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GOVERNMENT RELIEF FOR RISK ASSOCIATED WITH GOVERNMENT ACTION

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ABSTRACT

A significant source of risk arises from uncertainty concerning future government policy. Government action - - tax reform, deregulation, judicial decisions, budgetary shifts - - produces gains and losses for those who invested under preexisting rules. The effects of government relief - - compensation, grandfathering, phase-ins - - on ex ante incentives and risk bearing are examined in a model in which private insurance is taken into account. It is demonstrated that government relief is inefficient, even when private insurance is subject to moral hazard, because relief shields individuals from some of the effects of their actions.

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A significant source of risk arises from uncertainty concerning future government action. Government action produces gains and losses -- often amounting to billions of dollars -- for those who invested under preexisting rules.[1] Government policy with regard to these effects (often referred to as "transition policy") varies widely: full compensation for takings of real property, partial relief through grandfathering and phase-ins for tax reform and deregulation (in some instances but not others), and no relief for most budgetary shifts and changes in common law tort rules (as in the products liability context).

Risk associated with government action, despite its prevalence and magnitude, has not been recognized as presenting a general problem, and little attention has been devoted to analyzing the effects and efficiency of government relief.[2] For example, in Feldstein's (1976a, 1976b) influential analysis of losses arising from tax reform, a policy of compensation or other relief is advocated but no systematic framework in support is offered. Among the questions that must be addressed in analyzing government relief are whether insurance markets are able to provide appropriate compensation and how relief affects investment incentives.

Section 1 presents a model of the purest form of government relief: compensation (partial or complete). Private insurance markets are assumed to be present. Because such insurance is available, any allocation of risk that

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[1] Because anticipated change is reflected in pre-reform market values, the problem addressed here arises only when future policy is uncertain. In addition, any government action that affects the probabilities of future change, including action not entailing reform -- such as defeat of legislation or an announcement making future enactment more or less likely -- should be included in the analysis, for such events similarly produce gains and losses (unless complete relief is anticipated).

[2] Most discussion arises in the context of tax reform, where inquiry typically is limited to considerations of horizontal equity. The relationship between such appeals and the perspective offered here is considered in Kaplow (1989a).

can be achieved with government relief can also be achieved in the absence of relief. The provision of relief, however, shields investors from some of the consequences of their actions, which distorts ex ante investment decisions. Even when insurance coverage is partial due to the problem of moral hazard and even when the level of relief is less than the level of insurance coverage that individuals would otherwise have purchased, relief has this distorting effect because, at the margin, a portion of the incentive cost is borne by the government.

Section 2 considers the range of application of these results. First, it notes that gains produced by government action are subject to the same analysis as losses, suggesting that windfall taxation should be viewed symmetrically with compensation (and similarly for other methods by which gains and losses may be relieved). Second, the analysis is applied to methods other than outright compensation by which governments mitigate the effects of changes in policy. Grandfathering, delayed or partial implementation, and phase-ins have the same ex ante incentive effects as compensation schemes that provide equivalent levels of relief. In addition, such mechanisms are generally more inefficient than direct compensation due to their effect on ex post incentives. The analysis permits an efficiency ranking of mitigation schemes. Third, the case for full retroactive application of some new policies is explored. Finally, the assumptions on which the analysis rests are examined. Section 3 offers concluding remarks.

1. Ex Ante Analysis of Government Relief

A. *The Model and First-Best Outcome*

It is assumed that identical risk-averse individuals choose a level of investment, which determines net benefits in each of two states -- one corresponding to government action and one to inaction -- having a known probability.[3] Individuals also choose a level of insurance protection that

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[3] The probability of government action is assumed to be fixed. That the availability of relief may affect government decisionmaking is considered in

covers a portion of their loss, for which they pay an actuarially fair premium.[4] The government is committed to a policy of providing relief, financed by a lump-sum tax, for a portion of losses.

U = individual's utility as a function of wealth; $U' > 0$, $U'' < 0$;

k = individual's level of investment;

$b_i(k)$ = net benefits (private and social) from investment in state i; the two states are denoted by "a" for action and "o" for the "null" state, or status quo; $b_i'' < 0$, $i = o,a$; $\nexists$ k such that $b_o'(k) = b_a'(k) = 0$;[5] $\Delta b \neq 0$,[6] where $\Delta b = b_o - b_a$;

q = portion of loss $(b_o - b_i)$ covered by private insurance in state i;

π = private insurance premium;

g = portion of loss $(b_o - b_i)$ compensated by the government in state i;

τ = lump-sum tax, or "compensation premium"; and

p = probability of state a.

An individual's expected utility is

$$(1)\quad EU = (1-p)U(b_o(k) - \pi - \tau) + pU(b_a(k) - \pi - \tau + (q + g)\Delta b(k))$$
$$= (1-p)U_o + pU_a,$$

where U_a and U_o denote utility evaluated in the states with and without government action, respectively. The first-best levels of g, q, and k can be derived from (1) by substituting $pg\Delta b$ -- the expected cost of government compensation -- for τ and $pq\Delta b$ -- the expected cost of insurance payments -- for π and differentiating:

$$(2)\quad \frac{dEU}{dg} = \frac{dEU}{dq} = (1-p)U_o' \cdot [-p\Delta b] + pU_a' \cdot [-p\Delta b + \Delta b] = 0, \text{ or}$$

$$(3)\quad p(1-p)(U_a' - U_o')\Delta b = 0.$$

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section 2D. It is also possible that individuals could influence this probability (through lobbying, bribery, or investment decisions that affect subsequent government actions).

[4] It is assumed that insurance companies can observe individuals' aggregate purchases of insurance. See Arnott and Stiglitz (1987), Pauly (1974).

