On the Implications of Interlinking Credit-Product Contracts in Franchising

Abstract

It is often observed that a number of franchisors provide financing to their franchisees who face credit rationing in the formal credit market. The introduction of financing into a franchise contract leads to an interlinking of contracts where more than one transactions are simultaneously agreed upon. In this paper we derive the optimal contract in the presence of such interlinking of credit and product contracts and analyze their efficiency implications.

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Introduction

It is commonly observed that a number of franchise companies provide financing to their franchisees. Entrepreneur Magazine's annual Franchise 500 provides a list of franchisors who provide such financing. 9 out of the top 10 franchises listed in Entrepreneur's 2000 annual Franchise 500, which includes Subway, Snap-on Tools, Jiffy-Lube, Seven-Eleven Convenience Stores, Radio Shack, GNC, Jackson Hewitt Tax Services, Sonic Drive-In Restaurants and Mail Boxes Etc., franchise their brand-name and provide some type of in-house financing to their franchisees. Such financing covers a wide variety of things including the franchise fee, loans to buy equipment, accounting and payroll services, payroll taxes, inventory etc. "With Minuteman Press, for example, 3M supplied the franchisees with all of their presses and then their finance division financed them." (Scott, 2000) One possible rationale for providing such financing is the fact that many potential franchisees face credit constraints, i.e. they are unable to borrow the amounts they need from formal credit institutions. As a result, left to their own devices, most franchise managers may not be able to undertake the optimal amount of investment in the production process. Scott (2000) points out in her article in *Franchise World* (pp. 27-41) that "smart franchisors are beginning to realize how their own efforts can influence the growth of the system. To that end, many are setting up financing programs to assist in new store acquisition, as well as a host of other expansion/upgrading programs. Moto Photo is a good example. ... One barrier to franchise sales has been the $300,000 plus price tag. Coupled with the fact that some stores won't become profitable until the third year of operation, high debt service on a mortgage can create a hefty cash flow burden for a fledgling owner. The Moto Photo QuickStart program lets a franchisee buy a store for an initial cash investment as low as $60,000. Moreover, Moto Photo finances $15,000 of the franchise fee for a franchisee's first store. A note for the $15,000 is signed by the franchisee at a little over nine percent interest for eight years. Moto Photo also will finance $7,500 of the franchise fee for additional stores."

The introduction of financing into a standard franchise contract gives rise to the existence of interlinkage where two or more interdependent exchanges are simultaneously agreed upon. On one hand providing financing to franchise managers may improve efficiency by increasing the amount of investment by franchise managers who may otherwise be credit-constrained. At the same time by interlinking credit and franchise contracts the franchisor can use the monopoly power in one market (ownership of the brand-name) to gain rents in the credit market. For excellent discussions on the implications of such interlinking in agrarian contracts see Braverman and Stiglitz (1982). Basu (1983, 1987) also provides interesting discussions on the subject.

In this paper we analyze the nature of inter-linked credit and franchise contracts and consider their efficiency implications. We introduce adverse selection in the model by allowing for two different productivity types - high and low - among potential franchisees. The franchisor has prior beliefs about the manager's type. We show that with a standard franchise contract i.e., where the franchisor only leases the brand-name to the manager the amount of investment is suboptimal for all types of managers, when the managers face credit rationing from formal credit institutions. Also there is no unique optimal revenue sharing arrangement between the franchisor and the manager. With interlinked credit and franchise contracts the highest type agent is charged a lower interest rate than the franchisor's opportunity cost with succeeding higher rates for lower types. The level of investment in an outlet is closer to first best under interlinked contracts. The optimal franchise contract will involve a strict revenue sharing arrangement between the franchisor and the manager of high type and in some cases for the low type manager as well

Section 2 introduces the basic structure of the model and the formal credit market. Section 3 presents the optimal standard franchise contract. Section 4 studies the nature of the optimal credit-franchise interlinked contracts and its implications for investment efficiency and output sharing. Section 5 concludes.

