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„Discriminatory Tariffs for Franchises“

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***Abstract:*** *Franchises can be used to overcome the classical principal-agent problem. This is usually achieved by setting prices for inputs at marginal cost and sizing the profits of the agent by the fixed lump sum fee. However, there may be situations where it is rational to set prices above marginal cost, as this allows the principal to discriminate between more and less capable franchisees. In this thesis I apply theoretical models of price discrimination to determine the optimal pricing strategy for a franchisor facing such a situation. Moreover, in this context it is possible to explain the share of high-quality managers endogenously by allowing the agent to invest into their management quality. The thesis aims to explain one potential reason for franchisors to charge prices above marginal cost, abstracting from many other issues that arise in a franchise context.*

***German Abstract:*** *Das Geschäftsmodell eines Franchiseunternehmens kann dazu verwendet werden das klassische Principal- Agenten-Problem zu umgehen. Dafür werden die Preise für die Vorleistungen zu den Grenzkosten verrechnet und der gesamte Gewinn über eine einmalige Vorabzahlung vom Agenten zu Principal transferiert. Allerdings kann es Situationen geben, in denen die Preise über den Grenzkosten liegen, da dies dem Principal erlaubt zwischen mehr und weniger fähigen Managern zu unterscheiden. In meiner Arbeit werde ich Modelle für Preisdiskriminierung dazu verwenden eine optimales Tarifschema für Franchisegeber in solchen Situationen zu entwickeln. Darüber hinaus ist es in diesem Setting möglich den Anteil guter Manager endogen zu erklären. Die Arbeit zielt also darauf ab einen möglichen Grund für Preise über den Grenzkosten aufzuzeigen, wobei von vielen anderen Aspekten abstrahiert wird.*

# Contents

# 1 Introduction

Franchises have become increasingly popular as a business model, especially in areas such as gastronomy, the hotel business or the retail and service sector. In the US, more than 40% of the retail revenue is turned over by firms operating in a franchise framework. PwC state in their 2005 report for "The International Franchise Association", that franchised businesses operated more than 900,000 establishments in the US by 2005, counting both establishments owned by franchisees and by franchisors. Thus, 3.3% of all business establishments were run by franchised businesses. Together they provided around 11 million jobs, met a payroll of $278.6 billion, and produced an output of $880.9 billion. Therefore, franchises provided 8.1% of all private non-farm jobs, 5.3% of the total private-sector payroll, and 4.4% of the private sector output. The number of franchised establishments in the U.S. was still growing at an average annual rate of 4.3% between 2001 and 2005. Moreover, the number of jobs in franchises grew at an average annual rate of 3%, while their payroll and output grew with a rate of 5% and 9%.[1]

Franchising is mostly understood as a marketing concept, that allows small businesses to operate under an established brand name, and one form of how a firm can distribute its products. Therefore, the structure of a franchise is usually explained by allowing the franchisee to use an established business model, while the franchisor can expand faster at lower risk by relying on the resources of the franchisees. In this thesis I want to take a less common view concerning the reasons to choose the structure of a franchise as a business model.[2]

For franchises fee schemes typically consists of a lump sum initial franchise fee, which is paid upfront to join the franchise, and a royalty that is paid regularly and usually calculated as a percentage of of gross-sales, common are percentages

[1] Hempelmann, Bernd. "Optimal franchise contracts with private cost information." International Journal of Industrial Organization 24.2 (2006): 449-465.

PricewaterhouseCoopers: The International Franchise Association Educational Foundation. "The Economic Impact of Franchised Businesses Volume II: Results for 2005" (2008).

[2] Rubin, Paul H. "The Theory of the Firm and the Structure of the Franchise Contract." The Journal of law and economics 21.1 (1978): 223-233.

between 5% and 9%.[3] While I refer to the initial fee as fixed fee, the royalty is modelled as pricing inputs, which the franchisee has to buy from the franchisor, above marginal cost.

The idea here is that the franchise is a way for a monopolist, that faces a classical principal agent problem in its subsidiaries, to set the incentive for the store managers or in this context franchisors optimally. Abstracting from issues such as free-riding on the brand name by supplying quality below the standard as well as differences in the risk aversion or risk bearing capacity between franchisees and franchisor, this is done by setting the prices for the inputs equal to marginal cost and sizing as much as possible via a fixed lump sum fee. The focus of this thesis will be, to provide a rational explanation for a monopolist franchisor to charge its contract partners prices above marginal costs for the inputs apart from the common explanations. These other reasons usually are obtaining the integrated monopoly prices in case of competition between the down-stream franchisees or a lower risk aversion of the franchisor compared to the franchisees, which is reflected in a lower fixed fee combined with performance (profit or revenue) related payment schemes.[4]

My new perspective is interesting as opposed to the previous explanations, where prices above marginal costs lead to a higher efficiency and therefore are to the benefit of both, the franchisor as well as the franchisee, using the fee scheme for discrimination is primarily in the interest of the franchisor, who increases her/his profit at the cost of the franchisee, and actually leads to lower overall profits for the total franchise. Therefore, when negotiating about those contracts, it may be important to consider that the interest of the franchisor and franchisee are not always aligned when it comes to how much of the fee should be based on revenues. In addition my thesis should also increase the awareness that such tariff-schemes do not necessarily lead to a higher efficiency of the franchise but actually profits my be lower due to double-marginalisation.[5]

[3] Seid, Michael. "Understanding Franchise Payments and Royalty Fees." Retrieved from The Balance Small Business: https://www.thebalancesmb.com/what-is-a-royalty-fee-1350580 [11.05.2019]

[4] Rubin (1978)

[5] ibid

The models I would like to work out in this thesis are based on the idea of price discrimination. In the franchise context this would mean that for a particular location, the franchisor has only one potential contract partner, which is either of high or low management quality. In order for the the low-quality manager to not be turned away, the franchisor has to charge a lower fee than the high-quality manager would be willing to pay. As the franchisor cannot distinguish the low- from the high-quality manager when the contract is signed, s/he may use contract schemes where inputs are sold above marginal cost in order to get some additional benefit from high-quality managers as they demand more inputs. Or in case of a classical second-degree price discrimination tariff scheme, the low-quality managers are offered a quantity that is below the full information benchmark's equivalent.

Applying models of price discrimination to franchises does not just suggest new tariff schemes to increase profits for franchisors or explain why some franchisors decided to charge prices above marginal cost or use revenue- and profit-based tariffs, but also allows to model the fraction of high-quality managers endogenously. This is done by allowing the manager to choose whether s/he wants to incur a sunk cost in order to become a high-quality manager or not. Obviously, it would not make sense for a final consumer as analysed in the standard price discrimination models to incur a cost to value a good more. Thus, such a model can only be discussed reasonably in a franchise context.

The thesis will be structured as follows. First, there will be a literature review about papers regarding franchises as well as the literature concerned with price discrimination in general. Afterwards, I will introduce three models of different forms of price discrimination. Then, I compare the three models regarding the profit for the franchisor and franchisee as well as the consumer surplus and total welfare. For this comparison, I will analyse figures plotting each of the outputs I am interested in for a specific set of parameters and varying fraction of high- and low-quality managers. In the next section, I extend the basic model to explain the fraction of high- and low-quality managers endogenously. This is achieved by allowing the franchisees to choose whether to make a sunk cost investment in order to become high-quality managers. Towards the end, I will again analyse the result, this time varying the cost for changing the type. Finally, I will discuss the relevance and potential insights obtained by the models.

## 2 Literature Review

The literature I want to refer to can be categorized into two groups: one consists the literature of the concept of second-degree price discrimination and different tariff schemes to implement this. The second category of papers is concerned with the economic analysis of franchises and the problems that arise in this context.

The possibility of second-degree price discrimination is well known and was already mentioned in 1912 by Arthur C. Pigou in his book "The economics of welfare".[6]

An early solution to the problem of charging different prices for a good that two customer groups value differently was proposed by Walter Oi in his paper "A Disneyland Dilemma: Two-Part Tariffs for a Mickey Mouse Monopoly" (1971). The basic idea is to charge a fixed fee and additionally a price above marginal costs per consumed unit, such that the monopolist makes higher profits on customer groups with a higher demand. While the fixed fee is set in such a way that all the surplus of the customer group with the lowest willingness to pay is extracted, the unit price is set optimally by: $p = c'(\frac{E}{E+1+Ns_1})$ where $c'$ are the marginal costs, E the total elasticity of demand, N the number of customers and $s_1$ the market share of the demand of the customers with the lowest willingness to pay.[7]

The first approach to a second best solution, where one party is provided with an inefficiently low quantity, was worked out for the insurance industry by Rothschild and Stiglitz (1976), where they show that in case of low- and high-risk customers the only potential equilibrium in a competitive insurance market can be a separating one, in which both types choose the contract designed for them. The high-risk types have a higher demand for insurance and therefore get full insurance, while the low-risk customers get under-insurance and pay a lower premium. Further, they show that under plausible conditions, the market may not

[6]Pigou, Arthur C. "The Economics of Welfare" London: MacMillan and Co., (1920): Ch. 14, 240-255.

