



Optimal Monetary Provisions and Risk Aversion in Plural Form Franchise Networks A Model of Incentives with Heterogeneous Agents

Muriel Fadairo, Cintya Lanchimba, Miguel Yangari

► To cite this version:

Muriel Fadairo, Cintya Lanchimba, Miguel Yangari. Optimal Monetary Provisions and Risk Aversion in Plural Form Franchise Networks A Model of Incentives with Heterogeneous Agents. 2016. halshs-01251344v2

HAL Id: halshs-01251344

<https://shs.hal.science/halshs-01251344v2>

Preprint submitted on 11 Jan 2016

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

WP 1602 – January 2016

Optimal Monetary Provisions and Risk Aversion in Plural Form Franchise Networks A Model of Incentives with Heterogeneous Agents

Muriel Fadaïro, Cintya Lanchimba, Miguel Yangari

Abstract:

Existing literature on franchising has extensively studied the presence of plural form distribution networks, where two types of vertical relationships - integration versus franchising - co-exist. However, despite the importance of monetary provisions in franchise contracts, their definition in the case of plural form networks had not been addressed.

In this paper, we focus more precisely on the “share parameters” in integrated (company-owned retail outlet) and decentralized (franchised outlet) vertical contracts, respectively the commission rate and the royalty rate.

We develop an agency model of payment mechanism in a two-sided moral hazard context, with one principal and two heterogeneous agents distinguished by different levels of risk aversion. We define the optimal monetary provisions, and demonstrate that even in the case of segmented markets, with no correlation between demand shocks, the two rates (commission rate, royalty rate) are negatively interrelated.

Keywords:

Franchising, dual distribution, royalty rate, commission rate, moral hazard

JEL codes:

L14, D82

**Optimal Monetary Provisions and Risk Aversion
in Plural Form Franchise Networks
A Model of Incentives with Heterogeneous Agents**

Muriel Fadairo

Université de Lyon, Lyon F- 69007, France
CNRS, GATE L-SE, Ecully, F- 69130, France
Université J. Monnet, Saint-Etienne, F- 42000, France

Email: muriel.fadairo@univ-st-etienne.fr

Cintya Lanchimba

National Polytechnic School
Quito, Ecuador &
Université de Lyon, Lyon F- 69007, France
CNRS, GATE L-SE, Ecully, F- 69130, France
Université J. Monnet, Saint-Etienne, F- 42000, France

Email: cintya.lanchimba@epn.edu.ec

Miguel Yangari

National Polytechnic School
Department of Applied Mathematics
Quito, Ecuador

Email: miguel.yangari@epn.edu.ec

Abstract

Existing literature on franchising has extensively studied the presence of plural form distribution networks, where two types of vertical relationships - integration *versus* franchising - co-exist. However, despite the importance of monetary provisions in franchise contracts, their definition in the case of plural form networks had not been addressed.

In this paper, we focus more precisely on the “share parameters” in integrated (company-owned retail outlet) and decentralized (franchised outlet) vertical contracts, respectively the commission rate and the royalty rate.

We develop an agency model of payment mechanism in a two-sided moral hazard context, with one principal and two heterogeneous agents distinguished by different levels of risk aversion. We define the optimal monetary provisions, and demonstrate that even in the case of segmented markets, with no correlation between demand shocks, the two rates (commission rate, royalty rate) are negatively interrelated.

Keywords:

Franchising, dual distribution, royalty rate, commission rate, moral hazard.

JEL codes:

L14, D82

1 Introduction

This paper deals with the contractual design in franchise networks. Franchising can be defined as a vertical contractual relationship between two independent firms, an upstream unit, the franchisor, and a downstream unit, the franchisee. With the contract, the franchisor allows the franchisee to use his brand name, business format and know-how, in exchange for compensation, royalties and/or up-front fee. This organizational form is present in many economic sectors, and widespread internationally.

Most of the franchised networks are mixed systems where company-owned units coexist with franchised units¹. For example, statistics from the Bond's guide² highlight the predominance of mixed systems in North American franchising (74% in 2014). A similar situation is observed in other countries like Brazil (77% of the franchised networks in 2012 would be mixed networks, according to the Brazilian franchising association), France (with 65% of mixed networks in this country, according to the the most recent statistics of the National institute of statistics and economic studies, in 2007), or Venezuela (with 67% of mixed networks in 2012 according to the Venezuelan chamber of franchises). In addition, Lafontaine and Shaw (2005) provided evidence that dual distribution is not a transitory phenomenon, as the proportion of company-owned outlets remains relatively stable in mature franchised chains.

Consequently, dual distribution is the focus of an important stream of literature, in economics and strategic management (e.g. Gallini and Lutz, 1992 ; Bai and Tao, 2000 ; Sorenson and Sorensen, 2001 ; Srinivasan, 2006 ; Dant et al., 2008 ; Bürkle and Posselt, 2008 ; Perrigot et al., 2009 ; Hendrikse and Jiang, 2011 ; Perryman and Combs, 2012).

Contractual design is another important issue regarding franchising (Lafontaine, 1992 ; Brickley, 2002 ; Vazquez, 2005 ; Gonzalez-Diaz and Solis-Rodriguez, 2012a;

¹“Mixed networks”, “plural form” organization or “dual distribution” are used as synonymous and refer to the simultaneous presence of both franchised and company-owned outlets in the same network.

²The Bond's Franchise Guide is the main source of secondary data regarding franchising in the U.S.A and Canada.

Maruyama and Yamashita, 2012). Particular attention is paid to the royalty rate. Indeed, the royalty rate is a determinant monetary provision, defining the “share-contract”, that is the conditions under which the profit generated by the decentralized vertical structure is shared between the franchisor and the franchisee. For this reason, this contractual provision plays a central role as incentive device.

However, despite the importance of mixed networks and of monetary devices in franchise contracts, these subjects are the matter of two separate fields of literature. The aim of this article is to fill this gap. We provide a model of monetary provisions in the case of a plural form franchise network.

This paper builds upon Bhattacharyya and Lafontaine (1995)’s model, which remains a central reference in the literature dealing with monetary devices in franchise contracts. The two authors study formally the franchisor-franchisee relationship as a two-sided moral hazard problem, and define the optimal contract based on the royalty rate.

In this theoretical framework, we introduce the assumption of a mixed network. The incentive problem concerns then two types of agents, the manager of a company-owned unit and the franchisee. We study how the franchisor can contractually encourage both types of agents to achieved the best non-observable effort, in a risk environment associated to the variation of sales at the retail unit level. The agents are distinguished by different levels of risk aversion.