[5] Given the stated conditions on the second derivatives, if such a k existed, it would be the optimum and there would be no moral hazard.

[6] If the optimal investment given no insurance is such that $\Delta b = 0$, then the optimum entails no insurance. In this simple case, there is no risk to insure against in the first instance.

Wealth must thus be equal in the states with and without government action; hence, $q + g = 1$. The optimal k is determined by

$$(4)\quad \frac{dEU}{dk} = (1-p)U_o'\cdot[b_o' - p\Delta b'] + pU_a'\cdot[b_a' - p\Delta b' + \Delta b'] = 0.$$

Because wealth is equal in the two states, the first-best level of k satisfies

$$(5)\quad (1-p)b_o' + pb_a' = 0.$$

This means that the first-best level of k maximizes the expected return.

B. *First-Best Insurance*

There are two instances in which a first-best outcome would be achieved with private insurance in the absence of government relief. First, when insurance companies can observe states -- whether or not government action occurs -- a first-best outcome can be achieved through a state-contingent lump-sum transfer. The transfer is lump-sum in that the amount is independent of the gains or losses, and thus independent of the level of investment as well. Clearly such a scheme has no distorting effect on incentives, while it can equalize wealth in the two states.

Second, when insurance companies can observe the level of investment (ex ante or ex post), premiums or coverage can be made a function of investment in a manner that fully counteracts moral hazard. For example, a first-best outcome is achieved with full coverage ($q = 1$) and a premium $\pi(k) = pq\Delta b(k)$.

In both cases, government relief would offer no benefits in allocating risk and would distort ex ante incentives.[7] The intuition is that investors base their decisions only on their own exposure to loss -- that portion of the loss uncompensated by the government -- rather than on the total loss.

To demonstrate this, consider the case in which states are observable. It can readily be demonstrated that, for any g, insurance would entail premiums of $\pi_o = p(1-g)\Delta b$ and $\pi_a = -(1-p)(1-g)\Delta b$, with $q = 0$. That is, the investor

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[7] If relief were lump-sum -- that is, independent of the level of the loss -- it would cause no distortion. This is not, however, the typical form of relief. (E.g., with takings for a highway, it would involve identical compensation regardless of the value of improvements, unless it were possible to individualize such lump-sum payments. Insurance accomplishes this result when states are observable by contracting in advance for a suitable level of coverage.)

pays $p(1-g)\Delta b$ in both states, which finances a recovery in the event of government action of $(1-g)\Delta b$, producing equal wealth in the two states. The first-order condition for k is determined taking g, τ, q, π_o, and π_a as given:

(6) $$\frac{dEU}{dk} = (1-p)U_o' \cdot [b_o'] + pU_a' \cdot [b_a' + g\Delta b'] = 0, \text{ or}$$

(7) $$(1-p)b_o' + pb_a' = -pg\Delta b'.$$

Consider the case of $\Delta b' > 0$ -- i.e., government action is associated with a lower marginal return to investment.[8] In contrast to the first-best level of k, given by (5), investors will choose lower expected returns for $g > 0$ than for $g = 0$, because they take into account that increased investment will increase their expected payment from the government by $pg\Delta b'$. Clearly, $g = 0$ is the unique optimum. Moreover, the greater the portion of the loss compensated by government relief, the greater will be the resulting inefficiency.

It can be demonstrated that precisely the same results follow for the case in which levels of investment rather than states are observable.

<u>Proposition 1</u>: *If states or investment levels are observed by insurance companies, the first-best outcome is achieved with no relief ($g = 0$). Moreover, $g = 0$ is the unique optimum, and sign dEU/dg = -sign g, for $g \in [-(1-p)/p, 1]$.*[9]

<u>Proof</u>: See Kaplow (1987a).

Without government relief, the investor is able to join forces with the informed insurance company to alleviate all risk and still achieve a first-best level of investment. The investor's reaction to anticipated government relief involves both insurance and investment decisions. In these cases, private insurance will fully, and without moral hazard, cover all of the loss not covered by relief. The investor and insurance company, however, have no

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[8] For $\Delta b' < 0$, the direction of the distortion reverses.

[9] For g outside this range, expected utility will be less than for the corresponding endpoints, but the fall in expected utility need not be monotone unless further restrictions are made with respect to the b_i functions.

incentive to offset the incentive distortion, because it is borne entirely by the government (τ and g are taken as given).

Consider the applicability of first-best insurance. For government actions that are limited in number and readily specified in advance (and distinguishable ex post), a state-contingent contract should be feasible.[10] Investment levels might also be observable, at least in part. Thus, with the prospect that the government will level a building in order to build a highway, insurance premiums could be proportional to the value of the building.

Note also that the results for first-best insurance will hold when investors are risk-neutral. In this case, investors need no insurance, so observability of states or investment levels is not required. This case is important primarily because, with many government actions, gains and losses fall largely on investors in widely held corporations, most of whom hold diversified portfolios. In such cases, as a rough approximation, modeling investors as risk-neutral might be appropriate.[11]

C. *Second-Best Insurance*

When the assumptions of Proposition 1 are not fully applicable -- because states or investment levels are costly to specify by contract or verify -- one has a two-stage moral hazard problem.[12] The simple moral hazard problem [see

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10 For other actions, it may be possible to approximate such results by use of a proxy variable. For example, with policy changes affecting the prospects of a defense contractor, myriad possible actions might be indexed by the size of the defense budget, or that portion of the budget devoted to a particular sector, such as fighter aircraft.

11 If the government action imposed systematic risk (which often will not be the case), it should be noted that, in principle, the government is in no better position to absorb such risk than are financial markets. See the discussion in Kaplow (1987a) of the applicability of the results of Arrow and Lind (1970) in this context.

