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Spatial Competition and Interdependence in Strategic Decisions: Empirical Evidence from Franchising

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Abstract: This paper investigates spatial competition and spatial interdependence in two key strategic variables in franchising: the proportion of franchised outlets (franchise proportion) and the royalty rate. Employing a simultaneous equations model and data from 353 U.S. franchise chains in 43 sectors in 2005, we find robust evidence for significant spatial competition and stable interdependence in these two strategic variables. Specifically, we find spatial competition in each strategic variable, and spatial interdependence between the two strategic variables. Each strategic variable and its spatial lag are strategic complements in spatial competition due to the market share effect, while the two strategic variables are strategic substitutes in spatial interdependence due to the market power effect, and the former effect is stronger than the latter effect. Besides, we also find that franchisors are strongly inclined to a combination of a low royalty rate and a high franchise proportion, which evolves and stabilizes in the long-run equilibrium. These findings provide a consistent framework with which to explain many stylized facts in franchising, such as the time-invariance of a uniform royalty rate, the stability of a mixed organizational structure, and the co-existence of head-on competition and diversification of chains of different sizes.

JLE Classification: L1, L2

Keywords: Spatial Competition, Spatial Interdependence of Strategic Variables, Simultaneous Equations System, Market Share Effect, Market Power Effect

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1. Introduction

Competition among franchise chains is inherently spatial. When customers look from one franchise chain to another in search of similar goods and services, they are constrained by transportation costs, search costs and information asymmetry. Outlet dispersion thus gives a franchisor a degree of market power. However, as risks and costs from outlet dispersion increase with expansion, so does the need for local franchisees. To attract franchisees with greater flexibility and better information on the local markets, the franchisor in fact faces the same spatial dilemma as the customers. Hence, studies on spatial competition in franchising are ultimately centered around two questions. First, how does a franchisor decide on how aggressively to expand given that it has rivals in the local and adjacent markets? Second, how does a franchisor design a franchise contract to compete for skilled and experienced franchisees with its rivals in the local and adjacent markets? The spatial effects of these strategic decisions can further be classified as either a market share effect or a market power effect (Pinkse & Slade, 1998). The market share effect drives franchise chains to set up shop close to each other and adopt similar market strategies, while the market power effect drives franchise chains to stay away from each other and differentiate themselves. In a review of empirical studies, Borenstein & Netz (1999) find that the market share effect dominates the market power effect, suggesting that firms tend to cluster.

Although the necessity of and benefit from considering spatial competition and interdependence of firms are clear, empirical studies of spatial effects are rare. The main reason is that applicable techniques are underdeveloped. There is simply a large gap between modeling competition based on traditional economic approaches and measuring competition spatially. Appropriate econometric methodologies of estimating spatial interdependence among strategic variables were almost nonexistent before 1980s. Recently, the rapid growth in spatial economy (Anselin, 1988; Sheppard et al., 1992) and spatial econometrics (Kelejian & Prucha, 2004) has greatly removed these limitations, allowing for empirical examinations of spatial competition in many industries. Franchising has become the industry attracting the most research interest. Pinkse & Slade (1998), Kalnins (2003), Henrickson (2010) and Chisholm and Norman (2012) have all used various spatial econometric models to test the influence of spatial competition in retail prices in sectors such as gasoline stations, fast food, sports and cinemas. Our study adds to the existing literature by going beyond a single sector to consider the whole industry, and by examining a comprehensive system of multiple decisions at the chain level (such as the choice of franchise proportion and the design of franchise contract) rather than a single pricing decision at the outlet level.

Many analytical and empirical studies have suggested that delegation of decision-making authority and provision of incentives are both corporate governance mechanisms designed to

realize efficient internal control (Abernethy et al., 2004; Widener et al., 2007). This is also the case in the franchising industry. In franchising, it is important to recognize that the franchise proportion and the franchise contract are jointly determined. That is, decision rights are delegated and at the same time incentives are offered through an appropriate royalty rate in franchising.

Our study is the first to investigate spatial competition and spatial interdependence in strategic decisions across franchise chains within a uniform framework. Based on this framework, we aim to find a consistent explanation for many stylized facts in franchise chains, such as the uniformity and time-invariance of a low royalty rate and the stability of a mixed organizational structure among franchise chains.

Another contribution of our study is the way we measure the degree of spatial competition among franchise chains. Obviously, the “closer” a chain is to its rivals, the stronger the competition. However, there has never been a consensus on how best to measure “distance”. In fact, economists and geographers measure spatial competition in vastly different ways. Economists tend to focus on the economic aspects of competition and so have adopted a so-called “economic” distance that is based on income, population, trade, etc. In contrast, geographers tend to place a greater emphasis on the geographic characteristics of competition and so rely heavily on detailed geographic information to construct a Euclidean distance between spatial units. We think that both the economic distance and the geographic distance are important in defining spatial competition, especially for industries like franchising. In the analysis, we map the market presence of each franchise chain onto 50 U.S. states to construct a measurement of spatial competition as the density of franchise networks using a geographic algorithm. We believe that, with a combination of geographic features and economic considerations, our method measures spatial competition in franchising more properly than existing approaches and so has improved explanatory power.

Using data from 353 U.S. franchise chains in 43 sectors in 2005, we estimate a spatial simultaneous equations model to test the presence and influence of spatial interdependence in a firm's decisions on two crucial strategic variables: the franchise proportion and the royalty rate. Our empirical analysis indicates significant spatial competition and strong spatial interdependence in the two strategic variables. On the one hand, when franchise chains are isolated from spatial effects, there is a stable positive relationship between the two strategic variables. On the other hand, in a competition for market share, in each of the two decisions, franchise chains respond positively to the same decision made by competitors. However at the same time, for a decision made by competitors, to prevent an erosion of market power in head-on competition, franchise chains may shy away from direct competition by responding negatively using the other strategic variable. For instance, if one franchisor uses an organizational approach to strengthen its market power (i.e., to increase its franchise proportion), other franchisors may respond with a contractual approach (i.e., to increase the royalty rate) so that

more resources can be switched to new territories where their market power is more sustainable. That is, our results show evidence of both market share and market power effects, with the former being stronger than the latter, which is consistent with what Borenstein & Netz (1999) have predicted. Interestingly, what our study derives from the business world is a reflection of what happens in the animal world. Besides competing head-on with fellow animals for the same food, animals in a species can also survive severe competition through changing their body appearances and structures over time to compete for new sources of food, resulting in a diversified species distribution in the animal world over time. Likewise, we also observe a diversified chain distribution in franchising.

This paper is organized as follows. Section 2 presents a concise literature review. Section 3 presents our empirical model for spatial competition among franchise chains. Section 4 proposes our hypotheses for spatial competition among franchise chains and the spatial interdependence of decisions. Section 5 describes our data set and variables. Section 6 discusses in detail how we measure competition in a spatial framework. Our major empirical results are outlined in Section 7, followed by discussions in Section 8. Finally, Section 9 concludes the paper.

2. Literature Review

Interdependency among agents is constrained by both economic and spatial structures (Plummer & Sheppard, 2006). Hence, spatial competition typically involves multiple dimensions. Many empirical studies have found that the interdependence of decisions is quite closely tied to geographic heterogeneity; that is, decisions are not purely economically related. For instance, Haining et al. (1996) explore the spatial properties of sales and price configurations for firms competing in a geographically extensive market; Anselin et al. (1997) observe local spatial externalities between university research and high-technology innovation activity via the former's spillover into private R&D, which can transcend the boundaries of countries; McMillen et al. (2007) empirically explore price competition among private U.S. universities and show that the tuitions are inversely related to the distance between institutions; and Numan & Willekens (2012) find significant support for the hypothesis that an auditor's fees depend on its relative location in a market segment.

Spatial heterogeneity in competitive activities and strategic decisions among franchise chains has been widely documented. Combining franchised outlets and company-owned outlets allows a franchisor to have some level of centralized control, while at the same time maintaining a sufficient amount of local autonomy, which makes studies of spatial effects particularly relevant. Many studies in franchising have shown that location, distance or physical dispersion is the most significant factor in deciding on the franchise proportion. However, few of them have attributed such geographic heterogeneity to spatial competition. For exam-

ple, Fladmoe-Lindquist & Jacque (1995) find that geographic distance is positively related to the propensity to franchising as opposed to company ownership, which they interpret as a result of increasing monitoring costs. Also, Kalnins & Lafontaine (2004) provide empirical evidence that franchised outlets tend to locate in markets that are geographically close to each other and with similar demographic characteristics and they interpret it as a way to tackle the free-rider problem (through internalizing the cost of quality debasement) and to alleviate information asymmetry (through knowledge inter-transmission).

Gal-Or (1995) and Klein (1995) are pioneers in empirical spatial analysis. They examine intra-chain spillovers in investment due to brand sharing, which lead to chain-wide underinvestment because of franchisees' free-rider behaviors. Miller et al. (1999) further test the effects of intra-type, inter-type and inter-category competition on organizational structures in the retail sector. Focusing on a specific sector, Plummer et al. (1998) and Davis (2006) empirically examine the spatial effects in pricing competition among gasoline stations and among movie theaters. These works have made great progress toward understanding spatial competition. However, with recent developments in spatial econometrics, these works would have a lot of room for improvement.

Rapid developments in spatial econometrics have greatly removed the technical limitations for empirical studies of spatial competition. Pinkse & Slade (1998) are the first to test spatial competition in contracting among gasoline retailers in the city of Vancouver using a discrete choice spatial error model. Pinkse et al. (2002) further show that price competition among gasoline wholesalers was highly localized. Kalnins (2003) also employs a spatial econometric model to study the pricing competition of hamburgers among the four largest fast-food franchise chains. Most recently, Henrickson (2010) applies a spatial autoregressive model to empirically estimate spatial competition in the pricing of tickets to professional sports events. Chisholm & Norman (2012) extend Davis' (2006) study on spatial competition among movie theaters to a spatial econometric framework. However, these studies have some limitations. First, they are all single dimensional studies, whereas we consider multiple dimensions (the franchise proportion and the royalty rate). Second, these studies focus mostly on pricing. But pricing is only one of the many marketing strategies at a franchisor's disposal, and it alone does not capture the whole picture of spatial competition in a franchisor's decision-making process. In fact, it is usually the franchisees instead of the franchisors that have greater control over the price. Hence it is inappropriate to focus our study of the decision-making process of franchising at the chain level. Besides, a pricing decision made by a franchisee may be influenced by the royalty decision made by the franchisor. Our study is the first to extend previous studies of spatial competition to a multiple-dimensional system. We intend to provide answers to some puzzles in franchising, such as the uniformity and time-invariance of a low royalty rate, the stability of a mixed organizational structure adopted by almost all franchise chains, and the co-existence of severe competition and diversification of chains of different sizes.

In estimating spatial competition, we define the network of all franchised outlets belonging to the same chain in a specific state as a local market of this chain. Any such network operated by another chain in the same state is viewed as a local competitor, and any such network operated in a neighboring state is viewed as an adjacent competitor. For each local market of a chain, there are neighboring markets. The neighboring markets are defined as those neighboring states in which other chains have outlets. Although in existing practice the state-level geography is normally regarded as poor for analyzing most economic topics, especially when dealing with the question of adjacency, we argue that the state-level definition of a spatial unit (a franchise chain in our case) and its neighbors based on geographic borders is appropriate for our study. In fact, state-level spatial data is commonly employed in studies on macro decisions, but rarely in studies on micro decisions². One reason for this difference is that macro and micro focuses differ a lot. By assigning a smaller weight to the spatial unit at a below-state level, data at the state level carry more economic implications for spatial competition through having a wide range of alternatives from a simple Euclidean distance to complex economic discrepancies to measure “distance” between two spatial units (Devereux et al., 2007; Holly et al., 2010; Marrocu & Paci, 2012). In contrast, data below the state level often reveals spatial heterogeneity in competition, which becomes more distinguishable as the spatial scale narrows. Based on spatial data at the metropolitan, county, or even street level, most studies obtain significant results of spatial interdependence even when the simplest Euclidean distance is used (Kalnins, 2003; McMillen et al., 2007; Numan & Willekens, 2012). However, the observed spatial competition needs further examinations of the competition structure after taking into accounting heterogeneous features. Furthermore, a state-level definition is probably more suitable for our target industry of franchising. On the one hand, the boundary of a spatial unit should theoretically be determined according to the control territory and decision horizon of the decision maker. In franchising, decisions can be made at two levels. For decisions made at the outlet level such as pricing, a below-state level would no doubt be superior, since a franchisee’s control territory and decision horizon are local (Klein, 1995; Pinkse & Slade, 1998). However, for decisions made at the chain level, the state level would be better, since a franchisor generally has a nationwide control and decision horizon. In fact, the literature has shown that decisions at the corporate level are influenced greatly by national factors—such as the tax rate, regulations, real income—that vary across states (Becker & Henderson, 2000). On the other hand, since franchising is a sector filled with diversified small businesses, quite a lot of micro-chains are excluded at a below-state level, and some of them even fail to provide sufficiently detailed information about where their outlets are located. Therefore, with a priority for finding the economic implications of spatial competition but still maintaining geographic considerations, our study first defines spatial units at the state

² The study by Bode et al. (2012) on spatial externalities of foreign direct investment using data for the U.S. states is probably the only exception.

level then maps the franchise networks of these spatial units to compose a market structure based on the geographic superposition of market boundaries. Finally, to ensure that our choice of the state-level geography in defining a spatial unit and its adjacency is not subject to an estimation bias resulting from ad hoc assumptions, we conduct robust tests for our results using two exhaustive sets of functional regions according to similarities in economic activity proposed by Crone (1999) and the U.S. Bureau of Economic Analysis (BEA).

