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Disasters and an Optimum Agreement: A Note

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Abstract

In this note, we shall clarify that the probability of a disaster can be decreased in accord with the optimum agreement.

Keywords: Disaster, Whistleblowing, Compliance, Moral hazard, Optimum agreement

1. Introduction

According to news in the Daily Star (2010a, 2010b), a fire broke out during the daytime on December 14, 2010 at an 11-story garment factory in Ashulia. At least 26 people were reported dead. Only a few individuals died from burns, as the majority perished after falling from the building's upper floors. According to reports from survivors, there were as many as 300 workers on the 11th floor of the building at the time of the accident and of the seven escape routes to the floors below, four were blocked.

There is reason to believe that the losses could have been reduced to at least some degree if there had been a fire contingency plan in place (including investment towards fire extinguishing equipment, smoke ventilation measures, fire spread prevention, as well as fire drill training). However, if the BGMEA (Bangladesh Garment Manufacturers and Exporters Association) were to try to inspect all factories for implementation of fire contingency plans, the cost would be prohibitive. The reason for this is that, at the time of the accident, the number of BGMEA member factories stood at 5,150 (BGMEA (2009)). Also, since there were reportedly as many as 5000 workers in Ashulia factories at the time of the accident, the opportunity cost of holding evacuation drills would have also been substantial.

With this in mind, what approaches are available for getting factories to adopt costly fire contingency plans under the threat of a large-scale disaster? This note outlines an optimum agreement for factories' voluntary adoption of such costly plans.

2. Compliance

BGMEA already requires its members to implement fire contingency plans. If implemented, costs will be $c \geq 0$. These costs shall be borne by all factories in consideration. θ, the probability of a fire breaking out, is a function of c such that

$$\theta = 1/(c+1) \tag{1}$$

That is, implementing fire contingency plans has the effect of lowering the likelihood of a fire breaking out. (At the Ashulia factory, it was reported that multiple fire extinguishers were present, but there were no employees who knew how to use them.)

BGMEA is not actually able to supervise the implementation of fire contingency plans at the factories, so it is presumed that moral hazard is at play. Thus, an agreement (s, f) shall be presented to the factories. $s > 0$ is the injury compensation and $f > 0$ is the accident(s), due to an unimplemented contingency plan, that led to the compensation claim. The consequence is a fine levied against the factory at the time of discovery of the non-compliance. BGMEA is able to learn of the non-compliance through internal whistleblowers. The probability $p \in (0,1)$ of there being a whistleblower is exogenously determined.

Accidents come in small $h > 0$ and large $H > h$ sizes. BGMEA is able to observe both the small ones as well as the large ones. When h has been observed, it is possible to know whether a contingency plan had been implemented or not. But in the case of H, without a whistleblower it is not possible to establish whether the cause was non-implementation of a contingency plan.

3. The optimum agreement

The items below are of interest to BGMEA with respect to the issue of social cost. If factories bear the burden of $c > 0$, then accidents will be avoided with a probability of $1-\theta(c)$, and h occurs with a probability of $\theta(c)$. Taking the latter, if factories are only compensated in the amount of s, then the expected costs are

$$C^e\big|_{c>0} = c - \theta(c)s \tag{2}$$

On the other hand, since the expected value for social cost is $c+\theta(c)h$, the optimal compensation is $s^* = -h$. However, if the factories do not bear the burden of c, there is certainty of a major disaster H occurring. In this event, factories will only be compensated s at a probability of $1-p$, yet factories only have to pay f at a probability of p. Consequently, the expected costs for factories are

$$C^e\big|_{c=0} = pf - s \tag{3}$$

However, since social costs are H, if we consider $s^* = -h$, then the optimum fine would be $f^* = (H-h)/p$. Hence, the optimum agreement would be $(s^*, f^*) = (-h, (H-h)/p)$.

Under this optimum agreement, if we set $C^e\big|_{c>0} - C^e\big|_{c=0} = \Delta C$, then formulas (2) and (3) give us

$$\Delta C = c - H + h/(1+c) \tag{4}$$

If H is sufficiently large, then

$$c \begin{Bmatrix} > \\ < \end{Bmatrix} \hat{c} \Leftrightarrow \Delta C \begin{Bmatrix} > \\ < \end{Bmatrix} 0$$

, where $\hat{c} = \left(-(1-H) + \sqrt{\left((1-H)^2 + 4(H-h)\right)} \right) / 2$.

Consequently, as long as $c > \hat{c}$, the factory will sign the agreement. Furthermore, considering formula (1), the following proposition holds:

Proposition: θ can be decreased in accord with (s^*, f^*)

4. Concluding remark

If implementing fire contingency plans is extremely costly for factories, they will either be instinctively averse to signing a related agreement or fear for moral hazard if they do. The conclusions in this document are intended to combat that aversion.

Also, when there is the risk of large-scale disasters, under the optimum agreement, the payments by the factory will exceed the amount received as compensation. These payments are of a punitive nature. Therefore, a contract of this kind will bring about compliance, even though costly, and by extension, prevent large disasters.

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