12 In this model with only two states, one associated with no loss, the assumption that states are unobservable is unrealistic; more generally, it often will be possible to infer something about states or investment levels from the amount of the loss. The assumption of unobservability corresponds to an extreme case; the two-state model is retained for simplicity of exposition. It will be clear that many of the particular results and all the core intuitions hold more generally. For a model of a context in which complete unobservability is plausible, see Kaplow (1989b).

Arrow (1963), Holmström (1979), Shavell (1979)] is that involving the insurance company and investor when there is no government relief. The greater the level of coverage, the greater will be the degree to which investment decisions are distorted. Investors choose the level of coverage that optimally trades off incentive and risk-bearing costs.

The second stage of the problem is created by the prospect of government relief. That prospect affects not only investment but the insurance decision as well. Thus, a complete analysis of the problem in the general case must take into account the maximizing response in the insurance decision, and how it, in combination with government relief, will affect investment incentives. Since it will no longer be the case that the allocation of risk will be identical (or unimportant) for different levels of government relief, it is necessary to assess the trade-off between risk spreading and incentives.

Despite the greater complexity of the problem, the basic results emerge largely intact. It is still the case that government relief induces investors to behave as though only the uncompensated portion of the loss were incurred. As a result, in considering a marginal increase in the level of insurance coverage, individuals receive all the benefits with regard to the reduction in risk-bearing costs but bear, through the increase in premium, only that fraction of incentive costs that affects expected insurance payments; they ignore the effect on the expected cost of government relief.

It is helpful to state explicitly the government's optimization problem for the situation just described.

(8) $\max_{g,\tau} EU$ subject to:

(A) $\tau = pg\Delta b$

(B) $\max_{q,\pi} EU|_{g,\tau}$ subject to:

(i) $\pi = pq\Delta b$

(ii) $\max_{k} EU|_{g,\tau,q,\pi}$.

In analyzing this problem, it is useful to think of the investor as choosing total coverage $(q + g)$, even though the insurance premium will cover only the portion paid by the insurance company. Thus construed, it is clear that private insurance can mimic any level of relief: For any g, where q and k refer to the levels of insurance coverage and investment that would be chosen, consider the alternative of no relief, insurance coverage of $g + q$, and the corresponding level of investment, denoted as $\hat{k}$. It can readily be demonstrated that $EU|_{g,q,k} = EU|_{0,g+q,\hat{k}}$ and $k = \hat{k}$.[13] That is, any level of relief is equivalent to no relief combined with a corresponding increase in insurance coverage.[14]

The immediate implication is that $g = 0$ is an optimum, since the utility achievable at any $g \neq 0$ can also be achieved at $g = 0$. Uniqueness is demonstrated in the Appendix. The method involves noting that, at any optimum for which $g \neq 0$, the first-order condition for q must hold not only for the stated g, but also for the equivalent scheme involving no relief, which is not possible.

Proposition 2: *No relief, g = 0, is the unique optimum, even when states and investment levels are not observed by insurance companies.*

The intuition behind the inefficiency of government relief in this case is further illuminated by examining the first-order conditions for the private maximizing decisions. For optimization over k:

$$(9) \quad \frac{dEU}{dk} = (1-p)U_o'b_o' + pU_a' \cdot [b_a' + (q + g)\Delta b'] = 0.$$

Investment is affected by total coverage $(q + g)$. Note, however, that the incentive cost corresponding to insurance -- unlike that corresponding to

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13 Begin by considering the possibility that $\hat{\pi} = p\hat{q}\Delta b$. It is clear that (8Bii) will be identical for both problems, leading to the same choice of investment. (This result holds if the solution for (8Bii) is unique, as it will be in most cases of interest. See note 15. For other cases, it would be sufficient to assume that, if multiple global optima for k exist, the same selection rule is used in the initial and transposed problems.) Thus, $\hat{\pi}$ will satisfy (8Bi), and the conclusions follow.

14 Another way of viewing this result is to observe that the government optimization problem (choosing g) is the same as the private optimization subproblem (choosing q) when $g = 0$ -- compare (8) and (8B) -- except that the former problem has an added constraint.

relief -- is reflected in individuals' insurance decisions because the premium they must pay is determined by the level of coverage they select. To see this, determine dU/dq from (8B), substituting for π (using constraint (8Bi)) and noting that k is a function of q whereas (8B) has g taken as given.

$$(10)\ \frac{dEU}{dq} = (1-p)U_o' \cdot [b_o' k_q - pq\Delta b' k_q - p\Delta b]$$

$$+ pU_a' \cdot [b_a' k_q - pq\Delta b' k_q - p\Delta b + (q + g)\Delta b' k_q + \Delta b] = 0,$$

where k_q denotes the derivative of k with respect to q. The sum of the first U_o' term and the first and fourth U_a' terms equals zero, based on (9).[15] Rearranging terms yields

$$(11)\ p(1-p)\Delta b(U_a' - U_o') - pq\Delta b' k_q \bar{U}' = 0,$$

where $\bar{U}' = (1-p)U_o' + pU_a'$.

The first term of (11) indicates the benefits from further equalizing wealth between the two states. If government action results in a gain or loss that is not fully mitigated (that is, if $q + g < 1$), this term will be positive.[16]

$\Delta b' k_q$ is the moral hazard effect. Consider the case in which $\Delta b'$ is positive.[17] This indicates that the marginal return to investment is greater in the state without government action. In that instance, one would expect an increase in the level of insurance coverage (which applies in the state involving government action) to cause an increase in the level of investment, by making the marginal return in that state, as faced by the investor with insurance coverage, closer to the return in the state involving no action.[18]

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[15] As explored in Arnott and Stiglitz (1988) and Grossman and Hart (1983), for this substitution necessarily to be valid, the solution to (9) must be a unique maximum. The second-order condition (see note 36) is strictly negative for $q + g \in [0,1]$, which covers most cases of interest. This complication has little effect on what follows, as explored further in Kaplow (1987a).

