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Clues to recovery from major earthquakes: Perspectives gained from economic theory

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1. Earthquake disasters and economic problems

1.1 Problem A: Inefficient allocation of resources

The Tōhoku earthquake and tsunami of March 11, 2011 caused nearly 20 thousands deaths and an even larger number of dislocations.

Fig. 1 shows two of the pictures frequently reported by TV news networks after the earthquake. The left-hand side of Fig. 1 shows relief supplies being sent from around Japan and the right-hand side shows the blankets to be distributed for disaster victims.

The quick response to the unexpected disaster deserves praise, but from an economic theory, allocation of relief supplies was a problem. This is because goods that are perceived to be needed may not actually be needed: for example, food may be in short supply, but the relief agency might supply blanket. Moreover, people's preferences vary: while some *need* blankets, others *do not*. As such, distributing supplies to each individual is inefficient. A question then arises: how do we accomplish efficient supply allocation?

Fig. 1 Relief supplies (left); Blankets for distribution (right)

Reference: Institute for Fire Safety & Disaster Preparedness
(URL: http://www.saigaichousa-db-isad.jp/drsdb_photo/photoSearch.do)
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1.2 Problem B: Fund shortages and collections

Next, Fig. 2 contains a picture of a volunteer collecting contributions for earthquake victims. Though people's consideration and philanthropy are noteworthy, such collections are rarely enough to cover expenses, and state help is inevitable. Further, these collection efforts are inefficient (so much that they are counter-productive, by drawing in efforts better used elsewhere). A question then arises: how do we deal with fund shortages and what is the best way of collecting funds (taxes or donations)?

Fig 2 A volunteer collecting donations for earthquake victims

Reference: This picture was taken at the Ueno station by Taro Oishi on July 7, 2012, with the volunteer's permission.

2. Economic perspective for Problem A: Allocating resources effectively

2.1 Adam Smith and the market mechanism

Adam Smith, one of the world's pioneering economists, in his laws of the market, stated that the pursuit of self-interest among buyers and sellers eventually improves their own economic welfare through price adjustment in the market, which eventually leads to economic efficiency. He called this price adjustment the "invisible hand." This is a clue to solving Problem A.

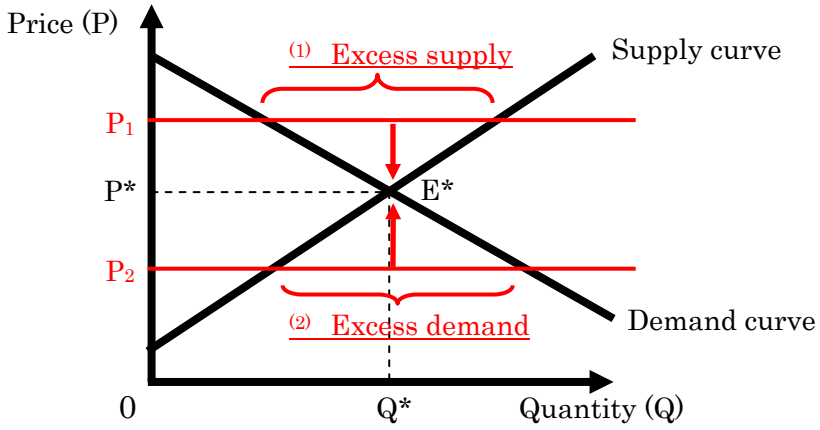
2.2 Demand curve, supply curve, and market equilibrium

Economists use a very famous method—namely, partial equilibrium analysis—to explain Adam Smith's insistence. Fig. 3 gives the framework of this analysis.

In Fig. 3, the demand curve gives the relation between the price of a good and consumed quantity; it decreases as consumed quantity increases, because consumption increases as price decreases. The supply curve gives the relation between the price of a good and produced quantity; it increases as produced quantity increases, because production increases as price increases.

If the price is higher than P*, then there is excess supply and price declines due to dead stocking. If the price is lower than P*, then there exists excess demand and price rises due to rush ordering. Thus, price and quantity move toward the equilibrium point E*, where both excess supply and demand do not exist. This is the market mechanism Adam Smith referred to as the "invisible hand."