Our study also contributes to the literature in another dimension by examining the spatial interdependence of organizational and contracting decisions in spatial competition. As documented by many studies in accounting, delegation of decision-making authority and incentive compensation are complementary corporate governance mechanisms (Nagar 2002; Abernethy et al., 2004; Widener et al., 2007). Windsperpger & Yurdakul (2007) put forth a similar idea, and suggest that ownership rights (the franchise proportion) and income rights (the royalty rate) should be combined. Their studies serve as the foundation for our model. A franchisor can adopt an appropriate organizational structure such as one featuring a high franchise proportion to share risk at a low monitoring cost, and meanwhile design a favorable franchise contract such as one involving a low royalty rate to attract local franchisees. Faced with this trade-off between risk-sharing and income-sharing, a franchisor should decide on its organizational form and contractual terms simultaneously.

Overall, this paper examines how a franchise chain utilizes both an organizational strategy and a contracting strategy simultaneously in spatial competition against neighboring chains. We are the first to conduct a study on spatial competition with multiple decision variables. We present evidence for spatial competition and spatial interdependence in decisions regarding the franchise proportion and the royalty rate among franchise chains in a spatially competitive equilibrium.

3. Empirical Modeling

A franchisor can respond to overlapping service territories and possible substitution of products and services in two ways: (1) set up a more appropriate ownership structure for the company; and (2) specify better contractual terms for franchisees. A franchisor's optimal decision on these two aspects can be expressed as a reaction function of other franchisors' optimal decisions, which takes the following form:

$$z_i = R(z_{-i}; X_i) \quad (1)$$

where z_i is a vector of two decision variables representing the franchise proportion and the royalty rate, and X_i is a vector of agent i 's preference characteristics. We call this expression a *spatial autocorrelations model (SARM)*.

Furthermore, instead of being viewed as exogenously given, the characteristics X_i of a franchise chain can also be interpreted as variables determined at an earlier stage (Pinkse & Slade, 1998). Hence, they may be spatially correlated when they are chosen, resulting in *spatial heterogeneity* if some of the characteristics are unobservable. Then, the reaction function (1) can be rewritten as

$$z_i = R_z(z_{-i}; x_i; u_i), \quad (2)$$

with $u_i = R_u(u_{-i})$ representing a vector of unobservable variables, which are spatially correlated with each other. We call this expression a *spatial errors model (SERM)*.

The slope of the reaction function (2) can be positive or negative. If the slope is positive, it implies that competitive strategies among neighboring franchise chains are “strategic complements” resulting either from information spillovers or from resource-flow constraints. Pinkse & Slade (1998) term this effect the market share effect, which leads firms to locate near competitors in an attempt to steal or capture more customers. If the slope is negative, it implies that competitive strategies are “strategic substitutes” being driven by either a differentiating intention or a cooperative consideration. This opposite effect is termed the market power effect, which leads firms to locate further away from rivals in order to capture consumers in a different market segment. Borenstein & Netz (1999), in a review of the empirical literature, found that the market share effect dominates the market power effect, indicating that firms tend to cluster.

Further, as a result of competition for the two major resources—customers and franchisees, a franchisor’s decisions on the franchise proportion and the royalty rate are expected to be interdependent. Thus, the observed pairs of the royalty rate and the franchise proportion, representing the equilibrium outcomes of two inter-related decisions, should be estimated using a simultaneous equations system. Consequently, our empirical model can be expressed as

$$Y_n = Y_n \Gamma + \bar{Y}_n \Lambda + X_n B + U_n, \quad (3)$$

with

$$Y_n = (y_{1,n}, \dots, y_{m,n}), \quad X_n = (x_{1,n}, \dots, x_{k,n}), \quad U_n = (u_{1,n}, \dots, u_{m,n}), \quad \bar{Y}_n = (\bar{y}_{1,n}, \dots, \bar{y}_{m,n}), \\ \bar{y}_{j,n} = W_n y_{j,n}, \quad j = 1, \dots, m, \quad (4)$$

where $y_{j,n}$ is an $n \times 1$ vector of cross-sectional observations on the dependent variable in the j -th equation, $x_{l,n}$ is an $n \times 1$ vector of cross-sectional observations on the l -th exogenous variable, $u_{j,n}$ is an $n \times 1$ disturbance vector in the j -th equation, W_n is an $n \times n$ spatial weights matrix of some known constants, and Γ , B and Λ are parameter matrices of dimensions $m \times m$, $k \times m$ and $m \times m$, respectively. In addition, to allow for general spatial lags in the endogenous

variables, we also include spatial error terms (i.e., spatial heterogeneity), indicating that the disturbances are interdependent as well.

Specifically, spatial spillovers in the endogenous variables are modelled via $\bar{y}_{j,n}$, $j = 1, \dots, m$, with the i -th element of $\bar{y}_{j,n}$, i.e., a spatial lag for $y_{j,n}$, expressed as

$$\bar{y}_{ij,n} = \sum_{r=1}^n w_{ir,n} y_{rj,n}. \quad (5)$$

Each element w_{ir} in W is specified to be nonzero if chain i is “close” to chain r , either geographically or economically. In such cases, chains i and r are said to be neighbors. The “closer” these neighbors are to each other, the more sensitive their interactions are. Thus, $\bar{Y}_n \Lambda$ exhibits spatial interactions among franchise chains, which is the empirical expression of the reaction functions described above.

Furthermore, $m = 2$ for our analysis, where y_{1i} represents chain i 's decision on the *proportion of franchised outlets* (*PFO*, i.e., the franchise proportion), and y_{2i} represents chain i 's choice of income share left to a franchisee after the latter pays a royalty rate, or the *inverse royalty rate*³ (*IRR*). Equation (3) can then be written as

$$\begin{aligned} \text{PFO equation: } PFO &= \gamma_1 \times IRR + \lambda_{11} \times WPFO + \lambda_{12} \times WIRR + \dots; \\ \text{IRR equation: } IRR &= \gamma_2 \times PFO + \lambda_{21} \times WIRR + \lambda_{22} \times WPFO + \dots. \end{aligned} \quad (6)$$

Notice that, since IRR is the inverse of the royalty rate, its coefficients should be interpreted inversely. For instance, a positive coefficient of IRR implies that the royalty rate has a negative impact, implying a substitution effect. Consequently, $Y_n \Gamma$ reveals the relations between two decision variables, which are described in two separate equations. For convenience, we define equation 1 as the PFO equation which estimates the impact of IRR on PFO in a competition for customers, and equation 2 as the IRR equation which estimates the impact of PFO on IRR in a competition for franchisees.

Due to the complexity of above issues in empirical work, we use the Generalized Spatial Two-Stage Least-Square (GS2SLS) and Generalized Spatial Three-Stage Least-Square (GS3SLS) estimators outlined by Kelejian & Prucha (2004). Furthermore, as described by Drukker et al. (2013), to allow for a generalized covariance structure for the disturbances, a two-stage generalized method of moment (GMM-GS2SLS)⁴ is also used. These methods ensure robustness of the estimators, yielding more efficient and consistent results than traditional estimation methods do.

³ As royalty rates are usually very low in practice (5-7% on average), without loss of explanatory power, we use “1 minus the royalty rate” as the dependent variable to facilitate the computation and estimation.

⁴ See the appendices.

4. Hypotheses

The main task of this paper is to examine both the role of spatial effects and spatial interdependence in competitive decisions. We propose to test the following hypotheses.

Hypothesis 1: Existence of spatial interactions

If spatial interactions among franchise chains exist, the coefficients of all spatial variables should be significantly nonzero, i.e., $\lambda_{11} \neq 0, \lambda_{12} \neq 0, \lambda_{21} \neq 0, \lambda_{22} \neq 0$ in (6). Thus, a franchisor would react strongly to its competitors' decisions, and the strength of its response would vary according to its "distance" from competitors.

Hypothesis 2: Existence of spatial competition

We expect interactions among franchise chains to reflect spatial competition, depending on "distance". However, as there are two alternative decisions to be made, such spatial competition will be integrated both within each decision and across decisions.

Hypothesis 2.1: Each decision variable and its spatial lag in spatial competition are strategic complements—the market share effect.

Consistent with existing studies, we expect a significant market share effect in spatial competition among franchise chains. That is, the spatial lag of each decision variable (i.e., $\bar{y}_{1,n}$ in the PFO equation and $\bar{y}_{2,n}$ in the IRR equation) is expected to have a positive coefficient (i.e., $\lambda_{11} > 0, \lambda_{22} > 0$). Hence, an increase in a decision variable made by neighboring competitors will lead to an increase in the same decision variable made by a franchisor in the center of the network.

Hypothesis 2.2: The two decision variables in spatial competition are strategic substitutes—the market power effect.

Besides responding toughly with a tit-for-tat strategy using the same decision variable, it may be beneficial as well to play the alternative decision variable. Wild animals in a species have two alternative strategies for survival amid fierce competition—they either compete head-on with fellow animals for the same food, or they pursue new sources of food by changing their body structures and appearances. Similarly, a franchisor may either engage in a direct rat-race against rivals to maintain its market share, or shy away from direct competition by using an alternative decision variable to protect its market power from being eroded. Switching resources from existing areas to new territories also provides it with more opportunities to create new market power. If such a market power effect does exist, we expect spatial lags across different decisions to be negative, i.e., $\lambda_{12} < 0, \lambda_{21} < 0$.

Hypothesis 3: Spatial competition in local markets is tougher than that in neighboring markets.

To test this hypothesis, we divide the overall spatial weights matrix into a local market weights matrix and a neighboring market weights matrix. By comparing the spatial coefficients derived from these two isolated spatial weights matrices, we can easily differentiate among the impacts of spatial competition with different intensities. As a franchise chain is “closer” to competitors located in local markets than to those located in neighboring markets, we expect spatial competition in local markets to be tougher. In other words, the spatial coefficients representing the local market effect will have greater absolute values than those representing the neighboring market effect.

Hypothesis 4: The franchise proportion and the inverse royalty rate within a chain are strategic complements.

As mentioned above, a viable customer network and competent franchisees are indispensable to a successful franchise chain. As a chain expands with a steady increase in the franchise proportion, it should also gradually increase the share of income allocated to franchisees (IRR) in order to attract new local franchisees and to retain existing ones. Hence, we expect the coefficients between the two decision variables, PFO and IRR, to be positive (i.e., $\gamma_1 > 0, \gamma_2 > 0$).

Hypothesis 5: Stable equilibrium in PFO and IRR is eventually realized.

If decisions on PFO and IRR are stable in the long-run, fluctuations caused by any deviation from equilibrium should eventually vanish. For instance, a 1% deviation in IRR_0 will cause a $\gamma_1\%$ deviation in PFO_0 according to equation 1; and according to equation 2, a $\gamma_1\%$ deviation in PFO_0 will lead to a $\gamma_2\gamma_1\%$ deviation in IRR_1 afterwards. Thus, if $\gamma_2\gamma_1 < 1$, any initial deviation will ultimately disappear over time so that we have a stable equilibrium. In other words, if $\gamma_2\gamma_1 < 1$, the spatial interdependence of PFO and IRR determined by equation system (6) is stable.

5. Data and Variables

The data used in our study is a cross-section sample consisting of 353 franchise chains from 43 sectors in the U.S. in 2005. It comes from two sources: the 2006 edition of Bond's Franchise Guide (which is referred to as Bond below) and company websites. Bond's Franchise Guide is an annual survey containing detailed information on nearly 1,000 franchise chains in the U.S. and Canada. It includes detailed information such as mail address, phone number, website, brief introduction, history, number of outlets in total, numbers of franchised

and company-owned outlets, distribution, franchise contractual terms, training, and so on. We first remove those observations for Canada, then those with severe data problems, especially those with missing data on the dependent and independent variables in our model. We visit each company's website for information on outlet location. Eventually, we end up with a sample of 353 observations. This sample consists of those franchise chains that are most representative of their own sectors, in that they account for major market shares in their own sectors (SUBWAY with more than 20,000 outlets in total, for example), they have long histories indicating long-term specialization in their own sectors (BERLITZ established in 1900, for example), and they have growth potential (EASYCHAIR MEDIA with a projected growth rate of about 250%, for example).

