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DOUBLE-SIDED MORAL HAZARD AND THE NATURE OF SHARE CONTRACTS

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Abstract

In this paper, we first establish that contractual arrangements involving revenue/profit sharing are often based on fairly simple, often linear, rules. In addition, we find that in many contexts, these contracts are not finely adjusted to the particular circumstances of individual agents or outlets, and that they do not vary over time to the extent current theories based on optimal contracting suggest they should. We then develop a simple model of such contractual arrangements based on double-sided moral hazard. We show that under some circumstances, this simple model can account for many of these stylized facts. More specifically, the model shows that customizing contract terms as a function of individual circumstances at the time of contracting need not be optimal in that the benefits from contract differentiation can, in some cases, be quite limited.

DOUBLE-SIDED MORAL HAZARD AND THE NATURE OF SHARE CONTRACTS

1. Introduction

This paper develops a simple double-sided moral hazard model of contractual arrangements involving some form of revenue/profit sharing, such as sharecropping, franchising, licensing and sometimes leasing, and examines how well this model can explain some of the interesting characteristics of these institutional arrangements. We focus on double-sided moral hazard as an explanation for these types of contracts for a number of reasons. First, we find that this is an intuitively appealing way to think about and formalize the type of relationships involved. Indeed, the notion that double-sided moral hazard can explain various institutional arrangements, including some of the above, is not new. Reid (1977) first used this type of argument to explain the existence and form of sharecropping contracts, while Rubin (1978) first suggested this as an explanation for franchising. More recently, these arguments have been formalized by Eswaran and Kotwal (1985) and Lal (1990) respectively.[1]

Second, we find that modelling sharing arrangements as resulting from the interaction of two input providers subject to incentive problems is consistent with the way most individuals involved in these types of agreements view their relationship. For example, in Lafontaine (1992c), the majority of franchisors said that they used royalties on sales in their franchise contract to harmonize the goals of both parties to the contract and provide for better incentives.

Finally, and most importantly, our interest in double-sided moral hazard as an explanation for these types of arrangements stems from the support it has received in the empirical literature. In the case of franchising arrangements, Brickley and Dark (1987), Norton (1988), Sen (1991) and Lafontaine (1992a) all find results that are consistent with the existence of moral hazard on the franchisee's side. In addition, Lafontaine (1992a) and Sen (1991) find support for the notion that there is moral hazard on the franchisor's side. Similarly, the notion that there is moral hazard

[1] Other analyses based on double-sided moral hazard include Cooper and Ross (1985), Emons (1988) and Dybvig and Lutz (1989), who all examine how double-sided moral hazard may explain some of the characteristics of product warranty contracts. Also, in a different context, Demski and Sappington (1991) discuss the use of buyout agreements as solutions to double-sided moral hazard problems.

at least on the tenant's side in sharecropping has been supported empirically in studies by Alston and Higgs (1982), and Alston, Datta and Nugent (1984) among others. Thus, our goal in this paper is to extend the existing work on contractual arrangements and double-sided moral hazard to show that even a simple model of this type can account for many of the stylized facts one finds when examining the payment schedules specified in these contracts.

The paper is organized as follows. In the next section, we discuss the available evidence and present some new data documenting a) a tendency to use linear payment schedules, b) the relative uniformity of contract terms across agents, and c) the stability of contract terms over time and/or as the number of agents increases. In Section 3, we first argue that many of these contractual arrangements involve the provision of effort by more than one party and can, thus, be modelled in a double-sided moral hazard framework. We then develop such a simple model of contractual relationships.[2] With risk-neutral parties, we show that the optimal contract involves a strictly positive revenue sharing component, and can be implemented via a linear scheme. While the single-sided moral hazard literature has focused on the tradeoffs between risk-sharing and efficient production, and derived optimal linear contracts under special assumptions on probability distributions and utility functions, our analysis shows that the insurance motive need not be invoked to obtain revenue sharing and linearity of contracts. Instead of focusing on attitudes toward risk, we concentrate on the form of the production function with two effort inputs. After extending the results on the optimal contract to the case of multiple agents, we turn, in Section 4, to a detailed examination of the features of the optimal contract with a CES production technology and separable, quadratic disutility (or cost of effort) functions. In the special case where the technology reduces to a Cobb-Douglas, we show that it may be optimal for a franchisor to offer the same royalty rate to all his potential franchisees at a point in time. This will be the case even if there is much heterogeneity across outlets and across individual franchisees. Similarly, we show that in the Cobb-Douglas case, firms would want to use the same franchise contract with their franchisees as the size of the franchised chain increases. In that sense, our model implies the kind of uniformity and stability of contract terms that one observes in

[2] To facilitate exposition, the model is described in terms of the franchising relationship. It should be clear however that it can be used to explain contract terms in other situations where two separate parties contribute some unobservable inputs to the production process.

several different contractual contexts. In contrast, much of the existing literature on the topic implies that contracts should be more specifically tailored to the particulars of the contracting parties. Concluding remarks are found in Section 5.

It is sometimes argued that contract uniformity and stability may be due to the existence of legal constraints preventing contract term differentiation across agents. Lafontaine (1992c) presents survey evidence suggesting that this is not the main motivation behind the standardization of contracts in business format franchising. In addition, McAfee and Schwartz (1992) advance further arguments against this explanation. Other possible explanations for the lack of highly customized contracts include the high transactions costs of designing many different contracts (as Holmström and Milgrom (1987) point out), the high administrative costs associated with differentiation (as noted by Holmström and Milgrom (1987), Lafontaine (1992c)), or the potential for franchisor opportunism ex-post in a context of downstream competition, which makes contract variation costly (see McAfee and Schwartz (1992) for a formal analysis of this point). While we agree that such cost arguments are important, our model is meant to demonstrate that another important type of explanation exists for the lack of contract customization. Our model emphasizes the fact that the benefits from differentiating contract terms across franchisees, and as circumstances change, may not be as large as one might expect them to be. In other words, even if the costs of differentiation were low, our model suggests that the benefits may be so small that contract term customization may not be worthwhile.

2. A Survey of the Current Evidence on Contract Terms

The empirical literature on contractual arrangements has grown significantly over the last few years. Much of this work has been concerned with the circumstances under which certain types of contracts will arise, for example, with the incidence of sharecropping versus fixed wage and fixed rental contracts (see e.g. Rao (1971), Alston and Higgs (1982), Chao (1983) and Alston, Datta and Nugent (1984)), or with the use of franchising versus company-ownership in business format franchising (see, notably, Brickley and Dark (1987), Norton (1987), Martin (1988) and Lafontaine (1992a)), or with contractual choice in the gasoline retailing industry (Shepard (1991) and Slade (1992)). Comparatively little attention has been given to the determinants of the terms of sharing arrangements, where by contract terms we mean those components of the contract that define the monetary obligations of the parties.[3] The few studies that exist focus mainly on either sharecropping (namely Chao (1983), Johda (1984) and Roumasset (1984)) or franchising (Sen (1991), Lafontaine (1992a,b,c) and Lafontaine and Shaw (1992)). A few patterns do emerge, however, from this set of papers. In what follows, we use the available evidence, and augment it with some new data on franchising contracts, to document the following: a) that payment rules tend to be simple and often linear b) that in many cases, the same contract terms are offered to all potential agents at a point in time, and c) that contract terms are relatively stable over time and/or as the number of agents increases.

2.1. The Use of Simple Contracts

The popularity of linear payment rules, where the sale price of a good or service is given by a combination of a fixed fee and a variable component usually defined as a per unit or a percentage royalty payment, hardly requires documentation. Several authors, including Arrow (1985), McAfee and McMillan (1987), Holmström and Milgrom (1987), and Milgrom and Roberts (1992), have already noted this tendency toward relatively simple, and often linear, rules rather than the complex, non-linear agreements predicted by much of the principal-agent literature. This has prompted some authors to examine conditions under which linearity will be optimal in the standard principal-agent framework (e.g. McAfee and McMillan (1987), Holmström and Milgrom (1987), Rogerson (1987)), while it has been used by others to justify limiting their analyses to linear rules only (see e.g. Stiglitz (1974), Gallini and Lutz (1992), Slade (1992)).

