Price bargaining and quantity bonus in developing economies*

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First version: April 2001
This version: January 14, 2003

Abstract

Consider a seller and a buyer bargaining over the price of an agricultural product in a developing economy. Think of the following common bargaining deal: the seller tries to persuade the buyer to accept a higher price and, in return, give the buyer a deal (i.e., extra units of the product for free). Why doesn't the seller just give the buyer a lower price instead of the deal? This paper provides an answer to this question. Although price can *apparently* replicate the use of quantity bonus (i.e., the free extra units), we argue that price bargaining *per se* limits the extent to which price can be used. Such bargaining deals are used because the seller can *post* them but *cannot post* prices. We explain why these sellers can post quantity bonuses. We give a condition under which the quantity bonus can replicate the equilibrium that would have obtained if the seller could directly post the price. We offer here a theory of bargaining deals.

Key words: price bargaining, non-price competition, posted prices, quantity bonus.

JEL Classification: D43, L13, O12.

*Our thanks are due to participants at a session of the 2001 CEA meetings for comments. We thank Gustavo Ventura whose comment on an earlier version significantly changed the paper's focus. We also thank Doug Allen, Dejan Kukic, Gordon Myers, Rashid Sumaila and seminar participants at the University of Guelph for comments.

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1. Introduction

Haggling over prices is a very common practice in many African, Caribbean, Latin American, and Asian economies. Flea markets and farmers markets in developed economies also share this bargaining feature even if to a lesser extent. There is also a trading practice, allied to price bargaining, usually involving agricultural produce in developing economies. This is the practice of a seller giving extra units of the produce (to a buyer) for free after bargaining over the price with the buyer. The buyer does *not* pay for this extra quantity. The extra quantity is not subject to bargaining, otherwise the buyer will be seen as ungrateful. During price bargaining, the seller usually (explicitly) tells the buyer to accept a higher price in return for the free units. We do not know of any word in the English language for this practice. Hereafter, we shall use *quantity bonus* to describe this practice. This practice is also called “dum” in Korea, “jaara” in parts of Ghana and Nigeria and “mbasela” in Zambia. Informal interviews confirm that the practice is also prevalent in places like Mexico, Phillipines, and several developing economies. Indeed, this practice is as pervasive as price bargaining in markets for agricultural produce. We wish to explain why the seller gives the buyer free units of the good when it *appears* that a lower price would serve the same purpose.

We model the quantity bonus as a fixed proportion of the quantity purchased. Thus quantity bonus is similar to promotional practices by firms in western economies where a consumer gets some units of a commodity for free for a given amount purchased; for example, “buy two, get one free”. What makes quantity bonus in developing economies different is its interaction with price bargaining as opposed to the interaction of quantity bonus and posted prices in western economies.

This practice implies some common pattern of social norms in exchange. It *appears* that the practice is *partly* generated by concerns of equity or fairness. The buyer walks away with the good believing that it was a fair bargain. For the most part we do not focus on this explanation. We argue that quantity bonus is a profit-maximizing strategy by sellers in a market where there is necessarily price bargaining. Quantity bonuses are used because they can be posted but prices cannot be posted. We explain why quantity bonuses can be posted. As noted above, the sellers in these markets usually persuade buyers (during price bargaining) to accept a higher price in return for a quantity bonus.

We are not aware of any work that attempts to analyze the nature of such market behavior. We offer here a framework and shed some light on the practice of quantity bonus. The paper adds to the literature on price haggling (Arnold and Lippman, 1998; Bester, 1993, 1994; Riley and Zeckhauser 1983). It also adds to the literature on non-price competition (Spence, 1977; White and Boudreaux, 1998). Finally, we think we offer what could be considered as a theory of bargaining deals.

Riley and Zeckhauser (1983) argue that haggling, as opposed to fixed posted prices, is sub-optimal for a seller. This is because haggling makes it difficult for a seller to post a high price if buyers know that they can always haggle and buy the good at a lower price. Bester (1994) argues that if the buyer's cost of switching sellers is relatively low, then most trade will be conducted via haggling.[1] Arnold and Lippman (1998) prove that sellers prefer posted prices when buyers have a sufficiently high bargaining ability.