5.1. A Sample Overview of Spatial Competition

To gain a full picture of spatial competition in franchising, we further compute the Herfindahl-Hirschman Index (HHI) for our sample in each state. Since the number of outlets opened by each chain in any state is generally unavailable, we calculate an approximate distribution of outlets for each chain across different states based on the population percentage of each state over the whole country. Hence, we obtain a state-level distribution of HHIs for 15 sub-industries⁵ in our sample by measuring the market share of each chain in each state as the ratio of the number of outlets opened by any chain to the total number of outlets opened by all chains competing in the same sub-industry. According to the classification of HHI proposed by the Department of Justice in its revised Horizontal Merger Guidelines 2010, we mapped all markets from the highly competitive markets (in the darkest green) to the highly concentrated ones (in the darkest red) for the 15 sub-industries in Figure 1. We find that spatial competition in franchising is intensive. As shown in Figure 1 and Table 1, within these 15 sub-industries, only 4 sub-industries are highly concentrated (if more than 50% of the sub-industry's national markets have an HHI over 2500), 6 sub-industries are highly competitive (if about 50% of the sub-industry's national markets have an HHI below 1500), and 5 sub-industries are moderately concentrated (if about 50% of the sub-industry's national markets have an HHI between 1500 and 2500). In particular, the Automotive Product & Service sub-industry ranks at the top of highly competitive markets, with about 92% of its nationwide markets having a HHI below 1500. The Building & Remodeling/Furniture/Appliance Repair sub-industry also shows a high degree of competitiveness, with 62% of its nationwide markets featuring extremely high competitiveness (i.e., $HHI < 1000$). On the contrary, the Packaging & Mailing sub-industry is the most highly concentrated market, with 100% of its national markets characterized by an HHI above 2500. However, market concentration is much lower in other sub-industries. The sec-

⁵ Actually, our sample contains 43 sectors in total according to Bond. We grouped those sectors offering common types of goods or services together, resulting in 15 sub-industries.

and most highly concentrated market is the Business sub-industry, but only 62% of its national markets have an HHI above 2500.

Table 1. HHI of 15 Sub-industries in Franchising

HHI	APS	FOO	E&P	BFA	RET	CEP	HOU	SPG	HFB	REP	P&M	BUS	MIS	RES	LOD
HCM (II)	56%	40%	40%	62%	2%	28%	-	-	-	-	-	-	-	-	-
HCM (I)	36%	48%	40%	12%	54%	20%	40%	16%	6%	2%	-	-	-	-	-
HCM	92%	88%	80%	74%	56%	48%	40%	16%	6%	2%	-	-	-	-	-
MCN (II)	4%	10%	8%	4%	22%	8%	26%	42%	48%	6%	-	4%	4%	2%	8%
MCN (I)	4%	2%	12%	8%	16%	14%	16%	24%	34%	30%	-	30%	44%	68%	86%
MCN	8%	12%	20%	12%	38%	22%	42%	66%	82%	36%	-	34%	48%	70%	94%
HCN (II)	-	-	-	14%	6%	16%	18%	12%	12%	34%	28%	64%	52%	30%	6%
HCN (I)	-	-	-	-	-	14%	-	6%	-	22%	72%	2%	-	-	-
HCN	-	-	-	14%	6%	30%	18%	18%	12%	56%	100%	66%	52%	30%	6%

Explanatory Notes

HCM (II)	Highly Competitive Type II with HHI <1000
HCM (I)	Highly Competitive Type I with $1000 \leq \text{HHI} < 1500$
MCN (II)	Moderately Concentrated Type II with $1500 \leq \text{HHI} < 1800$
MCN (I)	Moderately Concentrated Type I with $1800 \leq \text{HHI} < 2500$
HCN (II)	Highly Concentrated Type II with $2500 \leq \text{HHI} < 5000$
HCN (I)	Highly Concentrate Type I with $\text{HHI} \geq 5000$

APS	Automotive Products & Services	Comprises 2 sectors—Automotive Products & Services, and Auto/Truck/Trailer Rental
FOO	Food	Comprises 6 sectors—Coffee, Donuts/Cookies/Bagels, Cream/Yogurt, Quick Service/Take-outs, Restaurant/Family-Style, and Specialty Food
E&P	Education & Personnel	Comprises 2 sectors—Education/Personal Development/Training, and Employm

ent & Personnel

BFA	Building & Remodeling /Furniture/Appliance Repair	Comprises 1 sector
RET	Retail	Comprises 11 sectors—Art/Art Supplies & Framing, Clothing/Shoes/Accessories, Convenience Stores/Supermarkets/Drugs, Athletic Wear/Sporting Goods, Home Furnishings, Home Improvement & Hardware, Pet Products & Services, Photographic Products & Services, Specialty, Video/Audio/Electronic, and Miscellaneous
CEP	Child Development/Education/Products	Comprises 1 sector
HOU	Housekeeping Services	Comprises 4 sectors—Laundry & Dry Cleaning, Lawn & Garden, Maid Service & Home Cleaning, and Maintenance/Cleaning/Sanitation
SPG	Signs/Print/Graphics	Comprises 2 sectors—Print/Graphics, and Signs
HFB	Health/Fitness/Beauty	Comprises 3 sectors—Hairstyling Salons, Health/Fitness/Beauty, and Medical/Optical/Dental Products & Services
REP	Recreation/Entertainment/Publications	Comprises 2 sectors—Recreation/Entertainment and Publications
P&M	Packaging & Mailing	Comprises 1 sector
BUS	Business	Comprises 3 sectors—Financial Services, Advertising & Promotion, and Internet/Telecommunications/Miscellaneous.
MIS	Miscellaneous	Comprises 1 sector
RES	Real Estate Service	Comprises 3 sectors—Real Estate Inspection Service, Real Estate Services, and Rental Services
LOD	Lodging	Comprises 1 sector

Figure 1. Heterogeneity in spatial competition across sectors

In addition, our sample also indicates that spatial competition among franchise chains is highly heterogeneous across sectors. For instance, in the Automotive Products & Services sub-

industry, about 92% of its national markets are highly competitive; while in the Packaging & Mailing sub-industry, all its national markets are highly concentrated. Moreover, in the Child Development/Education/Products sub-industry, all three degrees of market concentration are common—28% of its national markets are highly competitive, 22% are moderately concentrated, and 30% are highly concentrated. However, 92% of the national markets for the Automotive Products/Services sub-industry are highly competitive, 94% of the national markets for the Lodging sub-industry are moderately concentrated, and 100% of the national markets for the Packing & Mailing sub-industry are highly concentrated.

5.2. Dependent Variables

There are two primary dependent variables in our model: the proportion of franchised outlets (PFO) and the inverse royalty rate (IRR).⁶ The sample overview of PFO is outlined in Figures 2–3 and Table 2. Although, as a whole, our sample accounts for about one-third of the full data set in Bond (33.74% by the number of franchisors and 31.34% by the size of total operating outlets), it retains the structure of the full data set quite well. For example, the PFO in our sample is 91.1% on average, deviating by only 0.0323 from that in Bond.

Table 2. A Sample Overview of PFO

Sample Characteristics	Total # of Franchisors	Units		
		Franchised Units/ PFO ^a	Company-owned Units/ PCO ^b	Total Units
Total in Our Sample	353	124,898	12,198	137,096
% of Total	-	91.10%	8.90%	100.00%
Total in Bond's Franchise Guide	993	386,041	51,397	437,438
% of Total	-	88.25%	11.75%	100.00%
Accountability of Our Sample	33.74%	32.35%	23.73%	31.34%
Deviation		0.0323		

^a The proportion of franchised outlets.

^b The proportion of company-owned outlets.

Source: The 2006 edition of Bond's Franchise Guide.

Some sectors have a strong propensity to franchise (a high PFO), especially those with a small operating scale, such as advertising and promotion, printing and graphics, clothing/shoes/accessories, and pet products and services. Some sectors have a weak propensity to franchise (a low PFO), especially those with a large operating scale, such as lodging, or with a high level of specialization, such as convenience stores/super markets/drugs, or with a high professional standard, such as medical/optical/dental products and services and rental services.

⁶ The inverse royalty rate is defined as one minus the royalty rate, which is the rate of revenue that a franchisee is allowed to keep after paying the royalty rate to the franchisor.

Figure 2. A Sample Overview of PFO: Sector Distribution

Also, as shown in Figure 3, the size distribution of franchise chains in our sample is consistent with that in Bond, whether in terms of absolute number or relative percentage. The franchise industry is highly concentrated in the sense that the market is dominated by a few big franchise chains and many medium-sized franchise chains. A few big franchisors (5.6% in number) with more than 1,000 outlets account for nearly 60% of all outlets in the industry (the market share), while those franchise chains (80% in number) with less than 1,000 but more than 25 outlets account for about 39.5% of the market share, leaving less than 0.5% of the market share to the remaining 14.16% franchise chains.

Figure 3. A Sample Overview of PFO: Size Distribution

Figure 4 and Table 3 present a sample overview of IRR. We can see from both of them that the sector distribution of IRR in our sample is quite similar to and even smoother than that in Bond, with a similar mean but a smaller standard deviation.

Table 3. A Sample Overview of IRR^c

Category	Our Sample		Bond's Franchise Guide	
	Sector	Value	Sector	Value
Maximum	Home Improvement & Hardware	97.5%	Athletic Wear/Sporting goods	96.5%
	Athletic Wear/Sporting goods	96.7%	Photographic P&S	96.3%
	Retail: Miscellaneous	96.2%	Rental Services	96.3%
			Advertising & Promotion	96.3%
Minimum	Internet/Telecomm./Misc.	89.9%	Internet/Telecomm./Misc.	79.8%
	Financial Services	90.0%	Child Develop./Edu./Products	83.7%
	Edu./Personal Develop./Training	91.0%	Employment & Personnel	90.0%
Mean	94.3%		93.8%	
Std. Dev.	0.016		0.03	

^c The Inverse Royalty Rate.

Source: The 2006 edition of Bond's Franchise Guide.

Moreover, our sample shows a slight tendency towards those observations near the upper bound. However, since a high inverse royalty rate is very common, we argue that this tiny deviation is acceptable.

Figure 4. A Sample Overview of IRR

A low inverse royalty rate is often adopted by sectors in which technology plays a crucial role. In such sectors, the franchisees are highly dependent on the on-going support from their franchisors. Examples of such sectors include the internet and telecommunications, financial services, and education/personnel development/training sectors. In contrast, the low-technology sectors or those with a low technology dependence tend to have a high inverse royalty rate.

5.3. Independent Variables

In line with the literature, we use the following 16 variables as regressors in our regression model.

ADR (the advertising rate) is the on-going advertising rate offered by the franchisor, representing the franchisor's effort. The higher the ADR is, the more costly it will be to expand the chain. Hence, a high ADR is usually observed in a mature chain.

BE (business experience) is the number of years since the firm was established. This reflects the maturity of the firm and is positively related to the brand value.

EP (expansion plan) is a dummy indicating whether or not the franchisor is currently seeking additional franchisees outside the U.S. If the chain plans to expand overseas, this variable takes a value of 1; otherwise, it takes a value of 0.

OS (on-going support) measures on-site support from the franchisor, including central data processing, central purchasing, field operations evaluation, field training, initial store opening, inventory control, franchisee newsletter, regional or national meetings, and a toll-free 800 telephone hotline. This variable takes a value of 0 initially. We examine each of the services one by one and adjust the variable. If the franchisor provides the service at no additional cost to the franchisee, we add a value of 2 to the variable; if the service is provided at an additional cost, we add a value of 1 to it; if the service is not provided, we add no value to it. This process is repeated until all the services have been examined. Hence, a greater value of OS implies that franchisees enjoy greater support from their franchisor, either through a wider variety of assistance activities, or at a lower cost to the franchisees.

PGR (projected growth rate) is the projected growth rate in terms of the number of outlets. It measures the franchise chain's growth potential. The lower the PGR is, the poorer the chain's current growth potential. It is usually the young and immature chains or those with poor brand value due to a lack of capital and competent franchisees that have a low PGR.

TII (total initial investment) is the amount of capital required to start a franchised outlet, including both cash and non-cash investments. This variable represents a financial constraint on a franchisee — an entry barrier. TII often rises with the brand value.

