Financial Constraints and Franchising Decisions*

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February 22, 2013

(Preliminary)

Abstract

We study how the financial constraints of agents affect the behavior of principals in the context of franchising. We develop an empirical model of franchising starting with a principal-agent framework that emphasizes the role of franchisees' collateral from an incentive perspective. We estimate the determinants of chains' entry (into franchising) and growth decisions using data on franchised chains and data on local macroeconomic conditions. In particular, we use collateralizable housing wealth at the state level as an inverse measure of the average financial constraints of potential franchisees. We find that a decrease in collateralizable housing wealth in the local economy leads to both later entry into franchising by local franchisors, and slower growth in the number of franchised – and total – outlets in these chains. We show that the corresponding job losses can be substantial.

Keywords: Contract, franchising, incentive
JEL: L14, L22, D22, D82, L8

*We thank participants of seminars at Berkeley, Boston College, Chicago Booth, Stanford GSB and Yale for their constructive comments.

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1 Introduction

The recent collapse of debt financing has been touted as a major factor affecting the viability and growth of small and large businesses alike.[1] The reduction in housing values that occurred in recent years has been linked to access to credit problems for small business owners.[2] It has also been described as a major factor affecting the development and growth of franchised chains in particular.[3]

The issue of franchisees having access to financing to invest in a franchised outlet has always been a major concern for participants in the industry. For example, being highly leveraged may considerably undermine the incentives of franchisees, incentives that are at the core of the franchising idea. In fact, most franchisors, including established franchisors with access to capital markets, require that their franchisees provide significant portions of the capital needed to open their franchise. Given this need for franchisees to bring capital to the business for franchisee incentive purposes, the financial constraints that franchisees face can become a constraint on franchise chain growth and affect the value of franchising from the perspective of the chain as well. This in turn would reduce the value of entering into franchising for those chains that have not yet invested in developing a franchise capability, and also slow down the growth of the many chains that rely on franchising in the retail and service sectors.[4] Despite the central role of the financial constraints of potential franchisees in the decisions of chains to franchise, this issue has not been studied in the theoretical or empirical contract literature.[5]

In this paper, we develop an empirical model of chains' franchising decision. We begin by setting up a principal-agent model where franchisee effort and the profitability of franchised outlets depend on how much collateral a franchisee is able to put up. In the model, the franchisee decides on her effort level before revenue is realized. She then decides whether or not to default on her debt contract. A higher collateral means higher costs of defaulting, and hence a greater incentive to work hard. Given agent heterogeneity in terms of collateralizable wealth, the chain chooses the optimal contract. Simulation results suggest that at the equilibrium, the expected profit generated by a franchised outlet for the chain is increasing in the average collateral as well as other factors such as the number of potential franchisees and the importance of franchisee effort in the business. We then derive profit functions that describe the expected value of opening a company-owned outlet and a

[1] There is much theoretical and empirical work on the importance of capital constraints for firm growth and survival. For example, see Clementi and Hopenhayn (2006) and the references therein.

[2] See for example Schweitzer and Shane (2010) and National Federation of Independent Businesses (2012).

[3] See for example Reuteman (2009) and Needleman (2011).

[4] For evidence on the increasing role of chains in the retail and service sectors, see Jarmin, Klimek and Miranda (2009).

[5] One notable exception is Laffont and Matoussi (1995), who consider the role of financial constraints in an agrarian context. In their model, when a tenant is financially constrained, it is impossible for her to sign a contract that offers a high share of output because such contracts also require a high upfront rental fee. In our context, franchisee wealth is used as a collateral, and the extent of collateral serves as an additional source of incentives beyond residual claims.

franchised outlet for the chain. Which option is most profitable determines both the timing of the chain's entry into franchising as well as the extent to which the chain grows via company-owned and franchised outlets. Chains for which a franchised outlet is more likely to generate higher profit than a company-owned outlet not surprisingly tend to enter into franchising earlier and expand relatively faster through franchised outlets.

In our empirical analyses, we estimate the determinants of chains' entry (into franchising) and growth decisions using data on more than 900 chains that started in business, and subsequently started franchising, sometime between 1984 and 2006. We combine these data with other information about local macroeconomic conditions. In particular, we use collateralizable housing wealth measured at the state level to capture the average financial constraints of potential franchisees in that state. If collateralizable wealth increases, we argue that it becomes easier for chains to find franchisees with sufficient collateralizable wealth, and this affects the likelihood that it becomes optimal to open a franchised outlet. Intuitively, the larger the number of potential franchisees who can put down more collateral to start a business, the greater the incentives franchisees have to work hard, and hence the greater the profitability of franchising to a chain.

The estimation results are intuitive and consistent with the predictions of our agency-theory model. We find that collateralizable housing wealth has a positive effect on the value of opening a franchised outlet relative to opening a company-owned outlet. This is in line with the predictions of our model, where franchisee borrowing against their collateral to start their business increases their incentives to work hard and hence the profitability of franchising to the franchisors. We also find a positive effect for the amount of labor needed at the outlet level, which is also in line with the idea that chains favor franchising when incentives for the local store manager are an important factor. This is because a manager's supervision activities are particularly important in more labor-intensive businesses. Similarly, we find that the benefit of franchising is greatest for restaurant chains, go to services, and retailers, the types of business for which it is vital for managers to supervise workers and oversee operations.

To understand the magnitude of the effect of franchisees' financial constraints on franchisors' decisions, and quantify the potential impact of the recent collapse in debt financing on franchising, we simulate the effect of a 30% decrease in the collateralizable housing wealth of potential franchisees. We find that chains enter into franchising somewhat later, and open fewer franchised and more importantly, from a job creation perspective, fewer total outlets. Specifically, we find that the number of total outlets of chains five years after they start in business decreases by 1 on average. The average decrease in the number of total outlets ten years after a chain start in business is 1.4. Combined with Census Bureau information about the importance of franchising in the U.S. economy, our results suggest that such a decrease in access to financing for franchisees could affect as many as 128,000 to 153,600 jobs.

This paper contributes to several streams of literature. First and foremost, it contributes to the empirical literature on contracting and contract theory. To this day, there is little empirical work on contracting, especially relative to the large amount of theoretical research in this area. Much of the earlier empirical literature focused on contract choices, for example, Brickley and Dark (1987), Lafontaine (1992), Laffont and Matoussi (1995), Ackerberg and Botticini (2002), Dubois (2002) and Lafontaine and Shaw (2005).[6] These papers usually regress contract types on principal and agent characteristics. Much of the work on inter-firm contracting in particular has been policy driven, focusing on the effects of various vertical restraints. Recent contributions in this area include Asker (2005), Brenkers and Verboven (2006), on exclusive dealing, Crawford and Yurukoglu (2012), on bundling, and Ho, Ho and Mortimer (2012) on full-line forcing. Others have examined the use and effect of non-linear wholesale prices (Villas-Boas (2007), Bonnet and Dubois (2010)) or revenue sharing in distribution contracts (Mortimer (2008), Gil and Lafontaine (2012)).[7] In the current paper, we study the importance of agents' financial constraints on the choice of organizational form, and the effect this has on the timing of entry into franchising for franchisors. To this end, we develop a theoretical principal-agent framework that emphasizes the role of franchisees' collateral from an incentive perspective, and combine the model with the data to examine the effect of this constraint on the decision of franchisors to franchise or operate establishments corporately.

This paper also relates to a new literature in macroeconomics on deleveraging, which considers how a decline in home equity borrowing can lead to a recession (e.g. Philippon and Midrigan (2011), Guerrieri and Lorenzoni (2011), Eggertsson and Krugman (2012), Mian and Sufi (2012)). In these papers, tighter borrowing constraints lead to a decline in aggregate demand and eventually a recession. We highlight a different channel through which decreased collateralizable housing values can affect economic growth and jobs. In our paper, a decrease in collateralizable housing wealth makes a potential franchisee unattractive to a chain by decreasing the power of incentives. As a result, fewer stores are opened and fewer jobs are created. We highlight this channel in our counterfactual simulations by varying the collateralizable housing wealth while holding other macroeconomic variables such as per-capita gross state product (GSP) constant.

The rest of the paper is organized as follows. We describe the data in the next section, Section 2. In Section 3, we develop the empirical model starting with a principal-agent framework. The estimation results are explained in Section 4. Section 5 presents the results of a counterfactual simulation where we study how tighter financial constraints of potential franchisees influence the franchising decision of chains. We conclude in Section 6.

[6]See Chiappori and Salanié (2002) for a survey on studies in agrarian markets and Lafontaine and Slade (2007) for a survey of studies in franchising. A separate set of papers examines executive or salesforce compensation. Most of these focus on the terms of the contract, however, rather than the choice of contract type.

[7]For a review of the empirical literature on inter-firm contracts in particular, see Lafontaine and Slade (2012)

2 Data

2.1 Data Sources and Variable Definitions

Our data on franchised chains, or franchisors, are from various issues of the Entrepreneur magazine's "Annual Franchise 500" surveys and the yearly "Source Book of Franchise Opportunities," now called Bond's Franchise Guide. Together, these sources provide information on 800 to 900 U.S. business format franchised chains each year from 1980 through 2006, except for 1999 and 2002, when the data were not collected. Business format franchisors are those that provide "turn-key" operations to franchisees in exchange for the payment of royalties on revenues and a fixed upfront franchise fee. They account for all of the growth in franchising, and are an important factor in the growth of chains in the U.S. economy. According to the Census bureau, business format franchisors operated more than 387,000 employer establishments in 2007, and employed a total of 6.4 million employees. Traditional franchising, which comprises car dealerships and gasoline stations, in contrast accounted for about 66,000 establishments, and 1.48 million employees.

For each franchisor that appears at least once in these data, we observe when the chain first started in business and when it started franchising, where the difference between the two is what we refer to as the waiting time. For example, if a chain starts franchising in the same year that it goes into business, the waiting time variable is simply zero. This variable is one of our main dependent variables below. In addition, we observe the U.S. State where each chain is headquartered, its business activity, and the amount of capital required to open an outlet (Capital Required).[8] Given our model below, we also need information about the number of employees that the typical outlet needs (Number of Employees).[9] Unfortunately, data on employment is available only in later survey years. Note that we view the Capital Required and Number of Employees needed to run the business as intrinsically determined by the nature of the business concept, which itself is intrinsically connected to the brand name. As such, these characteristics should not change from year to year. Yet we find some variation in the data. We use the average across all the observations we have for these two variables for each franchised chain under the presumption that most of the differences over time reflect noise in the data.[10] Finally, for each year when a franchised chain is present in the data, we also observe the number of company-owned outlets and the number of franchised outlets. These two variables describe a chain's growth pattern over time.

We expect differences in the type of business activity to affect the value of franchising for the

[8] We transform the latter variable to constant 1982-84 dollars using the Consumer Price Index.

[9] We count part-time employees as equivalent to 0.5 of a full-time employee.

[10] The data are collected via surveys, and are thus subject to some errors from respondents or transcription. There is also some variation in the reported years in which the firm begins franchising and when it starts in business. For these variables, we use the earliest date given because we see that franchisors sometimes revise these dates to more current values for reasons we do not fully understand. However, we make sure that the year of first franchising is after the first year in business. We also push the year of franchising to later if we have data indicating no franchised establishments in the years when the firm states it starts franchising.

chains. We therefore divide the chains among six "sectors" according to their business activity: 1- the set of firms that sell to other businesses rather than end consumers (Business Products and Services), 2- restaurants and fast-food (Restaurants), 3- home maintenance and related services, where the service provider visits the consumer at home (Home Services), 4- services consumed at the place of business of the service provider, such as health and fitness, or beauty salons (Go To Services), 5- the set of firms that sell car-related products and repair services (Auto Products and Services), and 6- retail stores (Retail).[11]

Our main explanatory variable of interest, however, is our measure of franchisee collateralizable wealth. We construct this variable by combining information from several sources. First, we obtained data on a yearly housing price index at the state level from the Federal Housing Finance Agency.[12] We use these data, along with data on housing values by state in 1980 (the base year of the aforementioned housing price index),[13] also from the Census Bureau, to generate time series of yearly housing values per state. Second, we obtained yearly data about home ownership rates across states from the Census Bureau.[14] Finally, we obtained data from the joint Census-Housing and Urban Development (HUD) biennial reports based on the American Housing Surveys, which summarize information on mortgages on a regional basis (Northeast, Midwest, South and West). Specifically, from this source, we obtained measures of regional housing values, total outstanding principal amount, and number of houses owned free and clear of any mortgage.[15] We use these data to calculate the average proportion of mortgage outstanding for homeowners in the region each year.[16] Since the reports are biennial, we ascribe the value to the year of, and the year before, the report. As the first report was published in 1985, this implies that the data we need to generate our main explanatory variable of interest begins in 1984.[17] We then combine this information on the proportion of outstanding mortgage for homeowners with the state home ownership rate and housing value time series to calculate our measure of Collateralizable Housing Wealth, given by:

[11]Note that we exclude hotel chains from our data because we have too few of them, and the type of services they offer cannot easily be grouped with the categories we use. Moreover, in this industry, firms use a third contractual form, namely Management Contracts, in addition to franchising and company ownership. Finally, there is much more brand switching in this sector than in any other franchising sector.