Linear pricing rules have been found in a number of diverse areas such as, but not limited to, sales force compensation, sharecropping, leasing arrangements, author's fees, legal fees, licensing agreements, and franchising. In business format franchising for example, the franchisee typically pays royalties calculated as a percentage of sales, over and above an upfront franchise fee.[4] More specifically, in the Entrepreneur

[3] In other words, we use this terminology to refer only to the monetary terms of the contract, such as royalty payments and fixed fees, as opposed to more qualitative contractual terms such as exclusive territories or resale price maintenance.

[4] The U.S. Dept. of Commerce (1988) applies the label of " Business Format" franchises to cases where the relationship between franchisor and franchisee "includes not only the product, service, and trademark, but the entire business format itself — a marketing strategy and plan,

Magazine's 1989 Franchise 500 listing, for example, 1000 of the 1082 business format franchisors said they require some form of variable royalty payment (either a royalty rate or an advertising fee calculated as a proportion of sales). In addition, almost all of them (1061 or 92.5%) ask for a fixed upfront payment (or franchise fee). Furthermore, in her survey, Lafontaine (1992c) found that of the 118 franchisors asking for royalty payments based on sales or profits, 93 said that the percentage rate was constant over all sales (or profits) levels.[5] These data clearly support the notion that business format franchising relies on mostly linear payment rules.

On the other hand, the practice of requiring minimum variable payments within an otherwise linear contract is fairly popular, and it clearly introduces non-linearities in the payment scheme.[6] For example, Lafontaine (1992c) found that 40 of her 123 respondents to this question indicated that they impose minimum royalty payments, in addition to their usual percentage rates and franchise fees.[7] We come back to this issue in Section 3. For the moment, we note that in the majority of cases, contracts are still linear, and that in those cases where they are not, the mechanisms used to introduce the non-linearity are very simple. We conclude that the reliance on simple and often linear rules in the types of contractual arrangements of interest here remains much greater than one would expect a priori. In addition, the modern principal-agent theory suggests that linear sharing contracts cannot be optimal without severe restrictions on the form of utility functions and probability distributions. Hence, we feel that this stylized fact of real world contracts needs further explanation.

operating manuals and standards, quality control, and continuing two way communication" (p. 3). Examples include restaurants, business and employment services, and real estate agencies. The other type of franchising, which is often called "Product and Tradename Franchising", is limited to car dealerships, soft-drink bottlers and gasoline service stations.

5 Another 20 said it was piece-wise linear, with 18 of them using a sliding scale and 2 of them opting for an increasing scale. The remaining four respondents said they use some "other" way to calculate royalties.

6 See Masten (1988) on this issue.

7 To our knowledge, maximum payment clauses are basically never used. Also, note that input markups, which are another potential source of revenues for the franchisor, are in fact linear in input sales, and in output as well if the downstream technology is one of fixed proportions (see Caves and Murphy (1976)).

2.2. The Similarity of Contract Terms across Agents

A tendency for the uniformity of contract terms across agents was first noted in the context of sharecropping arrangements. The propensity of sharecropping contract terms to remain relatively constant, at one-half, within and across regions, as well as over time, was one of the "stylized facts" that Newbery and Stiglitz (1979) suggested theories of sharecropping needed to explain.[8] Recent studies have challenged the universality of this claim (see e.g. Alston and Higgs (1982), Roumasset (1984) and Johda (1984)). Still, the preponderance of evidence is that these contracts are fairly uniform, and that 50/50 splits remain most common.[9] Yet authors also acknowledge that formal half splits can hide much variance in some of the side conditions stipulated in the contract.[10]

Similarly, the tendency for business format franchisors to use the same contract terms with all of their franchisees at a point in time was noted by Murrell (1983). Lafontaine (1992a) provides evidence on this issue using data in the 1986 Entrepreneur Franchise 500 survey. Also, in her own survey, Lafontaine (1992c) finds that 104 of her 126 respondents indicated either that their contract is offered on a take-it-or-leave-it basis, or that they allow for some negotiation of non-monetary terms only.

We can examine further the issue of contract term uniformity in franchising using new information from 54 disclosure documents, made available to us by business format franchisors.[11] Table 1 summarizes the three main types of fees actually levied by the 54 franchisors in our sample.

This table shows first that franchise fees tend to be more variable than royalty rates or advertising rates: 35 of the franchisors mentioned a number of possible franchise fees, while only 13 and 3 did so for the royalty rate and the advertising rate

[8] As noted by Allen (1985), the words for sharecropping in French and Italian, respectively *métayage* and *mezzadria*, mean dividing in half.

[9] See Chao (1983) for evidence that a 50–50 division was the standard for more than 2000 years in China.

[10] See Reid (1973) and Binswanger and Rosenzweig (1984) for example for arguments concerning variations in side conditions such as who pays for inputs such as fertilizer, harvest labor, etc.

[11] Disclosure statements are documents that the FTC requires franchisors to make available to inquiring or potential franchisees. They must contain information about the franchise and its main officers, and describe all of the fees the franchisee will have to incur. We sent a request for disclosure documents to 598 franchisors. Only 54 of them complied.

Table 1
Summary of the Fees in 54 Disclosure Documents Collected from Franchisors in 1989

FRANCHISE FEE		
Single Fee		19
Single Fee	17	
None (incl. Deposits Only)	2	
Multiple Fees		35
As Function of Market Potential	10	
Special Fee for Area Development Agreements	10	
Different Franchise Options	6	
Discounts for Additional Units	6	
Conversion Discounts	2	
No Explanation	1	
Total		54
ROYALTY RATE[1]		
Single Rate		41
Single Rate	35	
With Minimum Payment Required	6	
Multiple Rates		13
Sliding Scale	6	
Reduced Rate for Early Year(s)	4	
Special Rate for Area Development Agreements	1	
Increasing Scale	1	
Special Rates in Some Regions (within U.S.)	1	
Total		54
ADVERTISING FEE[2] (Excluding Initial Opening Promotional Fees)		
Single Fee		44
Single Rate(% of Sales)	16	
Single Rate Stated as a Minimum Requirement	13	
None Listed	8	
Single Rate Stated with Minimum $ Payments	5	
Single Rate Stated as a Maximum Requirement	1	
Single Rate Stated with Maximum $ Payments	1	
Multiple Fees		3
Different Rates across Different Markets	1	
Fee is a Function of Sales and Unit Size	1	
Min. and Maximum Rates Stated	1	
Other Type of Fee		7
Form of Advertising Specified (instead of cost)	4	
Fixed Monthly Payments (with built-in increases)	2	
Payment Set by Local Franchisee Group	1	
Total		54

[1] Input sales at a markup are not considered as a separate category in this table despite the fact that they can be a substitute for royalties. The requirements to buy inputs from the franchisor or from approved suppliers were found to be small and basically constant across all franchisees in a chain.