[7]Oi, Walter. "A Disneyland Dilemma: Two-Part Tariffs for a Mickey Mouse Monopoly" Quarterly Journal of Economics, 85 (1971): 77-96.

have an equilibrium at all, when a potential pooling contract would be preferred by both types and profitable to the provider as well.[8]

Maskin and Riley (1984) examine the possibility of price discrimination by quantity discounts. Starting with a model of two customers with different demand, they show that the best solution in case of incomplete information is to serve the efficient quantity to the high demand type and an inefficiently small quantity to the low demand customer. While all the willingness to pay is extracted from the low-type, the tariff set for the high-type is such that s/he is indifferent to choosing the low-type's contract. They expand the model by introducing more customer types and finally a continuum of types.[9]

While these three papers introduce just one pricing scheme for customers, Oi the two-part tariff, Rothschild and Stiglitz the second-best solution, and Maskin and Riley (1984) quantity discounts, I apply three different tariff schemes to franchisees or a down- and upstream firm and compare them. Further, I use the setting to explain the fraction of high- and low-types endogenously.

Rubin (1978) provides a good introduction to the advantages but also the economic problems that arise in the structure of franchises. He also discusses the most common tariff schemes used by franchisors. The paper mentions issues such as optimal incentives for managers, optimal risk bearing capacity, the possibility of misreporting profits or revenues in case of royalties based on those measures, the monitoring costs in general, which aim to explain whether a franchisor runs a store her/himself or gives it to a franchisee, and the problem of free-riding at the brand name by deviating from the standard, but does not explicitly model them. This paper also addresses the idea that with revenue-based royalties, the better managed stores pay a higher fee in total than the worse managed. However, Rubin rather explains this fact by uncertainty and risk aversion than discrimina-

[8]Rothschild, Michael and Joseph Stiglitz. "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information" The Quarterly Journal of Economics, 90 (1976): 629-649.

[9]Maskin, Eric, and John Riley. "Monopoly with incomplete information." The RAND Journal of Economics 15.2 (1984): 171-196.

tion of franchisees. Moreover, royalties are explained by setting incentives for the franchisor to supply the franchisee with efficient services.[10]

Many papers, such as Mathewson and Winter (1985), focus on the problem of free-riding at the national brand name by local franchisees and try to determine the best contract designs and monitoring schemes to prevent this.[11]

The Paper by Pénard et al. (2011) is also concerned with monitoring. In their case, the model is about comparing store managers that are employed by the franchisor with those that are operating as a franchisee regarding their incentives to shirk or misreport revenues. The analysis is based on franchises that only pay royalties regarding revenues and fixed fees for employed managers and aims to determine a strategy that minimizes monitoring costs. This is basically monitoring the stores that report the lowest revenue.[12]

Klein and Saft (1985) and Klein (1995) focus at defining contracts in order to minimize the free-riding incentive of the franchisee on the back of the brand name. Moreover, forcing the franchisee to use their standardised products is also the most convenient way to control quality. In this context also the problem of double-marginalisation is discussed. Klein and Saft also indicated evidence that a company managed to use tying contracts "as a mechanism to collect the rents collected by price-discriminating franchisees."[13]

Hempelmann (2006) models a situation of contract setting in case of the franchisee having private information about their marginal cost of sale, which in their setting are determined by advertising costs. According to the analysis the optimal

[10] Rubin, Paul H. "The Theory of the Firm and the Structure of the Franchise Contract." The Journal of law and economics 21.1 (1978): 223-233.

[11] Mathewson, G. Frank, and Ralph A. Winter. "The economics of franchise contracts." The Journal of Law and Economics 28.3 (1985): 503-526.

[12] Pénard, Thierry, Emmanuel Raynaud, and Stéphane Saussier. "Monitoring policy and organizational forms in franchised chains." International Journal of the Economics of Business 18.3 (2011): 399-417.

[13] Klein, Benjamin, and Lester F. Saft. "The law and economics of franchise tying contracts." The Journal of Law and Economics 28.2 (1985): 345-361.

Klein, Benjamin. "The Economics of Franchise Contracts." Journal of Corporate Finance, Vol. 2, No. 1, (1995) contract fees depend on whether the franchisor or the franchisee have a higher advertising effectiveness.[14]

Finally, the paper by Xi et al. (2016) addresses in particular the double marginalisation problem and inefficiencies due to asymmetric information, but in a different setting: The franchisee has an information advantage as s/he could to a certain degree first order price discriminate the final consumers. However, the franchisees cannot credibly communicate this information to the franchisor, who can dictate the prices that are charged to the customer while the franchisee adds some value by providing additional services, which determines the demand. The asymmetric information loss is due to the different price elasticities of the consumers which the franchisee knows but cannot credibly communicate to the franchisor, who sets the price. Further, there occurs double marginalisation as the franchisee has an incentive to provide a too low level of service.[15]

To conclude, non of the papers about franchisees addresses the possibility that revenue- or profit-based fee schemes are used by franchisors strategically to discriminate between different types of franchisees. Moreover, they argue that such royalties are to the mutual benefit of the franchisee and franchisor, while in my thesis discrimination also leads to double-marginalisation and thus lowers the efficiency of the franchise.

# 3 Model

The purpose of this section is to introduce a model setting that allows to analyse how a franchisor could potentially increase her/his profit by charging a low fixed fee in order to avoid that bad franchisees are turned away and at the same time try to extract as much profits from higher-quality managers as possible. The basic setting of all the models is that franchises are seen as a structure that solves the classical principle-agent problem: For this setting, both parties are assumed to be risk neutral. Further, I want to abstract from the much-discussed issue

[14] Hempelmann, Bernd. "Optimal franchise contracts with private cost information." International Journal of Industrial Organization 24.2 (2006): 449-465.

[15] Xie, Wenming, et al. "Optimizing product service system by franchise fee contracts under information asymmetry." Annals of operations research 240.2 (2016): 709-729.

of a franchisee's possibility to free-ride on the back of the brand name of the franchisor. Here the basic idea would be that the structure of the franchise is used to incentivise the franchisee's manager to act like a self-employed monopolist. In a first best solution, meaning the franchisor is perfectly informed about the franchisee's marginal costs and demand, in order to minimize the double marginalisation problem, the franchisor would charge prices equal to marginal cost for its inputs and extract all the franchisee's monopoly profit via the fixed fee.

The potential of increasing the franchisor's profit by charging input prices above marginal cost arises if the cost function and/or demand of the franchisee is not known to the franchisor. In the models, this is incorporated by allowing the franchisee's manager to be either of low or high quality with probability $\lambda$ and $1-\lambda$ respectively. The low-quality manager either faces higher costs for every given quantity and/or lower demand:

$$c_l(q) \geq c_h(q) \quad \wedge \quad p_l(q) \leq p_h(q) \quad \forall q$$

In this section I want to work out three different tariff-schemes and compare them afterwards . I expected those model to work better, in a sense that they would grant the higher profit to the franchisor, that require the more implausible assumptions and therefore might be the hardest to implement in reality. The basic idea of all the following models would be:

1. At first, the principal (franchisor) can offer a contract with different payment schemes to the agent (franchisee).
2. Then, nature determines whether the franchisee's management is of low or high quality.
3. The franchisee afterwards decides whether to accept or not or which contract to accept.
4. The franchisee maximizes profits as a monopolist given the input prices specified in the contract, the demand, and its own marginal cost, where the latter two are determined by the type.

5. The pay-off of the agent and the principal are determined by the profits each of them makes according to the contract as well as the type and behaviour of the franchisee. It is also possible to determine consumer surplus although consumers are not really seen as active players in the game.

In principle, the game can be solved by backward induction. The critical part is to invert the monopolist's price setting behaviour and specify the quantity sold by the franchisee as a function of the input price, which would then be set by the monopolist.

The mathematics for the general case ($c'_{h,l}(q) \geq 0 \quad \bigwedge \quad p'_{h,l}(q) < 0$) become quite evolved such that I decided to use specific functional forms of the cost and demand function: cost function with fixed cost and constant marginal cost $c(q) = c^f + c^v_{h,l} \times q$ and a linear demand function: $p_{h,l}(q) = a_{h,l} - b_{h,l} \times q$ with $c^v_h \leq c^v_l \quad \wedge \quad a_h \geq a_l \quad \wedge \quad b_h \leq b_l$ where at least one holds without equality. Further, I assumed constant marginal costs for the franchisor.

## 3.1 Discrimination by fixing quantities

In the first model, the franchisor is allowed to specify the exact quantity of inputs and the total price he is willing to sell to the franchisee. This is called the second best solution, as this setting gives the principal maximal flexibility and thus it is the solution that, given asymmetric information, comes closest to the first best solution, where the principal is informed about the agent's type. Admittedly, these are rather restricting and unrealistic assumptions that will be relaxed for the other tariff schemes.

