

# **Cournot Competition and Reduction of Corruption to Prevent Garment Factory Fires in Bangladesh**

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## **Abstract**

The number of member factories in the Bangladesh Garment Manufacturers and Exporters Association has grown more than 6.8 fold during the past 20 years to reach 5,700. This has been overshadowed by repeated deadly garment factory fires that have resulted in at least 267 workers losing their lives in Dhaka and the surrounding regions during the past 20 years. With a focus on work-related injury and death caused by major indifference to the small changes, this paper indicates that such work-related injury and death can be prevented through Cournot competition if factory owners employ managers, to whom they give two missions: maximize sales and ensure worker safety.

**JEL classification numbers:** D4, L1

**Keywords:** Corruption, Bangladesh, Readymade Garment Industry, Factory Fires, Cournot Competition

## **1 Introduction**

The Bangladesh readymade garment industry has continued to grow following the influx of global retailers that has driven exports for the past 20 years. Even with foreign investment regulations, the number of garment factories has continued to rise (1.7~28.3% YoY) and the Bangladesh Garment Manufacturers and Exporters Association (BGMEA) has seen its membership grow 6.8 fold from 834 members in FY1990 to reach 5,700 in FY2011(BGMEA(Website)).

This expansion of the readymade garment industry has been accompanied by repeated deadly garment factory fires. According to the Daily Star (2010a,b), garment factory fires in Dhaka and surrounding regions (i.e., Narayanganj, Narsingdi, Chittagong, and Ashulia) have caused the deaths of at least 267 workers during the past 20 years.

Paul-Majumder and Begum (2000) attributed the deaths caused by garment factory fires

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specifically to the following factors.

The survey of 1997 shows that in addition to other fire code violations, most of the garment factories do not have fire exits or fire alarms. (p.15)

In this paper, we primarily focus on the prevention of work-related injury and death caused by major indifference to the small changes. The study indicates that worker safety can be promoted through Cournot competition if factory owners employ managers, to whom they give two missions (i.e., maximize sales and ensure worker safety).

The aforementioned Paul-Majumder and Begum (2000) and Akhter et al. (2010) demonstrate an interest in the Bangladesh garment factory fires, but there exists few theoretical economic approaches. Sato (2012,2013) shows that a private contract between BGMEA and its member factories can reduce the number of victims of fires, but this research is an exception. This study indicates that the number of victims of fire as noted by Paul-Majumder and Begum (2000) can be prevented through quantitative competition between member factories.

Previous results that closely relate to the matters in this study are provided in Basu et al. (2013). Those results indicate that Cournot competition can lead to corruption of an entire industry. However, this conclusion relies on the standard profit maximization hypothesis under a theoretical economic approach. In this study, we indicate that the same results from Cournot competition as in Basu et al. (2013) can be restricted to a special case by identifying the factory manager differently from the owner and incorporating the burden of fixed costs into the manager's sales maximization behavior.

In the following, we present the Cournot competition model in section 2, and apply the Cournot limit theorem in section 3. Finally, we discuss the implications of these results in section 4.

## 2 Model

Each of  $n$  managers produces homogeneous products. The quantity of production for manager  $i, i=1, \dots, n; n \geq 2$  is represented as  $q_i$ , and we assume Cournot competition between managers.

The product's inverse demand function is represented as

$$p = a - b \sum_{i=1}^n q_i \quad (1)$$

, where  $p$  represents the product price, and  $a$  as well as  $b$  are positive constants.

The sales function of manager  $i$  is represented as

$$S_i = pq_i - \theta_i m \quad (2)$$

Here,  $m$  is fixed costs (For example, investment in "fire prevention measure"),  $\theta_i \in \{0,1\}$  indicates the type of each manager, and shows where  $i$  is corrupt (honest) as  $\theta_i = 0$  ( $\theta_i = 1$ ).

