Incentive-Compatible Mechanisms Are Not Credible

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WHY POLITICS IS MORE FUNDAMENTAL THAN ECONOMICS
INCENTIVE-COMPATIBLE MECHANISMS ARE NOT CREDIBLE

Gary Miller and Thomas Hammond

ABSTRACT

Efficient incentive-compatible schemes for resolving hidden action and hidden information problems have been shown to exist, thereby offering the hope that public goods can be provided in a neutral, non-political way. We argue that this hope is illusory. Such schemes inevitably generate a residual profit, and a property right to the residual creates a stake in inefficiency; the residual can be increased by a distortion of the efficient incentive system. In general, therefore, the residual-owners’ claims that they will not distort the efficient incentive scheme are not credible. Economic efficiency in the presence of externalities requires the resolution of a fundamentally political problem: the credible commitment of central officials to the implementation of an efficient incentive scheme that is not in their own best interest.

KEY WORDS • economic efficiency • externalities • incentive-compatible schemes • property rights • public goods • residual profit

From the redistributive societies of ancient Egyptian dynasties through the slavery system of the Greek and Roman world to the medieval manor, there was persistent tension between the ownership structure which maximized rents to the ruler (and his group) and an efficient system that reduced transaction costs and encouraged economic growth. This fundamental dichotomy is the root cause of the failure of societies to experience sustained economic growth . . . (North, 1981: 25).

Introduction

Why shouldn’t kings and the societies that they rule have a shared interest in economic growth? The purpose of this paper is to point out that a conflict between ruler self-interest and economic efficiency should be expected from the logical limitations on incentive design. Furthermore, this conflict means that the foremost problem facing any society is the political problem of ‘constraining the king’, the solution of which must precede the efficient operation of markets.

The authors would like to thank Randy Calvert and Barry Weingast for helpful comments on an earlier draft of this paper.
North and Weingast (1989) provide a fascinating discussion of 17th-century England which we take as an illustration of a fundamental political phenomenon. English kings, unconstrained before the Glorious Revolution by law or parliament, had the power to confiscate wealth accumulated by entrepreneurs. They could do this, for instance, in the form of 'forced loans', which might or might not be repaid according to the originally 'negotiated' terms.

It can be readily imagined that this pattern of behavior by the monarch would be influenced by the actions and representations of the citizens. Entrepreneurs would find their incentives to take actions that would result in accumulated wealth were much dampened; to the extent that they did accumulate wealth, they might well try to conceal the amount of the wealth from the king. North and Weingast (1989) demonstrate that the problem was much alleviated by the constitutional changes accompanying the Glorious Revolution. By constraining the actions of the king, entrepreneurs had more of an incentive to accumulate (and disclose) wealth.

Of course, the Glorious Revolution did not eliminate the incentives either for citizens to lie or for the government to take inefficient actions. As Adam Smith was to argue a century later, the British Parliament was itself committed to a series of actions which discouraged economic efficiency in the interest of actors who had sufficient power in parliament. The West Indies sugar planters made enough wealth through the protective policies of parliament that they could afford to buy a large number of seats in parliament in order to guarantee the maintenance of those policies. While these policies certainly enhanced the wealth of one set of economic actors with political power, they are generally regarded to have been inefficient overall. Thus, the Glorious Revolution may have improved the situation but it did not eliminate the conflict between the requirements of economic growth and the self-interest of those actors with political power.

Indeed, taking a panoramic view of economic history, North (1981) is persuaded that the conflict between the self-interest of the ruler(s) and overall social efficiency is one of the more inclusive and compelling generalizations to be made. Inefficient policies appear, they persist over time, and the best explanation for persistent inefficiencies is the self-interest of those with political power.

Even under those systems of constitutional rules which most constrain the self-interested actions of those in political power, such a tension can still be seen. The 19th-century American political system encouraged possibly the greatest economic expansion in the history of the world, but the rent-seeking activities of those actors who achieved political power clearly remained an inhibiting factor. Businesses knew before they undertook a major investment that political machines at the national, state or certainly the local level would have to be bought off; this kind of activity limited the efficiency of many of the public services that were necessary for economic growth,
including postal services and roads. Indeed, the Progressive reform move-
ment at the turn of the century can be seen as an attempt by American
business to limit the rent-seeking activities of political machines by further
constitutional reform; the central concern was that efficiency-enhancing
governmental services would be supplied automatically by professional
bureaucracies rather than sold by rent-seeking political machines (Miller,
1989).

Like the reformers of the Glorious Revolution, the Progressives were
successful in committing governmental actors to a set of rules which created
incentives for more economic growth. The city manager form of government
professionalized the flow of services in many cities in the country, making
it possible for the first time for entrepreneurs to undertake major economic
investments without having to calculate the costs of significant bribes to
political actors. As argued by Miller:

It is hard to imagine that the stunning urban development of twentieth century America
could have taken place without something like the Progressive reform movement. It
allowed thousands of entrepreneurs to invest in businesses in urban areas across the
United States without having to worry that the next change in party control in their
city government would result in a new round of extortion or an elimination of their
property rights in favor of rivals associated with the newly successful political cliques
(Miller, 1989: 691).

Yet even under the Progressive reforms, the new institutions of govern-
ment could be used to further the economic interests of those in political
power at the expense of economic efficiency. For instance, one of the fore-
most Progressive innovations was the independent regulatory agency, which
was intended to supply efficiency-maximizing professional decisions. While
the independent regulatory agencies remained markedly free of the forms of
rent-seeking (direct bribes) that characterized 19th-century party machines,
they did prove susceptible to political influence by special interests. The
Civil Aeronautics Board, for example, adopted the Progressive form of
decision-making by expert panel, but at a significant economic cost. Airlines
supported the political aspirations of members of Congress and presidential
candidates, who appointed board members sympathetic to the airlines, with
the result that the CAB limited entry and kept rates artificially high for
decades, at significant aggregate cost to the economy.