The optimal contract from the principal's point of view would be one that both types accept and the high-quality manager chooses the contract with the higher quantity of inputs. The whole surplus is extracted from the low-type such that the tariff s/he has to pay is so high that s/he is indifferent between accepting and not. The fee the high-type has to pay is so high that s/he is indifferent between accepting the high quantity and the low quantity contract. Therefore, the following two constraints have to hold with equality:

1. $T_l = q_l^* \times p_l(q_l^*) - c_l(q_l^*) - q_l^* \times mc$

   Where $T_l$ is the fixed fee paid by the low-type for quantity $q_l^*$ while inputs are priced at marginal costs and thus the costs are passed on to the franchisee.

2. $T_h = q_h^* \times p_h(q_h^*) - c_h(q_h^*) - q_h^* \times mc - q_l^* \times p_h(q_l^*) - c_h(q_l^*) - q_l^* \times mc + T_l$

   Here $T_h$ is the total fee that has to be paid for the high quantity $q_h^*$. And again the unit cost of the franchisor are passed on to the franchisee.

Consequently, the profit function for the franchisor would be:

$$\Pi(q_l, q_h) = \lambda \times T_l(q_l) + (1 - \lambda) \times T_h(q_l, q_h)$$

Note that in this setting, the costs for the inputs are already passed on to the franchisee and thus do not affect the profit function. The total amount paid to the franchisor would be: $T_h + q_h \times mc$ for $q_h$ and $T_l + q_l \times mc$ for $q_l$ respectively.

Afterwards the profit function is maximized by the franchisor with respect to $q_l$ and $q_h$. This gives the following two first order conditions:

1. $q_h: \quad (1 - \lambda)[p_h(q_h) + q_h \times p'_h(q_h) - c'_h(q_h) - mc] = 0$
2. $q_l: \quad \lambda[p_l(q_l) + q_l \times p'_l(q_l) - c'_l(q_l) - mc] +$
   $(1 - \lambda)[p_l(q_l) + q_l \times p'_l(q_l) - c'_l(q_l) - p_h(q_l) - q_l \times p'_h(q_l) + c'_h(q_l)] = 0$

Solving these two equations for $q_l$ and $q_h$ respectively yields:

1. $q_h^* = \dfrac{c'_h(q_h^*) + mc - p_h(q_h^*)}{p'_h(q_h^*)}$
2. $q_l^* = \dfrac{\lambda[c'_l(q_l^*) + mc - p_l(q_l^*)] + (1 - \lambda)[c'_l(q_l^*) - p_l(q_l^*) - c'_h(q_l^*) + p_h(q_l^*)]}{\lambda[p'_l(q_l^*)] + (1 - \lambda)[p'_l(q_l^*) - p'_h(q_l^*)]}$

The first equation specifies the same quantity as a (high-quality) monopolist facing competitive input prices would choose. This is known as efficiency at the top, as from the monopoly franchise perspective, the optimal quantity is provided. The second equation would do the same for a low-quality manager in case of $\lambda = 1$ but chooses a lower quantity, the smaller $\lambda$ gets. Therefore, for $\lambda < 1$ a quantity is provided that is even for a monopoly too low and can be seen as a form of double marginalisation due to information asymmetry as the franchisor chooses a quantity below the level a monopolist facing competitive input prices would provide in order to reduce the attractiveness of such a contract for the high-quality managers.

For the functional forms as specified above, this would mean:

1. $q_h^* = \dfrac{a_h - c_h^v - mc}{2 \times b_h}$
2. $q_l^* = max\{\dfrac{\lambda[a_l - c_l^v - mc] + (1-\lambda)[a_l - a_h - c_l^v + c_h^v]}{2[b_l - (1-\lambda)b_h]}; 0\}$

The condition about the quantity for the low-type to be positive also ensures that the profit of the high-type is positive and thus, it satisfies its participation constraint. However, one issue arises when it is assumed that low-types do not have to pay the fixed cost if the produce zero quantity. In this case it could be, that if the fix-cost is high and the low-type is just about starting to produce and only supplies low quantities that the franchisor would be better of by not selling to the low-type at all and keep seizing all the surplus from the high-type. This is not considered here as one would have to allow the high-type to choose the maximum of the two functions.

The profit of the franchisor would therefore be:

$$\Pi = q_l^*(a_l - q_l^* \times b_l - c_l^v - mc) - c^f + (1-\lambda)[(a_h - c_h^v - mc)(q_h^* - q_l^*) - (q_h^{*2} - q_l^{*2})b_h]$$

In case that the quantity for the low-type is set at the zero constraint, the profit is increased by $\lambda \times c^f$ as now the fixed fee would have to be paid in the case the low-type is not willing to participate in the market.

The profit function in principle consists of a fixed part that can be earned from both types plus some additional profit that can be made from the high-type. However it is important to note that both parts depend on the optimal quantity sold to both types. While $q_h^*$ does not depend on $\lambda$ $q_l^*$ does. This means that the part of the function I called fix-part also depends on $\lambda$ and the larger the fraction of low-types is, the more is sold to them and thus the profit from the fixed part increases while the additional profit that is made at the high-types decreases.

The profit of the high-quality manager, also known as the information rent:

$$\pi_h = q_l^*(a_h - a_l - c_h^v + c_l^v) - q_l^{*2}(b_h - b_l)$$

Remarkably, the high-type's profit only depends on $q_l^*$ and not her/his own quantity sold. This makes sense as the high-type can only make a profit if s/he has the outside option of the low-types contract. The higher the quantity offered to the low-type is more valuable this option is to the high-type.

The consumer surplus:

$$CS = \lambda \frac{b_l \times q_l^{*2}}{2} + (1 - \lambda) \frac{b_h \times q_h^{*2}}{2}$$

The consumer surplus consists of two parts: One is the high-type part and depends on the quantity sold by this type and the other part is the low-type part. In principle the consumer welfare increases when there are more high-types in the market. High-types in general generate more demand and sell more due to lower costs. However, there is also a tempering effect: the fewer low-types there are the lower is the quantity sold by them as the franchisee is more concerned about sizing more of the high-types profit, and therefore reduces the value of their outside option by lowering the quantity in the low-types contract. In the most extreme case the low-type's quantity is reduced to zero.

## 3.2 Discrimination by offering two different contracts

For this model, I relax the rather implausible assumption of offering a certain quantity when the contract is signed. In this more realistic setting, the franchisor cannot set specific quantities at the point the contract is signed, but has to allow for more flexibility. Here, it means that he can offer two contracts, each specifying a different fixed fee the franchisee has to pay up-front, and a unit price, at which the franchisee can buy the inputs. One would expect the low-quality franchisee to go for a contract with low fixed fee but high input prices, while the high-quality management would prefer a higher fixed fee but lower prices for inputs.

In this case, the profit function will be maximized by setting the two different prices for the inputs $p_l^{IN}$ and $p_h^{IN}$. Note that, here, quantities are a function of input prices, in particular the solution to the monopolist's problem, given the input prices is:

$$\Pi = \lambda[q_l^*(p_l^{IN}) \times [p_l^{IN} - mc] + T_l] + (1-\lambda)[q_h^*(p_h^{IN}) \times [p_h^{IN} - mc] + T_h]$$

However, it might be more profitable for certain parameter settings (if the fraction of low-types is too low) to neglect the low-type entirely and only focus on the high-type.

Where, similar to the previous model:

1. $T_l = q_l^* \times p_l(q_l^*) - c_l(q_l^*) - q_l^* \times p_l^{IN}$ and
2. $T_h = q_h^* \times p_h(q_h^*) - c_h(q_h^*) - q_h^* \times p_h^{IN} - q_{h_l}^* \times p_h(q_{h_l}^*) + c_h(q_{h_l}^*) + q_{h_l}^* \times p_l^{IN} + T_l$

Again, using the specified functional forms, the first order conditions with regard to the input prices yield:

1. $p_h^{IN} = mc$
2. $p_l^{IN} = min\{\frac{\lambda(2 \times b_l \times mc) + (1-\lambda)6[b_l(a_h - c_h) - b_h(a_l - c_l)]}{\lambda(2 \times b_l) + 18(1-\lambda)(b_l - b_h)}; a_l - c_l^v\}$

Choosing the minimum ensures that the quantity demanded by the low-type does not become negative, which also ensures that the profits for the high- and the low-type are not negative. Further, the condition $p_h^{IN} \leq p_l^{IN}$ has to hold. Otherwise, the franchisor would be better off focussing on the low-types only and also the information rent would be negative, thus the franchisee would be choosing the low-type contract even if he is a high-type.