In this paper we do not aim at providing an exhaustive theory of the dual system, but we assume it as given. We consider a situation where a firm has conceived a new concept. Before delegating part of the business, it has developed his activity through an integrated retail outlet. Once the product has matured in the market, the firm becomes a franchisor, delegating part of the retail activity to an independent unit - the franchisee. Hence, at a certain point of time, the sales of the structure are undertaken by both company-owned and independent retail units. Within this dual structure, we are interested by the determination of the optimal monetary provisions. At this regard, we make use of the agency theory and study an environment where the volume of sales of each unit is affected by a non-verifiable effort and by a random component relating to the environmental risk. Since the effort level cannot be made

part of the contract, the equilibrium monetary provisions will aim at providing incentives to the retailing units, and to the franchisor, to exert valuable efforts.

We demonstrate that at the equilibrium of monetary provisions regarding the independent outlet and the company-owned unit - respectively, the royalty rate and the commission rate - both monetary devices are interdependent and negatively related.

The remaining of the paper is organized as follows. After a short literature review (section 2), we present the formal model (section 3). We then proceed to the formal analysis (section 4). In order to study the interdependencies between the rates and how the equilibrium monetary provisions differ from optimality, we begin by introducing a benchmark situation where the provision of effort can be part of the contract designed by the franchisor. Our conclusion sums up the main findings and provides suggestions for further research (section 5). All the proofs are relegated to the appendix section.

2 Related Research

Given that this paper investigates monetary provisions in dual distribution with a double-sided moral hazard environment, it is related to three streams of literature: (a) agency theory, and more precisely moral hazard theory of franchising, (b) plural form distribution networks, (c) contractual design, and more precisely monetary provisions in franchise contracts.

The first stream of literature is the main theoretical background in the study of franchising. Indeed, franchising represents a rich context for investigating inter-organizational precepts and phenomena, due to its particular structure and its behavioral aspects. The nature of franchising allows for different vertical relationships inside the network. The relevance of agency theory in the study of vertical restraints is now widely accepted on the basis of initial contributions of Mathewson and Winter (1984, 1985) and Rey and Tirole (1986a, b). The agency framework has generated a large amount of literature dealing with franchising (e.g. Lafontaine and Slade, 2007 ; Barthél my, 2011 ; Etro, 2011 ; Gonzalez-Diaz and Solis-Rodriguez, 2012b ;

Perryman and Combs, 2012).

Agency literature of franchising examines the bilateral contract relationship between an upstream firm and a retailer within a distribution network. The contract thus creates an agency relationship because the upstream firm gives the downstream party a mandate for the commercial exploitation of its brand. The principal (the upstream firm, i.e. the franchisor) designs the contract, and the retailer may either accept or reject the contract. Contracts are uniform within the same network; the analysis refers thus to the representative contract. A moral hazard emerges downstream, as the retailers effort affects the profit function of the principal, who cannot observe this effort. However, franchising being based on renting the upstream firm's brand name, a moral hazard can also be considered upstream since retail sales depend on the franchisor's effort in promoting the brand and network reputation. The downstream firm (the franchisee) cannot fully observe the effort made by the franchisor while it suffers the consequences.

The second stream includes studies that account for the contract-mix (franchised and company-owned units) in the same network. Since Caves and Murphy (1976), capital constraint is a main argument to explain the presence of franchised units in distribution networks. Franchisees are seen as financial and human capital providers, enabling a fast and wide development of the network. In addition with the resource-based view, dual distribution is explained in the framework of agency theory, in terms of monitoring costs, signaling, or complementarity between the two types of units.

With the unilateral moral-hazard framework, that is moral hazard on the downstream side, an essential determinant of the extent of franchising in the network is the cost of monitoring the downstream units and maintaining control over the system. Control cost rises disproportionately with the increasing growth of the system, especially into more distant territories. For each new retailer, the upstream firm faces a choice about the way it will expand the network: company-owned unit *versus* independent retailer with a vertical contract as franchising. This choice reflects a trade-off between incentive and control. In the moral hazard context, higher incentives come from independent retailers, but better control is possible with inte-

grated units. The upstream choice concerning each downstream unit is motivated by the local conditions regarding the monitoring cost. Thus the contract-mix in the network is the result of localized decisions. This view finds empirical support in the econometrical literature on franchising data (Brickley and Dark, 1987 ; Brickley, 1999; Arrunada et al., 2001; Barthélémy, 2011).

Other interesting explanation of dual distribution is proposed by Gallini and Lutz (1992) in terms of signal. In a context of information asymmetry relating to the value of the upstream firm's brand name, these authors consider two types of franchisors (good type *versus* bad type), and demonstrate formally that good type franchisors can signal their type, and therefore provide relevant information to potential future franchisees. The signal devices are organizational forms that make the franchisor's revenue highly dependent upon the performance of the business concept ; like dual distribution. Lafontaine (1993) using US data and the predictions deriving from Gallini and Lutz (1992)'s seminal theoretical model of signal in franchising demonstrated that signaling theory is not quite appropriate to study franchising.

Finally, plural form networks are analyzed based on the complementarity between franchised and company-owned outlets. More than the result of localized choices relating to monitoring costs, or the result of signaling issues, dual distribution can be a global strategy of the upstream firm, which maximizes the synergies between the two types of retail units. In line with this view, Bai and Tao (2000) adapt the Holmstrom and Milgrom (1991)'s multitask model to study retailing as a two-task activity requiring i) an effort to maintain the brand name value and ii) an effort to sale. They argue that franchisees are better in performing the second task as their revenue depends on sale results, while the managers of company-owned units have a fixed wage. On the other hand, company-owned units are better in maintaining the brand value. Drawing thus attention on the complementarities between the two types of retail units, Bai and Tao (2000) analyze their coexistence in the network as a strategy which allows the franchisor to take advantage of the special feature of each type of unit. Sorenson and Sorensen (2001) support the idea of complementarities into the dual networks, while Mitsubishi *et al.* (2008), Perrigot *et al.* (2009), Hendrikse and Jiang (2011), show that dual distribution, as a governance

form, is more efficient than the others.

The third stream of literature considers monetary clauses and more particularly the share-parameter, that is the royalty rate. As discussed earlier, past research have focused on pure franchise systems.

In a context of unilateral moral hazard, that is on the franchisee side, the status of total residual claimant is the most effective incentive mechanism for the downstream firm. In this case, the share-contract includes an up-front fee and no royalties. Once the entry fee is paid, the retailer captures the totality of the results of its sale effort. Yet, royalties are common in distribution contracts. In the agency framework, the presence of royalties has two justifications. The first one, initially proposed by Martin (1988), concerns the need to insure the downstream firm against risk, namely, the hazard on the level of the final demand. Here the share contract defined by the royalty rate corresponds to a level of risk sharing.

The second justification concerns incentives in the context of bilateral moral hazard. Then, the franchise contract also has to contain an incentive mechanism for the upstream firm. The two-sided moral hazard requires ongoing payments to the franchisor to motivate its efforts in promoting the network reputation throughout the duration of the relationship. This bilateral moral hazard situation is the primary theoretical justification for profit-sharing contracts in distribution. This theory has developed since the seminal article of Mathewson and Winter (1985), who proposed the first formal analysis of franchise agreements in the framework of agency theory. This notion was augmented by Lal (1990), and by Bhattacharyya and Lafontaine (1995). The explanation of royalties in terms of bilateral moral hazard finds support in the econometric literature on franchise data (Lafontaine, 1992; Agrawal and Lal, 1995; Brickley, 2002; Vazquez, 2005).