The Model

The economic environment consists of three kinds of agents. The first kind, referred to henceforth as the “franchisor” are owners of a brand-name or a franchise which has a certain market value. The second kind of agents work in a project for the franchisor to generate revenue. They are called “managers”. Finally we have the formal credit institutions called “banks”.

A: The Production technology

The revenue generated at a particular outlet depends on the amount of investment and the type of the manager operating the outlet. The managers could be of two productivity types (denoted by θ): high and low. With price normalized to 1, revenue can be written as,

$$Y_j = F(\theta_j; K) + \epsilon, \qquad \#$$

for $j = L, H$. L and H stand for the low type and the high type agents respectively. K denotes the amount of investment in the production process. ϵ is a random variable with continuous distribution over some interval $[\underline{\epsilon}, \bar{\epsilon}]$ denoted by $G(\epsilon)$ with $E(\epsilon) = 0$ for $j = L, H$ footnote . This random realization of the state of nature does not allow the franchisor to infer the amount of investment undertaken from the observed revenue. Therefore it is not possible to write contingent contracts on revenue from an outlet.

Assumption 1: *The revenue function is strictly increasing and concave with respect to investment for all types of agents. It satisfies standard Inada conditions. In addition* $\boldsymbol{F}'_H(\theta_H; K) > \boldsymbol{F}'_L(\theta_L; K)$, *for all* $K > 0$, *where* F' *denotes the partial derivative of the revenue function with respect to investment.*

A manager of higher productivity will be able to generate more revenue with the same amount of investment than a manager with lower productivity. Let p denote the proportion of high type managers in the population. Hence $(1 - p)$ is the proportion of low type managers.

Assumption 2: *The franchisor and the banks are risk neutral. Managers are risk averse deriving utility from wealth according to* $U(.)$, *which is same for agents of both types. Utility is assumed to be a monotonically increasing and strictly concave function of wealth, i.e.,* $U'(.) > 0$ *and* $U''(.) < 0$.

Let X denote the total capital of the franchisor and ρ the opportunity cost of investment. From the franchisor’s perspective the first-best level of investment in an outlet is given by

$$K_j^* = \arg\max_K \; E[F(\theta_j; K) + \epsilon + \rho(X - K)],$$

Its easy to check that the first-best level of investment in an outlet satisfies

$$F'_j(\theta_j; K) = \rho \, . \qquad \#$$

Our primary aim is to study the best option for a franchisor when the managers are credit constrained. So we will assume that the managers are unable to finance the first best level of investment from their own wealth. This forces them to go to private sector banks and/or the franchisor for financing. For simplicity we assume managers of both types do not possess any wealth for production. Their ability to provide collateral for loans are also identical.

B: The Credit market

The credit market consists of large number of banks who provide credit for investment. The banks are unable to distinguish between different types of managers due to various constraints. Let B denote the amount of credit provided by a bank to the manager for the operation of an outlet. Let $\pi(B)$ denote the bank’s subjective probability of default on loans. We assume that $\pi'(B) > 0$, which means that banks believe that the probability of default is higher on loans of larger size. Let r^s stand for the gross lending rate of the bank. Banks also have to monitor the borrowers to prevent strategic bankruptcy. Let the per unit cost of monitoring be denoted by η. Monitoring is costly hence banks will choose to monitor only when a manager claims bankruptcy as is the case in standard debt contracts. We assume that the formal credit sector is competitive and banks break even. Suppose r^d is the gross rate of interest that the banks have to pay to their depositors. Then the zero profit condition for banks can be written as

$$r^d B = (1 - \pi(B))r^s B - \pi(B)\eta B \; . \qquad \#$$

For simplicity we are assuming that in the event of the borrower defaulting on his loan, the bank's payoff is zero . The zero profit condition gives us the supply function of credit from the banks. We can alternatively write this condition as

$$r^s = \frac{r^d + \eta\pi(B)}{1 - \pi(B)} = \frac{r^d}{1 - \pi(B)} + \frac{\eta\pi(B)}{1 - \pi(B)} . \qquad \#$$

