TECHNICAL APPENDIX 1

Parametric Forms and Parametric Values:

1) Principal’s utility function is $U_p(q) = q$ where $q$ is the number of units of the currency of transaction (pesos) that the individual possesses.

2) Risk averse agent’s utility function is $U_a(q) = 2q^{(1/3)}$ in experiment I and II and in cell 1 of experiment III. In cell 3 of experiment III, the risk averse agent’s utility function is $U_a(q) = 3q^{(1/3)}$, where $q$ is defined as above.

3) Risk neutral agent’s utility function is $U_a(q) = \frac{q}{25}$, where $q$ is defined as above.

4) Agent’s disutility for effort is $V(t) = t^2$, where ‘$t$’ is the level of effort. High level of effort was modeled as $t = 8$, and low level of effort was modeled as $t = 4$.

5) Price of good prospect list (high effort) in experiments I and II and cell 1 of experiment III is $U_a^{-1}(8^2) = 1,024$ pesos and in cell 3 of experiment III is $U_a^{-1}(8^2) = 455$ pesos.

6) Price of a poor prospect list (low effort) is $U_a^{-1}(4^2) = 64$ pesos.

7) Prices of good and poor lists to risk-neutral agent are 1,600 and 400 pesos respectively.

8) Probability of getting a sale is given by $p(t) = \frac{t}{12}$.

9) Reservation utility of the agent is $m = 100$.
10) Reservation wage of the agent is a function of the reservation utility and the utility function for the agent in the assigned condition. Reservation wage is 2,500 pesos in experiment I and II and in cells 1 and 2 in experiment III and is 1110 pesos in cell 3 in experiment III.

11) Contracts in experiment I were designed for an agent with reservation utility equal to 100. Contracts in experiment II and III were designed for an agent with reservation utility equal to 110.

12) Reject Option set at 100 utiles (2,500 pesos for all conditions in all experiments, except, cell 3 in experiment III where it is equal to 1110 pesos).

13) Selling price per unit of system is 10,000 pesos in experiment I and II and 3,000 pesos in experiment III.

14) For a given level of effort, the sales follow a binomial distribution given by:

\[ f(x = i | t) = C_i^t [p(t)]^i [1-p(t)]^{(n-i)} = \pi_i(t) \]
Deriving the basic contract from BLSS model

Let \( s(x) \) be the compensation offered by the Principal to the Agent for generating “x” units of sale. Hence the agent’s utility function is:

\[
U_a[s(x)] = 2[s(x)]^{1/2} \quad \text{(A1)}
\]

The Principal designs a compensation plan \( s(x) \) with the objective to:

maximize \( \sum_{x=0}^{\infty} [R(x)−s(x)]f_x \quad \text{(A2)} \)

such that

\[
\sum_i U[s(x=i)]f(x = i | t)−V(t)−m \geq 0 \quad \text{(A3)}
\]

\[
\sum_i U[s(x=i)]f_i(x = i | t)−V'(t) = 0 \quad \text{(A4)}
\]

(A3) indicates that the compensation plan satisfies the minimum utility constraint and (A4) indicates that the effort undertaken by the agent is optimal from the agent’s self-interest.

The Lagrangean for the above is given as:

\[
L[s(x,t)] = \sum_i [R(x)−s(x)]f_i + \lambda \left[ \sum_i U[s(x)]f(x/t)−V(t)−m \right] + \mu \left[ \sum_i U[s(x)]f_i(x/t)−V'(t) \right] \quad \text{(A5)}
\]

From Holmstrom (1979), the optimal compensation for (A5) satisfies,

\[
\frac{1}{U'[s(x)]} = \lambda + \mu \frac{f_i(x/t)}{f(x/t)} \quad \text{(A6)}
\]

From (A1), \( U'[s(x)] = [s(x)]^{-1/2} \quad \text{(A7)} \)

Also, \( f_i(x/t) = f(x/t)p(t) \left[ \frac{i-n}{p(t)[1−p(t)]} \right] \quad \text{(A8)} \)

Substituting (A7) and (A8) in (A6) we get
\[ s(x) = \left[ \lambda + \mu \frac{p'(t)(i-n.p(t))}{p(t)[1-p(t)]} \right]^2 \]  \hspace{1cm} (A9)