Our paper targets at conciliating both last presented strands of the literature, studying optimal monetary provisions in a dual distribution context. Assuming as given the plural form system, we analyze how those provisions are determined, and their possible interdependence relationship.

3 The Model

3.1 Baseline statements

We consider a two-sided moral hazard model of intra-brand competition with an exogenous downstream market structure, composed by a franchisee, denoted by (f) , and a company-owned unit denoted by (m) ³. Territorial exclusivity is afforded to each retail unit. Hence there is no direct interaction between the two outlets. We further assume that the retailing units are price takers. They can only influence demand or the volume of sales through a non verifiable effort. The network organizational structure is represented by Figure 1.

Our objective is to determine the optimal monetary provisions of the system, more precisely, the optimal royalty and commission rates.

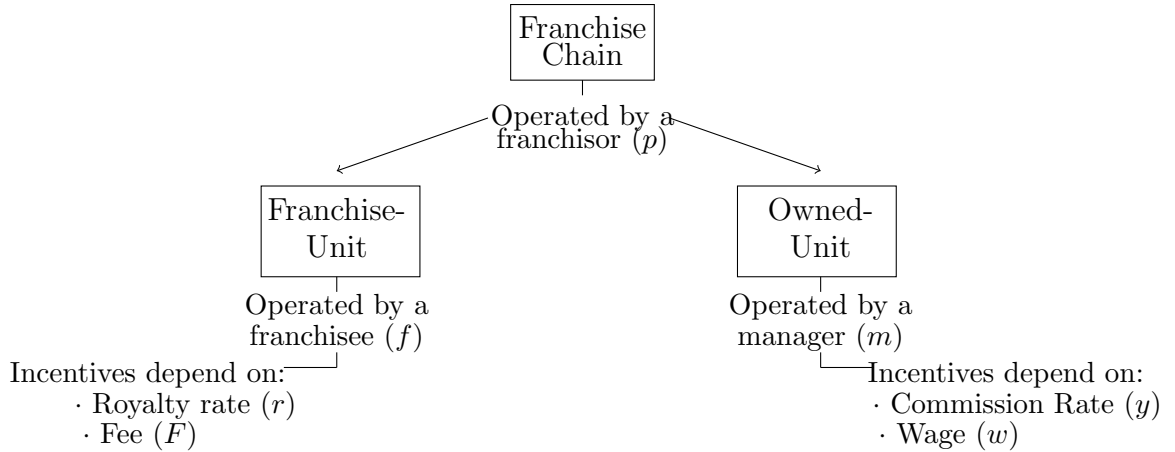


Figure 1

We model a static game with the following general scheme. First, the principal, i.e. the franchisor, designs a specific contract for each retail unit. The agents, i.e. the franchisee and the manager, decide whether or not to accept the contracts. The game ends if none of them accepts.

³We focus on the “representative” retail units, assuming that if more outlets are present in the network, all the franchised outlets are similar and all the integrated outlets are similar.

If the contracts are accepted, all the players, i.e. the principal and the two agents, provide a non-verifiable effort affecting the volume of sales on the market. The effort levels are chosen given the contracts that have been signed. However, for each player, the provided effort level is a free decision since effort is not a contracted variable. Once efforts had been made, the nature determines the state of the world, which is defined as a random shock affecting the demand realization in the two market-segments independently. Finally, the game outcome is achieved and the payoffs are executed according to the terms of the contracts.

As the effort levels cannot be part of the contract because they are not observable, and due to the random realization of demand, the franchisor's problem is to design a contract providing effort incentives for all the players. The time-schedule of the game is summarized in Figure 2.

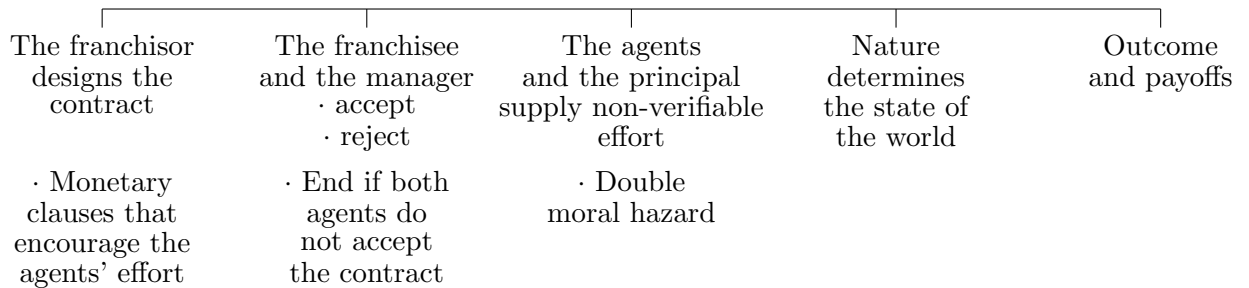


Figure 2

3.2 Risk and effort issues

We assume that the principal and the agents are risk-averse, with constant risk aversion. Their utility is expressed by $u(I) = -\exp(-\rho I)$, where I denotes the income and ρ is the coefficient of absolute risk aversion. In this context of risk aversion, the objective of each player is to maximize the certainty equivalent income:

$$CE = E(I) - R \quad (3.1)$$

where $E(\cdot)$ is the expectation operator and R denotes the risk premium.

Because the franchisor has constant absolute risk aversion, the risk premium equals:

$$R_p = \frac{\rho}{2} \text{Var}(I) \quad (3.2)$$

where ρ denotes the coefficient of absolute risk aversion, and $\text{Var}(I)$ the variability of income.

Considering that the franchisee is less risk averse than the manager, in all the cases, we assume that $\rho_{m(m)} > \rho_{f(M)}$, i.e. the minimum manager's coefficient of risk aversion is greater than the highest franchisee's coefficient of risk aversion.

Each retailer sells the franchisor's products. The franchisor produces at no cost. We normalize the selling price at 1. To generate sales at the outlet level, each retailer has to undertake a costly effort $e \geq 0$. The franchisor's effort increases sales of both retail units simultaneously. In addition with the effort of each player, the volume of sales is affected by a random component ϵ , that is a demand shock that none of the players is able to control. This uncertain environment precludes each player from inferring the effort levels of the other players from the observed volume of sales and gives scope to the moral hazard problem.