TL (training length) is the average number of training days provided by the franchisor to a franchisee at a new outlet. The length of the training period also reflects the height of the entry barrier as well as the brand value.

CA (co-operative advertising) is a dummy indicating the existence of a joint advertising program in which both the franchisor and franchisees contribute to promote the company's products. It takes a value of 1 if there is a joint advertising program; and 0 otherwise. CA helps to lower the entry barrier faced by fresh franchisees.

DC (distribution centralization) is the standard deviation of the proportion of outlets in the three biggest regions. It represents the possible marginal production cost. The more centrally distributed the outlets of a franchise chain are, the lower the cost of running the chain because of reduced transportation costs for distributing products or providing on-going services and assistance from the headquarters.

FA (financial assistance) is a dummy that has a value of 1 if the franchisor provides any form of financial assistance, such as sharing its financial contacts, providing templates for preparing a business plan, assisting in the loan application process, or making a lease or loan directly. Otherwise, the dummy has a value of 0. FA also reduces the entry cost of a new franchisee.

IA (initial assistance) is a dummy that has a value of 1 if some pre-operating assistance is provided by the franchisor to a franchisee, including providing an earning claims statement, site selection assistance and lease negotiations assistance. Otherwise, the dummy takes a value

of 0. Such pre-operating assistance is more often available in a mature chain with a valuable brand.

NW (net worth) is the minimum level of equity that a franchisee needs to possess in order to start a franchised outlet. It is also a proxy for entry barriers.

PD (physical dispersion) is the number of states in the U.S. where the franchise chain has outlets. It may imply a degree of supply elasticity. The more states the chain has outlets in, the more dispersed is the market it faces. This diversification of markets may imply lower supply elasticity.

RTFQ (required threshold on a franchisee's qualification) is the sum of values from six evaluation criteria: financial net worth, general business experience, specific industry experience, formal education, psychological profile and personal interviews⁷. All criteria are assigned a value from 5 to 1 with a high number representing high importance to the franchisor, where importance is obtained from questionnaires. In this case, these criteria are regarded as nonexclusive requirements for a qualified franchisee. The larger the RTFQ is, the more unique and technically savvy the franchisees are expected to be, indicating an increasing difficulty and complexity in successfully operating the local outlet.

SCS (size of corporate staff) is the number of full-time supporting staff members in a franchise chain, which usually rises as the chain becomes more mature.

UPDS (union power of the downstream side) is the sum of four proxies: the existence of an area development agreement, a sub-franchising agreement, a territory expansion agreement, and a franchisee association. The larger UPDS is, the more benefits franchisees are entitled to, indicating a stronger bargaining power of franchisees.

The variables used in the estimation of PFO are ADR, BE, EP, OS, PGR, TII, TL, CA, DC, FA, PD, and SCS; and those used in the estimation of IRR are ADR, BE, EP, OS, PGR, TII, TL, IA, NW, RTFQ, and UPDS. Notice that there are 16 control variables in our model, five of which only appear in equation 1 (the PFO equation) as they are key factors of chain expansion, while four only appear in equation 2 (the IRR equation) as they represent major incentives for franchisees. Therefore, our model satisfies the identification condition.

Notice that, our model contains a number of qualitative independent variables (EP, OS, CA, FA, IA, RTFQ, and UPDS). Traditionally, all qualitative independent variables should be measured using dummies, just like what we have done for EP, CA, FA and IA. However, OS, RTFQ and UPDS are category variables containing at least four categories each, which makes it difficult to treat them as dummies using a traditional approach, because that will create too many dummies, leading to a severe loss in the degree of freedom. Hence, by assuming that the

⁷ According to Bond's Franchise Guide, the six criteria have equal weights.

components in any of these three variables are equally important, we view OS, RTFQ and UPDS as counting variables instead, and so they can be interpreted as just as meaningful as other continuously-measured quantitative variables. In fact, it is also mentioned in Bond's Franchise Guide that all components of OS, RTFQ and UPDS are randomly specified without a strong preference for any particular one, so they can be used quantitatively without concern. Moreover, treating OS, RTFQ and UPDS as continuous counting variables helps to preserve our measurement for the degree of importance to the franchisor, which can hardly be explained using dummies⁸.

A summary description of the dependent variables, including their spatial lags, and of the independent variables is given in Table 4.

Table 4. Descriptive Statistics for the Dependent and Independent Variables

Variable	Description	Mean	Max.	Min.	Std. Dev.
PFO	Proportion of Franchised Outlets	84.58%	100.00%	0.00%	0.23
IRR	Inverse Royalty Rate	94.57%	100.00%	65.00%	0.03
WPFO	Spatial Lag of PFO	85.12%	100.00%	0.00%	0.19
WIRR	Spatial Lag of IRR	91.84%	100.00%	0.00%	0.16
ADR	Advertising Rate	2.06%	10.00%	0.00%	0.02
BE	Business Experience	28.22	106.00	4.00	17.17
EP	Expansion Plans	1.92	3.00	0.00	0.88
OS	On-going Support	15.34	21.00	4.00	3.39
PGR	Projected Growth Rate	28.25%	250.00%	0.36%	0.34
TII	Total Initial Investment	365.27	4500.00	12.65	564.28
TL	Training Length	26.96	421.00	0.50	30.30
CA	Co-operative Advertising	0.69	1.00	0.00	0.46
DC	Distribution Centralization	0.20	0.71	0.00	0.16
FA	Financial Assistance	0.68	1.00	0.00	0.47
IA	Initial Assistance	1.90	3.00	0.00	0.88
NW	Net Worth	162.65	4588.24	0.00	307.41
PD	Physical Dispersion	20.73	50.00	1.00	15.08
RTFQ	Required Threshold for the Franchisee's Qualification	20.26	30.00	0.00	4.47
SCS	Size of Corporate Staff	103.31	7000.00	1.00	505.85
UPDS	Union Power of Downstream Side	2.15	4.00	0.00	0.94

6. Specification of Competition in the Spatial Weights Matrix

At present, most empirical studies simply relate the degree of spatial competition to distance. The "closer" two spatial units are, the more severe the competition between them. However, this idea does not fully capture the essence of spatial competition. In fact, spatial

⁸ To avoid significant bias resulting from the assumptions on these three variables, we have conducted robustness estimations based on the traditional approach to classify OS, RTFQ and UPDS as dummies. The estimations verify that our major results are insensitive to measurement choices. These results are available upon request.

competition arises and intensifies as more markets overlap. As illustrated in Figure 5, the customer in the area where the two spatial circles of units i and r overlap faces location shocks, d_i^c and d_r^c , from the two units i and r , where a spatial unit represents a franchise chain or more precisely a chain's business network. Symmetric location shocks, d_i^f and d_r^f , from units i and r also affect the franchisee in this area. Thus, when unit i opens business in a market, its business network will keep on expanding until it encounters similar business networks from other units (unit r in the figure). From then on, unit i 's business network will expand at a lower rate as it and its rivals fight over the same piece of the market. The degree of competition rises as more markets overlap, which usually depends on how "close" these competing units are to one another.

Figure 5. An Illustration of Spatial Competition

Note: L_{j_n} is the location of unit j 's n th franchised outlet ($j=i$ and r).

Spatial competition based on overlapping markets has been discussed in the literature (Degryse & Ongena, 2005; Turnbull & Dombrow, 2006; Numan & Willekens, 2012), but the design of market overlap has not taken much geographic considerations. For instance, Turnbull & Dombrow (2006) use the overlapping trading days of co-listing houses in the same area as a proxy for spatial competition, but the degree to which the co-listing houses share the same markets is measured along the time dimension rather than along the geographic dimension. Regardless of the high conformity between the observed competition pattern and market overlapping, spatial competition based on market overlapping has rarely been considered in franchising. We aim to propose a way of incorporating both economic and geographic considerations into the measure of spatial competition for franchise chains. A state is considered as a market. For a given chain, those states in which the chain has outlets are called the chain's local markets. For each local market of a chain, its neighboring markets are defined as those neighboring states in which other chains have outlets. We define the severity of competition in terms of market density, which is measured by the thickness of geographically overlapping markets. The more two sets of markets overlap in the geographical sense, the "closer" the two chains are considered to be, and so the more competition facing each one.

Following that, we establish our measurement for such a density-based competitive "distance" in four steps described below.

Step 1: Does chain i provide the same or similar goods and services as chain r ?

If chain i provides the same or similar goods and services as chain r , we assume they are contiguous in business and operate in the same sector, and then assign a value of 1 to the spatial weights between these two chains. Otherwise, chains i and r are said to be noncontiguous in business, and then a value of zero is assigned to the spatial weights between them. That is, weights on all competitors in the same sector are assumed to be uniform.

Step 2: If chains i and r provide the same or similar goods and services, do they share the same *local markets*?

When chains i and r have outlets in the same U.S. state, their local markets overlap, implying severe spatial competition in that state. We refer to this as the local market effect and attach a larger weight to it. The more local markets chains i and r share, the greater their overlap, and so the “closer” they are to each other economically speaking, implying more severe spatial competition.

Take the largest chain (i.e., Gymboree Play & Music, measured in terms of both business history and the number of outlets) in the *child development/education/products* sector as an example. This chain had outlets in 39 of 50 U.S. states in 2005, and was facing spatial competition from 11 other chains in the same sector⁹. However, spatial competition between Gymboree Play & Music (GPM) and its competitors varied across local markets. As shown in the left map of Figure 6, the most severe competition was in Texas where all competitors had outlets; while the least severe competition was in South Dakota where no competitor had outlets. The more chains clustered within the same state, the more severe the competition, as indicated by the darker colour on the map. Further, we compare GPM’s spatial competition against one of its smallest rivals (i.e., Kid to Kid) and one of its largest rivals (i.e., Little GYM). It is clear that Little GYM is putting much more competitive pressure on GPM than is Kid to Kid as GPM and Little GYM have twice as many overlapping local markets as GPM and Kid to Kid.

⁹ In fact, there were 34 chains in this sector according to the 2006 edition of Bond’s Franchise Guide, but our sample covers 12 of them only.

Figure 6. GPM's measurement of local market competition: whole sector and peers

Step 3: *If chains i and r provide the same or similar goods and services, do they share the same **neighboring markets**?*

Competing chains may also be located in neighboring markets but not in the same local markets, implying less spatial competition as the chains will confront each other less often or less directly. We refer to this as the neighboring market effect, which is assumed to carry a lower weight than the local market effect. The more neighboring markets chains r and i share, the more competitive pressure they place on each other through neighboring markets.

As can be seen from the left map in Figure 7, among all 39 local markets, GPM faced the strongest spatial competition from neighboring markets in South Carolina but the weakest spatial competition from neighboring markets in Minnesota. In addition, Little GYM put more competitive pressure on GPM in the neighboring markets than Kid to Kid did, judging from both the coverage and extent of overlaps between markets.

Figure 7. Neighboring market competition for GPM: whole sector and peers

Step 4: *If both local and neighboring market effects exist, how does chain i spatially depend on chain r ?*

The spatial weights representing the overall spatial dependence of chain i on chain r “economically” are defined as the sum of the local and neighboring market effects.

Figure 8 exhibits the overall spatial competition that GPM is facing from the whole sector and from two of its peers, Kid to Kid and Little GYM. Although GPM faced the strongest local market competition in Texas and the strongest neighboring market competition in South Carolina, neither state was the one with the toughest competition. In fact, North Carolina was the most competitive market for GPM as both the local and neighboring market effects in this state are salient, while local market competition is weak in South Carolina but neighboring market competition is weak in Texas. In addition, although the local market effect is assumed to dominate the neighboring market effect, the latter better reflects the competition between big chains (GPM and Little GYM). Hence the competitive environment for big chains is more diversified.

Figure 8. Overall spatial competition for GPM: whole sector and peers

All in all, as our specification of the spatial weights matrix reflects both the geographic distance among competitors and the density of competitors, our definition captures spatial competition more accurately and comprehensively. Comparisons between our spatial weights matrix and the economic and geographic features of franchise chains strongly support our arguments. As shown in Figure 9, the spatial dependence of each chain in the *child development/education/products sector* on its competitors as measured by our spatial weights is highly consistent with the economic and geographic importance (especially the latter) of competitors. For instance, chains in this sector depend most heavily on GPM, Little GYM and Mad Science Group spatially; these three chains are also of the greatest economic importance (measured by the number of outlets) as well as the greatest geographic importance (measured by the number of states with outlets). Similar observations can be found in all 43 sectors.

Note: Each block of histograms represents the spatial effect imposed by each chain on all other competitors.