Substituting (A8) and (A9) in (A4) we get

\[ V'(t) = \sum_{i} 2 \left[ \lambda + \mu \frac{p'(t)(i-n.p(t))}{p(t)[1-p(t)]} \right] \left[ \frac{i-n.p(t)}{p(t)[1-p(t)]} \right] f(x = i/t)p'(t) \]  \hspace{1cm} (A10)

Solving (A10) we get,

\[ \mu = \frac{V'(t)p(t)[1-p(t)]}{2n[p'(t)]^2}; \lambda = \frac{m+V(t)}{2} \]  \hspace{1cm} (A11)

Substituting the values from (A11) into (A9) we get,

\[ s(x) = \left[ \left( \frac{m+V(t)}{2} - \frac{V'(t)p(t)}{2p'(t)} \right) + \left( \frac{V'(t)}{2np'(t)} \right)x \right]^2 \]  \hspace{1cm} (A12)

The salary parameter “B” is the first bracket term on the right hand side while the commission parameter “A” is the second bracket term. Notice that the salary parameter is a function of the reservation utility, the disutility of effort, and the probability of success, but it is independent of “n”. On the other hand, the commission parameter is independent of the reservation utility.

For reservation utility (m) = 100, desired level of effort (t) = 8, n = 4, and the various parametric forms given above we get,

\[ s(x) = [18 + 24.x]^2 \]  \hspace{1cm} (A13)

For m = 100, t = 8, n = 8 we get,

\[ s(x) = [18 + 12.x]^2 \]  \hspace{1cm} (A14)

Similarly, for m = 110, t = 8, and n = 8 we get,

\[ s(x) = [23 + 12.x]^2 \]  \hspace{1cm} (A15)

**Designing Salary Contract for No Moral Hazard Condition**

As the actions taken by the agent are observable, the form of the “forcing” contract offered to the agent is that the agent gets salary “s” if he/she takes high effort, but the agent gets nothing otherwise.

Hence the Principal’s problem is to choose “s” such that
\[ \sum_{i} \pi_i(t^*) \cdot U(s/t^*) \geq 100 \]  
\[ (B1) \]

\[ \sum_{i} \pi_i(t^*) \cdot U(s/t^*) \geq \sum_{i} \pi_i(t) \cdot U(s/t) \]  
\[ (B2) \]

(B2) implies \[ \sum_{i} \pi_i(t^*) \cdot s^{\frac{1}{2}} - 64 \geq \sum_{i} \pi_i(t) \cdot 2 \cdot (0)^{\frac{1}{2}} - 16 \]

Therefore, \[ \sum_{i} \pi_i(t^*) \cdot U(s/t^*) \geq 48 \]  
\[ (B3) \]

(B1) and (B3) show that if (B1) holds, (B3) holds. Hence Principal chooses to minimize “s” such that (B1) holds. The Lagrangean is given by:

\[ L(s, \lambda) = -s + \lambda \left( \sum_{i} \pi_i(t^*) \cdot 2 \cdot s^{\frac{1}{2}} - 64 - 100 \right) \]

\[ \therefore \frac{\partial L}{\partial s} = -1 + \lambda \left( \sum_{i} \pi_i(t^*) \cdot \frac{1}{2} \cdot s^{\frac{1}{2}} \right) \leq 0 \]

Solving we get \[ \lambda \leq s^{\frac{1}{2}} \]  
\[ (B4) \]

Similarly, \[ \frac{\partial L}{\partial \lambda} = \sum_{i} \pi_i(t^*) \cdot 2 \cdot s^{\frac{1}{2}} - 64 - 100 \geq 0 \]  
\[ (B5) \]

**Condition 1:** Suppose \( \lambda = 0 \). Hence (B5) is unconstrained \( \Rightarrow s > 0 \). Therefore (B4) is constrained \( \Rightarrow \lambda = s^{\frac{1}{2}} \). Therefore \( \lambda \neq 0 \), which is a contradiction.

