Can politicians calm public fears of food-borne risks or do they adopt excessively stringent preventive measures?: A political economy approach

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Abstract

The purpose of this paper is to examine politically sensitive food safety problems from the viewpoint of political economy. The model was built in order to clarify the behaviors of consumers and politicians, employing the prospect theory and the median voter theorem. Major findings and policy implications in this study are as follows:

Firstly, as an outcome of the theoretical analysis, it is suggested that politicians may magnify consumers' excessive response to food scares.

Secondly, several countervailing factors that can mitigate such consumers' excessive responses may exist. Nevertheless, in Japan, they may be weak or may have become weak and do not mitigate such excessive responses.

Finally, it is recommended that politicians' staff or advisers with scientific expertise should be reinforced. Furthermore, staff or advisers in consumer interest groups should also be reinforced in order to guide consumers with emotional food-borne risk scares in excess toward rational responses.

Key words: food safety, political economy, the prospect theory, the median voter theorem
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1. Introduction

Consumers' concerns about food-borne risks often develop into politically sensitive issues. This phenomenon has occurred not only in incidents that eventually resulted in real casualties but also in those with no real casualties, but potential casualties. The latter is illustrated by incidents such as the shutting-out of U.S. beef from the Japanese market due to the 2004 BSE scare, which caused serious economic damage to the U.S. beef industry. Similar incidents have repeatedly occurred in other nations involving various kinds of food-borne risks, such as GMO. The relationship between objective scientific data on food safety and political decision-making has thus become a growing concern in social science disciplines.

The purpose of this paper is to examine what kinds of political mechanisms exist behind this relationship. To this end, the next section presents assumptions underpinned by the prospect theory and the median voter theorem. In the third section, a model is built in order to compare how the change of parameters affects outcomes. Then, it is applied to the contemporary Japanese political situation.

In a previous study, Kramer (1990) suggested that consumers cannot accurately perceive real risks and therefore place inappropriate demands on politicians who consequently adopt inappropriate policies. This paper intends to test this proposition in a far more concrete form than the previous study.

Although there have been food-borne risks that eventually resulted in real casualties and thus demanded robust policy interventions, it is beyond the scope of the present paper to consider such cases. The reason is that the central concern of those cases is indeed how to resolve the problems of the revealed incidents, so they should be examined under a different theoretical framework.

2. Assumptions

Prior to building a model, based upon observation in recent incidents concerning food-borne risks, two preliminary assumptions are presented as follows:

Preliminary assumption 1: *Consumers are likely to imperfectly understand the scientific information on food-borne risks. Consequently, they behave according to their subjectively perceived risks.*

Preliminary assumption 2: *Politicians are also likely to imperfectly understand the scientific information on food-borne risks. They seem to behave in an attempt merely to maximize voters' support.*

Firstly, with regard to preliminary assumption 1, it is observed that consumers perceive increases of those risks in a sharply sensitive manner while reductions of those risks are only mildly appreciated. We often hear food companies' sales managers complain that they receive only a little premium from efforts to prevent food-borne risks even though consumers, on the surface, appreciate the direction of such efforts. On the other hand, consumers tend to harshly reject the products of companies that fail to maintain minimum sanitary standards even if such failures may not cause serious casualties. Considering these two different responses, it is reasonable to suppose that the consumer behavior relating to the increase or the decrease of food-borne risks is asymmetric.

Moreover, the marginal response to increases or reductions of risks seems to be evoked in a diminishing manner. In the case of a reduction, the fact that a food-borne risk is reduced is in itself important and people do not so much care about the degree of reduction. In the case of an increased risk, similar to the case of a reduction, the fact that a food-borne risk gets worse, itself, is of great concern to consumers, but they are not so conscious of the degree. Consequently, reflecting this diminishing manner, a response curve toward the reduction or the

increase of risks is likely to be concave to the horizontal axis.

Combining the asymmetric response and its diminishing manner, we can obtain a curve similar to the so-called 'prospect theory' presented by Kahneman and Tversky (1979).[1] Figure 1 depicts the change of the subjectively perceived risk following the pattern of the prospect theory.

The horizontal axis represents the level of objective risk, while the vertical axis represents the change of the degree of subjectively perceived risk. Toward the left hand side, risk increases, that is, safety decreases, while toward the right hand side risk decreases, that is, safety increases. The consumer feels safer compared with the present situation toward the top and feels less safe toward the bottom. If consumers could accurately evaluate the objective risk, the curve would become a 45-degree angled straight line. However, it is difficult for them to do that.

Consequently, an assumption for a model is presented as follows:

Assumption 1: *Consumers subjectively perceive food-borne risks according to the pattern of the prospect theory. The response toward an increase of risk and a decrease of that risk is asymmetric; that is, the response toward an increase of risk is more sensitive than toward a decrease. Additionally, either the response toward an increase or that toward a decrease is in a diminishing manner.*

With regard to preliminary assumption 2, there is a conceptual theory that a politician tends to adopt policies that satisfy the requirements of a median voter, not an average voter, aiming at maximizing voters' support. It is often argued that this median voter theorem does not necessarily hold in a real political arena. Nevertheless, according to Tresch (1995), even though there are constraints in the applicability of the median voter theorem, many studies have successfully employed it.