While clearly there are more and less efficient political institutions, the
history of what North and Weingast would call 'credible commitment'
through constitutional reform raises an important question. Is there an ideal
constitution toward which we may reasonably strive, or are there built-in
logical contradictions which limit the ability of a constitution to reconcile
the conflicting interests of political actors and economic efficiency?

If the former is true, then the ideal set of constitutional rules could
implement a government that would eliminate the conflict between the
requirements of economic growth and the self-interested actions of those
with (or seeking) political power. That is, given the correct set of rules, the self-interested behaviors of all political and economic actors would be mutually consistent, and consistent with economic efficiency. Once the ideal rules were implemented, government would become a self-maintaining machine. Government could be thought of in the same way as we think of a neoclassical market, in which the self-interested actions of all actors (both economic and political actors) aggregate to Pareto-efficient equilibria.

Many political economists seem to be committed to the search for this ideal set of constitutional rules. Indeed, many seem to argue that they have found such a set of rules in what are known as 'incentive-compatible mechanisms'. The purpose of this paper, however, is to argue that there is a built-in contradiction in the implementation of incentive-compatible mechanisms that eliminates the possibility of reconciling the demands of economic efficiency with the political demands of those in power. The political limitations on economic efficiency are not an historical accident, but a logical inevitability.

Politics, Efficiency and Public Goods

Strategic misrepresentation, or lying, is a political fact of life in every known political system; but need it be? Is it possible to imagine a political constitution that would generate no incentives for lying?

In competitive markets, we are relatively safe in assuming that individuals have no incentive to lie. The reason is that, with sufficient competition, each individual is a price-taker; one buyer therefore has little incentive to dissemble. If she purchases an item for a given price, then that may be presumed to reveal accurate information about her preferences.

With public goods, however, there seem to be built-in incentives for misrepresentation of preferences. If people are asked to contribute toward the provision of public goods, then each individual has a reason to disclaim any interest in the public goods in the hopes of free-riding on the contributions of others.

Creation of a political authority capable of coercing contributions (taxation) can eliminate free-riding, but it does not eliminate the incentive for lying. If an individual's tax is in any way linked to the provision of the public good, then an individual may lie to reduce the tax burden. If an individual's tax is not linked to the provision of the public good, then that individual may have an incentive to either exaggerate or understate the valuation of the public good to affect the probability of either receiving or avoiding a public good with positive or negative net benefit. In either case, policy-makers are deprived of the information necessary to make efficient decisions regarding the level of provision of public goods, and the policy
discourse among interest groups and legislative representatives of narrow constituencies is likely to proceed in an atmosphere of gross distortion and strategic misrepresentation.

As noted by Tideman (1985): 'The efficient provision of public goods has long been a dream of economists. For many years it seemed that the problem of motivating citizens to report their preferences honestly would forever thwart the dream.' Building on work by Arrow (1951), political economists discovered in the 1970s that an incentive for misrepresentation seems to be general (Gibbard, 1973; Satterthwaite, 1975). Lying could perhaps be ignored if it led to optimal social decisions; however, other political economists quickly made related discoveries showing that democratic voting processes had problems of stability and efficiency that seemed profound (McKelvey, 1976; Schofield, 1976). Lying is not only endemic, it seems to serve no socially useful purpose.

At about the same time, economists were elated to discover some collective-choice mechanisms that seemed to eliminate both inefficiency and the incentive to lie. Building on the early analysis of auction mechanisms by Vickrey (1961), economists discovered systems, known as 'incentive-compatible mechanisms' or 'demand-revealing processes', which provide incentives for members of an organization to provide truthful signals about the public goods problems they face (Tideman and Tullock, 1976). Furthermore, in some of these mechanisms, truthfulness emerges as a 'dominant strategy'; that is, it is in the interests of the individual to tell the truth about a public good no matter what others might choose to do.

Economist Nicholas Tideman wrote in the introduction to a special volume of Public Choice dedicated to these systems:

The feature of the demand-revealing process that makes it so exciting is that it becomes extremely close to the ideal of guaranteeing that collective decisions will be made efficiently (1977: 1).

The mechanisms involve a market-like auction, headed by a benign 'auctioneer' who obtains the information necessary to make Pareto optimal decisions, even for those problematic public good decisions which typically produce inefficiency in normal markets.

In effect, the incentive-compatible mechanisms can be seen as offering the efficiency of private-good markets for troublesome public-good decision-making. The failure of markets to provide efficient allocation of resources in the presence of public goods had been a powerful argument in favor of the state (Laver, 1981; Samuelson, 1954); but the existence of incentive-compatible mechanisms offered a vision of smoothly functioning public goods markets operating without coercion. In these communities, politics could be eliminated: individuals would submit voluntary and truthful 'bids', resulting in an efficient provision of public goods and fair allocations of
tax costs under the neutral competence of the 'auctioneer'. The provision of public goods would be subsumed under market-like institutions and market-like behavior, and the result would be market-like efficiency. Tideman has argued that 'it is fundamentally a lack of understanding that thwarts the efficient provision of local public goods without compulsory taxes' (1985: 201).