**Condition 2:** Suppose \( \lambda \neq 0 \), \( \Rightarrow (B2) \) holds as an equality (is constrained).

\[ \therefore \sum_{i} \pi_i(t^*) \cdot 2 \cdot s^{\frac{1}{2}} = 164, \Rightarrow s = (82)^2 = 6724. \]

Hence, the salary only contract for a reservation utility equal to 100 is given by \( s = 6724 \)  
\[ (B6) \]

Similarly, if the reservation utility, \( m \), is equal to 110, \[ \sum_{i} \pi_i(t^*) \cdot 2 \cdot s^{\frac{1}{2}} = 174, \Rightarrow s = (87)^2 = 7569. \]
Hence, the salary only contract for a reservation utility equal to 110 is given by
\[ s = 7569 \]  \hspace{1cm} (B7)

Similarly, when the utility function is given by \( U_a = 3s^\frac{1}{2} \) and for a reservation utility equal to 110, \( s = (58)^2 = 3364. \)  \hspace{1cm} (B8)

**Designing the Franchise Fee Contract for Risk Neutral Agent**

In this case, the Principal’s Utility function \( U_p(q) = q \) and the Agent’s utility function \( U_a(q) = \frac{q}{25} \). The reservation utility, \( m = 110 \). The Principal intends to design a forcing Franchise Fee Contract \( (F) \) such that he maximizes \( (F) \) subject to the following constraints:

\[ \sum_i \pi_i (t^*) U_a \left( \frac{10000i-F}{t^*} \right) \geq 110 \]  \hspace{1cm} (C1)

\[ \sum_i \pi_i (t^*) U_a \left( \frac{10000i-F}{t^*} \right) \geq \sum_i \pi_i (t) U_a \left( \frac{10000i-F}{t} \right) \]  \hspace{1cm} (C2)

The Lagrangean for the above is:

\[ L(F, \lambda_1, \lambda_2) = F + \lambda_1 \left\{ \sum_i \pi_i (t^*) \left( \frac{10000i-F}{25} \right) - 64 - 110 \right\} \]

\[ + \lambda_2 \left\{ \sum_i \pi_i (t^*) \left( \frac{10000i-F}{25} \right) - 64 - \sum_i \pi_i (t) \left( \frac{10000i-F}{25} \right) + 16 \right\} \]  \hspace{1cm} (C3)

\[ \therefore \frac{\partial L}{\partial F} = 1 + \lambda_1 \left\{ \frac{- \sum_i \pi_i (t^*)}{25} \right\} + \lambda_2 \left\{ \frac{- \sum_i \pi_i (t^*)}{25} + \frac{\sum_i \pi_i (t)}{25} \right\} \leq 0 \]  \hspace{1cm} (C4)

Solving we get, \( 25 \leq \lambda_1 \)  \hspace{1cm} (C5)

\[ \frac{\partial L}{\partial \lambda_1} = \sum_i \pi_i (t^*) \left( \frac{10000i-F}{25} \right) - 64 - 110 \geq 0 \]  \hspace{1cm} (C6)
\[
\frac{\partial L}{\partial \lambda_2} = \sum_i \pi_i(t^*) \left(\frac{10000i - F}{25}\right) - \sum_i \pi_i(t) \left(\frac{10000i - F}{25}\right) \geq 48
\]  
(C7)

**Condition 1:** Suppose \( \lambda_1 = 0, \lambda_2 = 0 \). This solution is not feasible as (C5) is violated.

**Condition 2:** Suppose \( \lambda_1 \neq 0, \lambda_2 = 0 \). \( \lambda_1 \neq 0 \) \( \Rightarrow \) (C6) is constrained.

\[ \therefore \sum_i \pi_i(t^*) \left(\frac{10000i - F}{25}\right) = 174 \]

\[ \therefore F^* = 48983.33 \]  
(C8)

\[ \lambda_2 = 0 \Rightarrow \sum_i \pi_i(t^*) (10000i) - F - \sum_i \pi_i(t) (10000i) + F \geq 48 \times 25 \]

\[ \Rightarrow 26666.67 \geq 1200 \]

This is a feasible solution.