From above the rate of interest charged on a loan, r^s, is increasing in the size of the loan i.e.,

$$\frac{\partial r^s}{\partial B} = \frac{(r^d + \eta)\pi'(B)}{[1 - \pi(B)]^2} > 0 \; . \qquad \#$$

In the banking literature it has been noted that as the amount of money borrowed increases there is a greater incentive to default on loans. Hence when banks cannot monitor their borrowers they limit the amount of lending to an individual. In Stiglitz and Weiss (1981) such rationing takes the form of shutting out some firms from the formal credit market completely. However the situation we have in mind is the one posited by Gale and Hellwig (1985) where all borrowers are able to acquire loans but every borrower is rationed as to the amount they can borrow. The terms of the loan do not allow first best level of investment as the lending rate has a risk premium attached to it, making the interest rate charged on loans r^s, "too high" for both the low and high type managers.

This credit rationing arises from the fact that the lending institutions cannot perfectly monitor the borrowers. Also in the event of default these institutions, lacking intimate knowledge of the business, may have a harder time recovering the loan. When the financing is provided by the franchisor the moral hazard problem is reduced to a large extent due to a variety of factors. First the franchisor has first hand knowledge about the business. Moreover in the event of one franchise manager defaulting on the loan, the franchisor can often bring in another franchisee to take over the outlet. Also a large number of franchisors in awarding franchises select managers who are either past employees or have substantial experience in the business. Thus the franchisor is able to assess the potential franchisee's suitability much better than a commercial lending institution.

The Standard Franchise contract

We start with a standard franchise contract where the franchisor does not provide any financing to the manager. A standard franchise contract is a pair (α_j, β_j) where α_j is the franchise fee charged by the franchiser to the jth type of manager, $(1 - \beta_j)$ is royalty rate which is the share of the franchisor in the revenue of an outlet. These amounts are decided before any production activity. The actual payments are made after production takes place. We concentrate only on linear contracts between the franchisor and the manager as the largest majority of franchise contracts tend to be linear and they also satisfy the desirable optimality properties (see Bhattacharya and Lafontaine 1995). So the contracts we consider are such that the pay-off to the franchisor can be written as $\alpha + (1 - \beta)F(.,.)$.

The optimal contract can be

- a pure franchise fee contract if $\alpha > 0, \; \beta = 1$,

• a standard franchise contract with both a franchise fee and a royalty rate if $\alpha > 0,\ \beta \in]0,1[$, and

• a "wage" contract if $\alpha < 0,\ \beta = 0$.

Let B_j be the amount of credit borrowed by the manager of type j from the bank. Note that under

a standard franchise contract the only source of investment is from the banks, i.e, $K_j = B_j$. So in this part of our analysis the terms Investment (K) and Borrowing (B) are synonymous. Given an interest rate r^s charged by the bank the manager maximizes the following problem:

$$\max_{\{B\}} \quad E\{U[\beta_j F(\theta_j; B) - \alpha - r^s B_j]\},$$

Solution to this problem gives us the demand function for credit. The credit demand function derived from above can be written as:

$$EU'(.)[\beta_j F_j'(.) - r^s] = 0 \qquad \Rightarrow B_j = \Phi_j(r^s, \beta)$$

with j =L, H and $\Phi_j(r^s, \beta) = (F_j')^{-1}(\frac{r^s}{\beta})$. $\Phi_j(r^s, \beta)$ is a decreasing function of r^s and a increasing function of β.