Sales volumes, respectively for the franchisee and the manager, are then:

$$S_f(e_f, e_p) = \alpha e_f + \frac{\delta e_p}{2} + \varepsilon_f \quad (3.3)$$

$$S_m(e_m, e_p) = \beta e_m + \frac{\delta e_p}{2} + \varepsilon_m \quad (3.4)$$

where α, β and δ are exogenous demand parameters representing the effort influence on sales volumes. The sales of each outlet are only affected by the outlet effort (franchisee or manager's effort) and by the franchisor's effort which benefits equally to both retail units. Hence, we assume that there is no effort externality between the outlets, while the franchisor's effort to promote the network works as a public good in the system. The random variable ε_j follows a normal distribution $\varepsilon_j \sim N(0, \theta_j^2)$ for $j = f, m$. In addition, we assume that the cost of effort is increasing, convex, and the same for all the players:

$$C(e) = \frac{e^2}{2} \quad (3.5)$$

Introducing the cost of effort in equation (3.1), we obtain the certainty equivalent for each player:

$$CE_i = E(I_i) - R_i - \frac{e_i^2}{2} \quad \text{for } i = p, m, f \quad (3.6)$$

Regarding the parameters of the model, we make the following assumptions that will be used for the analysis.

Assumption 1. *The parameter of lost aversion for the franchisee is such that*

$$\rho_{f(M)} - \rho_{f(m)} = \frac{(\rho_{f(M)} + \rho_p)^2}{6} > \frac{2}{3}\rho_p.$$

Assumption 2. *The parameter of lost aversion for the manager is such that $\rho_{m(M)} -$*

$$\rho_{m(m)} = \frac{(\rho_{m(M)} + \rho_p)^2}{6} > \frac{2}{3}\rho_p.$$

In order to ensure an equilibrium, we assume the following:

Assumption 3.

$$((\rho_p + \rho_{f(M)})\theta_f^2 + \frac{\delta}{2} + \alpha^2)^2 = 6(\rho_{f(M)} - \rho_{f(m)})\theta_f^2(\alpha^2 + \rho_p\theta_f^2 - \frac{e_m}{2}\frac{\delta}{\beta})$$

Assumption 4.

$$((\rho_p + \rho_{m(M)})\theta_m^2 + \frac{\delta}{2} + \beta^2)^2 = 6(\rho_{m(M)} - \rho_{m(m)})\theta_m^2(\beta^2 + \rho_p\theta_m^2 - \frac{e_f}{2}\frac{\delta}{\alpha})$$

The aim of the franchisor is to design contracts which incite the agents to make costly effort maximizing their certainty equivalent.

As demonstrated by Bhattacharyya and Lafontaine (1995), the analysis can be restricted to linear contracts without loss of generality. In addition, evidence regarding relatively simple and often linear payment rules is rather extensive.

Assumption 5. *Contracts have the following form: $\{F, x\}$, where F is a fixed payment and x is an output-based rate.*

Using linear contracts, the risk premium for three players is defined as follows:

$$R_f = \frac{1}{2}(r\rho_{f(M)} + (1-r)\rho_{f(m)})Var((1-r)\theta_f) \quad (3.7)$$

$$R_m = \frac{1}{2}((1-y)\rho_{m(M)} + y\rho_{m(m)})Var(y\theta_m) \quad (3.8)$$

$$R_p = \frac{\rho_p}{2}Var(r\theta_f + (1-y)\theta_m) \quad (3.9)$$

Hence, the risk premium associated with the franchisee depends on the coefficient of risk aversion, which can vary between the minimum “ $\rho_{f(m)}$ ” and the maximum “ $\rho_{f(M)}$ ”, the percentage of revenue assigned to him $(1-r)$, and the variance in sales denoted by θ_f . Similarly, the manager’s risk premium depends on the coefficient of risk aversion, which can vary between “ $\rho_{m(m)}$ ” and “ $\rho_{m(M)}$ ”, the percentage of revenue assigned to him (y) , and the variance in sales θ_m . Lastly, the franchisor’s risk premium $(r, (1-y))$ is based on the two percentages that he receives, and on the variance in sales of both retailing units.

By reformulating the equations for the certainty equivalent, we obtain for the franchisor:

$$CE_p = r \left(\alpha e_f + \frac{\delta e_p}{2} \right) + (1-y) \left(\beta e_m + \frac{\delta e_p}{2} \right) + F - \frac{e_p^2}{2} - w - \frac{\rho_p}{2} (r^2\theta_f^2 + (1-y)^2\theta_m^2 + 2Cov(\theta_f r, \theta_m(1-y))) \quad (3.10)$$

The first and the second parts of the expression represent the income provided by the franchisee and by the manager, depending on their effort and on the franchisor’s effort. The last component is the cost for the franchisor, composed of the risk premium and the cost of effort.

The certainty equivalent for the franchisee, depending negatively on the royalty

rate (r), the fixed fee (F) he has to pay to the franchisor, the risk premium and the cost of effort, is reformulated as follows:

$$CE_f = (1 - r) \left(\alpha e_f + \frac{\delta e_p}{2} \right) - F - \frac{e_f^2}{2} - \frac{1}{2} (r \rho_{f(M)} + (1 - r) \rho_{f(m)}) (1 - r)^2 \theta_f^2 \quad (3.11)$$

Finally, the certainty equivalent for the manager, depending positively on the wage (w) and the commission rate (y) received from the franchisor, and negatively on the risk premium and the cost of effort is:

$$CE_m = w + y \left(\beta e_m + \frac{\delta e_p}{2} \right) - \frac{e_m^2}{2} - \frac{1}{2} ((1 - y) \rho_{m(M)} + y \rho_{m(m)}) y^2 \theta_m^2 \quad (3.12)$$

4 Analysis

4.1 The franchisor's problem

In franchise systems, the franchisor is typically responsible for promoting the chain. Franchisees and managers are responsible for managing the outlets on a day-to-day basis. The downstream and upstream efforts affect the outlet performance. However, the effort levels are not easily monitored.

On this basis, the franchisor's problem can be expressed as follows:

$$\begin{aligned}
 Max_{[r,y,w,F,e_p]} CE_p = & \underbrace{r \left(\alpha e_f + \frac{\delta e_p}{2} \right) + F}_{\text{Income from franchised unit}} + \underbrace{(1-y) \left(\beta e_m + \frac{\delta e_p}{2} \right) - w}_{\text{Income from company-owned unit}} - \underbrace{\frac{e_p^2}{2}}_{\text{Cost}} \\
 & - \underbrace{\frac{\rho_p}{2} Var(r\theta_f + (1-y)\theta_m)}_{\text{Franchisor's risk aversion}},
 \end{aligned}$$

subject to:

$$\begin{aligned}
 (i) \quad CE_m &= w + y \left(\beta e_m + \frac{\delta e_p}{2} \right) - \frac{e_m^2}{2} - \frac{1}{2}((1-y)\rho_{m(M)} + y\rho_{m(m)})y^2\theta_m^2 \geq 0 & (IR_m) \\
 (ii) \quad CE_f &= (1-r) \left(\alpha e_f + \frac{\delta e_p}{2} \right) - F - \frac{e_f^2}{2} - \frac{1}{2}(r\rho_{f(M)} + (1-r)\rho_{f(m)})(1-r)^2\theta_f^2 \geq 0 & (IR_f) \\
 (iii) \quad \frac{d(CE_p)}{de_p} &= r\frac{\delta}{2} + (1-y)\frac{\delta}{2} - e_p = 0 & (IC_p) \\
 (iv) \quad \frac{d(CE_f)}{de_f} &= (1-r)\alpha - e_f = 0 & (IC_f) \\
 (v) \quad \frac{d(CE_m)}{de_m} &= y\beta - e_m = 0 & (IC_m)
 \end{aligned}$$

Conditions (i) and (ii) are the participation constraints. These conditions must be met for the manager and the franchisee accept the contracts. We normalize to zero the outside option of both agents. The last three conditions are the incentive constraints affecting the effort levels. Since effort variables in the model are continuous, we use the first-order approach.