This was an especially exciting possibility to economists who had long articulated a preference for the voluntarism and efficiency of the marketplace over the coercion, confiscation and rent-seeking of politics. 'Politics' could finally be exorcised in favor of the neutral competence of the Invisible Hand.

We ask in this paper whether a dominant strategy incentive-compatible mechanism could indeed provide public goods without politics. We consider the following thought experiment: suppose a Utopian community is advertised in a newspaper. The community will provide private goods through a market mechanism and public goods will be provided by an incentive-compatible mechanism. Should rational individuals, who perhaps are heartily disenchanted with the inadequacies of congressional budgeting, be willing to move to such a Utopia? Would such a community, once created, be free of politics?

We argue that rational individuals should not be willing to submit to such an experiment, and that in any case there are central political problems built into the implementation of an incentive-compatible mechanism.

The root of these problems lies in a technical issue known as budget-balancing. Under any incentive-compatible mechanism, a system of taxes and incentive payments is used to elicit truthful messages from the members of the group; however, under an incentive-compatible mechanism, these taxes and payments can never result in exactly the right amount of money necessary to pay for the public goods. The central official will inevitably be left with a 'residual' profit or loss after the incentive-compatible mechanism has done its job.¹

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¹ Mark Walker (1981) has demonstrated that some mechanisms create Nash equilibria without dominant strategies in which everyone tells the truth and there is no residual. In these mechanisms, people will choose to tell the truth only if everyone else does. We regard this as an affirmation of the inevitability of politics. As Walker demonstrated in his earlier paper (1980), the absence of truth-dominance makes these mechanisms vulnerable to strategic manipulation: 'One cannot devise a mechanism, in other words, that will always provide for Pareto optimal allocation and financing of public goods, and that will at the same time be immune to strategic manipulation' (1980: 1522). Walker also mentions that: 'Since it appears that there may not be any mechanism which is successful in every respect, we will need a theory in which we can deal analytically with the trade-offs among various kinds of failure' (1980: 1535). In this paper, we examine the trade-offs necessary when we demand truth-dominance.
This has been regarded as simply a technical problem by most economists (Tideman, 1977, 1985). The purpose of this paper is to argue that the technical problem of budget-imbalancing in fact obscures the nature of the political conflict that would inevitably erupt if an incentive-compatible mechanism were ever implemented. The inevitable residual generated by efficient incentive schemes must become the object of political conflict. Indeed, the size of the residual can be enlarged by a perversion of the incentive-compatible mechanism. This creates a stake in inefficiency; whoever has an ownership right to the residual will have an incentive to lie in such a way that the efficiency of the system is thrown off. There is a built-in tension between profit-maximization by the central decision-maker and efficiency for the community as a whole.

Thus, if the founder of a Utopian community intends to use an ‘incentive-compatible mechanism’ in its resource allocation decision, any rational citizen should mistrust such a stated intention, knowing that whoever implements such a mechanism would have an opportunity for self-enrichment at the expense of social efficiency.

Practically, the problem generated by incentive-compatible mechanisms is a classic political problem: ‘who shall guard the guardian?’. Whether the neutral auctioneer is envisioned as a benign dictator, political leader or bureaucrat, the necessary assumption for the incentive-compatible mechanism is not just neutrality but altruism. Without altruism, the central decision-maker who implements the incentive-compatible mechanism will have a stake (and presumably an opportunity) for self-serving perversion of the system. The political problem of devising a means of keeping this power under control must be resolved before the benefits of incentive-compatible mechanisms can be realized. Needless to say, this fundamental political problem has not been addressed, much less resolved, by the economic literature on incentive-compatible mechanisms.

Philosophically, we believe that the results in this paper confirm the inevitability of politics – with all its misrepresentation, conflict of interest and potential for inefficiency. The literature on incentive compatibility has papered over these problems by implicitly assuming the existence of an altruistic central decision-maker, and by neglecting to confront the full implications of the budget-imbalancing problem.

**Incentive-Compatible Scheme No. 1**

The running example in this paper will assume a group of citizens facing a consumption decision about a public good. (It could just as easily be a team of interdependent producers facing production decision about a jointly produced team good; we would simply replace ‘taxes’ with ‘incentive payments’ and ‘benefit messages’ with ‘cost messages’.)
Imagine that there are two citizens, Anne and Bill, and a central decision-maker who are all trying to decide whether or not to undertake production of a public good (say, a dam) that will cost $100. The central decision-maker is assumed to have no valuation of the public good. If the good is produced for either citizen, it will be available to both. The fact that neither Anne nor Bill has bought the item on their own suggests that they do not find it worth $100 individually. However, it could be that each values it at $60, which would mean that it would be efficient for the central decision-maker to obtain the public good for them. Let us assume that the central decision-maker announces that she will build the dam if the sum of the valuation messages from Anne and Bill is greater than $100.

If the central decision-maker asks Anne what she thinks the dam is worth, she is likely to respond by asking how the good is to be paid for. If she is to be expected to pay $50 (or any fixed amount) for the dam, then she will in general have no reason to tell the truth about her valuation of it. If her valuation is greater than her assigned tax share, then she will want the dam to be produced, and she will have every reason to exaggerate her valuation of it in order to guarantee that it is built. If her valuation is less than her assigned tax share, then she will want the dam stopped, and will understate the benefits she would experience. The phenomenon of supporters and opponents greatly exaggerating the benefits and costs of pork barrel projects is of course familiar to observers of Congress.