Given the demand function for credit it follows that in equilibrium,

$$r^s = \beta_j F_j'(\theta_j; B)\ ; \qquad j = H, L. \qquad \#$$

Given a contract pair $(\alpha_j,\ \beta_j)$ the indirect utility function of the manager of type j is

$$V_j(\alpha, \beta, r^s) = E\{U[\beta_j F(\theta_j; \Phi_j(r^s, \beta_j))\ - \alpha - r^s \Phi_j(r^s, \beta_j)]\}; \qquad j = L, H,$$

with the following properties which we shall call [**P1**]:

$$\frac{\partial V_j(\alpha, \beta, r^s)}{\partial r^s} = EU'(.)(-\Phi_j(r^s, \beta_j)),$$

$$\frac{\partial V_j(\alpha, \beta, r^s)}{\partial \alpha_j} = -EU'(.),$$

$$\frac{\partial V_j(\alpha, \beta, r^s)}{\partial \beta_j} = EU'(.)F(\theta_j; .).$$

[P1] implies that the single crossing property is satisfied.

Proposition 1 *There exists a continuum of optimal contracts where* $\{(\alpha_j > 0, \beta_j > 0); j = H, L\}$. *A pure franchise fee contract* $\{(\alpha_j > 0, \beta_j = 1); j = H, L\}$ *is an optimal contract.*

Proof: See the appendix. [End Proof]

Proposition 1 states that there could be a continuum of optimal contracts. footnote A revenue sharing arrangement between the franchisor and the manager is not necessarily superior to a pure franchise fee contract. The royalty rate cannot be pinned down and in this setup it will perhaps depend on institutional factors such as what is considered to be a fair arrangement. However, in this regard we would like to point out that a pure franchise fee contract maximizes the amount of investment in an outlet as it does not distort the demand for credit from the manager.

Let us look at the optimal investment from a franchisor's point of view. The franchisor possesses X units of capital. We have denoted the return to holding this capital as ρ. It is a reasonable assumption that ρ is equal to r^d, the return paid by the banks to their depositors. We can state the following result.

Proposition 2 *Let* $\widetilde{B}_L$ *be the solution to* $F_L^{'}(\theta_L;B) = \frac{r^d+\eta\pi(B)}{1-\pi(B)}$. *If* $r^s(\widetilde{B}_L) = \frac{r^d+\eta\pi(\widetilde{B}_L)}{1-\pi(\widetilde{B}_L)} > \rho$ *then the amount of investment in outlets is sub-optimal for managers of both the high and low types*

Proof: See the appendix. [End Proof]

As noted before under a standard franchise contract the only source of investment is from banks i.e. $K_j = B_j$. The lending rate r^s will exceed rate paid to depositors r^d (and therefore the franchisor's opportunity cost ρ), for any probability of default that is greater than zero and less than one. This follows from the fact that we can write from above $r^s(\widetilde{B}_L) = \frac{r^d}{1-\pi(\widetilde{B}_L)} + \frac{\eta\pi(\widetilde{B}_L)}{1-\pi(\widetilde{B}_L)}$. The existence of the probability of default leads to the addition of a risk-premium to the lending rate. As long the interest charge by banks on their loans exceeds the franchisor's opportunity cost, there will be credit rationing to the franchise managers. The banking sector is unable to distinguish between managers of different types. As a result the high productivity manager also gets credit constrained as he has to pay an even higher rate of interest than the lower productivity manager. Since the investment in outlet will bring about increase in revenue from the outlet, the franchisor can gain by providing credit to the manager and interlinking the credit-franchise contract.

The Credit-Franchise interlinked contract

Next we consider the case where the franchisor provides financing to the managers. The franchiser has the option of charging the monopoly interest rate which would be "very high". However as we know from the industrial organization literature (see Tirole, 1988) the franchisor can actually increase his pay-off by asking for a two-part tariff instead of charging the monopoly interest rate. Interlinking the output and credit contracts allows him to do so. He can now charge a much lower rate of interest and then extract the entire consumer surplus from the agent through the fixed franchise fee and/or royalty rate. In this situation it will be profitable for the franchisor to offer credit to the agents and inter-link the two types of contracts; the terms of the franchise contract and the rate of interest charged on the loan.