[1] For related but different argument based on the costs of bargaining, see Wang (1995).

Riley and Zeckhauser (1983) also argue that posted prices may be used to prevent collusion between buyers and sales agents. We elaborate on this point by arguing that where there are no principal/agent problems, haggling should be more prevalent than posted prices. The reason is that there is no incentive for the seller to under-state the price at which the good was sold; the seller is the sole residual claimant of the profit from the transaction. Haggling is therefore more likely in small businesses and among market women in developing countries where there is no separation of ownership and control or where there are less likely to be agency problems. In contrast, in big businesses and super-markets where there are likely to be agency problems, the principal has the incentive to post prices rather than giving salesmen (i.e., agents) the discretion of negotiating the price with buyers. With posted prices, sales agents cannot under-state the price at which the good was sold. One may argue that the principal could instruct sales agents to bargain over the price subject to the condition that the good is not sold below some *minimum* price. However, there may be no point in doing so if bargaining is time-consuming and if the principal is likely to end up with the minimum price anyway (given that the sales agents have the incentive to under-state the bargained price and report the *minimum* price).

The perishability of agricultural products makes it difficult for market women in developing countries to commit to posted prices. We are not suggesting that prices cannot be posted for perishable goods. However, the shorter the time required for a seller to dispose of a good (before it loses its value), the more difficult it is to credibly commit to a posted price. Also, since there is a lot of variance in the quality of agricultural produce in developing economies, buyers are reluctant to accept posted prices because of quality uncertainty.[2] Allowing buyers to bargain over prices makes them feel more comfortable about getting a price which matches their *perceived* quality of the commodity.

In summary the following factors explain why price bargaining (not posted prices) exists in LDC agricultural markets: (i) quality uncertainty due to heterogeneity of agricultural produce (ii) inability to commit to a posted price due to the perishability of agricultural products, and (iii) the absence of agency problems due to the prevalence of sole proprietorships in LDC agricultural markets.

Given price bargaining in LDC agricultural markets, we are interested in the following question: why do sellers offer quantity bonus, when it appears that price can replicate quantity bonus? As noted above, Riley and Zeckhauser (1983) showed that price posting is more profitable than bargaining if the seller can post prices. They argue that the primary cost of allowing buyers to bargain is that "…it encourages buyers to refuse a high price in the hope of getting a lower one (p. 270)." To eradicate this cost, they show that sellers should post prices if they could. Our argument is that if sellers cannot post prices they will allow price bargaining but will also use non-price tools (like quantity bonus) that they can post to reduce (not necessarily eliminate) the cost identified by Riley and Zeckhauser (1983). Quantity bonus is an example of what we call a bargaining deal. A bargainer will offer such deals to increase his share of the surplus.

In the next section, we offer a model that examines price bargaining and quantity bonus. We show that it is an equilibrium to have bargained prices and quantity bonus. In section 3, we argue that while it may appear that price can replicate quantity bonus, the

[2] Indeed, markets with quality uncertainty or high variance in quality tend to have price haggling than markets with less quality variability. For example, the used-car market is subject to more price bargaining than the market for new cars.

inability of sellers to post prices explains why they use quantity bonus (a strategic tool which they can post). We explain why the sellers can post quantity bonuses. Concluding remarks follow in Section 4.

2. A basic model

Consider a seller and a buyer who bargain over the price of a good.[3] Suppose the buyer wants to purchase q units of the good. Let the price be p. The seller has a marginal cost of $c \geq 0$ for the good. The buyer's demand function for the good is $q = a - p$, where $a > c$.

We model the practices of haggling (bargaining) over the price and quantity bonus as a four-stage game. In stage 0, the seller announces and *commits* to a quantity bonus. In stage 1, the buyer and the seller bargain over the price. In stage 2, the buyer announces the quantity he wants to buy, given the price. In stage 3, the buyer gets the quantity bonus. We assume this sequence of actions because it conforms to our understanding of what happens in the real world (i.e., LDC agricultural markets). One could argue that an efficient outcome will be attained if the buyer and seller bargain over price and quantity jointly. While this is an interesting theoretical possibility, we opt for the sequence of actions which conforms to reality because buyers and sellers do *not* bargain over quantity in these markets.