Furthermore, it is more likely that politicians' behavior follows the median

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[1] This idea was originally suggested by Nakajima (1999).

voter theorem in the food safety area than in other policy areas. This is because features of the food safety issue are, for example, single peaked preference and non-ideological adherence, which enable the theorem to increase its validity.

Considering these characteristics together, another assumption is presented as follows:

Assumption 2: *Politicians make decisions on the level of preventive measures for the food-borne risks following the median voter theorem.*

3. Model

As a framework of a model, the following are assumed:

Framework: *On one hand, voters evaluate politicians as vote-worthy according to the effect of policies advocated by them on changing the subjectively perceived safety. On the other hand, voters also evaluate politicians as vote-worthy according to budgetary efficiency. Voters regard expenditures on preventive measures as a burden imposed on taxpayers. The integrated evaluation from these two aspects is determined by weighting them by the subjectively predicted probability of whether real damage occurs or not. Especially for the effect on consumers' subjective perception of safety, the evaluation is affected by consumers' behaviors following the prospect theory and by politicians' behaviors following the median voter theorem.*

According to this framework, an integrated policy evaluation function (IPEF) is described as follows:

$$\text{IPEF} = \rho \times (\text{PEF1} + \text{PEF2}) + (1 - \rho) \times \text{PEF2}$$

$$= \rho \times \text{PEF1} + \text{PEF2}$$

PEF1: The part of IPEF evaluated by the subjectively perceived safety

PEF2: The part of IPEF evaluated by the budgetary efficiency

ρ : The probability of the occurrence of real damage subjectively predicted by voters

It should be noted that the probability appropriate to use in this context is not the probability objectively predicted on scientific grounds, σ, but ρ.

First, consider PEF1. The degree of the change in consumers' subjectively perceived safety from the present situation is represented as $\triangle$SPS (Subjectively perceived safety). $\triangle$SPS increases when the subjectively perceived risk decreases; that is, the food becomes safer. $\triangle$SPS decreases when the food becomes less safe. According to assumption 1, $\triangle$SPS can be described as the pattern following the prospect theory. $\triangle$SPS is described as follows:

$$\triangle\text{SPS} = \alpha \times \log(Q - \Gamma + 1) \qquad \text{if } Q > \Gamma,$$
$$= - \beta \times \log(\Gamma - Q + 1) \qquad \text{if } Q < \Gamma \quad \text{------------(1)}$$

Q: The level of objective food safety for a certain hazard

Γ: The level of objective food safety in the present situation

α, β : Parameters that represent degrees of transformation from objective safety to subjectively perceived safety

Figure 1 can be regarded as a depiction of $\triangle$SPS. The horizontal axis depicts Q, while the vertical axis depicts $\triangle$SPS. The center of the horizontal axis represents Q as equal to Γ. The center of vertical axis represents $\triangle$SPS as equal to zero.

Q is affected by the level of preventive measures adopted in the policy, q. PEF1 is determined not by Q, but by $\triangle$SPS. These relationships are described as follows:

$$Q = F_1(q), \qquad \triangle\text{SPS} = F_2(Q), \qquad \text{PEF1} = F_3(\triangle\text{SPS})$$

q: The level of preventive measures adopted in the policy

With regard to the equation PEF1 = F_3 ($\triangle$SPS), it is assumed that $\triangle$SPS is

proportionally transformed into PEF1. This transformation would be described, for example, by a form such as PEF1 = K $\times \triangle$SPS. It is also assumed that the relationship between Q and q is proportional. Under these assumptions, the formula PEF1 = $F_3(F_2(F_1(q)))$ is described as a formula similar to formula (1), in which the parameters α, β would be replaced by other parameters A, B and the present situation of the safety level Γ would be replaced by the present situation of the level of the preventive measure γ.

Thus, PEF1 is described as follows:

PEF1 = K $\times \triangle$SPS

$\quad\quad$ = K $\times \alpha \times \log(Q - \Gamma + 1)$ $\quad\quad\quad\quad$ if Q > Γ,

$\quad\quad$ = - K $\times \beta \times \log(\Gamma - Q + 1)$ $\quad\quad\quad\quad$ if Q < Γ

$\quad\quad$ = A $\times \log(q - \gamma + 1)$ $\quad\quad\quad\quad\quad\quad$ if q > γ,

$\quad\quad$ = - B $\times \log(\gamma - q + 1)$ $\quad\quad\quad\quad\quad$ if q < γ $\quad\quad$ ----------(2)

Figure 2 depicts the relationship between PEF1 and q. This is similar to figure 1, but q replaces Q in the horizontal axis and PEF1 replaces $\triangle$SPS in the vertical axis. γ locates at the center of the horizontal axis, while the center of the vertical axis means that PEF1 is equal to zero. Figure 2 also reflects the pattern of the prospect theory.