[12]These data apparently are revised at the source quite frequently, perhaps as often as every time a new quarter is added. It also has been moved around several web sites. The version used here is the "States through 2010Q3 (Not Seasonally Adjusted) [TXT/CSV]" series in the All-Transactions Indexes section at http://www.fhfa.gov/Default.aspx?Page=87. The base period of the index is 1980Q1.

[13]These values are reported in constant year 2000 based dollars. We transform them to constant 1983-84 based constant dollars using the Consumer Price Index.

[14]See U.S. Census Bureau, Housing and Household Economic Statistics Division.

[15]These can be found in Tables 3-14 and 3-15 of the biennial reports. The data for housing values and for total outstanding principal are reported in the form of frequencies for ranges of values. We use the middle value for each range and the frequencies to calculate expected values for these.

[16]Specifically, this variable is calculated as: $\frac{\frac{(TOPA*NTOPA)}{(NTOPA+NF)}}{(HousingValues)}$, where TOPA is Total Outstanding Principal Amount, NTOPA is the Number of Households that Reported Outstanding Principal, and NF is the Number of Households with Houses owned Free and Clear of any mortgage.

[17]The regional data is ascribed to all states in each region.

(one minus the average proportion of mortgage still owed) multiplied by the home ownership rate and by housing value for each state/year.

2.2 Linking Chain-Level and State-Level Data

Because we are interested in how the chains grow as well as how long they wait, after starting in business, until they begin franchising, we need to observe the macroeconomic conditions that each chain faces from the time it starts its business. Since the data for collateralizable wealth is only available from 1984 onward, we must restrict our analyses to franchisors that started in business from that year on. This constraint reduces our usable sample of franchisors in an important way, from 2936 to 1344 US-based franchisors. It also means that well-known and established brands such as McDonald's and Burger King, established in the 1950s, are excluded from our analyses. Given that franchising was still relatively new at that time, it might be that chains that started in business in the 50s and 60s did not know about or consider franchising as a viable option until many years after they started in business. Business owners who started in the 80's and 90's are, we expect, more likely to start thinking of franchising sooner after they start their business. Nonetheless, as we describe further below, in our model we allow owners to be unaware, or not thinking about franchising, in the early years after they start their business.

After eliminating franchised chains for which we have some missing data, as well as hotel chains, and deleting observations for 56 outlier franchisors who either grow very fast (the number of outlets increases by more than 100 in a year) or shrink very fast (more than half of the existing outlets exit in a year), our final sample then consists of 3872 observations covering 945 distinct franchised chains headquartered in 48 states, all of which started in business – and hence also franchising – in 1984 or later.

We combine the data on chains with our state/year collateralizable wealth and other yearly state-level macroeconomic data, namely data on the local level of economic activity, i.e. Gross State Product (GSP), which we obtain from the Bureau of Economic Analysis. We use the Consumer Price Index data from the Bureau of Labor Statistics to generate a measure of real annual GSP. We obtained yearly state population estimates data from the Census Bureau and use this to create a measure of Per Capita Real GSP.[18]

Our goal, with both our main explanatory variable of interest as well as our macroeconomic variables, is to capture the environment within which the chain is likely to want to expand or seek franchisees. Since we cannot observe where they seek potential franchisees, we use information about where chains headquartered in each state typically expand to generate measures of the relevant conditions, i.e. the conditions that the chain likely faces. Because we need to observe chains from the time they star in business, so we can characterize the conditions they faced each

[18]The population data were downloaded from: http://www.census.gov/popest/states/.

year while making decisions about when to become involved in franchising, our data are mostly about young chains. As a rule, most young chains and franchisors expand first in their state of headquarters and then move on to establish outlets in other, mostly nearby states. We can see this tendency in our data: in each survey year, franchisors report the state where they operate the most outlets. We use this information – for the latest year at which we observe a chain, but before year 15 after they start franchising, as we are trying to capture expansion patterns for relatively young franchised chains – to construct a square matrix, the element (i, j) of which is the percentage of franchisors in our data that are headquartered in state i and report state j as the state where they have the most outlets. The resulting matrix, in Appendix A, confirms that most "young" franchisors operate most of their outlets in the state where they are headquartered. This can be seen by the fact that the diagonal elements are fairly large, typically larger than any off diagonal element. However, holding the state of origin constant and looking along a row in this matrix, it is also clear that franchisors headquartered in certain, typically smaller states, view some other, usually nearby states, as good candidates to expand into even early on in their development. For example, 25% of the franchisors from Nevada have more outlets in California than in any other state. Only 13% of them report having more outlets in Nevada than anywhere else. Similarly, many franchisors headquartered in Utah (48% of them) have expanded into California to a greater extent than they have in their own state. Only 36% of them have most of their establishments in Utah proper.

We interpret this matrix as an indication of where the franchisors from each state in our data are most likely to want to expand during the period that we observe them. We therefore use the elements of this matrix, along a row – i.e. given a state of headquarters – to weigh our state/year-level macroeconomic variables and match them to our chain/year variables.

2.3 Summary Statistics and Basic Data Patterns

Summary statistics for all our variables, including our weighted macroeconomic and collateralizable wealth measures, are presented in Table 1. They show that most of the chains in our data waited only a few years after starting in business to become involved in franchising, with an average of only 3 years between the two. The majority of the chains in our data also are relatively small, and they rely on franchising a lot: the mean number of franchised outlets is 36, while the mean number of company owned outlets is only 3.45. After they start franchising, the chains tend to open mostly franchised outlets. They also do not grow as fast as perhaps some might expect. Specifically, for the 96 chains that we observe exactly 3 years after they start franchising – which requires that they survive this long and that they answer the survey in the relevant year – we find that the median number of new company owned outlet is zero, while the median number of new franchised outlets is 10. For the 49 chains that we observe exactly 5 years after they start of franchising, the median number of new company outlet is again 0, while the number of franchised outlets is 19. The chains also are not very capital intensive, not surprisingly, with an average amount of capital required of \$92,000. The variation around this mean, however, is quite large. Finally, the information in this table shows that the franchisors in our data are distributed fairly evenly across our main sectors, with the exception of Auto Products and Services which is the least populated of our sectors.

Table 1: Summary Statistics

	Mean	Median	Std. Dev.	Min	Max	Obs
Waiting Time (Years)	3.15	2	3.16	0	18	945[a]
Company-owned Outlets	3.45	1	7.41	0	106	3872[b]
Franchised Outlets	36.34	18	44.74	0	285	3872
Required Employees	5.58	3.5	7.67	0.5	112.5	945
Required Capital (Constant 82-84 \$100K)	0.92	0.54	1.44	0	19.72	945
Business Products & Services	0.12	0	0.33	0	1	945
Home Services	0.14	0	0.35	0	1	945
Go To Services	0.21	0	0.41	0	1	945
Auto; Repair	0.07	0	0.26	0	1	945
Restaurants	0.21	0	0.41	0	1	945
Retail	0.25	0	0.43	0	1	945
Coll. Housing Wealth (82-84 \$10K)	3.61	3.28	1.17	2.11	13.21	1104[c]
Population (Million)	8.67	8.2	4.73	1.14	28.92	1104
Per-Capita Gross State Product (82-84 \$10B)	1.89	1.8	0.54	1.26	6.6	1104

[a]At the chain level
[b]At the chain/year level
[c]At the state/year level, for 48 states between 1984 and 2006.

Figure 1 gives more detail about the overall growth in the number of outlets across the chain/years in our data. Specifically, for each chain, we compute the yearly change in the total number of outlets (including both company-owned outlets and franchised outlets).[19] In the figure, we include each chain only once, by taking the average of the calculated yearly growth in number of outlets over the years we observe each chain. We show this average yearly growth in number of outlets against the chain's waiting time (i.e. the number of years between when it starts in business and when it begins franchising). Figure 1 shows that chains that enter into franchising faster also grow faster on average. This is true across all sectors.

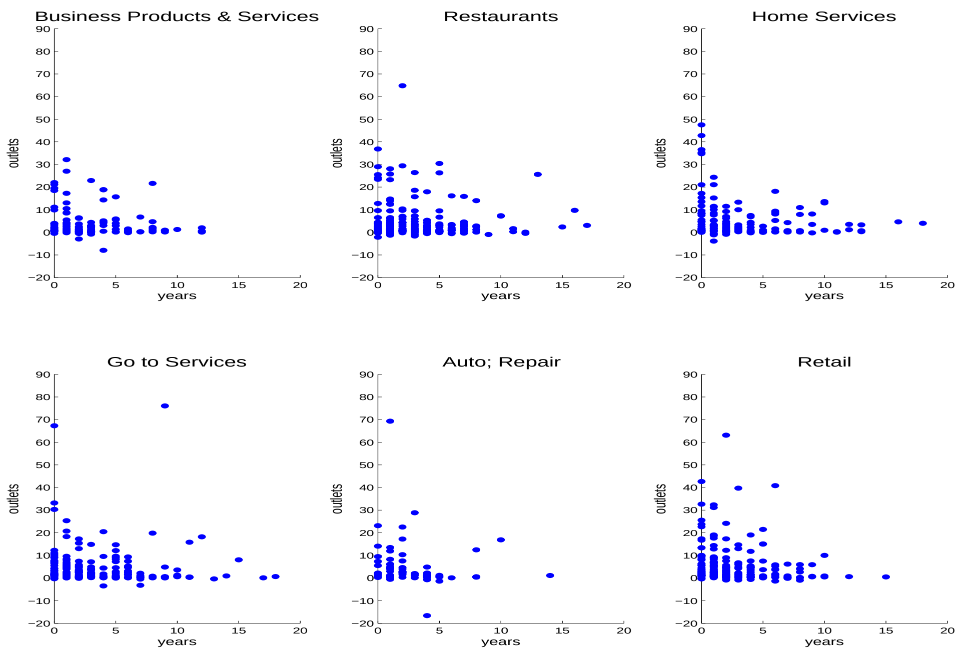
Similarly, we show the relative growth in the number of franchised outlets in Figure 2. In this figure, for each chain, we compute the yearly change in the number of franchised outlets and the yearly change in the number of company-owned outlets separately, and then we average the yearly ratios of these two over time.[20] Figure 2 shows that chains that start franchising faster not only grow

[19]When the data on the number of outlets is missing for all chains, as in, for example, 1999, we compute the change in number of outlets from 1998 to 2000 and divide the result by 2 to compute the yearly change.

[20]When there is no change in the number of company-owned outlets between two years, we replace the ratio by the change in number of franchised outlets, thereby treating the number of company outlets as if it has increased by

faster overall (per Figure 1) but also grow relatively faster through franchised outlets. This is quite intuitive. Firms make decisions about entry into franchising based on their expectations of growth after entry. In the context of franchising, a chain with a business model that is particularly suitable for franchising and that has a lot of opportunities to open outlets probably starts franchising earlier.

Figure 1: Entry and Growth by Sector (Average Yearly Growth in Total Outlets and Waiting Time before Franchising)

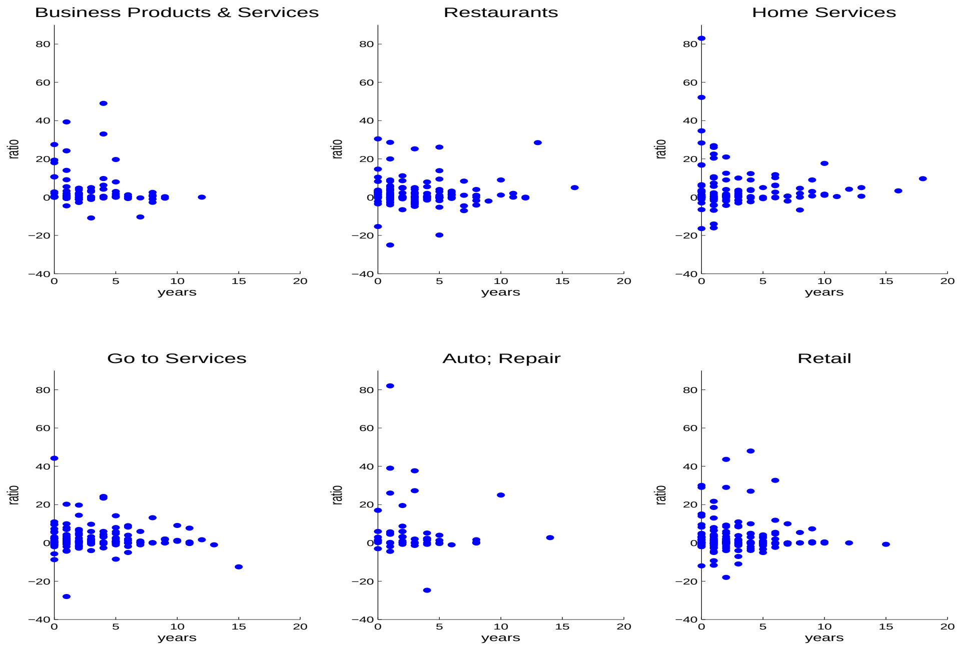


3 The Model

In this section, we develop our empirical model of franchisors' franchising decision. We begin with a theoretical principal-agent model with a typical chain who faces a set of heterogenous potential franchisees. Specifically, franchisees differ in the amount of collateral they can put forth. The model emphasizes how these differences in collateralizble wealth affect the chain's decisions. From this theoretical model, we derive linearized profit functions that describe the expected value of opening a company-owned outlet and a franchised outlet for this chain. Which option is most profitable then determines when the chain starts franchising as well as the extent to which the chain grows via company-owned and franchised outlets. In the next Section, we take the model predictions to data and estimate the determinants of franchised chains' entry (into franchising) and growth decisions.