In the following, we focus first on the case of symmetric information, to highlight in a second step the specific features of the case with asymmetric information.

4.2 Case 1: Symmetric information

In case of symmetric information, i.e. when all the players have the same information, both before establishing the contract and during the relationship, efforts are observable and contractable. Then, the optimal monetary provisions depends only on risk aversions, as expressed by proposition 1:

Proposition 1. *When all relevant information is verifiable, optimal monetary provisions depend only on the degree of risk aversion of the players. Thus,*

$$r^* = 1 - \sqrt{\frac{2\rho_p}{3(\rho_{f(M)} - \rho_{f(m)})}} \quad y^* = \sqrt{\frac{2\rho_p}{3(\rho_{m(M)} - \rho_{m(m)})}}$$

Because the effort level is part of the contract designed by the franchisor, the distribution of risk between the players depends only on the relative absolute risk aversions. Then, optimality requires that lower is the risk aversion of a player, compared to the others, higher is the risk he bears. Since in the specific case of symmetric information, there is no need to provide incentives to induce effort, the franchisor's maximization problem is only based on the participation constraints (Appendix A).

The royalty and commission rates act as insurance devices. If the franchisor's risk aversion increases, he will prefer a safer payment mechanism to extract the surplus of the franchised unit. Therefore, he will set a higher up-front fee and a lower royalty rate, as the rate depends on uncertain sales. In addition, to extract income from the company-owned unit, the franchisor will prefer to pay a lower wage with a higher commission rate. If the franchisee's risk aversion increases, he will prefer a payment mechanism based on a higher royalty rate and a lower up-front fee. This is a way to share with the franchisor the risk related to sales. Finally, if the manager's risk aversion increases, he will prefer a higher fixed wage in addition with a lower commission rate related to the uncertain sales on the downstream market.

4.3 Case 2: Asymmetric information

We focus now on the case where efforts are not observable and they can not be part of the contracts. In this case, our game is subject to moral hazards, and the contracts designed by the franchisor have to provide incentives in order to promote the three players' effort. The correlation between the events of the two segment-market is set at zero⁴.

In this case, the optimal monetary provisions do not only depend on the relative risk aversions, and have to vary according to the obtained outputs. Therefore, the franchisor's maximization problem depends now on the participation and on and the incentive constraints (Appendix B). We obtain the following proposition:

Proposition 2. *With non contractible efforts and uncorrelated events $Cov(\theta_f, \theta_m) = 0$, the monetary provisions are interdependent, negatively related, and equal to:*

$$r^* = 1 - \sqrt{\frac{2(\alpha^2 + \rho_p \theta_f^2 - \frac{e_m \delta}{2\beta})}{3(\rho_{f(M)} - \rho_{f(m)})\theta_f^2}} \quad y^* = \sqrt{\frac{2(\beta^2 + \rho_p \theta_m^2 - \frac{e_f \delta}{2\alpha})}{3(\rho_{m(M)} - \rho_{m(m)})\theta_m^2}}$$

As in the previous case, the royalty and commission rates depend on the relative absolute risk aversion of the three players. However, because of the bilateral moral hazard, they now depend also on the efforts provided by the agents and by the franchisor.

Thus, if the manager's effort generates more sales, the principal must incite this effort with a higher commission rate. The same reasoning applies for the franchisee. In this case, the incentive mechanism is a reduction of the royalty rate. Finally, the incentive devices for the franchisor's effort are a higher royalty rate and a lower commission rate. This generates an inefficient distribution of risk, but allows for promoting incentives for the players to make greater effort.

An interesting result is that the monetary provisions are interrelated, even if the demand shocks on the segment markets are not correlated. This result is explained by the franchisor's effort, acting as a public good for both retailing units⁵.

⁴This implies that:

$R_p = \frac{\rho_p}{2} Var(r\theta_f + (1-y)\theta_m) = \frac{\rho_p}{2} (r^2\theta_f^2 + (1-y)^2\theta_m^2 + 2Cov(\theta_f r, \theta_m(1-y)) y Cov(\theta_f r, \theta_m(1-y))) = 0$

⁵Complementary results available upon request show that with correlated events $Cov(\theta_f, \theta_m) \neq 0$, the optimal provisions are interdependent but higher than in the case with no correlation.

5 Conclusion

Existing literature on franchising has extensively studied the presence of mixed distribution networks. However, despite the importance of monetary provisions in franchise contracts, their definition in the case of plural form networks had not been addressed.

In this paper, we focus more precisely on the “share parameters” in integrated (company-owned retail outlet) and decentralized (franchised outlet) vertical relationships, respectively the commission rate and the royalty rate.

We develop an agency model of payment mechanism in a two-sided moral hazard context, with one principal and two heterogeneous agents distinguished by different levels of risk aversion. We define the optimal monetary provisions, and demonstrate that even in the case of segmented markets, with no correlation between demand shocks, the two rates (commission rate, royalty rate) are negatively interrelated.

Two limitations of the model can provide avenues for future research. First, the market structure of our model is exogenous. The contractual choices are thus studied independently of the organizational choices. Yet, for example, the mix level in the network, that is the proportion of company-owned retail units, may influence the payment mechanisms. Second, we assume here that there is no externality between the retail outlet efforts. However, demand interdependencies coming from the effort provided by the different retail units may influence the determination of monetary provisions in distribution contracts.

We anticipate that future research will benefit and hopefully build on the approach presented in this paper.