[2] Including national, regional and local requirements, but excluding grand opening expenses.

respectively.[12] Furthermore, this table establishes that there are different rationales behind variations in franchise fees and variations in royalty and advertising rates. Most of the cases where the franchise fee varies relate in some way to the market potential of the unit. In 10 cases, this was done directly by stating that this fee was a function of the size of the territory, its population, and market potential, or a function of the size of the unit itself. In another 10 cases, this was achieved through the requirement of different fees for area development agreements, where the franchisee agrees to develop a number of units in a given territory. Finally, in 6 cases, the franchise fee was different for different types of stores within a given franchise, for example for a stand alone restaurant compared to a food-court version of the same. In 8 cases, the different franchise fees were due to differences in the costs to the franchisor of franchising the units in question. This occurs either because the unit already exists as an independent business, and it is being converted to this franchise, or because a franchisee from within the system is starting the new unit. In both cases, the franchisor incurs less costs since some of the services typically offered by franchisors to new franchisees are uncessary in these cases.[13]

Multiple royalty rates, on the other hand, occur mostly when the franchisor chooses to use a sliding (or increasing) scale, or when he reduces the fees over the first few years of operation. All of these are offered to all franchisees entering into the franchise contract at a given time. Of these, only the sliding and increasing scale clauses adjust for differences in market potential across outlets. Finally, the use of a variety of advertising fees is mostly due to the franchisor's desire to maintain flexibility in setting these fees. On the one hand, contracts often stipulate minimum advertising

[12] The extent to which the franchise fee is allowed to adapt to market potential apparently is underestimated in surveys published in the trade literature. For example, looking at the 1990 Franchise 500 from Entrepreneur magazine, which gives data for 1989, out of a total of 1082 franchisors, we find that 190 indicate a range for their franchise fee, and 14 say that it varies. This leads to about 20% of the sample of franchisors with a variable franchise fee, as compared to 60% in our sample. In comparison, 100 franchisors indicated a range for their royalty rate, and 46 of them said that it varies. In total, this leads to about 14% of the franchisors with a variable royalty rate, which is much closer to our estimate of 18%. From a comparison of the fees given in the disclosure documents with those found in the survey for the 50 franchisors in both samples, we found 21 cases for which the Entrepreneur survey gave a single franchise fee, while the disclosure document revealed the possibility of different franchise fees. In all cases, the Entrepreneur survey gave the value of the "standard" fee.

[13] In at least one instance, the disclosure document contained a specific clause to the effect that the discounted fee was available to established franchisees buying a new franchise only if they would forego certain specified franchisor services.

rates (13 cases) as a way to allow the franchisee to spend more on local advertising if she so wishes (see Ozanne and Hunt (1971), p. 217 for a sample clause of this type). On the other hand, maximum rates are sometimes specified when the franchisor wants to allow himself to modify the advertising contribution of his outlets as the need arises over the duration of the contract (which according to the U.S. Dept. of Commerce (1988) is about 15 years on average). In fact, of the 54 franchisors considered here, 17 had clauses requiring the franchisee to join any local or regional advertising group that the franchisor (and in some cases the other franchisees in the area) might choose to organize. Another 7 franchisors included a clause stating that they might change the advertising fee from time to time, at their discretion, and 3 of the 8 franchisors without any advertising fee gave themselves the option to establish a new national or regional advertising fund, and require franchisees to contribute some portion of their revenues to it. Though they could not be counted in Table 1, given that the classification was based on actual rather than potential fees, maximum requirements often appeared in these latter types of clauses. Hence advertising rates do vary, but they vary over time during the period of the contract, not across franchisees.

One possible source of franchisor revenues that is not covered in Table 1 relates to the sale of inputs by the franchisor to the franchisee at a mark-up.[14] In examining the contract terms, one must consider whether the use of such input mark-ups might allow franchisors to discriminate among outlets. From the disclosure statements, we find first that input purchase requirements are typically not very important in terms of volume.[15] More importantly, they are identical for all franchisees. Since non-discrimination laws would make it difficult for franchisors to demand different prices from their franchisees, we conclude that input sales at a mark-up do not result in different franchisees being treated differently.[16]

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14 Licensing contracts also often impose input purchase requirements in addition to the payment of royalties (as a percentage of sales, or on a per unit basis) and fixed upfront fees. (See Lovell (1969).)

15 Rather than requiring that franchisees buy from the franchisor, the typical requirement is that the franchisee must buy from an approved supplier. Whether the franchisor derives revenues from the supplier in that case is unknown, but again, such revenues, if they were proportional to the amount of input sold, would simply represent a type of tax equivalent to the imposition of a royalty rate.

16 In fact, it is not even clear that business format franchisors derive profits from the sale of inputs to their franchisees. In two surveys of franchisees asking whether they think that the prices they pay for the inputs they buy from their franchisor are higher or lower than the prices

In summary, we find that in business format franchising, the fixed component of the contract, namely the franchise fee, tends to vary more with the market potential of individual outlets (though the formula for calculating them remains the same across franchisees), while royalty rates, advertising rates, and input sale requirements are typically constant across all franchisees who join the chain at a given point in time.

Finally, one can find some evidence of uniformity of contract terms across agents in other areas such as in leasing, and to some extent licensing. In the former case, both Kaysen (1956) and Masten and Snyder (1993) discuss the fact that United Shoe Machinery used only three different leasing contracts with their customers. These contracts involved either fixed monthly rentals, monthly charges combined with per unit charges, and unit charges only. In all cases, for each type of machine being leased, the charges were the same for all customers. Similarly, though there is much more contract term customization in licensing, both Caves, Crookell and Killing (1983) and Contractor (1981) document the existence of "industry norms" in the setting of royalty rates for licensing agreements. These norms are used as starting points in the determination of the terms of individual contractual arrangements.

The point of the above discussion is not to say that we always find uniformity in contract terms. In some cases, firms do choose to treat different agents differently. For example, while there are a limited number of different linear contracts in gasoline retailing (3 in the U.S., 4 in Canada), contract terms apparently do vary within each standard type: the per diem fee and the commission rates were different for different commissioned agents in Slade's (1992) data.[17] Similarly, we saw that licensing contract terms are customized to some extent. Our point is that in many differents contexts, we find much less customization than one would expect to occur under presently available explanations for these types of contracts.

2.3. The Stability of Contract Terms

There are only a limited number of cases where researchers have been able to document the evolution of the terms of various contracts over time and/or as the

they could obtain on the market, a slight majority of franchisees stated that they believed their franchisor's prices to be somewhat higher. See Ozanne and Hunt (1971) and Hunt and Nevin (1975) on this.

17 From a private conversation with Slade.

number of contracts a firm gets involved in increases. First, in the case of franchising contracts, we find some papers that provide insight on how firms adjust the terms of their contract (i.e. of the contract they offer to new franchisees) over time and/or as the size of the chain changes. Lafontaine (1992a) and Sen (1991) both examine the terms of franchised contracts of a fairly large number of franchisors (548 and 600 respectively) in a given year (in 1986 and 1988 respectively). Both authors find a small but significant positive relationship between royalty rates and the number of outlets in the chain. Lafontaine (1992a) also finds that the royalty rate decreases as the amount of time a firm has been in business increases.[18]

However, since it is not possible to control, for example, for firm specific effects with cross-sectional data, one would want to use panel data to examine these issues. Three recent studies have used this approach. First, Banerji and Simon (1991) examine the contract terms of 27 franchisors which they observe for at least 3 consecutive years over the 1978 to 1990 period (on average, each firm was observed for almost 6 years). They find that 18 of their 27 firms have never changed their royalty rates, and the 9 that remain changed it only once. Franchise fees were modified somewhat more frequently, though still not very often (11 franchisors never changed it, another 11 changed it once, 3 changed it twice, and the other two changed it more than twice). Second, Lafontaine (1992b) compared the royalty rates and franchise fees of franchisors observed at two points in time: first, when they started franchising, and second, at least 5, but no more than 8, years later. She notes that across her sample of 125 firms, the average royalty rate decreased from 7.04 to 6.65%, while the average franchise fee increased from 14.2 to 16.2 thousands in 1980 dollars. She adds that neither of these changes are statistically significant. Third, and finally, Lafontaine and Shaw (1992) present empirical evidence on the evolution of the terms of franchise contracts based on a panel data set of more than 2000 franchisors observed for up to eleven years between 1980 and 1990. They find little adjustment of royalty rates over time or as the chain expands, and again a greater variability in franchise fees. Finally, 59 of the 130 respondents in Lafontaine (1992c) said they never altered their royalty rates since they first started their operations, and 36 indicated that they have never changed their franchise fee.

