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Financial Constraints and Moral Hazard: The Case of Franchising*

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June 2016

Abstract

Financial constraints are considered an important impediment to growth for small businesses. We study theoretically and empirically the relationship between the financial constraints of agents and the organizational decisions and growth of principals, in the context of franchising. We find that a 30 percent decrease in average collateralizable housing wealth in an area is associated with a delay in chains' entry into franchising by 0.33 years on average, or 10 percent of the average waiting time, and a reduction in chain growth and hence a reduction in franchised chain employment of about 9 percent.

Keywords: Contracting, incentives, principal-agent, empirical, collateralizable housing wealth, entry, growth

JEL: L14, L22, D22, D82, L8

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1 Introduction

The recent Great Recession led to a sizable deterioration in households' balance sheets. The resulting decline in households' collateralizable wealth has been suggested as a major factor adversely affecting the viability and growth of small businesses. For example, in their report for the Cleveland Fed, Schweitzer and Shane (2010) write "(we) find that homes do constitute an important source of capital for small business owners and that the impact of the recent decline in housing prices is significant enough to be a real constraint on small business finances." Franchised businesses are an economically important subgroup of small businesses. According to the Economic Census, franchised businesses accounted for 453,326 establishments and nearly $1.3 trillion in sales in 2007. They employed 7.9 million workers, or about 5% of the total workforce in the U.S. The literature suggests that the main purpose of the franchise relationship is to induce higher effort from a franchisee compared to a salaried manager.[1] Because of the importance of effort and moral hazard, franchisors – even established ones with access to capital markets – normally require that their franchisees put up significant portions of the capital needed to open a franchise. As described in the trade press, franchisors view this requirement as a way to ensure that franchisees have "skin in the game."

In this paper, we study theoretically and empirically the relationship between the financial constraints of agents and the organizational form decisions and growth of principals in the context of franchising. We develop a principal-agent model to show that how much collateral an agent can post may affect her incentives to work hard because higher collateral makes the agent more averse to default, which, in turn, leads her to exert more effort. We show that an agent's financial constraints then affect the principal's interests in engaging in the relationship, i.e., the principal's organizational form decisions. We then show that this effect is important empirically using data on franchised chains' timing of entry into franchising and growth through opening company-owned and franchised outlets.

We view franchising as an ideal context to study the issue of agents' financial constraints and moral hazard, and how they relate to principals' organizational decisions and growth, for two main reasons. First, through their initial decision to begin franchising and their marginal decisions on whether to open each new outlet as a franchisee- or company-owned outlet, we obtain many observations regarding organizational choice, i.e., the choice between vertical separation (franchising) and integration (company-ownership). Second, industry participants themselves emphasize the role of franchisee financial constraints and express concern about its likely effect on their growth (see for example Reuteman (2009) and Needleman (2011)).

[1] A franchised establishment carries the brand of a chain and conforms to a common format of the products or services offered. However, the outlet is owned by a franchisee, who is a typical small entrepreneur, i.e., an individual (or a household) who bears the investment costs and earns the profit of the establishment, after paying royalties and other fees to the chain, also known as the franchisor. See Lafontaine and Slade (2007) for a survey of the literature.

We begin by building 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 signs two contracts, namely, a franchise contract with her franchisor and a debt contract with a bank, so she can finance the required capital. After committing to these, the franchisee decides on effort. Revenue is then realized, at which point the franchisee decides whether or not to default on the debt contract. A higher level of collateral means that for a given effort level, it is less likely that the franchisee defaults as the opportunity cost of defaulting is higher. At the same time, the franchisee's payoff when she does not default is increasing in effort. Therefore, a higher level of collateral leads to higher returns to effort and thus greater incentives to choose high effort. When an opportunity to open an outlet arises, the franchisor's problem is to choose whether to proceed and, if so, via what organizational form, i.e., company-owned or franchised. In equilibrium, the expected profit generated by a franchised outlet for the franchisor is increasing in the average collateral of potential franchisees. In other words, potential franchisees' financial constraints affect franchisors' organizational choices, and, consequently, their growth via franchising and company-owned outlets.[2]

We then take the intuition developed in the model to the data. Our empirical model describes franchisors' growth decisions via company-owned and franchised outlets. It also describes their timing of entry into franchising – an aspect of the franchisors' organizational choices that has not been endogenized or analyzed in the literature. Using data from 934 chains that started their business and subsequently started franchising some time between 1984 and 2006, we estimate the determinants of these decisions. We combine our chain-level data with information about the aggregate economic conditions in the expected expansion area of these chains. In particular, we use the average collateralizable housing wealth in a chain's expected expansion area to capture the average financial resources of this chain's potential franchisees.[3]

Collateralizable housing wealth can have an effect on the opening of franchised outlets not only through affecting the organizational form decisions as discussed above, but also through its effect on demand. We can separate these because we observe two growth paths, the growth path in the number of company-owned outlets and the growth path in the number of franchised outlets. The variation in the relative growth of the number of franchised outlets helps us capture the effect of collateralizable housing wealth on the organizational choice, while the variation in the overall

[2]Our theoretical model also implies that banks will ration potential franchisees with too little collateral. In other words, in our model, collateralizable housing wealth affects franchisors' organizational choices not only through its effect on the effort of franchisees who are qualified to get a loan, but also via the number of potential franchisees who are qualified to get a loan, both due to the same underlying incentive problem.

[3]See Aizcorbe, Kennickell and Moore (2003) and Bricker, Kennickell, Moore and Sabelhaus (2012) on how housing wealth is a major component of a household's total assets, and Robb and Robinson (2014) for evidence on how formal credit channels are the most important sources of funding for startups. Similarly, the Census' Survey of Business Owners in 2002 and 2007 show that, on average, 40.24% of franchisees who started their businesses in 2002 (and 33.52% in 2007) used bank loans to at least partially finance their initial investments. These percentages are higher than the percentages of independent establishments using bank loans, which were 22.24% in 2002 and 18.64% in 2007.

growth of a chain allows us to control for the demand effect.

Our empirical results are consistent with the implications of our principal-agent model of franchising: we find that collateralizable housing wealth has a positive effect on the tendency to open a franchised outlet relative to opening a company-owned outlet. In addition, we find that the effect of collateralizable housing wealth on the value of franchising increases with the number of employees needed in the business. Assuming the number of employees in an outlet is a proxy for the importance of a franchisee's effort (a typical assumption in the franchising literature, because employee supervision is a major task for franchisees in the types of businesses that are franchised), these larger effects for more labor-intensive businesses are consistent with the idea 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. This again is suggestive of the incentive channel through which potential franchisees' financial constraints can affect the franchisors' growth. We also discuss potential alternative explanations for the positive effect of collateralizable housing wealth on the relative growth of franchising and explain how they relate to our model and empirical results.

To understand the magnitude of the effect of franchisees' financial constraints on franchisors' decisions according to our estimates, we simulate the effect of a 30 percent decrease in the collateralizable housing wealth of potential franchisees, a change consistent with the decline in housing values during the recent Great Recession. We find that chains enter into franchising later, and open fewer franchised outlets. More importantly from a job creation perspective, they also open fewer total outlets. Specifically, chains on average delay entry into franchising by 0.33 years, or 10% of the average waiting time. The number of total outlets of chains five years after they start their business decreases, on average, by 2.37, or 9.4%. The average decline in the number of total outlets ten years after a chain starts its business is 3.97, or 9.26%.

By studying the way in which agents' financial constraints can affect principals' organizational form decisions and growth, this paper contributes first and foremost to the empirical literature on contracting. There exists relatively little empirical work on contracting compared to the large amount of theoretical research in this area.[4] In the present paper, we focus in particular on the relationship between agents' financial constraints and principals' organizational form decisions, growth and timing of entry into franchising.[5] We view the incentive effect of collateralizable wealth that we emphasize as complementary to that of the residual claims or incentive compensation that

[4]Empirical examples include Brickley and Dark (1987), Lafontaine (1992), Laffont and Matoussi (1995), Ackerberg and Botticini (2002), Dubois (2002) and Lafontaine and Shaw (2005). See Chiappori and Salanié (2003) for a survey of empirical work on testing contract theory and Lafontaine and Slade (2007) for a survey of the empirical literature on franchising.

[5]Laffont and Matoussi (1995) is the only paper that we are aware of that also considers the role of agents' financial constraints. In their model, when the tenant for a piece of land 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 collateral, and the amount of collateral serves as an additional source of incentives beyond residual claims.

are the typical focus of the agency literature. This is because collateralizable wealth can provide incentives to franchisees in the early years of operation for their business, a period during which profits, and hence residual claims, are often negative but the amount of wealth put up in the business is relatively high.

This paper is also related to a recent literature in macroeconomics on deleveraging, which considers how a decline in home equity can lead to a recession. One channel highlighted in that literature is that the decline in housing values leads to a decline in aggregate demand and eventually a recession.[6] Other papers focus on how the value of firms' physical assets affects their investment decisions or how households' housing wealth affects their propensity to engage in self employment.[7] Different from these papers that investigate how one's financial constraints affect one's own decisions, we study the relationship between the agents' financial constraints and the principals' organizational form decisions and growth.[8] In our paper, a decrease in collateralizable housing wealth makes an agent less attractive to a principal by decreasing the power of incentives. As a result, chains that would otherwise have found franchising attractive and used two ways to expand (through company-owned outlets or franchised outlets) are now more constrained, and hence open fewer stores and create fewer jobs.

The rest of the paper is organized as follows. In Section 2, we outline our principal-agent model. We describe the data in Section 3. We develop our empirical model in Section 4, and discuss estimation results in Section 5. In Section 6, we use a simulation to quantify the effect of financial constraints on the extent of franchising according to our model. We conclude in Section 7.

2 Theoretical Framework

In this section, we provide a model to illustrate how, from a principal-agent perspective, collateralizable wealth could increase a franchisee's effort level. As a result, for a franchisor, the relative profitability of franchised relative to company-owned outlets increases. We then show how this leads to a direct link between potential franchisees' collateralizable wealth and chains' decisions to expand at the margin via franchised or company-owned outlets.

In the model, we take the parameters of the franchising contract as given.[9] The franchise

[6]For example, see Philippon and Midrigan (2011) and Mian and Sufi (2012).

[7]For example, see Chaney, Sraer and Thesmar (2012), Adelino, Schoar and Severino (2013) and Fort, Haltiwanger, Jarmin and Miranda (2013).

[8]Because of this, the reverse causality issue that some of this literature is concerned with, relating to how a firm's investments affect the value of its real estate or how owning a small business affects the value of a household's collateral, does not arise in our setting. Moreover, franchisees are a very small fraction of the population in a chain's market, and so even if their wealth were affected by the chain's decisions, this would not affect the overall value of housing in the chain's market (see Chaney, Sraer and Thesmar (2012) for a similar argument about small firms). We address the related issue of potential omitted variable bias in our robustness analyses, in Section 5.4.

[9]This follows the empirical evidence that generally there is a commitment to the franchise contract terms at the

contract requires that the franchisee provide a certain amount of capital. The franchisee signs a collateralized debt contract with a bank to finance this requirement.[10] The debt contract specifies the repayment (the loan size plus the interest) depending on the franchisee's collateral. In Section 2.1 below, we show that under reasonable conditions, the franchisee's effort decreases as the difference between the repayment and the collateral increases. Thus, as long as this difference (repayment − collateral) is decreasing in collateral, the franchisee's effort is increasing in the amount of collateral. This is intuitive because the more collateral the franchisee puts up, the greater the return to effort, i.e., the franchisee faces a higher-powered incentive scheme. We show in Online Appendix (Section A) that the repayment will be decreasing in collateral at the equilibrium in a model where banks compete in a Bertrand fashion, implying that (repayment − collateral) indeed is decreasing in collateral. In Section 2.2, we show that the positive relationship between a franchisee's collateral and her effort implies that a franchisor is more likely to open a franchised outlet rather than a company-owned outlet when potential franchisees have more collateralizable wealth on average. Section 2.3 provides a numerical example to illustrate these results.