References

- [1] Arrunada, B., Garicano, L. and Vazquez, L. (2001). Contractual allocation of decision rights and incentives: the case of automobile distribution, *Journal of Law Economics and Organization*, 7, pp. 257-286.
- [2] Bai, C. and Tao, Z. (2000). Contract Mixing In Franchising as a Mechanism for Public-Good Provision, *Journal of Economics and Management Strategy*, 9(1), 85-113.
- [3] Barthélémy J., (2011) Agency and Institutional Influences on Franchising, *Journal of Business Venturing*, 26, 93 103.
- [4] Bhattacharyya, S. and Lafontaine, F. (1995). Double-Sided Moral Hazard and the Nature of Share Contracts, *RAND Journal of Economics*, 26(4), 761-781.
- [5] Brickley, J. (1999) Incentive conflicts and contractual restraints: evidence from franchising, *Journal of Law and Economics*, 42, 745-774.
- [6] Brickley, J. (2002). Royalty Rates and Upfront Fees in Share Contracts: Evidence from Franchising, *Journal of Law, Economics and Organization*, 18: 511-535.
- [7] Brickley, J and Dark F. (1987). The Choice of Organizational Form: The Case of Franchising. *Journal of Financial Economics*, 18, 401-420.
- [8] Caves R., Murphy W. (1976). Franchising: Firms, Markets and intangible assets, *Southern Economic Journal*, 42, 572-586.
- [9] Dant R., Perrigot R., and Cliquet G. (2008). A cross-cultural comparison of the plural forms in franchise networks: United states, France and Brazil, *Journal of Small Business Management*, 46:286-311.
- [10] Etro F. (2011). Endogenous market structures and contract theory: Delegation, principal-agent contracts, screening, franchising and tying, *European Economic Review*, 55, 463-479.
- [11] Gallini, N., Lutz, N. (1992). Dual Distribution and Royalty Fees in Franchising. *Journal of Law, Economics and Organization*, 8, 471-501.

- [12] Gonzalez-Diaz M. and Solis-Rodriguez V. (2012a). How to design franchise contracts: the role of contractual hazards and experience, *Journal of Small Business Management*, 50(4):652-677.
- [13] Gonzalez-Diaz M. and Solis-Rodriguez V. (2012b). Why do entrepreneurs use franchising as a financial tool? An agency explanation, *Journal of Business Venturing*, 27, 325-341.
- [14] Hendrikse, G. and Jiang, T. (2011). An Incomplete Contracting Model of Dual Distribution in Franchising, *Journal of Retailing*, 87(3), 332-344.
- [15] Holmstrom B. and Milgrom P.(1991), Multi-task principal-agent analyses: linear contracts, asset ownership and job design, *Journal of Law, Economics and Organization*, 7: 24-52.
- [16] Lafontaine, F. (1992), Agency theory and franchising: some empirical results, *Rand Journal of Economics*, 23, 263-283.
- [17] Lafontaine, F. (1993). Contractual Arrangements as Signaling Devices: Evidence from Franchising. *Journal of Law, Economics and Organization*, 9, 256-289
- [18] Lafontaine, F. and Blair, R. (2005), *The Economics of Franchising*, Cambridge University Press.
- [19] Lafontaine, F. and Shaw, K. L. (2005), Targeting managerial control: evidence from franchising. *Rand Journal of Economics*, 36, 13150.
- [20] Lafontaine, F. and Slade, M. (2007), Vertical Integration and Firm Boundaries: The Evidence. *Journal of Economic Literature*, 45(3): 629-685..
- [21] Lal, R. (1990). Improving channel coordination through franchising, *Marketing Science*, 9, 299-318.
- [22] Martin, R.E. (1988), Franchising and risk management, *American Economic Review*, 78, 954-968.

- [23] Maruyama M. and Yamashita Y. (2012), Franchise fees and royalties: Theory and empirical results, *Review of Industrial Organization*, 40:167-189.
- [24] Mathewson F, Winter R. (1984), An economic theory of vertical restraints, *The RAND Journal of Economics*, 15: 2738.
- [25] Mathewson, F. and Winter, R. (1985), The economics of franchise contracts, *Journal of Law and Economics*, 28, 503-526.
- [26] Mitsuhasshi H., Shane S. and W. Sine (2008), Organization governance form in franchising: efficient contracting or organizational momentum?, *Strategic Management Journal* , 29(10): 1127-1136.
- [27] Perrigot R., Cliquet G. and Piot-Lepetit I. (2009), Plural form chain and efficiency: Insights from the french hotel chains and the DEA methodology, *European Management Review*, 27: 268-280.
- [28] A. Perryman and J. Combs. (2012), Who should own it? an agency-based explanation for multi-outlet ownership and co-location in plural form franchising, *Strategic Management Journal*, 33(4):368-386.
- [29] Rey, P. and Tirole, J. (1986a), The logic of vertical restraints, *American Economic Review*, 76, 921-939.
- [30] Rey, P. and Tirole, J. (1986b), Vertical restraints from a principal-agent viewpoint, in Pellegrini, L. and Reddy, S.K. (Eds), *Marketing Channels, Relationships and Performance*, Lexington Books, Lexington, 3-30.
- [31] Rubin P. (1978). The Theory of the Firm and the Structure of the Franchise Contract, *Journal of Law and Economics*, 21(1): 223-233.
- [32] Sorenson O. and Sorensen J. (2001), Finding the right mix: Franchising, organizational learning and chain performance, *Strategic Management Journal*, 22(6/7): 713-724.
- [33] Srinivasan R. (2006), Dual distribution and intangible firm value: Franchising in restaurant chains, *Journal of Marketing*, 70(3):120-135.

- [34] Vazquez L. (2005), Up-front franchise fees and ongoing variable payments as substitutes: An agency perspective, *Review of Industrial Organization*, 26: 445-460.
- [35] Vroom G. and Gimeno J. 2007, Ownership form, managerial incentives, and the intensity of rivalry, *Academy of Management Journal*, 50(4): 901-922.

6 Appendices

6.1 Appendix A

Proof of proposition (1): We consider here a context of symmetric information where effort is observable and can be part of the contract offered by the franchisor. In this case, the reduced problem is as follows:

$$\begin{aligned}
 Max_{[r,y,w,F,e_p,e_f,e_m]} CE_p = & \underbrace{r \left(\alpha e_f + \frac{\delta e_p}{2} \right) + F}_{\text{Income from franchised unit}} + \underbrace{(1-y) \left(\beta e_m + \frac{\delta e_p}{2} \right) - w}_{\text{Income from company-owned unit}} - \underbrace{\frac{e_p^2}{2}}_{\text{Cost}} \\
 & - \underbrace{\frac{\rho_p}{2} (r^2 \theta_f^2 + (1-y)^2 \theta_m^2 + 2Cov(\theta_f r, \theta_m (1-y)))}_{\text{Franchisor's risk aversion}},
 \end{aligned}$$

subject to:

$$\begin{aligned}
 (i) \quad CE_m = w + y \left(\beta e_m + \frac{\delta e_p}{2} \right) - \frac{e_m^2}{2} - \frac{1}{2}((1-y)\rho_{m(M)} + y\rho_{m(m)})y^2\theta_m^2 &\geq 0 & (IR_m) \\
 (ii) \quad CE_f = (1-r) \left(\alpha e_f + \frac{\delta e_p}{2} \right) - F - \frac{e_f^2}{2} - \frac{1}{2}(r\rho_{f(M)} + (1-r)\rho_{f(m)})(1-r)^2\theta_f^2 &\geq 0 & (IR_f)
 \end{aligned}$$