### 3 Cournot Competition

Using equations (1) and (2) to derive the equilibrium quantity of production  $q_i^*$  and equilibrium price  $p^*$  for manager  $i$ , respectively results in the following:

$$q_i^* = \left( a - b \sum_{j \neq i} q_j \right) / 2b, i, j = 1, \dots, n$$

and

$$p^* = a - \left( a - b \sum_{j \neq i} q_j \right) n / 2$$

Taking the limit values for the number of factories in relation to the equilibrium price leads to

$$\lim_{n \rightarrow \infty} a - \left( a - b \sum_{j \neq i} q_j \right) n / 2 = a$$

So in terms of equation (2), when  $n \rightarrow \infty$ , in equilibrium, sales can be represented as

$$S_i^* = \left( a^2 - ab \sum_{j \neq i} q_j \right) / 2b - \theta_i m$$

Transforming the first term in the numerator on the right hand side into vertex form results in

$$S_i^* = \left( a - b \sum_{j \neq i} q_j / 2 \right)^2 / 2b - \theta_i m \quad (3)$$

When  $\theta_i = 0$ , then  $S_i^* > 0$  for an arbitrary  $m$ , which means a corrupt manager enters the industry. Replacing the first term on the right hand side of equation (3), with  $\left( a - b \sum_{j \neq i} q_j / 2 \right)^2 / 2b = k$ , when  $\theta_i = 1$ , if  $m > k$ , then  $S_i^* < 0$ , hence, an honest manager exits the industry, but if  $m \leq k$ , then  $S_i^* \geq 0$  and conversely an honest manager enters the industry.

In other words, a mix of corrupt managers and honest managers exists within the same industry, and when each manager's behavior is focused on maximizing sales. If  $m > k$ , then the corruption caused by competition affects the entire industry. Conversely, if  $m \leq k$ , the corruption caused by competition does not affect the entire industry.

Therefore, the following proposition holds true.

**Proposition:** Cournot competition does not necessarily cause corruption of the entire industry if the cost of fire prevention is sufficiently small.

## 4 Conclusion

The optimal contract designed by Sato (2013) can be applied by the manager in this study to the optimal contract between the owner, who has voluntarily taken on burden  $m$ , and the manager. The effectiveness of this contract relies on its ability to be used as a threat to terminate the consignment of production when the owner becomes aware of worker complaints, such as when concerns regarding the neglect of safety are reported in the media.

If the owner tasks the manager with a mission to maximize sales following the execution of such a contract, work-related injury and death actually caused by major indifference to the trivial amount of prevention can be completely prevented through the Cournot competition.

## References

- [1] Akhter, S., Salahuddin, A. F. M., Iqbal, M., Malek, A. B. M. A., and Jahan, N., Health and occupational safety for female workforce of garment industries in Bangladesh, *Journal of Mechanical Engineering*, **41**(1), (2010), 65–70.
- [2] Basu K., McGavock, T., and B.Zhang, When competition corrupts: A theoretical analysis of market structure and the incidence of corruption, *The World Bank Policy Research Working Paper*, No.6596, (2013).
- [3] BGMEA (Website) (<http://www.bgmea.com.bd/#ad-image-3>) accessed February 26, 2014.
- [4] The Daily Star, February 27,2010a, Major RMG fires since '90: [http://www.thedailystar.net/newDesign/latest\\_news.php?nid=27425](http://www.thedailystar.net/newDesign/latest_news.php?nid=27425) accessed November 12, 2013.
- [5] The Daily Star, December 15,2010b, 26 killed in factory fire: <http://www.thedailystar.net/newDesign/news-details.php?nid=166145> accessed November 12, 2013.
- [6] Paul-Majumder, P. and A. Begum, The gender imbalances in the export oriented garment industry in Bangladesh, *The World Bank POLICY RESEARCH REPORT ON GENDER AND DEVELOPMENT Working Paper Series*, No. 12, (2000).
- [7] Sato, H., Protecting against disaster with contracts, *International Journal of Humanities and Social Science*, **2**(17), (2012), 251-253.
- [8] Sato, H., Preventing fires through contracts with global retailers, *Kyushu Sangyo University Discussion Paper Series*, No.64, (2013).
- [9] Sato, H., Preventing garment factory fires through competition, *Kyushu Sangyo University Discussion Paper Series*, No. 65, (2014).