From the above evidence, we conclude that franchisors adjust the terms of their

[18] The effect of the number of outlets on the franchise fee is negative, but not statistically different from zero. The number of years in business has no effect on the franchise fee either.

contracts quite infrequently, and that the changes, in levels, are quite small. Hence over periods of up to 10 or so years, the terms of these contracts are relatively stable. We also find that franchise fees are adjusted somewhat more frequently than royalty rates.[19] The existing empirical evidence on sharecropping also supports the notion that the share parameter in these contracts has been remarkably stable over time, while other aspects of the contract seem to have been modified to a much larger degree. Finally, with respect to leasing contracts, Kaysen (1956) notes that there were no changes in monthly charges or in unit charges for the vast majority of United Shoe Machinery's machines over the 1922–1946 period . In all of these cases, we would argue that the observed degree of stability is much greater than one would expect it to be under current theories. We believe that this aspect of these contractual relationships also warrants further study.

3. Double-sided Moral Hazard

From the above review of the empirical evidence, we conclude that contractual arrangements are often based on fairly simple, often linear, rules. In addition, in many contexts, contracts are not finely adjusted to the particular circumstances of individual agents or outlets, and they do not vary over time to the extent current theories based on optimal contracting suggest they should. In the remainder of this paper, we develop a simple model of contractual arrangements based on double-sided moral hazard. We show that under some circumstances, this simple model can account for many of the stylized facts noted above. More specifically, the model shows that customizing contract terms as a function of individual circumstances at the time of contracting need not be optimal in that the benefits from contract differentiation can, in some cases, be quite limited.

Much of the evidence surveyed above was concerned with business format franchising. For that reason, and also because this allows us to describe the model in more concrete terms, we formulate our model in the context of the franchising relationship.

[19] As noted earlier, advertising fees are sometimes stated in a way that allows franchisors to change them over time within the contract period. Since these fees were added to royalty rates in most cases in the above studies, the conclusions drawn here should be understood in terms of the "usual" or "average" advertising rate. In other words, the empirical evidence suggests that the stated usual advertising fee, or the average advertising fee if a range was given, and the stated royalty rate, do not change much over time.

It should be clear however that our conclusions apply to any type of contractual arrangement where the two parties each contribute some unmarketed input to the production process. Most of the contractual relationships discussed above can be, or have been, characterized in this way. For example, as noted earlier, Reid (1977) and Eswaran and Kotwal (1985) viewed sharecropping arrangements as a means to provide incentives to both tenants and landlords in a model where each is assumed to provide some unmarketed input. More specifically, Eswaran and Kotwal (1985) assumed that the tenant was best at providing labor supervision, which in turn influenced the efficiency of labor. The landlord, with his greater access to market information, was assumed to be better equiped to provide general managerial inputs.

Similarly, licensing contracts typically involve much more than simply the one-time transfer of technology. As noted by Contractor (1981), "It is much more accurate to view technology transfer as a relationship rather than as an act" (p. 13). He presents data describing a large number of licensing agreements and finds that the vast majority of them include provisions relating to the transfer of trademarks, know-how, periodical technical expertise, etc. In other words, the licensor provides several inputs that are critical to the success of the agreement and whose value depend on his level of effort. And of course, much of the licensee's local managerial effort is unobservable yet also critical. Hence double-sided moral hazard models are well suited to describe this type of relationship as well.

Finally, Masten and Snyder (1993) make a strong case that United Shoe Machinery's leasing contracts can be viewed as mechanisms providing incentives to the company to support the machinery and its users technically. Both this input, and the user's managerial skills and expertise in his own business, affect the final outcome of the relationship, and are difficult to monitor. This raises the possibility of interpreting their leasing contracts as solutions to double-sided moral hazard considerations.

3.1. The Model

In business format franchising, the franchisor is typically responsible for providing training and general support to his franchisees. He is also the one who is in charge of promoting and advertising the chain nationally, and more generally of developing and maintaining the value of his tradename. The franchisee, on the other hand, is responsible for managing the outlet. This involves supervising employees, keeping track of local needs and overseeing local advertising. Both of these sets of inputs affect the performance of the outlet. However, the intensity of efforts devoted to such activities is not easily monitored by parties other than the individual providers of the effort. We model this by assuming that the downstream production function has two arguments, the franchisee's effort level which we denote by e for franchis"ee", and the franchisor's, r.[20] We use a general production function, which we write as

$$X = f(e, r) + \epsilon \tag{3.1}$$

where X is the total monetary return produced and ϵ is a random term with mean 0 and variance σ^2. In order to focus more clearly on the issue of joint production, we abstract from risk-sharing concerns and assume that both parties are risk-neutral.[21] We also assume that the realization of ϵ is unobservable to both parties and that the effort levels are unverifiable. As a result, contracts based on either e or r are not feasible.[22]

We take $f(\cdot,\cdot)$ to be a standard neoclassical production function. Letting subscripts denote partial derivatives, this implies that f_e and f_r are positive, that f_{ee} and f_{rr} are negative, and that f_{er} is positive. We further assume that $f(0, r) = 0$ and $f(e, 0) = 0$. This assumption simply emphasizes the team production aspect of the production technology by stating that both inputs are required for any production to

20 This approach is equivalent to assuming that the franchisor sells some input to the franchisee, that embodies his contribution, and that is then used by the franchisee according to the downstream technology to obtain downstream output. However, in this case, one would have to assume that the quality, or some other aspect of the goods sold to the franchisee, is unknown to the latter. Otherwise there would not be any observability problem on the franchisor's effort level. In other words, the franchisee would have to be buying some kind of bundle, such as cars and the value of the name attached to the cars (both of which are a function of the franchisor's effort), and be unable to assess the contribution of this bundle of goods to total output. Since business format franchising does not necessarily involve input purchase requirements, we find our approach to be a more realistic description of this, and of other institutions of interest, such as sharecropping and some licensing arrangements. See Mathewson and Winter (1990) for a similar approach to modelling the franchisor–franchisee relationship.

21 Note that this assumption is consistent with the fact that some franchisors use a fixed rent contract. Lafontaine (1992a) found that 37 of the 548 franchisors in her sample used this type of contract. Since they assign all the risk to the franchisee, these contracts can only be optimal if the franchisee is risk-neutral or if risk is not an important factor in the determination of the contract terms.

22 Since there are two sources of effort provision, we do not need to make the assumption of non-shifting support that is required in the standard moral-hazard literature.

occur. We also assume that the franchisor's and the franchisee's disutility of effort functions are given by $U(r)$ and $V(e)$ respectively, both of which we assume to be increasing and strictly convex in effort. Since neither effort level is verifiable, any enforceable contract has to be based on the downstream output level. Using ρ to denote the franchising contract, the Pareto-optimal program for this problem may be written as:

$$\max_{\rho,e,r}\{\rho(f(e,r)+\epsilon)-U(r)\} \tag{3.2}$$

subject to

i) $E\,[\rho'\cdot(f_r(e,r))\,]=U'(r)$

ii) $E\,[\,(f_e(e,r))-\rho'\cdot(f_e(e,r))\,]=V'(e)$

iii) $E\,[\,(f(e,r)+\epsilon)-\rho(f(e,r)+\epsilon)\,]-V(e)\geq k$

where k stands for the franchisee's reservation utility level. Constraints i) and ii) represent the franchisor's and the franchisee's incentive compatibility constraints respectively, and iii) is the franchisee's individual rationality or participation constraint.