1, to avoid division by 0.

Figure 2: Entry and Relative Growth by Sector (Average Ratio of Growth in Franchised Outlets to Growth in Company-owned Outlets and Waiting Time before Franchising)



3.1 A Principal-Agent Model of Franchising

Suppose that revenue for a specific chain outlet can be written as a function $G(\theta, a)$. The variable θ captures the quality of the idea of the chain, the local conditions for that specific outlet and a profit shock. It is random and drawn from some distribution $F(\theta)$. Let a be the effort level of the manager of the outlet. The revenue function is increasing in both θ and a. The cost of effort is given by a cost function $\Psi(a)$, which is increasing and strictly convex with $\lim_{a\to\infty} \Psi'(a) = \infty$ and $\Psi(a) > 0$ for any $a > 0$.

Suppose that opening an outlet in this chain requires capital of I. We assume that the franchisor can borrow I or use her own capital whenever it wants to open a corporate outlet.[21] However, we assume that a franchisee's wealth is smaller than I so that she needs to borrow from a bank in the form of a debt contract (R, C), where R denotes the repayment and C is the collateral that the bank receives in case the debtor defaults on the payment of R.

We first describe the effort choice and the decision to default or not on the obligation to repay the bank of a typical franchisee who puts down a collateral amount C. We then discuss the chain's decision-making process facing a set of potential franchisees with heterogenous collateralizable wealth.

After signing both the franchise and the debt contracts, the franchisee chooses her effort level

[21] Profits from company operated outlets thus are expressed net of the cost of this capital.

a and then the revenue shock θ is realized. Let s be the royalty rate, namely the share of revenues that the franchisee pays to the franchisor.[22] The franchisee thus keeps $(1-s)\,G(\theta,a)$ amount of revenue. If the business turns out to be profitable, the franchisee will choose not to default on her obligation, i.e. she will pay the repayment R. Doing so is worthwhile also because it allows her to share in the continuation value of the outlet, which we take to be $W(\theta,a)$. Her payoff is thus $(1-s)\,G(\theta,a)+(1-s)\,W(\theta,a)-R-\Psi(a)$ when she does not default. Note that very often chains charge not only a fraction of revenues s for the right to operate a franchise, but also a lump-sum one-time fixed fee (i.e. a franchise fee). Since this fee is a constant, we incorporate it in the cost function $\Psi(a)$. For simplicity, we assume that the franchisee incurs no other costs beside those associated with her effort and access to capital.

If the franchisee chooses to default, the bank seizes the collateral C and any money from the liquidation of the outlet assets.[23] The franchisee's payoff then is $(1-s)\,G\,(\theta,a)-C-\Psi(a)$.[24] The franchisee defaults if and only if $R-(1-s)\,W\,(\theta,a)>C$. Let θ^* be the critical state of the world below which default occurs. In other words,

$$R-(1-s)\,W\,(\theta^*,a)=C. \tag{1}$$

In the discussion below, we make the dependence of the repayment R on the amount of money borrowed (I) and the collateral (C) explicit: we denote it by $R\,(C,I)$. For given I, we assume that the repayment is decreasing in C. We also assume that the continuation value is increasing in the revenue shock θ and the franchisee effort a. Under these two assumptions, $\frac{\partial\theta^*}{\partial C}<0$. In other words, as the collateral increases, the repayment is smaller and thus it is less likely that the franchisee will default.[25]

Suppose the franchisee is risk averse and her utility function is $-e^{-\rho w}$, where $\rho>0$ is her constant absolute risk aversion parameter and w is her payoff. Then, the expected utility of the franchisee can be written as:

$$\begin{aligned} U &= \int_{-\infty}^{\infty} -e^{-\rho[(1-s)G(\theta,a)+((1-s)W(\theta,a)-R(C,I))\mathbf{1}(\theta>\theta^*)-C\mathbf{1}(\theta\leq\theta^*)-\Psi(a)]}dF\,(\theta) \qquad (2)\\ &= \int_{-\infty}^{\theta^*} -e^{-\rho[(1-s)G(\theta,a)-C-\Psi(a)]}dF\,(\theta)+\int_{\theta^*}^{\infty} -e^{-\rho[(1-s)G(\theta,a)+(1-s)W(\theta,a)-R(C,I)-\Psi(a)]}dF\,(\theta) \end{aligned}$$

[22] Royalty payments are almost always a proportion of top-line revenues in business format franchising.

[23] The liquidation of the outlet assets typically yields an amount that is much smaller than the continuation value of the outlet. See e.g. Fraser (1999). As long as the scrap value is smaller than $(1-s)W$, the default condition in (1) implies that the scrap value must be smaller than $R-C$ when a franchisee chooses to default. As a result, the bank would seize the scrap value as well as the collateral C.

[24] Besides the collateral C, there might be other costs of defaulting such as the adverse effect of defaulting on the franchisee's credit record. We ignore such costs for simplicity. Adding a constant to represent these costs would not affect our results qualitatively.

[25] See Einav, Jenkins and Levin (2012) for evidence that credit contract design also matters in the consumer credit market for subprime loans. In particular, higher down payment requirements reduce the number of loans, and the likelihood of repayment is substantially lower for larger loans.

For any given I, C and s, the franchisee maximizes (2) with respect to a. The first-order condition is

$$\frac{\partial U}{\partial a}=\rho\int_{-\infty}^{\theta^*}\left[(1-s)\frac{\partial G(\theta,a)}{\partial a}-\Psi'(a)\right]e^{-\rho[(1-s)G(\theta,a)-C-\Psi(a)]}dF(\theta) \tag{3}$$
$$+\rho\int_{\theta^*}^{\infty}\left[(1-s)\left(\frac{\partial G(\theta,a)}{\partial a}+\frac{\partial V(\theta,a)}{\partial a}\right)-\Psi'(a)\right]e^{-\rho[(1-s)(G(\theta,a)+V(\theta,a))-R(C,I)-\Psi(a)]}dF(\theta)=0.$$

In Supplemental Appendix D, we show that $\frac{\partial^2 U}{\partial a \partial C}>0$ at the interior solution of this utility maximization problem a^*. Therefore, $\frac{\partial a^*}{\partial C}>0$ by the implicit theorem and the second-order condition $\frac{\partial^2 U}{\partial a^2}<0$. Intuitively, as collateral increases and thus repayment decreases, the marginal benefit from not defaulting increases. In other words, the marginal utility from increasing effort so as to avoid defaulting increases with C. Therefore, the more collateralizable wealth a franchisee has for borrowing money, the higher her effort level. In the end, the franchisee's expected utility depends on C, s as well as the fixed fee L, which is embedded in the cost function $\Psi(\cdot)$. We denote her expected utility by $\tilde{U}(s,L,C)$. The franchisor's expected profit is $\tilde{\pi}_f(s,L,C)=\int_{-\infty}^{\infty}[sG(\theta,a^*)+sW(\theta,a^*)\mathbf{1}(\theta>\theta^*)]dF(\theta)+L.$

We now describe the franchisor's problem. Suppose that for each specific opportunity that a franchisor has for opening an outlet, there are N potential franchisees each of whom has a collateralizable wealth C_i drawn from a distribution F_C. Let F_N be the distribution of N. If the fixed fee that the chain charges is high enough, some potential franchisees may find that their participation constraint ($\tilde{U}(s,L,C)>-e^{-\rho w}|_{w=0}=-1$) is not satisfied. From the remaining set of potential franchisees, the chain picks the one that generates the most expected profit. It then compares this expected profit from establishing a franchised outlet to the expected profit from a company-owned outlet. We assume that a minimum level of effort a_0 can be induced even for an employed manager. This could be thought of as an observable component of effort or a minimum standard that can be monitored at low cost. The profit of a company-owned outlet is therefore determined by a_0 and θ. We denote the expected profit of a company-owned outlet, net of the compensation of the manager, by $\tilde{\pi}_c$. For given (F_N,F_C), the chain chooses the franchise contract (s,L), i.e. it chooses the royalty rate s and the fixed fee L, to maximize its expected profit. In summary, the franchisor's problem is

$$\max_{(s,L)}E_N E_{(C_1,\ldots,C_N)}\max\left\{\max_{i=1,\ldots,N}\tilde{\pi}_f(s,L,C_i)\mathbf{1}\left(\tilde{U}(s,L,C_i)>-1\right),\tilde{\pi}_c\right\}.$$

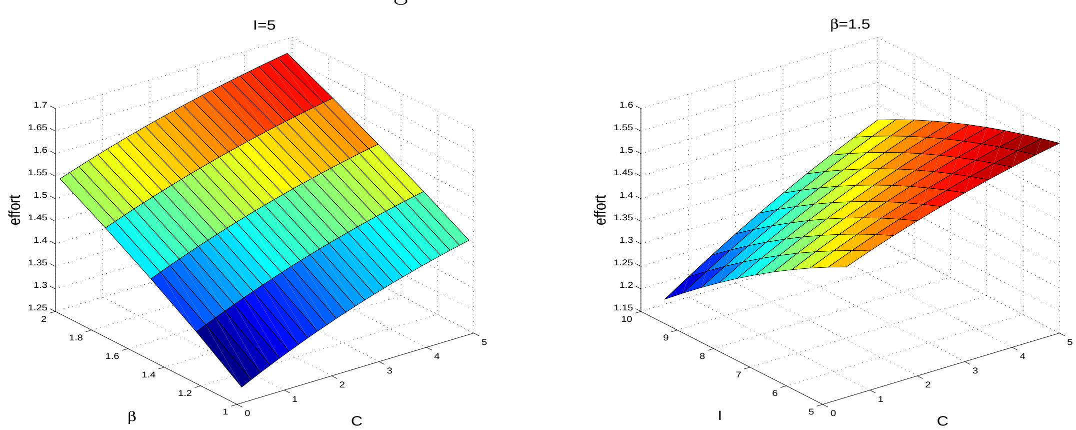
Since we cannot derive a full analytical solution to a general model such as the one above, with uncertainty of defaulting and heterogenous franchisees, in the next Section, we use a parameterized version of the model to illustrate some properties of the franchisee's behavior and the franchisor's profit function.

3.2 An Illustrative Example

We describe the parameterized version of the model fully in Appendix B, and only introduce some necessary notation here. Let $\bar{N}$ be the mean of the number of potential franchisees for a given opportunity, and $\bar{C}$ be the mean of potential franchisees' collateralizable wealth. We assume that the revenue function $G(\theta, a) = \theta + \beta a$, where β captures the importance of the outlet manager's effort.

For fixed royalty rate $s = 5\%$, we can compute the optimal effort level as the collateralizable wealth of a potential franchisee, the importance of the manager's effort and the required capital vary. Results are shown in Figure 3. In both panels, the x-axis is the collateralizable wealth (C). The y-axis is the importance of the manager's effort (β) in the left panel and the required capital (I) in the right panel. The z-axis is the franchisee's optimal effort level. Both panels illustrate our model prediction above that the franchisee's choice of effort level will be increasing in C. When the collateral C increases, the franchisee has more incentive to work hard as the marginal benefit from not defaulting is higher. The left panel of Figure 3 also shows that the effort level is increasing in the importance of the manager's effort β. A similar intuition applies: as β increases, the marginal utility of effort increases, which leads to a higher optimal effort level. Finally, we can see from the right panel that an increase in the amount of capital required to open an outlet, I, has the opposite effect of an increase in C. Intuitively, for given C, an increase in I implies a higher loan and repayment level, which in turn decreases the opportunity cost of default. This then has a dampening effect on the franchisee's incentives to work hard.