Figure 9. Degree of spatial interdependence vs. economic and geographic importance for the child development/education/products sector

7. Results

The estimation results from equation system (3), or more specifically equation system (6), using three estimation methods are reported in Table 5. For example, the estimated equation system using the GMM_GS2SLS method is

$$\begin{aligned} \text{PFO equation: } PFO &= 1.6681 \times IRR + 0.4371 \times WPFO - 0.4416 \times WIRR + \dots; \\ &\quad (\gamma_1) \quad (\lambda_{11}) \quad (\lambda_{12}) \\ \text{IRR equation: } IRR &= 0.0617 \times PFO + 0.0500 \times WIRR - 0.0450 \times WPFO + \dots. \end{aligned} \quad (7)$$

Table 5. Estimation Results for Spatial Competition

	GS2SLS		GS3SLS		GMM_GS2SLS	
	PFO	IRR	PFO	IRR	PFO	IRR
Obs.	353	353	353	353	353	353
C	-0.3108 (0.5738)	0.8969*** (0.0208)	-1.6786*** (0.5071)	0.8684*** (0.0196)	-0.7317 (0.4684)	0.8802*** (0.0101)
PFO		0.0454** (0.0185)		0.0748*** (0.0173)		0.0617*** (0.0086)
IRR	1.0962* (0.6304)		2.6276*** (0.5564)		1.6681*** (0.5162)	
WPFO	0.6023*** (0.0831)	-0.0561*** (0.0194)	0.6626*** (0.0807)	-0.0708*** (0.0187)	0.4371*** (0.0803)	-0.0450*** (0.0092)
WIRR	-0.5117*** (0.1089)	0.0587*** (0.0205)	-0.5851*** (0.1059)	0.0708*** (0.0200)	-0.4416*** (0.1083)	0.0500*** (0.0097)
ADR	-1.0527* (0.0570)	-0.0506 (0.0948)	-0.8727 (0.5499)	-0.0191 (0.0923)	-1.0565** (0.5039)	-0.0168 (0.0636)
BE	-0.0011* (0.0007)	0.0003** (0.0001)	-0.0016** (0.0006)	0.0003*** (0.0001)	-0.0021*** (0.0004)	0.0003*** (0.0001)
EP	0.0552*** (0.0209)	-0.0034 (0.0034)	0.0578*** (0.0202)	-0.0054*** (0.0033)	0.0307*** (0.0075)	-0.0039*** (0.0011)
OS	0.0032 (0.0030)	-0.0003 (0.0006)	0.0022 (0.0029)	-0.0003 (0.0005)	0.0030 (0.0021)	-0.0002 (0.0003)
PGR	-0.1606*** (0.0341)	0.0133** (0.0060)	-0.1743*** (0.0330)	0.0190*** (0.0058)	-0.2045*** (0.0343)	0.0178*** (0.0037)
TII	-0.0001*** (1.82E-05)	6.49E-06* (3.63E-06)	-0.0001*** (1.78E-05)	7.97E-06** (3.52E-06)	-0.0001*** (2.39E-05)	7.55E-06*** (1.96E-06)
TL	-0.0009*** (0.0004)	0.0001* (0.0001)	-0.0011*** (0.0003)	0.0001** (0.0001)	-0.0012*** (0.0004)	0.0001** (3.89E-05)
CA	0.0414* (0.0231)		0.0332* (0.0201)		0.0245 (0.0156)	
DC	0.2135*** (0.0728)		0.1790*** (0.0639)		0.2297*** (0.0590)	
FA	0.0509** (0.0216)		0.0415** (0.0190)		0.0436*** (0.0155)	
IA		0.0043** (0.0021)		0.0031* (0.0018)		0.0037*** (0.0013)
NW		5.31E-06 (5.16E-06)		3.99E-06 (4.51E-06)		3.03E-06 (2.56E-06)
PD	0.0027*** (0.0008)		0.0021*** (0.0008)		0.0024*** (0.0006)	
RTFQ		-0.0008**		-0.0006*		-0.0006***

		(0.0004)		(0.0003)		(0.0002)
SCS	-0.0001***		-0.0001***		-0.0001***	
	(2.15E-05)		(1.91E-05)		(1.15E-05)	
UPDS		0.0007		0.0003		0.0014
		(0.0018)		(0.0015)		(0.0011)
ρ	-0.5785***	0.0364***	-0.5785***	0.0364***	-0.5785***	0.0364***
	(0.0314)	(0.0002)	(0.0314)	(0.0002)	(0.0314)	(0.0002)
Moran's I	-0.0297	0.0613*	-0.0297	0.0613*	-0.0297	0.0613*
	(0.0402)	(0.0325)	(0.0402)	(0.0325)	(0.0402)	(0.0325)
R^2	0.5191	0.0320	0.4551	0.0887	0.4941	0.1038

*** Significance at 1% level; ** Significance at 5% level; * Significance at 10% level.

Note: Standard errors are in parentheses.

7.1. Spatial Competition

In line with **Hypothesis 1** and the results of Global Moran's I test, all the estimates of the spatial dependent variables (WPFO and WIRR) show significant spatial effects in our model, especially in the disturbances of PFO. That is, every franchise chain, regardless of its sector and type, reacts strongly to its neighboring chains in each decision.

Second, our results show the significant spatial competition, as predicted by **Hypothesis 2**. On the one hand, both PFO and IRR depend positively on their own spatial lags, WPFO and WIRR, respectively, which supports our conjecture on the existence of a *market share effect* in **Hypothesis 2.1**. Explanations for this result are as follows. Take the PFO equation in (7) as an example. The first explanation is based on the resource-flow effect. If neighboring chains expand by opening more franchised outlets, competition intensifies. To avoid losing customers to neighboring chains and to prevent its market share from eroding, a franchise chain should respond with the same strategy: expand by setting up more franchised outlets of its own. Another explanation for such an industry-wide same-directional move is the information spillover effect. An expanding strategy by others can be viewed as a signal of an improvement in the business environment. If so, a similar action is likely to be profitable. Driven by both the resource-flow and information spillover effects, a change in the organizational structure of one chain may cause an industry-wide same-directional change in the organizational structures of all other chains. Similar conclusions can be drawn based on the IRR equation.

On the other hand, as predicted by **Hypothesis 2.2**, we also find a *market power effect* in the competition among franchise chains. Both PFO and IRR respond negatively to each other's spatial lags, WIRR and WPFO. That is, if one franchisor tries to expand its market share using an expansionary contractual approach, other franchisors will avoid head-on competition using a contractionary organizational approach, and vice versa. As indicated by the negative coefficients -0.4416 and -0.0450 in (7) for example, if one franchisor offers a lower royalty rate (that is, a higher WIRR for franchisees), other franchisors will avoid head-on competition by opening fewer franchised outlets (that is, a lower PFO). Conversely, if one

franchisor is expanding with more franchised outlets, other franchisors will be forced to downsize to prevent their market power from being exhausted in head-on competition. The royalty rate is increased (IRR declines) for those other franchisors not only to compensate for their loss of market share, but also to avoid head-on competition in order to gather more resources to create new market power. However, we find that this market power effect is much weaker than the market share effect, as suggested by most existing studies (e.g., Borenstein & Netz, 1999).

Also, we find that spatial competition for customers is more fierce than that for franchisees (i.e., $\lambda_{11} > \lambda_{21}$). As customers are more mobile and less informed about the chain than franchisees, they are usually more sensitive to observable variables, such as price and location. As a result, in a competition for customers, a franchisor has to react with a tough tit-for-tat strategy. Contrarily, franchisees are usually attracted by unobservable terms, such as control rights, culture, and career potential. Therefore, a franchisor can adopt a unique competitive strategy for franchisees, instead of imitating its competitors' actions.

7.2. Local vs. Neighboring Market Competition

Table 6 outlines the results using the local and neighboring market spatial weights matrices in Panels A and B. The results are consistent with those in Subsection 7.1, implying that the empirical evidence for spatial competition is robust.

In addition, after comparing those spatial coefficients in Panels A and B of Table 6, we find significant support for **Hypothesis 3**. A franchise chain's response to its competitors in the local markets is stronger than that in the neighboring markets (i.e., each $|\lambda_{ij}|$ in Panel A is greater than the corresponding $|\lambda_{ij}|$ in Panel B). This finding provides further evidence for the presence of spatial competition. If a franchise chain indeed reacts to her competitors spatially, then the "closer" they are, the stronger the competitive response will be between them. Since competitors in local markets are "closer" than those in neighboring markets, the local market effect is expected to be stronger than the neighboring market effect.

Besides, the above difference between local and neighboring markets is more salient in the competition for customers (shown in the PFO equation) than in the competition for franchisees (shown in the IRR equation). As analyzed above, customers are mobile and hence more sensitive to the convenience of location, which makes spatial competition through an expansion of franchised outlets in neighboring markets much weaker than that in local markets. However, this location effect has little impact on the competition for franchisees. Different from customers who have to visit outlets for goods or services, franchisees do not need to move to the state where the franchisor is registered to obtain a contract for opening a fran-

chise outlet. Thus, from a franchisee's viewpoint, it does not matter much whether a favorable royalty rate is offered by chains in local markets or in neighboring markets.

Table 6. Local Market Competition vs. Neighboring Market Competition^a

Panel A: Local Market Competition ($w_{ir} = w_{ir}^l$)						
	GS2SLS		GS3SLS		GMM_GS2SLS	
	PFO	IRR	PFO	IRR	PFO	IRR
Obs.	353	353	353	353	353	353
PFO		0.0438** (0.0183)		0.0727*** (0.0172)		0.0636*** (0.0093)
IRR	0.9648 (0.6017)		2.3048*** (0.5261)		1.7295*** (0.4938)	
WPFO	0.6306*** (0.0800)	-0.0563*** (0.0196)	0.6858*** (0.0757)	-0.0716*** (0.0190)	0.4533*** (0.0759)	-0.0445*** (0.0093)
WIRR	-0.5356*** (0.1073)	0.0590*** (0.0207)	-0.6016*** (0.1019)	0.0717*** (0.0202)	-0.4535*** (0.1058)	0.0488*** (0.0098)
...	...	...	...	...	...	...
Moran's I	-0.0311 (0.0405)	0.0627* (0.0332)	-0.0311 (0.0405)	0.0627* (0.0332)	-0.0311 (0.0405)	0.0627* (0.0332)
R^2	0.5860	0.0222	0.5346	0.1033	0.5646	0.1130
Panel B: Neighboring Market Competition ($w_{ir} = w_{ir}^n$)						
	GS2SLS		GS3SLS		GMM_GS2SLS	
	PFO	IRR	PFO	IRR	PFO	IRR
Obs.	353	353	353	353	353	353
PFO		0.0456** (0.0187)		0.0747*** (0.0174)		0.0508*** (0.0086)
IRR	1.2956* (0.7512)		3.2500*** (0.6643)		1.9618*** (0.5431)	
WPFO	0.5405*** (0.0941)	-0.0560*** (0.0190)	0.6140*** (0.0928)	-0.0685*** (0.0184)	0.3827*** (0.0917)	-0.0395*** (0.0090)
WIRR	-0.4543*** (0.1176)	0.0588*** (0.0203)	-0.5455*** (0.1157)	0.0688*** (0.0198)	-0.3878*** (0.1176)	0.0475*** (0.0096)
...	...	...	...	...	...	...
Moran's I	-0.0284 (0.0404)	0.0602* (0.0324)	-0.0284 (0.0404)	0.0602* (0.0324)	-0.0284 (0.0404)	0.0602* (0.0324)
R^2	0.4078	0.0395	0.3155	0.0817	0.3598	0.0526

*** Significance at 1% level; ** Significance at 5% level; * Significance at 10% level.

^a The full set of results is available upon request.

7.3. Interdependence and Stable Equilibrium

Table 5 shows that the coefficients of the endogenous variables (PFO and IRR) are positive and statistically significant, indicating interdependence between the franchise proportion and the royalty rate. Consistent with **Hypothesis 4**, we call this positive relationship the strategic complementary interdependence. It makes sense that PFO and IRR should interact as strategic complements. On the one hand, an expansion of franchised outlets allows a franchisor to maintain profitability at a lower royalty rate. On the other hand, a lower royalty rate induces an expansion of franchised outlets, which brings promising business opportunities to

local outlets through a growing customer network. It turns out that the influence of PFO on royalties is small relative to the influence of royalties on PFO.

Further, as shown in (7), the product of the strategic complementarity between PFO and IRR is smaller than 1 (i.e., $\gamma_1\gamma_2 = 0.0617 \times 1.6681 = 0.1029 < 1$), implying a stable equilibrium in PFO and IRR, as predicted by **Hypothesis 5**. A high PFO only provides a marginal stimulus to royalties as described by the PFO equation. Thus, without strong support from favorable royalties, a high PFO reduces gradually as suggested by the IRR equation, which further weakens its impact on royalties. Such a process continues until the PFO shrinks to an appropriate level that can be matched by just the right amount of royalty incentives in the long-run equilibrium. Thus, as illustrated in Figure 10, the system we estimate can self-adjust along a converging path back to its equilibrium after a deviation, which may explain the observed phenomenon in practice of the long-run stability and uniformity of both the organizational structure and contractual terms in franchise chains.