We assume that for q units of the good purchased, the seller gives the buyer αq units of the good for free, where $\alpha \geq 0$. Hence the buyer spends a total of pq on the good

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[3]It is important to note that our analysis does not hinge on the assumption of one buyer. As in Bester (1993, 1994) if we assume that buyers do not interact strategically and are identical, then these assumptions together with constant returns to scale (i.e., constant marginal cost) imply that the equilibrium outcome is independent of the number of buyers.

but consumes $(q + \alpha q)$ units. So he effectively pays an (average) price of $p/(1 + \alpha)$. Given p and α, his "effective" demand for the good (i.e., taking into account the quantity bonus), is $\hat{q} = \hat{q}(p, \alpha) = a - p/(1 + \alpha)$.[4] For the sake of exposition, we refer to α as the quantity bonus. It is *important* to note that $\hat{q}$ is what he consumes (*not* what he pays for); he pays for $\hat{q}/(1 + \alpha)$ units at a price of p and gets $\alpha\hat{q}/(1 + \alpha)$ units for free.

We assume complete information and our solution concept is sub-game perfection. We solve the game by backward induction. Hence, we begin the analysis from the last stage (i.e., stage 3). In this stage, the buyer gets his quantity bonus, $\alpha\hat{q}/(1 + \alpha)$. In stage 2, the buyer announces the quantity of good he wants to buy, $\hat{q}/(1 + \alpha)$.[5] We use consumer's surplus, CS, as his measure of welfare. Using $\hat{q} = a - p/(1 + \alpha)$, we get

$CS = 0.5[a(1 + \alpha) - p]^2/(1 + \alpha)$. The seller's profit is $\Pi = \hat{p}\,\hat{q}(p, \alpha) - c\,\hat{q}(p, \alpha)$, where

$\hat{p} \equiv p/(1 + \alpha)$.

Stage 1

We assume that in stage 1 the price agreed upon is the outcome of the following simple alternating-offers bargaining game.[6] There are two rounds of bargaining. In the first round, the buyer makes an offer. If the seller accepts the offer, the game is over. If she rejects the offer, then she makes a counter offer in round two. If the buyer rejects the

[4]Most papers on price bargaining assume that the buyer wants a unit or some fixed amount of the commodity. Hence the quantity purchased by the buyer is not endogenous. Since quantity bonus is used to manipulate the quantity demanded, we need to make quantity endogenous.

[5] Given that we have already specified a demand function, the solution in stage 2 is trivial. If we had begun with a utility function, then the buyer's demand function will be derived in stage 2. This will involve choosing q to maximize his surplus.

[6]While our bargaining model is very simple, it is important to note that our result does not necessarily depend on the form of the bargaining game.

offer, the game is over. If the buyer accepts the offer, the game is over. If the parties fail to agree on a price in round 2, the seller gets a payoff of $S > 0$ and the buyer gets a payoff of $B > 0$. Let $\delta_b, \delta_s \in (0, 1)$ be the discount factors of the buyer and seller. One may argue that it is inconsistent to have a discount factor between bargaining rounds but not between the four stages of the game. As in bargaining models like Rubinstein (1982), the discount factor captures the cost of delay in bargaining. Hence, we could use something else other than the discount factor (like an exogenous probability of a breakdown in negotiations, a shrinking total surplus between rounds, etc) to capture the cost of delay (see Binmore, et. al (1986)).

We assume complete information. In this stage, α is fixed. It is obvious that the buyer's surplus is monotonically decreasing with the price, p. When the seller offers a price, p, she is actually offering a price, $\hat{p} = p/(1 + \alpha)$. She chooses $\hat{p}$ to maximize $\Pi = [\hat{p}(a - \hat{p}) - c(a - \hat{p})]$ subject to the buyer's participation constraint. Ignoring the buyer's participation constraint (for a moment), the seller's profit is maximized when she chooses $p = p^M = 0.5(a + c)(1 + \alpha)$ or $\hat{p} = 0.5(a + c)$.

