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**Sales Contests versus Quotas with Imbalanced Territories**

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\* Corresponding Author**Sales Contests versus Quotas with Imbalanced Territories**

**Abstract**: This paper studies the consequences of sales contests versus quota systems when territories have imbalanced sales potential. How do the optimal sales, efforts of salespeople, and profits vary with territory imbalance in a sales contest and how do these change if compensation is based upon quotas? Our major result is that territory imbalance has a differential effect: it hurts a contest more than a quota. In a sales contest, the salesperson in the stronger territory only need to mimic the effort of the salesperson in the other territory to maximize compensation, but this implies that the salesperson in the weaker territory will shirk relative to a quota system. Handicapping the contest to correct for territory imbalance overcomes its disadvantage vis-à-vis the quota plan, but this is seldom incorporated into sales contests.

Keywords: Imbalanced Sales Territories, Sales Contest, Quotas, Sales Potential**1. Introduction**

Firms frequently use sales contests and quotas to motivate salespeople, especially with an eye to accelerating short-term results (Murphy and Dacin 1998; Murphy et al. 2004; Oyer 2000; Darmon 1979). A sales contest pits one salesperson against others while a quota prespecifies a sales goal required to earn a bonus.

A major consideration in designing any compensation system, including sales contests and quotas, is the sales potential of the different territories assigned to the salespeople. The number and quality of the customers in a territory has a huge impact on sales, and such sales potential is one of the three major factors in territory planning (Talley 1961). In their influential book on sales force compensation, Zoltners et al. (2006) say that the measurement of territory potential is one of the five critical steps in setting sales force goals.

There have been some attempts at incorporating territory potential in sales response functions (Lucas et al. 1975), but the problem of properly accounting for territory potential in designing compensation persists. Though managers try as best they can to balance the territories, as a practical matter this is not always feasible and maybe too costly. Many practitioners have commented on how unequal sales territories are in actual practice. Quite recently Zoltners and Lorimer (2000, p.139) have remarked that, “We have observed that sales managers are frequently surprised to learn how unequal their sales territories are.” Cravens et al. (1972) have noted that balancing territories is a persisting problem (p. 31). Moreover, the problem of determining and aligning territory potential is likely to endure (see Zoltners et al. 2006). Thus, in multi-territory selling situations territories could be imbalanced, so sales managers will have to design compensation plans taking into account different territory potentials. This practical and managerially relevant consideration is the setting for our research.

We focus on two commonly occurring types of sales force compensation plans: sales contests and quota-bonus plans (henceforth, ‘quotas’). Both are widely used by firms, mostly for short-term profits goals, to boost sales, to focus sales force attention, to improve morale, or to reward performance (Zoltners, et al. 2006, chapters 7 and 10). In both the contest and the quota systems, salespeople win a prize if they surpass a sales threshold. The compensation systems differ in how the threshold is determined: in the contest, the threshold is the sales level of other salespeople, and in the quota, the threshold is a predetermined sales figure. The contest uses the rank-order of a salesperson’s results while the quota looks only at that individual’s results.

Our first goal is to investigate how the contest’s winning and losing prizes is affected by degree of territorial imbalance. The same is done for a quota system. This provides guidelines for how managers implementing a given compensation system can better design them to incorporate the effects of territory imbalance. Additionally, we ask how the agents’ efforts and firm profits in the quota system and in a contest respond to changes in territory imbalance.

The specific research questions we address in this paper are as follows. First, under a sales contest compensation plan, how do the optimal sales efforts, bonus payments, and profits vary with the degree of imbalance in the sales potential of the territories? Second, under a quota-based compensation plan, how do the optimal sales efforts, bonus for quota, and profits vary with the degree of imbalance in the sales potential of the territories? Third, are equilibrium efforts of the salespeople and firm profits greater for a sales contest or for a quota plan when the territories are imbalanced? Fourth, if territories are inherently different, how can the payment system be adjusted to compensate?