**Condition 3:** Suppose \( \lambda_1 = 0, \lambda_2 \neq 0 \). This is not feasible as it violates (C5).

**Condition 4:** Suppose \( \lambda_1 \neq 0, \lambda_2 \neq 0 \). \( \lambda_1 \neq 0 \) \( \Rightarrow \) (C7) is constrained to equality.

\[ \Rightarrow \sum_i \pi_i(t^*) (10000i) - \sum_i \pi_i(t) (10000i) = 1200 \]

\[ \Rightarrow 26666.67 = 1200 \]  
(C9)

Hence this is not a feasible solution too. The only feasible solution is \( \lambda_1 \neq 0, \lambda_2 = 0 \).

The Optimal Franchise Fee Contract, \( F^* = 48983.33 \), and the agent’s expected utility from taking higher effort \( (t = 8) \) is higher than from taking lower effort \( (t = 4) \).

That is,

\[ \sum_i \pi_i(t=8) (10000i) - 1600 > \sum_i \pi_i(t=4) (10000i) - 400 \]  
(C10)
Designing a Linear Compensation Contract for a Risk Neutral Agent

In this case, the Principal chooses the salary parameter (B) and the commission parameter (A) to maximize \(- \sum \pi_i(t^*)(B + Ai)\) such that:

\[
\sum \pi_i(t^*) U_a[(B + Ai)/t^*] \geq 110
\]

(C11)

\[
\sum \pi_i(t^*) U_a[(B + Ai)/t^*] \geq \sum \pi_i(t) U_a[(B + Ai)/t]
\]

(C12)

\[
\therefore L(A,B,\lambda_1,\lambda_2) = -\sum \pi_i(t^*)(B + Ai) + \\
\lambda_1 \left[ \sum \pi_i(t^*) \frac{(B + Ai)}{25} - 64 - 110 \right] + \\
\lambda_2 \left[ \sum \pi_i(t^*) \frac{(B + Ai)}{25} - 64 - \sum \pi_i(t) \frac{(B + Ai)}{25} + 16 \right]
\]

\[
\therefore \frac{\partial L}{\partial A} = -\sum \pi_i(t^*)i + \lambda_1 \sum \pi_i(t^*) \frac{i}{25} + \lambda_2 \left[ \sum \pi_i(t^*) \frac{i}{25} - \sum \pi_i(t) \frac{i}{25} \right] \leq 0
\]

\[
\Rightarrow -8 \left( \frac{2}{3} \right) + \lambda_1 \left( \frac{16}{25*3} \right) + \lambda_2 \left( \frac{8}{25*3} \right) \leq 0
\]

\[
\Rightarrow 2 \lambda_1 + \lambda_2 \leq 50
\]

(C13)

\[
\frac{\partial L}{\partial B} = \sum -\pi_i(t^*) + \lambda_1 \left[ \sum \pi_i(t^*) \frac{1}{25} \right] + \lambda_2 \left[ \sum \pi_i(t^*) \frac{1}{25} - \sum \pi_i(t) \frac{1}{25} \right] \leq 0
\]

\[
\Rightarrow -1 + \frac{\lambda_1}{25} + \frac{\lambda_2}{25}(0) \leq 0
\]
Therefore we have, $\lambda_1 \leq 25$

(C14)

$$\frac{\partial L}{\partial \lambda_1} = \sum_i \pi_i(t^*) \frac{(B + Ai)}{25} - 64 - 110 \geq 0$$

(C15)

$$\frac{\partial L}{\partial \lambda_2} = \sum_i \pi_i(t^*) \frac{(B + Ai)}{25} - \sum_i \pi_i(t) \frac{(B + Ai)}{25} \geq 48$$

(C16)

**Condition 1:** Suppose $\lambda_1 = 0$, $\lambda_2 = 0$. From (C13) and (C14), we get $A < 0$, $B < 0$. This is not feasible.

**Condition 2:** Suppose $\lambda_1 = 0$, $\lambda_2 \neq 0$. This means that from (C14), $\lambda_1 < 25$.

Hence from (C14) again, $B = 0$. $\lambda_2 \neq 0$ means that (C16) is constrained to equality.

$$\therefore \frac{1}{25} \left[ \sum_i \pi_i(t^*) - \pi_i(t) \right] A i + \sum_i \pi_i(t^*) B - \sum_i \pi_i(t) B \right] = 48$$

$$\therefore \sum_i \left[ \pi_i(t^*) - \pi_i(t) \right] A i = 48 \times 25 = 1200$$

$$\therefore A \left( \frac{8}{3} \right) = 1200 \quad \Rightarrow \quad A = 450$$