Theorem: Without loss of generality, the optimal sharing rule can be represented by a linear contract.[23]

Proof: The intuition for the proof is as follows. Let the slope of the optimal sharing rule at the optimum be β. Then by choosing a linear rule with slope β and adjusting the fixed fee accordingly, exactly the same incentives and total payments can be achieved as with the optimal sharing rule assumed. (See the Appendix for a full proof.)

Note that while a linear contract implements the second-best levels of effort on the part of both parties, it is not in any way the unique contract that achieves this end. In particular, a linear contract with a minimum royalty commitment can also be used to implement the second-best effort levels given the risk-neutrality assumptions used. This is because a minimum royalty amount, so long as it is strictly less than the expected royalty amount under the optimal linear scheme, essentially plays the same role as the fixed fee and affects only the individual rationality constraint and not the marginal incentives embedded in the incentive compatibility conditions.

[23] Romano (1991) independently derived a version of this result.

Since the optimal outcome can be implemented via a linear contract, and since the random term attached to f does not affect results, we can relabel variables so that they now stand for their respective expected values. The franchisor's problem can now be rewritten more simply as:

$$\max_{\beta,F,e,r} \{F + \beta f(e,r) - U(r)\} \tag{3.3}$$

subject to

i) $\beta f_r(e,r) = U'(r)$

ii) $(1-\beta) f_e(e,r) = V'(e)$

iii) $(1-\beta) f(e,r) - F - V(e) \geq k.$

where F is a fixed fee and β is a royalty rate on the (dollar) output.

The Lagrangian for this problem is

$$\mathcal{L} = F + \beta f - U(r) - \lambda\left[U' - \beta f_r\right] - \mu\left[V' - (1-\beta) f_e\right] - \nu\left[k - (1-\beta) f + F + V(e)\right] \tag{3.4}$$

The first order conditions for the optimization are as follows:[24]

i) With respect to F: $1 - \nu = 0$ which implies $\nu = 1$. Hence the franchisee's individual rationality constraint must be binding, i.e.

$$(1-\beta) f(e,r) - F - V(e) = k. \tag{3.5}$$

This implies that there are no rents left downstream.[25]

ii) With respect to e:

$$\beta f_e + \lambda[\beta f_{re}] - \mu[V'' - (1-\beta) f_{ee}] + \nu[(1-\beta) f_e - V'] = 0. \tag{3.6}$$

24 We assume that $f(\cdot,\cdot)$ is sufficiently concave and that $U(\cdot)$ and $V(\cdot)$ are sufficiently convex so that the second order conditions hold.

25 We could allow the franchisee to earn rents in our framework by letting k denote a utility level that is above the franchisee's reservation utility level by an amount a, where a is defined as an efficiency wage. Kaufmann and Lafontaine (1992) make the case that McDonald's franchisees on average earn economic rents, and that these are a mechanism for contractual self-enforcement.

The last term in this condition is equal to zero given the franchisee's incentive compatibility constraint, so we have

$$\beta f_e + \lambda[\beta f_{re}] - \mu[V'' - (1-\beta) f_{ee}] = 0. \tag{3.7}$$

iii) With respect to r:

$$[\beta f_r - U'] - \lambda[U'' - \beta f_{rr}] + \mu[(1-\beta) f_{er}] + \nu(1-\beta) f_r = 0 \tag{3.8}$$

where the first term in bracket is equal to zero given the franchisor's incentive compatibility constraint. Since $\nu = 1$, we can rewrite (3.8) as

$$-\lambda[U'' - \beta f_{rr}] + \mu[(1-\beta) f_{er}] + (1-\beta) f_r = 0. \tag{3.9}$$

iv) With respect to β:

$$f + \lambda f_r - \mu f_e - \nu f = 0 \tag{3.10}$$

which given $\nu = 1$, can be rewritten simply as

$$\lambda f_r = \mu f_e. \tag{3.11}$$

From these conditions, we find that the multipliers for the incentive compatibility constraints, λ and μ, must be non-zero. For $\lambda f_r = \mu f_e$ to hold, given that we have assumed that $f_r,\ f_e > 0$, it must be that λ and μ are both non-zero, or that they are both equal to 0. If the latter was true, then from (3.7) and (3.9), we have respectively that

$$\beta f_e = 0 \tag{3.12}$$

and

$$(1-\beta) f_r = 0. \tag{3.13}$$

But with $f_r,\ f_e > 0$, these two conditions cannot hold simultaneously. Hence it must be that λ and μ are both strictly non-zero.

Relating the first order conditions to the case where there is moral hazard only on the franchisee's side, i.e. where there is no notion of franchisor effort, then $f_r = 0$, $f_{rr} = 0$ and $f_{er} = 0$, whereas $f_e > 0$. From (3.11), it must be that $\mu = 0$. But then from (3.7), $\beta f_e = 0$ so that $\beta = 0$. This is the usual result: under risk neutrality, the agent that provides the only unobservable input becomes the single residual claimant. In other words, in this case the franchisee does not share his income at all with the franchisor. Similarly, one finds from the above equations that if the franchisor is the only one providing an unobservable input, he becomes the sole residual claimant, i.e. $\beta = 1$. For the franchisee to accept this contract then requires that the franchise fee be negative, i.e. that the franchisee be paid a fixed wage. However, with double-sided moral hazard, we have the following result.

Corollary: With double-sided moral hazard the optimal contract cannot have $\beta = 0$ or $\beta = 1$. In other words, output must be shared.

Proof: From the incentive compatibility constraints, we have:

$$\beta f_r(e,r) = U'(r) \tag{3.14}$$

and

$$(1-\beta) f_e(e,r) = V'(e). \tag{3.15}$$

From the individual rationality constraint, we know that $f(e,r)$ must be positive, otherwise F would have to be negative. But then the franchisor earns negative profits, in which case he is better off not contracting with the franchisee.[26] For $f(e,r) > 0$, it must be, from our team production assumption, that both e and r are positive. Hence, $U'(r)$ and $V'(e)$ must also both be positive. Then, if β was either 0 or 1, one of the incentive compatibility conditions above would not be satisfied. As a result, β must be strictly between 0 and 1. **Q.E.D.**

Note that the incentive compatibility conditions on the two parties imply that

$$\frac{\beta}{(1-\beta)} = \frac{U'(r)/f_r(e,r)}{V'(e)/f_e(e,r)} \tag{3.16}$$

which yields, on rearrangement,

$$\beta = \frac{U'(r)/f_r(e,r)}{V'(e)/f_e(e,r) + U'(r)/f_r(e,r)} \tag{3.17}$$

That is, for a given level of β, the effort levels adjust so that the contribution of the franchisor to the sum of marginal disutilities weighted by respective productivities is

[26] In other words, the franchisor's individuality constraint, which was not explicitely stated in the program, but which requires that the franchisor obtain a non-negative return, rules out his sustaining expected losses.

equal to the royalty rate. The constrained pareto program can, thus, be viewed as imposing an efficiency constraint which embodies the utility cost of productive effort by each party at the margin. The optimal royalty rate is the one that maximizes the franchisor's utility subject to this efficiency constraint and subject to the reservation utility constraint of the franchisee. Since λ and μ are non-zero, we can rewrite the above equations to get an expression for the optimal level of β denoted by β^*:

$$\beta^* = \frac{f_r^2\,[\,(1-\beta^*)f_{ee} - V''\,]}{f_e^2\,[\,\beta^* f_{rr} - U''\,] + f_r^2\,[\,(1-\beta^*)f_{ee} - V''\,]}. \tag{3.18}$$

While this equation can, in principle, be solved for β^*, the resulting expression fails to yield any intuition behind the factors determining the optimal royalty rate without further structure on the production function and the disutility functions. One reason behind the difficulties in interpretation lies in the fact that the expression for the optimal β^* involves the third power of the marginal productivities. In particular, we are unable to obtain simple, closed-form expressions for the levels of the optimal efforts on the part of the two parties without greater amount of structure. As a result, in Section 4, we explore the solutions to the problem above with CES production functions and power disutility.