The Lagrangian of the problem is:

$$\begin{aligned}
 \iota = & r \left(\alpha e_f + \frac{\delta e_p}{2} \right) + (1-y) \left(\beta e_m + \frac{\delta e_p}{2} \right) + F - \frac{e_p^2}{2} - w - \frac{\rho_p}{2} (r^2 \theta_f^2 + (1-y)^2 \theta_m^2) \\
 & - \lambda_1 \left(\frac{e_m^2}{2} + \frac{1}{2}((1-y)\rho_{m(M)} + y\rho_{m(m)})y^2\theta_m^2 - w - y \left(\beta e_m + \frac{\delta e_p}{2} \right) \right) \\
 & - \lambda_2 \left(F + \frac{e_f^2}{2} + \frac{1}{2}(r\rho_{f(M)} + (1-r)\rho_{f(m)})(1-r)^2\theta_f^2 - (1-r) \left(\alpha e_f + \frac{\delta e_p}{2} \right) \right).
 \end{aligned}$$

We then proceed to calculate the first order conditions of the Lagrangian.

With respect to wages and to the up-front fee, we obtain respectively:

$$\lambda_1 = 1, \tag{6.1}$$

$$\lambda_2 = 1 \tag{6.2}$$

With respect to both Lagrange multipliers, we get the following conditions:

$$w + y \left(\beta e_m + \frac{\delta e_p}{2} \right) - \frac{e_m^2}{2} - ((1-y)\rho_{m(M)} + y\rho_{m(m)}) \frac{y^2 \theta_m^2}{2} = 0 \quad (6.3)$$

$$(1-r) \left(\alpha e_f + \frac{\delta e_p}{2} \right) - F - \frac{e_f^2}{2} - (r\rho_{f(M)} + (1-r)\rho_{f(m)}) \frac{(1-r)^2 \theta_f^2}{2} = 0 \quad (6.4)$$

Therefore, the franchisee's and manager's individual rationality constraint must be binding, which implies that there is no rent left downstream. By calculating the first-order condition of the Lagrangian with respect to the effort of the principal we obtain:

$$r \frac{\delta}{2} + (1-y) \frac{\delta}{2} - e_p - \lambda_1 \left(-y \frac{\delta}{2} \right) - \lambda_2 \left(-(1-r) \frac{\delta}{2} \right) = 0 \quad (6.5)$$

and substituting by equations (6.1) and (6.2) into (6.5), we get:

$$r \frac{\delta}{2} + \frac{\delta}{2} - y \frac{\delta}{2} - e_p + y \frac{\delta}{2} + \frac{\delta}{2} - \frac{\delta}{2} r = 0 \rightarrow e_p = \delta$$

This expression indicates that the effort of the franchisor is such that the marginal cost equals the marginal benefit. This last effect is represented by the effectiveness that the effort has on the demand to both units. By the same procedure, we obtain that the effort for the manager and the franchisee are equal to:

$$e_m = \beta; \quad e_f = \alpha$$

Regarding the first order condition with respect to the royalty rate we obtain:

$$\alpha e_f + \frac{\delta e_p}{2} - \rho_p \theta_f^2 r - \lambda_2 \left(\frac{1}{2} (\rho_{f(M)} - \rho_{f(m)}) (1-r)^2 \theta_f^2 - (r\rho_{f(M)} + (1-r)\rho_{f(m)}) (1-r) \theta_f^2 + \alpha e_f + \frac{\delta e_p}{2} \right) = 0$$

Substituting with the expressions obtained previously, we get:

$$3(\rho_{f(M)} - \rho_{f(m)})(1-r)^2 - 2(\rho_{f(M)} + \rho_p)(1-r) + 2\rho_p = 0 \quad (6.6)$$

In accordance with Assumption 1, we know that $\rho_{f(M)} - \rho_{f(m)} = \frac{(\rho_{f(M)} + \rho_p)^2}{6}$, then

$$\left(\sqrt{3(\rho_{f(M)} - \rho_{f(m)})(1 - r)} - \sqrt{2\rho_p} \right)^2 = 0 \quad (6.7)$$

Therefore,

$$r^* = 1 - \sqrt{\frac{2\rho_p}{3(\rho_{f(M)} - \rho_{f(m)})}} \quad (6.8)$$

The same calculations are applied for the commission rate.

We get:

$$\begin{aligned} & -(\beta e_m + \frac{\delta e_p}{2}) + \rho_p(1 - y)\theta_m^2 \\ & -\lambda_1 \left(\frac{1}{2}(-\rho_{m(M)} + \rho_{m(m)})(y^2\theta_m^2) + ((1 - y)\rho_{m(M)} + y\rho_{m(m)})y\theta_m^2 - (\beta e_m + \frac{\delta e_p}{2}) \right) = 0 \end{aligned}$$

$$3(\rho_{m(M)} - \rho_{m(m)})y^2 - 2(\rho_{m(M)} + \rho_p)y + 2\rho_p = 0 \quad (6.9)$$

In accordance with Assumption 2, we know that $\rho_{m(M)} - \rho_{m(m)} = \frac{(\rho_{m(M)} + \rho_p)^2}{6}$, then

$$\left(\sqrt{3(\rho_{m(M)} - \rho_{m(m)})y} - \sqrt{2\rho_p} \right)^2 = 0 \quad (6.10)$$

Hence

$$y = \sqrt{\frac{2\rho_p}{3(\rho_{m(M)} - \rho_{m(m)})}} \quad (6.11)$$

□

6.2 Appendix B

Proof of proposition (2): We consider here a context of two-sided moral hazard, where efforts are not observable and cannot be part of the contract. The reduced problem is similar to case 1, but we introduce now the incentive constraints:

$$(iii) \quad \frac{d(CE_p)}{de_p} = r\frac{\delta}{2} + (1-y)\frac{\delta}{2} - e_p = 0 \quad (IC_p)$$

$$(iv) \quad \frac{d(CE_f)}{de_f} = (1-r)\alpha - e_f = 0 \quad (IC_f)$$

$$(v) \quad \frac{d(CE_m)}{de_m} = y\beta - e_m = 0 \quad (IC_m)$$

We first characterize the monetary provisions, before proving points i) and ii) of proposition 2.