(C17)

$\lambda_1 = 0$ means that (C15) is not constrained to equality.

$$\sum_i \pi_i(t^*) \frac{(B + Ai)}{25} > 174$$

But $B = 0$, $\Rightarrow \left( \frac{16}{3} \right) A > 174 \times 25$. This means that $A > 815.625$

(C18)

(C17) and (C18) imply that this is not possible.
Condition 3: Suppose $\lambda_1 \neq 0, \lambda_2 \neq 0$. $\lambda_2 \neq 0$ means that (C16) is constrained to equality. This gives us $A = 450$. $\lambda_1 \neq 0$ means that (C15) is constrained to equality. This gives $\left(\frac{16}{3}\right)A + B = 174*25$. Substituting $A = 450$, we get $B = 1950$.

As $B > 0$, implies (C14) is constrained to equality. This implies that $\lambda_1 = 25$.

Substituting $\lambda_1 = 25$ in (C13) we get $\lambda_2 = 0$. This is a contradiction.

Condition 4: Suppose $\lambda_1 \neq 0, \lambda_2 = 0$. $\lambda_1 \neq 0$ means that (C15) is constrained to equality. Therefore, $\left(\frac{16}{3}\right)A + B = 174*25$

(C19)

Also, $\lambda_2 = 0$ means that (C16) is not constrained to equality. Therefore,

$A > 450$.

(C20)

This is a feasible solution. Equations (C19) and (C20) can be solved for different constrained values of $A$ and $B$ to arrive at a menu of contracts, each of which induces the agent to take high effort ($t^* = 8$) and generates a profit equal to the franchise fee (48983.33) for the Principal.

We decided to implement a pure commission only contract in our experimental setting. Hence, $B = 0$. Substituting in (C19) the pure commission contract is given by

$s(x) = \left[ 815.x \right]$

(C21)

The equivalence between the franchise fee and the pure commissions contract is demonstrated next.

**Equivalence of Franchise Fee Contract and Linear Compensation Contract**

The two type of contracts are defined as being equivalent *if and only if* the following three conditions are satisfied.
(i) The expected profits of the risk neutral principal remain the same under both the contracts if the agent takes appropriate action.

From (C8) we see that the optimal franchise fee contract gives the Principal 48983.33 in expected profits if the agent takes high effort and from (C10) we see that the agent’s expected utility is higher if she takes higher effort than lower effort when offered the franchise fee contract. From (C21), the optimal pure commissions contract is given by \( s(x) = \lfloor 815.x \rfloor \). Hence the Principal’s expected profit if the agent takes high effort is,

\[
\sum_{x=1}^{\infty} \pi_i(t=8) \left[ 10000.x - 815.x \right] = 48983.33
\]

(C22)

Therefore, (i) is satisfied.

(ii) The most desirable action for the agent under both the contracts is the same (\( t = 8 \)).

If the agent is offered the pure commissions contract, \( s(x) = \lfloor 815.x \rfloor \), and if the agent takes low effort (\( t = 4 \)), the net expected utility of the agent is:

\[
\sum_{x=1}^{\infty} \pi_i(t=4) U \left\{ 815.x / t=4 \right\} - V \left\{ t=4 \right\} = 71 < m
\]

(C23)

On the other hand, if the agent undertakes high effort (\( t = 8 \)), the net expected utility of the agent is,

\[
\sum_{x=1}^{\infty} \pi_i(t=8) U \left\{ 815.x / t=8 \right\} - V \left\{ t=8 \right\} = 110 = m
\]

(C24)

Hence, the agent would take higher action if this contract is offered, which is the same as in the case of the optimal franchise fee contract. Hence condition (ii) is satisfied.

(iii) The agent’s market constraint is satisfied to equality by both type of contracts.

From (C24) we also see that the agent is indifferent between taking high effort and rejecting the contract altogether because she gets her reservation wage somewhere
else. This is also true for the optimal franchise fee contract, see \{(C2),(C6), and (C8)\}. Hence both, the optimal franchise fee contract and the pure commission contract, satisfy the market participation constraint for the agent. Hence condition (iii) is satisfied.