In general, the price for the low-type is higher than or equal to $mc$. As a consequence as in the previous model the high-type gets the efficient quantity, while in case of price discrimination the quantity sold to the low-type is below the efficient amount. I also calculated a third quantity $q^*_{h_l}$ which represents the outside option of the franchisor, it is the optimal quantity s/he would demand if the low-type's contract and price were chosen.

This results in the following quantities:

1. $q^*_h = \dfrac{a_h - c^v_h - p^{IN}_h}{2 \times b_h}$
2. $q^*_l = \dfrac{a_l - c^v_l - p^{IN}_l}{2 \times b_l}$
3. $q^*_{h_l} = \dfrac{a_h - c^v_h - p^{IN}_l}{2 \times b_h}$

The profit of the franchisor is choosing the maximum of the functions (1.) where discrimination occurs and that looks similarly to the profit function of the previous model. The only differences are that there is an additional term that increases profits, which comes from the margin that is charged at the low-types and the fact that the quantity is in general lower than in the previous case. As we will see later, and corresponds to intuition, this second effect dominates resulting in general in lower profits than in the previous case. The second function (2.) is the profit made by the franchisor when s/he ignores the low-type completely and only maximizes the profit s/he can make from the high-type. In practice, this means charging prices at marginal cost and setting the fixed fee at a level that subtracts all the profit from the franchisee:

$$\Pi = max \begin{cases} q^*_l(a_l - q^*_l \times b_l - c^v_l - mc) - c^f & \\ +(1-\lambda)[(q^*_h - q^*_l)(a_h + c^v_h - mc) - (q^{*2}_h - q^{*2}_l)b_h + q^*_l(mc - p^{IN}_l)] & (1.) \\ (1-\lambda)[q^*_{h_{only}}(a_h - b_h * q^*_{h_{only}} - c^v_h - mc) - c^f] & (2.) \end{cases}$$

For the information rent it has to be distinguished between the two cases. In the case of discrimination, the high-quality manager gets some profit known as the information rent. In this case, this is basically the difference between what s/he could earn if s/he chose the low-type's contract and what the low-type actually gets before paying the fixed fee. Of course, without any discrimination.

Consequently, in the second case, there is no info rent to be gained by the high-type:

$$\pi_h = \begin{cases} q^*_{h_l}(a_h - b_h \times q^*_{h_l} - c^v_h - p^{IN}_l) - q^*_l(a_l - b_l \times q^*_l - c^v_l - p^{IN}_l) & \text{for (1.)} \\ 0 & \text{for (2.)} \end{cases}$$

The consumer surplus is also quite similar to the previous model. However, here, also the second case has to be considered where only the high-types are offered a contract that they can accept. Note again that the quantity for the low-type is different than in the previous model and thus also the consumer surplus is affected:

$$CS = \begin{cases} \lambda \frac{b_l \times q^{*2}_l}{2} + (1-\lambda)\frac{b_h \times q^{*2}_h}{2} & \text{for (1.)} \\ (1-\lambda)\frac{b_h \times q^{*2}_h}{2} & \text{for (2.)} \end{cases}$$

## 3.3 Two part tariff

The most restrictive model allows the franchisor to specify only a single fixed fee and a unique price for the inputs. Here, charging a price above the marginal costs is the only way to extract more profit from the high- than from the low-quality manager.

The profit the franchisor gets is the fixed fee from both, plus a margin earned from setting prices above marginal cost. The total amount earned from the margin depends on the quantity sold, which is of course higher for the high- than for the low-quality manager. The profit function for the franchisor is therefore:

$$\Pi = T + (p^{IN} - mc)(\lambda \times q_l + (1-\lambda)q_h)$$

Where T is:

$$T = q^*_l[p_l(q^*_l) - p^{IN}] - c_l(q^*_l)$$

Note that $q^*_l$ is a function of the input price and the profit function is maximized subject to $p^{IN}$. However, here it would be also possible that the profit was higher by just focussing on the high-quality managers and setting prices equal to marginal costs and sizing their whole surplus with the fixed fee. This would imply that low-quality managers are not willing to participate in the market:

Using the specified functional form:

$$\Pi = T_h = q^*_{h_{only}}[a_h - b_h \times q^*_{h_{only}} - c^v_h - mc_{inputs}] - c^f$$

With

$$q^*_{h_{only}} = \frac{a_h - c^v_h - mc}{2b_h}$$

Back to the initial case, assuming the profit from serving both is higher: Again, using the specified functional form, the optimal price for the inputs would be:

$$p^{IN*} = \frac{(c_l - a_l + \lambda(a_l - c_l + mc))b_h + (mc + a_h - c_h - \lambda(mc + a_h - c_h))b_l}{(2\lambda - 1)b_h + (2 - 2\lambda)b_l}$$

Given those input prices the franchisee chooses the quantities:

1. $q^*_l = \dfrac{a_l - c^v_l - p^{IN*}}{2b_l}$
2. $q^*_h = \dfrac{a_h - c^v_h - p^{IN*}}{2b_h}$

Now, for both types the quantity is inefficient. However, the quantity for the high-type is larger than for the low-type and as the fixed fee is the same, earning a margin from the units sold is the only way to distinguish the high- from the low-type in this tariff scheme. Thus, the profit for the franchisor is:

$$\Pi = max \begin{cases} q^*_l(a_l - b_l \times q^*_l - p^{IN*} - c^v_l) - c^f + (p^{IN*} - mc)(\lambda \times q^*_l + (1-\lambda)q^*_h) & (1.) \\ (1-\lambda)[q^*_{h_{only}}(a_h - b_h * q^*_{h_{only}} - c^v_h - mc) - c^f] & (2.) \end{cases}$$

While the fixed fee is set exactly in order to extract all the profit from the low-type, the high-quality manager earns some profit in case of discriminatory tariffs. This profit is basically the difference between the profit of the high- and that of the low-type before the fixed fee is paid given the unit prices for the input:

$$\pi_h = \begin{cases} q_h^*(a_h - b_h \times q_h^* - p^{IN*} - c_h^v) - q_l^*(a_l - b_l \times q_l^* - p^{IN*} - c_l^v) & \text{for (1.)} \\ 0 & \text{for (2.)} \end{cases}$$

The consumer surplus looks similar to the second model, and the only difference comes from the different quantities that are sold. For the second case without discrimination, the result is exactly the same, however it is important to note that for the second tariff-schemes higher values of $\lambda$ are required to make discriminatory tariffs attractive.

$$CS = \begin{cases} \lambda \frac{b_l \times q_l^{*2}}{2} + (1-\lambda)\frac{b_h \times q_h^{*2}}{2} & \text{for (1.)} \\ (1-\lambda)\frac{b_h \times q_{h_{only}}^{*2}}{2} & \text{for (2.)} \end{cases}$$

## 3.4 Comparison

When comparing the three tariff schemes, the first one is in a way expected to be the most efficient. Fixing the quantities sold for a certain fixed fee is the most flexible tariff-scheme for the franchisor, who tries to maximize her/his profit by at the one hand extracting as much as possible form the high-type while knowing that at the other hand this comes at the cost of setting an inefficiently low quantity for the low-type, which reduces the profit s/he can make on both types via the fixed fee. The second fee setting scheme is more realistic, as it does not require to fix the quantities beforehand but sets unit prices. However, this leads to a lower efficiency from the franchisor's perspective as there is now a discrepancy in the quantity that the two types of managers would demand in case of the contract that is designed for the low-type. Thus, compared to the first model, the high-quality manager would get some additional profit as s/he can choose a higher quantity. This would lower the fixed fee for the high-type's contract as this out-side option has improved. However, this might be partly compensated by the franchisor if s/he charges an even higher margin at the low-type's contract and thus reduces the quantity even further. Finally, there is the obviously even less flexible third model, in which the price for the input and the fixed fee is set in such a way that double marginalisation occurs for both types.

The following figures compare the three models for the $\lambda$ ranging from 0 to 1 and are produced for a certain specification which can be found in the appendix.

As expected, the franchisor's profit is highest for any $\lambda$ in the first model (if we allow the franchisor to choose the maximum of the function as specified and the function where it only serves the high-type). The second-best fee scheme from the franchisor's perspective is that of the second model, which in this setting comes pretty close to the first fee scheme. Clearly worse is the two-part tariff. This is quite intuitive, as model 3 is a special case of model 2, where the principal is restricted to charge the same price and fixed fee for both. Model 2, in turn, is a restricted version of model 1 where the principal is restricted by the fact that he has to induce the quantities via the price, however for any given price, the high-quality manager demands a higher quantity than the low-type. Thus, accepting the low-types contract is relatively better for the high-type, compared to the case where the quantities are fixed.