Since figure 2 represents the degree of subjective evaluation of the policy, the shape of the curve varies due to individual sensitivities. Some consumers are highly sensitive to the change of q, while others are less sensitive. The difference in the shapes of the curves is depicted in figure 2.

The distribution of this difference in sensitivity among consumers can be depicted in figure 3. In this diagram, the horizontal axis represents the parameter A, which reflects various individual sensitivities related to the shape of the curve of PEF1. The vertical axis represents the density of consumers or voters. It may not be normally distributed. Rather, when food safety is of great concern, the

distribution of individual sensitivities is skewed toward higher sensitivity as depicted in 3A. Consequently, the sensitivity of the median consumer is higher than the mean of all consumers' sensitivities. By contrast, when food safety is not of major concern, the distribution is skewed toward lower sensitivity as depicted in 3B. The sensitivity of the median consumer is lower than the mean of all consumers' sensitivities.

Next, consider PEF2. The cost of implementing preventive measures is a burden imposed on taxpayers. Voters negatively evaluate the strengthening of the food safety policy as an increase in their tax burden. A cost function is described as follows:

$$C = \lambda + \mu \times q$$

C: Cost function of preventive measures for reducing a food-borne risk

λ: Fixed cost of preventive measures

μ: Marginal cost of preventive measures per unit of scientific risk reduction

It is reasonable to suppose that a burden of taxpayers is considered as the degree of the change from the present situation. Therefore, the transformation of this cost function into a political evaluation function is as follows:

$$PEF2 = - \{C(q) - C(\gamma)\}$$
$$= - \mu \times (q - \gamma) \qquad \text{------------------(3)}$$

Considering together PEF1 and PEF2, IPEF is described as follows:

$$IPEF = \rho \times PEF1 + PEF2$$
$$= \rho \times \{A \times \log(q - \gamma + 1)\} - \mu \times (q - \gamma)\} \qquad \text{if } q > \gamma$$
$$= - \rho \times \{B \times \log(\gamma - q + 1)\} - \mu \times (q - \gamma)\} \qquad \text{if } q < \gamma \qquad \text{--------(4)}$$

Figure 4A illustrates the meaning of the integrated policy evaluation function. Although this figure does not directly depict the function, it demonstrates the

relationship between two parts of the function, that is, $\rho \times$ PEF1 and PEF2. This diagram depicts the former by a curved line and the latter by a straight line. Both lines go through the origin where the present level of preventive measures under the present policy (q = γ) and the present policy evaluation (IPEF=0) are located. The point where the gap between the curved line and the straight line attains the maximum shows the point where the value of IPEF is maximized.

Figure 4A depicts the case when food safety is of considerable concern. As an extreme example, Figure 4B shows the case when a concern for food safety becomes critical. Conversely, Figure 4C shows the case when food safety is not of major concern.

The difference between figures 4A, 4B and 4C can be explained by the subjectively predicted probability ρ. This strongly reflects the contemporary public sentiment around food safety that is easily affected by concerning incidents and the media's reports of them. On the other hand, individual variations in the shape of the curve among voters still exist according the difference of parameter A.

As shown in the diagrams, in the case of figure 4A and 4B, the optimum point at which the value of the function IPEF is maximized satisfies the second-order condition. Therefore, resolving the first-order condition gives the optimum. The optimum of q is the one that satisfies the equation as follows:

$$\partial (\text{IPEF}) / \partial q = \partial / \partial q [\{\rho \times A \times \log(q - \gamma + 1)\} -$$
$$\{\mu \times (q - \gamma)\}] = 0 \qquad \text{----------------(5)}$$

The optimum value is given as follows:

$$q^* = (\rho \times A / \mu) + \gamma - 1 \qquad \text{------------------(6)}$$

Due to the difference of A among consumers, the value of q* varies among voters. According to assumption 2, the degree of preventive measures politically adopted by politicians is the q* of the median voter. Thus, the median voter's q* is equal to the political equilibrium of q.

On the other hand, in the case of the figure 4C, only the corner solution gives the optimum value. This point, $q = \gamma$, means that the present situation is the best. This consequence is robust because the curve kinks drastically at this point. The individual variation of the parameter, to some extent, may not change the outcome of this equation.

Consider the implication of these results. Suppose the case when food safety is of great concern. As previously considered in figure 3, the degree of A for the median voter is greater than A for the mean of all consumers in this case. The following inequality is obtained.

$A_{mean} < A_{med}$

Suffix mean: the degree for the voter with the average sensitivity of all voters

Suffix med: the degree for the median voter

Since σ, the objective probability on scientific grounds, is far smaller than ρ, the subjectively predicted probability, in the case when food safety is of great concern, the following inequality is deduced.