Suppose that Anne's tax share is not a fixed amount, but is proportional to her stated benefit as a percent of the total announced benefit. If she says the dam is worth $60 and Bill says it is worth $90 to him, then she will pay 40 percent of the cost, or $40. With this tax rule, she would have every reason to understate her valuation, in hopes that she can escape paying her full share of the cost of the dam. This is of course a version of 'free-riding', and would result in inefficient decisions being made.

An incentive-compatible mechanism would allocate the costs differently. We will begin with a scheme which we call the Incentive-Compatible Scheme No. 1, which is adapted from Groves and Loeb (1975, 1979) by way of Radner (1987), see Table 1. The central decision-maker announces that the project will be undertaken only if the sum of Anne’s and Bill’s stated benefits is greater than $100. We shall denote this decision rule as: $$M_a + M_b > 100.$$ This can be rewritten as:

$$M_a > 100 - M_b.$$ 

Suppose the central decision-maker were to stipulate that Anne’s tax share would be equal to $$100 - M_b.$$ Then Anne would realize that the project would be adopted if and only if she were to report her benefits to be greater than $$100 - M_b.$$ But since $$(100 - M_b)$$ is equal to her tax share if adopted, then Anne would be able to get the project approved whenever
Table 1. Proposed Dam Costing $100: Incentive-Compatible Tax System No. 1

<table>
<thead>
<tr>
<th>Citizen</th>
<th>Alleged Benefit</th>
<th>Tax to Citizens if Dam is Built</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne</td>
<td>$M_a$</td>
<td>$100 - M_b$</td>
</tr>
<tr>
<td>Bill</td>
<td>$M_b$</td>
<td>$100 - M_a$</td>
</tr>
<tr>
<td>Total</td>
<td>$M_a + M_b$</td>
<td>$200 - (M_a + M_b)$</td>
</tr>
</tbody>
</table>

Source: Adapted from Radner (1987, Table 1.1: 20).

her net benefit is positive, simply by reporting the truth. Similarly, she could get the project killed whenever her benefits are less than her tax share, simply by reporting the truth. Incentive compatibility links self-interested disclosure of hidden information and efficient decision-making.

For example, suppose Anne’s true benefits were $30. By lying about these benefits, she can hurt only herself, no matter how large or small Bill’s valuation message is. Suppose Bill’s valuation message is equal to $80. Then Anne’s tax share would be $20 [$ = $100 - $80], and she would want the dam built because her true valuation is greater than her tax. Exaggerating her valuation message would not make the project more likely or her taxes smaller, but understating her valuation (by reporting less than $20) would guarantee that the dam would be killed and would hurt her. Similarly, if Bill’s message were $40, then her tax share would be $60. She would want to kill the project, because the tax share would be greater than her $30 valuation. Understating her valuation message would not make the project any less likely than telling the truth, but exaggerating (by reporting more than $60 costs) would result in the adoption of a project harmful to her. Thus, no matter whether Bill reports a high or low benefit message, Ann’s self-interest can only be hurt by misrepresenting her own benefits.

Note that this incentive to tell the truth remains no matter whether Bill is honest or not, because the center official’s decision and Anne’s self-interest depend on Bill’s report in exactly the same way. But if Bill’s tax share is set equal to $100 less Anne’s valuation message, then Bill will also have an incentive to tell the truth.

Thus, the central decision-maker can be confident that the messages she receives are in fact accurate depictions of Anne’s and Bill’s valuations of the dam. The only problem is that Incentive Compatible System No. 1 also guarantees that the central decision-maker will receive insufficient funds to pay for the dam.

For instance, if Anne’s true (and reported) valuation of the dam is $30 and Bill’s is $95, then Anne’s allocation of the cost will be $100 - $95 = $5 and Bill’s will be $100 - $30 = $70. Their costs become the center’s revenues, and the central office will have only $75 worth of revenue to pay for a dam that costs $100.
In general, the aggregate taxes from Anne and Bill will equal:

$$100 - M_a + 100 - M_b = 200 - (M_a + M_b).$$

But this sum is greater than the cost of the dam only when the project is inefficient (i.e. whenever $M_a + M_b < 100$). Whenever the project is efficient, the center must collect less revenue than the cost of the project. In fact, the greater the valuation of the public good, the more efficient the project, and the greater will be the center's deficit. The only time that the center could have a surplus is when the citizens report benefits that are less than the project's costs; but then it is committed to not building the dam. The center must run a deficit if the project is efficient.

**Impossibility Result: Hidden Information and Budget-Balancing**

Is it possible to think of an incentive-compatible mechanism that also balances the budget? There are a large number of variations on incentive-compatible mechanisms. However, research on incentive-compatibility has demonstrated that there is no efficient, incentive-compatible mechanism that is also budget-balancing (Groves, 1985; Hurwicz, 1979; Walker, 1978). Every efficient incentive-compatible scheme must generate a residual. Budget-balancing is inconsistent with the creation of incentives for efficient Nash equilibria. Groves writes (speaking of the problem in the context of a firm):

Either the full cost feature [budget-balancing], incentive compatibility, or optimality of decisions must be sacrificed. If making optimal decisions is the main task of the procedure and managers are trusted to follow the incentives defined by the firm, then it appears that full cost allocation schemes are inappropriate for these purposes, regardless of how useful they might be for purposes other than making optimal decisions (1985: 96).

While this might seem to be simply an accounting problem for firms and governments, it is in fact a very real economic problem. Every firm exists by allocating real resources in the form of capital investments, executive salary and compensation, and payroll, among divisions. Each of the divisions is expected to provide a return on that investment – in other words provide a profit. At the same time, the firm's center has to be run at a profit as well. That is, it does no good at all if the center hands out more in the way of resources to the divisions than it receives in return. Similarly, while deficit financing is a familiar phenomenon in government, we also know it is not costless. The nation may pay a cost in inflation or loss of economic control to foreign bond-holders.