**1.1 Relevant Literature**

Our study contributes to three research streams. First, the theory of bonus-quota has been analyzed by Kim (1997) and Oyer (2000) in economics, and in marketing by scholars like Joseph and Kalwani (1998), Mantrala, Raman and Desiraju (1997), Mantrala, Sinha and Zoltners (1994) and Raju and Srinivasan (1996). Second, the theoretical literature on contests began with the pioneering work of Lazear and Rosen (1981), Nalebuff and Stiglitz (1983), and Green and Stokey (1983) in economics, and was continued in marketing by Kalra and Shi (2001). We differ from both these literature streams by incorporating imbalanced territories in our analysis, and this allows us to explore the effect of degree of imbalance on quantities of interest like the winning and losing prizes in a contest and the bonus and quota for a bonus-quota system. Third, although some researchers in economics have theoretically compared rank-order and individual performance systems, prominent among them being Lazear and Rosen (1981) and Green and Stokey (1983), we differ in several ways compared to this literature as seen in Table 1. Few papers contrast rank-order contests and piece-rates as ours does, and all that do impose the requirement that the market situations are identical (homogeneous costs, productivity, and territory strength). All the papers that permit heterogeneous situations study exactly one of the compensation systems, rank-order or individual but not both. Finally, while according to a recent field survey, bonus-quota are used by 72% of firms compared to 58% of firms using commission rates (Joseph and Kalwani 1998), none of the papers compare quotas to sales contests, as ours does.

Quotas and contests have been studied empirically by Mantrala, Krafft and Weitz (1999), Nalbanthian and Schotter (1997) and Wu and Roe (2005) amongst others, with mixed findings. Of course, all three of these papers assume balanced territories. While Nalbanthian and Schotter (1997) find that relative performance systems are more profitable, Wu and Roe (2005) find that an individual target-based system is better, except when the common shock term in the sales response function is dominant. However, the latter paper (like Bull, Schotter and Weigelt 1987 and Chen, Ham and Lam 2011) does not use the optimal prize structure, so their experimental results are inherently incomplete.

*Table 1.* Multi-Agent Payment Systems:

Asymmetric Situations and Rank-Order/Individual Performance

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| --- | --- | --- | --- | --- |
|  | Payment System Based Upon: | |  | |
|  | Rank-order Performance | Individual Performance | Comparison of Rank-Order vs. Individual Payment Systems? | |
| Asymmetry in Sales Situations? | Contests | Quota or Commission | Contest vs. Commission | Contest vs. Quota |
| Homogeneity | Lazear & Rosen (1981)  Green & Stokey (1983)  Nalebuff & Stiglitz (1983)  Kalra and Shi (2001)  **This paper** | Lazear & Rosen (1981)  Green & Stokey (1983)  Nalebuff & Stiglitz (1983)  Kim (1997)  **This paper** | Lazear & Rosen (1981)  Green & Stokey (1983)  Nalebuff & Stiglitz (1983)  **This paper** | **This paper** |
| Heterogeneity | Lazear & Rosen (1981)  Meyer (1992)  **This paper** | Mantrala, et al. (1994)  Raju and Srinivasan (1996)  Levy and Vukina (2002)  **This paper** | **This paper** | **This paper** |

**1.2 Presaging the Main Result**

While territorial imbalance hurts both a contest and a quota, our main theoretical result shows *it hurts the contest more*.This differential effect is novel. The extant comparative literature which only considers homogeneous situations finds that for risk neutral agents, an individual compensation system, such as a quota system, never dominates a relative compensation system, such as a contest. In fact, a quota and a contest are equivalent from the point of view of firm profits for homogenous agents (balanced territories). This is not true with imbalanced territories and the basic logic of the disparity is as follows. The salesperson in the stronger territory exerts just enough effort to match the other’s effort, anticipating that the contest will then be won by the strength of the territory. The salesperson in the weaker territory realizes that effort cannot overcome the weakness of the territory, and with reduced likelihood of winning the contest, cannot justify costly effort. Consequently, both salespeople shirk relative to the effort motivated by a quota. It is important to note that the main finding is not based upon a quota generating more information or having more tactical degrees of freedom. The disparity holds *even if* the firm offers a common quota for all territories, so that each compensation system has two tools: bonus and quota for the quota system and winning and losing prizes for the contest. Nor is the finding based upon a quota’s superior control of payment risks, because the result holds even with risk-neutrality of agents.

Can territory imbalance be reversed by appropriate compensation design? We also investigate territory-specific bonus-quota plans and handicapped contests. When the firm optimally handicaps, like Lazear and Rosen (1981) we find this corrects for territory imbalance. However, while territory-specific quotas are commonplace, handicapped contests are seldom observed, giving the main result practical import.