The Lagrangian is equal to:

$$\begin{aligned} \iota = & r \left(\alpha e_f + \frac{\delta e_p}{2} \right) + (1-y) \left(\beta e_m + \frac{\delta e_p}{2} \right) + F - \frac{e_p^2}{2} - w - \frac{\rho_p}{2} (r^2 \theta_f^2 + (1-y)^2 \theta_m^2) \\ & - \lambda_1 \left(\frac{e_m^2}{2} + \frac{1}{2}((1-y)\rho_{m(M)} + y\rho_{m(m)})y^2 \theta_m^2 - w - y \left(\beta e_m + \frac{\delta e_p}{2} \right) \right) \\ & - \lambda_2 \left(F + \frac{e_f^2}{2} + \frac{1}{2}(r\rho_{f(M)} + (1-r)\rho_{f(m)})(1-r)^2 \theta_f^2 - (1-r) \left(\alpha e_f + \frac{\delta e_p}{2} \right) \right) \\ & - \lambda_3 \left((e_p - r\frac{\delta}{2} - (1-y)\frac{\delta}{2}) \right) - \lambda_4 (e_f - (1-r)\alpha) - \lambda_5 (e_m - y\beta). \end{aligned}$$

We then proceed to calculate the first order conditions of the Lagrangian. With respect to wages and to the up-front fee, we obtain respectively:

$$\lambda_1 = 1 \quad (6.12)$$

$$\lambda_2 = 1 \quad (6.13)$$

With respect to all Lagrange multipliers, we get the following conditions:

$$w + y(\beta e_m + \frac{\delta e_p}{2}) - \frac{e_m^2}{2} - \frac{1}{2}((1-y)\rho_{m(M)} + y\rho_{m(m)})y^2 \theta_m^2 = 0 \quad (6.14)$$

$$(1-r)(\alpha e_f + \frac{\delta e_p}{2}) - F - \frac{e_f^2}{2} - \frac{1}{2}(r\rho_{f(M)} + (1-r)\rho_{f(m)})(1-r)^2 \theta_f^2 = 0 \quad (6.15)$$

Therefore, the franchisee's and manager's individual rationality constraint must be binding, which implies that there is no rent left downstream.

$$(r + (1 - y))\frac{\delta e_p}{2} = e_p \quad (6.16)$$

$$(1 - r)\alpha = e_f \quad (6.17)$$

$$y\beta = e_m \quad (6.18)$$

The effort provided by each agent and by the principal is equal to their incentives and to the impact of their effort on the downstream sales. By calculating the first-order condition of the Lagrangian with respect to the effort of the principal we obtain

$$r\frac{\delta}{2} + (1 - y)\frac{\delta}{2} - e_p - \lambda_1 \left(-y\frac{\delta}{2}\right) - \lambda_2 \left(-(1 - r)\frac{\delta}{2}\right) - \lambda_3 = 0 \quad (6.19)$$

Substituting by equations (6.12) and (6.13) and (iii) into (6.19), we get:

$$\lambda_3 = \frac{\delta}{2}(y - r + 1) \quad (6.20)$$

The Lagrangian with respect to the manager's effort indicates that:

$$(1 - y)\beta - \lambda_1(e_m - y\beta) - \lambda_5 = 0 \quad (6.21)$$

Substituting equation (6.12) into (6.21), we get:

$$\lambda_5 = \beta(1 - y) \quad (6.22)$$

From the Lagrangian with respect to the franchisee's effort we get:

$$r\alpha - \lambda_2(e_f - (1 - r)\alpha) - \lambda_4 = 0 \quad (6.23)$$

Substituting equation (6.13) and (iv) into (6.23), we obtain:

$$\lambda_4 = r\alpha \quad (6.24)$$

Regarding the first order condition with respect to the royalty rate we obtain:

$$\begin{aligned} & \alpha e_f + \frac{\delta e_p}{2} - \rho_p r \theta_f^2 + \lambda_3 \frac{\delta}{2} - \lambda_4 \alpha \\ & - \lambda_2 \left(\frac{1}{2} (\rho_{f(M)} - \rho_{f(m)}) (1-r)^2 \theta_f^2 - (r \rho_{f(M)} + (1-r) \rho_{f(m)}) (1-r)^2 \theta_f^2 + \alpha e_f + \frac{\delta e_p}{2} \right) = 0 \end{aligned} \quad (6.25)$$

Substituting equation (6.13), (6.20) and (6.24) into (6.25), we get:

$$\begin{aligned} & -r(\rho_p \theta_f^2 + \frac{\delta}{2} + \alpha^2) - \frac{1}{2} (\rho_{f(M)} - \rho_{f(m)}) (1-r)^2 \theta_f^2 \\ & + (r \rho_{f(M)} + (1-r) \rho_{f(m)}) (1-r) \theta_f^2 + (y+1) \frac{\delta}{2} = 0 \end{aligned}$$

Then:

$$3(\rho_{f(M)} - \rho_{f(m)}) (1-r)^2 - 2(\rho_p \theta_f^2 + \frac{\delta}{2} + \alpha^2 + \rho_{f(M)} \theta_f^2) (1-r) + 2(-y \frac{\delta}{2} + \rho_p \theta_f^2 + \alpha^2) = 0 \quad (6.26)$$

Substituting equation (6.18) into (6.26), in accordance with Assumption 3, we get:

$$r^* = 1 - \sqrt{\frac{2(\alpha^2 + \rho_p \theta_f^2 - \frac{e_m}{2} \frac{\delta}{\beta})}{3(\rho_{f(M)} - \rho_{f(m)}) \theta_f^2}} \quad (6.27)$$

The same calculations are applied for the commission rate.

We get:

$$\begin{aligned} & -(\beta e_m + \frac{\delta e_p}{2}) + \rho_p (1-y) \theta_m^2 - \lambda_3 \frac{\delta}{2} + \lambda_5 \beta \\ & - \lambda_1 \left(\frac{1}{2} (-\rho_{m(M)} + \rho_{m(m)}) y^2 \theta_m^2 + ((1-y) \rho_{m(M)} + y \rho_{m(m)}) y \theta_m^2 - \beta e_m - \frac{\delta e_p}{2} \right) = 0 \end{aligned} \quad (6.28)$$

Substituting equation (6.17) into (6.28), in accordance with Assumption 4, we obtain:

$$y^* = \sqrt{\frac{2(\beta^2 + \rho_p \theta_m^2 - \frac{e_f}{2} \frac{\delta}{\alpha})}{3(\rho_{m(M)} - \rho_{m(m)}) \theta_m^2}} \quad (6.29)$$

□

6.3 Appendix C

Summary results - Comparative statics for different fundamentals of the economy:

| Variable | Symmetric Information | Asymmetric Information |
|--------------------|-----------------------|------------------------|
| $\rho_f \uparrow$ | $r \uparrow$ | $r \uparrow$ |
| $\rho_p \uparrow$ | $r \downarrow$ | $r \downarrow$ |
| $\rho_m \uparrow$ | $(1 - y) \uparrow$ | $(1 - y) \uparrow$ |
| $\rho_p \uparrow$ | $(1 - y) \downarrow$ | $(1 - y) \downarrow$ |
| $\delta \uparrow$ | | $r \uparrow$ |
| $\delta \uparrow$ | | $(1 - y) \uparrow$ |
| $\alpha \uparrow$ | | $r \downarrow$ |
| $\beta \uparrow$ | | $(1 - y) \downarrow$ |
| $r \uparrow$ | | $(1 - y) \downarrow$ |
| $(1 - y) \uparrow$ | | $r \downarrow$ |