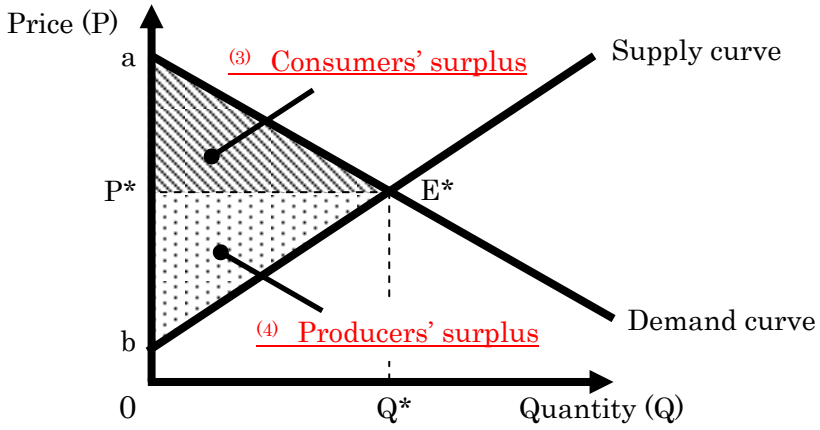
Fig. 3 Demand and supply curve of a good



2.3 Market mechanism and welfare

We now discuss whether the above market mechanism improves welfare. In this regard, we use welfare analysis. Fig. 4 shows consumer welfare (consumers' surplus) and producer welfare (producers' surplus) at the equilibrium point E*. At E*, all goods are traded at price P*, but if Q < Q*, consumers are willing to pay more than P* and the producers are willing to provide less than P*. Therefore, consumers' surplus is expressed as aP*E*, and producers' surplus is given as bP*E*. The area abE* is referred to as total surplus (consumers' surplus plus producers' surplus).

Fig. 4 Consumers' surplus and producers' surplus



We now discuss what happens when the market is not at equilibrium. Fig 5 shows the case of P > P*: herein, consumers purchase only amount Q (< Q*), because pricing is high. Consequently, total

surplus is less than at equilibrium. Fig 6 shows the case of P < P*: herein, producers supply only amount Q (< Q*), because pricing is low. Here, too, total surplus is less than at equilibrium. As a result, we have that both total surplus and total welfare are the highest at equilibrium.

Fig. 5 Case of P > P*

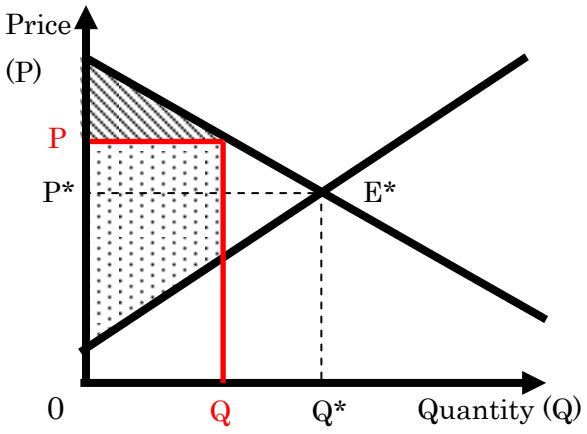
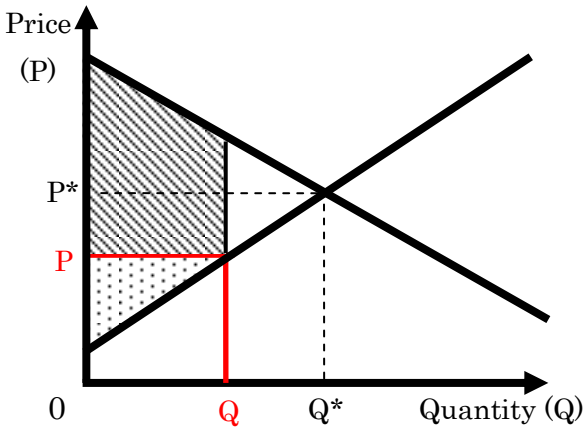


Fig. 6 Case of P < P*



2.4 Brief conclusion

The market mechanism enables us to achieve efficient allocation of resources (There is no excess supply or excess demand, and resources are adequately allocated to the people who need them). This implies that we should not distribute relief goods (blankets, foods, etc.), but rather disburse money to the affected people so that they can purchase these goods by themselves. After any major disaster, our priority should be restoring such a market mechanism as soon as possible.