Figure 10. A Stable Long-Run Equilibrium

Finally, the above interdependence and stable equilibrium are both reconfirmed in local and neighboring markets separately. In addition, our results show that interactions between PFO and IRR in local markets are weaker than those in neighboring markets (i.e., γ_1 and γ_2 in Panel A are smaller than those in Panel B). One explanation is that facing stronger spatial competition from contiguous chains, a franchise chain will find it more difficult to recruit competent franchisees and to expand its customer networks in local markets, which reduces its incentive to invest both resources in local markets.

7.4. Robustness Tests

In order to ensure our results are not sensitive to the assumptions made in defining spatial units (in Section 2) and the qualitative independent variables (in Section 5.2), we conduct two robustness tests.

First, we define adjacency between two spatial units based separately on their economic relations and geographic borders rather than the latter only. That is, two states will be treated as “adjacent” in the economic sense if they belong to the same economically functional region. Two regional classifications have been proposed by the U.S. Bureau of Economic Analysis (BEA) and Crone (1999) for this purpose. The former classification introduced in 1950s groups the 48 mainland U.S. states into 8 regions based primarily on cross-sectional similarities in their socioeconomic characteristics (see Appendix IV); while the latter approach groups the states into 6 regions based on similarities in their business cycles (Crone, 1999) (See Appendix IV). As shown in Table 7, our main results above are strongly supported using these two approaches, indicating that our estimations are robust to a change in the definition of spatial units. This result suggests that interdependence among franchise chains can be explained by both geographic and economic relationships.

Table 7. Robustness Tests for Measuring “Adjacency”^a

Panel A: Based on Geographic Border						
	GS2SLS		GS3SLS		GMM_GS2SLS	
	PFO	IRR	PFO	IRR	PFO	IRR
PFO		0.0454** (0.0185)		0.0748*** (0.0173)		0.0617*** (0.0086)
IRR	1.0962* (0.6304)		2.6276*** (0.5564)		1.6681*** (0.5162)	
WPFO	0.6023*** (0.0831)	-0.0561*** (0.0194)	0.6626*** (0.0807)	-0.0708*** (0.0187)	0.4371*** (0.0803)	-0.0450*** (0.0092)
WIRR	-0.5117*** (0.1089)	0.0587*** (0.0205)	-0.5851*** (0.1059)	0.0708*** (0.0200)	-0.4416*** (0.1083)	0.0500*** (0.0097)
Panel B: Based on Economic Similarities—BEA Classification						
	GS2SLS		GS3SLS		GMM_GS2SLS	
	PFO	IRR	PFO	IRR	PFO	IRR
PFO		0.0450** (0.0184)		0.0744*** (0.0172)		0.0618*** (0.0084)
IRR	1.0597* (0.6368)		2.5779*** (0.5635)		1.5976*** (0.5346)	
WPFO	0.6023*** (0.0839)	-0.0557*** (0.0195)	0.6620*** (0.0814)	-0.0709*** (0.0189)	0.4435*** (0.0785)	-0.0461*** (0.0092)
WIRR	-0.5114*** (0.1092)	0.0583*** (0.0206)	-0.5841*** (0.1061)	0.0708*** (0.0201)	-0.4405*** (0.1071)	0.0506*** (0.0098)
Panel C: Based on Economic Similarities—Crone (1999) Classification						
	GS2SLS		GS3SLS		GMM_GS2SLS	
	PFO	IRR	PFO	IRR	PFO	IRR
PFO		0.0461** (0.0183)		0.0764*** (0.0170)		0.0636*** (0.0081)
IRR	1.1294* (0.6670)		2.7987*** (0.5875)		1.7145*** (0.5331)	
WPFO	0.5803*** (0.0868)	-0.0565*** (0.0193)	0.6470*** (0.0844)	-0.0714*** (0.0187)	0.4372*** (0.0785)	-0.0459*** (0.0089)
WIRR	-0.4913*** (0.1114)	0.0586*** (0.0205)	-0.5713*** (0.1085)	0.0707*** (0.0200)	-0.4508*** (0.1066)	0.0510*** (0.0096)

*** Significance at 1% level; ** Significance at 5% level; * Significance at 10% level.

^a The full set of results is available upon request.

Second, we use dummies to measure three qualitative independent variables, OS, RTFQ and UPDS. Since each variable comprises numerous components (9 in OS, 6 in RTFQ, and 4 in UPDS), to avoid introducing too many dummies into regression, we assign a value of 1 to one component and a value of 0 to all remaining components in each of these three variables each time, which leads to 216 different combinations of three dummies for these variables. Take one combination of RTFQ, OS and UPDS representing financial net worth, central data processing and area development agreement as an example. A value of 1 assigned to each variable indicates that: (1) financial net worth is viewed as an important criterion for qualifying someone as a franchisee; (2) the franchisor provides central data processing assistance to its franchisees; and (3) the union power on the downstream side is strengthened through an area development agreement. Then we run our model 216 times for each of these 216 combinations, by which we actually regard components of each variable as exclusive. The estimated coefficients for endogenous variables and spatial lags as well as their significance levels in both equations are plotted in Figure 11. The results are highly consistent with what we have obtained previously with significant stability, confirming that our previous results are free of estimation bias from arbitrarily selecting measurements for qualitative independent variables.

Note: The numbers at the top are estimated coefficients; the numbers at the bottom are t-values.

Figure 11. Estimation Results for 216 Different Combinations of RTFQ, OS and UPDS

8. Discussions

Our results in Section 7 have rich theoretical and empirical implications. Firstly, the effects of an increase (say, 1%) in the income-sharing ratio for franchisees in neighboring chains (WIRR) will be felt by the franchise chain in the local market (in the center) through three channels: (1) the franchise proportion in neighboring chains (WPFO) will increase (by 1.6681%) due to the strategic complementary effect, which will in turn lead to an increase in the franchise proportion (PFO) for this franchise chain (by $0.4371 \times 1.6681\% = 0.7291\%$) due to the market share effect; (2) driven by a symmetric market share effect, the income-sharing ratio for franchisees in this franchise chain (IRR) will also increase (by 0.0500%), thus leading to a further increase (by $1.6681 \times 0.0500\% = 0.0834\%$) in the PFO of this franchise chain due to the strategic complementary effect; (3) in contrast to the previous two channels, the market power effect will cause the PFO of this franchise chain to decrease (by 0.4416%) directly in response to the increase in WIIR. As the last channel has a smaller effect than the total effect of channels (1) and (2), it only alleviates, rather than reverses, the increase in PFO as a response to the increase in WIIR, but its impact is still noticeable. For instance, the increase in PFO due to a 1% increase in WIIR shrinks by a half from 0.8125% to 0.3709% due to the market power effect. Our finding of the latter type of effect in spatial competition provides a strong empirical explanation for the observed puzzle of the co-existence of severe competition and diversification of chains of different sizes, in an industry (such as franchising) featuring high homogeneity in products/services and a wide variety of operating scales. As the market power effect reduces the incentives of franchise chains to engage in head-on competition, it gives small- and medium-sized chains room to survive and possibly thrive.

Secondly, our finding that PFO and IRR are strategic complements contradicts the property rights view, but is consistent with agency costs theory. According to the property rights view, when a franchisor offers a lower royalty rate to its franchisees so as to provide incentives for local investment, it will simultaneously increase its corporate control by having a higher proportion of company-owned outlets (PCO) as a way of compensating for her diluted residual income rights. Hence, PCO and royalty rate (or, PFO and IRR) should be substitutes (Wind-sperger & Yurdakul, 2007). However, according to agency costs theory, a lower royalty rate motivates franchisees to work hard and so reduces agency costs in local outlets, which benefits the franchise chain in its growth. Thus, PFO and IRR interact positively (Penard et al. 2003). Our results support the latter, or if both mechanisms are valid, we argue that the latter will have a dominant impact on the decision-making process in franchising. To understand this, we need to examine more closely the unique characteristics of this industry. Franchising is a popular way of growing a business quickly. Because of a small operational scale in each outlet

and high homogeneity in products and services, expanding one's market share is more important than making huge profits in the short run.¹⁰ In addition, treating an increase in PCO purely as another way for the franchisor to maintain its share of residual income rights is inappropriate as well. Actually, from the industrial organization's point of view, both organizational structures, franchising and company ownership, have their own benefits. While franchising can stimulate local managers to make the best efforts, company ownership can rely on management skills from the headquarters. Hence, if franchising benefits expansion more, it makes sense to increase the franchise proportion.

Besides the above spatial effects and interdependence, we have also conducted estimations on other independent variables. Our results in Table 4 suggest that, the franchise proportion is influenced by three types of factors. First, a higher entry barrier—such as higher requirements for initial investment (TII), longer training duration (TL), lack of co-operative advertising programs (CA) and financial assistance (FA)—weakens the expansion potential, leading to a lower PFO. Second, geographic advantages in marketing, such as a highly dispersed (PD) and decentralized (DC) national market and an overseas expansion plan (EP), help a franchise chain expand rapidly and smoothly. Lastly, the younger and more immature a franchise chain is, as indicated by a lower advertisement rate offered (ADR), less business experience (BE), poorer growth potential (PGR), lower requirements for initial investments (TII), shorter training duration (TL), and smaller corporate size (SCS), the higher its franchise proportion.

In addition, we further find from Table 4 that, a franchisor's royalty decisions are determined by a trade-off between the benefits from preserving the brand value at the outlet level and the costs of doing so. If the chain has a highly-valued brand name, as indicated by longer business experience (BE) and stronger growth potential (PGR), but would incur relatively lower costs in preserving the brand name through, for example, offering pre-operation assistance (IA), setting higher requirements for initial investments (TII) and providing more training (TL), then attracting competent franchisees through favorable royalties (a lower royalty rate or conversely a higher IRR) is good for its success. However, if the costs of preserving its brand value at the outlet level are high either due to high uncertainty, as in the case of an overseas expansion plan (EP), or due to the need for complicated management skills, as indicated by higher quality threshold for required franchisees (RTFQ), then offering a larger income share to franchisees (a higher IRR) may not bear fruit. On the other hand, increasing the royalty rate (a lower IRR) but providing other favorable terms in the franchise contract (such as greater discretion in decisions, well-established chain culture, potential in career develop-

¹⁰ This is also supported by the fact that in franchising, royalty rates are low but franchising propensity is high in general.

ment, etc.) will enable the franchisor to find high-quality franchisees who can better cope with complex tasks.

Our results show that, driven by a common variable, the franchise proportion co-moves with the royalty rate in the same direction, which is largely consistent with the literature (Lafontaine, 1992). However, our results are substantially different from those in the literature if we take spatial factors into account. Firstly, different from Lal (1990), our data indicates that the positive relationship between a franchisor's inputs and the royalty rate does not always hold. Some inputs from a franchisor, such as publicly shared business experience, are not closely tied to its incentive for providing those inputs; hence, in this case, a low royalty rate would suffice. Other inputs, such as initial assistance and training, are crucial to the success of a franchised outlet; hence, in this case, a low royalty rate is necessary as a complementary incentive for franchisees. Secondly, as in Caves & Murphy (1976), the capital-market-imperfection argument is such that a high franchise proportion is associated with an increasing need for financial capital by the franchisor, which is measured by the amount of capital required to open an outlet. However, we find that the initial investment is negatively correlated with PFO. In other words, our data indicates that franchising is not a means for franchisors to obtain capital.

Our work is related to the literature on local monopolies, in particular, local convenient stores. Stelder (2012) investigated local spatial monopolies, each of which is formed by a cluster of its own establishments. He shows that a substantial portion of consumers in the Netherlands, about one quarter, is locked within 1km of such local monopolies. Guy (2013) developed a model of competition between local walkable shops and distant car-reachable shops. His work suggests that not only does competition from low-cost supermarkets may drive many local shops out of business, but also it may raise prices and reduce the capacity utilization in local shops. These studies are consistent with ours in that spatial factors are important in firms' strategic considerations.

9. Conclusion

The primary goal of this study is to provide an initial analysis on whether and how franchise chains interact with each other in choosing their corporate governance strategies, such as those related to the organizational structure and contractual terms. A number of theoretical models and empirical studies have suggested that the decisions of self-interested agents are spatially interdependent due to either the market share effect or the market power effect. By properly specifying the competitive structure in the spatial weights matrix from both the economic and geographic viewpoints, we identify the impacts of such spatial interdependence.