$q^*_{sci} < q^*_{mean} < q^*_{med} = q_{peq}$

Suffix sci: the optimum level of preventive measures on scientific grounds

Suffix peq: the optimum level for politicians (Political equilibrium)

Since politicians are supposed to choose the degree of the policy favored by the median voter according to the assumption, it is possible that the consumers' excessive response to the food scare would be magnified in the political process.

Conversely, supposing the case when food safety is not of major concern, the following inequality is obtained.

$A_{mean} \geqq A_{med}$

The following inequality can be deduced.

$q^*_{sci} > q^*_{mean} \geqq q^*_{med} = q_{peq}$

Since the political equilibrium in the case when food safety is not of major

concern is a corner solution, this equilibrium is almost equal to the optimum point for the mean of all consumers as well as that of the median voter. The political magnification may not be observed in this case.

4. Discussion

(1) Countervailing Factors

Due to the results obtained, it is theoretically possible that the political equilibrium of the level of preventive measures diverges from the rational level based upon scientific data. Nevertheless, in reality, such a discrepancy between q^*_{sci} and q_{peq} may not necessarily be very wide. Several factors[2] shown below may mitigate this irrationality.

A. Politicians' (including their staff or advisers) capability of understanding scientific information

B. Ethical behavior principles of politicians that encourage them to behave for the public interest, not for self-interest

C. Bureaucrats' role in guiding consumer opinions towards administrative decisions by providing scientific, objective information

D. Consumer interest group leaders' (including their staff or advisers) capability of understanding scientific information and dissuading general consumers' emotional responses that are incompatible with scientific judgments

These factors should be regarded as countervailing factors that reduce the gap between a scientific optimum and a political optimum. If they are powerful enough, political decisions may be made closer to the scientifically optimum point. Whether they are powerful or not is critical in mitigating consumers' excessive responses.

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[2] Business interest groups' behaviors may also be an influence. However, the present discussion is limited to other political actors such as politicians and bureaucrats.

(2) What has happened in Japan?

So far, the outcomes of the analysis and related arguments were common in most countries. Next, let us discuss what has happened into the case of recent food safety problems in Japan. Three phenomena concerning these countervailing factors are observed as follows:

1. Politicians' lack of staff or advisers with scientific expertise is causing the political countervailing factor to be weak.

Even though politicians intrinsically possess a self-interest motivation of maximizing their support by prioritizing the median voter's preference, two countervailing factors, A and B listed above, would be expected to enable politicians to mitigate consumers' emotional response. Nonetheless, in reality these powers may not be adequate. Factor B does not seem to vary from country to country. Factor A, however, does vary from country to country.

According to commonly available findings in the political science literature, politicians in Japan have a limited number of political staff and advisers as compared with their counterparts in the U.S. and other developed countries. This suggests their relative weakness in their capability to understand scientific information. Political parties are also in the same situation. This fact would seem to explain why Japanese politicians cannot adequately mitigate consumers' excessive response to food-borne risks.

2. Bureaucrats have lost power due to the reform of the general political system from bureaucrat-led to politician-led. Additionally, they have lost the trust of consumers due to their own failures.

Although bureaucrats as well as politicians may be motivated by self-interest

such as maximizing their budget[3], they principally play a role of providing scientific information that guides consumers toward the correct direction concerning food safety. Especially in Japan, bureaucrats rather than politicians were traditionally in charge of polices involving technical matters such as food safety. Consumers believed that bureaucrats possessed adequate information and gave much credence to bureaucrats' judgments. Thus, in the past, the countervailing factor C was relatively strong in Japan.

However, in the last decade, a change in the country's political system has taken place. Traditional bureaucrat-led decision-making has been replaced by politician-led decision-making. During this transition, politicians' and their staff's scientific expertise has been revealed.

Additionally, several incidents of corruption and bungled policy implementation undermined consumer confidence in bureaucrats' reliability.

3. Consumer groups' lack of staff or advisers with scientific expertise is causing the consumer side's countervailing factors to be weak

Although the number of Japanese organizations that generally represent the interests of consumers has increased, they remain immature. The lack of staff or advisers with scientific expertise in these organizations is weakening the countervailing factors on the consumer side.

Under the "risk analysis" system recommended by CODEX, more emphasis is put on "risk communication." Consequently, at every stage of governmental decision-making, convincing consumers is needed. Consequently, it becomes increasingly difficult for decision-makers to neglect consumers' emotions. However, according to people involved in consumer movements, consumer

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[3] If bureaucrats concentrate their effort on such issues in which public opinion is heating up, they have a chance to acquire larger budgets. The budget-maximizing strategic behavior may encourage bureaucrats to over-emphasize policies concerning those issues.

interest groups do not have adequate staff or advisers with scientific expertise, compared with similar groups in the U.S. and other developed countries. For example, in the U.S., experts holding PhDs in natural science fields are involved in consumer interest groups as advisers or even staff, whereas, in Japan, no such experts are involved. This fact is weakening the consumer side's countervailing factors.