3. Economic perspective for Problem B: Fund shortages and collections (donations or taxes)

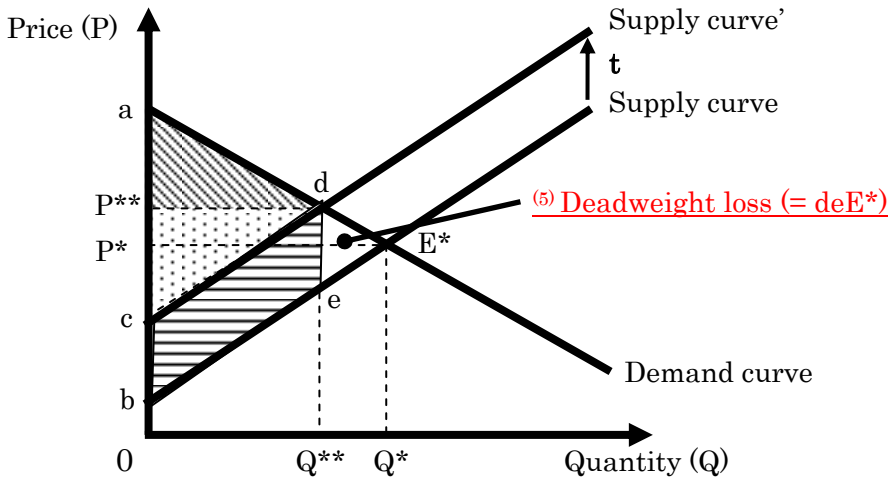
3.1 Fund collections: Taxes or donations

Policymakers need to know the efficiency of fund collection so that they make informed decisions in this regard. In what follows, we examine which is more efficient: taxes or donations.

3.2 Taxes and efficiency

First, we examine the efficiency of taxes. If a tax of $t is imposed per good, then the supply curve shifts upward to supply curve' (see Fig. 7). This means that suppliers want to increase the price by $t, because the producers pass on the tax of $t to the consumers. After tax imposition, the market equilibrium point shifts from E* to d. Then, consumers' surplus is expressed as aP**d, producers' surplus is expressed as P**cd, and tax revenue is expressed as cbed. Further, total surplus is less than when no tax was imposed. The lost surplus is expressed as deE*, and is called dead weight loss. This means that taxation to collect funds for restoration is accompanied by a loss.

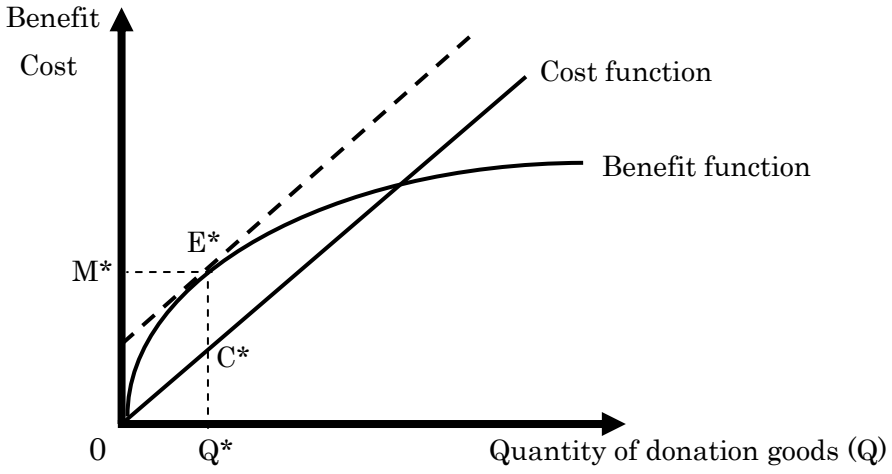
Fig. 7 Tax and Welfare



3.3 Donations and efficiency

Next, we examine the efficiency of donations. Fig. 8 shows the benefit function and cost function of donations, where we define donations as tickets under which consumers can purchase as many as they want. The cost function of donations is expressed as an upward line, because it can be described as the product of the number of tickets and the unit price of each ticket. The benefit function is expressed as a diminishing marginal curve, because it follows the law of diminishing marginal utility. The optimum consumption is the point where the slope of the benefit function equals that of the cost function (i.e., Q* in Fig. 8). At the optimum point, a consumer's net benefit is E*C* and his/her cost (i.e., share of donations allocated to the restoration fund) is C*Q*. Consumers can refuse to accept donations, and hence, the existence of donations is not a loss for consumers. This implies that donations are more efficient than taxes.

Fig. 8 Donation goods and utility maximization



3.4 Brief conclusion

From the above analysis, donations are superior to taxes with regard to fund collection, and hence, should be preferred. However, donations alone would seldom be enough and taxes will be required. Moreover, raising taxes will also help in the redeeming of national bonds after restoration has been completed.

4. Conclusion

We used economic theory to assess measures for post-disaster management. Particularly, we focused on inefficiency in resource allocation, and on ascertaining which is better for fund collection, taxes or donations. We found that reintroducing/restoring the market mechanism for post-disaster resources is a more efficient approach than individual distribution. We also found that while donations are more efficient than taxes, they alone are seldom enough. Taxes eventually have to be used, and are likely to have positive effects on the government's balance sheet post-restoration.