Using a cross-sectional data set of 353 franchise chains from 43 sectors in the U.S., we find evidence for the coexistence of both the market share effect and the market power effect. The market share effect arises directly from the incentive to compete for scarce resources and the incentive to learn from spillover information. This effect drives each decision, either the franchise proportion (PFOs) or the royalty rate, to react positively to itself spatially. The market power effect results from an intention to prevent one's market power from being eroded in head-on competition, such that these two decisions react negatively to each other spatially. Consistent with the literature, we find that the market share effect dominates the market power effect, indicating that franchise chains tend to “cluster” in economic distance. This result greatly helps to explain why we observe high uniformity across different sectors of franchise chains in terms of both the mixed organizational structure and the royalty rate in practice.

Besides, we also find a positive stable relationship between the franchise proportion and the royalty rate. When a franchise chain wants to expand through franchising, it should offer a low royalty rate to attract franchisees. This relationship between a lower royalty rate and a higher franchise proportion evolves and stabilizes in the long-run equilibrium. This result offers an empirical interpretation of three stylized facts in franchising: the combination of a low royalty rate and a high franchise proportion, the time-invariance of a royalty rate, and the stability of a mixed organizational structure.

As robustness checks, we further test spatial competition and stable interdependence in the two decisions using different competitive “distances”. Our results show that spatial competition is stronger in local markets than in neighboring markets, which is consistent with the conclusion that “closer” chains are more sensitive to each other's actions. However, the complementary relationship between expanding through franchising and offering a favorable royalty rate is weaker in local markets than in neighboring markets, which suggests a stronger complementary relationship over distance.

Finally, a further examination of the traditional non-spatial factors shows consistent results with the literature. Specifically, we find that, on the one hand, high entry barriers reduce the franchise proportion, while geographic advantages and immaturity drive a franchisor to expand its chain through franchising. On the other hand, a trade-off between the benefits from preserving the brand name in an expansion of franchised outlets and the costs of doing so determines the franchisor's royalty rate. If the benefits dominate, a lower royalty rate is offered; otherwise, a higher royalty rate is offered.

References

- Abernethy, M.A., Bowens, J. and van Lent, J. 2004. Determinants of Control System Design in Divisionalized Firms. *The Accounting Review*, 79(3): 545-570.
- Anselin, L. and Kelejian, H.H. 1997. Testing for Spatial Error Autocorrelation in the Presence of Endogenous Regressors. *International Regional Science Review* 20: 153–182.
- Anselin, L., Varga, A. and Acs, Z. 1997. Local Geographic Spillovers between University Research and High Technology Innovations. *Journal of Urban Economics*, 42: 422-448.
- Aten, B. 1997. Does Space Matter? International Comparisons of the Prices of Tradables and Nontradables. *International Regional Science Review*, 20, 35–52.
- Becker, R. and Henderson, V. 2000. Effects of Air Quality Regulations on Polluting Industries. *Journal of Political Economy*, 108:379-421.
- Bivand, R. and Szymanski, S. 2000. Modeling the Spatial Impact of the Introduction of Compulsory Competitive Tendering. *Regional Science and Urban Economics*, 30:203-19.
- Bode, E., Nunnenkamp, P. and Waldkirch, A. Spatial Effects of Foreign Direct Investment in US States. *Canadian Journal of Economics*, 45(1): 16-40.
- Bond, R.E. 2006. *Bond's Franchise Guide*, 2006 edition. Source Book Publications,
- Borenstein, S. and Netz, J. 1999. Why Do All the Flights Leave at 8 AM?: Competition and Departure-Time Differentiation in Airline Markets. *International Journal of Industrial Organization*, 17(5): 611-640.
- Brueckner, J.K. 2003. Strategic Interaction among Governments: An Overview of Empirical Studies. *International Regional Science Review*, 26:175-188.
- Buettner, T. 2001. Local Business Taxation and Competition for Capital: The Choice of the Tax Rate. *Regional Science and Urban Economics*, 31:215-45.
- Caves, R.E. and Murphy, W.F. 1976. Franchising: Firms, Markets, and Intangible Assets. *Southern Economic Journal*, 42(April): 572-586.
- Chisholm, D. and Norman, G. 2012. Spatial Competition and Market Share: an Application to Motion Pictures. *Journal of Cultural Economics*, 36(3):207-225.
- Cliff, A. and Ord, J.K. 1972. Testing for Spatial Autocorrelation among Regression Residuals. *Geographical Analysis*, 4:267–284.
- Crone, T.M. 1999. An Alternative Definition of Economic Regions in the United States Based on Similarities in State Business Cycles. *The Review of Economics and Statistics*, 87(4):617-626.

- Davis, P. 2006. Spatial Competition in Retail Markets: Movie Theaters. *RAND Journal of Economics*, 37(4):964-982.
- Degryse, H., Ongena, S., 2005. Distance, Lending Relationships, and Competition. *Journal of Finance*, 60(1): 231-266.
- Devereux, M.P., Lockwood, B. and Redoano, M. 2007. Horizontal and Vertical Indirect Tax Competition: Theory and Some Evidence from the USA. *Journal of Public Economics*, 91: 451-479.
- Drukker D.M., Egger, P. and Prucha, I.R. 2013. On Two-Step Estimation of a Spatial Autoregressive Model with Autoregressive Disturbances and Endogenous Regressors. *Econometric Review*, 32(5-6):686-733.
- Figlio, D.N., Kolpin, V.W. and Reid, W.E. 1999. Do States Play Welfare Games? *Journal of Urban Economics*, 46:437-54.
- Flademoe-Lindquist, K. and Jacque, L.L. 1995. Control Modes in International Service Operations: The Propensity of Franchising. *Management Science*, 41: 1238-1249.
- Fredriksson, P.G., and Millimet, D.L. 2002. Strategic Interaction and the Determinants of Environmental Policy across US States. *Journal of Urban Economics*, 51: 101-22.
- Gal-Or, E. 1995. Maintaining Quality Standards in Franchise Chains. *Management Science*, 41:1774-1792.
- Geoghegan, J., Wainger, L. and Bockstael, N. 1997. Spatial Landscape Indices in A Hedonic Framework: An Ecological Economics Analysis Using GIS. *Ecological Economics*, 23:251–64.
- Gimpel, J.G. and Schuknecht, J.E. 2003. Political Participation and the Accessibility of the Ballot Box. *Political Geography*, 22:471-488.
- Guy, F. 2013. Small, Local and Cheap? Walkable and Car-oriented Retail in Competition. *Spatial Economic Analysis*, 8(4): 425-442.
- Haining, R., Plummer, P. and Sheppard, E. 1996. Spatial Price Equilibrium in Interdependent Markets: Price and Sales Configurations. *Papers in Regional Science*, 75(1): 41-64.
- Henrickson, K.E. 2010. Spatial Competition and Strategic Firm Relocation. *Economic Inquiry*, 50(2):364-379.
- Hepple, L.W. 1995. Bayesian Techniques in Spatial and Network Econometrics: 2. Computational Methods and Algorithms. *Environment and Planning A*, 27:447–469.
- Holly, S., Pesaran, M.H. and Yamagata, T. 2010. A Spatio-Temporal Model of House Prices in the USA. *Journal of Econometrics*, 158: 160-173.

- Kalnins, A. 2003. Hamburger Prices and Spatial Econometrics. *Journal of Economics and Management Strategy*, 12:591-616.
- Kalnins, A. and Lafontaine, F. 2004. Multi-unit Ownership in Franchising: Evidence from the Fast-food Industry in Texas. *RAND Journal of Economics*, 35:747–761.
- Kelejian, H.H. and Prucha, I.R. 2004. Estimation of Simultaneous Systems of Spatially Interrelated Cross Sectional Equations. *Journal of Econometrics*, 118: 27–50.
- King, M. 1981. A Small Sample Property of the Cliff-Ord Test for Spatial Correlation. *Journal of the Royal Statistical Society B*, 43:263–264.
- Klein, B. 1995. The Economics of Franchise Contracts. *Journal of Corporate Finance*, 2:9-37.
- Lafontaine, F. 1992. Agency Theory and Franchising: Some Empirical Results. *The RAND Journal of Economics*, 23(2): 263-283.
- Lal, R. (1990). Improving Channel Coordination through Franchising. *Marketing Science*, 9, 299–318.
- LeSage, J.P. 1997. Bayesian Estimation of Spatial Autoregressive Models. *International Regional Science Review*, 20:113–129.
- Marrocu, E. and Paci, R. 2012. Education or Creativity: What Matters Most for Economic Performance? *Economic Geography*, 88(4): 369-401.
- McMillen, D.P., Singell, L.D. and Waddell, G.R. 2007. Spatial Competition and the Price of College. *Economic Inquiry*, 45(4): 817-833.
- Miller, C.E., Reardon, J. and McCorkle, D.E. 1999. The Effects of Competition on Retail Structure: An Examination of Intratype, Intertype, and Intercategory Competition. *Journal of Marketing*, 63: 107–120.
- Nagar, V. 2002. Delegation and Incentive Compensation. *The Accounting Review*, 77(2): 379-395.
- Numan, W. and Willekens, M. 2012. An Empirical Test of Spatial Competition in the Audit Market. *Journal of Accounting and Economics*, 53:45-465.
- Pinkse, J. and Slade, M.E. 1998. Contracting in Space: An Application of Spatial Statistics to Discrete-choice Models. *Journal of Econometrics*, 85:125–154.
- Pinkse, J., Slade, M.E. and Brett, C. 2002. Spatial Price Competition: A Semiparametric Approach. *Econometrica*, 70: 1111–1153.
- Plummer, P. and Sheppard, E. 2006. Geography Matters: Agency Structures and Dynamics at the Intersection of Economics and Geography. *Journal of Economic Geography*, 6(5): 619-637.

Plummer, P., Haining, R. and Sheppard, E. 1998. Spatial Pricing in Interdependent Markets: Testing Assumptions and Modeling Price Variation. A Case Study of Gasoline Retailing in St Cloud, Minnesota. *Environment and Planning A*, 30: 67-84.

Plummer, P., Sheppard, E. and Haining, R. 1998. Modeling Spatial Price Competition: Marxian versus Neoclassical Approaches. *Annals of the Association of American Geographers*, 88(4): 575-594.

Revelli, F. 2002. Local Taxes, National Politics and Spatial Interactions in English District Election Results. *European Journal of Political Economy*, 18:281–299.

Rubin, H. (1978). The Theory of the Firm and the Structure of the Franchise Contract. *Journal of Law and Economics*, 21, 223–233.

Saavedra, L.A. 2000. A Model of Welfare Competition with Evidence from AFDC. *Journal of Urban Economics*, 47:248–79.

Sheppard, E., Haining, R. and Plummer, P. 1992. Spatial Pricing in Interdependent Markets. *Journal of Regional Science*, 32(1): 55-75.

Sorenson, O. and Stuart, T.E. 2001. Syndication Networks and the Spatial Distribution of Venture Capital Financing. *American Journal of Sociology*, 106: 1546-1588.

Starr, H. 2001. Using Geographic Information Systems to Revisit Enduring Rivalries: the Case of Israel. *Geopolitics*, 15:131–150.

Stelder, D. 2012. Spatial Monopoly of Multi-Establishment Firms: An Empirical Study for Supermarkets in the Netherlands. *Papers in Regional Science*, 91(1): 181-192.

Topa, G. 2001. Social Interactions, Local Spillover and Unemployment. *Review of Economic Studies*, 68:261-295.

Turnbull, G.K. and Dombrow, J. 2006. Spatial Competition and Shopping Externalities: Evidence from the Housing Market. *Journal of Real Estate Finance Economy*, 32: 391-408.

Widener, S.K., Shackell, M.B. and Demers, E.A. 2010. The Juxtaposition of Social Surveillance Controls with Traditional Organizational Design Components. *Contemporary Accounting Research*, 25(2): 605-638.

Windsperger, J. and Yurdakul, A. 2007. The Governance Structure of Franchising Firms: A Property Rights Approach. In *Economics and Management of Networks. Franchising, Strategic Alliances, and Cooperatives* edited by Cliquet, G., Hendrikse, G., Tuunanen, M. and Windsperger, J. New York: Physica-Verlag Heidelberg, 69-95.

Appendix I: Estimation Issues

The spatial simultaneous equations model (3) creates estimation complications due to feedback simultaneity, spatial autoregressive lag simultaneity, and spatial cross-regressive lag simultaneity with spatially autoregressive disturbances. Hence, a couple of issues should be cautiously taken into account. Two of these issues are particularly important.

First, concerning identification, the number of basic endogenous variables that appear on the right-hand side of each equation should be smaller than the number of exogenous variables in the system but not in that equation.