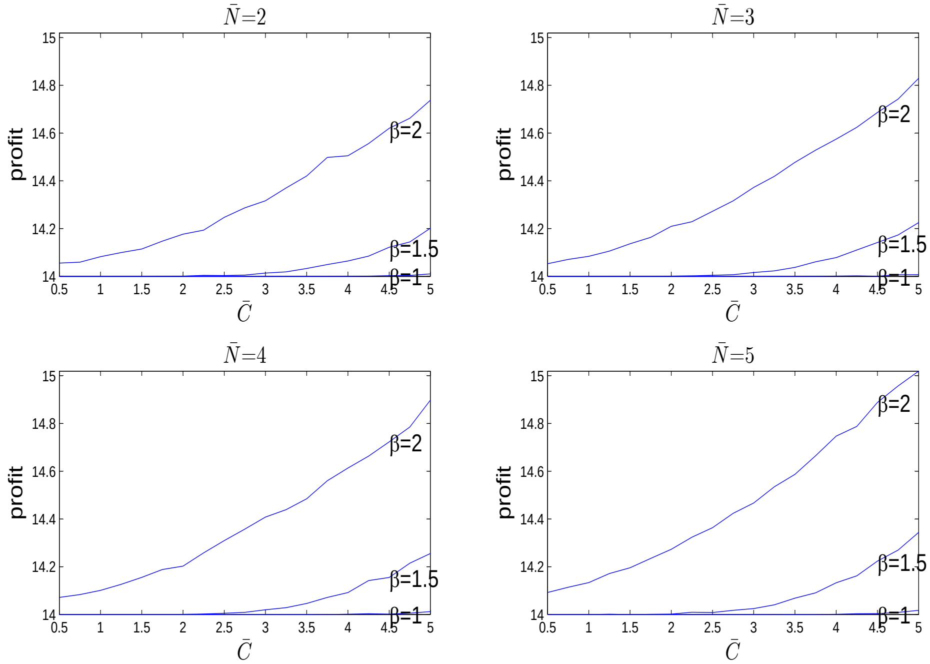
Figure 3: Franchisee's Effort



The parameterized model also yields a number of intuitively appealing properties for the chain's expected profit function. Figure 4 provides a graphical illustration of these properties. Note that the profit of opening a company-owned outlet in our example is 14, which is based on the normalization that a hired manager's effort a_0 is 0.

Four features of the expected profit for the chain can be seen from Figure 4. First, the chain's

Figure 4: Chain's Expected Profit



expected profit is increasing in the average collateralizable wealth of the potential franchisees. This is intuitive as the chain's expected profit is increasing in the franchisee's effort, which is itself increasing in C. In that sense, our model explains the common practice of franchisors to insist that franchisees put their own wealth at stake. Second, it is increasing in the importance of the franchisee effort β as a larger β also means a higher incentive for the franchisee to exert effort. Third, the slope of the chain's profit with respect to C is increasing in β, implying that the marginal effect of C on profit is increasing in β. This is again intuitive because the revenue function is $\theta + \beta a$, where the effort level is increasing in C. Fourth and finally, as we can see by looking across the four panels in Figure 4, the chain's profit is increasing in the average number of potential franchisees $\bar{N}$. In other words, for a given distribution of collateralizable wealth, more potential franchisees means that there is a greater chance of finding a franchisee with sufficient collateralizable wealth to make her a good candidate for the chain.

3.3 The Empirical Model

Our data describe the timing of when a chain starts franchising and how it grows – and sometimes shrinks – over time through a combination of company-owned and franchised outlets. The model above gives predictions on the relative attractiveness of a franchised outlet to a chain, which then determines the timing of its entry into franchising and the growth decision. One empirical approach we could adopt given this would be to parameterize the model above as in Appendix

B and take its implications to data and estimate the primitives of that model. However, this approach is computationally intensive. For each trial of the model parameters, we would have to solve a principal-agent model with heterogenous agents and uncertainty about default. This makes it costly to incorporate covariates. This approach also requires that we make functional form assumptions on primitives on which the data and context provide little information. We therefore take a different approach and use the findings above as guidance to specify the profit functions directly.

Specifically, we assume that the value of a company-owned outlet and that of a franchised outlet are, respectively

$$\begin{aligned} \pi_{ci\tau} &= \boldsymbol{x}_{it}^{(c)} \boldsymbol{\beta}_c + u_{ci} + \varepsilon_{ci\tau}, \\ \pi_{fi\tau} &= \pi_{ci\tau} + \boldsymbol{x}_{it}^{(f)} \boldsymbol{\beta}_f + u_{fi} + \varepsilon_{fi\tau}, \end{aligned} \tag{4}$$

where $\boldsymbol{x}_{it}^{(c)}$ is a vector of observable chain i- or chain i/year t-specific variables that affect the profitability of opening an outlet, i.e., the distribution of θ in Section 3.1. The vector $\boldsymbol{x}_{it}^{(f)}$ consists of the observables that influence the relative profitability of a franchised outlet, compared to a company owned outlet. According to the results in Section 3.2 this vector includes the financial constraints of chain i's potential franchisee pool. It also includes determinants of the importance of manager effort (β) such as the number of employees, given that employee supervision is a major task for managers in the types of businesses that are franchised, as well as the interaction of the number of employees and the average collateralizable wealth, per the third effect on chain profit described above. Finally, it depends on the population in the relevant market environment since the population level influences the number of potential franchisees. Let $u_i = (u_{ci}, u_{fi})$ capture the unobserved profitability of a company-owned and a franchised outlet. The error terms $\varepsilon_{ci\tau}$ and $\varepsilon_{fi\tau}$ capture the unobserved factors that affect the profitability of each type of outlet given opportunity τ.

We assume that opportunities to open an outlet arrive exogenously, and their arrival follows a Poisson process with rate m_i for chain i, where $m_i = exp(m + u_{mi})$ and u_{mi}'s are i.i.d. and follow a normal distribution with mean 0 and variance σ_m^2. When an opportunity τ arrives in year t after chain i has started franchising, the owner can choose to open a company-owned outlet, a franchised outlet or pass on the opportunity. Let $\boldsymbol{x}_{it} = \left(\boldsymbol{x}_{it}^{(c)}, \boldsymbol{x}_{it}^{(f)}\right)$. We assume that $\varepsilon_{ci\tau} = \epsilon_{ci\tau} - \epsilon_{0i\tau}$ and $\varepsilon_{fi\tau} = \epsilon_{fi\tau} - \epsilon_{ci\tau}$, and that $(\epsilon_{ci\tau}, \epsilon_{fi\tau}, \epsilon_{0i\tau})$ are i.i.d. and drawn from a type-1 extreme value distribution. Then, the probability that chain i opens a company-owned outlet conditional on the arrival of an opportunity is

$$p_{ac}(\boldsymbol{x}_{it}, u_i) = \frac{\exp\left(\boldsymbol{x}_{it}^{(c)} \boldsymbol{\beta}_c + u_{ci}\right)}{\exp\left(\boldsymbol{x}_{it}^{(c)} \boldsymbol{\beta}_c + u_{ci}\right) + \exp\left(\boldsymbol{x}_{it}^{(c)} \boldsymbol{\beta}_c + u_{ci} + \boldsymbol{x}_{it}^{(f)} \boldsymbol{\beta}_f + u_{fi}\right) + 1}, \tag{5}$$

where the subscript a stands for "after" (after starting franchising) and the subscript c represents "company-owned". Similarly, the probability of opening a franchised outlet conditional on the arrival of an opportunity is

$$p_{af}\left(\boldsymbol{x}_{it},u_i\right)=\frac{\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+u_{ci}+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_{fi}\right)}{\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+u_{ci}\right)+\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+u_{ci}+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_{fi}\right)+1}. \tag{6}$$

If, however, chain i has not started franchising by year t, the probability of opening a company-owned outlet conditional on the arrival of an opportunity is

$$p_{bc}\left(\boldsymbol{x}_{it},u_i\right)=\frac{\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+u_{ci}\right)}{\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+u_{ci}\right)+1}, \tag{7}$$

where the subscript b stands for "before" (before starting franchising).

Given that the opportunity arrival process follows a Poisson distribution with rate m_i for chain i, the number of new company-owned outlets opened in year t before chain i starts franchising follows a Poisson distribution with mean $m_i p_{bc}\left(\boldsymbol{x}_{it},u_i\right)$. Similarly, the number of new company-owned outlets opened after chain i starts franchising follows a Poisson distribution with mean $m_i p_{ac}\left(\boldsymbol{x}_{it},u_i\right)$; and the number of new franchised outlets has mean $m_i p_{af}\left(\boldsymbol{x}_{it},u_i\right)$.

Note that it is difficult to separately identify the opportunity arrival rate and the overall profitability of opening an outlet. For example, when we observe that a chain opens a small number of outlets per year, it is difficult to know whether this is because the chain had only a few opportunities during the year, or because it decided to take only a small proportion of a large number of opportunities. (That said, we do have some information that helps to separately identify them. We come back to this issue further below.) Therefore, we normalize u_{ci} to be 0. We assume that u_{fi} follows a normal distribution with mean 0 and variance σ_u^2. Having set u_{ci} equal to 0, in terms of notation we drop this term and replace u_{fi} by u_i in the remainder of the paper.

We now describe a chain's decision to start franchising. When an owner starts her business, she may or may not be aware that franchising exists, or that it could be a viable option for her kind of business. We capture this in our model by allowing the owner to be aware or thinking about franchising in their first year in business with some probability $q_0 < 1$, and for every other year after that, for those that are not yet aware, they become aware that franchising is a viable option for their business with some probability, q_1. Once the owner becomes aware, at the beginning of each year from that point on, she decides whether to pay the sunk cost to start franchising. The start of franchising is costly because franchisors must develop operating manuals, contracts, disclosure documents – to abide by the Federal Trade Commission (FTC) disclosure requirements, and those of the many states that have such rules as well if the firm plans to expand in any of those – and processes to support and control franchisees when they become involved in franchising. The business owner must devote significant amounts of time to these activities, in addition to relying on lawyers and accountants, and they risk affecting the existing business adversely in the process.[26] Note that all of these costs are sunk: none of them are recoverable in the event that the business owner decides to stop franchising. Let ω_{it} be the sunk cost that chain i has to pay to start franchising. This cost is firm-specific because the owner's time and ability, and the complexity of the business format, for example, all affect this cost, and these are all firm specific. This decision therefore depends on how the value of entry into franchising minus the setup cost compares with the value of waiting.

The value of entry is the expected net present value of all future opportunities after entry into franchising. The expected value of each opportunity τ is

$$\begin{aligned} & E_{\left(\varepsilon_{ci\tau},\varepsilon_{fi\tau}\right)} \max\left\{\pi_{ci\tau},\pi_{fi\tau},0\right\} \\ = \quad & \log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_i\right)+1\right)\end{aligned}$$

Given that the expected number of opportunities is m_i, the expected value of all opportunities in period t when the firm can franchise is $m_i\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_i\right)+1\right)$. We assume that $\boldsymbol{x}_{it}$ follows a Markov process. Thus, the value of entry satisfies

$$\begin{aligned} VE_i\left(\boldsymbol{x}_{it}\right) \quad = \quad & m_i\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_i\right)+1\right) \\ & +\delta E_{\boldsymbol{x}_{it+1}|\boldsymbol{x}_{it}} VE_i\left(\boldsymbol{x}_{it+1}\right), \end{aligned} \tag{8}$$

where δ is the discount factor. Note that for notational simplicity, we denote the value of entry by $VE_i\left(\boldsymbol{x}_{it}\right)$ instead of $VE\left(\boldsymbol{x}_{it},\nu_i,u_i\right)$ where ν_i and u_i the unobservable components in the opportunity arrival rate and the relative profitability of a franchised outlet.