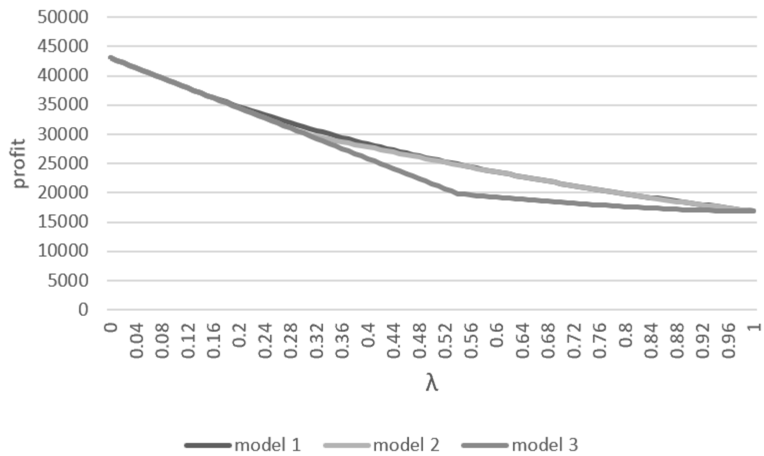



figure 1: franchisor's profit

The quantity sold to and by the low-type is zero for low values of $\lambda$ and starts first with increasing smoothly in the first model (it would slightly jump if the fixed cost problem would be considered). The increase has a negative curvature. For the second model, the condition $p_h^{IN} \leq p_l^{IN}$ ensures that the slope is negative. The curvature depends on whether $\frac{18}{16}b_h \gtrless b_l$. It is positive if $\frac{18}{16}b_h < b_l$ and negative if $\frac{18}{16}b_h > b_l$. There is no curvature if $\frac{18}{16}b_h = b_l$. For the third model, the quantity is positively sloped with a positive curvature in $\lambda$. All three models end up providing the most efficient quantity at $\lambda = 1$.

As analysing comparative statics analytically is becoming enormously complex, I will from now on discuss the intuition behind the result, analysing the included figures based on numeric results for the specification of parameters found in the appendix.

Here, for example, it is interesting to note that once price discrimination becomes attractive for the franchisor, the quantity sold to the low-type jumps upwards even above the quantity sold in the second-best solution, that is the first model.

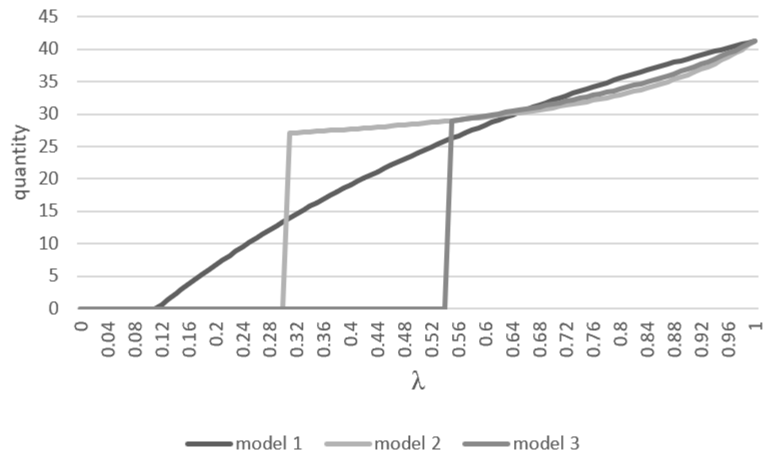



figure 2: quantity sold by low-type

Clearly, the information rent gained by the high-type franchisee can only be larger than zero if the low-type is served as well, as otherwise all his profit would be sized via the fixed fee. While the second and third model end up at the same point, the first model ends up at a much lower value at $\lambda = 1$ as there, the high-types are not completely ignored. This is intuitively clear, as for the first model, deviating to the low-type's contract would result in an inefficiently low quantity for the high-type. For the second and third model however, it is optimal to ignore the high-types completely if there are none and thus they can deviate to the low-types contract where the price is the same and thus, the quantity remains at the efficient level. In other words the difference comes from the fact that the in the first model the quantities are set, and the optimal quantities are different for the high- and the low-type, while in the other two models the quantities are induced via prices and the optimal price is the same for both types, the marginal cost of the franchisor.

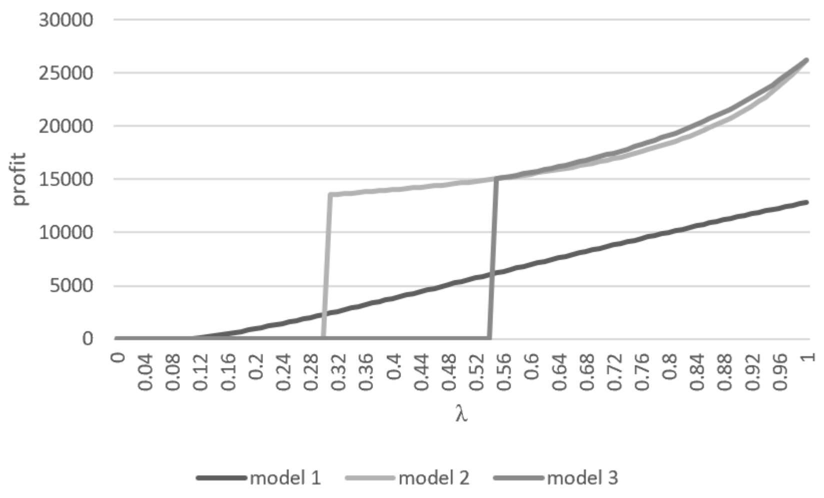



figure 3: information rent

The consumer surplus is primarily determined by $\lambda$ and the quantity sold by the low-quality franchisee. It is in principle decreasing in $\lambda$, as demand is higher for high-quality managers. Further, it is increasing in the quantity sold by the low-type, this is why it jumps up for the first and second model when discrimination starts to occur. Interestingly, the opposite happens in the third model, as there, the positive effect of selling to the low-quality type is off-set by a reduction of the quantity sold by the high-quality manager.

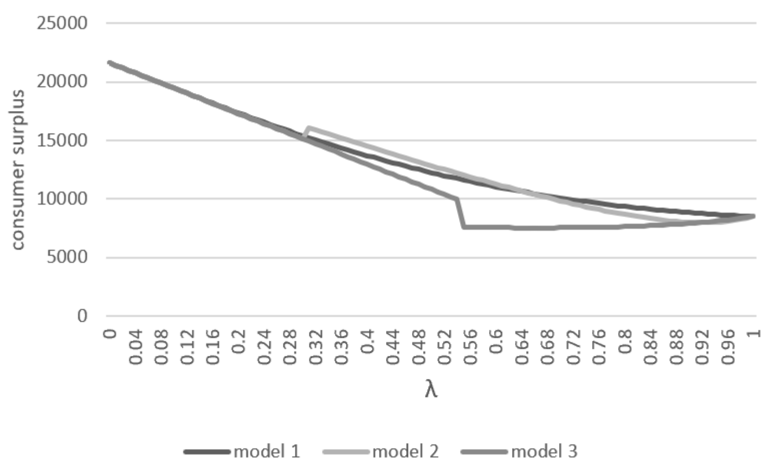



figure 4: consumer surplus

Finally, the results can be aggregated to analyse total welfare. All models start and end at the same point, where only high- and low-types respectively are present and all models offer contracts that are optimal for the present type.

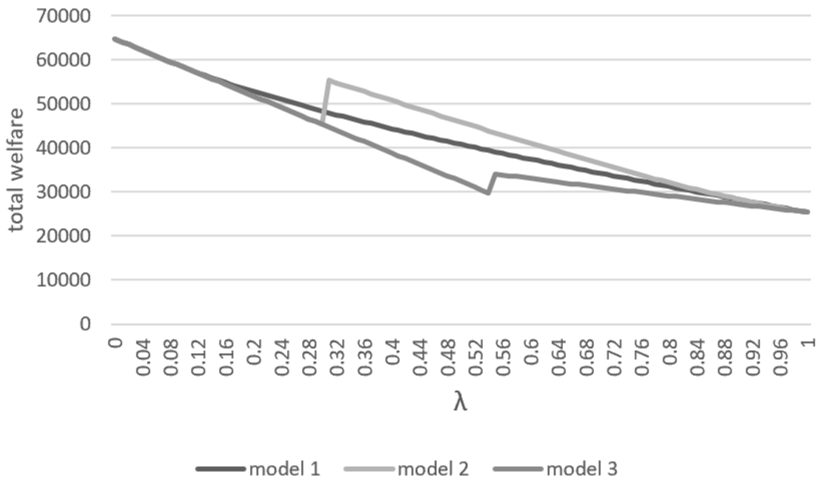



figure 5: total welfare

The profit functions move as expected and, from the franchisor's perspective, the first model weakly dominates the second, which in turn weakly dominates the third model. The most striking result is that contrary to the initial intuition, where one would assume that in the second model there is an additional term reducing the quantity sold to the low-type, actually there are values of $\lambda$ where the quantity sold to the low-type is higher in the second compared to the first model. This can be explained by the following reasoning: The second model is worse at discriminating between high- and low-types and therefore, it makes sense to sell more to the low-type and set the fees closer to each other. In other words, as discrimination works worse, it is done less and overall welfare increases. So, consumers and the high-quality manager gain more than the franchisor loses.