We solve this bargaining game backwards, so we begin from round 2. Let the price offered by the seller in this round be p_2. Suppose p_2 is such that $CS_2 = 0.5[a(1 + \alpha) - p_2]^2/(1 + \alpha) = B$ and $p_2 \leq p^M$. Then the seller will offer the price $p_2 = a(1 + \alpha) - \sqrt{2(1+\alpha)B} \leq p^M$. For the sake of analysis, we focus on this case. The corresponding profit for the seller is $\Pi_2 = [p_2/(1 + \alpha)]\hat{q}(p_2, \alpha) - c\hat{q}(p_2, \alpha) = (a - c)\sqrt{2B/(1+\alpha)} - 2B/(1+\alpha)$ which we assume is, at least, equal to S. Hence when the game gets to this round the buyer will accept the seller's offer. Now consider round 1. In this round, if the buyer's offer, p_1, is such that $CS_1 = \delta_b CS_2 = \delta_b B < B$, then $p_1 > p_2$. So $p_1 > p^M$, if $p_2 = p^M$. In this case, both the buyer and the seller prefer a lower price. So this cannot be an equilibrium offer. Hence we restrict the analysis to $p_2 < p^M$, such that $p_2 < p_1 \leq p^M$, if $CS_1 = \delta_b CS_2 = \delta_b B$. If the buyer's offer is such that $CS_1 > \delta_b B$, we assume that these restrictions on the prices hold. Under these assumptions, the buyer will offer a price, p_1, such that $[p_1/(1+\alpha)]\hat{q}(p_1, \alpha) - c\hat{q}(p_1, \alpha) = \delta_s \Pi_2$. Let this price be $p_1 \equiv p^* = p^*(\alpha)$. We assume that the buyer's associated surplus $CS_1 \equiv CS^* \geq \delta_b CS_2 = \delta_b B$. As in alternating-offers bargaining models with complete information, there is a sub-game perfect price (in round 1) which the buyer offers and the seller accepts immediately.

Taking the derivative of

$[p^*(\alpha)/(1+\alpha)]\hat{q}(p^*(\alpha), \alpha) - c\hat{q}(p^*(\alpha), \alpha) = \delta_s \Pi_2 \equiv \Pi^*$ with respect to α gives

$\frac{\partial p^*}{\partial \alpha} = \frac{\partial \Pi^*/\partial \alpha - [p^* - c][\partial \hat{q}/\partial \alpha] + \hat{q}[p^*/(1+\alpha)^2]}{\hat{q}(\cdot)/(1+\alpha) + [p^* - c][\partial \hat{q}/\partial p]}$. This derivative is positive, if $\partial \Pi^*/\partial \alpha > 0$. To see this, note that the seller's profit (i.e., the LHS of equation (1)) is increasing for $\hat{p} \in [0, 0.5(a + c))$. Hence $\hat{p} \equiv p^*/(1+\alpha)$ must be increasing in this range, if the seller's profit is increasing. If α is increasing, then p^* must increase for $p^*/(1+\alpha)$ to increase. Therefore, given $p_1 = p^* < p^M$, it follows that $\partial p^*/\partial \alpha > 0$. The buyer is willing to accept a higher price, if he knows that he will be compensated with a quantity bonus and the seller will only offer a quantity bonus if that will cause the buyer to accept a higher price and her profit will increase. As noted earlier, the sellers in these markets usually persuade buyers (during price bargaining) to accept a higher price in return for a quantity bonus.

Stage 0

We now determine the seller's choice of α. The optimal α is given by

$\alpha^* = \text{argmax } \delta_s\Pi_2$.

Note, however, that for our purposes, we do not need to find the optimal α (i.e., α^*). All that we require is that some quantity bonus (i.e., $\alpha > 0$) is preferred to a zero quantity bonus (i.e., $\alpha = 0$). In other words, it is sufficient to show that $\partial\Pi^*/\partial\alpha > 0$ at $\alpha = 0$, where $\delta_s\Pi_2 \equiv \Pi^*$. Given $\Pi_2 = (a - c)\sqrt{2B/(1+\alpha)} - 2B/(1+\alpha)$, $\partial\Pi^*/\partial\alpha > 0$ at $\alpha = 0$, if $2B - 0.5(a - c)\sqrt{2B} > 0$. We assume that this condition holds.