If chain i has not entered into franchising at the beginning of year t, it can only choose to open a company-owned outlet – or do nothing – when an opportunity arises in year t. The expected value of opportunities in year t is therefore $m_iE_{\varepsilon_{ci\tau}}\max\left\{\pi_{ict},0\right\}=m_i\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+1\right)$. As for the continuation value, note that if the chain pays the sunk cost to enter into franchising next year, it gets the value of entry $VE_i\left(\boldsymbol{x}_{it+1}\right)$. Otherwise, it gets the value of waiting $VW_i\left(\boldsymbol{x}_{it+1}\right)$. So

[26] There is also the option of hiring a specialized consulting firm to help with this process. Hiring such firms easily costs \$100,000 to \$200,000, or more. These are substantial amounts for most of the retail and small-scale service firms in our data. But the cost of the owner spending time investigating and considering how to organize a franchise, which often is incurred at the expense of time on the business itself, takes the form of increased likelihood of failure and lower profits as well.

the value of waiting this year is

$$\begin{aligned} VW_i\left(\boldsymbol{x}_{it}\right) &= m_i E_{\varepsilon_{ci\tau}} \log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+1\right) \\ &\quad +\delta E_{\boldsymbol{x}_{it+1}|\boldsymbol{x}_{it}} E_{\boldsymbol{\omega}_{it+1}} \max\left\{VE_i\left(\boldsymbol{x}_{it+1}\right)-\omega_{it+1},\, VW_i\left(\boldsymbol{x}_{it+1}\right)\right\}. \end{aligned} \tag{9}$$

Let $V_i\left(\boldsymbol{x}_{it}\right)$ be the difference between the value of entry and the value of waiting: $V_i\left(\boldsymbol{x}_{it}\right) = VE_i\left(\boldsymbol{x}_{it}\right) - VW_i\left(\boldsymbol{x}_{it}\right)$. Subtracting equation (9) from equation (8) yields

$$\begin{aligned} V_i\left(\boldsymbol{x}_{it}\right) &= m_i\left[\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_i\right)+1\right)-\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+1\right)\right] \\ &\quad +\delta E_{\boldsymbol{x}_{it+1}|\boldsymbol{x}_{it}} E_{\boldsymbol{\omega}_{it+1}} \min\left\{\omega_{it+1},\, V_i\left(\boldsymbol{x}_{it+1}\right)\right\} \end{aligned} \tag{10}$$

In the second part of equation (10),

$$E_{\boldsymbol{\omega}} \min\left\{\omega,\, V\right\} = E\left(\omega|\omega < V\right)\Pr\left(\omega < V\right) + V\left(1-\Pr\left(\omega < V\right)\right).$$

Therefore, the Bellman equation (10) can be rewritten as

$$\begin{aligned} V_i\left(\boldsymbol{x}_{it}\right) &= m_i\left[\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_i\right)+1\right)-\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+1\right)\right] \\ &\quad +\delta E_{\boldsymbol{x}_{it+1}|\boldsymbol{x}_{it}}\left[E\left(\omega_{it+1}|\omega_{it+1} < V_i\left(\boldsymbol{x}_{it+1}\right)\right)\Pr\left(\omega_{it+1} < V_i\left(\boldsymbol{x}_{it+1}\right)\right)\right. \\ &\quad \left. +V_i\left(\boldsymbol{x}_{it+1}\right)\left(1-\Pr\left(\omega_{it+1} < V_i\left(\boldsymbol{x}_{it+1}\right)\right)\right)\right]. \end{aligned} \tag{11}$$

Chain i starts franchising at the beginning of year t if and only if the difference between the value of entry and the value of waiting is larger than the setup cost, i.e., $V_i\left(\boldsymbol{x}_{it}\right) \geq \omega_{it}$. We assume that the entry cost shock ω_{it} follows a log-normal distribution with mean and standard deviation parameters ω and σ_ω. Let $\Phi\left(\cdot, \sigma_\omega\right)$ be the distribution function of a standard normal random variable. Then, the probability of entry conditional on i is thinking about franchising is given by

$$g\left(\boldsymbol{x}_{it}; \nu_i, u_i\right) = \Phi\left(\frac{\log V\left(\boldsymbol{x}_{it}; \nu_i, u_i\right)-\omega}{\sigma_\omega}\right), \tag{12}$$

where we replace $V_i\left(\boldsymbol{x}_{it}\right)$ by $V\left(\boldsymbol{x}_{it}; \nu_i, u_i\right)$.

The parameters of the model are estimated by maximizing the likelihood function of the sample - using simulated maximum likelihood. We conclude this section with a description of the log-likelihood function. For each chain i in the data, we observe when it starts in business (denoted by B_i, and treated as exogenous) and when it starts franchising (denoted by F_i). So, one component of the likelihood function is the likelihood of observing F_i conditional on chain i's unobservable component of the arrival rate (ν_i) and its unobservable profitability of opening a franchised outlet (u_i):

$$p\left(F_i|\nu_i, u_i\right). \tag{13}$$

See Appendix C for details on this component of the likelihood.

We also observe the number of company-owned outlets (denoted by n_{cit}) and the number of franchised outlets (denoted by n_{fit}) for $t = F_i, ..., 2006$.[27] Therefore, another component of the likelihood function is the likelihood of observing $(n_{cit}, n_{fit}; t = F_i, ..., 2006)$ conditional on chain i's timing of franchising (F_i) and the unobservables (ν_i and u_i):

$$p\left(n_{cit}, n_{fit}; t = F_i, ..., 2006 | F_i; \nu_i, u_i\right). \tag{14}$$

For more than 25% of the chains in the data, the number of outlets decreases at least once during the time period we observe this chain. To explain these negative changes in number of outlets, we assume that an outlet can exit during a year with probability γ. The number of company-owned outlets in year t is therefore

$$n_{cit} = n_{cit-1} - \text{exits}_{cit} + (\text{new outlets})_{cit}, \tag{15}$$

where exits_{cit} follows a binomial distribution parameterized by n_{cit-1} and γ. As explained above, $(\text{new outlets})_{cit}$ follows a Poisson distribution with mean $m_i p_{ac}(\boldsymbol{x}_{it}, u_i)$ or $m_i p_{bc}(\boldsymbol{x}_{it}, u_i)$ depending on whether the chain starts franchising before year t or not. Similarly,

$$n_{fit} = n_{fit-1} - \text{exits}_{fit} + (\text{new outlets})_{fit}, \tag{16}$$

where $(\text{new outlets})_{fit}$ follows a Poisson distribution with mean $m_i p_{af}(\boldsymbol{x}_{it}, u_i)$. The recursive equations (15) and (16) are used to derive the probability (14). See Appendix C for further details.

Since our data source is about franchised chains, we only observe a chain if it starts franchising before the last year of our data, which is 2006. Therefore, the likelihood of observing chain i's choice as to when it starts franchising (F_i) and observing its outlets $(n_{cit}, n_{fit}; t = F_i, ..., 2006)$ in the sample depends on the density of $(F_i, n_{cit}, n_{fit}; t = F_i, ..., 2006)$ *conditional* on the fact that we observe it, i.e., $F_i \leq 2006$:

$$\mathcal{L}_i = \frac{\int\int p\left(F_i|\nu_i, u_i\right) \cdot p\left(n_{cit}, n_{fit}; t = F_i, ..., 2006|F_i; \nu_i, u_i\right) dP_{\nu_i} dP_{u_i}}{\int\int p\left(F_i \leq 2006|\nu_i, u_i\right) dP_{\nu_i} dP_{u_i}}. \tag{17}$$

The log-likelihood function is obtained by taking the log and summing up over all chains.

Our estimates of the parameters $\boldsymbol{\beta}_c, \boldsymbol{\beta}_f, m, \sigma_m, \sigma_u, \omega, \sigma_\omega, q_0, q_1$ maximize the log-likelihood function (17). Data on the growth of franchised outlets relative to the growth of company-owned outlets help us identify the parameters in the relative profitability of a franchised outlet ($\boldsymbol{\beta}_f$). For example, if chains in high collaterallizable housing wealth states grow more rapidly through franchised outlets

[27] Since our data source is a survey on franchisors, we only observe the number of outlets of a chain after it starts franchising. The last year of our sample is 2006.

relative to their growth in company-owned outlets, the coefficient of collateralizable housing wealth in the relative profitability of a franchised outlet (an element of $\boldsymbol{\beta}_f$) would be positive. Variation in the total number of outlets, however, can arise not only from variation in the profitability of outlets for this chain but also from variation in the arrival rate that is specific to this chain. We therefore cannot include the same covariates in the arrival rate and in the profitability of a company-owned outlet. This exclusion restriction allows us to identify the coefficients in the general profitability of an outlet and the arrival rate separately. We do allow a constant term in the profitability of an outlet and need to identify it separately from the average opportunity arrival rate m. This identification is possible because for some chains, we observe them in the data in the year when they start franchising. In other words, we observe the accumulated number of company-owned outlets they have chosen to open before they started franchising, which provides information on their overall growth before they have the option to franchise. Once the relative profitability of a franchised outlet is identified as well, the ratio of the overall growth before and after a chain starts franchising identifies the constant term in the general profitability of an outlet. When a chain is very profitable even when it is constrained to open only company-owned outlets, adding the option of franchising has a smaller impact on its overall growth, vice versa. When this constant is identified, variation in the total growth can be used to pin down the average arrival rate.

Dispersion in the total number of outlets identifies the standard deviation of the arrival rate (σ_m). Dispersion in relative growth identifies the variation of the unobserved relative profitability of a franchised outlet (σ_u^2). Given the growth pattern, data on waiting time identifies the distribution of the entry cost, i.e., (ω, σ_ω). Furthermore, the probabilities of being aware or thinking about franchising in the first and then in later years in business (q_0 and q_1) also are identified by the observed variation in waiting time.

4 Estimation Results

Our estimation results are shown in Table 2. In this table, all estimated parameters have the expected signs. They are also all statistically significant except for the coefficient of population in the relative profitability of a franchised outlet. In other words, we find evidence that population levels affect the profitability of outlets positively, but not that it differentially affects the profitability of franchising. One interpretation of this result is that the main effect of population operates through the demand for the product of the chain, rather than the availability of franchisees. The fact that we also find that per capita state product has a positive effect on the profitability of outlets provides further evidence that the demand effect is particularly important in the chain's decisions to grow the number of outlets.

Our main explanatory variable of interest, collateralizable housing wealth, has a positive effect on the value of opening a franchised outlet relative to opening a company-owned outlet. In other

Table 2: Estimation Results

	parameter	standard error
Log of opportunity arrival rate		
constant	3.095	0.012
std. dev.	1.377	0.014
Profitability of an outlet		
constant	-3.210	0.039
population	0.024	0.006
per-capita state product	0.023	0.002
Relative profitability of a franchised outlet		
collateralizable housing wealth	0.100	0.007
population	0.001	0.003
capital needed	-0.348	0.011
employees	0.032	0.003
(coll. housing wealth)×(employees)	0.012	0.001
business products & services	-0.473	0.093
restaurants	0.659	0.053
home services	-0.426	0.069
go to services	0.197	0.050
auto; repair	-1.157	0.046
constant (retailer)	2.642	0.062
std. dev.	2.056	0.023
Outlet exit rate	0.283	0.001
Log of entry cost		
mean	1.995	0.218
std. dev.	0.464	0.011
Probability of thinking of franchising		
at the time of starting business	0.129	0.013
in subsequent years	0.163	0.012

words, when franchisee financial constraints are less binding, namely they have more collateral to put forth, the chains increase their reliance on franchising relative to company ownership. This is in line with the predictions of our model, where franchisee borrowing against their collateral to start their business increases their incentives to work hard and hence the profitability of franchising to the franchisors. The positive effect of the amount of labor needed – which we use to measure the importance of the manager's effort – is in line also with the idea that incentives for the manager are an important factor leading chains to favor franchising. Moreover, we find that the interaction of collateralizable wealth with the amount of labor also has a positive effect on the chain's decision to grow via franchising. This confirms the prediction of our model that franchisee incentives arising from having more collateral at stake are particularly valuable in businesses where the manager's role is more important to the success of the business. Similarly, the coefficients for the sector dummy variables suggest that, controlling for the level of labor and capital needed, the benefit of franchising is greatest for restaurant chains, go to services, and retailers, i.e. that these types of businesses are particularly well suited to having an owner operator, rather than a hired manager, on site to supervise workers and oversee operations more generally. Finally, the negative effect of capital required on the relative profitability of franchising is consistent with the prediction of our model; when the amount to be borrowed goes up, the franchisee's probability of default is greater, which makes franchising less appealing.

We also find a large and highly significant rate of closure of outlets in our data. It implies that about 28% of all outlets close every year. This is larger than the 15% exit rate documented in Jarmin, Klimek and Miranda (2009) for single retail establishments. Most likely this is in part because our data includes relatively more firms from industries with higher than average exit rates (e.g. restaurants per their analyses).[28] Also, our data comprises mostly new franchised chains in their first years in franchising. Two things happen to these chains that explain our high exit rate. First, many of them are experimenting and developing their concept while opening establishments. Some of this experimentation, in terms of product as well as location types – e.g. rural, suburban and urban, in strip malls or stand alone, in high or low income areas, and so on – will not pan out, resulting in some establishments being closed down. Second, when chains begin to franchise, they often transform some of the outlets they had established earlier as company outlets into franchised outlets. In our outlet counts, such transfers would show up as an increase in number of franchised outlets, combined with a reduction, and thus exit, of a number of company owned outlets.

Finally, we find evidence that only a fraction of the chains in our data are aware or thinking of franchising from the time they start in business. The majority of them, namely (100%-13%), or 87%, do not think of franchising in their first year in business.[29] The probability that they

[28]See also Abrams (2004), who reports on a study conducted by Prof. H.G. Parsa at Ohio State University. Prof. Parsa tracked new restaurants from 1996-1999 and found that 59 percent of them closed within those three years.

[29]Note that around 17% of chains in our data starts franchising right away, which is greater than our estimate of 13% who are aware of franchising when they start their business. This discrepancy is because the observed proportion

become aware or start thinking about franchising the next year or the years after that is larger, at 16% each year. The estimated average entry cost – the cost of starting to franchise – is 8.18 ($= e^{1.995+0.5 \cdot 0.464^2}$). According to our estimates, this is about four times the average value of outlets that the chains choose to open.[30]

To see how well our estimated model fits the entry and the expansion patterns of the chains in the data, we compare the distribution of the waiting time from the data with the same distribution predicted by the model according to a simulation in Figure 5(a). We make a similar comparison for the distributions of the number of company-owned and franchised outlets also in Figures 5(b) and 5(c), respectively.