2.1 Franchisee's Effort Decisions

Denote the required capital to open an outlet by I. A franchisee finances I through a debt contract that specifies the repayment (R) depending on the franchisee's collateral (C). Let D be the difference $R - C$.[11] We focus on D because, as we will show later, this is the only variable from the debt contract that the franchisee's effort incentives depend on. After signing the debt contract, the franchisee chooses her effort level e. The cost of effort is $\Psi(e)$, which is an increasing and strictly convex function with $\lim_{e\to\infty} \Psi'(e) = \infty$. Then, the profit shock θ, drawn from a distribution $F(\theta)$, is realized. The profit function $G(\theta, e)$ is strictly increasing in both θ and e. We assume that $G_{e\theta}(\theta, e) \geq 0$ (the marginal benefit of effort is weakly increasing in the profit shock) and $G_{ee}(\theta, e) \leq 0$ (weakly diminishing marginal returns to effort). Both conditions hold when $G(\theta, e)$ is separable in θ and e. We also impose a regularity condition that $G_e(\theta, e)$ is bounded and $\lim_{\theta\to-\infty} G(\theta, e) = -\infty$ for any finite e. We assume that a share of the profit, $sG(\theta, e)$, $0 < s < 1$, is paid to the franchisor as a royalty payment.

If the franchisee does not default on her obligation, she pays the repayment, keeps her collateral, and earns her share of the profit. So, her payoff is given by $(1 - s)G(\theta, e) - D$. If the franchisee defaults, however, her payoff is 0. The franchisee defaults if and only if $(1 - s) G(\theta, e) - D < 0$. We

time of entry into franchising. To the extent that franchise contract terms do change, which happens rarely, they will be applied to all new franchisees and replace old contracts for existing franchisees at the time of contract renewal. See also Lafontaine and Shaw (1999) on the stability of the contract terms over time.

[10] In practice, franchisors typically do not offer loans to franchisees. This likely has the advantage of serving as a form of commitment device, a way to avoid renegotiations with failing franchisees.

[11] In the model, we assume that the franchisee has no liquid assets. If some of the franchisee's assets are liquid and the franchisee puts them down as equity and borrows less, both R and C decrease. Thus, this assumption is not crucial for our results.

define $\hat{\theta}$ as the critical state of the world below which default occurs, which is implicitly determined by:

$$(1-s)\,G(\hat{\theta},e)-D=0. \tag{1}$$

Clearly, this critical value $\hat{\theta}$ depends on the franchisee's effort e and on D. We denote it by $\hat{\theta}\,(e,D)$. Given that $G\,(\theta,e)$ is strictly increasing in both θ and e, the critical value $\hat{\theta}$ is strictly decreasing in e. From equation (1), we can see that $\hat{\theta}$ is also strictly increasing in D. In other words, a franchisee is less likely to default if she chooses a higher level of effort or when the level of uncollateralized repayment is smaller.

The franchisee chooses her effort level e to maximize her expected utility:

$$V\,(e,D)=U\,(0)\,F(\hat{\theta}\,(e,D))+\int_{\hat{\theta}(e,D)}^{\infty}U\,((1-s)\,G\,(\theta,e)-D)\,dF\,(\theta)-\Psi\,(e)\,, \tag{2}$$

where the utility function $U\,(w)$ is assumed to be increasing and weakly concave in her payoff w. We also impose a regularity condition that $\lim_{w\to\infty}U'\,(w)<\infty$. The first-order condition is

$$\frac{\partial V\,(e,D)}{\partial e}=\int_{\hat{\theta}(e,D)}^{\infty}U'\,((1-s)\,G\,(\theta,e)-D)\,(1-s)\,G_e\,(\theta,e)\,dF\,(\theta)-\Psi'\,(e)=0. \tag{3}$$

When the franchisee works harder, on the one hand, she obtains a higher payoff conditional on not defaulting; on the other hand, she incurs a higher cost of effort. Her optimal effort is determined by this tradeoff.

From the expression of $\frac{\partial V(e,D)}{\partial e}$ in equation (3), we can see that D affects the marginal benefit of effort through two channels. First, $\hat{\theta}$ is increasing in D so that as D increases, the franchisee defaults in more states of the world and thus is less likely to benefit from choosing high effort. This reduces the incentives for the franchisee to exert effort. In essence, this effect is equivalent to reducing the equity stake of the franchisee, which reduces the power of the incentive scheme. However, there is also a wealth effect that works in the opposite direction. When D goes up, effective wealth in non-bankruptcy states is decreased ($(1-s)G-D$ decreases in D). As a result, the marginal utility of effort in non-bankruptcy states is increased (recall $U''\,(\cdot)\leq 0$).

The countervailing incentive and wealth effects above are well known in the incentive literature and there exists a broad range of conditions under which the wealth effect will be dominated. In a simple benchmark case, where the utility function $U\,(\cdot)$ is a CARA utility function with a constant risk aversion coefficient ρ, and $G\,(\theta,e)$ is separable in θ and e, the following condition is sufficient for the incentive effect to dominate: $\rho\leq\frac{f(\hat{\theta}(e,D))}{\left[1-F(\hat{\theta}(e,D))\right](1-s)}$.[12] In fact, there exists a positive number

[12] In this case, $U''\,(\cdot)=-\rho U'\,(\cdot)$. Let $G\,(\theta,e)=\theta+h\,(e)$. (When $G\,(\theta,e)$ is separable in θ and e, this functional form is without loss of generality.) Then, $\frac{\partial^2 V(e,D)}{\partial e\partial D}=(1-s)\,h'\,(e)\,[-U'\,(0)\,f(\hat{\theta})\frac{\partial\hat{\theta}}{\partial D}+\int_{\hat{\theta}}^{\infty}\rho U'\,((1-s)\,G\,(\theta,e)-D)\,dF\,(\theta)]<(1-s)\,h'\,(e)\,U'\,(0)\,[-f(\hat{\theta})\frac{\partial\hat{\theta}}{\partial D}+\rho(1-F(\hat{\theta}))]$. The inequality holds because $U''<0$ and $\hat{\theta}$ satisfies equation (1). By

$M > 0$ such that $\frac{f(\hat{\theta}(e^*(D),D))}{\left[1-F(\hat{\theta}(e^*(D),D))\right](1-s)} > M$, where $e^*(D)$ is optimal effort.[13] Therefore, a sufficient condition is $\rho \leq M$. Note that this is a sufficient condition, but not a necessary one. This is immediately clear by considering the case where θ follows an exponential distribution. In this case, optimal effort $e^*(D)$ is decreasing in D without any restriction on ρ.[14] In our numerical example below (Section 2.3), we show that the optimal effort is decreasing in D for a normal distribution of θ and a value for the risk aversion parameter that is in the range estimated in the literature.

In summary, we have shown that under certain conditions, the franchisee's optimal effort is decreasing in the difference between repayment and collateral. These results imply that effort is increasing in the collateral as long as (repayment − collateral) is decreasing in collateral. In Online Appendix (Section A), we show that this difference indeed decreases with collateral at the equilibrium when banks compete in a Bertrand fashion. The result that a franchisee's effort is increasing in her collateral is intuitive: when a franchisee puts more down as a collateral, she has more at stake and, hence, greater incentives to work hard to avoid default.

2.2 Franchisor's Problem

We have shown that, under certain conditions, a franchisee's effort increases with her collateral. Thus, the attractiveness of opening a franchised outlet relative to opening a company-owned outlet increases when a potential franchisee with more collateral is available. We now describe the consequences of this mechanism for the franchisor's organizational form decisions.[15]

Suppose that for each specific opportunity that a franchisor has for opening an outlet, there are N potential franchisees, each of whom has collateralizable wealth C_i drawn from a distribution. As we showed in Section 2.1, franchisee i's optimal effort depends on C_i. With a slight abuse of notation, we denote effort as a function of C_i by $e^*(C_i)$, and refer to the corresponding critical state of the world for default as $\theta^*(C_i)$. The expected profit for the franchisor from a franchisee with collateral C_i then is $\tilde{\pi}_f(C_i) = \int_{\theta^*(C_i)}^{\infty} sG(\theta, e^*(C_i))\, dF(\theta)$. If the franchisor chooses to open a franchised outlet, it will pick the franchisee that generates the largest expected profit. Alternatively, the franchisor can open a company-owned outlet and obtain the expected profit $\tilde{\pi}_c$. Whether the franchisor opens a franchised or a company-owned outlet depends on the comparison

plugging in $\frac{\partial\hat{\theta}}{\partial D} = \frac{1}{1-s}$, we have the sufficient condition for $\frac{\partial^2 V(e,D)}{\partial e \partial D} < 0$, which implies that $e^*(D)$ is decreasing in D by a standard comparative statics argument.

[13] This is because at the optimal effort level, $\hat{\theta}(e^*(D), D)$ is bounded. If $\hat{\theta}(e^*(D), D) = -\infty$, equation (1) holds only if $e^*(D) = \infty$. However, given that G_e is bounded, $\lim_{w\to\infty} U'(w) < \infty$ and $\lim_{e\to\infty} \Psi'(e) = \infty$, the first-order condition (3) would not hold if $e^* = \infty$. On the other hand, if $\hat{\theta}(e^*(D), D) = \infty$, the first-order condition (3) becomes $-\Psi'(e) = 0$, which is also a contradiction.

[14] When $f(\theta) = \gamma e^{-\gamma\theta}$, $\frac{\partial^2 V(e,D)}{\partial e \partial D}$ in Footnote 12 becomes $(1-s)h'(e)\rho\gamma e^{-\gamma\hat{\theta}}[-\frac{1}{1-s} + \frac{\rho}{\rho(1-s)+\gamma}]$, which is negative.

[15] As will be clear below, we do not allow for strategic considerations in the growth and entry decisions of the chains in our data. The young small franchised chains that we focus on typically choose to go into business only if they can design a product and concept that is different enough from existing ones to give them some specific intellectual property. As a result of this differentiation and their small size, we do not expect that strategic considerations play much of a role in the early growth and entry into franchising decisions that we are interested in.

of $\max_{i=1,\dots,N} \tilde{\pi}_f(C_i)$ with $\tilde{\pi}_c$.

Given that the franchisee's effort is increasing in her collateral C_i, the franchisor's expected profit $\tilde{\pi}_f(C_i)$ is also increasing in C_i. As a result, when there is a first-order stochastic dominating shift in the distribution of C_i, the franchisor is more likely to open a franchised outlet rather than a company-owned outlet, i.e., $\Pr\left(\max_{i=1,\dots,N} \tilde{\pi}_f(C_i) \geq \tilde{\pi}_c\right)$ increases.[16] In other words, franchisees' financial constraints affect the franchisors' organizational form decisions.

2.3 A Numerical Example

The above two subsections established that under certain conditions, a franchisee's optimal effort increases with her collateral, and, as a result, a franchisor is more likely to choose to open a franchised rather than a company-owned outlet if franchisees have more collateral. In this subsection, we use a numerical example to illustrate how franchisees' collateralizable wealth affects a franchisor's organizational decisions. In this numerical example, we assume a CARA utility function with a constant risk aversion coefficient ρ, and a linear revenue function $G(\theta, e) = \theta + \lambda e$, where λ captures the importance of the outlet manager's effort. We choose parameters of the model either based on existing estimates in the literature (for example, we set the risk aversion parameter according to the estimates in Cohen and Einav (2007)) or based directly on our data, described in the next section (for example, we assume that the amount of capital needed to open an outlet is $I = 93,000$, the average capital needed in our data, in 82-84 dollars). Online Appendix (Section B) provides a detailed description of the numerical example and how the value of each parameter is chosen.

