Annex 1 – Extended abstract for Contributed Paper session

Paper Title	Collusion or Historical Inertia: Weight vs Sucrose Pricing in the Sugarcane Market of Pakistan

Contributed Paper abstract prepared for presentation at the 91st Annual Conference of the Agricultural Economics Society, Royal Dublin Society in Dublin, Ireland

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Abstract	***200 words max***
I study the following question: why do sugar mills in Pakistan pay cane farmers by weight instead of sucrose content? I develop a two-stage pricing game that reflects the key market features. Notably, I model the post-harvest deterioration of cane in the spatial competition. In the first stage, mills choose the price regime: payment by weight or by sucrose content. In the second stage, for a given pricing regime, mills compete in prices. I show that if both mills choose the same regime, then the equilibrium profits are higher under the weight regime. The intuition behind this result is that the cane starts losing its moisture and weight immediately after the harvest. Mills' revenue from one unit of cane remains the same under both regimes, but the evaporation of moisture increases the effective transportation cost for farmers and hence reduces the competition between mills under weight pricing. Using numerical analysis, I then show that two pure strategy equilibria involve both mills pay by weight and both pay by sucrose in the second stage of the game. Numerical analysis generates a coordination game. The fact that mills pay by weight indicates collusive behaviour among the mills. I also show that under parameter values that represent the historical conditions of the market, weight pricing is the only equilibrium; indicating the possibility of historical inertia. Finally, I suggest a lower bound on the price floor as an equilibrium switching policy.	

Keywords	Agricultural Pricing, Market Structure, Transportation, Collusion.
JEL Code	L13, L91, D4, Q1

Introduction	***100 – 250 words***
Pakistan is the 5th largest sugarcane producer in the world in terms of area under cane cultivation, but stands at 15th in terms of sugar production. Pakistan stands almost at the bottom in the world ranking in terms of per hectare yield. Sugar recovery is slightly above 8 %, whereas in many countries, it ranges from 12 to 14 percent (FAS-USDA, 2009). One of the reasons for the poor performance by Pakistan's sugar industry is the low quality of cane. In this paper, I argue that this may be due to the pricing structure of the market. Sugarcane delivered to the processing mills is priced entirely by its weight and no consideration is paid to the quality of cane. However, the quality of cane, as measured by the sucrose content, is the most important determinant of sugar production and profits of the mills. Despite universal recognition that the quality of cane needs to be improved, why mills do not give any price incentives to farmers is a conundrum.	

Methodology	***100 – 250 words***
To study this paradoxical pricing behaviour of sugar processing mills, I develop a two-stage pricing game that reflects the market features. Notably, I model the post-harvest deterioration	

of cane. Post-harvest deterioration of cane requires processing of cane soon after harvest to maximize production. However, some delay may be profitable for the mills. While cane starts losing moisture (tonnage) immediately after harvest, the sucrose content as a percentage of the mass in staling cane reaches its highest at 72 − 96 hours. From the mill's perspective, this implies that the value of the cane remains constant before sugar inversion starts, but the cost of purchasing cane is reduced if it pays farmers by weight.

In the first stage, two mills choose between two pricing regimes; weight pricing and sucrose pricing. Weight pricing disregards the sucrose content in the cane and pays farmers entirely by weight. Sucrose pricing pays farmers by the sucrose content in the cane and pays no consideration to the weight. Once mills have chosen the price regime, they compete in prices. While mills interact with each other strategically, farmer-mill interaction is non-strategic. Farmers observe the prices chosen by the mills and choose which mill to take their crop to. In addition to the standard transportation cost farmers also bear the evaporation cost if they are paid by weight. The cane loses its moisture at a constant rate, s, and under weight pricing, farmer only receives the payment on the remaining proportion, 1-s.

Results

100 – 250 words

The model implies that for a given sucrose level, mills' profits will always be higher under the weight pricing regime as compared to the sucrose regime. This is due to the fact that moisture loss implies that the effective transportation cost paid by the farmers is higher under weight pricing. Therefore, pricing by weight reduces the intensity of competition among mills. Mills pay relatively lower prices and make higher profits at the expense of farmers. Secondly, we show that there are multiple equilibria: both mills pay by weight and both mills pay by sucrose. Weight pricing is payoff dominant while the sucrose pricing is risk dominant. Current practice of paying farmers by weight suggests that mills coordinate on weighting pricing. This conclusion seems especially plausible when mills are regularly involved in delaying weighing and crushing the delivered cane. However, we also show that the possibility of historical inertia cannot be ruled out. Finally, we suggest a lower bound on the price floor that can be used as an equilibrium switching policy. The policy need not be permanent and becomes impotent once the new equilibrium (sucrose pricing) is achieved.

Discussion and Conclusion

100 – 250 words

This paper addresses an important policy question not only in Pakistan but also in other South Asian countries since similar issues arise in India. Our analysis shows how the perishable nature of the crop can be used to earn higher profits. We provide the rationale for mills' pricing behaviour and explain why mills do not give price incentive to farmers to increase the sucrose content. Our study highlights the importance of considering the nature of the crop/product in understanding market behaviour and forming policy.