[16] When Δb is positive (negative), wealth is lower (higher) in state a, so marginal utility is higher (lower) state a.

[17] When $\Delta b'$ is negative, the argument to follow suggests that the sign for k_q is negative.

Optimal private insurance thus trades off risk-bearing and incentive costs. Government relief distorts this decision because the moral hazard term is weighted by q rather than q + g: Only that portion of moral hazard relating to private insurance is reflected in the investor's insurance decision.

It is also instructive to examine the level of private insurance that would be selected for any given level of government relief.

Proposition 3: *If government relief is less than complete, insurance coverage is positive but insufficient to provide complete compensation. If government relief is complete, no insurance is purchased. That is,* $g < 1 \Rightarrow q \in (0, 1-g)$ *and* $g = 1 \Rightarrow q = 0$.[19]

Proof: See the Appendix.

The intuition of Proposition 3 allows one to understand the effects of relief on private insurance decisions, and therefore on investment as well. If government relief is less than complete, insurance coverage will be positive: When $q = 0$, a marginal increase in q reduces risk-bearing costs and imposes no private incentive costs. Note that $q > 0$ even when $g > q^*$, where q^* is the optimal level of insurance in the absence of relief. That is, additional coverage is purchased even when government relief already exceeds the coverage one would have purchased in its absence. Yet, no matter how high the level of partial relief, one will not be induced to purchase insurance that, combined with relief, provides complete coverage: At $q = 1-g$ (i.e., full coverage for one's exposure), a marginal reduction in q entails no risk-bearing costs and reduces private incentive costs.[20]

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18 Due to subtle income effects, this relationship need not hold in general. For many cases of interest, a sufficient condition would be that U is a nonincreasing absolute risk aversion utility function. See Kaplow (1987a).

19 Also, $g > 1 \Rightarrow q \in (1-g, 0)$.

20 For $g = 1$, there is no further risk to spread, and $q \neq 0$ imposes two costs: It creates risk not otherwise present and it creates private incentive costs. Note that, although $q < 0$ would diminish total incentive costs, such costs are borne by the government, so there is no private benefit; in fact there will be a private cost if $q \neq 0$, since, for purposes of private insurance, incentive costs are defined relative to a baseline that takes g as given.

More precise characterizations require further restrictions because of subtle wealth effects. In the simplest cases, assuming a nonincreasing absolute risk aversion utility function, Kaplow (1987a) demonstrates that total coverage ($q + g$) is greater when (positive) relief is offered than when there is no relief. The reason is that, for any level of positive relief, the risk-spreading benefits of marginally increasing total coverage beyond q^* are the same as in the case of no relief, but the incentive costs, at the margin, are strictly less when relief is positive. Thus, even though one would expect insurance coverage to be less the greater is the level of government relief, the reduction in private coverage (relative to q^*) does not fully offset government relief. Note that even when relief is less than q^*, individuals purchase enough insurance to produce total coverage in excess of q^*.

Government relief could have been mimicked by greater private coverage (with no relief), but was rejected by the investor because the greater risk spreading was not worth the incentive cost. Because there is no externality in the private insurance decision, government relief cannot improve upon it.[21]

D. *Market and Government Risks Compared*

It is commonly stated that government relief against losses induced by market forces -- interpreted broadly to include changes in technology and consumer taste as well as natural disasters and acts of foreign governments -- is inefficient. Similarly, opposition to windfall taxation -- e.g., of extraordinary gains in the case of a successful new product -- is based on the fact that such windfalls are merely the tail of a probability distribution of returns that was part of the ex ante inducement for investment. This section has offered a model equally applicable to market and government risks. The intuition is that, just as a firm might overinvest if losses caused, e.g., by an unexpected decrease in demand, are expected to be mitigated by the government, the same effect follows if similar losses caused, e.g., by

[21] This does not rule out all government action, such as taxes and subsidies applied to the relevant activities. See Arnott and Stiglitz (1986). For most instances of government risk, however, it does not appear that there will generally be a plausible tax/subsidy scheme to offset the moral hazard produced by private arrangements and exacerbated by government relief.

increased competition due to deregulation, are to be mitigated. For virtually any government policy change imaginable, one can identify a corresponding action in the market that would produce the same effects on investors.

2. Extensions and Discussion

A. *Symmetry of Gains and Losses*

All of the analysis thus far (and to follow) is equally applicable to gains and to losses. When $\Delta b > 0$, $g > 0$ means that losses are (partially) compensated. Gains correspond to $\Delta b < 0$, in which case $g > 0$ involves windfall taxation. Thus, at noted in the preceding section, mitigation of gains tends to produce underinvestment.

This symmetry should be emphasized because in many contexts involving government risk it is far more common to hear cries for relief for losses due to government action, but no such demands that gains be taxed away or otherwise mitigated. Much academic commentary as well has proceeded as though mitigation of losses were the only issue. In a few contexts, such as the windfall profits tax accompanying oil price deregulation, gains have been explicitly taken into account.

Overall, regardless of which concern dominates in a particular instance, it is important to recognize that both the incentive and risk effects are fully symmetric with respect to whether gains or losses are involved. Since most government actions involve both gains and losses, this observation is relevant to virtually all considerations of government risk.