Figure 1(a) shows how a franchisee's effort varies with the importance of her effort (λ) and the collateralizable wealth of a potential franchisee (C_i). From the figure, we can see that the franchisee's choice of effort level is increasing in C_i. Intuitively, when the collateral C_i increases, the franchisee has greater incentives to work hard as the return to marginal effort is higher. Reflecting a standard result in the franchising literature, Figure 1(a) also shows that the optimal effort level is increasing in the importance of the manager's effort λ. A similar intuition applies: as λ increases, the marginal benefit of effort increases, which leads to a higher optimal effort level.

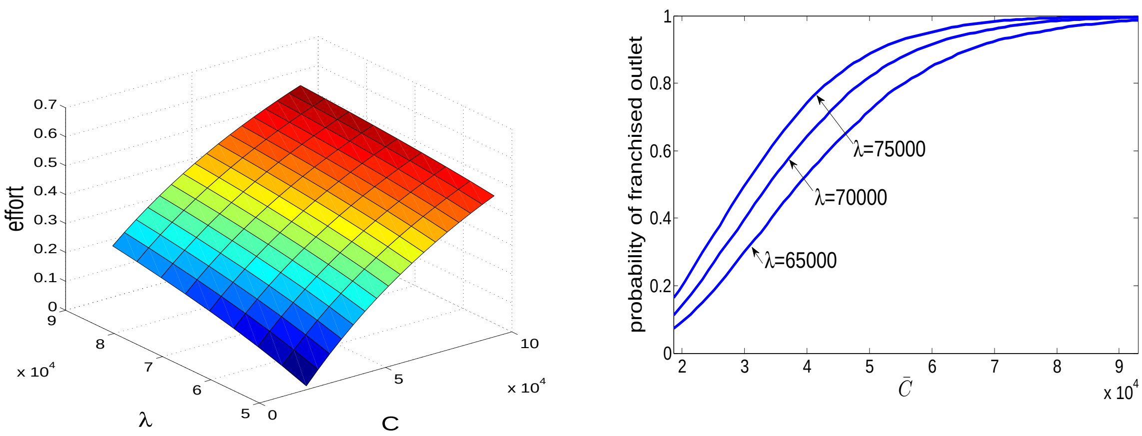
Figure 1(b) shows the franchisor's probability of opening a franchised outlet as a function of $\bar{C}$, the average collateralizable wealth of potential franchisees. From the figure, we can see that the franchisor is more likely to open a franchised outlet when the average collateralizable wealth of potential franchisees, $\bar{C}$, is higher. This is consistent with the intuition from Section 2.2. Since the franchisor's expected profit is increasing in franchisee i's effort, which is itself increasing in

[16] For a franchisee who can finance I completely with liquidity, an increase in her collateralizable wealth does not have an impact on her effort and outlet profit. But as long as it is not the case that all potential franchisees have enough liquidity to completely finance I (i.e., $C_i < I$ for some i), a first-order stochastic dominating shift in the distribution of C_i still increases the probability that the franchisor opens a franchised outlet rather than a company-owned one.

Figure 1: A Numerical Example

(a) Franchisee's Effort

(b) Franchisor's Probability of Opening a Franchised Outlet Rather Than a Company-owned Outlet



Note: In this numerical example, effort e is measured as a fraction of available working hours. See Online Appendix (Section B) for details.

C_i, an increase in $\bar{C}$ increases the chain's expected profit from franchising. As a result, when an opportunity arises, the franchisor is more likely to open a franchised outlet rather than a company-owned outlet. Again consistent with results in the franchising literature, we also see from Figure 1(b) that the franchisor's probability of opening a franchised outlet is increasing in the importance of the franchisee effort's λ, as a larger λ also means a higher incentive for the franchisee to exert effort.

In what follows, we take the intuition developed in this theoretical framework to the data. We start with describing the data in Section 3.

3 Data

3.1 Data Sources and Variable Definitions

In this section, we describe our main data sources and how we measure the variables of interest. Further details can be found in Online Appendix (Section C).

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." Our data are about business-format franchised chains. 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. These franchisors account for all of the growth in the number of franchised outlets since at least the 1970's (see Blair and Lafontaine (2005), Figure 2-1), and have played an important role in the growth of chains in the

U.S. economy. According to the Census bureau, business-format franchisors operated more than 387,000 establishments in 2007, and employed a total of 6.4 million employees. Traditional franchising, which comprises car dealerships and gasoline stations, accounted for the remaining 66,000 establishments and 1.5 million employees in franchising.

For each franchisor in our data, we observe when the chain first started its business and when it started franchising. We refer to the difference between the two as the waiting time. For example, if a chain starts franchising in the same year that it goes into business, the waiting time is zero. In addition, we observe the U.S. state where each chain is headquartered, its business activity, the amount of capital required to open an outlet (Capital Required) and the number of employees that the typical outlet needs (Number of Employees). 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, we treat these characteristics as fixed over time for a given chain/franchisor. Finally, for each year when a franchised chain is present in the data, we observe the number of company-owned outlets and the number of franchised outlets. These two variables describe a chain's growth over time.

We expect differences in the type of business activity to affect the value of franchising for the chains. We therefore divide the chains into six "sectors" according to their business activity: 1- the set of chains 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 chains that sell car-related products and repair services (Auto; Repair), and 6- retail stores (Retailer).[17]

Our main explanatory variable of interest is a measure of average potential franchisee collateralizable wealth in a chain's expected expansion area. We construct this variable by combining information from several sources. First, we obtained yearly housing values per state from the Federal Housing Finance Agency and the Census Bureau. Second, we obtained yearly data about home ownership rates across states from the Census Bureau. Finally, we obtained a region/year-level measure of the average proportion of mortgage outstanding for homeowners using data from the joint Census-Housing and Urban Development (HUD) biennial reports. They summarize information on mortgages on a regional basis (Northeast, Midwest, South and West). Since the reports are biennial, we assign the value of the average proportion of mortgage outstanding in a given year also to the year before. As the first report was published in 1985, this implies that the data we need to generate our main explanatory variable of interest begin in 1984. We then combine

[17]We exclude hotel chains from our data because we have too few of them in our sample, and the type of services they offer cannot easily be grouped with the categories we use. Moreover, in this industry, firms often use a third contractual form, namely, management contracts, in addition to franchising and company ownership.

this region-level information with the state-level time series of housing values and home ownership rates to calculate the average collateralizable housing wealth per household for each state/year: $(1 -$ the average proportion of mortgage still owed) $\times$(the home ownership rate)$\times$(housing value). Online Appendix (Section C) provides more details on the measure of collateralizable housing wealth.

We also collect data on credit supply from the National Federation of Independent Business (NFIB)'s Small Business Economic Survey. The NFIB, a small business organization, collects data through quarterly surveys from its members. The NFIB reports the net percentage of small businesses surveyed that find it harder to get loans than it was three months ago. We take the average of these quarterly data to generate a yearly measure. We then take the negative of the average so that an increase in the measure represents an increase in credit supply.[18] The credit supply variable is meant to capture variations in the supply of credit by financial institutions conditional on the amount of collateralizable wealth available to potential borrowers.

3.2 Linking Chain Data and Aggregate Economic Data

In this section, we explain how we link our macroeconomic variables to the chain-level information using the expected expansion area of a chain.

Our sample consists of 934 franchised chains headquartered in 48 states, all of which started their business – and hence also franchising – in 1984 or later. In other words, the franchised chains in our data are mostly young chains. Franchised or not, young chains typically expand in their state of headquarters and then later move on to establish outlets in other, usually nearby or related states (e.g., see Holmes (2011) for the case of Wal-Mart). We can see this tendency to expand first in the state of headquarters in our data because in post-1991 survey years, franchisors report the states where they operate the most outlets. So, for example, one of the largest chains in our data is Two Men and a Truck, a Michigan-based chain founded in 1984 that provides moving services. It started franchising in 1989 and, by 2006, had 162 franchised and 8 company-owned outlets. This company had more outlets in Michigan than anywhere else until 2005, more than 20 years after its

[18] For a robustness analysis in Online Appendix (Section G), we also collect data on credit supply from the Federal Reserve's "Senior Loan Officer Opinion Survey on Bank Lending Practices" (SLOOS). We use two alternative measures on credit supply from this survey: (1) the net percentage of domestic banks loosening standards for C&I loans to small firms, and (2) the net percentage of domestic banks decreasing their collateral requirements for small firms. Unfortunately, different from the NFIB data, which covers our entire sample period, data on the SLOOS measures are available only from 1990 on. Though the Federal Reserve initiated a survey on bank lending practices in 1964, publicly available data begin in 1990. Moreover, there were several changes in the survey before 1990 in terms of questions asked or banks surveyed, so the data before 1990 are not directly comparable to those afterwards. As a result, with the latter, we have to drop 482 franchisors from our original sample of 934 franchisors. Moreover, small firms in the SLOOS data are likely to be much larger than a typical chain outlet in our data. This is because a firm is considered small in the SLOOS data as long as its annual sales are less than 50 million dollars. On the other hand, participants in the NFIB survey are more likely to be representative of the potential franchisees in our context. The average number of employees in our data is 5.6, while the modal number of employees among participants of the NFIB survey is 3 to 5.

founding. But throughout this period, it was expanding also outside of Michigan, most importantly in Ohio and then Florida. In 2006, Florida became the state where it had the most outlets.

To combine the chain-level data with yearly state-level data, we could link the two data sets based on where the headquarter of each chain is. But the typical expansion pattern described above indicates that the aggregate economic conditions in a chain's headquarter state may not capture fully the environment faced by the chain as it expands. Therefore, to link the data on chains to the relevant aggregate economic data, we use the information for the 1049 franchisors in our data set that we observe at least once within 15 years after they start franchising to construct a square matrix,[19] the element (i, j) of which is the percentage of franchisors that are headquartered in state i and report state j as the state where they have the most outlets. We use only one year of data per franchisor, namely the latest year within this 15-year period, to construct the matrix. The resulting matrix, shown in Online Appendix (Section C), confirms that most young chains operate most of their outlets in the state where they are headquartered. This can be seen by the fact that the diagonal elements of the matrix 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, 21% of the franchisors from Nevada have more outlets in California than in any other state. Only 14% of them report having more outlets in Nevada than anywhere else. Similarly, many franchisors headquartered in Utah (52% of them) have expanded into California to a greater extent than they have in their own state. Only 35% of them have most of their establishments in Utah.

We interpret this matrix as an indication of where the franchisors from each state 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 headquarters state – to weigh our state/year-level variables and match them to our chain/year-level variables. In a robustness analysis, we consider an alternative matrix where we account for the fraction of a chain's outlets in the top three states in the construction of the weights rather than only using information on which state is the top state. Online Appendix (Section C) provides further details on the construction of that matrix as well.

3.3 Summary Statistics

Summary statistics for all our variables, including chain characteristics such as the waiting time and the number of outlets, as well as our weighted aggregate economic variables and collateralizable wealth measures, are shown in Table 1. We also present summary statistics for our two national-level macroeconomic variables, the NFIB credit supply variable and the national interest rate, the latter of which we proxy for by using the effective federal funds rate, obtained from the Federal

[19] Note that we include for this exercise some chains that are excluded from our main analyses for lack of data on other variables.