The inevitability of a residual raises the central problem of this paper. The center has a stake in making sure that that residual is not negative.
The central office of a multidivisional firm certainly must guarantee that it does not invest more in the divisions than it generates in revenue from their efforts. Similarly, government officials want to make sure that they raise at least as much in taxes as the cost of the public works they provide. Since their own salaries presumably come out of the difference between the tax revenues and the true production costs of the projects they supply, they need to guarantee that losses are minimal, or better yet, that the residual is positive.

A Stake in Inefficiency

Consequently, the central office would have every incentive to 'cheat' under Incentive Compatible Scheme No. 1. Cheating could come in the form of a misrepresentation of the costs of the public works project being considered. With this misrepresentation would come an altered decision rule and larger tax payments from the citizens.

The center, for example, could simply announce that the dam (which would in truth cost $100) would instead cost $120. This would be a subject about which the individual citizens would be rationally ignorant, since accurate auditing of the true cost of public projects is in itself a public good and rational citizens would free-ride on each other rather than undertake such a task. The leaders of most organizations could be assumed to have a monopoly on this information, and thus have leeway to misrepresent public good cost information with little hope of being discovered.

If the dam were announced by the center to cost $120, rather than $100, then the decision rule would be altered: the dam will be constructed if and only if:

$$M_a + M_b > 120.$$

With this mis-stated revenue figure and altered decision rule, some efficient projects (with cost totals between $100 and $120) would also be killed. But for combinations of cost messages greater than $120, the central office would run less of a deficit, or even a profit. For instance, if Anne's valuation were $30 and Bill's $95, then Anne's tax share would be $120 - $95 = $25 and Bill's tax share would be $120 - $30 = $90. Taxes would total $115 instead of the $75 that a truthful revelation of dam costs would yield. Exaggerating the costs by $20 yields the center a profit of $15 instead of a loss of $25.

Is there any reason for the central office to stop with a $20 exaggeration of the costs of the project? Obviously not. Assuming that the central office is willing to trade off the probability of killing off somewhat efficient (but deficit-generating) projects in exchange for smaller deficits or larger profits
on the projects it does approve, the central official has an 'optimal exaggeration' of project costs that depends on her subjective estimation of the distribution of valuation messages. If, for instance, she believes that any summed valuation between $0 and $200 is equally likely, then her expected profits are maximized by reporting the costs of the $100 project to be $166.67 (Hammond and Miller, 1990).

Interestingly enough, these exaggerations of the project cost do not spoil the incentive compatibility of the decision rule. Suppose Anne knows that her tax share is $120 – B_b, and she knows that the decision rule is to accept the project if and only if the sum of the reported benefit messages is greater than $120. She would still have every incentive to report the truth. Thus, the center's exaggeration of costs results in a different mechanism that still supplies accurate information to the center but sacrifices efficiency in organizational decision-making to the self-interest of the center.

In the simple version of the incentive-compatible mechanism, then, efficiency and compatibility are guaranteed for the citizens only through the use of an incentive scheme that gives the government an incentive to lie. Self-interest drives the government to misrepresent its own hidden information at the cost of efficiency in decision-making. The incentive-compatible mechanism creates an incentive for truth-telling by citizens but creates an incentive for lying and inefficiency by the government.

If a Utopian community were being created on a desert island, the founders, reading the literature on incentive-compatible mechanisms, might believe that such a mechanism would be the means for efficiently providing public goods. However, scheme No. 1 would either guarantee bankruptcy for the community or be the means by which the center could cheat its members at the expense of efficient public-good decision-making. Is there any mechanism that can solve the problem of hidden information without bankrupting the center and without providing an incentive for misrepresentation and inefficiency?

**Incentive-Compatible Scheme No. 2: Guaranteeing a Profit for the Center**

The literature on incentive compatibility has almost uniformly assumed that the central official who imposes the incentive scheme and collates the resulting messages is in fact an altruist. This assumption, which differs so markedly from the rest of economics, is so engrained in the literature on incentive compatibility that it is rarely even mentioned explicitly. One time in which it was mentioned explicitly was in Green and Laffont (1979: vii):
We consider a central decision-maker whose action is selected from among a given set of alternatives. He is benevolent and, ideally, if the full description of the economic system were known to him, he would select according to some rule from among the Pareto optima.

This assumption is completely untenable in the case of the decentralized business firm – if nothing else, pressures from the capital market would force the entrepreneur to abandon Scheme No. 1 because more money would be paid out to subordinates than would be generated by the efficient actions and accurate information that these payments would elicit. But the use of incentive-compatibility mechanisms was first suggested by Groves (1973) for just these profit-maximizing firms. Clearly, such a firm cannot be asked to absorb losses just so that the potential profits of efficient decision-making are all paid out to division managers. The profit-maximizing firm would have no interest in solving the problem of hidden information if the solution required such deficit-generating bonuses to the division managers.

Similarly, a central governmental official would have reason to maximize profits as well. Even if the government leaders do not formally have a property right to the residual generated by a government, a surplus can be used to run the government more easily to justify a generous stipend or to build grander public residences, offices and monuments. It is difficult to imagine a realistic scenario in which self-interested government officials do not have a stake in the tax revenues generated, net of public-good costs.

One answer proposed by Groves and Loeb (1975) is an altered incentive-compatible mechanism that is guaranteed to result in efficient decision-making and to produce a profit for the central office. The incentive-compatible mechanism cannot be made to be budget-balancing, but it can at least make the inevitable residual positive. One such mechanism is illustrated below.