The three phenomena above that commonly undermine the power of the countervailing factors are likely to enlarge the degree of the discrepancy between the objectively rational preventive measures and their political equilibrium based upon the median voter's subjectively perceived risk. It should be noted that the second and third phenomena are regarded as consequences of the socio-political change towards a more democratic society. Ironically, in the process of becoming the more democratic political system, this discrepancy may be enlarging.

5. Conclusion

Major findings and policy implications in this study may be summarized as follows:

Firstly, the theoretical analysis suggests a high possibility that politicians may magnify consumers' excessive response to food scares, contrary to the expectation that they play a role of calming public fears of food scares and adopting a rational level of preventive measures based upon scientific data.

Secondly, several countervailing factors that actually mitigate consumers' excessive responses may exist. Nevertheless, in Japan, they may be weak or have become weak and do not mitigate such excessive responses. It is probable that consumers' excessive responses in Japan are becoming greater than in other countries.

Finally, policy implications from this economic analysis are very clear. It is recommended that politicians place greater emphasis on recruiting staff or advisers with scientific expertise. Similarly, consumer interest groups need to engage staff or advisers with technical expertise in order to guide consumers away from excessively emotional reactions to food-borne risk scares towards more rational directions.

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Figure 1. The Prospect Theory

Decrease of subjectively perceived risk

Present situation

Increase of objective risk

Decrease of objective risk

Increase of subjectively perceived risk
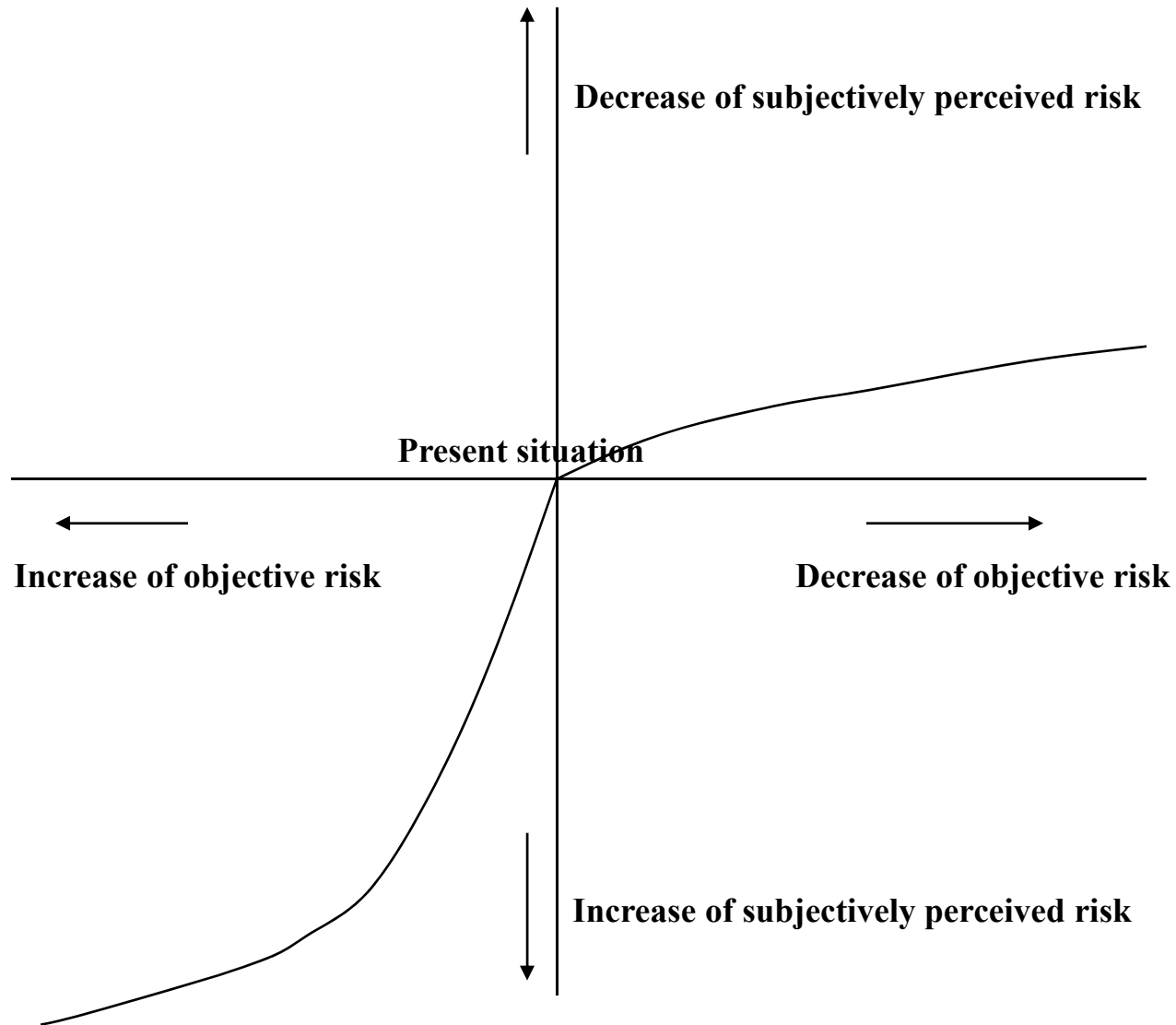
Figure 2. The part of IPEF evaluated by subjectively perceived safety