Reserve.[20]

Table 1 shows that the chains in our data waited on average about 3 years after starting their business to become involved in franchising. The majority of the chains are small, and they rely heavily on franchising: the mean number of franchised outlets is 35.56, while the mean number of company-owned outlets is only 3.43. Though not reported in this Table, our data also indicate that the average yearly growth in company-owned outlets before a chain starts franchising is 0.59. After they start franchising, the chains tend to open mostly franchised outlets. For example, the average change in the number of franchised outlets five years after a chain starts franchising is 38.52, while the average change in the number of company-owned outlets during these five years is 0.45. Similarly, the average number of additional franchised and company-owned outlets in the ten years after a chain starts franchising are 44.21 and 3.67, respectively.

Table 1: Summary Statistics

	Mean	Median	S. D.	Min	Max	Obs
Waiting Time (Years)	3.17	2	3.16	0	18	934[a]
Company-owned Outlets	3.43	1	7.40	0	106	3820[b]
Franchised Outlets	35.56	17	44.28	0	285	3820
Required Employees	5.61	3.50	7.79	0.50	112.5	934
Required Capital (Constant 82-84 $100K)	0.93	0.55	1.45	0	19.72	934
Business Products & Services	0.16	0	0.36	0	1	934
Restaurants	0.21	0	0.41	0	1	934
Home Services	0.12	0	0.33	0	1	934
Go To Services	0.21	0	0.41	0	1	934
Auto; Repair	0.06	0	0.23	0	1	934
Retail	0.24	0	0.43	0	1	934
Coll. Housing Wealth (82-84 $10K)	3.62	3.34	1.31	1.83	14.17	1104[c]
Population (Million)	8.84	8.23	5.52	0.52	31.68	1104
Per-Capita Gross State Product (82-84 $10K)	1.89	1.79	0.63	1.22	7.47	1104
Interest Rate (%)	5.33	5.35	2.41	1.13	10.23	23[d]
Credit Supply	-0.50	-0.47	0.21	-1.05	-0.15	23

[a]At the chain level; [b]At the chain/year level; [c]At the state/year level; [d]At the year level

In terms of our chain-level explanatory variables, Table 1 shows that the typical establishment in these chains employs five to six employees. The average amount of capital required to open an outlet is $93,000 (in constant 1982-84 dollars). The variation around this mean, however, is quite large. Franchisors in our data are also distributed fairly evenly across our main sectors, with the exception of "Auto; Repair" which is the least populated of these sectors.

Finally, the descriptive statistics for our weighted aggregate economic variables show that the average collateralizable housing wealth was about $36K in 1982-84 constant dollars over the 1984

[20]While the effective federal funds rate may not be the interest rate faced by the franchisees, it serves as a shifter for the interest rate structure.

- 2006 period, while per capita gross state product averaged \$19K over the same period.[21]

3.4 Descriptive Analysis

In this section, we characterize the relationship between collateralizable housing wealth and the organizational form decisions of franchisors using reduced-form regressions. To separate the effect of collateralizable housing wealth on organizational form decisions (i.e., how much they rely on franchising rather than opening company-owned outlets when they grow) from its effect on franchisors' overall growth through demand, we focus on comparing the conditional probability of opening a franchised to that of opening a company-owned outlet, where both probabilities are conditional on opening an outlet. To this end, we use the ratio of a chain's growth in franchised outlets to its growth in company-owned outlets as the dependent variable.[22] Specifically, for each observation where we observe the chain for two consecutive years, we compute the change in the number of franchised outlets and the change in the number of company-owned outlets. We use observations where both changes are positive and define their ratio as the dependent variable.[23] Results are shown in Table 2.

In these regressions, we control for all the variables that our model suggests might affect the desirability of franchising relative to company-ownership, namely financial factors such as the interest rate and credit supply, as well as chain-specific characteristics such as capital and number of employees needed. We add sector, and then also state, fixed effects in Columns 2 and 3.[24] We also include population size, which affects the availability of potential franchisees in our model, and an interaction term between the number of employees and collateralizable housing wealth to capture the fact that incentives for the outlet manager may be particularly important in those businesses with greater number of employees.[25]

In all three regressions, the estimated coefficient of collateralizable housing wealth is positive and statistically significant, suggesting that collateralizable housing wealth has a positive effect on

[21] See Table C.1 and related discussion in Online Appendix (Section C) for the descriptive statistics for the macroeconomic variables using the alternative weighting matrix mentioned above.

[22] If the conditional probability is described by a Logit model such as Pr(open a franchised outlet | open an outlet)= $\frac{\exp(\text{franchised outlet profit})}{\exp(\text{franchised outlet profit})+\exp(\text{company-owned outlet profit})+1}$ and Pr(open a company-owned outlet | open an outlet)= $\frac{\exp(\text{company-owned outlet profit})}{\exp(\text{franchised outlet profit})+\exp(\text{company-owned outlet profit})+1}$, then the ratio of these two conditional probabilities is exp(franchised outlet profit−company-owned outlet profit). In other words, the ratio of the franchising growth and the company-owned outlet growth represents the relative profitability of opening a franchised compared to a company-owned outlet.

[23] As mentioned in Footnote 22, this ratio is meant to capture the ratio of the conditional probability of opening a franchised outlet to that of opening a company-owned one. But when the change in the number of outlets is zero or negative, the ratio of the changes does not capture the latter. As a result, we are able to use only 304 observations in these regressions.

[24] For each chain, we add a state fixed effect according to the state where its headquarters is located.

[25] In Online Appendix (Section D), we present instrumental variable results for the same set of regressions using the Saiz (2010) measure of supply elasticity as an instrument for collateralizable housing wealth. We again find a sizable effect of collateralizable housing wealth on the tendency to grow via franchising relative to company ownership. The results are similar in magnitude to those shown in Table 2, but less statistically significant.

Table 2: Regressions of (Franchising Growth)/(Company-owned Growth)

	(1)	(2)	(3)
collateralizable housing wealth	1.436***	1.453***	1.664*
	(0.524)	(0.533)	(0.986)
interest rate	-0.313	-0.337	-0.120
	(0.568)	(0.562)	(0.650)
credit supply	0.594**	0.589**	0.343
	(0.252)	(0.263)	(0.299)
capital needed	-0.851**	-0.898**	-0.970**
	(0.382)	(0.350)	(0.429)
population	-0.146	-0.168	1.092
	(0.112)	(0.114)	(1.219)
employees	-0.010	-0.045	-0.158
	(0.140)	(0.169)	(0.196)
(coll. housing wealth)×(employees)	0.039	0.039	0.050
	(0.049)	(0.051)	(0.045)
sector fixed effects		yes	yes
state fixed effects			yes
R2	0.05	0.06	0.17
Observations	304	304	304

the relative growth in franchising compared to company ownership. The signs of the estimated coefficients of other variables generally also are as expected, although they are mostly not statistically significant. The main exceptions are the credit supply, which affects the relative growth via franchising positively, and the amount of capital required, which does the opposite.

In sum, the results from these reduced-form analyses point to collateralizable housing wealth as an important factor explaining the different growth paths for franchised and company-owned outlets. In the next section, we develop an empirical model and estimation approach that rely more directly on our theoretical framework and allow us to utilize to a much greater extent the information contained in our data to further explore the relationship between collateralizable housing wealth and the relative growth in franchising.

4 The Empirical Model

As discussed in Section 3, our data describe when a chain starts franchising and how it grows – and sometimes shrinks – over time through a combination of company-owned and franchised outlets. In this section, we use the intuition from our theoretical framework above to develop an empirical model describing these decisions by a chain. In contrast to the descriptive analyses in Section 3.4, in this section, we study both the decision on when to start franchising and how much to rely on franchising in the growth process in one model. We do this because chains make decisions about entry into franchising based on their expectations of growth after such entry. A chain for which franchising is particularly valuable should therefore start franchising earlier. In other words, the decisions on the timing of entry into franchising and a firm's expansion path – in terms of both company-owned and franchised outlets – are intrinsically linked, and both contain information on the relative profitability of a franchised versus a company-owned outlet. Moreover, this link in turn leads to a selection issue: since our data are about franchised chains, we only observe a chain if it starts franchising before the last year of our data. As we show in Online Appendix (Section F), ignoring this selection issue (i.e. ignoring the endogenous timing of entry into franchising) leads to results that under-predict the number of franchised outlets. Another advantage of the empirical model in this section over the descriptive analyses in Section 3.4 is that we are now able to utilize more of the information in our data. In particular, we are able to utilize data on covariates even for chain/year observations where data on the number of outlets is missing.[26] Moreover, we allow outlets to exit and estimate the exit rate in the empirical model in this section based on the observed negative net growth and an exclusion restriction that the number of franchised outlet in the first year after a chain starts franchising does not depend on the exit rate. Therefore, we are also able to explain zero or negative net growth and use such observations in the estimation. In contrast, as explained in Footnote 23, we could only use observations with positive net growth in the descriptive analyses in Section 3.4.

In our empirical model, we assume that, at the beginning of each year, a chain decides whether to pay a sunk cost to start franchising if it has not yet done so. During the course of each year, the chain decides what to do when opportunities to open outlets arise. Given an opportunity, the chain that has not started franchising yet can either set up a company-owned outlet or give up the opportunity. If it has already started franchising, it has the additional option of opening a franchised outlet. In what follows, we first describe the model primitives, then the chains' growth decisions, and finally each chain's decision as to when to enter into franchising.

Model Primitives

We assume that, for each franchisor (chain), there is a random process for the arrival of opportunities to open outlets. For example, an opportunity can arise when a site in a mall becomes available. Specifically, we assume that the yearly arrival process follows a Poisson process with rate m_i for chain i, where $m_i = exp(m + u_{mi})$ and u_{mi} is a firm-specific unobservable term that captures unobservable factors that affect both the growth of company-owned and franchised outlets. We assume that these u_{mi}'s are i.i.d. and follow a truncated normal distribution with mean 0 and variance σ_m^2, truncated such that the upper bound of m_i is 200 per year.[27]

[26] For example, as explained in Online Appendix (Section C), we are missing data for all franchisors for 1999 and 2002. When data is missing for a chain in year t, we do not observe this chain's growth from year $t-1$ to t and from year t to $t+1$. Therefore, we cannot use data in years t and $t+1$ in descriptive analyses. In contrast, the empirical model in this section will describe the distribution of the number of outlets in $t+1$ conditional on the number of outlets in $t-1$, and how this distribution is influenced by covariates in year t and year $t+1$.

[27] In the data, the maximum increase in a chain's number of outlets between two years is 100.

When an opportunity τ arrives in year t after chain i has started franchising, the franchisor can choose to open a company-owned outlet, a franchised outlet or pass on the opportunity. The chain gets nothing if it passes on the opportunity. We assume that the value of a company-owned outlet and that of a franchised outlet for the chain given an opportunity τ can be written as, respectively,

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

where $\boldsymbol{x}_{it}^{(c)}$ is a vector of observable chain i-, or chain i/year t-specific variables that affect the general profitability of an outlet. This vector also includes the collateralizable housing wealth, population size and per-capita gross product faced by chain i, all of which can affect demand. The vector $\boldsymbol{x}_{it}^{(f)}$ consists of the observables that influence the *relative* profitability of a franchised outlet. This vector includes the collateralizable housing wealth. In addition, it includes determinants of the importance of manager effort such as the number of employees, given that employee supervision is a major task for franchisees/managers in the types of businesses that are franchised, as well as the interaction of the number of employees and the average collateralizable wealth.

In equation (4), u_{fi} represents the unobserved component in the relative profitability of a franchised outlet. It accounts for the fact that the business formats of some chains are more amenable to codification, and thus franchising, than others. The unobserved profitability of franchising will be greater for such chains.[28] We assume that u_{fi} follows a normal distribution with mean 0 and variance σ_u^2. 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 $\varepsilon_{ci\tau} = \epsilon_{ci\tau} - \epsilon_{0i\tau}$ and $\varepsilon_{fi\tau} = \epsilon_{fi\tau} - \epsilon_{0i\tau}$, and that $(\epsilon_{ci\tau}, \epsilon_{fi\tau}, \epsilon_{0i\tau})$ are i.i.d. and drawn from a type-1 extreme value distribution.

