrium scenario) for each of these counterfactual scenarios. A few insights emerge. First, we note that in year 4, there is a noticeably greater share of corporate-run stores for the focal chain when the threat of entry occurs after 5 years than when the threat of entry occurs after 10 years. Second, it appears that the proportion of corporate-run outlets is relatively largest in year 8 and 9 when the rival chain is a potential entrant after 10 years than when the rival chain is a potential entrant after 5 years. In summary, these results suggest that corporate outlets may be used disproportionately in years leading up to the expectation of a new potential entrant.

The stronger incentive to preempt markets via corporate-run outlets is consistent with the underlying estimated parameters. Namely, a key difference is that the cannibalization effects affect only franchisee-run outlets. Therefore, the potential long-run benefits of preemptive strategies are outweighed by the encroachment costs associated with cannibalization for franchisee outlets. In contrast, because of negligible costs associated with cannibalization for corporate-run outlets, any benefit from preemption is likely to outweigh the encroachment costs. It is interesting to note that even though franchisee outlets would suffer the most from encroachment related to preemptive entry, they may also benefit from keeping rival out of the market as their revenues are more sensitive to inter-brand competition.

6 Conclusion

This paper is the first to provide detailed analysis that incorporates both retail chain expansion and ownership structure decisions. By allowing ownership structure to play a role in explaining the industry dynamics, our estimated model is capable of reconciling contrasting ideas that have emerged from the franchising literature. We estimate this new model using data from the convenience store industry in Japan, which contains information about the number of outlets and total sales for all of the chains across geographic markets. The estimates reveal a number of interesting patterns. First, we demonstrate that corporate-run and franchisee-run outlets expand in different ways. Second, we show that revenues are generally larger for franchisee-run outlets. Finally, our cost estimates reveal that it is more costly to expand via corporate-run outlets as opposed to corporate-run outlets. In summary, our results provide evidence in favor of both revenue-based and cost-based explanations behind franchising incentives. However, cost-benefit analysis of franchising demonstrates that expanding via franchisee-run outlets need not be a strictly dominant strategy given the stronger cannibalization effects that franchisee-run outlets face relative to corporate-run outlets (as evidenced in both policy function and revenue function estimates), and thus, helps rationalize the fact that many retailers still (or increasingly) rely on corporate-run outlets despite the well-known revenue-based and cost-based concerns. Finally, our counterfactual analysis illustrates that preemptive motives may rationalize corporate-based expansion, even under the presence of revenue and cost-based benefits of franchisee-run outlets. The preemptive motives may materialize via disproportionately faster growth among corporate-run outlets leading up to a threat of entry.

Methodologically, we see our work as one of the first to partially bridge the gap between static retail network (e.g., Jia, 2008; Nishida, 2013b) and dynamic retail entry/expansion models. We see a few qualitative similarities between the decisions behind franchise system configurations, and retail network configurations. First, analogous the retail network literature, the chain makes a joint decision regarding the optimal configuration of stores based on ownership-type. Second, the chain optimizes based on the configurations that lead to the highest profits in the system (i.e., maximizing profits from the corporate-run and franchisee-run outlets). Finally, stores of one ownership-type have externalities on neighboring stores of the same (or different) ownership-types.

Our analysis abstracts away from the two-sided nature of franchising. That is, to some extent, franchisees have to agree to the terms and conditions of the franchising agreement (i.e., fees, royalty rates, operating requirements, etc...). Consequently, potential franchisees themselves may decide to join the chain depending on their access to housing wealth that can be used for collateral (e.g., Fan, Kuhn, and Lafontaine, 2013), or the demand-based quality premium that chain brands command via informed customers (e.g., Hollenbeck, 2013). However, for future research, we see potential in incorporating recent insights about dynamic network formation by Lee and Fong (2013) to accommodate the decisions both at the franchisor and franchisee level.

Future work could explore more granular geographic patterns in franchising over time. For example, do we see franchisee-run outlets in close proximity other franchisee-run outlets, and how do these spatial patterns change over time? One reason that we may see clusters of franchisee-run outlets is when they share the same franchisees; to manage concerns about encroachment, the chain may give incumbent franchisees first rights for newly opened outlets in close proximity (Blair and Lafontaine, 2005). While our current setting and data limits us from exploring such patterns, we see opportunities in merging our empirical framework with the dynamic spatial oligopoly model proposed in Aguirregabiria and Vicentini (2014).

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