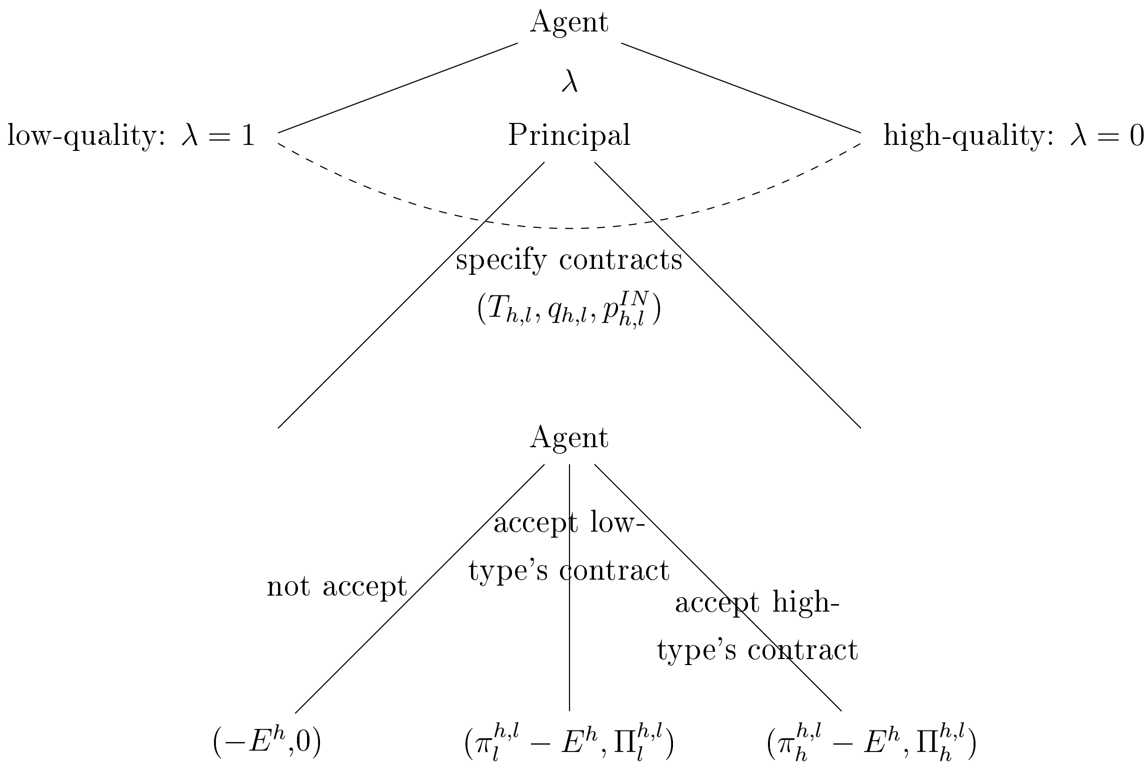
# 4 Extended model

For this section, I want to change the model setting slightly. Instead of treating $\lambda$ as exogenous, I want to add a further decision at the beginning which allows the franchisee to decide whether s/he wants to invest into her/his quality. If s/he decides to invest, her/his type changes to high-quality, but s/he has to pay a sunk cost for education: E.

While the relevance of such a model for practice may be disputable, the setting of a franchisee rather than a customer being discriminated is probably the only reasonable setting to allow for the fraction of high- and low-types not to be treated as exogenous. Clearly, it would be absurd to consider a customer to pay a sunk cost in order to get a higher valuation for a certain good, while the idea of a manager investing in her/his management quality seems to be relatively plausible.

## 4.1 Theoretical set-up

In this setting, there are three equilibrium candidates: one where the franchisee's management invests for sure, one where it does not invest and a mixed equilibrium in which the management is indifferent whether to invest or not and does so with some probability $(1 - \lambda)$.




The first equilibrium candidate cannot be a sub game perfect Nash-equilibrium as if it would be profitable to invest the franchisor would infer that the franchisee will invest for sure and thus set the price at marginal cost and size all the high-quality franchisee's profit via the fixed fee. However, in this case, the management is not able to recover the cost for the education.

Similarly, not investing cannot be part of an equilibrium strategy as long as the education cost is low enough such that investing is considered at least sometimes ($E < a_h - a_l$). If the franchisor believes, every manager is of low-quality and sets the price and fee accordingly, this is the most profitable situation one could think of to be a high-type manager. As the information rent is the highest if $\lambda = 1$ for all three models.

In the mixed equilibrium, the franchisee's management has to be indifferent between investing in education or not, as otherwise, it would be better to go for a pure strategy. The only sub-game perfect Bayesian equilibrium exists when the manager decides to invest with a probability that is such: If the franchisor has correct believes about this probability, s/he would set in each model the fee and prices such that the information rent earned by the franchisee is exactly equal to the cost for education E.

Therefore, the model can be solved by setting the cost for education equal to marginal cost and solving for $\lambda$. Afterwards, the three models can be compared again regarding the franchisor's profit and the consumer surplus.

To solve the equilibrium for each of the three models the cost for E is set equal to the information rent and the equation is than solved for $\lambda$:
$E = \pi_h(\lambda)$

These are all quadratic equations in $\lambda$ which have to be solved using the quadratic formula. The inputs for the quadratic formula can be found in the appendix.

The only relevant solutions are those where $0 \leq \lambda \leq 1$. Further, one has to verify for model 2 and 3 that for the corresponding fraction $\lambda$, it is indeed optimal for the franchisor to offer a discriminatory tariff and not just focus on the high-type.

## 4.2 Results

After introducing the theoretical set-up of the extended model, I now want to discuss the consequences this extra decision has for the results of the models and how it may affect the decision of which tariff scheme to use.

The first thing to look at is the fraction of low-quality managers $\lambda$ that allows for an equilibrium to exist for a given cost of education.

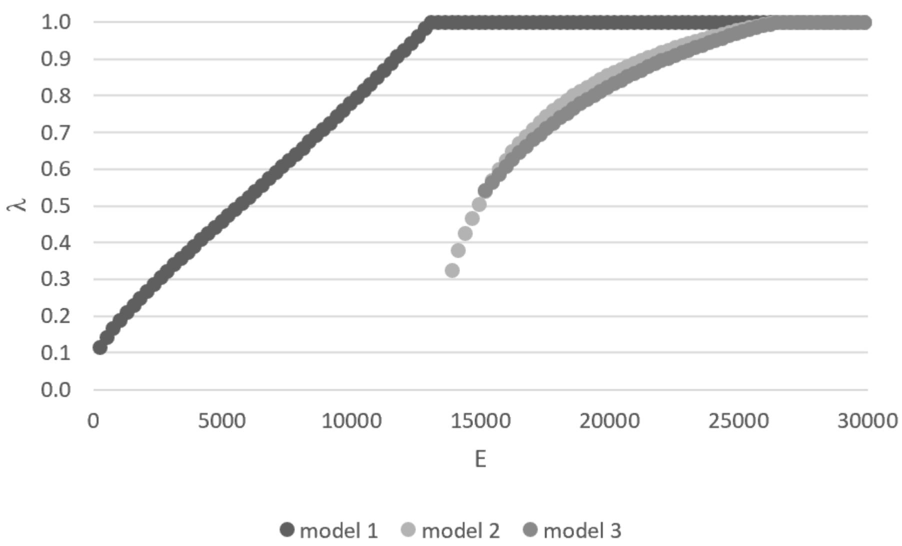



figure 6: $\lambda$

While there is a solution for the first model for any cost of education, the second and the third model do not allow to specify $\lambda$ between 0 and 1 that leads to an equilibrium when the cost of education is low. This follows from a discontinuity of the best response function of the franchisor due to the jump in the best response function of setting prices/ quantities for the low-type. This jump occurs at the point where the franchisor's best response changes from not discriminate for low $\lambda$ to use discriminating tariff-schemes. Assume that E is low: This makes it in the first place relatively attractive to invest and become a high-type. Thus, the fraction of being high-type is high. However, if the fraction for being high-type exceeds a certain threshold, the franchisor would respond by not using a discriminatory tariff scheme but only subtract all the profit from the high-type.

This in turn would mean that the high-quality manager could not recover the sunk cost and would not invest in the first place. But, if in the equilibrium strategy "not invest" would be played with probability one, the optimal tariff scheme of the franchisor would be focussing on the low-type only and then, there is a potential gain for being high-type.

The next question is how the profit for the franchisor depends on the cost of education. Here, where the models overlap, one can compare the different tariff schemes in this setting and decide which would be optimal for the franchisor to implement.