The contract offered by the franchisor now is a triple (α_j, β_j, I_j) , $j = H,L,$ where α_j is the franchise fee charged by the franchiser to the $j$the agent, $(1-\beta_j)$ is royalty rate and I_j is the gross interest rate charged on loans. These amounts are decided before any production activity. The actual payments are made after production takes place.

Now the manager is able to borrow from the bank as well as the franchisor. Let C_j be the amount of credit provided by the franchisor to the manager of type j. If a manager is borrowing from the bank as well as from the franchisor then it must be the case that $r^s = I_j$; $j = H,L$. Given the demand function for credit it follows that,

$$r^s(B,r^d,\eta) = I_j = \beta_j F_j^{\prime}(\theta_j;C_j+B_j)\ ; \qquad j = H,L. \qquad \#$$

The total investment in an outlet $K_j = C_j + B_j,$ is the sum of borrowed funds from the franchisor and the bank. Agents can substitute between loans provided by the franchisor and the bank, provided they are willing to pay the required rate of interest. This degree of substitutability can be measured by carrying out the following exercise. Inverting the credit supply function we get

$$Bj = \tau(I_j)\ ; \qquad j = H,L, \qquad \#$$

where $\tau(.)$ is an increasing function of I_j. $\tau(.)$ measures the substitutability between the two kinds of credit. Suppose that the franchisor decides to raise his rate of interest, given the total demand for credit from the manager, the amount of loan that the manager takes from the franchisor falls and he tries to take as much loan as he can from the banks. However, as he tries to borrow more from the bank, the bank also charges him a higher interest rate. This process goes on until the bank interest rate and the franchisor's interest rates are the same and the manager is indifferent between the two sources of credit. Therefore, the amount of credit taken from bank increases by $\tau(.)$ due to an increase in franchisor's rate of interest.

Therefore, the manager's demand for credit from the franchisor is given by

$$C_j = \Phi_j(I_j,\beta_j) - \tau(I_j); j = H,L \qquad \#$$

and the indirect utility function of the managers are

$$V_j(\alpha,\beta,I) = E\{U[\beta_j F(\theta_j;\Phi_j(I_j,\beta_j)) - \alpha - I\Phi_j(I_j,\beta_j)]\}; \qquad j = L,H,$$

with the following properties which we shall call [**P2**]:

$$\frac{\partial V_j(\alpha,\beta,I)}{\partial I_j} = EU'(.)(-\Phi_j(I_j,\beta_j)),$$
$$\frac{\partial V_j(\alpha,\beta,I)}{\partial \alpha_j} = -EU'(.),$$
$$\frac{\partial V_j(\alpha,\beta,I)}{\partial \beta_j} = EU'(.)F(\theta_j;.).$$

Now we are in a position to state our main propositions.

Proposition 3 (**a**) *With an interlinked credit-franchise contract the high type manager is provided with optimal credit. The amount of investment by the high type manager solves* $F'_H(\theta_H;K^*_H) = \rho$. (**b**) *The interest rate charged to the high type manager* I^*_H *is less than the franchisor's opportunity cost* ρ. (**c**) *The optimal contract offered to the high type agent must involve revenue sharing i.e.,* $\beta^*_H < 1$.

Proof: See the appendix. [End Proof]

Proposition 4 *The credit given to the low type agent is sub-optimal. If* $p < \frac{\tau(I_L)}{\Phi_H(I_L)-\Phi_L(I_L)+\tau(I_L)}$ *then the optimal contract offered to the low type will involve sharing as well.*

Proof: See the appendix. [End Proof]

The amount of credit provided to low type manager is still suboptimal i.e., $F'_L(\theta_L;K^*_L) > \rho$. This happens because the franchisor is trying to make the manager's choose different types of contracts. However, its quite easy to check that in the worst case scenario the franchisor will provide no credit to the low type manager and the level of investment will be the same as in the standard franchise contract. The franchisor offers revenue sharing contract to the high type agent to get a part of the revenue generated from the high type manager's project.