Chains' Growth Decisions

Given the above primitives of the model, and using $\boldsymbol{x}_{it} = \left(\boldsymbol{x}_{it}^{(c)}, \boldsymbol{x}_{it}^{(f)}\right)$, the probability that

[28]We do not allow for an unobservable component of the general profitability because 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 ascertain 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 identifies the overall profitability of an outlet. This is because we know about the accumulated number of company-owned outlets they have chosen to open (minus closings) before they started franchising, which provides information on their overall growth before they start franchising. Once the relative profitability of a franchised outlet is identified, the ratio of the overall growth before and after a chain starts franchising identifies the baseline profitability, i.e., the profitability of a company-owned outlet. If a chain is very profitable even when it is constrained to open only company-owned outlets, adding the option of franchising (by entering into franchising) has a smaller impact on its overall growth. However, this information is not very powerful. That is why we do not allow for separate unobservable components or include covariates in the arrival rate equation.

chain i opens a company-owned outlet conditional on the arrival of an opportunity is

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

after chain i has started franchising. In this equation, the subscript a stands for "after" (after starting franchising) and the subscript c stands for "company-owned." Similarly, the probability of opening a franchised outlet conditional on the arrival of an opportunity is

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

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

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

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 $m_i p_{bc}(\boldsymbol{x}_{it})$. Similarly, the number of new company-owned outlets and the number of new franchised outlets opened each year after chain i starts franchising also follow Poisson distributions with mean $m_i p_{ac}(\boldsymbol{x}_{it}, u_{fi})$ and $m_i p_{af}(\boldsymbol{x}_{it}, u_{fi})$, respectively.

Chains' Decision to Enter into Franchising

The start of franchising is costly because franchisors must develop operating manuals, contracts, disclosure documents and processes to support and control franchisees. The franchisor must devote significant amounts of time to these activities, in addition to relying on lawyers, accountants and possibly consultants. Note that all of these costs are sunk: none of them are recoverable in the event that the chain decides to stop franchising or goes out of business. Let ω_{it} be the sunk cost that chain i has to pay to start franchising in year t. We assume that ω_{it} follows a log-normal distribution with mean and variance parameters ω and σ_ω^2. To explain the fact that in the data some franchisors take a long time to enter into franchising, we also allow for some probability mass on the event that the entry cost is infinity. Specifically, this probability is $1 - q_0$ in a chain's first year in business and $1 - q_1$ after the first. One interpretation of these probabilities could be that for some, in particular, inexperienced potential franchisors, the entry cost may be prohibitively high. With probability q_0 or q_1, the potential franchisor gets to draw the entry cost from the log-normal distribution. From that point on, she always draws from the log-normal distribution. Then, at the beginning of each year, after observing the entry cost draw, she decides whether to pay the sunk cost to start franchising. The entry-into-franchising decision depends on how the value of entry into franchising minus the sunk cost compares with the value of waiting.

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

$$\begin{aligned} & E_{(\varepsilon_{ci\tau},\varepsilon_{fi\tau})}\max\{\pi_{ci\tau},\pi_{fi\tau},0\} \\ &= \log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_{fi}\right)+1\right). \end{aligned} \tag{8}$$

Given that the expected number of opportunities in a year is m_i, the expected value of all opportunities in year t after the chain starts franchising is $m_i\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_{fi}\right)+1\right)$. We assume that $\boldsymbol{x}_{it}$ follows a Markov process.[29] Thus, the value of entry satisfies

$$\begin{aligned} VE\left(\boldsymbol{x}_{it},\boldsymbol{u}_i\right) = {} & m_i\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c+\boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f+u_{fi}\right)+1\right) \\ & +\delta E_{\boldsymbol{x}_{it+1}|\boldsymbol{x}_{it}}VE\left(\boldsymbol{x}_{it+1},\boldsymbol{u}_i\right), \end{aligned} \tag{9}$$

where δ is the discount factor and $\boldsymbol{u}_i=(u_{mi},u_{fi})$ are the unobservable components in the opportunity arrival rate and in the relative profitability of a franchised outlet, respectively.

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 $m_iE_{\varepsilon_{ci\tau}}\max\{\pi_{ict},0\}=m_i\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+1\right)$. 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 $VE\left(\boldsymbol{x}_{it+1},\boldsymbol{u}_i\right)$. Otherwise, it gets the value of waiting $VW\left(\boldsymbol{x}_{it+1},\boldsymbol{u}_i\right)$.[30] So the value of waiting this year is

$$\begin{aligned} VW\left(\boldsymbol{x}_{it},\boldsymbol{u}_i\right) = {} & m_i\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right)+1\right) \\ & +\delta E_{\boldsymbol{x}_{it+1}|\boldsymbol{x}_{it}}E_{\omega_{it+1}}\max\left\{VE\left(\boldsymbol{x}_{it+1},\boldsymbol{u}_i\right)-\omega_{it+1},\ VW\left(\boldsymbol{x}_{it+1},\boldsymbol{u}_i\right)\right\}. \end{aligned} \tag{10}$$

Let $V\left(\boldsymbol{x}_{it},\boldsymbol{u}_i\right)$ be the difference between the value of entry and the value of waiting: $V\left(\boldsymbol{x}_{it},\boldsymbol{u}_i\right)=$

[29] We assume that the dynamic variables follow a VAR(1) model. While the coefficients of the lagged variables are assumed to be the same across U.S. states, we allow the constant term in the VAR(1) model to be state-specific.

[30] Note that different from the standard entry literature, the value of waiting is not assumed to be zero. This is because when the chain does not enter into franchising, it can still grow through opening company-owned outlets and also has the option of entering into franchising later. Fan and Xiao (2015) make a similar point on the value of waiting in the context of firm entry in the local telephone industry.

$VE(\boldsymbol{x}_{it}, \boldsymbol{u}_i) - VW(\boldsymbol{x}_{it}, \boldsymbol{u}_i)$. Subtracting equation (10) from equation (9) yields

$$V(\boldsymbol{x}_{it}, \boldsymbol{u}_i) = m_i \left[\log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right) + \exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c + \boldsymbol{x}_{it}^{(f)}\boldsymbol{\beta}_f + u_{fi}\right) + 1\right) - \log\left(\exp\left(\boldsymbol{x}_{it}^{(c)}\boldsymbol{\beta}_c\right) + 1\right)\right] + \delta E_{\boldsymbol{x}_{it+1}|\boldsymbol{x}_{it}} E_{\omega_{it+1}} \min\left\{\omega_{it+1}, V(\boldsymbol{x}_{it+1}, \boldsymbol{u}_i)\right\}. \quad (11)$$

In sum, 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 entry cost, i.e., $V(\boldsymbol{x}_{it}, \boldsymbol{u}_i) \geq \omega_{it}$. Since we assume that the entry cost ω_{it} follows a log-normal distribution with mean and standard deviation parameters ω and σ_ω, the probability of entry conditional on i getting to draw the entry cost from the non-degenerate log-normal distribution is given by

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

where $\Phi(\cdot)$ is the cumulative distribution function of a standard normal random variable.

Likelihood Function

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

$$p_i(F_i|\boldsymbol{u}_i). \quad (13)$$

Online Appendix (Section E) provides details on the computation of 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 $t = F_i, ..., 2006$.[31] 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 entry into franchising (F_i) and the unobservables $(\boldsymbol{u}_i)$:

$$p_i(n_{cit}, n_{fit}; t = F_i, ..., 2006|F_i; \boldsymbol{u}_i). \quad (14)$$

For about 29% of the chains in the data, the number of outlets decreases at least once during

[31] Since our data source is a survey on franchisors, we only observe the number of outlets of a chain after it starts franchising. But we actually do not observe it for all years between F_i and 2006, the last year of our sample, for three reasons. First, as explained in Online Appendix (Section C), we are missing data for all franchisors for 1999 and 2002. Second, some chains may have exited before 2006. Third, franchisors sometimes do not participate. For simplicity in notation, we omit this detail in describing the likelihood function in this section. Online Appendix (Section E) provides details on how we deal with missing data.

the time period we observe this chain. To explain these negative changes in the number of outlets, we assume that an outlet, franchised or company-owned, can exit with probability γ each year. The number of company-owned outlets in year t is therefore

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

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

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

where $(\text{new outlets})_{fit}$ follows a Poisson distribution with mean $m_i p_{af}(\boldsymbol{x}_{it}, \boldsymbol{u}_i)$ and exits_{fit-1} follows a binomial distribution parameterized by n_{fit-1} and γ. The recursive equations (15) and (16) are used to derive the probability in (14). See Online Appendix (Section E) 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., $F_i \leq 2006$. This selection issue implies, for example, that among the chains that start their business in the later years of our data, only those that find franchising particularly appealing will appear in our sample. Similar to how this is handled in a regression where selection is based on a response variable (such as a Truncated Tobit model), we account for this in the likelihood function by conditioning as follows:

$$\begin{aligned} \mathcal{L}_i &= \Pr\left(F_i, n_{cit}, n_{fit}; t = F_i, ..., 2006 | F_i \leq 2006\right) \\ &= \frac{\int p_i\left(F_i|\boldsymbol{u}_i\right) \cdot p_i\left(n_{cit}, n_{fit}; t = F_i, ..., 2006|F_i; \boldsymbol{u}_i\right) dP_{\boldsymbol{u}_i}}{\int p_i\left(F_i \leq 2006|\boldsymbol{u}_i\right) dP_{\boldsymbol{u}_i}}. \end{aligned} \tag{17}$$

Our estimates of the parameters $\left(\boldsymbol{\beta}_c, \boldsymbol{\beta}_f, \gamma, m, \sigma_m, \sigma_u, \omega, \sigma_\omega, q_0, q_1\right)$ maximize the log-likelihood function obtained by taking the logarithm of (17) and summing up over all chains.

Identification

We now explain the sources of variation in the data that allow us to identify the model parameters. As mentioned above, collateralizable housing wealth is expected to affect the relative profitability of opening a franchised outlet via its effect on the franchisee's incentives to put up effort. It may also, however, affect the general profitability of an outlet in the chain through the demand for the chain's products or services. We can separate these effects because we observe two growth paths, the growth path in the number of company-owned and the growth path in the number of franchised outlets. Variation in the relative growth of the number of franchised outlets helps us identify the effect of collateralizable housing wealth via the incentive (or supply) channel, while variation in the overall growth of the chain allows us to identify the effect of collateralizable housing wealth via the demand channel. Note that the identification of the effect of this variable in our analyses relies on both cross-sectional and time variation in collateralizable housing wealth. In particular, our data covers a period of 22 years, within which two recessions and a significant period of economic growth occurred. Figure C.1 in Online Appendix (Section C) shows the time series of collateralizable housing wealth for each state.

In addition, one might be concerned that potentially omitted variables in the relative profitability of franchised outlets could bias our estimated effect of collateralizable housing wealth via the incentive channel. We address this concern further below in a robustness analysis by also estimating a model that includes state fixed effects in the relative profitability of a franchised outlet. We find that our results are robust to this alternative specification. Section 5.4 provides further details on this issue.

The observed shrinkage in the number of outlets gives us a lower bound estimate of the outlet exit rate. The change in number of franchised outlets in the first year when a chain starts franchising, which presumably represents new franchised outlets that have opened in that year, rather than a combination of newly opened and closed outlets, further helps us identify this parameter. Dispersion in the total number of outlets allows us to identify the standard deviation of the arrival rate (σ_m). Dispersion in relative growth identifies the standard deviation of the unobserved relative profitability of a franchised outlet (σ_u). Given the growth patterns, data on waiting time (the difference between when a chain starts its business and when it starts franchising) identifies the distributional parameters for the cost of entering into franchising, i.e., $(\omega, \sigma_\omega, q_0, q_1)$.