Consumer with high sensitivity to risk

Consumer with ordinary sensitivity to risk

PEF1>0

PEF1 = 0

Consumer with low sensitivity to risk

PEF1<0

Present level of preventive measures

Reduction of preventive measures $(q < \gamma)$

$q = \gamma$

Strengthening of preventive measures $(q > \gamma)$
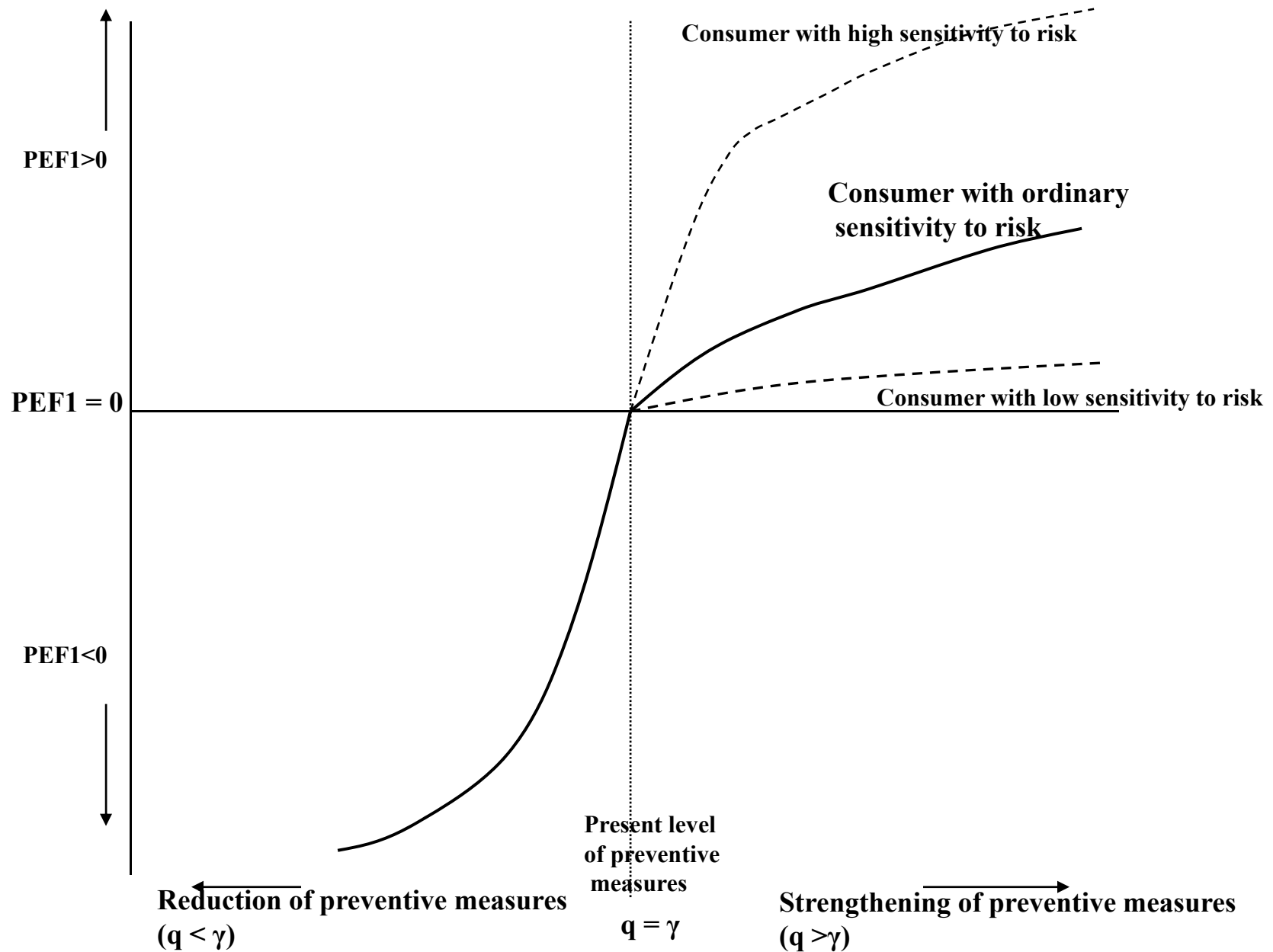
Figure 3. Distribution of individual sensitivities to food safety