In order to guarantee that the center will not run a deficit, the incentive system must raise at least as much tax revenue as the project costs. For instance, we will assume minimum tax payments of $20 for Anne and $80 for Bill. How these minimum tax payments are determined is outside the model, and would presumably be the subject of a great deal of political conflict within the government. But any arbitrary division of the cost of the project into minimum tax payments will guarantee a positive residual for the government.

The decision rule, as before, will be that the project will be adopted if it is efficient:

$$M_a + M_b > 100.$$  

If the project is adopted, each citizen's tax will be defined as $100 - M_j$ (where $M_j$ is the other citizen's valuation message) – unless that amount is less than the minimum tax, in which case the minimum tax is imposed.
Table 2. Proposed Dam Costing $100: Incentive-Compatible Tax System No. 2 (guaranteeing a profit for the center)

<table>
<thead>
<tr>
<th>Citizen</th>
<th>Alleged Benefit</th>
<th>Tax to Citizens if Dams is Built (the larger of)</th>
<th>Tax to Citizens if Dam is Not Built (the larger of)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne</td>
<td>$M_a$</td>
<td>($100 - M_b$) or $20$</td>
<td>($M_b - 80$) or $0$</td>
</tr>
<tr>
<td>Bill</td>
<td>$M_b$</td>
<td>($100 - M_a$) or $80$</td>
<td>($M_a - 20$) or $0$</td>
</tr>
<tr>
<td>Total</td>
<td>$M_a + M_b$</td>
<td>$100+$</td>
<td>$0+$</td>
</tr>
</tbody>
</table>

*Source: Adapted from Radner (1987, Table 1.1: 20).*

This minimum tax rule could very easily destroy the incentive compatibility of the mechanism. For instance, Bill, facing a minimum tax of $80 if the project is adopted, will have an incentive to understate his valuation of the dam if it is less than $80. If he values the dam at $75 and Anne values the dam at $30, then Anne's message will result in a tax for Bill of, not $70, but $80. Bill could kill the dam by sending in a false valuation message, making himself better off. This would result in an inefficient decision not to build the dam. The minimum tax creates a perverse bias in favor of no dam on the part of the citizens.

In order to restore an incentive for truthfulness on the part of the citizens, the necessary solution is to charge each citizen a tax even if the project is *not adopted*, under just those conditions in which an understated valuation would kill an efficient project (see Table 2).

Anne's payment if the project is *not* adopted is then defined to be the greater of $0$ or $M_b - 80$. Bill's tax payment if the project is not adopted is the greater of $0$ or $M_a - 20$. If $M_a$ is greater than $20$, then Bill will have to pay the minimum tax if the project is adopted, since $100 - M_a$ will be less than his minimum tax of $80$; but if $M_a$ is greater than $20$, he will also have to pay a tax even if the project is not adopted. If Bill tries to avoid the minimum tax of $80$ by understating his true valuation, he will only end up having to pay a tax for depriving the society of the dam. This acts to restore the incentive to tell the truth.

The same is true for Anne. Suppose Anne's true valuation is $15$ and Bill's is $90$. The project is efficient and should be built. However, her tax if the project is built is going to equal her minimum tax of $20$, since $100 - M_b = 10$. She will end up with a negative net benefit ($-5$) if she tells the truth. She could get the project killed by submitting $M_a < 10$; but in so doing she would have to pay $90 - 80 = 10$. Her loss would be smaller telling the truth than lying. The modified incentive-compatibility mechanism maintains every reason to tell the truth, even though her minimum tax cost will sometimes be greater than the benefit.

Thus, with Scheme No. 2, incentive compatibility is maintained and the
center is guaranteed that it will not have to run a deficit. But this does not mean that it is a perfect scheme. Scheme No. 2 can guarantee a profit for the center only by imposing losses on the subordinates – the system is not individually rational for the citizens. The citizens have to pay taxes for projects that are not adopted, and either Anne or Bill could easily run a deficit even if the project is efficient and is adopted. A minimum tax is necessary to guarantee that the center runs a profit, but any possible minimum payment table will result in violations of individual rationality for citizens.

If a Utopian community were being created, an incentive-compatible scheme like No. 2 might well be proposed as a viable way of providing for public goods without bankrupting the center. However, it must not be imagined that Scheme No. 2 is a viable, non-political solution to public-good problems. Implementation of such a scheme would neither eliminate the negative aspects of politics, nor would it get many volunteers. The allocation of the minimum taxes would be an all-important redistributational decision of pure politics – complete conflict of interest with no efficiency basis for guiding the decision. Once decided, citizens would still prefer not to participate in such a Utopian scheme because they could look forward to individual bankruptcy in order to keep the center solvent. And, as the next section reveals, Scheme No. 2 still has not eliminated the incentive for the leaders to cheat the members.

**Profit-Maximization Under Incentive-Compatible Scheme No. 2**

Even when the center is guaranteed a profit, it will still have every incentive to manipulate and distort the incentive-compatible mechanism. In short, the center will still have incentives to misreport the costs of the project and to make inefficient project decisions, increasing center profit at the expense of overall efficiency.

For instance, although the center is guaranteed a profit, it could always increase those profits by misreporting the costs of the dam as $120 instead of $100. This would require a set of minimum tax payments totalling $120 – for instance $35 for Anne and $85 for Bill. And to maintain the incentive for telling the truth under this scheme, the center would impose a tax if the dam is not approved of $M_b - $85 for Anne and $M_a - $35 for Bill, whenever those values are positive (see Table 3).