The left panel of Figure 5(a) shows the distribution of the waiting time in the data while the right panel of Figure 5(a) displays the simulated distribution of the waiting time *conditional on* a chain having started franchising by 2006. Since a chain is included in our data only after it started franchising and the last year of our sample is 2006, this conditional distribution is the model counterpart of the distribution in the data. Comparing the two panels of Figure 5(a), we can see that our estimated model fits the entry decision of chains in the data rather well.

For its part, Figure 5(b) compares the distribution of the number of company-owned outlets in the data (in the left panel) and the distribution of the number of company-owned outlets in the years after a chain starts franchising, and hence also conditional on the chain having started franchising no later than 2006 (see the right panel).[31] This comparison is the appropriate one to make because we only observe the size of a chain after it starts franchising. Comparing the two figures indicates that our empirical model fits the percentage of chain/years with more than one company-owned outlet well. But the model over-predicts the fraction of chain/years with no company-owned outlet, and under-predicts the fraction with only one company-owned outlets. It does predict the sum of these two fractions pretty well, however. This is probably because our model does not capture a chain's desire to keep at least one company-owned outlet as a showcase for potential franchisees, and for running experiments for new products, for example. Similarly, Figure 5(c) plots the distribution of the number of franchised outlets in the data (on the left) and the model predicted distribution of this number conditional on a chain having started franchising no later than 2006 (on the right).[32] The overall fit is good, but, not surprisingly, the distribution predicted by the model is much smoother than that in the data.

We also simulate the distribution of the number of company-owned and franchised outlets when the decision on the timing of entry into franchising is ignored. Specifically, in these simulations we

is conditional on starting to franchise by 2006.

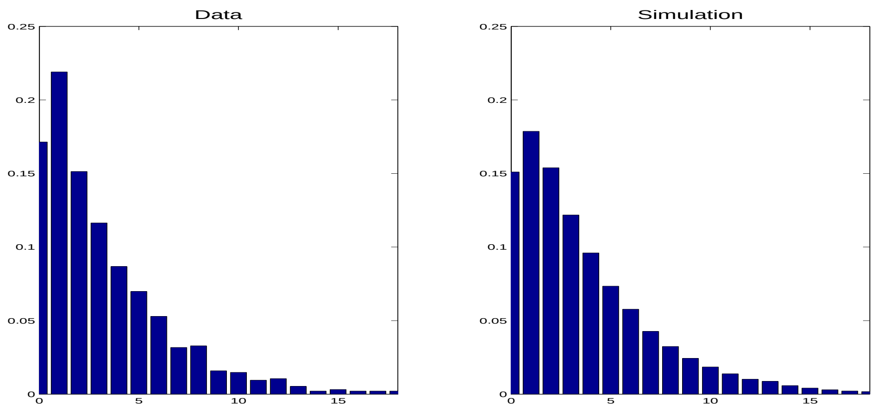
[30]The value of an opened outlet is $E(max\{\pi_{ci\tau}, \pi_{fi\tau}\}|max\{\pi_{ci\tau}, \pi_{fi\tau}\} > 0)$. It is 1.93 on average (across chain/years) according to our estimates.

[31]Since there are only a few chain/years with more than 50 company-owned outlets, we truncate the graphs on the right at 50 for readability.

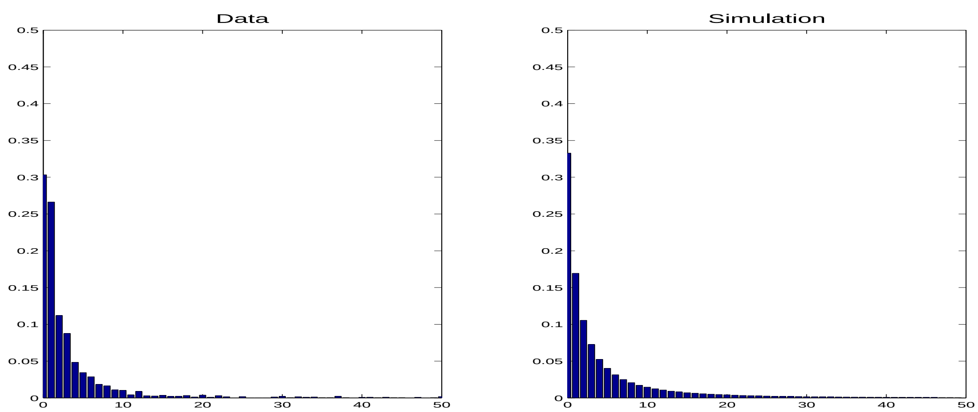
[32]Similar to 5(b), we truncate the graphs on the right at 200 because there are only a few chain/years with more than 200 franchised outlets.

Figure 5: Fit of the Model

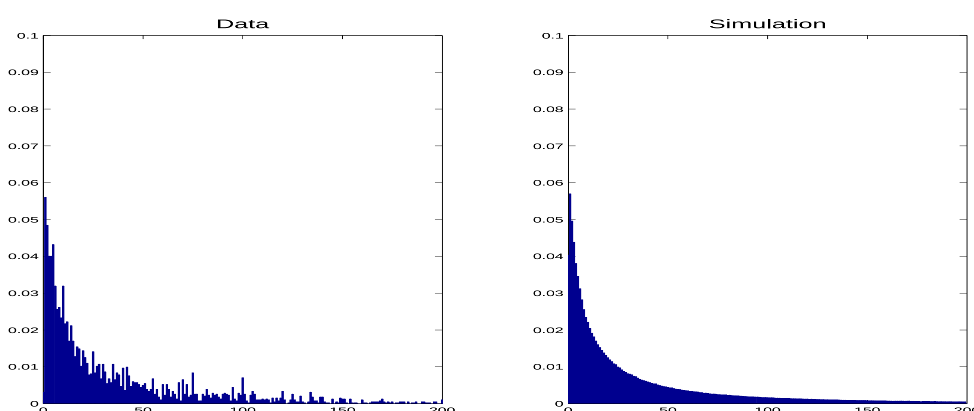
(a) Distribution of Waiting Time: Data vs. Simulation



(b) Distribution of the Number of Company-owned Outlets: Data vs. Simulation



(c) Distribution of the Number of Franchised Outlets: Data vs. Simulation



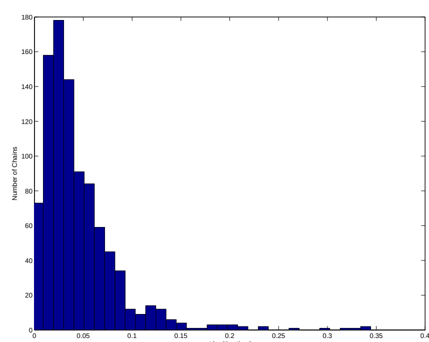
take the observed waiting time in the data as exogenously given. The simulated distributions are shown in Supplemental Appendix E.

5 Counterfactual Simulations

In this Section, we conduct a counterfactual simulation where collateralizable housing wealth is decreased by 30% in all state/years in the data. This exercise serves two purposes. First, it helps us understand the economic meaning of the estimated effect of collateralizable housing wealth on the extent of franchising and the expansion of the chains. Second, it allows us to explore the likely effect of the reduction in housing values on the growth of small businesses, in this case franchised establishments.

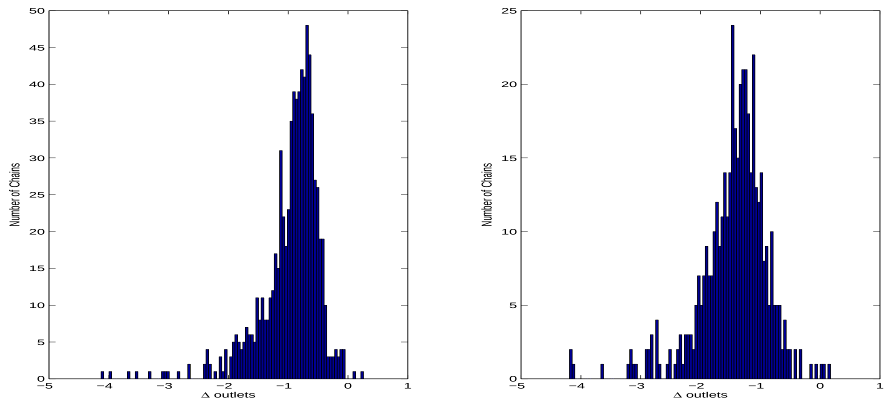
Figure 6 shows the distribution of the average change in waiting time that results from this change in collateralizable wealth. For each chain/simulation draw, we compute the waiting time with and without a 30% decrease in local collateralizable housing wealth. We then compute the average waiting time across simulations for this chain. The histogram of these average changes in waiting time is presented in Figure 6. We use the simulated distribution without the decrease rather than the empirical distribution directly from the data as the benchmark for two reasons. First, we do not want estimation errors to contribute to the observed differences between the distributions with and without the decrease in collateralizable housing wealth. Second, since we are interested in the effect of tightening franchisee's financial constraints on waiting time, we need to plot the *unconditional* distribution of the waiting time, which is not observable in the data. In the data, we only observe the distribution conditional on entry into franchising before 2006.

Figure 6: The Effect of Potential Franchisees' Financial Constraints on Chain's Waiting Time



From Figure 6, we can see that all chains in our data go into franchising on average (averaged over simulations) later with than without the change in franchisee financial constraints. The impact of decreased collateral wealth on the chains' decisions to start franchising is small though. The average effect for most chains is less than 0.05 (years). It is also possible that changes in franchisee wealth could make franchising less attractive to chains that might have considered it as a viable

Figure 7: The Effect of Potential Franchisees' Financial Constraints on the Number of Outlets



option if franchisees with suitable wealth were easier to find. This, however, is beyond the scope of what our simulations can capture explicitly, as the simulations are based on a set of chains that we know chose to franchise by 2006.

Figure 7 shows the average change in the number of company-owned outlets and franchised outlets that results from the 30% decrease in potential franchisee collateralizable wealth. The results of our simulations imply that the number of total outlets of chains five years after they start in business decreases by 0.95 on average (averaged over simulations and the 764 firms in our sample that started in business no later than 2002).[33] In total, these 764 firms would fail to open 726 outlets with 4269 jobs – according to our data on number of employees per establishment – in the process.[34] Similarly, there are 447 firms in our sample that started franchising no later than 1997. Our simulation indicates that these firms would have 644 fewer outlets ten years after starting in business, or 1.44 fewer outlets each on average. The corresponding amount of jobs loss would be 3608.

Of course, the franchised chains in our sample are only a subset of all franchisors – they are the chains that started in business after 1984 but before 1997 or 2002, and that started franchising before 2006, and that were included in our data sources. To understand the overall impact of the tightening of franchisees' financial constraints might be, we can use the average percentage changes in the number of outlets five and ten years after a firm starts its business. They are, respectively, 2.0% and 2.4%. Per the 2007 Economic Census information, business-format franchised chains had more than 380,000 establishments, and accounted for 6.4 million jobs in the U.S. Using the latter figure, and the percentage changes in outlets that we obtain, the predicted number of jobs affected

[33]The average number of outlets five years after a chain starts its business is 25.78 in the data. The simulated counterpart (without any change in collateralizable housing wealth) is 38.08. This much larger average simulated number of outlets arises in part because we have a few firms that grow quite large – much larger than real firms do – in our simulations.

[34]The jobs numbers also are averaged over simulations. We can simulate the lack of job creation because we observe the typical number of employees needed in an outlet for each chain.

could be as large as 128,000 to 153,600.

6 Conclusion

In this paper, we have shown theoretically and empirically that the entry of a chain into franchising and its growth via franchised relative to company-owned outlets are intrinsically linked. We have also shown that both of these depend in a systematic way on the availability of financial resources of potential franchisees. The magnitude of the effects is not large, but still sizable, suggesting that financial constraints play an important role for the type of small business owners that franchisors try to attract into their ranks. Finally, while our data, like those that are typically available to study small businesses, only show the net change in number of outlets each year, our model allows us to separately identify both the creation and exit of outlets in the data. Our results suggest that outlet exit rates – which include a number of transfers between franchising and company ownership – are quite high in these types of businesses, higher perhaps than current estimates – which are also high – indicate.