Whether the franchisor offers a revenue sharing contract to the low-type manager or not depends on *p*, the franchisor's prior belief about the proportion of high-type managers in the population. Note that *p* is bounded from above by 1. If it is the case that the demand for credit coming from both the high and low type managers are identical i.e. $\Phi_H = \Phi_L$, then the low-type manager gets a sharing contract for any $p < 1$. However the demands for credit coming from the high and low type managers are different with the former demanding a higher level of credit. If $\Phi_H(.) - \Phi_L(.)$ is large then the low-type manager is offered a sharing contract only if *p* is "small".

With the interlinked credit and franchise contract the franchisor has more tools at his disposal to extract the informational rent from the franchise manager. This is because under the standard franchise contracts the only mechanism for extracting downstream rent is the franchisee fee while here the franchisor can use either the franchise fee or the interest rate. The interlinked contract will allow the franchisor to do at least as well as he did in pay-off terms as the standard franchise contract and in some cases strictly better.

Conclusion

In this paper we have analyzed the nature of inter-linked credit and product contracts in the context of franchising. We show what form the optimal contract will take. We show that providing financing to franchise managers who may otherwise face credit rationing from formal credit institutions leads to an increase in the level of investment. For high type managers we get optimal investment while for the low type the level of investment is at least as much if not higher with financing than without. We find that in the presence of such interlinkage the optimal contracts would involve output sharing between the franchisor and the high type manager in all cases and the franchisor and the low type manager is some cases. So any franchisor who provides financing to the franchise manager will not write a pure franchise fee contract but would rather use both the franchise fee and the royalty rate (output share). This last finding is interesting and significant in view of the large literature on sharecropping (See Singh, 1989 and Bhattacharya and Lafontaine, 1995) and the controversy regarding the frequent use of the output share in both tenancy contracts and franchising.

Appendix

Proof of Proposition 1

The franchisor's problem is

$$\max_{\{(\alpha_j,\beta_j);j=L,H\}} \quad p[\alpha_H + (1-\beta_H)Y_H] + (1-p)[\alpha_L + (1-\beta_L)Y_L] + \rho X\ ,$$

subject to

$$V_L(\alpha_L,\beta_L,r^s) \geq 0 \qquad (IR_L),$$

$$V_H(\alpha_H,\beta_H,r^s) \geq 0 \qquad (IR_H),$$

$$V_L(\alpha_L,\beta_L,r^s) \geq V_L(\alpha_H,\beta_H,r^s) \qquad (IC_L),$$

$$V_H(\alpha_H,\beta_H,r^s) \geq V_H(\alpha_L,\beta_L,r^s) \qquad (IC_H),$$

where IR_j and IC_j refer to the Individual Rationality and Incentive Compatibility conditions for manager types $j = L,H$ respectively. Using our single crossing property it is easy to show that at optimum only (IR_L) and (IC_H) will bind. We will omit a formal proof of this statement. The proof is simple and follows along the lines of Laffont and Tirole (1993) pp. 55-58. The Lagrangian for the franchisor's maximization problem is

$$\begin{aligned}\pounds = p[\alpha_H + (1-\beta_H)Y_H] + (1-p)[\alpha_L + (1-\beta_L)Y_L] + \rho X \\ + \lambda[V_L(\alpha_L,\beta_L,r^s)] + \mu[V_H(\alpha_H,\beta_H,r^s) - V_H(\alpha_L,\beta_L,r^s)]\end{aligned}$$