B. *Alternative Mechanisms for Government Relief*

Rather than pure schemes of compensation (or windfall taxation), mechanisms that directly nullify a government action to some degree are more common. Grandfathering consists of an exemption of preexisting investment. Partial (scaled-back) and delayed implementation are also employed. Both reduce the impact of government action, and thus the gains and losses imposed.[22] Phase-ins are a hybrid, in which the degree of implementation increases with the passage of time. Further combinations (e.g., partial grandfathering, which may expire or be phased-out after a period of time) are possible.

There are three incentive effects, one ex ante and two ex post, to consider. The most important point is that all relief mechanisms are like pure compensation in their effect on ex ante incentives. Although the model of section 1 purported to be about compensation (and windfall taxation), it covers these other schemes as well. For example, grandfathering, no implementation ("partial" implementation at a zero level), and infinite delay each correspond to full compensation. Intermediate versions of each mechanism correspond to partial compensation; since the model was general as to levels of relief, the results are immediately applicable.[23]

While all mechanisms are qualitatively similar with regard to their ex ante incentive effects, their ex post incentive effects differ. First, note that grandfathering and other direct mitigation schemes tend to be more distorting than equivalent degrees of direct compensation (and windfall

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[22] Moreover, because of typical nonlinearities concerning the effects of risk and the returns to implementing a policy, it might seem plausible that a favorable trade-off could be achieved. If the optimal level of implementation -- i.e., ignoring concerns relating to incidental gains and losses -- is characterized by zero marginal net benefits, the loss from modestly scaling back might be quite small. In contrast, risk-bearing costs rise disproportionately with the magnitude of gains and losses. Some such argument is needed to explain why, if partial reduction or modest delay of a policy change were desirable, it would not follow that complete abandonment would be even better.

Zodrow (1981, qualified in 1985) has correctly noted that, because of the likely decreasing marginal net benefits associated with implementing various policies, immediate partial implementation is probably preferable to a delay that similarly mitigates losses from government action, since delay might be expected to cause a full proportional reduction in net benefits of new policy. As noted in the text to follow, such considerations are secondary in that they (partially) address only one of three effects of such mitigation, the others of which are generally decisive against both forms of relief.

[23] Some modifications are necessary to account for the differing contours of alternative strategies. For example, it is well-known that complete grandfathering amounts to more than full compensation because of the scarcity effect. This can simply be modeled as $g > 1$. The only relevant complication is that the relief offered by some mechanisms may not be a uniform proportion of the loss, requiring the use of a more complex (nonlinear) compensation function to make the relevant comparison. For more details, see Kaplow (1987a).

taxation) in terms of their ex post effect on *old* investment. For example, it is more efficient to compensate directly for the decreased market value created by a Pigouvian tax than to grandfather, because the latter approach destroys the corrective effect of the tax on *future* output. In some instances (including many in the income tax context) there may be no such future effects once the past investment decision has been made; in all others, pure compensation/taxation schemes will dominate these alternatives (unless administrative cost considerations alter the balance).[24]

With respect to ex post effects for *new* investment, grandfathering schemes differ from delay or partial implementation (to an extent achieving the same degree of relief). Because grandfathering, unlike the latter schemes, does not provide any relief for post-reform investment, it is more efficient in that it avoids an additional ex post distortion: that is, it achieves the benefits of the government action as to new investment sooner or to a greater extent. It is thus difficult to justify, except on administrative grounds, most delay or partial implementation schemes commonly observed in many contexts, since they could be converted into equivalent grandfathering schemes.

The conclusion is that all mechanisms for relief are subject to the same analysis with regard to the central issue examined here: the efficiency of ex ante decisions. In addition, when government relief is to be provided, the available mechanisms can be ranked by the inefficiency they produce, making possible equivalent relief at less cost.

C. *Retroactive Application*

Thus far, the analysis has indicated the efficiency of immediate, full implementation with no other government relief. In some instances, however,

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[24] Grandfathering and delayed or partial implementation schemes avoid the need to value particular investments, and thus are typically simpler. In addition, delayed or partial implementation may be simpler than grandfathering, the latter requiring that one distinguish old from new investment, which could be complicated in some contexts. Interestingly, this administrative ranking is the reverse of the ranking on incentive grounds, although the simplest scheme of all -- no mitigation -- is also the best in terms of incentives.

the ex ante analysis implies that retroactive application would be efficient. For example, if an activity is found to have negative external effects that have existed for some time, it would be optimal not only to tax future production (or otherwise regulate the activity) but to charge for the past harm caused. The anticipation of such retroactive application is necessary to align ex ante incentives, particularly since private actors will sometimes have had (or might have been able to obtain) better information than the government at the time their previous investment decisions were made. Common law tort liability -- e.g., for newly discovered hazardous activities -- often functions in this manner.

Retroactive application is efficient when new information available to government decisionmakers suggests that past circumstances were different from what the government previously believed. By contrast, it is inefficient where circumstances themselves have changed -- for example, where changed water flow patterns make discharges that were harmless in the past detrimental in the future.

This dichotomy is illuminated by considering a hybrid case. Suppose that a new analysis indicates that a highway should have been built twenty years ago, which would have entailed leveling a set of buildings. It would be inefficient to tax the interim earnings on investments in such buildings because, given that the highway was not built, the return on such buildings was socially as well as privately valuable. If building the highway is still desirable, it would be efficient to level the buildings now, without compensation for future earnings. Given the actual timing of the highway project, this policy provides investors, ex ante, with an earnings stream reflecting the social value of investment in buildings in the path of the future highway. The treatment of this hybrid case arises naturally from understanding that the new information was, by assumption, relevant to the value of the buildings only insofar as it led the government to build the highway. That event constitutes a change in circumstances as of the time the highway is built, making applicable the branch of the analysis under which retroactive application is inefficient.