3.2. Extending the Model to Multiple Franchisees

Our simple double-sided moral-hazard formulation can be readily extended to the case of multiple franchisees. In doing this, there are a number of issues that can be examined. In this section, we examine how the franchise contract might be affected by the number of franchisees in the chain. In this analysis, we assume that the outlets and franchisees within a chain are all identical and focus on a symmetric equilibrium, described by (β, F). We then examine how the optimal royalty rate and franchise fee vary as the number of outlets in the chain increases. In that sense, ours is a comparative statics result, not a dynamic one.

To simplify our analysis, we first rewrite our model for the single franchisee case as follows:

$$\max[f(e,r) - U(r) - V(e)] \tag{3.19}$$

s.t.

$$\beta f_r(e,r) = U'(r) \tag{3.20}$$

$$(1-\beta)f_e(e,r) = V'(e). \tag{3.21}$$

This formulation simply incorporates the franchisee's binding individual rationality constraint into the objective

To extend this version of the model to the multiple franchisee case, we assume that there are n franchisees, each of which has a production function given by $f(e_i, \cdot)$, for $i = 1, \ldots, n$. In other words, franchisee i's output is independent of the other franchisees' effort levels, and all franchisees produce under the same type of technology. In terms of the franchisor's effort, in what follows, we consider two possible extreme cases: first, we examine the case where the franchisor's effort is specific to each outlet. In other words, we assume that the franchisor expends a certain level of effort r_i in each outlet, and that this effort benefits only this outlet. We have in mind cases where the franchisor mainly provides such things as training and general support or consulting services to his franchisees. Second, we consider the other extreme case where the effort expended by the franchisor is a public good, that is where all franchisees benefit in the same way from the franchisor's level of effort, r. This case is meant to capture other types of activities usually carried out by franchisors, namely the effort they expend to maintain the value of their tradenames (through advertising, monitoring franchisees, etc.). This latter characterization, which treats the franchisor's effort as a public good, is the most customary in the limited multiple franchisee literature. See for example Mathewson and Winter (1985) and Katz and Owen (1991).

When the franchisor's effort is a private good for each franchisee, under symmetry, the franchisor's problem can be written as

$$\max[nf(e,r) - U(nr) - nV(e)] \tag{3.22}$$

s.t.

$$n\beta f_r(e,r) = nU'(nr) \tag{3.23}$$

$$(1-\beta)f_e(e,r) = V'(e), \tag{3.24}$$

where r is the per outlet level of franchisor effort, and $U' = \frac{dU(x)}{dx}|_{x=nr}$. Note that due to the focus on the symmetric solution, we are only trying to determine the optimal royalty rate at first.

It is worth pointing out that in the case where $U'(\cdot)$ is a constant, that is for $U(\cdot)$ linear, then $U'(nr) = U'(r)$ and the constraint set described in this version of the multiple franchisee problem reduces to the constraint set of the single franchisee problem. In addition, in this particular case, the objective function becomes n times the objective function from the single franchisee case. Hence the solution to the multiple franchisee problem when the franchisor effort is a private good, and in particular the optimal sharing rule, will be identical to that found in the single franchisee problem, whatever the production technology might be, if the franchisor's marginal disutility of effort is constant.

When the franchisor's effort can be represented as a public good, the franchisor's problem is given by

$$\max[nf(e,r) - U(r) - nV(e)] \tag{3.25}$$

s.t.

$$n\beta f_r(e,r) = U'(r) \tag{3.26}$$

$$(1-\beta)f_e(e,r) = V'(e) \tag{3.27}$$

where r represents the franchisor's effort, which is common to all franchisees.

Both these problems can be solved in an identical fashion to the case of the single franchisee in the previous section to yield expressions for the optimal β^* which are analogous to the one derived earlier for the single franchisee case. As in the earlier section, however, without additional structure, such equations are hard to interpret. As a result, we solve the problems with the aid of numerical procedures using specific functional forms in the next section.

4. Results Obtained Under Specific Functional Forms

In this section, we describe the results we obtain from solving the programs above for the optimal sharing rule under specific functional form assumptions. We assume that the production function is CES, i.e.

$$X = f(e,r) = [ae^{\rho} + br^{\rho}]^{1/\rho} \tag{4.1}$$

where a and b are the input intensity parameters, and ρ is the substitution parameter, with $-\infty \leq \rho \leq 1$. Note that this function reduces to a linear production function when $\rho = 1$, and to the Cobb-Douglas production function when $\rho = 0$. Also, in this formulation, the CES production function exhibits decreasing returns to scale if the sum of a and b is greater than one, constant returns to scale if it equals one, and increasing returns to scale otherwise. For the disutility of effort or cost functions, we use quadratic functional forms, that is

$$U(r) = \frac{\delta^r r^2}{2} \tag{4.2}$$

and

$$V(e) = \frac{\delta^e e^2}{2}, \tag{4.3}$$

where the δ's are scale parameters that allow us to vary the cost of effort both in absolute and relative terms.

Table 2

Comparative Static Results for the Share Parameter β

Franchisor's Input Type:	Value of ρ	$d\beta/da$	$d\beta/db$	$d\beta/d\delta_e$	$d\beta/d\delta_r$	$d\beta/dn$
Private	$\rho > 0$	−	+	+	−	−
	$\rho = 0$	−	+	0	0	0
	$\rho < 0$	−	+	−	+	+
Public	$\rho > 0$	−	+	+	−	+
	$\rho = 0$	−	+	0	0	0
	$\rho < 0$	−	+	−	+	−

We solve numerically the two multiple franchisee programs described in Section 3. We allowed for decreasing as well as constant returns to scale by using values of .25 and .5 for each of a and b. δ_r and δ_e were in turn given values of 1 or 2. The substitution parameter was set to a number of different levels, encompassing the case of a linear production function, at $\rho = 1$ all the way to $\rho = -10$, which implies a fairly low degree of substitutability between the two inputs. The exact values used were ρ=-10, -4, -2, -1, -.5, -.1, 0, .1, .5, 1. Finally, for the number of outlets, we used n=1, 2, 3, 10, and 100.

Table 2 summarizes our results. The first two columns show how the share parameter β adjusts to changes in the input intensity parameters. These results are consistent with what one would expect a priori: No matter whether the franchisor's input is a private or a public good, we find that β, which is the share of output that is paid to the franchisor, always goes up as the importance of the franchisor's input increases. Correspondingly, this share goes down when the importance of the franchisee's input in the production process is increased.

The next two columns in Table 2 describe the effect on the optimal β of changes in the parties' cost of effort parameters. Again in this case we find that our assumptions concerning whether or not the franchisor's input is a private or a public good are irrelevant. In either case, as long as ρ is greater than 0, the franchisor's share goes up as the franchisee's cost of effort increases relative to his. In other words, efficiency here requires that we give more incentives to the owner of the relatively less costly input, and less to the owner of the relatively more costly input, when the two are good substitutes for each other ($\rho > 0$). When ρ is smaller than zero, the franchisor's effort is not such a good substitute for the franchisee's. Hence, in an attempt to secure a sufficient level of franchisee effort, it is the share that goes to the franchisee that increases as the cost of his effort increases. Finally, when ρ equals zero, that is when the production function is Cobb-Douglas, changes in the δ's, in absolute or in relative terms, have absolutely no effect on the optimal sharing parameter.[27]

This last result implies that if the production technology can be adequately captured by a Cobb-Douglas function, the optimal share parameter is unaffected by the differences in the cost of effort parameters that one would normally find among a heterogeneous population of potential franchisees. Hence franchisee heterogeneity would not lead to contract customization in terms of royalty rates adjustments under this type of technology (and cost of effort functions).