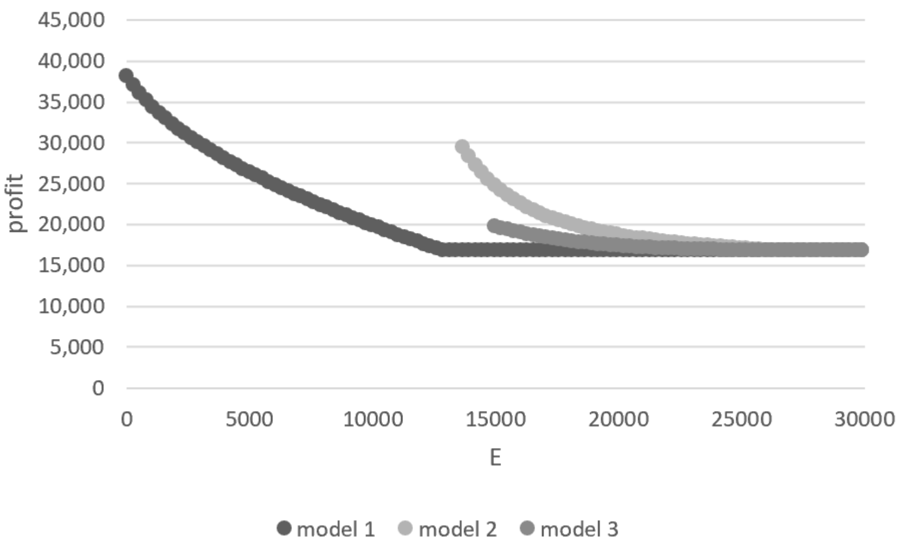



figure 7: franchisor's profit given E

As one can see here at least for this parameter setting, the second model obviously dominates the third one and even offers a higher profit for the franchisor for the range where an equilibrium can be found and E is relatively high.

As the profit of the franchisee is necessarily always zero in equilibrium, the next to analyse is the consumer surplus.

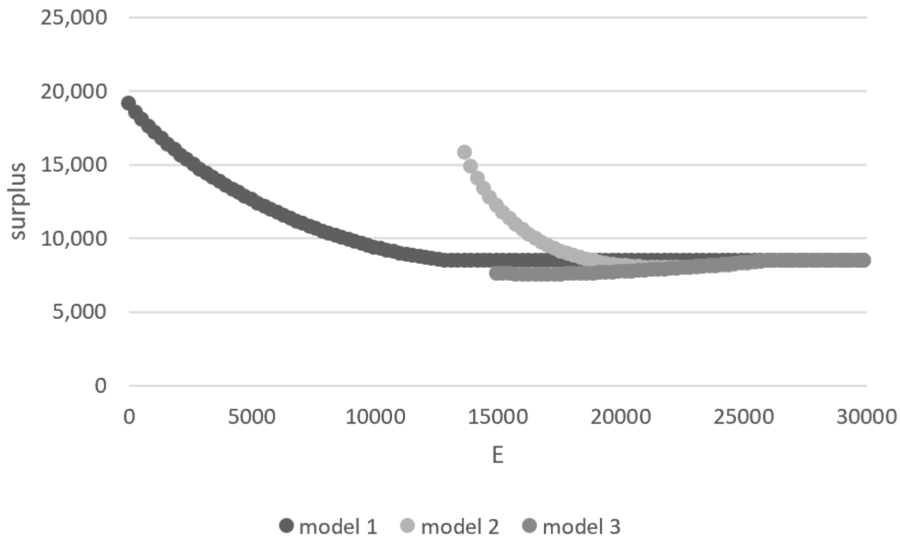



figure 8: consumer surplus given E

Here, it is interesting to note that in the second as well as in the third model the consumer surplus for relatively high levels of E falls below the level for the even higher values of E where the fraction of low-types becomes 1. This can only be explained by the inefficiently low quantities sold in case of price discrimination and the fact that this is in particular relevant for the relatively large probability of being low-type.

Finally, the total welfare is obtained by aggregating franchisor's profit and consumer surplus.

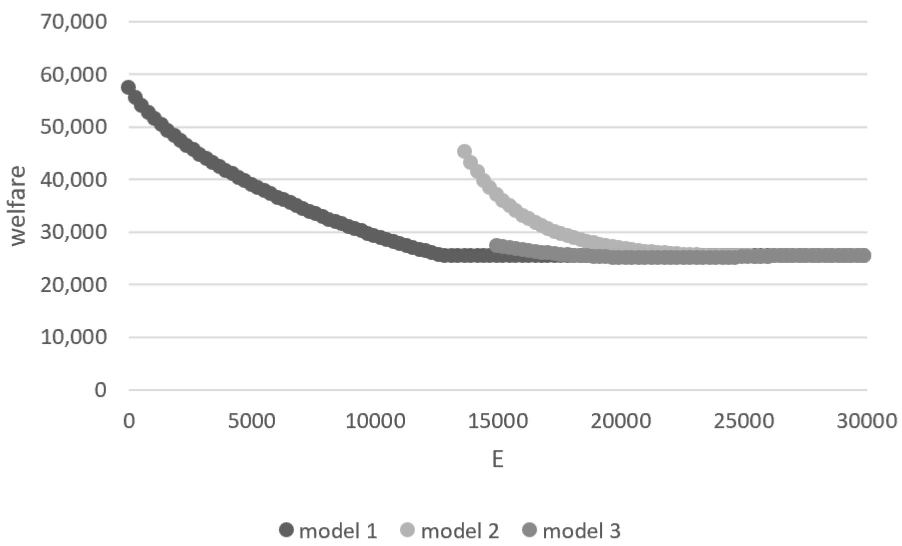



figure 9: total welfare given E

In this figure, at least it appears that total welfare is, for all three models, a decreasing function in E, at least where an equilibrium exists. For high levels of E, where for all models the equilibrium is defined, the second model is obviously welfare enhancing compared to the first and the third model, while the third model is quite close to the first.

# 5 Conclusion

Applying models of price discrimination to the tariff setting of franchises is not just a plausible explanation for why in such corporate structures, prices above marginal cost as well as revenue- and profit-based tariffs are used, but also allows for interesting extensions of the standard model.[16]

When comparing the three types of tariff-schemes, the trade-off between extracting a part of the additional rent earned by the high-quality manager and the problem of a shrinking pie that the total franchise gets due to double-marginalisation becomes obvious. In principle, the classical second degree price discrimination where the quantities are fixed has the best relation of rent extraction and double-marginalisation and thus, it is used for the smallest fraction of low-quality managers $\lambda$, while in the two-part tariff, the franchisor destroys a larger part of the pie when he tries to seize a higher fraction from the high-quality manager's information rent. Therefore, this tariff-scheme only becomes profitable for the franchisor for relatively high values of $\lambda$. This trade-off has interesting implications for total welfare.

The trade-off is far from trivial, this can be illustrated best by the example of the second model, which can be considered a hybrid of the others. As such, this model is the second best from the franchisor's perspective, yielding for any $\lambda$ a higher profit than the third but a lower profit than the first model. In the second model the franchisor would start using price discrimination for a value of $\lambda$ that is between the values of model 1 and 3. However, once the franchisor starts to offer to both types, s/he sizes for some parameter specifications, like the one given, a lower share than in the first model as s/he would destroy a larger part of the pie. So the franchisor's absolute profit is larger if s/he takes the lower share of the larger pie rather than the same or even larger share as in the first model of a much smaller pie. Therefore, in this setting, the franchisee and the consumers are better of than in the first model and even the total welfare increases.

[16]Rubin, Paul H. "The Theory of the Firm and the Structure of the Franchise Contract." The Journal of law and economics 21.1 (1978): 223-233.

Seid, Michael. "Understanding Franchise Payments and Royalty Fees." Retrieved from The Balance Small Business: https://www.thebalancesmb.com/what-is-a-royalty-fee-1350580 [11.05.2019]

This trade-off and its consequences for the information rent also affect the extended model crucially, because in equilibrium the information rent equals the cost of education. The worse the double-marginalisation rent extraction trade-off is, the higher is the information rent for the high-quality manager for any given $\lambda$. Therefore, when the information rent equals the cost of education and we compare two models for a given cost of education and thus keep the information rent constant, the models that have the worse initial trade-off require a lower $\lambda$, meaning more high-quality managers. This, in turn, leads to a larger pie that can be distributed and therefore, for some parameter specifications, even the franchisor can be better off in equilibrium when using a tariff-scheme that, in principal, performs worse.

Based on the results of the basic model and the comparisons, specifying a contract offering two different prices and fixed fees would seem to be a reasonable suggestion to franchisors as it yields, at least for the specification I analysed, a similar profit for any value of $\lambda$ than the second best solution (model 1) without having the critical restriction of having to specify exact quantities in advance, which is not practical. In this setting, the two-part tariff is clearly worse, however, this may be different if a continuity of types rather than the simplified assumption of two types is considered. This could be an interesting topic for further research.