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Appendix

A The Weight Matrix Used in Constructing Values for Macroeconomic Variables that are Relevant to each Chain

	AK	AL	AR	AZ	CA	CO	CT	DC	DE	FL	GA	HI	IA	ID	IL	IN	KS	KY	LA	MA	MD	ME	MI	MN	MO	MS	MT
AL	0	0.63	0	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0	0	0
AR	0.08	0	0.38	0	0	0.08	0	0	0	0.08	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AZ	0	0	0	0.44	0.35	0	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	0.01	0.83	0.01	0	0	0	0.02	0.01	0	0	0	0	0	0	0.01	0	0	0	0	0.01	0.01	0.01	0	0
CO	0	0	0	0	0.19	0.63	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	0	0	0	0	0	0	0.73	0	0	0	0.05	0	0	0	0	0	0	0	0	0.09	0	0	0	0	0	0	0
DC	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DE	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FL	0	0	0	0	0.13	0.01	0.01	0.01	0	0.61	0.03	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0.01	0	0	0
GA	0	0.02	0	0	0.09	0	0	0	0	0.18	0.38	0.02	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0	0
HI	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IA	0	0	0	0	0	0	0	0	0	0.11	0	0	0.78	0	0.11	0	0	0	0	0	0	0	0	0	0	0	0
ID	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0.25
IL	0	0	0	0	0.11	0	0	0	0	0.02	0	0	0	0	0.64	0.02	0	0	0	0	0	0	0.05	0.02	0	0	0
IN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	0.55	0	0.09	0	0	0	0	0.09	0	0	0	0
KS	0	0	0	0	0	0	0	0	0	0.07	0	0	0.07	0	0	0	0.33	0	0	0	0	0	0	0.07	0.13	0	0
KY	0	0	0	0	0	0	0	0	0	0.11	0	0	0	0	0	0.05	0	0.58	0	0	0	0	0.05	0	0	0	0
LA	0	0	0.06	0	0.06	0	0	0	0	0	0	0	0	0.06	0	0	0	0	0.56	0	0	0	0	0	0	0	0
MA	0	0	0	0	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.65	0	0	0	0	0	0	0
MD	0	0	0	0	0.17	0	0	0	0	0.10	0	0	0	0	0	0	0.03	0	0	0	0.47	0	0.03	0	0	0	0
ME	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0
MI	0	0	0	0	0.08	0	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0.02	0	0	0.80	0	0	0	0
MN	0	0	0	0.04	0.08	0	0.02	0	0	0.04	0	0	0.02	0	0.02	0	0	0	0	0	0	0	0	0.55	0	0	0
MO	0	0	0	0	0	0	0	0	0	0.10	0	0	0.05	0	0.05	0	0.10	0	0	0	0	0	0	0	0.52	0	0
MS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.67	0
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00
NC	0	0	0	0	0.05	0	0	0	0	0.11	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0
NE	0	0	0	0	0.14	0	0	0	0	0.03	0	0	0.03	0	0.03	0	0.03	0	0	0	0	0	0.03	0	0	0	0
NH	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0	0
NJ	0	0	0	0	0.09	0	0	0	0	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0	0	0	0
NV	0	0	0	0	0.25	0.06	0	0	0	0.06	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NY	0	0	0	0	0.08	0	0.04	0	0	0.08	0.04	0.02	0	0.02	0	0	0	0.02	0	0.02	0	0	0.02	0	0	0	0
OH	0	0	0	0	0.12	0	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0.03	0	0.03	0	0	0	0
OK	0	0	0	0	0	0	0	0	0	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OR	0	0	0	0.05	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA	0	0	0	0	0.02	0	0	0	0.02	0.05	0.02	0	0	0	0.02	0	0	0.02	0	0	0.02	0	0	0	0	0	0
RI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0	0	0	0	0	0
SC	0	0	0	0	0.11	0	0	0	0	0.11	0	0	0	0	0	0	0	0	0.11	0	0	0	0	0	0	0	0
SD	0	0	0	0	0	0	0	0	0	0.10	0	0	0.10	0	0	0	0	0	0	0	0	0	0	0.10	0	0	0
TN	0	0.03	0.03	0	0.09	0	0	0	0	0.09	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TX	0	0	0	0.02	0.18	0	0	0	0	0.03	0.02	0	0	0	0.01	0	0	0	0	0	0	0	0.01	0	0	0	0
UT	0	0	0	0	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VA	0	0	0	0	0.16	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0	0	0	0	0	0
VT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WA	0	0	0	0	0.10	0	0	0	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WI	0	0	0	0	0.08	0	0	0	0	0.08	0	0	0	0	0.08	0	0	0	0	0	0	0	0.08	0.04	0	0	0
WV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0	0	0	0	0	0	0	0	0	0	0

	NC	ND	NE	NH	NJ	NM	NV	NY	OH	OK	OR	PA	RI	SC	SD	TN	TX	UT	VA	VT	WA	WI	WV	WY	sum
AL	0	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
AR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.08	0.23	0	0	0	0	0	0	0	1
AZ	0	0	0	0	0	0	0	0.06	0	0	0	0	0	0	0	0.03	0.03	0	0	0	0	0.03	0	0	1
CA	0.01	0	0	0	0	0	0.01	0.01	0.01	0	0.01	0	0	0	0	0.01	0.03	0	0	0	0.01	0	0	0	1
CO	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0.06	0	0	0	0	0	0	0	1
CT	0	0	0	0	0.05	0	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
DC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
DE	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0	0	0	0	0	0	1
FL	0.01	0	0	0	0.03	0	0	0.05	0.02	0	0.01	0.01	0	0	0	0	0.06	0	0	0	0	0	0	0	1
GA	0.06	0	0	0	0.02	0	0	0.02	0.02	0	0.02	0.03	0	0.03	0	0.02	0.09	0	0	0	0	0	0	0	1
HI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
IA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ID	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
IL	0	0	0	0	0.02	0	0	0	0.07	0	0	0	0	0	0	0	0.05	0	0	0	0	0	0	0	1
IN	0	0	0	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
KS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	0.20	0	0	0	0	0.07	0	0	1
KY	0	0	0	0	0	0	0	0	0.11	0	0	0	0	0	0	0	0.05	0	0	0	0	0.05	0	0	1
LA	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0	0.06	0	0	0	0	0	1
MA	0.04	0	0	0	0	0	0	0.04	0.04	0	0	0.04	0.04	0	0	0	0.08	0	0	0	0	0	0	0	1
MD	0	0	0	0	0	0	0	0.03	0	0	0	0.03	0	0	0	0	0.03	0	0.07	0	0	0.03	0	0	1
ME	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0	1
MI	0	0	0	0	0.02	0	0	0	0.02	0	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0	1
MN	0.02	0	0.04	0	0	0	0	0	0.10	0	0.02	0.02	0	0	0	0	0	0	0	0	0	0.04	0	0	1
MO	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0	0	0.14	0	0	0	0	0	0	0	1
MS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	1
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
NC	0.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ND	0	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
NE	0	0	0.52	0	0	0	0	0	0.03	0	0	0	0	0	0	0	0.07	0	0.03	0	0	0.03	0	0	1
NH	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
NJ	0	0	0	0	0.56	0	0	0.09	0.02	0	0	0.09	0	0	0	0.02	0.02	0	0.02	0	0	0	0	0	1
NV	0.13	0	0	0	0	0	0.13	0	0	0	0	0.06	0	0	0	0	0	0	0.06	0	0.19	0	0	0	1
NY	0	0	0	0	0.04	0	0	0.59	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	1
OH	0.01	0	0	0	0.01	0	0	0	0.66	0	0	0.01	0	0	0	0.01	0.03	0.01	0	0	0	0	0	0	1
OK	0	0	0	0	0	0	0	0	0	0.25	0	0.08	0	0	0	0.08	0.50	0	0	0	0	0	0	0	1
OR	0	0	0	0	0	0	0	0	0	0	0.62	0	0	0	0	0	0	0	0	0	0.24	0	0	0	1
PA	0	0	0	0	0	0	0	0.07	0	0	0	0.65	0	0.02	0	0	0.05	0	0	0	0	0	0.02	0	1
RI	0	0	0	0	0	0	0	0	0	0	0	0	0.60	0	0	0	0	0	0.20	0	0	0	0	0	1
SC	0	0	0	0	0.11	0	0	0	0.11	0	0	0	0	0.44	0	0	0	0	0	0	0	0	0	0	1
SD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.70	0	0	0	0	0	0	0	0	0	1
TN	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.03	0	0.03	0	0	0	0	0	1
TX	0	0	0	0	0	0.02	0.01	0.01	0.01	0	0	0	0	0	0	0.01	0.67	0	0.01	0	0	0	0	0	1
UT	0	0	0	0	0	0	0	0.04	0	0	0.08	0	0	0	0	0	0.04	0.36	0	0	0	0	0	0	1
VA	0.04	0	0	0	0	0	0	0.08	0.04	0	0	0.08	0	0	0	0	0	0	0.52	0	0	0	0	0	1
VT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	1
WA	0	0	0	0	0	0	0	0	0	0	0.10	0	0	0	0	0	0.10	0	0	0	0.65	0	0	0	1
WI	0	0	0	0	0	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0.58	0	0	1
WV	0	0	0	0	0	0	0	0	0.20	0	0	0.20	0	0	0	0	0	0	0	0	0	0	0.40	0	1

For a chain whose home state is AL, for example, its macroeconomic variable is the weighting sum of the macroeconomic variable in the 51 states where the weights are given by the first row.

B Details on the Parametric Model in Section 3.2

In this Appendix, we describe the parametric model in Section 3.2. In this parametric model, we assume a linear revenue function $G(\theta, a) = \theta + \beta a$ and a linear continuation value $W(\theta, a) = 2\theta + 4a$. The profit shock θ follows a normal distribution with mean 6 and standard deviation 6. Opening an outlet in this chain requires capital $I = 5$. In the debt contract, the repayment R depends on the amount of money borrowed (I) and the collateral (C) according to the following linear function: $R = (1+r)\,I$ where $r = 0.5 - (0.5 - 0.01)C/I$. In other words, the interest rate is 50% when $C = 0$ and 1% when $C = I$.

The franchisee's utility function is $-e^{-\rho w}$ where $\rho = 0.02$ is her absolute risk aversion parameter and w is her payoff. It is costly for her to exert effort. The cost is $\Psi(a) = e^{a}$.[35]

We assume that the number of potential franchisees N follows a Poisson distribution with mean $\bar{N}$. The collateralizable wealth that each potential franchisee has follows a truncated normal distribution with mean $\bar{C}$ and variance 1. It is truncated on the left at 0.

The expected profit from a company-owned outlet is $\tilde{\pi}_c = E_\theta\left[G(\theta, a_0) + W(\theta, a_0)\,\mathbf{1}\left(W(\theta, a_0) > 0\right)\right] - I$. We normalize the hired manager's effort a_0 to be 0 and the corresponding compensation to be 0. Thus, $\tilde{\pi}_c = 14$ in our example.

C Details on the Log-likelihood Function

In this Section, we derive the log-likelihood function (17), which consists of three components: $p(F_i|\nu_i, u_i)$, $p(F_i \leq 2006|\nu_i, u_i)$ and $p(n_{cit}, n_{fit}; t = F_i, ..., 2006|F_i; \nu_i, u_i)$.

The likelihood of observing F_i conditional on chain i's unobservable component of the arrival rate (ν_i) and its unobservable profitability of opening a franchised outlet (u_i) is

$$p(F_i|\nu_i, u_i) = \sum_{t'=B_i}^{F_i}\left[\prod_{t=B_i}^{t'-1}(1-q_t)\cdot q_{t'}\cdot\prod_{t=t'}^{F_i-1}\left(1-g(\boldsymbol{x}_{it};\nu_i,u_i)\right)\cdot g(\boldsymbol{x}_{iF_i};\nu_i,u_i)\right], \tag{C.18}$$

where q_t is the probability that the chain is thinking about franchising in a specific year. As explained above, $q_t = q_0$ when $t = B_i$ and $q_t = q_1$ when $t > B_i$. Thus, the first summand in (C.18), $q_{B_i}\cdot\prod_{t=B_i}^{F_i-1}\left(1-g(\boldsymbol{x}_{it};\nu_i,u_i)\right)\cdot g(\boldsymbol{x}_{iF_i};\nu_i,u_i)$, is the probability that chain i is thinking of franchising from the very beginning, but chooses not to start franchising until the year of F_i. Similarly, the second summand in (C.18), $(1-q_{B_i})q_{B_i+1}\cdot\prod_{t=B_i+1}^{F_i-1}\left(1-g(\boldsymbol{x}_{it};\nu_i,u_i)\right)\cdot g(\boldsymbol{x}_{iF_i};\nu_i,u_i)$, is the probability that chain i starts to thinking of franchising one year after it starts business, but

[35] In Section 3.1, we include the the one-time lump-sum fixed fee that the franchisee pays the chain L in the franchisee's cost function. So, $\Psi(a)$ is in fact $e^{a} + L$.

does not start franchising until the year of F_i. The sum of all such terms gives us the probability of starting franchising in year F_i.