Second, the existence of spatial error autocorrelation should be tested by means of a *Moran's I* test, the null hypothesis of which is

$$H_0: \Lambda = 0 \text{ and } \rho = 0; \quad H_1: \Lambda \neq 0 \text{ or } \rho \neq 0. \quad (8)$$

Under such a null hypothesis, the statistic can be expressed as follows:

$$I = \frac{N}{S_0} \frac{e' W e}{e' e} \xrightarrow{d} N(E[I], Var[I]), \quad (9)$$

where e is a vector of OLS residuals and $S_0 = \sum_i \sum_r w_i w_r$ corresponds to the sum of spatial weights.¹¹ In particular, for a row-standardized W , $S_0 = N$, and hence $I = e' W e / e' e$. With $E[I]$ and $Var[I]$ being replaced by their consistent estimators respectively, an asymptotic test can be constructed such that the null hypothesis is rejected at the α level of significance if

$$\left| \frac{I - \hat{E}[I]}{\sqrt{\widehat{Var}[I]}} \right| > z_\alpha, \quad (10)$$

with

$$\begin{aligned} \hat{E}[I] &= \frac{tr(MW)}{N - K}, \\ \widehat{Var}[I] &= \frac{tr(MWMW') + tr(MWMW) + [tr(MW)]^2}{(N - K)(N - K + 2)} - (\hat{E}[I])^2, \end{aligned}$$

where $M = I - x(x'x)^{-1}x'$.

However, the existence of endogenous dependent variables violates the fundamental assumption of there being no correlation between regressors and the error term. Hence, similar to the estimation of the parameters, the implementation of Moran's *I* test for spatial error autocorrelation is based on residuals derived from a consistent estimator such as the IV meth-

¹¹ Moran's *I* test is shown to be similar to the Durbin-Watson test, implying similar optimality properties in the two tests (King, 1981).

od. From Anselin and Kelejian (1997), a revised Global Moran's I test that is appropriate to our model can be constructed as follows:

$$I_{j,n}^* = \frac{n}{S_0} \frac{\tilde{u}'_{j,n} W_n \tilde{u}_{j,n}}{\tilde{u}'_{j,n} \tilde{u}_{j,n}}, \quad n^{1/2} I_{j,n}^* \xrightarrow{d} N(0, \phi_j^2), \quad (11)$$

where $\tilde{u}_{j,n} = y_{j,n} - Z_{j,n} \delta_{j,n}$ is the IV residual. Then, a consistent estimator for the asymptotic variance of ϕ_j^2 is

$$\hat{\phi}_{j,n}^2 = \frac{\hat{s}_{2,n}}{2\hat{s}_{1,n}^2} + \frac{4}{\hat{s}_{1,n}^2 \hat{\sigma}_{jj,n}} \hat{A}_{j,n}, \quad (12)$$

with

$$\begin{aligned} \hat{s}_{1,n} &= \sum_{i=1} \sum_{r=1} \frac{w_{ir,n}}{n}, \\ \hat{s}_{2,n} &= \frac{\text{tr}[(W_n + W_n')(W_n + W_n')]}{n}, \\ \hat{\sigma}_{jj} &= \frac{\tilde{u}'_{j,n} \tilde{u}_{j,n}}{n}, \\ \hat{A}_{j,n} &= (n^{-1} \tilde{u}'_{j,n} W_n Z_{j,n}) \left[n(Z'_{j,n} P_H Z_{j,n})^{-1} \right] (n^{-1} Z'_{j,n} W_n' \tilde{u}_{j,n}). \end{aligned}$$

The results of the test are reported in Table 4, which indicates that there are significant spatial effects in our system.

Last but not least, there are certain rules for choosing W . First, due to the need for asymptotics of consistent and asymptotically normal estimators, the range of dependence allowed by the structure of W is limited. For example, for an explicit form of the variance-covariance matrix for y to be obtained in convergence, all the elements of W have to be less than one. Therefore, the elements of the spatial weights matrix are typically row-standardized, such that, for each i , $\sum_r w_{ir} = 1$. Second, although there is no strong evidence against using endogenous variables in defining the spatial weight matrix, we should be cautious in maintaining exogeneity in the weight matrix. Thus, as a general approach, all diagonal elements in the spatial weight matrix are defined as zero, implying that the only spatial effect considered in chain i 's decision equation would come from chain i 's competitors, rather than chain i itself.

Appendix II: Theoretical Background for Spatial Competition

Assume that a franchisor's objective function is of the following form:

$$U(z_i, z_{-i}, k_i, s_i; X_i),$$

where z_i is a vector of two corporate governance variables (τ_i, r_i) representing the franchise proportion τ_i and the royalty rate r_i , which describes the preferences; X_i is a vector of agent i 's preference characteristics. Also, k_i is the brand value, defined as an index revealing managerial experience and market knowledge of franchise chain i , which describes expectations. The observational learning process Φ yields a minimum brand value relative to the cost $C(z_i)$ of establishing the brand name through observations of other chains' cost-adjusted minimum brand value, which can be written as

$$\frac{k_i}{C(z_i)} = \Phi \left[\frac{k_{-i}}{C(z_{-i})} \right] \quad \text{or} \quad k_i = C(z_i) \Phi \left[\frac{k_{-i}}{C(z_{-i})} \right] \equiv \phi(z_i, z_{-i}), \quad (13)$$

where ϕ is called the information function. Furthermore, s_i is a vector of resource levels (c_i, e_i) for customers and potential franchisees, which indicates resource constraints defined by the following expressions:

$$\sum_{i=1}^n c_i = \bar{C}, \quad \sum_{i=1}^n e_i = \sum_{i=1}^n \tau_i N_i = \bar{E}, \quad (14)$$

where N_i is the total number of outlets in franchise chain i . Let the distribution functions of customers and franchisees with respect to their "economic" spatial locations be $G_c(\cdot)$ and $G_e(\cdot)$, respectively. Then, according to the rules of the Hotelling game, we have

$$P(X_i) + t_c G_c^{-1}(\tilde{c}_i) = k_i, \quad \Pi(z_i; X_i) - t_e G_e^{-1}(\tilde{e}_i) = \gamma, \quad \gamma = \Gamma(r_i; r_{-i}),$$

where $P(\cdot)$ is the average retail price and $\Pi(\cdot)$ is the average local profit; t_c and t_e are "transportation costs" to customers and potential franchisees, respectively; and γ represents the endogenously required return of potential franchisees, which is a function of monetary terms offered by franchise contracts. Note that $G_c^{-1}(\tilde{c}_i)$ defines the location of the indifferent customers who determine the boundary of the product market for franchise chain i . Similarly, $G_e^{-1}(\tilde{e}_i)$ defines the location of the indifferent potential franchisees who determine the boundary of the managerial market for franchise chain i . Then, together with constraint (14), the solution of (c_i, e_i) is given as

$$c_i = H_c(k_i; X_i), \quad e_i = H_e(z_i, z_{-i}; X_i).$$

By substituting k_i from equation (13) into this solution, the distributions of the two resources can be rewritten as functions of $(z_i, z_{-i}; X_i)$ as follows:

$$c_i = H_c[\phi(z_i, z_{-i}); X_i], \quad e_i = H_e(z_i, z_{-i}; X_i).$$

Now, we can express the franchisor's objective function in a more explicit form:

$$U\{z_i, z_{-i}, \phi(z_i, z_{-i}), H_c[\phi(z_i, z_{-i}); X_i], H_e(z_i, z_{-i}; X_i); X_i\} \equiv \hat{U}(z_i, z_{-i}; X_i). \quad (15)$$

Then, maximizing (15) gives the reaction function of z_i , which can be written as

$$z_i = R(z_{-i}; X_i). \quad (16)$$

This expression is a model with *spatial autocorrelations*.

The characteristics of a franchise chain X_i are given exogenously, which, following the four-stage game proposed by Pinkse & Slade (1998), can be interpreted as variables determined in an earlier stage. These characteristics may be spatially correlated when they are chosen, which may introduce *spatial heterogeneity* into our model if some of the characteristics are unobservable. Formally, suppose that the vector of characteristics X_i contains both a vector of observable variables x_i and a vector of unobservable variables u_i . Then, the reaction function (16) can be rewritten as

$$z_i = R_z(z_{-i}; x_i; u_i), \quad (17)$$

with $u_i = R_u(u_{-i})$ being spatially correlated with each other.

Appendix III: Specifying the Spatial Weights Matrix

Step 1: Defining the business-related distance

By assuming an $N \times 1$ dummy vector D with ascending order for the 43 sectors and the same order for all franchise chains belonging to the same sector, we can define a rough *business-related* distance between chain i and chain r as

$$w_{ir} = \begin{cases} 1, & \text{if } D_i = D_r, \\ 0, & \text{otherwise.} \end{cases} \quad (18)$$

Step 2: Defining the local market effect

Suppose that there is a 50×1 vector s_i representing the market locations of chain i , with $s_{p,i} = 0$ indicating that i has no outlet in state p and $s_{p,i} = 1$ indicating that i has at least one outlet in state p ($p = 1, \dots, 50$). The local market effect of a neighbor r on i is measured by the ratio of common local markets in which both i and r are located to the total number of markets in which i is located, i.e.,

$$w_{ir}^l = \frac{\sum_{p=1}^{50} s_{p,i} s_{p,r}}{\sum_{p=1}^{50} s_{p,i}} = \frac{s_i \cdot s_r}{s_i \cdot \mathbf{1}}, \quad (19)$$

where $\mathbf{1} = (1, 1, \dots, 1) \in \mathbb{R}^{50}$.

Step 3: Defining the neighboring market effect

Let S be a 50×50 state matrix defined by $S = (S_1, \dots, S_{50})$, where S_p is a 50×1 column vector such that if state p and state q are neighboring states, then $S_{p,q} = S_{q,p} = 1$; otherwise $S_{p,q} = S_{q,p} = 0$. Let $w_{p,r}$ be the neighboring market effect on state p from chain r , which is defined as the proportion of neighboring markets around state p occupied by chain r . Formally, $w_{p,r}$ is defined as

$$w_{p,r} = \frac{\sum_{q=1}^{50} S_{p,q} S_{q,r}}{\sum_{q=1}^{50} S_{p,q}} = \frac{S_p \cdot S_r}{S_p \cdot \mathbf{1}}. \quad (20)$$

Here, $w_{p,r}$ is less than 1, implying that the spatial dependence on any franchise chain r with outlets located in neighboring states is lower than that on those chains located within the same state.

As a result, the chain-level neighboring market effect of chain r on chain i is measured by the ratio of the sum of all state-level neighboring market effects of chain r on chain i to the total number of markets in which chain i is located, i.e.,

$$w_{ir}^n = \frac{\sum_{p=1}^{50} S_{p,i} w_{p,r}}{\sum_{p=1}^{50} S_{p,i}} = \frac{S_i \cdot w_r}{S_i \cdot \mathbf{1}}, \quad (21)$$

where w_r is a 50×1 vector of the state-level neighboring market effects from chain r (with an element of $w_{p,r}$ in its p -th row).

Step 4: Obtaining the final spatial weight

Ultimately, the spatial weights representing the overall spatial dependence of chain i on chain r "economically" can be written as

$$w_{ir} = \begin{cases} w_{ir}^l + w_{ir}^n, & \text{if } D_i = D_r \\ 0, & \text{otherwise.} \end{cases} \quad (22)$$

Appendix IV: Two Regional Breakdowns for the 48 U.S. Mainland States

The BEA regional breakdown		
1	New England	Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut
2	Mideast	New York, New Jersey, Pennsylvania, Delaware, and Maryland
3	Great Lakes	Ohio, Indiana, Illinois, Michigan, and Wisconsin
4	Plains	Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas

5	Southeast	Georgia, Florida, Virginia, West Virginia, North Carolina, South Carolina, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, and Louisiana
6	Southwest	Oklahoma, Texas, Arizona, and New Mexico
7	Rocky Mountain	Montana, Idaho, Wyoming, Colorado, and Utah
8	Far West	Washington, Oregon, California, and Nevada
The Crone (1999) regional breakdown		
1	Maine, New Hampshire, Massachusetts, Arizona, Utah, and Montana	
2	Ohio, Indiana, Illinois, Michigan, Iowa, and Delaware	
3	Georgia, Florida, Virginia, North Carolina, South Carolina, Missouri, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Oklahoma, and Rhode Island	
4	New York, New Jersey, Pennsylvania, Maryland, Connecticut, West Virginia, and Vermont	
5	Washington, Oregon, California, Nevada, Idaho, Nebraska, Texas, Wyoming, Minnesota, Louisiana, and Kansas	
6	North Dakota, South Dakota, Colorado, New Mexico, and Wisconsin	