5 Estimation Results

5.1 Baseline Estimation Results

The baseline estimation results, in Table 3, indicate that both population and per-capita gross state product, our measure of income, affect the general profitability of outlets positively. Presumably, this is because they increase the demand for the products of the chains. Collateralizable housing wealth, however, has a negative effect on the general profitability of a chain's outlets. In other words, collateralizable housing wealth reduces how much consumers want to consume the products of the chains. One potential explanation for this result is that rent may be high in those regions where collateralizable housing wealth is high, making outlets less profitable. Alternatively, for given income, higher wealth may indeed have a negative effect on the demand for the type of products sold by franchised chains (e.g., fast food).

Table 3: Estimation Results

	est.	s.e.
Log of opportunity arrival rate		
constant	3.019***	0.014
std. dev.	1.342***	0.022
General profitability		
constant	-3.384***	0.039
population	0.237***	0.005
per-capita state product	0.008***	0.001
collateralizable housing wealth	-0.053***	0.006
Relative profitability of a franchised outlet		
collateralizable housing wealth	0.221***	0.006
employees	0.021***	0.002
(coll. housing wealth)×(employees)	0.015***	0.0001
interest rate	-0.034***	0.003
capital needed	-0.529***	0.013
credit supply	1.343***	0.025
population	0.007***	0.001
business products & services	-0.029	0.042
restaurant	0.192***	0.046
home services	1.706***	0.075
go to services	0.780***	0.057
auto; repair	1.215***	0.057
constant (retailer)	2.383***	0.068
std. dev.	2.749***	0.033
Outlet exit rate	0.313***	0.001
Entry cost		
mean parameter	3.118***	0.076
std. dev. parameter	0.734***	0.004
probability q_0	0.188***	0.017
probability q_1	0.190***	0.014

*** indicates 99% level of significance.

As predicted, however, collateralizable housing wealth has a positive effect on the value of opening a franchised outlet relative to opening a company-owned outlet in our data. In other words, when franchisees have more collateral to put up, the chains increase their reliance on franchising relative to company ownership. This is in line with the intuition that franchisee borrowing against their collateral to start their business increases their incentives to work hard and hence the profitability of franchising to the franchisors. In addition, we use the typical amount of labor needed in an outlet in each chain to measure the importance of the agent's effort. Not only is the estimate of its direct effect positive and statistically different from zero, but we also find a statistically significant positive effect for the interaction of this variable with collateralizable wealth. In other words, when the role of the manager, as captured by a greater number of employees required, increases, the effect of collateralizable wealth on the relative profitability of franchising compared to opening company outlets becomes greater.

To understand the magnitude of this interaction effect, we compute the effect of a 30% decline in collateralizable housing wealth in all state/years for a typical firm with 1 employee and for a typical firm with 10 employees.[32] (The standard deviation of the number of employees in the data is 7.79.) We find that a 30% decline in collateralizable housing wealth leads to a 20.5% drop in the number of outlets five years after the firm starts its business for a typical firm with 1 employee, and a 22.6% drop when the number of employees is 10. The effects on the number of outlets ten years after the firm starts its business are -16.5% and -18.5% for these two scenarios respectively. Since hiring and managing labor is a major part of what local managers do, these larger effects for types of businesses that use more labor are consistent with the implication 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. This again is consistent with the incentive channel through which potential franchisees' financial constraints affect the franchisors' growth.

We also find that the interest rate affects the attractiveness of franchising negatively. One explanation consistent with our theoretical framework is the following: since a higher interest rate will imply higher repayment obligations, an increase in the interest rate increases the likelihood of defaulting. This leads to reduced incentives for the franchisee and hence a lower value of franchising to the franchisor. Similarly, when the amount to be borrowed (capital needed) goes up, the same intuition applies and franchising becomes less appealing to a chain. This explains the negative effect of capital required on the relative profitability of franchising. On the other hand, according to our results, both credit supply and population have a positive effect on the relative profitability of franchising. This is presumably because both variables affect the number of potential franchisees. 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 home services and auto and repair shops, i.e., that these types of businesses are particularly well suited to having an owner operator on site, rather than a hired manager, to supervise workers and oversee operations more generally.

Our estimate of the exit rate parameter implies that about 31% of all outlets close every year. This is somewhat larger than the 26% exit rate found by Parsa, Self, Njite and King (2005) for restaurants and the 15% documented in Jarmin, Klimek and Miranda (2009) for single retail establishments. This is presumably because our data comprises mostly newly franchised chains in their first years in franchising.

Finally, the estimated average entry cost – the cost of starting to franchise – is 29.59 ($= e^{3.118+0.734^2/2}$). According to our estimates, this is about 15 times the average value of the franchised outlets that the chains choose to open.[33] In the data, on average, seven franchised outlets are opened

[32] In this simulation, we set the value of all covariates, except "employees," to their average level.

[33] The value of an opened franchised outlet is $E(\pi_{fi\tau}|\pi_{fi\tau} > \pi_{ci\tau}$ and $\pi_{fi\tau} > 0)$. It is 1.94 on average (across

in the first year when a chain starts franchising, and seventeen are opened in the first two years in franchising. So, it takes on average between one and two years for a chain to grow 15 franchised outlets to recoup the sunk cost of entering into franchising.

In summary, our estimation results suggest that chains are more likely to grow through franchising when there is an increase in collateralizable housing wealth, or a decrease in the interest rate or in required capital. These findings are consistent with the predictions of our theoretical framework because such changes all lead to a decrease in D, the difference between the repayment and the collateral, in our theoretical framework. Similarly, the result that both population and credit supply have a positive coefficient in the relative profitability of franchising is also consistent with our theoretical framework as an increase in these two variables presumably leads to an increase in the number of potential franchisees N. Our estimation results also suggest that businesses in sectors where a manager's on-site supervision is particularly important tend to rely on franchising more. Moreover, within a business sector, an increase in the number of employees in an outlet leads to an increase in the relative profitability of franchising. These results are again consistent with our theoretical model (as well as the literature) because businesses in such sectors and with more employees per outlet are expected to have a larger λ (importance of a manager's effort to the business profit). Finally, we find a positive effect for the interaction of the number of labor needed with collateralizable wealth on franchising. Since the amount of employees in an outlet shifts the importance of a franchisee's effort, if we expect collateralizable wealth to positively influence a franchisee's incentives to exert effort, we should expect the interaction of these two variables to have a positive impact on the value of opening a franchised outlet relative to opening a company-owned outlet. The statistically significant and positive estimate of the coefficient for the interaction of collateralizable housing wealth and the amount of labor needed therefore provides additional support for the incentive channel highlighted in this paper.

5.2 Alternative Explanations and Discussion

Thus far, we have emphasized the incentive effect of collateral and shown empirical results consistent with our model predictions. In this section, we discuss two potential alternative explanations (a credit rationing explanation and an adverse selection explanation) and how they relate to our model and our results.

5.2.1 A Credit Rationing Explanation

One alternative explanation that would not rely on an incentive effect of collateral to explain the positive effect of collateralizable housing wealth on the relative growth of franchising is the

chain/years) according to our estimates, which is about 1/15 of the estimated costs of entering into franchising (= 29.59). This finding is in line with estimates from case studies (see, for example, Grossmann (2013)).

following: when the average collateralizable housing wealth decreases, fewer people are qualified to get the kind of loan they need to finance the capital required to open an outlet. In other words, banks engage in a certain degree of credit rationing. As a result, chains' growth through franchising relative to their growth through opening company-owned outlets slows down.

More formally, suppose there are N potential franchisees and N is increasing in the average collateralizable housing wealth because the latter affects the number of people qualified to get a loan. Each potential franchisee is characterized by her type t_i. The type t_i can be the quality of franchisee i or the effort that she will put forth. To assume away incentive effects, we assume that t_i is exogenously drawn from a distribution. Suppose the profit that a franchisor gets from a franchised outlet operated by franchisee i is $\pi_{fi} = st_i + L$ where s is the royalty rate and L is a constant that includes the franchise fee and a profit shock. Suppose the profit that a franchisor gets from opening a company-owned outlet is π_c. The franchisor prefers to open a franchised outlet with franchisee i if and only if $\pi_{fi} > \pi_c$.[34] The probability that the franchisor will open a franchised outlet rather than a company-owned outlet is $\Pr(\max_{i=1,...,N} t_i > (\pi_c - L)/s)$, which is an increasing function of N. A reduction in the average collateralizable housing wealth leads to a decrease in N. As a result, this probability decreases. In what follows, we discuss three issues with using this alternative model to explain our results.

First, the fact that both this alternative model and our model can explain the positive effect of collateralizable housing wealth on the relative growth of franchising suggests that there may be two channels through which collateralizable housing wealth can affect the relative growth of franchising: through affecting franchisee incentives (the incentive channel) and through affecting the number of potential franchisees (the credit rationing channel).[35] However, a model with only the credit rationing channel cannot explain all our empirical findings. In particular, because effort is exogenous in this alternative model, it cannot explain why the number of employees in an outlet has a positive effect on the relative growth of franchising, or why the interaction of the number of employees and collateralizable housing wealth also has a positive coefficient.[36] By contrast, once we allow effort to be a decision made by a franchisee, it will be affected by the amount of collateral

[34] In this model, a franchisor chooses between opening a franchised outlet or a company-owned outlet. Another alternative explanation is that a franchisor's growth through opening company-owned outlets is fixed exogenously and its growth through franchising is increasing in collateralizable housing wealth due to the same credit rationing reason. Such a model is equivalent to the model in this section when we replace π_c by 0.

[35] While we emphasize the incentive channel in our theoretical model in Section 2, our model can also accommodate the credit rationing channel. This is because, in our model, both a first-order stochastic dominating shift in the distribution of C_i and an increase in the number of potential franchisees N can increase the probability that a franchisor opens a franchised outlet rather than a company-owned one, i.e., $Pr(max_{i=1,...,N}\tilde{\pi}_f(C_i)) \geq \tilde{\pi}_c$.

[36] In fact, when we extend the above model to allow for an interaction of the number of employees with effort but still keep effort exogenous, we get the opposite prediction that the number of employees in an outlet should have a negative effect on the relative growth of franchising. Intuitively, as a manager's effort becomes more important for profit, from a franchisor's perspective, the lower bound of the exogenously drawn franchisee effort needed for franchising to dominate the company-owned outlet increases. In other words, the franchisor becomes more selective, and so the probability of opening a franchised outlet rather than a company-owned outlet decreases.

and, therefore, the incentive channel arises.[37] With the incentive channel, we generate predictions consistent with our empirical findings that cannot be explained by a model without this channel.

Second, absent the incentive problem, it is difficult to explain why chains, including even established and large ones, require franchisees to invest in their outlets. If chains required investments for the sole purpose of obtaining capital, established chains with access to capital markets should stop opening new franchised establishments and revert back to company ownership for all their establishments at some point because undiversified investors (franchisees) are a costly source of capital.[38] This was known as the "ownership redirection" hypothesis in the franchising literature. However, established firms continue to franchise, and to be heavily franchised overall (see also Lafontaine and Shaw (2005) on the lack of "redirection"). We view this as additional evidence in support of the importance of the incentive problem: franchisors do not view franchisees purely as investors. In addition to bringing in capital to the business, a franchisee also puts in effort and thus directly affects its performance. Requiring franchisees to invest raises the stakes and incentivizes them to work hard.