**2. Sales Contest versus Quotas when Territories are Imbalanced**

Suppose a risk-neutral firm employs two risk-neutral salespersons who will exert efforts to sell the firm’s goods. Each salesperson is assigned to a separate territory, i=1,2. The firm cannot observe the levels of salespersons’ effort, ei, but can observe dollar sales, si. The sales in a territory depend not only on the salesperson’s level of effort but also on the territory potential. Without loss of generality, we assume territory 1 is the stronger territory. In particular, the sales in territory 1 is , and the sales in territory 2 is , where 0<k<½ is the advantage of territory 1 over territory 2. Here μ is a positive constant, ei is the effort level of salesperson in territory i, and a random component of sales, i, is uniformly distributed on the interval [- ½ , ½ ].[[1]](#footnote-1) Sales in territory 1 are shifted up by k and the sales in territory 2 are shifted down by the same amount; we limit the imbalance k to ½ so that sales are never negative with certainty. The random variable, i, independent and identically distributed across different territories, reflects the sales influenced by territory-specific environmental shocks outside the salespersons’ control. The assumption of independence is chosen to level the playing field to focus just on territory imbalance. If there were common shocks, they would cancel in a comparison of sales in a contest but would not disappear in a quota system.

We examine two payment systems, sales contests and quota. Consider first a sales contest between two salespersons with a bonus paid to the one with the higher sales:

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The contest has two prizes, S and S+B, with S given to the contest loser and S+B given to the contest winner. Second, in a quota system the salesperson is entitled to a bonus only if sales exceeds a prespecified quota, Q, and not otherwise:

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The quota system has two facets to control, B and Q, the same number as in the sales contest.[[2]](#footnote-2) In general the B’s for the contest and quota scheme are different as seen in sections 2.1 and 2.2.

**2.1 Sales Contest with Imbalanced Territories**

Winning the sales contest is never certain because of the random components of sales. The probability that the salesperson in territory 1 wins the sales contest is Prob(s1≥s2) =

Prob(μ+k+e1+1 ≥ μ–k+e2+2). The derivation of this probability and all other mathematical details are found in a technical-appendix on the authors’ webpage. Efforts are costly to the salespeople and rise quadratically, ei2. The net expected utilities of risk neutral salespeople are

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where is the utility available at the second best job. The firm’s expected profit is  because the territory imbalance terms cancel, the expected value of the random terms in sales are zero, both salespeople are paid a salary, and precisely one of them wins a bonus in the contest.

As in the traditional principal-agent models, the firm chooses salary and bonus to maximize expected profit assuming that the agents choose Nash equilibrium efforts and the salesperson in the weaker territory is just willing to participate rather than taking the second best job. The technical-appendix provides the derivation of the equilibrium effort levels, bonus salary, and profit in a sales contest, which are functions of territory imbalance k as follows.

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From these we can establish the predicted adjustment of the decision makers to increased territory imbalance, as described next.

Note that the efforts of the two agents are identical in (5) even though the two territories are not balanced. The salesperson in the stronger territory knows that he has a natural advantage and all that matters to winning the contest is having more total sales than the weaker territory. The stronger territory salesperson can simply match the effort of the other salesperson, allowing her natural territorial advantage to win the contest with less work. The salesperson in the weak territory recognizes that her/his extra hustle can always be matched by the rival so the contest outcome is determined by the unlucky assignment to this territory.

Differentiation of (5) with respect to k leads to the conclusion that, as the territories become more imbalanced, the common level of effort diminishes. Following the above logic, this makes sense because the salesperson in the weaker territory becomes more discouraged that work will pay dividends as k increases. When k has increased to , this discouragement will drive the effort in the weaker territory to zero (matched in the stronger territory).

What about the firm’s compensation? As the territories become more imbalanced, the salespeople exert less effort and this reduces the firm’s incentive to pay the salesperson for winning the contest: the derivative of the bonus in (6) with respect to k is negative. To keep the salespeople participating, the salary in (7) must increase as k grows.

While the firm will reduce bonuses, this is a second-best adjustment. Even though for given effort, the total expected sales is unaffected by greater territory imbalance (sales in territory 1 goes up as much as it goes down in territory 2), the effort is not given. As seen in Proposition 1, effort drops with greater imbalance, so the expected profits also fall.

**Proposition 1**: In a contest with imbalanced territories:

1. Regardless of how imbalanced their territories, the two salespeople exert identical effort to win the sales contest.
2. The common effort decreases in territory imbalance.
3. The firm’s optimal profit decreases in territory imbalance.