First order condition with respect to α_L, α_H using properties [**P1**]yields,

$$(1-p) - \lambda[\int U'(.)dG(\epsilon)] + \mu[\int U'(.)dG(\epsilon)] = 0, \qquad \#$$

and

$$p - \mu[\int U'(.)dG(\epsilon)] = 0. \qquad \#$$

Using (10) and (11) we get,

$$\mu = \frac{p}{EU'(.)}.$$

$$\lambda = \frac{1}{EU'(.)}.$$

In an optimal contract α_H is chosen such that IC_H binds and α_L is chosen such that IR_L binds. Let $\{(\hat{\alpha}_j > 0, \hat{\beta}_j > 0); j = H, L\}$ be an optimal contract. If $\hat{\beta}_L < 1$, it implies that a small increase in β_L will reduce the franchisor's expected payoff by $(1-p)F(\theta_L; \hat{B}_L)$. However an increase in β causes an increase in the utility of the low-type manager by $EU'(.)F(\theta_L; \hat{B}_L)$ from [**P1**]. This enables the franchisor to increase the franchise fee α_L such that IR_L binds again. Increase in α_L relaxes the IC_H constraint also. This enables the franchisor to raise α_H . The total increase in the franchisor's revenue from raising the franchise fee for both type of managers is given by the shadow price of the IR_L and IC_H constraints which is equal to $(1-p)F(\theta_L; \hat{B}_L)$. Therefore the franchisor can design a continuum of contracts which yields the same payoff for the franchisor. A pure franchise fee contract is therefore also an optimal contract. qed

Proof of Proposition 2

$\tilde{B}_L$ solves $F_L'(\theta_L; B) = \frac{r^d + \eta\pi(B)}{1-\pi(B)}$. This will be the maximum amount of investment by a manager of low type. This corresponds to the amount borrowed and invested if the low-type manager is given a pure franchise fee contract. Therefore the interest rate charged by the bank to the low-type manager will be $r^s(\tilde{B}_L) = \frac{r^d + \eta\pi(\tilde{B}_L)}{1-\pi(\tilde{B}_L)}$. If $r^s(\tilde{B}_L) > \rho$ it implies that the amount of investment in an outlet run by the low type manager is suboptimal. It follows that the interest rate charged to the high type manager is strictly greater as the demand for credit from the high type manager is higher. Hence investment in an outlet run by the high type manager is also sub-optimal. qed

Proof of Proposition 3

The franchisor's problem is

$$\max_{\{(\alpha_j,\beta_j,I_j);j=L,H\}} p[\alpha_H + (1-\beta_H)Y_H + (I_H - \rho)(\Phi_H(I_H, \beta_H) - \tau(I_H)]$$
$$+ (1-p)[\alpha_L + (1-\beta_L)Y_L + (I_L - \rho)(\Phi_L(I_L, \beta_L) - \tau(I_L))],$$

subject to

$$V_L(\alpha_L, \beta_L, I_L) \geq 0 \qquad (IR_L),$$

$$V_H(\alpha_H, \beta_H, I_H) \geq V_H(\alpha_L, \beta_L, I_L) \qquad (IC_H).$$

The Lagrangian for the franchisor's maximization problem is

$$£ = p[\alpha_H + (1-\beta_H)Y_H + (I_H - \rho)(\Phi_H(I_H, \beta_H) - \tau(I_H))] +$$
$$(1-p)[\alpha_L + (1-\beta_L)Y_L + (I_L - \rho)(\Phi_L(I_L, \beta_L) - \tau(I_L))]$$
$$+ \lambda V_L(\alpha_L, \beta_L, I_L) + \mu[V_H(\alpha_H, \beta_H, I_H) - V_H(\alpha_L, \beta_L, I_L)].$$

where λ and μ are multipliers associated with individual rationality constraint of the low type agent and the incentive compatibility of the high type agent respectively. First order condition with respect to α_L, α_H using properties [**P2**] yields similar values for λ and μ i.e,

$$\mu = \frac{p}{EU'(.)} \; .$$

$$\lambda = \frac{1}{EU'(.)} \; .$$

Differentiating the Lagrangian with respect to I_H and using property [**P2**] we get,