Third, the literature on the use of collateralization and credit rationing in credit markets suggests that credit rationing arises from the same underlying incentive problem that we emphasize. Credit rationing exists because banks impose minimal collateral requirements. Most models explaining why banks impose such collateral requirements build on the idea that there exists some asymmetric information problem, and the collateral is used to address that. For example, Bester (1987) argues that collateral requirements are used in the credit market as a response to moral hazard issues; and borrowers are credit rationed because their collateral holdings are too low to generate a sufficient incentive effect.[39] A franchisor wants to pick the potential franchisee who has the greatest incentives to work hard; and a bank rations only those who have the least incentives to work hard. The objectives of these two principals (i.e., the franchisor and the bank) are therefore aligned in making sure that franchisees are induced to exert high effort.

In summary, changes in collateralizable housing wealth can affect potential franchisees' incentives (due to affecting how much skin they have in the game) and the number of potential franchisees (due to banks' credit rationing), both leading to a change in relative franchising growth. However, a model with only credit rationing where credit rationing is unrelated to incentives cannot explain

[37]Of course, for a potential franchisee who has enough liquidity to finance the required capital, an additional increase in her collateralizable housing wealth does not have an impact on her effort and profit. As explained in Footnote 16, however, as long as it is not the case that all potential franchisees can finance the required capital with available cash, a shift in the distribution of collateralizable housing wealth has a positive effect of the relative growth of franchising.

[38]As pointed out by Rubin (1978), absent an incentive motive, franchisors would do better, in terms of capital cost, if they sold shares in a diversified portfolio of establishments to their (risk averse) investors rather than selling separate establishments to separate individuals (as is done under franchising).

[39]Similar to Bester (1987), our theoretical model (Proposition 3 in Online Appendix Section A) shows that a franchisee may be rationed out of the credit market when her collateralizable wealth is too small. In addition to dealing with moral hazard issues, collateral requirements can also be used to deal with hidden information by inducing self selection by high-type borrowers only (see, for example, Bester (1985)). We discuss this further in Section 5.2.2.

some of our empirical findings and other industry facts about franchising. Moreover, the existence of credit rationing is also related to the incentive effect of collateral.

5.2.2 An Adverse Selection Explanation

A hidden information problem can also explain our empirical findings. For example, some franchisees may have a lower cost of exerting effort, and franchisors would want to select such franchisees. Since franchisees who have a lower cost of exerting effort also would be willing to put more down as collateral, there would be a positive relationship between collateral and a franchisee's type.[40] What is important for our results is that there exists a positive relationship between collateral and a franchisee-specific determinant of profit. This determinant can be the franchisee's type or the effort she chooses. Therefore, a hidden-information model and our model are very similar: in our model, the positive relationship exists because of the incentive effect of collateral; in the hidden-information model, the positive relationship exists because of the selection function of collateral.

In this paper, we focus on effort and moral hazard because of the importance of effort to the franchise relationship. The franchising trade press is replete with comments regarding the importance of franchisee effort. For example, FranSource International's "Benefits of Franchising Your Business" states that "Franchising puts a 'business owner' in charge" and "A new business demands a great deal of time, effort and sacrifice. Franchisees are motivated by their ownership of the business and the capital they have invested." Moreover, franchisors typically include explicit clauses in their franchise contracts imposing a requirement for best effort, and some also require full-time effort. For example, McDonald's contract includes the following clause: 13. Best efforts. Franchisee shall diligently and fully exploit the rights granted in this Franchise by *personally devoting full time and best efforts.* [McDonald's corporation Franchise Agreement, 2003, p. 6.] Not surprisingly, then, effort also has been a major focus of the franchising literature (see Lafontaine and Slade (2007) for a survey of relevant theory and empirical analyses).

Industry participants also explicitly recognize the incentive effect of franchisees having skin in the game. For example, William Ackman, the founder and CEO of Pershing Square Capital Management LP and one of Burger King's investors, is quoted in in Needleman and Loten (2012): "the franchisee has more skin in the game. He's going to put his heart and soul into it". Similarly, in discussing whether young entrepreneurs should buy a franchise out of college, Jeff Elgin, the CEO of FranChoice Inc, a franchise consulting firm, says "Franchisors found that young franchisees with no 'skin in the game' in terms of personal cash investment were far more likely to give up whenever the going got tough ..." In his book, Gilfillan (2015) says that "your liquid capital represents your 'skin in the game,' as the saying goes. When you put up as much as $100,000 of your own money

[40] Similarly, as mentioned in Bester (1985) and Bester (1987), any asymmetric information problem, on effort or type, can explain the use of collateral in lending.

to buy into a franchise concept, you demonstrate a tremendous commitment to the success of that investment. The franchisor wants you to be that committed, and so do the lenders who help you access the balance of your startup capital."

In summary, while an adverse selection explanation can also explain our empirical findings and is fundamentally similar to our moral hazard model, we focus on the effect of collateralizable housing wealth on franchisors' organizational choice decision through the lens of moral hazard. We do so because of the importance of effort to the franchise relationship and the emphasis that industry participants put on franchisees having skin in the game as an assurance that the required effort will be forthcoming.

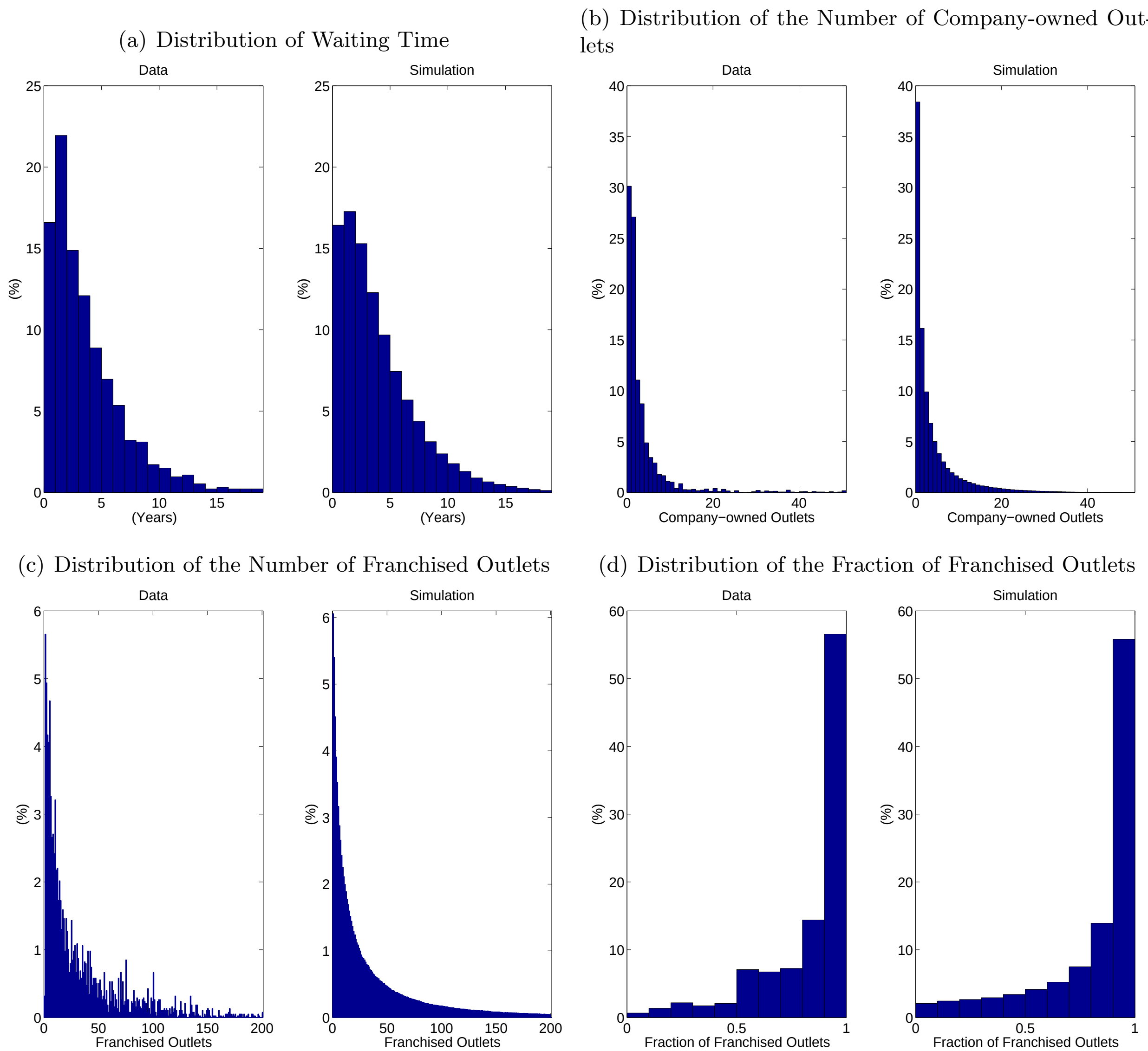
5.3 Fit of the Model

To see how well our estimated model fits the entry and the expansion patterns of the chains in the data, we compare the observed distribution of the waiting time (left panel of Figure 2(a)) to the same distribution predicted by the model *conditional on* a chain having started franchising by 2006 (right panel of Figure 2(a)). Since a chain is included in our data only after it starts franchising and the last year of our sample is 2006, this conditional distribution is the model counterpart of the distribution in the data. We make a similar comparison for the distributions of the number of company-owned outlets, the number of franchised outlets and the fraction of franchised outlets in Figures 2(b), 2(c) and 2(d), respectively.[41] In all cases, our estimated model fits the data well. Figure 2(b) shows that the model somewhat over-predicts the fraction of chain/years with no company-owned outlet while also under-predicting the fraction of observations with one company-owned outlet. We believe this occurs because our model does not capture the chain's desire to keep at least one company-owned outlet as a showcase for potential franchisees and a place to experiment with new products, for example. The figures also show, not surprisingly, that the distributions predicted by the model are smoother than those in the data. For example, in Figure 2(d), there is a discrete increase in the percentage of observations at 0.5. Thus, having 50% of franchised outlets seems to be a focal point for chains. In the data, the percentage of observations with exactly 50% of outlets being franchised is 4.7%, whereas the percentage of observations with the fraction of franchised outlets in the ranges of [40%, 50%) and [50%, 60%) are 3.4% and 4.1% respectively. The existence of a focal point, which presumably is not primarily explained by economic arguments, is not captured by our model.

In Online Appendix (Section F), we simulate the distribution of the number of company-owned and franchised outlets when the decision on the timing of entry into franchising is taken as exogenous, i.e., the selection issue is ignored. In this case, the simulation underestimates the number of franchised outlets quite a bit. In particular, it over-predicts the percentage of observations with zero

[41] Since there are only a few chain/years with more than 50 company-owned outlets, or more than 200 franchised outlets, we truncate the graphs in Figures 2(b) and 2(c) on the right at 50 and 200 respectively for readability.

Figure 2: Fit of the Model: Data vs. Simulation



(a) Distribution of Waiting Time

(b) Distribution of the Number of Company-owned Outlets

(c) Distribution of the Number of Franchised Outlets

(d) Distribution of the Fraction of Franchised Outlets franchised outlet: it predicts this percentage to be 16% when it is 0.3% in the data. This is because ignoring selection means that we draw the unobservable profitability of a franchised outlet from the unconditional distribution so that, even when the draw is so small that the chain should not have started franchising, the simulated number of franchised outlets corresponding to this draw, which is most likely to be very small, is included in the computation of the distribution of the predicted number of franchised outlets. This confirms the importance of accounting for selection in our analyses.