Density of consumer

A: The case when food safety is of great concern

Mean of all consumers' sensitivity

Median consumer's sensitivity

Consumer with low sensitivity to food safety

Consumer with high sensitivity to food safety

Density of consumer

Median consumer's sensitivity

Mean of all consumers' sensitivity

B: The case when food safety is not of major concern

Consumer with low sensitivity to food safety

Consumer with high sensitivity to food safety

Figure 4A. Integrated Policy Evaluation Function (The case when food safety is of considerable concern)

Increase of safety (positive): PEF1

Increase of cost (negative): PEF2

$\partial(\text{IPEF}) / \partial q = 0$
Maximum point of IPEF

ρ × PEF1
(Median voters')

1 × PEF2

Decrease of safety (negative): PEF1

Decrease of cost (positive): PEF2

Political Equilibrium level of preventive measures

q^*_{pep}

Present level of preventive measures

$q = \gamma$

Reduction of preventive measures (q < γ)

Strengthening of preventive measures (q > γ)

Figure 4B. Integrated Policy Evaluation Function
(The case when food safety concern becomes extremely high)

Increase of safety (positive): PEF1

Increase of cost (negative): PEF2

∂(IPEF) / ∂q = 0
Maximum point of IPEF

$\rho \times$ PEF1
(Median voters')

$1 \times$ PEF2

Decrease of safety (negative): PEF1

Decrease of cost (positive): PEF2

Political Equilibrium level
of preventive measures
q^*_{pep}

Present level
of preventive
measures
$q = \gamma$

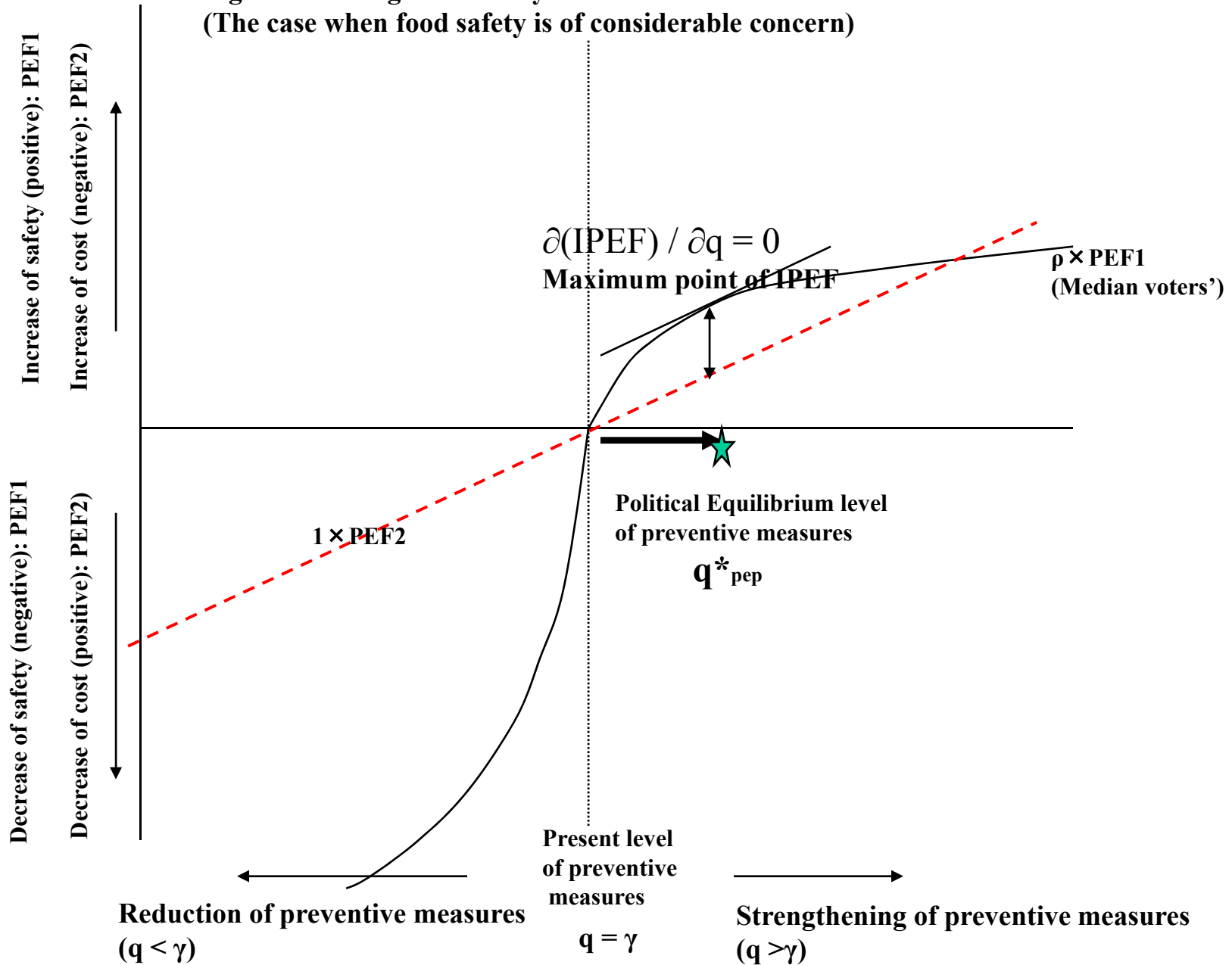Reduction of preventive measures
$(q < \gamma)$

