Recommendations to Prevent Delays in Distribution of Free Textbooks to the Target Population

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ABSTRACT

Every year, the government distributes free textbooks to all children who enroll in government schools in India. The state government nominates a public unit to oversee the distribution. The public unit expects to complete the distribution before the start of the academic session. Students in state board-affiliated private schools purchase the same textbooks, and the timing of the free textbook distribution matches the supply of textbooks in the private market. In 2021-2022, the public unit in Madhya Pradesh distributed approximately 6 crore textbooks to 94.4 lakh students across 92,965 state board-affiliated government schools. In the same year, the public unit sold textbooks to 56 lakh students studying in about 45,000 private schools affiliated with the state board. However, the public unit frequently observes delays in distributing free textbooks to government school students.

This study evaluates the performance of the textbook distribution operation and identifies the factors that lead to delays. The public unit procures textbooks from suppliers through a bidding process. Suppliers' daily production includes quantities for market sales and contract quantities for the public unit. The profit margin from market sales and supplies to the public unit determines how much weight each quantity gets in the production mix. The combined aggregate capacity of the supplier's supplying textbook to the public unit determines the selection of net contract quantities expected to be distributed by the public unit. Additionally, the allocation of the quantities for market sales and supplies to the public unit in the production mix should match the proportion of population in the state. Delays occur when the public unit cannot find enough suppliers or when the production mix favors quantities for market sales.

In Essay 1, we model the scenario in which the supplier's per unit cost is dependent of the installed capacity of the supplier. If the supplier capacity is higher than a threshold capacity, the supplier per unit cost is lowest. The public unit, aiming to meet delivery timelines within a minimum budget, can directly or indirectly control two key variables: the markup on the cost of textbooks sold in the market and the per unit cost quoted by the suppliers in the bidding process. Our findings show that supplier availability depends on the cost difference between small and large suppliers depending on the threshold capacity criterion. If the public unit cannot find enough large suppliers, delays are more likely. To find the required number of suppliers, the public unit provides raw materials at the lowest cost to all suppliers who win the contract. This reduces the bidding prices for smaller players and encourages greater participation. As the target population varies, we found that a mixed Cournot equilibrium exists when the state population has equal size of government and private school students. When the population of

private school students is higher, the public unit should not sell in the market, whereas when target population is higher, then the public unit should provide raw materials to all contract suppliers to achieve on-time deliveries and maximize welfare.

In Essay 2, we model a scenario where the public unit faces collusion among small or large suppliers. Small suppliers collude to aggregate their capacities and lower per-unit costs, while large suppliers collude to prevent small suppliers from bidding. In this case, the market resembles a mixed market equilibrium when the state population has equal size of government and private school students. When the population of private school students is higher, the public unit should not sell in the market, whereas we found that in case of collusion, the public unit should provide raw materials to all contract suppliers independent of the population to achieve on-time deliveries and maximize welfare. We discovered that when the target population proportion is higher, collusion among small suppliers dominates the bidding process.

Keywords: Capacity-quantity game, Production mix, Welfare economics, Free Textbook distribution, Welfare scheme, Collusion

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