In fact, we can solve analytically for the optimal β in the Cobb-Douglas case (see Appendix 2 for the derivations.) The result shows that the optimal share parameter not only is unaffected by the cost of effort parameters, as seen in Table 2, but

[27] This would also be true in the Cobb-Douglas case if we had a disutility function of any power of the input.

that it also does not depend on any scale parameter that one may introduce in the production function. This suggests that the optimal β is also invariant with the scale of operations of the outlet. In other words, we find that the same share parameter may be optimal for very heterogeneous outlets, that is outlets with very different potential volumes (due to difference in the desirability of the location for example) as well as for heterogeneous franchisees (as captured by differences in their cost of effort parameter). Note, however, that because the franchise fee is chosen to make the franchisee's participation constraint binding, the optimal franchise fee will be a function of both the scale parameter and the individual franchisee's cost of effort parameter. Hence we would expect to observe more variability in this fee, compared to the royalty rate. This is consistent with the empirical evidence presented earlier.

As an interesting contrast, we note that such an insensitivity of royalty rates to the size of the market and to franchisee heterogeneity is not possible to obtain, for example, in models that view the contract as a signal of franchisor quality. Although it is true that a high quality franchisor, by setting a combination of a low franchise fee and a high royalty rate, can distinguish himself from a low quality one (see for example Desai and Srinivasan (1990) and Gallini and Lutz (1992)), in general, both the royalty rate and the franchise fee that he charges will be dependent on the characteristics of the markets he operates in. Even if the franchisor charged the same rate across franchisees, this rate would be a function of the distribution of franchisee market sizes (and of the franchisees' productivity). Thus any addition of a new franchisee, or loss of an existing one, would result in a change in the optimal royalty rate. With hidden action instead of hidden knowledge, the determination of the optimal royalty rate comes first, and the franchise fee acts as a residual chosen such as to satisfy the franchisee's individual rationality constraint. As a result, incentive compatibility is satisfied with only the royalty rate determination. In signaling models, on the other hand, it is the pair of royalty rate and franchise fee that together are responsible for sorting conditions to hold.

Finally, the last column in Table 2 shows how the optimal β is affected by changes in the number of franchisees. In this case, whether one assumes the franchisor's input to be a public or a private good clearly affects the results. In particular, if the franchisor's effort is store-specific, then increases in the size of the chain imply a reduction in the amount of franchisor input in each outlet unless the franchisor's total effort increases more than proportionately. Hence we would expect in this case that the franchisor's share of each outlet's output would have to increase to give him incentives to put forth more effort to compensate for its dilution across many outlets. In fact, our results show that this intuition does not always hold. On the other hand, if the franchisor's effort is public, there is no such dilution effect. However, since the franchisor now obtains a share from a larger number of outlets, increases in his effort level increase his revenues to a much larger extent than they used to at the margin, as can be seen from his incentive compatibility constraint $(n\beta f_r(e,r) = U'(r))$. Hence we might expect that when the franchisor's input is a public good, it would be optimal to reduce his share, and increase franchisee's incentives, as the size of the chain increases. Again, our results show that this intuition does not necessarily carry through. In both cases, the answer hinges on the degree of substitutability between the franchisor's and the franchisee's inputs.

Under the assumption that the franchisor's effort is private, his share of each outlet's output does increase with the size of the chain when the substitution parameter ρ is less than 0. However, this effect is negative if ρ is greater than zero. In other words, when the two inputs are not such good substitutes for each other, that is when $\rho < 0$, increases in the size of the chain are best handled by increasing the franchisor's share. Without these extra incentives, the franchisor's per outlet effort would be too low. And since the franchisee's effort cannot easily substitute for it, the effect on output would be devastating. Hence, the optimal solution involves more incentives to the franchisor, at the expense of the franchisee's effort level. If, on the other hand, the two inputs are good substitutes ($\rho > 0$), then the reduction in the franchisor's per outlet effort can best be compensated for by increasing the franchisees' effort levels. This in turn is achieved by a reduction in the franchisor's share of output. In either case, the end result is an increase in the total effort being put forth by the franchisor as the size of the chain increases. However, on a per outlet basis, both the franchisee's and the franchisor's effort level, and therefore production, decrease as the franchised chain becomes larger.[28]

Not too surprisingly, we find the opposite relationships when we assume that the franchisor's input is a public good. Explanations for these follow a logic very similar to that above. When $\rho < 0$, the two inputs are not good substitutes. Here,

[28] In fact, e_i^* and r^* go down with the size of the chain for all cases except when the two inputs are perfect substitutes, i.e. when $\rho = 1$. In that case, e_i goes up, and the franchisor's total effort decreases.

the franchisor's marginal incentive to put forth effort increases as the size of the chain increases, but the franchisee's does not. Since we need the two inputs, in the optimal solution, the franchisor's share of each outlet's output (β) must be reduced to give incentives to the franchisees. On the other hand, if the franchisor's effort can "replace" the franchisee's easily, that is if $\rho > 0$, it becomes more efficient to give incentives to the franchisor whose increased effort benefits all outlets simultaneously. Hence we get that his share of each outlet's output must go up. In both cases, both optimal levels of effort, e_i^* and r^*, go up as the size of the chain increases.[29]

Lastly, we note that there are two sets of circumstances in Table 2 under which the share parameter, β, might be unaffected by changes in the size of the chain. First, we see that this occurs directly when the production function is Cobb-Douglas. Second, if the franchisor's effort encompasses both types of inputs, as we suggested earlier, our results imply that two opposite forces bear on the share parameter. Whether the final effect on β is positive, negative or nil would then depend on the relative strength of these two effects. When these two forces more or less cancel each other out, it will be optimal for franchisors to continue to use the same share parameter as the size of the chain increases. Hence this model can accommodate in a number of ways the observed tendency of firms to use fairly stable sharing rules.

Note that these considerations have nothing to say about the franchise fee. In this version of the model, this fee will not only vary with the characteristics of the individual franchisee and individual market, but also with the size of the chain through the effect the latter has on both effort levels. This again is consistent with our observation, in Section 2, that franchise fees are modified more often, as a chain matures and expands, than are royalty rates.

5. Conclusion

In this paper, we first established some stylized facts about the payment rules used in a number of revenue/profit sharing arrangements. In particular, we highlighted the widespread use of simple linear payment rules that are fairly uniform and stable. We did, however, show evidence that the fixed component of the contract tends to vary more than the share parameter. We then developed a simple

[29] In fact, e_i^* and r^* go up with the number of outlets in all cases except when the two inputs are perfect substitutes, i.e. when $\rho = 1$. In that case, r still goes up, but e_i decreases.

double-sided moral hazard model that could account for all these features.

We found that the optimal second best contract could be implemented via a linear contract under risk neutrality. In that sense, this paper provides a new and simple explanation for the preponderance of linear contracts. Moreover, we showed that with simple cost of effort functions, the share parameter would be constant across franchisees with different cost of effort parameters if the technology could be described (at least approximately) by a Cobb-Douglas production function. Similarly, different scales of operation at different locations would not require a change in the share parameter under this type of technology (and cost of effort functions) in our model. However, the model predicts that differences in the cost of effort across franchisees and in the size of the market for each outlet should lead firms to require different franchise fees in our model. This we found to be consistent with our observation that franchise fees are more variable than royalty rates, and that they are often specifically stated in terms of market potential. Finally, we saw that the share parameter would not need to be altered as the size of the franchise chain increases if 1) the franchisor's effort is a private good, and the cost of effort function is linear, or 2) if the technology is well captured by a Cobb-Douglas function, or 3) if the technology can be described by a CES production function, and the franchisor's effort is channelled into the provision of both private and public goods. In this latter case, the effects of increasing the size of the chain go in opposite directions, and could cancel each other out. These results, we argue, are consistent with our finding that share parameters tend to be relatively constant over time.