Note that retroactivity does not merely present a special case. Rather, the analysis of this issue is necessary to define "immediate" implementation, and thus the meaning of "no relief" as well, since delay, as section B noted, is itself a form of relief.

D. *Premises of the Analysis*[25]

1. *The policy concerning government relief.* At the core of the ex ante approach is the assumption that the government relief to be provided is fully anticipated. This is equivalent to assuming that the government consistently and credibly follows a given relief policy, at least in each identifiable context. If inconsistent policies could be maintained, it would be optimal, ex ante, to announce no relief, but, ex post, to remedy any gap between the partial relief obtained under second-best private arrangements and full coverage.[26] Presumably, such a policy could not be credibly maintained.

Given the repeat nature of the process of policy change in many contexts and the wide range of institutional mechanisms, it seems plausible that a government could commit to a consistent policy toward relief. If so, the analysis here suggests which one would be most efficient. Note, however, that the long-run optimal policy is not necessarily appropriate ex post when no such policy has previously been announced. But in considering any prescription based on ex ante effects, one must address how to reach the long run and whether action, ex post, consistent with the policy one ultimately seeks to establish is helpful or necessary in establishing the desired reputation.[27]

2. *Optimality of underlying government action.* The welfare characterizations (in contrast to the analysis determining behavior) assumed that there was no divergence between the private and social returns to

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[25] Kaplow (1987a) addresses these and other assumptions in greater depth.

[26] Thus, government relief poses the general time-consistency problem explored in Kydland and Prescott (1977).

[27] If any commitment could be made credibly, the optimal policy would be to announce immediately that, forever after, there would be no relief (the long-run optimal policy), but to provide full compensation/windfall taxation for the losses and gains engendered by the announcement itself.

investment. This assumption will often hold regardless of the desirability of the underlying government action. For example, the social value of buildings destroyed for a highway project is zero after their destruction regardless of the wisdom of the project.

In other instances, the efficiency analysis is dependent upon the desirability of the new policy, as when the value of an investment is reduced by a Pigouvian tax. Then, the welfare results for relief require the further assumption that the government action was, in relevant respects, desirable. Assuming the opposite -- that most or all policy changes are undesirable -- leads to a simple contrary prescription: government mitigation, as by infinite delays in implementation, that maximally disrupts all change. The efficient government policy assumption, where necessary for the welfare analysis, serves to highlight optimal relief policy as an adjunct to optimal underlying substantive policy.[28]

The model also assumes that the policy toward relief does not influence the determination and implementation of underlying policies. This need not be the case. It is sometimes suggested that requiring relief would impede bad reforms or make good reforms politically feasible -- although the opposite effects are also possible. For example, it may be that a government agency undervalues the costs of its projects, since costs are not directly borne by the relevant decisionmakers. Although many difficulties with this argument are often overlooked -- most obviously that benefits may also be undervalued -- the result of accepting it is that the complete government problem entails an incentive trade-off: Further relief requirements would improve the agency's incentives at the expense of private incentives. As another example, government relief will facilitate enactment of reforms when powerful losers need to be bought off. Thus, in the context of deregulation, some suggest that entrenched interests be bribed into accepting the more efficient policy. The ex ante analysis indicates that more than distribution is at stake if such

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[28] In addition, the analysis in such instances implicitly assumes that efficiency rather than distributional objectives motivate the government action. Relief is relatively uninteresting in the latter case: Full relief for a tax scheme used to finance welfare programs would tax back all the welfare benefits and compensate losers by returning all tax payments.

pay-offs are to become a habit. See Kaplow (1987b). Moreover, within the political process itself, an ex ante perspective may suggest that the willingness ex post to buy off such opposition will increase ex ante rent seeking that initially creates such inefficient policies. See McKenzie (1986).

3. *Additional market imperfections.* The analysis admitted no market imperfections other than the information problems producing moral hazard. Transaction and administrative costs may also be relevant. Arrangements for each of the myriad possible risks may be quite expensive through individual insurance contracts, necessarily made ex ante, whereas government relief, being ex post, need only be made available when government action results. Of course, the same can be said (as with most other imperfections) for conventional market risks, where the argument for government mitigation may be as strong.[29] One response is a single insurance policy that covers a wide range of risks. In addition, such transaction costs, combined with the moral hazard problems emphasized here, may contribute to the prevalence of diversification rather than particularized insurance to deal with a large range of observed risks, both market- and government-induced.

The model also assumed that individuals accurately assess risk. Consider instead the extreme case where individuals mistakenly believe the probability of action to be zero. There would be no adverse ex ante incentive effects from government relief (investment decisions are already distorted), and private insurance would not have been purchased (because any premium would seem too high).[30] This parallels one case for disaster relief. But compulsory insurance is more efficient than simple ex post relief,[31] as the

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[29] One difference, noted above, is that relief through grandfathering, delay, and direct mitigation is probably simpler than compensation; analogs are not available with regard to some private risks.

[30] The government having better information does not itself justify relief, as the information may be made available to private actors. The example assumes transmission is too costly, due, for example, to psychological characteristics that limit processing of information that comes in simple, summary form. See Kunreuther et al. (1978); Kahneman, Slovic, and Tversky (1979).

[31] To avoid the incentive problem examined here for any who perceive a positive probability of incurring a loss, the premium charged would have to

required ex ante payment of the premium in many contexts will induce more efficient ex ante investment even by actors who continue to misperceive the probabilities. For example, one contemplating construction of a building in a flood plain or in a zone likely to be condemned soon for a highway would act differently if required to pay in advance an insurance premium reflecting the probability of adverse events. Note, therefore, that government insurance -- voluntary or compulsory -- is fundamentally different from government relief.