**2.2 Quota with Imbalanced Territories**

Now consider a bonus-quota system. The quota compensation system pays a bonus to the salesperson in a territory if and only if the territory’s sales exceed a pre-specified, but optimally set, quota regardless of the sales in the other territory. In this section we will analyze the case where the firm offers a single bonus and quota common to both territories to contrast to the contest’s two prizes. As above, we also assume risk-neutrality. Thus we can lay aside the issue of control of risk and the number of decision variables the firm adjusts as alternate explanations for the quota plan’s superior performance, and focus entirely on how territory imbalance affects the agents’ efforts in a contest and quota. It is important to point out that a single quota plan and risk neutrality are assumed only here in Section 2 to isolate agents’ efforts as drivers of our main theoretical result stated as ‘Main Result’ in section 2.3. In Sections 3 and 4, we allow the firm to offer territory-specific quotas and handicapped contests to correct for territory imbalance and introduce risk-averse agents.

Using the same method for the quota as was used for the contest, we solve for the equilibrium quota compensation and the corresponding equilibrium efforts levels and firms’ profit in the appendix, as summarized below.

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To keep the salesperson in the weaker territory participating, the firm reduces the quota as imbalance increases, making it easier to obtain the bonus. Because the quota is achieved more frequently, the profit maximizing bonus is reduced. Although these adjustments mitigate the problem of imbalanced territories, the expected profit of the firm falls with the degree of territory imbalance.

With a quota-based compensation system, the effort is primarily driven by the bonus. As the territories become more imbalanced the effort in both territories is reduced because the bonus is reduced.

**Proposition 2:** In the quota system with imbalanced territories:

1. The optimal bonus, quota, and profit decrease as the territories’ potential becomes more imbalanced.
2. The effort decreases in territory imbalance.

**2.3. Comparison of Sales Contest and Quota with Imbalanced Territories**

By contrasting equation (5) for the contest to equation (9) for the quota, we see that effort in the contest is uniformly below that of the quota for imbalance territories. Why is this? In the contest, additional effort improves the likelihood of winning but with an incremental benefit that depends on the excess of effort over that found in the other territory. As we have seen it is likely that the two efforts will be similar, so the incremental benefit of greater hustle is not large. On the other hand, in the quota additional effort pays dividends regardless of what is done in the other territory. Hence, exerting more effort has a bigger effect in a quota system than a contest.

**Proposition 3:** Effort is larger with a quota-based system than a sales contest, and when territory imbalance is large enough that both salespeople would stop exerting effort in a sales contest, they would still exert positive effort under a quota system.

The main theoretical insight that we offer in this paper is that territory imbalance harms the contest more than the quota. Contrast profits for the contest in equation (8) to those for a quota in equation (12), and one can see that if k ≤ k0≈0.19 the profit in a contest is below that of a quota system.

**Main Result:** When the territories are imbalanced with respect to their sales potentials, the firm’s profit with a contest is uniformly lower than its profit with a quota system.

The rationale for the Main Result lies in the optimal efforts of the agents in the contest and quota system described in Proposition 3. The agent in the weaker territory anticipates effort matching and so does not exert extra effort to win the contest. The Main Result shows a clear point of departure of our work from the extant theory literature comparing individual and relative systems. [[3]](#footnote-3) This literature finds that with risk neutral agents, the firm is indifferent between a contest and a quota when territories are balanced.

Turn now to the bonuses. The sales contest and quota plan both pay a salesperson a bonus for high sales. In the contest “high” sales is relative to the other salesperson and in the quota system there is an absolute standard for “high.” Which payment system has the higher bonus? By contrasting equation (6) to equation (10), the optimal quota offers a larger bonus. The marginal probability of receiving the bonus with respect to effort is higher in the quota than the contest because the quota does not have to contrast imbalanced territories. Thus, larger bonuses are more profitable in a quota than a contest.

**3. Handicapped Contest versus Dual Quota Systems**

Sales practitioners may feel that the disadvantage of contest vis-à-vis quotas with imbalanced territories stated in the Main Result is common knowledge. However, one must be careful not to compare a contest to a quota system that has been tailored to the territory sales potential. To avoid this confound, we allow the firm to both handicap the contest and to offer territory-specific quotas, which we call a dual quota system. Without loss of generality we assume μ=0 for this section.

**3.1. Contest with Handicapping**

Because of the known advantage of territory 1 over territory 2, it seems unfair for the contest to contrast sales that are in part beyond the control of the salespeople. Suppose instead that the weaker territory 2 is given an accounting head start in an amount h. That is, for the purposes of the contest, sales are treated as though they were are s1-h and s2+h. Let the handicapped imbalance be denoted K≡k-h. According to (1), the equilibrium effort levels that result are . The maximum efforts are achieved at K=0. By deducting this implied handicap h=k from territory 1 and adding it to territory 2, the problem reduces to the balanced case. For the handicapped contest the profit is (see Appendix).