From a regulatory point of view in the setting I used it would probably make sense to protect consumers from two-part tariffs and if the fraction of the low-type is very high also from the second tariff-schemes.

To conclude, applying discriminatory tariffs to franchises results in a nontrivial trade-off and allows for interesting extensions of the standard price discrimination models. This setting allows for relatively complex comparative statics, which leaves quite a lot of possibilities for further analytical analysis and perform sensitivity analysis regarding the parameters. For example it would be interesting to analyse the intersection of the quantity sold to the low-type of model 2 and 3 in the first setting as a function of the parameters.

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# 7 Mathematical Appendix

The quadratic formula has to be solved using the following inputs in order to obtain the fraction $\lambda$ that ensures that for each model the information rent equals the cost for education:

$$\frac{-B\pm\sqrt{B^2-4AC}}{2A}$$

For model 1:

$A = 4E \times b_h^2 - 2b_h[(a_l - a_h - c_l^v + c_h^v)^2 - (a_l - c_l^v - mc)(a_l - a_h - c_l^v + c_h^v)] + [(a_l - c_l^v - mc) - (a_l - a_h - c_l^v + c_h^v)]^2(b_h - b_l)$

$B = 8E(b_h \times b_l - b_h^2) + 2b_h(a_l - a_h - c_l^v + c_h^v)$

$C = 4E(b_h - b_l)^2 - (a_l - a_h - c_l^v + c_h^v)^2(b_h - b_l)$

For model 2:

$A = (2b_l \times mc - 6(b_l(a_h - c_h^v) - b_h(a_l - c_l^v)))^2(b_l - b_h) + (2b_l \times mc - 6(b_l(a_h - c_h^v) - b_h(a_l - c_l^v)))(18b_h - 16b_l)(2c_h^v \times b_l - 2a_h \times b_l - 2c_l^v \times b_h + 2a_l \times b_h) + (18b_h - 16b_l)^2(a_h^2 \times b_l - 2a_h \times c_h^v \times b_l - a_l^2 \times b_h + 2a_l \times c_l^v \times b_h - c_l^{v2} \times b_h - 4E \times b_h \times b_l)$

$B = 2(6(b_l(a_h - c_h^v) - b_h(a_l - c_l^v)))(2b_l \times mc - (6(b_l(a_h - c_h^v) - b_h(a_l - c_l^v))))(b_l - b_h) + (18b_h - 16b_l)(6(b_l(a_h - c_h^v) - b_h(a_l - c_l^v))) + 18(b_l - b_h)(2b_l \times mc - (6(b_l(a_h - c_h^v) - b_h(a_l - c_l^v))))(2c_h^v \times b_l - 2a_h \times b_l - 2c_l \times b_h + 2a_l \times b_h) + 36(b_l - b_h)(18b_h - 16_l)(a_h^2 \times b_l - 2a_h \times c_h^v \times b_l - a_l^2 \times b_h + 2a_l \times c_l^v \times b_h - c_l^{v2} \times b_h - 4E \times b_h \times b_l)$

$C = (6(b_l(a_h - c_h^v) - b_h(a_l - c_l^v)))^2(b_l - b_h) + 18(b_l - b_h)(6(b_l(a_h - c_h^v) - b_h(a_l - c_l^v)))(2c_h^v \times b_l - 2a_h \times b_l - 2c_l \times b_h + 2a_l \times b_h) + 18^2(b_l - b_h)^2(a_h^2 \times b_l - 2a_h \times c_h \times b_l - a_l^2 \times b_h + 2a_l \times c_l^v \times b_h - c_l^{v2} \times b_h - 4E \times b_h \times b_l)$

For model 3:

$A = 4(b_h - b_l)^2((a_h - c_h^v)^2 b_l - (a_l - c_l^v)^2 b_h - 4E \times b_h \times b_l) + 2(b_h - b_l)((a_l - c_l^v + mc)b_h - (a_h - c_h^v + mc)b_l) + ((a_l - c_l^v + mc)b_h - (a_h - c_h^v + mc)b_l)^2(b_l - b_h)$

$B = 4(b_h - b_l)(2b_l - b_h)((a_h - c_h^v)^2 b_l - (a_l - c_l^v)^2 b_h - 4E \times b_h \times b_l) + (2(b_h - b_l)((c_l^v - a_l)b_h + (mc + a_h - c_h^v)b_l) + (2b_l - b_h)((a_l - c_l^v + mc)b_h - (a_h - c_h^v + mc)b_l))(2b_l(c_h^v - a_h) - 2b_h(c_l^v - a_l)) + 2((a_l - c_l^v + mc)b_h - (a_h - c_h^v + mc)b_l)((c_l^v - a_l)b_h + (mc + a_h - c_h^v)b_l)(b_l - b_h)$

$C = (2b_l - b_h)^2((a_h - c_h^v)^2 b_l - (a_l - c_l^v)^2 b_h - 4E \times b_h \times b_l) + (2b_l - b_h)((c_l^v - a_l)b_h + (mc + a_h - c_h^v)b_l)(2b_l(c_h^v - a_h) - 2b_h(c_l^v - a_l)) + ((c_l^v - a_l)b_h + (mc + a_h - c_h^v)b_l)^2(b_l - b_h)$

Note that only $0 \leq \lambda \leq 1$ are valid solutions. Further in particular for model 2 and 3 it has to be checked that for the returned $\lambda$ the franchisor will indeed use discriminatory tariffs and is not better off serving just the low-type.

Parameter specifications for figures in the result section:

- $a_h = 1000$
- $a_l = 900$
- $b_h = 5$
- $b_l = 10$
- $c_h^v = 20$
- $c_l^v = 25$
- $c^f = 150$
- $mc = 50$

# 8 Appendix

## 8.1 English Summary

The master thesis is about applying the concept of consumer price discrimination to the tariff setting of franchises. The thesis starts with introducing the business model of franchises and its relevance in business. Then, the idea of applying price discrimination to franchises' tariffs is encouraged by providing an alternative explanation for revenue or profit based fees or suggesting to franchisors to consider such methods to increase profits.

The literature review is split in two main categories. The first part is about the classic papers regarding price discrimination such as Oi (1971) or Rothschild and Stiglitz (1976). The second category are economic papers about franchises in general.

Then, the general setting of the model is introduced. Afterwards, I explain in detail three different tariff schemes and later compare and interpret the results. For this step I numerically analyse the models varying the fraction of high-types from zero to one. Then, the model is extended by adding a further step. Instead of treating the fraction of high-quality managers as exogenous, I add another decision layer that allows the franchisee's manager to choose whether to invest in sunk cost to update her/his quality-type. Finally, I will also evaluate and compare all three tariff schemes in this setting numerically. This time the cost of education is varied.

My master thesis concludes with a discussion about the relevance of the models and the insights obtained.

## 8.2 German Summary/ Deutsche Zusammenfassung

Meine Masterarbeit befasst sich mit dem Konzept der Preisdiskriminierung, das auf die Tarifsetzung von Franchiseunternehmen angewandt wird. In der Einleitung wird daher das Geschäftsmodell von Franchiseunternehmen vorgestellt und die Bedeutung für die Geschäftswelt hervorgehoben. Die Idee der Anwendung von Preisdiskriminierung auf die Tarifsätze von Franchisestrukturen wird dadurch begründet, dass diese zum einem eine alternative Erklärung für umsatz- bzw. profitabhängige Tarife ist und zum anderen als Vorschlag für FranchisegeberInnen dient, solche Überlegungen anzustellen um die Gewinne zu erhöhen.

Die Literaturzusammenfassung umfasst zwei Kategorien von Artikeln. Der erste Teil befasst sich mit klassischen Arbeiten zum Thema Preisdiskriminierung, sowie zum Beispiel Oi (1971) oder Rothschild and Stiglitz (1976). Die zweite Kategorie bezieht sich auf Werke zum Thema Franchise im Allgemeinen.

Im Hauptteil wird das generelle Setting des Modells vorgestellt. Dabei erkläre ich im Detail drei unterschiedliche Tarifschemen, interpretiere und vergleiche die Ergebnisse. Für diesen Schritt wird das Modell numerisch analysiert und der Anteil der ManagerInnen, welche von hoher Qualität sind, von 0 bis 100% variiert. In der Folge wird das Modell um einen Schritt erweitert. Anstelle des Anteiles an ManagerInnen von hoher Qualität als exogen zu betrachten, wird eine weitere Entscheidungsebene eingeführt, welche es den FranchisenehmerInnen erlaubt zu entscheiden ob sie bereit sind, versenkte Kosten in Kauf zu nehmen um ihre Qualität zu erhöhen. Schlussendlich werden auch in diesem Setting alle Tarifschemen numerisch evaluiert und verglichen. In diesem Fall werden die Kosten für die Qualität variiert.

Beendet wird die Masterarbeit mit einer Diskussion über die Relevanz und Einordnung des Modells sowie der daraus gewonnenen Erkenntnisse.