The model also ignored problems of adverse selection, which, unlike moral hazard, may suggest the efficiency of government relief.[32] Adverse selection only arises, however, when probabilities are specific to individuals and known only to them, both unlikely with government policy changes of general applicability. It is possible that adverse selection problems could act in synergy with moral hazard in some contexts. For example, a firm may have unique knowledge as to the likelihood its products will be banned or the magnitude of loss that will result, in large part because its actions in researching and developing the product -- actions affecting this probability -- generate private information.

3. Concluding Remarks

This investigation indicates that government relief of all forms -- whether for gains or losses -- distorts the efficiency of ex ante decisions concerning risk spreading and incentives in the same way that government relief for market risks would distort behavior. In many instances, such relief distorts investment incentives in the process of achieving risk mitigation that private parties could have accomplished efficiently -- as where investors can diversify their holdings or enter into first-best insurance arrangements. The result is that the benefits of market arrangements are discarded to an extent that rises with the level of relief.

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depend upon other insurance coverage or supplementary coverage would have to be banned.

[32] See Dahlby (1981). Relief should be contrasted with other government activity, such as subsidizing goods purchased in too little quantity due to moral hazard. See note 21.

In other cases, where moral hazard renders private arrangements second-best, relief distorts the trade-off between risk and incentives.

The problem of government risk arises in a wide range of contexts.[33] With evolutions in common law tort doctrine, it is common for there to be no relief, and sometimes retroactive application, as when damages are assessed for prior harm caused by acts not previously viewed as violating the law. For takings, there is full compensation (though virtually no taxation of gains). The most plausible justification for this practice may relate to concerns about the incentives of government actors.[34] For tax reform and regulatory reform, the wide mix -- grandfathering, phase-ins, and no relief -- might best be explained by the balance of political forces, although the analysis here casts doubt on the efficiency of such relief and suggests that, if unavoidable, such pay-offs often may be accomplished more efficiently by choosing different mechanisms. For budgetary shifts[35] and many other government actions, there is no relief, perhaps because many such policy changes are seen as more akin to market risks for which government assistance is less common. Previously, it has not been recognized that these widely varying contexts raised many of the same questions.

When substantial government relief is to be offered, whether because the assumptions of the model do not apply or because political forces make relief unavoidable, the analysis here offers three insights. First, charging a premium ex ante may help preserve incentives, as illustrated with disaster relief and takings. Second, banning supplementary insurance may avoid the inefficiency that arises from the maximizing response that entails additional private risk mitigation. Such analysis might be applied to government

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[33] These examples and others are considered further in Kaplow (1986, 1987a, 1987b). For partial analyses of the example of government takings, see also Blume and Rubinfeld (1984) and Blume, Rubinfeld, and Shapiro (1984).

[34] When the constitutional requirement of just compensation was adopted, insurance and other financial markets were not well developed. Nearly full compensation may well have been efficient in many contexts, viewed solely in terms of risk and incentives. Fears of abuse of power, however, more directly relate to the origins of the provision.

[35] Government contracting is also amenable to the analysis presented here, although additional considerations involving asymmetric information must be taken into account.

insurance programs, such as Medicare. Third, carefully selecting among relief policies may limit inefficiency, as mechanisms that provide equivalent relief generally give rise to different incentive costs.

Appendix

Proposition 2: Proof of Uniqueness

At a global optimum, g, the first-order condition for q (11) must hold. The discussion of (8) implies that it must also hold for ($\hat{g} = 0$, $\hat{q} = g + q|_g$), since g is assumed to be a global optimum. Moreover, EU = E$\hat{U}$ and k = $\hat{k}$, so (11) can equal zero in both cases only if $qk_q = \hat{q}\hat{k}_q$.

Taking the derivative of the first-order condition (9) with respect to q and regrouping yields

$$\text{(A1)}\quad k_q\Big[(1-p)U_o'b_o'' + (1-p)b_o'U_o''\cdot[b_o' - pq\Delta b'] + pU_a'[b_a'' + (q+g)\Delta b''] + $$
$$+ p[b_a' + (q+g)\Delta b']U_a''\cdot[b_a' + (q+g-pq)\Delta b']\Big]$$
$$= p\Delta b(1-p)b_o'U_o'' - pU_a'\Delta b' - p\Delta b(1-p)[b_a' + (q+g)\Delta b']U_a''.$$

It simplifies matters and aids interpretation to separate the terms corresponding to U_{kk}, which denotes d^2EU/dk^2.[36] The bracketed term on the left side of (A1) thus becomes

$$\text{(A2)}\quad U_{kk} - pq\Delta b'\Big[(1-p)b_o'U_o'' + p[b_a' + (q+g)\Delta b']U_a''\Big].$$

Using this result, (A1) can be rewritten as

$$\text{(A3)}\quad k_q[U_{kk} - q\theta] = \Omega.$$

The discussion of (8) implies that θ, Ω, and U_{kk} are identical for both scenarios because each term depends only on q + g, U, and k. Therefore, we can equate

$$\text{(A4)}\quad k_q[U_{kk} - q\theta] = \hat{k}_q[U_{kk} - \hat{q}\theta].$$

Factoring, we have

36

$$\frac{d^2EU}{dk^2} = (1-p)U_o'b_o'' + (1-p)U_o''b_o'^2 + pU_a'\cdot[b_a'' + (q+g)\Delta b''] + pU_a''\cdot[b_a' + (q+g)\Delta b']^2.$$

(A5) $qk_q[U_{kk}/q - \theta] = \hat{q}\hat{k}_q[U_{kk}/\hat{q} - \theta]$.