(i), (ii), and (iii) indicate that both, the optimal franchise fee contract and the pure commissions contract, are not only incentive compatible but also equivalent.

**TECHNICAL APPENDIX 2**

**Inducing Risk Preferences**

**General Approach.** Assume that the experimental subject is an expected utility maximizer and has a strictly increasing preference, $U(x)$, for dollars. That is, if there are dollar prizes $x_1$ and $x_2$, where $x_1 > x_2$, then $U(x_1) > U(x_2)$. Now, consider that this subject is offered a lottery given by:

Get $x_1$, if spinner settles in area between 0 and $y$, or,

$x_2$, otherwise.

Let $p(x_1)$ be the probability of the spinner settling in the shaded area. The expected utility from the lottery is given as:
\[EU(x) = p(x_1)U(x_1) + p(x_2)U(x_2)\]

(1)

For the above two-prize lottery, \(p(x_1) + p(x_2) = 1\); hence (1) can be re-written as:

\[EU(x) = p(x_1)U(x_1) + [1 - p(x_1)]U(x_2)\]

(2)

Hence, in a two-prize lottery, the expected utility is \textit{linear} in the probability of winning the preferred prize.

**Decision setting of the subject:** The subject is asked to choose an action, \(a\), from a possible set of actions, \(A\). As a result of this action, the subject receives some exchange units, \(q\), that are stochastically related to the action per a probability distribution function, \(f(q/a)\). The range of possible exchange units is \(Q\), where \(q \in Q\).

These exchange units are then converted, using a pre-specified function \(G(q)\), into the probability of winning the preferred prize (\(x_1\)) in a two-prize lottery. The final payoff is determined by the outcome of the lottery.

Given this decision setting, the subject solves:

\[
\max_a \int_Q f(q/a) \left[ p(x_1/q)U(x_1) + \left[1 - p(x_1/q)\right]U(x_2) \right] dq
\]

(3)

As \(U(.)\) is strictly increasing, we can uniquely transform it such that, \(U(x_1) = 1\), and \(U(x_2) = 0\). Hence (3) becomes

\[
\max_a \int_Q f(q/a) \ p(x_1/q) dq
\]

(4)

If the experimenter controls the mapping of exchange units, \(q\), into the probability of winning the preferred prize (that is, \(p(x_1/q)\) is pre-specified to behave as per \(G(q)\)), the maximizing problem in (4) becomes equivalent to:
That is, the subject behaves as if her preference function is $G(q)$.

Hence by (i) introducing an intermediate exchange unit, $q$, that get converted to probability, (ii) controlling the relation used to convert these intermediate exchange units into probability, and (iii) controlling the stochastic relationship between the exchange units and the subjects’ actions, the experimenter can control the subjects’ preference function over exchange units. The subject can be induced to act as if they have the preference relation that the experimenter pre-specifies over the exchange units. This preference function, $G(q)$, can be pre-specified to be linear, concave, or convex over the exchange units to induce the subject to be risk neutral, risk averse, or risk preferring, respectively, over the exchange units.

**Implementing Specific Utility Functions**: To induce a subject to behave according to any selected utility function, $G(q)$, where $q$ are pesos won in the experiment, we map $q$ along the circumference by solving the two equations below:

$$a + bG(q_{\text{low}}) = 0$$

(6)

$$a + bG(q_{\text{high}}) = 360$$

(7)

**Multiple Wheels**. In our studies, each principal is shown a single prize wheel corresponding to the utility function assigned to them ($G(q) = q$). Here, $q$ is the net revenue to the principal after paying the agent his compensation. The agents are shown multiple wheels because their net utility function, $G(q) = U_a(s(x)) - V(t)$, depends on the disutility of their selected course of action. Thus, we require as many wheels as courses of action open to the agent in that particular setting. For instance, agents who can either a) reject, or b) accept/buy good list, or c) accept/buy poor list will have three prize wheels. This corresponds to the case when the agent’s actions are unobservable. In
contrast, when the agent’s actions are observable, the agent has only two options (reject
or accept/buy good list). Hence, in this setting we will require only two wheels for the
agent. $q$ for the agent is the actual compensation derived from the offered compensation
plan due to the realized outcome.