$$F'_H - \rho = \frac{(I_H - \rho)\tau'(I_H)\beta_H}{\Phi'_H(I_H,.)} + \frac{\tau(I_H)\beta_H}{\Phi'_H(I_H,.)} \; , \qquad \#$$

and first order condition with respect to β_H yields

$$(F'_H - \rho)\frac{-I_H\Phi'_H(I_H,.)}{\beta_H^2} = 0 \; . \qquad \#$$

Therefore in an optimal contract $F'_H(\theta_H;K^*_H) = \rho$ where $K^*_H = C^*_H + B^*_H$. Substituting in (12) we can solve for the optimal interest rate charged to the high type manager. This implies that the interest rate charged to the high type manager satisfies $I^*_H + \tau(I^*_H)/\tau'(I^*_H) = \rho$, which means that the interest rate charged to him is lower than ρ. The share of the manager in the output is $\beta^*_H = \frac{I^*_H}{\rho}$. This proves that the optimal contract between the company and the high-type manager must involve revenue sharing, i.e, $\beta^*_H \in (0,1)$ and is uniquely determined. The optimal franchise fee α_H can be solved by using IC$_H$ and IR$_{L.}$ qed

Proof of Proposition 4

In the problem faced by the franchiser the first order condition with respect to I_L gives us

$$[F'_L(\theta_L,K_L) - \rho]\frac{\Phi'_L(I_L,.)}{\beta_L} - (I_L - \rho)\tau'(I_L) - \tau(I_L) \qquad \#$$
$$= -\frac{p}{(1-p)}[\Phi_H(I_L,.) - \Phi_L(I_L,.)] \; ,$$

and first order condition with respect to β_L gives us

$$[F'_L(\theta_L,K_L) - \rho] = -\frac{p\beta_L^2}{(1-p)\Phi'_L(I_L,.)I_L}[F(\theta_H,K_L) - F(\theta_L,K_L)] \qquad \#$$

Notice the right hand side is strictly positive unless $\beta_L = 0$. Since we are ruling out “wage” contracts $\beta_L \neq 0$. $\beta_L = 0$ only for a “wage” contract (company-ownership). Thus the solution to this expression will yield $F'_L(\theta_L,K_L) > \rho$ which proves our assertion that the amount of investment by the low type manager is sub-optimal. Now suppose $p < \frac{\tau(I_L)}{\Phi_H(I_L) - \Phi_L(I_L) + \tau(I_L)}$. We want to show that in an optimal contract for the low type agent β_L cannot be 1. Suppose not i.e., $\beta^*_L = 1$. Then from the demand for credit of low type manager, equation (14) reduces to

$$(I_L - \rho) = \frac{-\frac{p}{(1-p)}[\Phi_H(I_L) - \Phi_L(I_L)] + \tau(I_L)}{\Phi'_L(I_L) - \tau'(I_L)} \; .$$

Substituting in (15) we get

$$\frac{-\frac{p}{(1-p)}[\Phi_H(I_L) - \Phi_L(I_L)] \ + \tau(I_L)}{\Phi_L'(I_L) - \tau'(I_L)} = -\frac{p}{(1-p)\Phi_L'(I_L)}[F(\theta_H, K_L) - F(\theta_L, K_L)].$$

The right hand side is always positive. The denominator in the left hand side is always negative. Now consider $-\frac{p}{(1-p)}[\Phi_H(I_L) - \Phi_L(I_L)] \ + \tau(I_L) = \frac{p}{(1-p)}\Phi_L(I_L) - \frac{p}{(1-p)}\Phi_H(I_L) + \tau(I_L) > 0$ if $p < \frac{\tau(I_L)}{\Phi_H(I_L) - \Phi_L(I_L) + \tau(I_L)}$. Hence the above expression does not have a solution. We have a contradiction. qed

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