From the requirement that $qk_q = \hat{q}\hat{k}_q$, it follows that $q = \hat{q}$.[37] Recalling that $\hat{q} = g + q$, the conclusion is that $g = 0$.

Proof of Proposition 3

Begin with the case of $g < 1$. $q = 0$ can be ruled out by reconsidering the first-order condition for maximization over q:

$$(11)\ p(1-p)\Delta b(U_a' - U_o') - pq\Delta b' k_q \bar{U}' = 0.$$

For $q < (1-g)$, $q + g < 1$, which implies that the first term is positive: First, note that the difference in wealth between the two states is $(q + g - 1)\Delta b$. Therefore, $\Delta b > 0$ ($\Delta b < 0$) implies that the difference in marginal utilities is positive (negative). At $q = 0$, (11) is positive.

For $g \leq 1$, consider $q < 0$ as a possible optimum. Let k be the optimal investment given q. Compare the utility level thus resulting with the utility produced by the same k and $q = 0$. The difference in expected wealth between the two cases is simply $-\pi + pq\Delta b$, which equals zero (8Bi). But for $g \leq 1$ and $q < 0$, the spread in wealth is greater than with $q = 0$, so expected utility must be less. Therefore, $q < 0$ also cannot be an optimum.

Finally, consider the possibility that $q + g \geq 1$. First, if $q + g = 1$, wealth is equal in the two states, so the first term in (11) equals zero. The sign of the second term can be determined from (A1), noting that $q + g = 1$ implies $b_o' = 0$.[38] The right side terms in (A1) are zero except for the

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[37] This derivation implicitly assumed $qk_q \neq 0$, $U_{kk} \neq 0$, and that qk_q and $\hat{q}\hat{k}_q$ are not both infinite. If $qk_q = 0$, for (11) to equal zero, it must be that marginal, and thus total utility is equal in each state, which holds only if $q + g = 1$. In that case, the utility equals that at ($g = 0$, $q = 1$). Proposition 3 demonstrates that $g = 0 \Rightarrow q < 1$, ruling this out. Inspection of U_{kk} (see note 36) readily demonstrates that a sufficient condition for it to be strictly negative is $q + g \in [0, 1]$. Proposition 3 and the discussion following (8) guarantee that $\hat{q} \in (0, 1)$ and $\hat{q} = q + g$, so that, at an optimal g, this holds. Finally, given g, for qk_q and $\hat{q}\hat{k}_q$ both to be infinite, both k_q terms must be infinite. From (A3), this requires $U_{kk} - q\theta = 0$ and $U_{kk} - \hat{q}\theta = 0$. This is only possible if $q = \hat{q}$, the desired conclusion, or $\theta = 0$ *and* $U_{kk} = 0$ simultaneously, the latter just having been ruled out.

second, which is strictly negative (positive) in the case where $\Delta b' > 0$ ($\Delta b' < 0$), and the second and fourth terms on the left side equal zero, with the other terms strictly negative, so $k_q > 0$ ($k_q < 0$).[39] If $q \neq 0$, $q + g = 1$ is thus not an optimum, and a smaller q is locally preferred. And $q = 0$, with $q + g = 1$, contradicts that $g < 1$.

Consider $q + g > 1$; i.e., $q > 1-g$. Let $\hat{k}$ be the optimal investment under that scheme, and $\bar{k}$ be the optimal investment when $q + g = 1$. In (9), the bracketed part of the second term equals $b_o' + (q + g - 1)\Delta b'$. For the case where $\Delta b' > 0$,[40] since an optimum requires (9) to equal zero, it must be that $b_o'(\hat{k}) < 0$. By assumption, $b_o'' < 0$. Therefore, $\hat{k} > \bar{k}$. Compare the utility level at q and $\hat{k}$ with that at $q = 1-g$ and $\hat{k}$. $\hat{k} > \bar{k}$ implies that expected wealth is greater at $q = 1-g$ and $\hat{k}$, because all b's are the same (since the same k is assumed) and the change in the insurance policy produces a gain in expected wealth because the cost per unit of remaining coverage is less (since the level of investment associated with $q = 1-g$ is less). Moreover, the greater expected wealth is distributed perfectly equally between states when $q = 1-g$. These two effects imply that the utility level is greater as well, which rules out the possibility that $q > 1-g$ can be an optimum.[41]

It now follows as well that $g = 1 \Rightarrow q = 0$. At $g = 1$, $q = 0$ implies that (11) equals zero (as both terms equal zero). $q < 0$ was ruled out above. $q > 0$ is ruled out by the argument just presented that $q > 1-g$ cannot be an optimum. Therefore, at $g = 1$, $q = 0$ is the optimum.

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[38] The bracketed portion of the second term in (9) is

$$b_a' + (q+g)\Delta b' = b_a' + 1\cdot(b_o' - b_a') = b_o'$$

Therefore, (9) reduces to $\bar{U}'b_o' = 0$.

[39] The possibility that $\Delta b' = 0$ needs no special consideration, as it is clear from (9) that this would only occur if $b_o' = b_a' = 0$, which was ruled out by assumption.

[40] For the case where $\Delta b' < 0$, the relationship between the levels of investment discussed in the text to follow is reversed, but this also produces greater expected wealth in the case where $q = 1-g$ due to reduced premiums (the combination of the greater k and the reversed sign of $\Delta b'$ produces the same effect as the lower k and $\Delta b' > 0$). The remainder of the argument in text thus holds in this case as well.

[41] The proof for $g > 1$ follows that for $g < 1$, mutatis mutandis.

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