5.4 Robustness

We report the results of two robustness analyses in this section. In the first robustness analysis, we address the concern that potentially omitted state characteristics might affect the relative profitability of a franchised outlet, which could bias our estimate of the effect of collateralizable housing wealth on the relative profitability of franchising, the coefficient of interest. We do this by adding state fixed effects in the relative profitability function. As shown in Table 4, our estimation results are robust to including such fixed effects, implying that our results are not driven by unobservable state-specific variation.

In the second robustness analysis, we reestimate our baseline model using a different weighting matrix to alleviate potential concerns that our results might be too dependent on the specific way in which we link the chain-specific and aggregate variables. This alternative weighting matrix uses information on chains' top three states (three states where each chain has the most outlets) rather than only the top state. The construction of this weighting matrix is described further, and the actual matrix also is shown, in Online Appendix (Section C.4). Results from this robustness analysis, in Table 5, are also very similar to the baseline results. In terms of our main variable of interest, we find a coefficient for collateralizable wealth that is even larger than in our baseline specification. We conclude that our results are robust to reasonable variations in the way we link the aggregate economic data to our data on chains, and that our current baseline results provide relatively conservative estimates of the effects of interest.

In addition to the above two robustness analyses, we have conducted two more robustness analyses whose results can be found in Online Appendix (Section G). In one of these robustness analyses, we allow the coefficient of collateralizable housing wealth to be state-specific. In the other, we replace the National Foundation of Independent Business' measure of credit supply by two alternative measures from the Federal Reserve's "Senior Loan Officer Opinion Survey on Bank Lending Practices". Our results are robust to both alternatives.

Table 4: Robustness Analysis: Including State Fixed Effects in the Relative Profitability of a Franchised Outlet

	est.	s.e.
Log of opportunity arrival rate		
constant	3.034***	0.016
std. dev.	1.330***	0.025
General profitability		
constant	-3.431***	0.040
population	0.277***	0.006
per-capita state product	0.011***	0.001
collateralizable housing wealth	-0.079***	0.006
Relative profitability of a franchised outlet		
collateralizable housing wealth	0.263***	0.007
employees	0.009**	0.005
(coll. housing wealth)×(employees)	0.019***	0.001
interest rate	-0.027***	0.003
capital needed	-0.531***	0.021
credit supply	1.672***	0.032
population	0.006**	0.003
business products & services	-0.005	0.089
restaurant	-0.026	0.075
home services	1.545***	0.090
go to services	0.768***	0.071
auto; repair	1.308***	0.087
std. dev.	2.562***	0.043
Outlet exit rate	0.316***	0.001
Entry cost		
mean parameter	3.151***	0.180
std. dev. parameter	0.647***	0.002
probability q_0	0.178***	0.019
probability q_1	0.189***	0.015

** indicates 95% level of significance. *** indicates 99% level of significance.

Table 5: Robustness Analysis: Different Weighting Matrix to Link Chain and Aggregate Economic Data

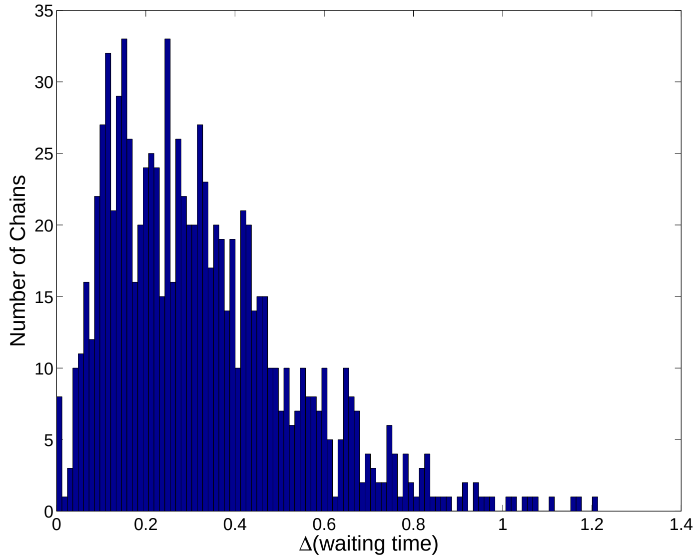
	est.	s.e.
Log of opportunity arrival rate		
constant	3.026***	0.013
std. dev.	1.346***	0.022
General profitability		
constant	-3.244***	0.044
population	0.258***	0.006
per-capita state product	0.007***	0.001
collateralizable housing wealth	-0.070***	0.007
Relative profitability of a franchised outlet		
collateralizable housing wealth	0.237***	0.006
employees	0.009**	0.004
(coll. housing wealth)×(employees)	0.016***	0.001
interest rate	-0.037***	0.003
capital needed	-0.490***	0.016
credit supply	1.319***	0.027
population	0.007***	0.001
business products & services	-0.025	0.048
restaurant	0.199***	0.048
home services	1.657***	0.054
go to services	0.713***	0.052
auto; repair	1.101***	0.061
constant (retailer)	2.362***	0.071
std. dev.	2.666***	0.029
Outlet exit rate	0.310***	0.001
Entry cost		
mean parameter	2.880***	0.234
std. dev. parameter	0.643***	0.031
probability q_0	0.154***	0.017
probability q_1	0.176***	0.014

** indicates 95% level of significance. *** indicates 99% level of significance.

6 Assessing the Economic Importance of Collateralizable Housing Wealth

Because our model is non-linear, we gauge the magnitude of the effect of collateralizable housing wealth using a simulation approach akin to what is often done to calculate marginal effects in other non-linear models. We do this using our baseline results and a decrease in collateralizable housing wealth of 30% in all state/years in the data. This exercise helps us understand the economic magnitude of the estimated effect of collateralizable housing wealth on the extent of franchising and the expansion of the chains. A 30% decline in collateralizable housing wealth, moreover, is in

Figure 3: The Effect of Potential Franchisees' Financial Constraints on Chains' Waiting Time



line with the reduction in housing values that occurred during the great recession.[42]

To highlight the incentive channel, we focus on results from a change in collateralizable housing wealth in the relative profitability of franchising only.[43] Figure 3 shows the distribution of the changes in waiting times (between a chain starting a business and starting to franchise) 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 collateralizable housing wealth.[44] We then compute the average waiting time across simulations for this chain. The histogram of the average changes in waiting time (averaged over simulations), in Figure 3, shows that all chains go into franchising on average later with, compared to without, the change in franchisees' financial constraints. The average effect of decreased collateralizable housing wealth on the chains' decisions to start franchising is a delay of 0.33 years. The average waiting time in the data is 3.15 years, so the average delay is about 10% of the average waiting time.

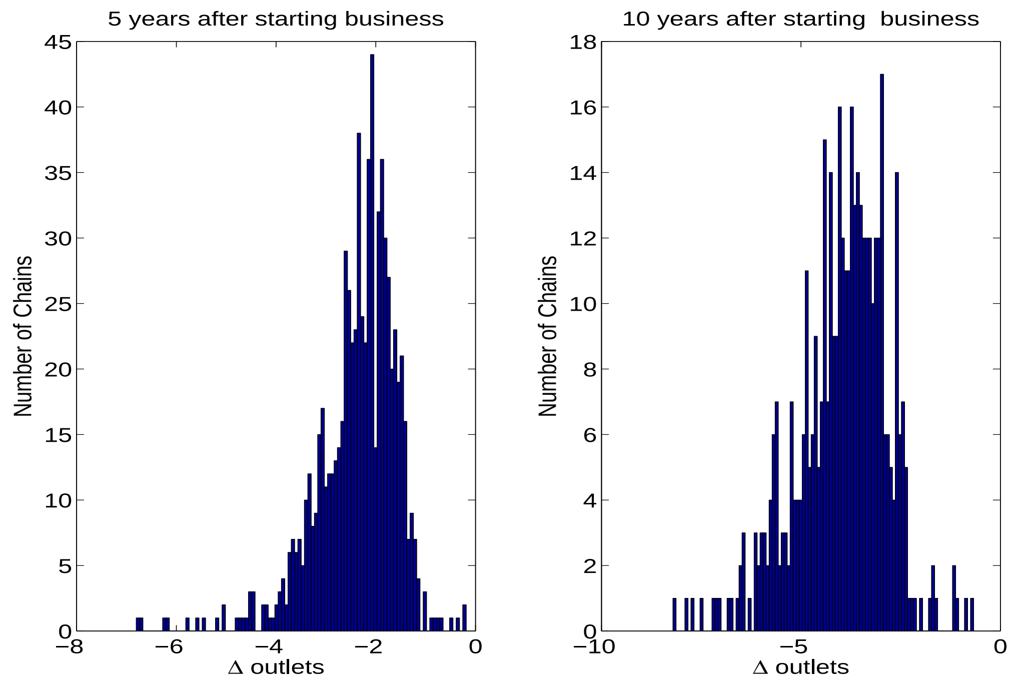
Figure 4 shows the average change in the total number of outlets, both franchised and company-owned, that results from the 30% decrease in collateralizable housing wealth. The results of our

[42]Median net worth fell 38.8 percent between 2007-2010 mostly because of the reduction in housing values (see Bricker, Kennickell, Moore and Sabelhaus (2012)).

[43]Our estimation results imply that collateralizable housing wealth has a negative effect on the demand side. If we allow this channel to operate as well, we get lower net effects, in the order of 5% to 6% reductions in the total number of outlets, instead of the 9% we report below, which isolates the effect of interest, namely, the one that operates through the incentive channel.

[44]We use the simulated distribution without the decrease in collateralizable housing wealth 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 4: The Effect of Potential Franchisees' Financial Constraints on the Number of Outlets



simulations imply that the total number of outlets of chains five years after they start their business decreases by 2.37 or 9.40%.[45] This average is taken over simulations and 757 chains that appear in our sample in the fifth year after they start their business. In total, these 757 chains would fail to open 1,795 outlets, and they would fail to create 9,633 jobs in the process.[46] Similarly, there are 437 chains that appear in our sample in the tenth year after starting their business. Our simulation indicates that these chains would have 1,734 fewer outlets ten years after starting in business, or 3.97 (9.26%) fewer outlets each on average. The corresponding job loss would be 10,080. Of course, this is a partial equilibrium result for understanding the economic magnitude of the key estimated parameters. For example, we hold the number of employees in an outlet constant in these simulations, whereas in reality, this could be a margin on which the chains would adjust. This number is rather constant within chains over time in our data, however, which is to be expected given the standardized business concepts that these chains emphasize.

[45] The average number of outlets five years after a chain starts its business is 24.97 in the data. The simulated counterpart (without any change in collateralizable housing wealth) is 25.47.

[46] These 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.

7 Conclusion

In this paper, we examined how financial constraints of agents affect the organizational choice decisions of principals and thus their growth, using data from franchised companies. We have shown theoretically and empirically that the entry of a chain into franchising and its growth via franchised and company-owned outlets are intrinsically linked. We have also shown that they all depend in a systematic way on the availability of financial resources of potential franchisees. The magnitude of the effects is sizable, suggesting that financial constraints could play an important role for the type of small business owners that franchisors try to attract into their ranks. In other words, our results suggest that franchisees' investments in their businesses are an important component of the way franchisors organize their relationships with their franchisees. As a result, when collateral values decrease, franchising as a mode of organization becomes less efficient and franchisors' organizational choices become more constrained. This, in turn, can reduce the growth and total employment of these chains.

We view the incentive effect of collateralizable housing wealth that we emphasize as complementary to that of the residual claims that have been the typical focus of the theoretical and empirical literature on franchising. The reliance on franchisee collateralizable housing wealth gives strong incentives to franchisees in the early years of their business, a period during which profits, and hence residual claims, are small or even negative. Franchising thus provides an ideal setting to consider the relationship between moral hazard and agent collateral, a relationship that has not been emphasized in the literature to date and yet might play an important role in other contexts as well.

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