The inefficiency in such a system is clear – those marginally efficient projects worth between $100 and $120 would not be approved. For all projects that are approved, however, the center would get a larger profit. And the center would also generate profits for some projects that are not adopted, by means of the truth-maintaining taxes.
Table 3. Proposed Dam Costing $100: Whose Announced Costs Are $120 Incentive-Compatible Tax System No. 2

<table>
<thead>
<tr>
<th>Citizen</th>
<th>Alleged Benefit</th>
<th>Tax to Citizens if Dam is Built (the larger of)</th>
<th>Tax to Citizens if Dam is Not Built (the larger of)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne</td>
<td>$M_a$</td>
<td>($120 - M_b$) or $35$</td>
<td>($M_b - $85$) or $0$</td>
</tr>
<tr>
<td>Bill</td>
<td>$M_b$</td>
<td>($120 - M_a$) or $85$</td>
<td>($M_a - $35$) or $0$</td>
</tr>
<tr>
<td>Total</td>
<td>$M_a + M_b$</td>
<td>$120+$</td>
<td>$0+$</td>
</tr>
</tbody>
</table>

For instance, suppose Anne's true valuation of the dam is $30 and Bill's is $95. Then the truthful reports from Anne and Bill would result (with costs exaggerated to $120) in the minimum tax payments of $85 from Bill and $35 from Anne, and a $20 surplus for the center. The center would be rewarded for lying about the costs of the dam.

It is important to remember that the motivation for Scheme No. 2 was the recognition that the center has no reason to impose an efficient, incentive-compatible scheme (such as Scheme No. 1) that guarantees itself a loss. But profit-maximization would subvert Scheme No. 2 as well since even greater (non-negative) profits can be guaranteed at the cost of organizational efficiency.

The irony is clear: the academic search for a mechanism that would allow the center to have the information it needs to make efficient decisions has succeeded in finding these mechanisms. However, the implementation of this mechanism would require the center itself to withstand a constant temptation to lie and make inefficient decisions. Indeed, if any community were to announce its intentions to implement fairly and neutrally a Groves–Loeb incentive-compatible mechanism as a way of making public-goods decisions, then the citizens would have to regard that as a non-credible commitment.

The Necessity of Perverse Incentives for the Center

So far, our chain of reasoning was initiated by the Groves theorem establishing that incentive-compatible mechanisms must create a residual, followed by an inquiry into the implications of residual-maximization by the center. The implications seem to be that a resolution of the problem of hidden information is impossible given both profit-maximization by the center and individual rationality by employees.

In other words, in the range of incentive systems available to the leadership of an organization, there exist incentive systems which can forestall self-interested misrepresentation by the general membership and allow
Pareto optimal group decisions. However, leaders never have an incentive to choose these Pareto optimal, incentive-compatible mechanisms. *The obstacle to efficiency in public-good provision is the self-interest of leaders who can generate larger net revenues with other schemes.*

To see this, we can assume the opposite and arrive at a contradiction. Let us assume that there are $N + 1$ members of a society, operating under an incentive-compatible mechanism. The community operates under a constitution that requires that public-goods decisions be made by Scheme No. 2. The first member is the leader, who has as a strategy space a signal about the cost of a public good. Each of the other $N$ members has a strategy space consisting of possible signals about their own valuation of a public good. The $N$ members each receive a tax that is given by the cost message of the leader less the sum of the other $N - 1$ valuation messages. The leader's pay-off is some proportion of the revenues generated, net of the public-good costs.

The $N$ members of the organization, because it is an incentive-compatible mechanism, have an incentive to tell the truth about their valuation of the public good. Can it be that the leader also has an incentive to tell the truth about the cost of the public good? If so, then collectively the $N + 1$ members will be in a Pareto optimal Nash equilibrium. It will also be budget-balancing because the leader absorbs the residual. But this contradicts the Groves theorem mentioned at the beginning of the paper, which says that budget-balancing, Pareto optimality and Nash equilibrium are mutually inconsistent. Therefore, as long as the leader has any stake in the residual generated by the acts of the members, then she *must* have an incentive to misreveal the costs of the public good. Profit-maximization by the leader is inconsistent with an efficient Nash equilibrium for the polity as a whole.

*‘Constraining the King’: Profit-Maximization vs. Efficiency*

The primary theme of this paper is to argue that budget-breaking is much more than a technical problem. Rather, the correct interpretation of the budget-balancing constraint on incentive systems is that there is a fundamental and underlying tension between the self-interest of the residual claimant, on the one hand, and institutional efficiency, on the other. The profit-maximizing center can never afford to spend the money necessary to achieve global efficiency.

Because they violate budget-balancing, efficient incentive schemes provide a temptation for those who own shares in the residual profits. In short, efficient incentives for subordinates require self-denial by superiors.

Every society needs a system to provide public goods, and leaders to implement the system; but every society has also experienced a fundamental
political problem caused by a conflict of interest between what is good for the leaders and what is good for the overall society. The correct interpretation of the literature on incentive compatibility and its problems with budget-balancing is that it provides a way of understanding the necessity of political conflict and constitutional struggle, not a way of circumventing politics.

Back to the Real World

Admittedly, the analysis of incentive-compatible mechanisms in this paper relies on a ‘toy’ problem, with one public good and a unitary ‘center’. In the toy problem, it was the assumption that the unitary center has an interest in the inevitable residual generated by an incentive-compatible mechanism that caused the logical inconsistency. But perhaps, in the real world, there is some way around this assumption.