In addition, this simple model can straightforwardly be extended or modified to accommodate some other interesting features of the franchising relationship. For example, we saw that in those cases where the franchisee does not provide any unobservable and unverifiable input, the optimal contract would be one where $\beta = 1$. This might explain why franchisors operate some of their outlets directly if those outlets are such that the manager's effort is relatively easily to monitor. This is consistent with empirical results in Brickley and Dark (1987) who found that company-owned outlets tended to be closer to a franchisor's monitoring headquarters than franchised outlets. In other words, the location of the company-owned outlet made it possible for the franchisor to observe the manager's behavior with relative ease.

Also, several authors have found some evidence that there might be rents left with franchisees. Mathewson and Winter (1985) argue that the presence of queues of potential franchisees in popular chains suggests the presence of such rents; Lafontaine (1992a) and Banerji and Simon (1991) find no negative correlation between franchise fees and royalty rates, even after controlling for the value of the tradename and the sectors of operation of the franchise. They argue that this may be due to the existence of downstream rents. Finally, Kaufmann and Lafontaine (1992) make the case that McDonald's franchisees, on average, earn economic rents, and that these are a mechanism for contractual self-enforcement. In our model, we showed that the franchisee's participation constraint always bind, and thus that there are no rents left downstream. However, we could have allowed the franchisee to earn rents in our framework by letting k denote a utility level that is above the franchisee's reservation utility level by an amount a, where a is defined as an efficiency wage.

In general, we find this approach of modeling revenue or profit sharing arrangements based on double-sided moral hazard quite promising primarily because of its simplicity and its accordance with the survey evidence of the motivations of the actual parties to such contracts. It seems to us that the emphasis on risk-sharing, as opposed to double-sided moral hazard, that is found in the extant literature ignores important real world aspects of these contractual processes. We hope that this work will encourage further developments in this direction.

APPENDIX I

Proof of Theorem 1:

The program is

$$\max_{\rho,e,r}\{\rho(f(e,r)+\epsilon)-U(r)\} \tag{5.1}$$

subject to

i) $E\,[\,\rho'(f_r(e,r)+\epsilon)\,]=U'(r)$

ii) $E\,[\,(f_e(e,r)+\epsilon)-\rho'(f_e(e,r)+\epsilon)\,]=V'(e)$

iii) $E\,[\,(f(e,r)+\epsilon)-\rho(f(e,r)+\epsilon)\,]-V(e)\geq k$

Let the solution to this program be e^*, r^* and $\rho^*(X)$. Then at the optimum,

$$\begin{aligned}V'(e)&=\frac{\partial}{\partial e}E\,[\,f(e^*,r^*)+\epsilon-\rho^*(f(e^*,r^*)+\epsilon)\,]\\&=f_e(e^*,r^*)-\frac{\partial}{\partial e}E\,[\,\rho^*(f(e^*,r^*)+\epsilon)\,].\end{aligned}$$

Similarly,

$$U'(r)=\frac{\partial}{\partial r}E\,[\,\rho^*(f(e^*,r^*)+\epsilon)\,]. \tag{5.2}$$

Refer to the function $E\,[\,\rho^*(f(e,r)+\epsilon)\,]$ as $S(f(e,r))$. Then,

$$\frac{\partial}{\partial r}E\,[\,\rho^*(f(e,r)+\epsilon)\,]=S'(f(e,r))\cdot f_r(e,r) \tag{5.3}$$

and

$$\frac{\partial}{\partial e}E\,[\,\rho^*(f(e,r)+\epsilon)\,]=S'(f(e,r))\cdot f_e(e,r). \tag{5.4}$$

Consider now the alternative linear contract $F+\beta X$ with

$$\beta=S'(f(e^*,r^*)). \tag{5.5}$$

It is easy to verify that this contract satisfies the incentive compatibility constraints at (e^*,r^*). Furthermore, the point (e^*,r^*) is supported as a global optimum when standard Inada conditions are imposed on the relevant functions. The value of F has no impact on the incentive compatibility constraints. Hence it can be freely adjusted to satisfy the participation constraint. **Q.E.D.**

APPENDIX II

Analytical Results Obtained Under Cobb-Douglas Technology

Assume that downstream production follows a Cobb-Douglas technology, i.e.

$$X = f(e, r) = Ke^{\gamma}r^{\alpha} \tag{5.6}$$

where $0 < \gamma, \alpha < 1$. For the utility functions, we continue to use quadratic functional forms,

$$U(r) = \frac{\delta^r r^2}{2} \tag{5.7}$$

and

$$V(e) = \frac{\delta^e e^2}{2}. \tag{5.8}$$

Under these conditions, we have the following derivatives:

$$f_r = \alpha K r^{\alpha-1} e^{\gamma} = \alpha f / r \tag{5.9}$$

$$f_e = \gamma K r^{\alpha} e^{\gamma-1} = \gamma f / e \tag{5.10}$$

$$f_{rr} = \alpha(\alpha - 1) K r^{\alpha-2} e^{\gamma} = \alpha(\alpha - 1) f / r^2 \tag{5.11}$$

$$f_{ee} = \gamma(\gamma - 1) K r^{\alpha} e^{\gamma-2} = \gamma(\gamma - 1) f / e^2. \tag{5.12}$$

Substituting these into the equation for β, i.e. equation (3.18), we get[30]

$$\frac{\beta}{(1-\beta)} = \frac{\alpha^2 e^2}{\gamma^2 r^2} \frac{[(1-\beta) f_{ee} - \delta^e]}{[\beta f_{rr} - \delta^e]}. \tag{5.13}$$

Combining this with the incentive compatibily constraints, which in this case become

$$\beta f_r = \frac{\beta \alpha f}{r} = \delta^r r \tag{5.14}$$

and

$$(1-\beta) f_e = \frac{(1-\beta)\gamma f}{e} = \delta^e e, \tag{5.15}$$

[30] A sufficient condition for the second-order conditions to hold in this case is that $\alpha + \gamma \leq 1$. However, some degree of increasing returns may also allow for the second order conditions to be satisfied.

we get

$$\beta = \frac{\theta \delta^e e^2}{\delta^r r^2 + \theta \delta^e e^2} \tag{5.16}$$

where $\theta = \alpha^2(\gamma - 2)/\gamma^2(\alpha - 2)$. Substituting (5.16) into the incentive compatibility constraints, dividing one by the other, and taking the square root gives

$$\frac{r^2}{e^2} = \frac{\delta^e}{\delta^r}\sqrt{\frac{\alpha}{\gamma\theta}}. \tag{5.17}$$

Substituting this back into (5.16) gives

$$\beta = \frac{1}{\left[1 + \sqrt{\theta\alpha/\gamma}\right]} \tag{5.18}$$

which after replacing θ by its value becomes

$$\beta = \left[1 + \sqrt{\frac{\gamma(\alpha - 2)}{\alpha(\gamma - 2)}}\right]^{-1}. \tag{5.19}$$

Hence the optimal share parameter β is a function of the exponents in the production function and only those. It does not depend on the franchisor's or the franchisee's disutility of effort parameters, nor does it depend on the scale parameter K or on the franchisee's reservation utility level k.

Having solved for the optimal royalty rate β, the franchise fee F will be chosen to extract all downstream profits. This implies that

$$F = (1 - \beta)X - V'(e^*) - k \tag{5.20}$$

which may be rewritten as

$$F = (1 - \beta)Ke^{*\gamma}r^{*\alpha} - k - \delta^e e^*. \tag{5.21}$$

In other words, while the royalty rate is independent of K, the franchise fee is positively related to K. Not surprisingly, the franchise fee also decreases with increases in the franchisee's reservation utility level, k, and with increases in his disutility of effort parameter, δ^e.

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