The likelihood of observing chain i in the sample, i.e., $F_i \leq 2006$, is thus the sum of the probability that chain i starts franchising right away ($F = B_i$), the probability that it starts one year later ($F = B_i + 1$), ..., the probability that it starts before 2006, i.e.,

$$p\left(F_i \leq 2006 | \nu_i, u_i\right) = \sum_{F=B_i}^{2006} p\left(F | \nu_i, u_i\right).$$

To derive the likelihood of observing the growth path $(n_{cit}, n_{fit}; t = F_i, ..., 2006)$ of chain i conditional on its timing of franchising, note that the number of company-owned outlets in year t is given by equation (15), copied below:

$$n_{cit} = n_{cit-1} - \text{exits}_{cit} + (\text{new outlets})_{cit},$$

where exits_{cit} follows a binomial distribution parameterized by n_{cit-1} and γ; and $(\text{new outlets})_{cit}$ follows a Poisson distribution with mean $m_i p_{ac}\left(\boldsymbol{x}_{it}, u_i\right)$ or $m_i p_{bc}\left(\boldsymbol{x}_{it}, u_i\right)$ depending on whether the chain starts franchising before year t or not. Given that the mixture of a Poisson distribution and a binomial distribution is a Poisson distribution[36] and the sum of two independent Poisson random variables follows a Poisson distribution, n_{cit} follows a Poisson distribution with mean $\sum_{\tau=B_i}^{t} m_i p_c\left(\boldsymbol{x}_{i\tau}, u_i\right)(1-\gamma)^{t-\tau}$ where $p_c\left(\boldsymbol{x}_{i\tau}, u_i\right) = p_{cb}\left(\boldsymbol{x}_{i\tau}, u_i\right)$ for $\tau < F_i$ and $p_c\left(\boldsymbol{x}_{i\tau}, u_i\right) = p_{ca}\left(\boldsymbol{x}_{i\tau}, u_i\right)$ for $\tau \geq F_i$. The likelihood of observing n_{cit} in the year the chain starts franchising (i.e. in the first year that we can observe this chain in the data) conditional on it starting franchising in year F_i is therefore

$$p_{n_{cit}|F_i}\left(\nu_i, u_i\right) = \Pr\left(n_{cit}; \sum_{\tau=B_i}^{t} m_i p_c\left(\boldsymbol{x}_{i\tau}, u_i\right)(1-\gamma)^{t-\tau}\right) \text{ for } t = F_i.$$

For subsequent years ($t = F_i + 1, ..., 2006$), we need to compute the likelihood of observing n_{cit} conditional on F_i as well as n_{cit-1}. According to equation (15), this conditional probability is the convolution of a binomial distribution ("$n_{cit-1}-\text{exits}_{cit}$" follows a binomial distribution with parameters n_{cit-1} and $1-\gamma$) and a Poisson distribution ($(\text{new outlets})_{cit}$ follows a Poisson distribution

[36]If X follows a binomial distribution with parameters (N, p) and N itself follows a Poisson distribution with mean m, then X follows a Poisson distribution with mean mp. In equation (15), $n_{oit-1}-\text{exits}_{oit}$ follows a binomial distribution with parameters n_{oit-1} and $1-\gamma$.

with mean $m_i p_{ac}(\boldsymbol{x}_{it}, u_i)$):

$$\begin{aligned} & P_{n_{cit}|n_{cit-1},F_i}(\nu_i, u_i) \\ = & \sum_{Y=0}^{n_{cit-1}} \Pr(Y|n_{cit-1}; 1-\gamma) \Pr\left((\text{new outlets})_{cit} = n_{cit} - Y; m_i p_{ac}(\boldsymbol{x}_{it}, u_i)\right). \end{aligned}$$

However, when n_{cit-1} is not observable but n_{cit-2} is, we need to compute $P_{n_{cit}|n_{cit-2},F_i}$. Note that $n_{cit} = n_{cit-2} - \text{exits}_{cit-1} + (\text{new outlets})_{cit-1} - \text{exits}_{cit} + (\text{new outlets})_{cit}$ can be rewritten as

$$\begin{aligned} & \text{outlets in } n_{cit-2} \text{ that do not exit before } t \\ + & \text{ new outlets in } t-1 \text{ that do not exit before } t \\ + & \text{ new outlets in } t, \end{aligned}$$

where "outlets in n_{cit-2} that do not exit before t" follows a binomial distribution with parameters $(n_{cit-2}, (1-\gamma)^2)$, "new outlets in $t-1$ that do not exit before t" follows a Poisson distribution with mean $m_i p_{ac}(\boldsymbol{x}_{it-1}, u_i)(1-\gamma)$ and "new outlets in t" follows a Poisson distribution with mean $m_i p_{ac}(\boldsymbol{x}_{it}, u_i)$. Therefore,

$$\begin{aligned} & P_{n_{cit}|n_{cit-2},F_i}(\nu_i, u_i) \\ = & \sum_{Y=0}^{n_{cit-1}} \Pr\left(Y|n_{cit-1}; (1-\gamma)^2\right) \Pr\left((\text{new outlets})_{cit} = n_{cit} - Y; m_i p_{ac}(\boldsymbol{x}_{it-1}, u_i)(1-\gamma) + m_i p_{ac}(\boldsymbol{x}_{it}, u_i)\right). \end{aligned}$$

The conditional probabilities $p_{n_{fit}|F_i}(\nu_i, u_i)$, $P_{n_{fit}|n_{fit-1},F_i}(\nu_i, u_i)$ and $P_{n_{fit}|n_{fit-2},F_i}(\nu_i, u_i)$ can be computed analogously. Since Poisson events that result in company-owned and franchised outlet expansions are independent events (because Poisson events are independent), the likelihood of observing chain i's growth path is

$$\begin{aligned} & p(n_{cit}, n_{fit}; t = F_i, ..., 2006|F_i; \nu_i, u_i) \\ = & p_{n_{ciF_i}|F_i}(\nu_i, u_i) \cdot \prod_{t=F_i+1}^{2006} P_{n_{cit}|n_{cit-1},F_i} \cdot p_{n_{fiF_i}|F_i}(\nu_i, u_i) \cdot \prod_{t=F_i+1}^{2006} P_{n_{fit}|n_{fit-1},F_i} \end{aligned}$$

and when the observation of a year is missing (for example, in 1999 and 2002 when the data were not collected), we replace $P_{n_{cit}|n_{cit-1},F_i}$ and $P_{n_{fit}|n_{fit-1},F_i}$ by $P_{n_{cit}|n_{cit-2},F_i}$ and $P_{n_{fit}|n_{fit-2},F_i}$.

D Proofs for Section 3.1

In this Section, we show that $\frac{\partial^2 U}{\partial a \partial C} > 0$ at the interior solution to the franchisee's utility maximization problem. Note that the effect of increasing C on the marginal utility of effort is

$$
\begin{aligned}
\frac{\partial^2 U}{\partial a \partial C} &= \rho^2 \int_{-\infty}^{\theta^*} \left[(1-s) \frac{\partial G(\theta,a)}{\partial a} - \Psi'(a) \right] e^{-\rho[(1-s)G(\theta,a)-C-\Psi(a)]} dF(\theta) \\
&+\rho \left[(1-s) \frac{\partial G(\theta^*,a)}{\partial a} - \Psi'(a) \right] e^{-\rho[(1-s)G(\theta^*,a)-C-\Psi(a)]} f(\theta^*) \frac{\partial \theta^*}{\partial C} \\
&+\rho^2 \frac{\partial R}{\partial C} \int_{\theta^*}^{\infty} \left[(1-s) \left(\frac{\partial G(\theta,a)}{\partial a} + \frac{\partial V(\theta,a)}{\partial a} \right) - \Psi'(a) \right] e^{-\rho[(1-s)(G(\theta,a)+V(\theta,a))-R(C,I)-\Psi(a)]} dF(\theta) \\
&-\rho \left[(1-s) \left(\frac{\partial G(\theta^*,a)}{\partial a} + \frac{\partial V(\theta^*,a)}{\partial a} \right) - \Psi'(a) \right] e^{-\rho[(1-s)(G(\theta^*,a)+V(\theta^*,a))-R(C,I)-\Psi(a)]} f(\theta^*) \frac{\partial \theta^*}{\partial C}.
\end{aligned} \tag{D.19}
$$

It can be simplified as follows when (1) is plugged in:

$$
\begin{aligned}
&\rho^2 \int_{-\infty}^{\theta^*} \left[(1-s) \frac{\partial G(\theta,a)}{\partial a} - \Psi'(a) \right] e^{-\rho[(1-s)G(\theta,a)-C-\Psi(a)]} dF(\theta) \\
&+\rho^2 \frac{\partial R}{\partial C} \int_{\theta^*}^{\infty} \left[(1-s) \left(\frac{\partial G(\theta,a)}{\partial a} + \frac{\partial V(\theta,a)}{\partial a} \right) - \Psi'(a) \right] e^{-\rho[(1-s)(G(\theta,a)+V(\theta,a))-R(C,I)-\Psi(a)]} dF(\theta) \\
&+\rho^2 (1-s) \frac{\partial V(\theta^*,a)}{\partial a} e^{-\rho[(1-s)(G(\theta^*,a)+V(\theta^*,a))-R(C,I)-\Psi(a)]} f(\theta^*) \frac{\partial \theta^*}{\partial C}.
\end{aligned} \tag{D.20}
$$

At the interior solution of the franchisee's effort choice problem, the first order condition (3) holds. Given that $\frac{\partial V}{\partial a} > 0$, the first summand in (3) is negative and the second is positive. Since $\frac{\partial R}{\partial C} < 0$, the sum of the first two terms in (D.19) is negative. The last term is also negative because $\frac{\partial \theta^*}{\partial C} < 0$. Therefore, the derivative in (D.20) is positive.

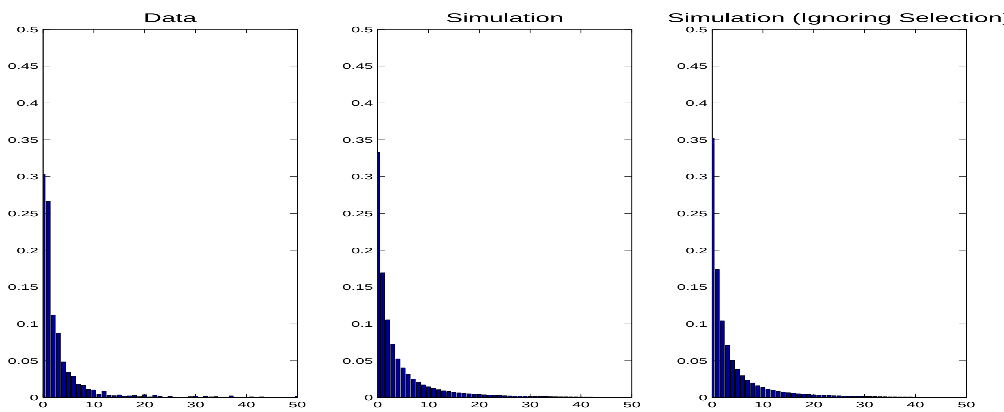
E Simulated Distributions of the Number of Outlets when Selection is Ignored

In this Section, we show simulated distributions of the number of company-owned and franchised outlets when the decision on the timing of entry into franchising is ignored. Specifically, in these simulations we take the observed waiting time in the data as exogenously given. The simulated distributions are shown in the right panels of Figures 8(a) and 8(b). We include the two panels in Figure 5(b) (and 5(c)) as the left and the middle panels in Figure 8(a) (and Figure 8(b)) for comparison. When we compare the middle panel of Figure 8(a) (the simulated distribution of the number of company-owned outlets when selection is considered) and the right panel of the same figure (the simulated distribution when the timing of entry is ignored), we can see that these two distributions are very similar. This is because two effects are at play, and they presumably cancel each other out. On the one hand, chains that enter into franchising quickly tend to grow faster overall either because they are presented with more opportunities to open outlets or because outlets of these chains are more likely to be profitable. This effect is illustrated in Figure 1. On the other hand, chains that enter into franchising fast are chains for which a franchised outlet is likely to be particularly profitable relative to a company-owned outlet. This effect is suggested by Figure 2. The latter effect shifts the distribution of the number of company-owned outlets to the left, while the first effect shifts the same distribution to the right.

The second effect is also consistent with the comparison of the middle panel and the right panel of Figure 8(b) for the number of franchised outlets. The simulated distribution of the number of franchised outlets when the entry decision is taken as exogenous (in the right panel) is shifted to the left from the simulated distribution where the entry decision is endogenized (in the middle panel). This is because when we simulate the distribution in the right panel, we draw the unobservable profitability of a franchised outlet from the unconditional distribution. So even if the draw is not in favor of a chain opening a franchised outlet when an opportunity arrives, the simulated number of franchised outlets corresponding to this draw, which is most likely to be very small, is included to compute the distribution. When the timing of entry is taken into account, however, a chain with unfavorable draws is likely to delay its entry into franchising, and therefore it is not included in the computation of the conditional distribution of the number of franchised outlets.

Figure 8: Simulated Distributions of the Number of Outlets when Selection is Ignored

(a) Number of Company-owned Outlets



(b) Number of Franchised Outlets