A Small Efficient Residual

One way out of the problem is to argue that the size of the residual gets diminishingly small when the center makes efficient decisions for a large population’s public-goods decisions, as pointed out by Tideman and Tullock (1976: 1155–1156). That is, as administered by an ideal ‘center’, the residual profits are a very small efficiency loss in an otherwise efficient mechanism.

This is an interesting theoretical fact; but the size of the ‘efficient’ residual is not the point of our analysis. The point is that a self-interested ‘center’ can make the size of the residual be very large indeed if there is a willingness to sacrifice economic efficiency. That is in fact the point of the isomorphism with North’s observations from economic history. Absolute monarchs could make decisions that generate very little incentive away from efficiency if they would just choose to do so. The point is that they could do much better by making decisions that create large distortions. The size of the correctly administered residual has nothing to do with the perverse incentives facing self-interested officials.

Plural Center

We can imagine that the ‘center’, which is asked to implement an incentive-compatible tax scheme for public goods, is not a unitary actor, but a democratic legislature, like the parliament. Then, perhaps, each individual legislator would have such a small stake in the residual that they would individually ignore the residual, making collective decisions only in the
manner of the idealized economic implementor of incentive-compatible mechanisms.

This seems to us to clearly be no answer at all. By making sufficiently self-interested decisions, the legislature can collectively make the residual large enough that any one member's share would be sufficient to motivate a normal economic actor.

Salaried Plural Center

Let us imagine that legislature is paid a salary that does not vary with the size of the residual generated by its actions. This is clearly the motivation for professionalized state legislatures proposed by the modern successors to the American Progressive movement.

A salaried legislature might be very willing to implement an incentive-compatible mechanism in a neutral, efficient manner if its members could indeed be completely insulated from the benefits of the residual generated by the state's actions. However, in denying the legislature a stake in the residual, there will clearly be other economic interests who may have a stake in it; for instance, the government's contractor for the dam would be pleased if the $100 dam could generate $120 worth of tax revenue. The contractor could offer campaign contributions to individual legislators' re-election campaigns; this would be motivating for the legislators even if they anticipated economic rewards only of the salaried legislator, if the alternative were unemployment (or any smaller salary available out of the legislature). In return, the contractor would expect the legislator to support non-competitive bidding, or other arrangements that would guarantee the contractor a stake in the difference between total tax payments and the minimal costs of the public good.

Professional Bureaucrat

The possibility of a corrupt legislature could be avoided by constitutional procedures that prohibit the salaried legislature from appointing a contractor, soliciting bids, making budgetary decisions, or in any other way implementing the public-good decisions of the incentive-compatible mechanism. The sole responsibility of the legislature, for example, could be the appointment of a professionalized bureaucrat who would be salaried and responsible for supervising and implementing the incentive-compatible mechanism in keeping with the original intentions of the economic inventors of the notion.

Clearly, such a system might work. The city manager profession has an impressive record of disinterested, selfless bureaucrats who reportedly make day-to-day public-good decisions for local governments in such a way as to maximize the economic well-being of their inhabitants. In these cities,
members of the city council are not worth bribing because they do not control the decisions that influence the distribution of the residual. City managers, to the extent that they live up to their reputations, cannot be bribed (Schiesel, 1977).

However, to the extent that such a system works, it is clearly because city managers have been selected and/or trained not to be economic actors. It is not the case that they have no incentive or opportunity to be bribed.

The logical limitation described in this paper was generated by consistently assuming economically interested actors. But if we assume the existence of economically disinterested actors who take the role of city managers, it is not clear that there is a problem to be solved in the first place. We have simply to find out how such disinterested altruistic actors are created, and then reproduce them throughout the political system.

**Conclusion**

The impossibility of reconciling budget-balancing with efficiency and incentive-compatibility (Hurwicz, 1979) is more than a minor technical flaw. The purpose of this paper is to show that the impossibility result reveals something fundamental about social systems: no smoothly-running, apolitical system of self-interested actors can supply an efficient level of public goods. When we survey the chaos, conflict and inefficiency of politics, we can at least console ourselves that we have not overlooked some logically possible apolitical utopia. The incompatibility of budget-balancing with efficient Nash equilibria means that there is no incentive system that will lead to a perfect coincidence of self-interest with social well-being. Where public goods are concerned, the Invisible Hand is never as perfect as the proponents of incentive-compatible mechanisms would have us believe.

We view this paper as providing an important political justification for the literature on 'credible commitment'. A political leader of an island nation who promised to make public-good decisions by means of an incentive-compatible mechanism would not be believed by rational citizens. Such citizens would face the same fundamental political problems that the rest of us face: how could we constrain the political leader from giving in to incentives for abuse and inefficiency?

If it were possible to combine Pareto optimality, Nash equilibrium and budget-balancing in a single perfect incentive-compatible mechanism, then there would be no problem of credible commitment, and perhaps, no politics. Instead of the chaos and misrepresentation of politics, we could simply impose the perfect incentive scheme and no-one – members or leaders – would ever have an incentive to depart from it. If some society along the way had discovered such an (impossibly) perfect system, then
politics would have come to an end. The polity would have become a smoothly running machine, endlessly making optimal decisions about all manner of public goods.

Such a scenario is impossible because of the logical impossibility of combining efficiency, Nash equilibrium and budget-balancing. As a result, politics must be seen as general and inevitable. Every society must struggle with the same dilemmas of constraining its rulers; the constitutional problem is paramount. It is only as rulers are partially and imperfectly constrained by constitutional limitations and social norms that the benefits of market-generated economic growth can be discovered.

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