In this model, if the seller's profit is increasing in α, the buyer's surplus must be decreasing in α. However, there is an upper bound on α, given that the buyer's surplus, CS^*, cannot fall below δ_bB. This means that at $\alpha = 0$, we require $CS^* > \delta_bB$. It is easy to satisfy this requirement by making δ_b and/or B sufficiently small. As α increases, the seller's surplus increases and the buyer's surplus falls till the optimal α is such that $CS^* = \delta_bB$ if $p^*/(1 + \alpha^*) \leq 0.5(a + c)$. If $CS^* = \delta_bB$ and $p^*/(1 + \alpha) > 0.5(a + c)$, then α is reduced such that $p^*/(1 + \alpha^*) = 0.5(a + c)$ and $CS^* > \delta_bB$.

If the seller cannot post price, p, but can post α, then she can post $\hat{p} \equiv p/(1 + \alpha)$, if p is a function of α. However, this does not necessarily mean that the seller can replicate the equilibrium that would have obtained if she could directly post the price. To see this, note that depending on the nature of bargaining, the relationship between p and α may differ. Suppose p^{nb} is the optimal price if the seller could post prices. Then quantity bonus allows the seller to replicate this equilibrium if there exists an α which solves the equation $p^{nb} = p(\alpha)/(1 + \alpha)$ or $p(\alpha) - (1 + \alpha)p^{nb} = 0$, where $p(\alpha)$ is the function which links the bargained price with α. However, there may not be a feasible solution to this equation. In this case, quantity bonus cannot replicate the equilibrium which would have obtained if the seller could directly post the price.

2.1 Discussion

It is important to emphasize that quantity bonus benefits the seller but hurts the buyer. The price which maximizes total surplus is p = c. The seller only benefits if quantity bonus increases the average price. That is, the (average) price

$p^*/(1 + \alpha^*) > p^{**}$, where p^{**} is the bargained price if the seller does not offer a quantity bonus and p^* is the price with quantity bonus. Since quantity bonus must increase the (average) price for the seller to benefit, it means that total surplus decreases. Hence this only makes sense if the seller gets a bigger share of the smaller surplus such that she is better off than she was with a bigger total surplus (when no quantity bonus is offered). Note that quantity bonus causes the buyer to bargain less "aggressively". This is because he is willing to accept a higher price because he knows he will be a given a quantity bonus. If this decrease in the buyer's bargaining "behavior" is sufficiently high then quantity bonus is good for the seller. Hence quantity bonus could exist in equilibrium although it benefits the seller but reduces the buyer's surplus.

If quantity bonus reduces the surplus of the buyer, why doesn't the buyer reject it when it is offered. The reality is that a buyer cannot credibly refuse a quantity bonus, given that is an *ex-post* offer. If he could refuse it, he will bargain more "aggressively".

But he knows that he cannot credibly commit to rejecting the quantity bonus *ex-post* when bargaining is over and the bonus is offered. Since both the buyer and seller know this, their bargaining behavior is accordingly affected. Note that we have assumed that the seller can commit to a quantity bonus. A reason why the seller will commit to *announced* quantity bonuses is because reneging on her promise has a social sanction. If this social sanction is sufficiently high, then the buyer knows that the seller will not renege on her promise.

Our argument is somewhat related to Dow (1993). In a model in which capital bargains with labor, he argues that capitalists may choose inefficient forms of organization if it enhances the bargaining power of capital by so much that capital gets a sufficiently bigger share of the smaller total surplus compared to their share of a bigger total surplus if they had chosen a more efficient form of organization. It follows that labor is worse off. In our case, offering quantity bonus increases price and makes total surplus smaller. But the seller's share of this smaller surplus is sufficiently bigger such that she finds it optimal to offer a quantity bonus. Offering a quantity bonus will not benefit the seller if the buyer can also offer the seller a deal which neutralizes the adverse effect of quantity bonus on the buyer's welfare. However, it may still be a Nash equilibrium for both parties to offer bargaining deals. We elaborate on this point in the final section.