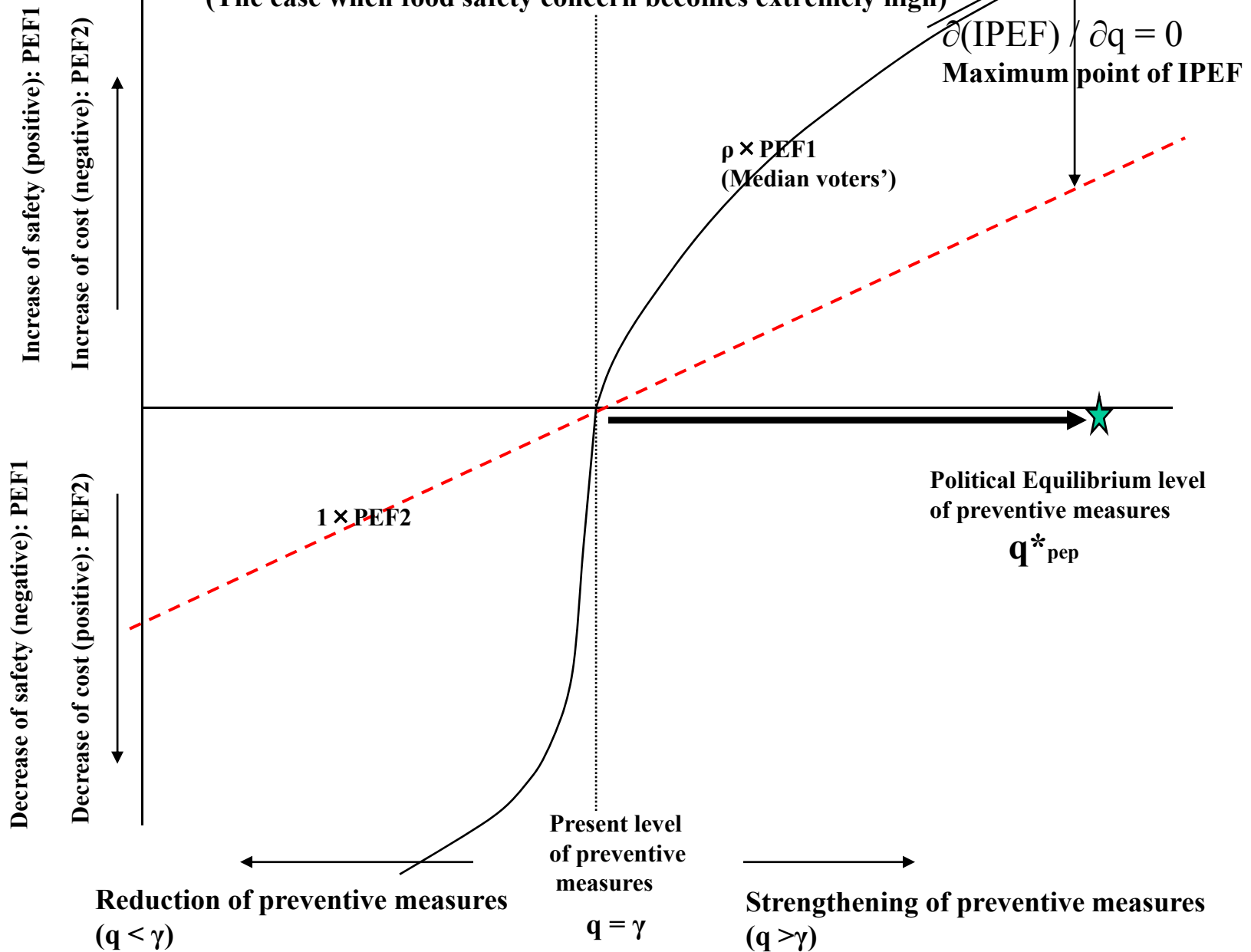Strengthening of preventive measures
$(q > \gamma)$

**Figure 4C. Integrated Policy Evaluation Function
(The case when food safety is not a major concern)**

Increase of safety (positive): PEF1

Increase of cost (negative): PEF2

Decrease of safety (negative): PEF1

Decrease of cost (positive): PEF2

Corner solution
 = The present situation
Maximum point of IPEF

$\rho \times$ PEF1
(Median voters')

$1 \times$ PEF2

Present level
of preventive
measures

Reduction of preventive measures
$(q < \gamma)$

$q = \gamma$

Strengthening of preventive measures
$(q > \gamma)$