**3.2 Dual Quota Plans**

In parallel with handicapped contest, consider dual quotas. The quota territory 1, Q1, is greater than the quota for territory 2, Q2, due to the territory imbalance. The equilibrium efforts, bonus and territory-specific quotas for the dual quota case are given in the appendix. The firm’s profit is, .

From a comparison of profits we can see that for the risk neutral case, handicapping the contest exactly corrects for territory imbalance and the firm’s profit with the handicapped contest equals its profit when it sets two territory-specific quota plans.

**4. Sales Contest versus Quota when Agents are Risk Averse**

In the analytical sales force literature it is common to assume that, while the firm is risk neutral, the agents are risk averse. We incorporate risk aversion into our model by adopting a commonly used constant absolute risk aversion specification,, where the risk aversion coefficient satisfies 0<r<1. For risk-averse salespersons, we must rely on computational methods to solve for the equilibrium efforts and compensations systems (contest, handicapped contest, single quota, and dual quotas).

For example, in the sales contest, the utility for salesperson 1 if she wins the contest is  and utility for losing is . The expected net utility is. We consider different values of k for a fixed risk aversion,  (none of the results depend on this specific r). The numerical simulation with risk aversion suggests that the profit of dual bonus quotas dominates handicapped contest, and that the profit of single bonus quota dominates contest (see Figure 1).

**Figure 1: Profit Comparisons with Risk Averse Agents**

**Profits**

**Territory Imbalance, k**

Dual Quota

Handicapped Contest

Quota

Contest

**k0**

**Proposition 4**: The firm will benefit more from the dual bonus quota than the handicapped contest than the single bonus quota than the contest, when salespersons are risk averse and there is any modest amount of territory imbalance: .

If agents are risk-averse then when territories are balanced, k=0, the quota is superior to even the handicapped contest. With a quota the agents are better able to control their payment risk, since risk is a facet of only their territory. In the contest, the payment risk is greater since it depends on another territories environmental shock. Therefore, risk-averse agents prefer a quota scheme even when territories are balanced.

Recall, that the random components of sales were assumed to be independent across territories. If there was an element of risk common to both territories, this would cancel in comparing sales s1 to s2, but would remain in comparing s1 to the quota Q. Common shocks give a risk reduction advantage to the contest (see Green and Stokey 1983). Territory imbalance gives the motivational advantage to the quota scheme. Thus, in the presence of territory imbalance, the amount of common shock required to restore the contest’s advantage may be unreasonably high.

**5. Conclusions**

Contests and quotas are very commonly used incentive systems for sales forces and it is well known that the potentials of the sales territories are very critical to the success of any compensation program. Our main result finds that the effect of territory imbalance is different for contests and quotas: it harms the contest more than the quota. Moreover, the advantage of the quota system increases with the degree of imbalance. Previous studies comparing contest and quota compensation systems assumed balanced territories.

To understand the differential effect one can examine the agents’ optimal efforts in the contest versus the quota system with imbalanced territories. In an imbalanced contest the agent in the likely stronger territory can lower effort (compared to when the potentials are the same) and merely match the effort of the agent in the likely weaker territory. Knowing this, the agent in the likely weaker territory does not exert effort to win the contest. This depresses the efforts of both the agents in the contest. The quota system, being individualistic, is unaffected by similar economic forces, and therefore the efforts in a quota system are higher than in the contest.

Other contractual forms may overcome the problems of territory imbalance, for instance introducing territory-specific quota plans and handicapped contests where a weak territory is given a head start. We find that for risk neutral agents, handicapping the contest and setting territory-specific quotas correct for the problems of territory imbalance. In the more common case with risk-averse agents, dual quotas dominate handicapped contests, even when the contest is optimally handicapped.

Practically speaking, the firm can easily offer two territory-specific bonuses and quotas and indeed, territory-specific quotas are commonplace. However, handicapped contests are very rare in practice. Handicapping the contest may create more problems than it solves owing to the inter-personal comparisons that contests encourage. There are fairness concerns, problems of doing the handicapping correctly, and also problems of motivating agents in territories that have not received the handicap (see Meyer 1992).

In light of the above, we summarize our main managerial implication: When territories are imbalanced, sales managers should offer bonus-quota plans rather than running sales contests.