3. Quantity bonus versus price

We have shown that quantity bonus in developing economies may be beneficial to the seller. But why doesn't the seller ignore quantity bonus and instead reduce the price? That is, a price equal to $p^*/(1 + \alpha^*)$ could replicate any equilibrium with quantity bonus.

It is important to note that we have argued that sellers in these markets are forced to bargain over the price with buyers because they cannot credibly commit to a price. To argue that price can replicate quantity bonus is to claim that the sellers can post prices. In a world of complete information, the only price they can credibly post is a price equal to marginal cost. If they "post" any price above marginal cost the buyers have the incentive to bargain anyway. In these markets, any initial asking price (above marginal cost) by a seller is seen as an invitation to bargain rather than a final price until both parties have agreed on a price via bargaining. The buyers will still bargain even if the initial asking price by a seller gives a higher surplus than the surplus they expect to get from other sellers. After all, the buyers are trying to maximize the difference between the surplus from the seller (they are currently dealing with) and their option value. Indeed, in some cases when a buyer asks a seller for a price, the seller will not quote a price but will instead ask the buyer to quote a price. This is because the seller knows that any price she quotes in response to the buyer's question "what is your price", will be followed by a lower quoted price by the buyer resulting in bargaining. Indeed, the seller expects the buyer to bargain and will be surprised if he didn't.[7] These buyers cannot commit that they will not bargain. Given that any initial price quoted (above marginal cost) will not be

[7] For example, the following quote which we found at *http://www.alexanderpalace.org/petersburg1900/10.html* illustrates our point: "Bargaining in Russia was standard practice and it drove American visitors mad. It happened everywhere - even when a shop or hotel posted a sign claiming "Prix Fixe", fixed prices. No one who knew the system would be foolish enough to pay the listed price in hotels."

accepted as the final offer by buyers anyway, it does not make sense to use price alone.[8] Our argument is that even if the seller announced a zero quantity bonus (i.e., $\alpha = 0$) and quoted a price that gave the buyer the same surplus as in the Nash equilibrium above, the buyer will bargain over the price if it is above marginal cost. This will make the seller worse off since she will have to offer a bigger surplus than the surplus in the Nash equilibrium above. As McAfee and Vincent (1997, p 247) write: "[a]lthough in many environments, bargainers would like to impose take-it-or-leave-it offers, they often cannot credibly commit never to attempt to renegotiate in the event that no sale occurs".

The argument above is again related to Dow (1993). In his model, if labor can commit to forgo bargaining over the wage, the surplus-maximizing wage will be chosen by both parties and the surplus will be divided through side payments. Dow (1993) excludes this scenario by assuming that if capital bribes labor to accept such deals, labor can simply pocket the bribe and restart negotiation without penalty. In other words, just as the buyer, in our model, cannot commit to not bargain over the price, the workers in Dow's model cannot commit to not bargain over the wage.

In contrast the buyers do not bargain over the quantity bonus in these markets. They usually see it as favor or gift from the seller since they do not directly pay for the quantity bonus. To bargain over favors or gifts is considered to be socially unacceptable; it suggests that the intended recipient is ungrateful. The reader might argue that since the buyers know that they indirectly pay for the quantity bonus, why should they think that it

[8] We recognize though that our bargaining framework does not explicitly model the process of bargaining. In an explicit alternating-offers bargaining model, like ours, with complete information no bargaining actually takes place since in a sub-game perfect equilibrium one party announces a price in the first period and the other party accepts immediately. Our complete information model is only an approximation of what happens in the real world. But it should be clear to the reader that our main results in propositions 1 and 1a do not depend on the assumption of complete information. This assumption is made for tractability.

is a gift? Consider then the following alternative argument. The buyers can always threaten to walk away if they do not like the price offered by the seller. The seller may then be forced to reduce the price. In contrast, they cannot force the seller to increase the quantity bonus by threatening to walk away because the transaction has already been completed by then and so – in a one-shot interaction - the seller will not care if the buyer walked away. This argument may still hold in a repeated setting if the game is repeated. For example, if the game is repeated for a finite number of times, it is obvious that even if the buyers want to build a reputation of refusing quantity bonuses in earlier periods, it does not make sense to refuse the bonus in the last period. Then backward induction reasoning shows that they will not refuse it in earlier periods. This argument implies that the buyers cannot bargain over the quantity bonus even if they wanted to. Of course, we have not examined the possibility of a buyer offering a seller a bargaining deal.

In general, we do not necessarily need the condition that buyers do not bargain over quantity bonuses. Our result will still go through if buyers bargain over quantity bonus but they bargain over it to a lesser extent than they do over prices. That is, price and quantity bonus must have different characteristics with respect to the ease with which they can be posted. However, from a modeling standpoint, it is easier if the buyers do not bargain over the quantity bonus.

The argument above is probably weakened if the buyers decide to bargain over the quantity bonus *before* they bargain over the price. Note, however, that the quantity bonus is contingent on a successful transaction. The sellers will be reluctant to bargain over the quantity bonus when there is a possibility that the parties may not agree on a price. Bargaining over the quantity bonus before price bargaining will be perceived by sellers and indeed by buyers as a waste of time, when there is no guarantee that a price will be agreed upon thereafter. It is like putting the cart before the horse. But if even if the buyer decides to bargain over the quantity bonus this might not alter our result. Bargaining over the quantity bonus implies that the seller cannot unilaterally choose α in stage 0. But if the seller prefers a positive α and the buyer prefers a zero α, then our result still goes through so long as the seller can commit to a positive quantity bonus and the buyer cannot commit to reject a quantity bonus, when it is offered.

Since the sellers can post quantity bonuses but cannot post prices, they rely on quantity bonus as an additional tool when using price alone is less profitable. We wish to re-iterate that arguing that price can replicate quantity bonus is tantamount to claiming that a seller can post prices. Once we *accept* price bargaining as the process by which price is determined in these markets, then there is room for quantity bonus. Having *agreed* on a price via bargaining, it does not make sense for the seller to reduce the price because that nullifies the whole idea of bargaining over the price in the first place.[9] Quantity bonus could be seen as an additional tool that these sellers use to maximize their profits in a world where prices cannot be posted.[10] Indeed, as indicated in section 1, Riley and Zeckhauser (1983) showed that price posting is more profitable than bargaining if the seller can post prices. They argue that the primary cost of allowing buyers to bargain is

[9] If the seller can reduce the price after an *agreed-upon* bargained price, then this has to be included in the bargaining game, since the buyer must anticipate this. This complicates the bargaining game and calls into question why the seller bargains in the first place.

[10] This does not necessarily mean that quantity bonus will not exist in markets with posted prices. However, if they do it must be the case that, for some reason, further price competition is not profitable or is ineffective in attracting customers. Indeed, sellers or firms engage in various forms of non-price competition, when competing in prices is not profitable. Consider a market in which buyers consider a good to be low quality when the price is below a certain threshold. To attract buyers, the sellers may not engage in price competition below this threshold price. Instead they may engage in some form of non-price competition like offering warranties to signal the quality of their good.

that "…it encourages buyers to refuse a high price in the hope of getting a lower one. (p. 270)" To eradicate this cost, they show that sellers should post prices if they can. Our argument is that if sellers cannot post prices they will allow price bargaining but will also use non-price tools (like quantity bonus) that they can post to reduce (not necessarily eliminate) the cost identified by Riley and Zeckhauser (1983). These tools are, however, contingent on a successful transaction (which would necessarily involve a price). The seller has the incentive to commit to a quantity bonus because it increases her profit in a market where she cannot post prices.