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**Technical-Appendix**

**Appendix 1: Contest with risk neutral agents**

The probability for salesperson in territory 1 winning contest is[[4]](#footnote-4)

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Let , then

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Similarly, the probability for salesperson in territory 2 winning contest is

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The expected utilities of salesperson 1 and 2 are

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Take the derivative with respect to e1 and e2 respectively:

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Both salespersons should have consistent beliefs about which territory is better, so either both upper branches or the lower branches of (18) and (19) are satisfied at the same time. When both upper branches of (18) and (19) are true, doesn’t satisfy the conditioning inequality; when both lower branches of (18) and (19) are true, , satisfying the corresponding conditioning inequality  for any k>0.

Substitute into the firm’s profit, and the expected profit is

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Bind EU2:

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|  | . | ( |

Solve for salary:

|  |  |  |
| --- | --- | --- |
|  | . | ( |

The expected profit is

|  |  |  |
| --- | --- | --- |
|  | . | ( |

The first order condition for bonus is

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| --- | --- | --- |
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Solve for B:

|  |  |  |
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|  | . | ( |

The equilibrium efforts are

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and the equilibrium salary is

|  |  |  |
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The maximal expected profit is

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**Appendix 2: Bonus-Quota with a Common Quota and Risk-Neutral Agents**

The sales for territory 1 is  and for territory 2 is  Accordingly, the probabilities of making quota for each salesperson are

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| --- | --- | --- |
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|  |  | ( |

Expected utility is Pr(i makes Q)B-ei2-, so the optimal effort is ei=B/2. The participation constraints for the two salespersons’ expected utilities are

|  |  |  |
| --- | --- | --- |
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|  | . | ( |

The firm’s profit is .

Binding participation via , we solve for equilibrium quota in terms of B and .

|  |  |  |
| --- | --- | --- |
|  | , | ( |

and the expected profit of the firm is

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| --- | --- | --- |
|  | . | ( |

Set the first derivative of expected profit with respect to B equal to zero, . We have

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**Appendix 3: Handicapped Contest and Dual Quotas**

**3.1 Handicapped Contest**

Straightforward algebra gives the optimal effort, bonus and salary and firm’s profit in a contest,

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| , , . , | ( |

**3.2 Dual Quota Plans**

The sales of territory 1 are  and the sales of territory 2 are . The probabilities of making quotas respectively are

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| --- | --- | --- |
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|  |  | ( |

Participation constraints are

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| --- | --- | --- |
|  | , | ( |
|  | . | ( |

Optimal effort requires  and . The efforts in terms of bonus are . Binding at both participation constraints, quotas in terms of bonus are  and . So we rewrite the expected profit in terms of B only:

|  |  |  |
| --- | --- | --- |
|  |  | ( |

Set the first derivative of expected profit with respect to B to zero, . The equilibrium efforts, bonus, territory-specific quotas and firm profit are

|  |  |
| --- | --- |
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**Appendix 4: Salary and Commission**

Suppose that payment is in the form of salary plus a commission rate . The expected utility of the weaker territory is therefore EU2=S+(-k+e2)-e22- . It is straightforward to show that effort is half of the commission rate and maximized expected utility is EU2\*=S-k+¼2-. The expected profit of the firm who sets salary to keep the weak territory occupied is

E=(1-)-2(+k- ¼ 2). The consequence of profit maximization is that \*=2(½ -k) and

E\*=2(½ -k)2-2. Back substituting the effort equals e1\*=e2\*= ½ -k.

1. Similar to other authors like Krakel (2008) we assume that the territory potentials are common knowledge. However our Main Result in Section 2.3 is not an artifact of this information structure. We have analyzed the case where the agent in a territory is uncertain of the potential in the other territory. This merely adds more uncertainty to the sales response functions since the additive potential term now has a random component as well. However, since this holds for both the contest and the quota, our focal comparison is unaffected by this alternate information structure. [↑](#footnote-ref-1)
2. Our comparison of a contest and a quota is a comparison of *short-term* incentives. It is assumed that agents get paid a base salary and the short-term incentive sits on top of the base salary which is outside of the model. In both the contest and a quota the agents get a lump sum amount B if they beat the other rival or if they exceed quota. The S in the contest case given in equation (1) should not be interpreted as a base salary but rather as the losing prize. [↑](#footnote-ref-2)
3. If the compensation was salary and commission, the optimal commission rate is 2(½ -k) and the resulting effort and profits are identical to those of the quota. Comparing the contest to the commission rate system is therefore equivalent to comparing it to the quota (as seen in the appendix). [↑](#footnote-ref-3)
4. Equation numbering in the Appendix continues that of the main document. [↑](#footnote-ref-4)