We summarize the discussion in the following proposition:

Proposition 1: *If sellers cannot post prices but can post quantity bonuses, then it is an equilibrium for sellers and buyers to bargain over prices and for sellers to post quantity bonuses.*

We now state a more general proposition:

Proposition 1a: *In markets where sellers cannot post prices they will allow price bargaining but will use non-price tools (like quantity bonuses) to maximize profits, if they can post these non-price tools.*

These propositions are very general. They do not hinge on the number of sellers, the nature of bargaining, how often the buyer and seller interact, etc. While these modifications might *slightly* alter the results, the crucial thing to note is that these propositions hinge on the following conditions: (a) the inability of sellers to post prices, (b) the ability of sellers to post and commit to quantity bonuses or other non-price tools, (c) giving quantity bonus increases the sellers' profit, and (d) the inability of buyers to reject quantity bonuses, when they are offered ex post.

Note, however, that we have ruled out the possibility of the buyer offering a counter bargaining deal. While this is *may be* limitation of our analysis, it is consistent with what happens in LDC agricultural markets although we have assumed instead of explain why the buyer does not offer a counter bargaining deal. However, allowing the buyer to offer a counter bargaining deal will not substantially change our result. If this counter bargaining deal neutralizes the seller's bargaining deal, then our result that the seller's bargaining deal increases her profit will not hold. But if the buyer's deal neutralizes the seller's deal, it must be the case that the buyer gave the seller something of value equal to the seller's quantity bonus (after the transaction was complete). In effect, the buyer returned the seller's quantity bonus. This means that the buyer rejected the seller's quantity bonus. But we have assumed that the buyer cannot reject the seller's offer.

The analysis also sheds some light on non-price competition. If sellers cannot post prices, they might try to compete by offering non-price bargaining deals. Note that our result will still go through if there are two sellers, so long as one seller has a lower marginal cost of production than the other seller. Introducing a second seller only changes the buyer's option value. The seller with a higher marginal cost will post a price equal to marginal cost; this will be the highest surplus that she can offer. Indeed, this will be the price that she will post in a Bertrand equilibrium. The seller with a lower marginal cost can offer a quantity bonus in conjunction with a bargained price which gives a *higher* surplus and gives her (i.e., seller) a positive profit; this might even replicate a Bertrand equilibrium if the quantity bonus is chosen accordingly.

4. Conclusion

We have argued that it is optimal for sellers use quantity bonus or bargaining deals in markets where prices cannot be posted. One may argue that offering quantity bonus is a social norm. We have shown that sellers have an incentive to offer quantity bonuses even if it appears they are being coerced by this social norm. Our analysis shows it may actually be beneficial for the seller to offer a quantity bonus. Quantity bonus is offered because the sellers can post them (i.e., make take-it-or-leave-it offers). The reason they can commit to these offers is that they do not care if the buyers threaten to walk away if the bonus is not increased, since the transaction has been completed by that time anyway. In contrast, since the transaction is contingent on price, the sellers usually care if a buyer threatens to walk away if the price is not lowered.

It is important to note that while quantity bonus indirectly allows the seller to post the price, it may not fully replicate the equilibrium which might have obtained if the seller could directly post the price. As argued above, this depends on the nature of bargaining or the bargaining model used which in turn determines the relationship between the bargained price and the quantity bonus (e.g., the $p(\alpha)$ function in our model). It is also possible that it may not be optimal to offer a quantity bonus. This will be the case if $\partial\Pi^*/\partial\alpha < 0$ for all α. This holds if $2B - 0.5(a - c)(1 + \alpha)\sqrt{2B} < 0$ for all α. A sufficient condition for this to hold is $2B - 0.5(a - c)\sqrt{2B} < 0$.

The analysis also has general implications for bargaining situations. It suggests that during bargaining, the parties will try to extract surpluses from each other or improve upon their bargaining outcomes by offering bargaining deals (i.e., variables that they can post after bargaining is successfully completed). We have offered here a theory of bargaining deals.

Posted prices are more likely to be public information while bargained prices tend to be private information. Since posted prices are public information, sellers can easily undercut each other's price because each seller's price is easily observable. The same argument does not necessarily hold when there is price bargaining or when prices cannot be posted. An interesting research agenda will be to examine how sellers compete when they cannot post prices and bargained prices are private information.

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