Earmarking: Bundling to Signal Quality

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Abstract

Earmarking is a form of bundling in which government adopts a tax policy while specifying the uses of the revenue. This paper explores how bundling can enhance efficiency: it can inform the public of the quality of a program proposed, or of the quality of the agency that will be responsible for designing and implementing the program.We show that policies that appear inefficient in isolation may become justified when bundled.

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1 Introduction

Governments sometimes bundle policies in ways that may appear inefficient. One important example is earmarking–at the time government imposes a tax, it specifies the uses of the revenue. Such bundling has two disadvantages. First, it limits the flexibility of government; government for example, may find itself with money to spare for building rural roads at a time when it cannot afford to improve rail infrastructure. Another example is the imposition of a road toll where the money must be spent on public transport by the local transport agency even if these projects fail a cost-benefit test. The second disadvantage is that bundling can make it difficult to monitor an agent. For example, Dewatripont, Jewitt, and Tirole (1999) show that accountability and effort could decrease when multiple missions are allocated to one agency.

In the face of such inefficiency why is bundling common? This paper proposes an explanation. Consider a principal (say the voters, Congress, or a prime minister) who must decide whether to approve a policy proposed by an agent (say a governmental agency). Adopting the proposed policy may be more attractive the more competent the agency or official in charge, but the principal is unsure about the agent's competence, and desires to learn about it. Suppose the principal can evaluate the quality of a policy in one area (called M, for Monitored), but not in another (called N, for Not monitored), and that the agency's competence across the two areas is correlated. Then the principal may approve policy N only if it is bundled with policy M. This bundling allows the principal to better estimate the quality of policy N than when N is proposed alone. The rest of the paper explores this idea. For concreteness, we shall speak of earmarking a toll or tax revenue for a transportation project.

A large literature of course considers bundling of policies, and the practice of logrolling to build coalitions has long been recognized. The relevant literature is discussed below. But we note here two puzzles left unexplained by that literature. One is the problem of commitment—why does a future government abide by earmarking set by a previous government? Second, why does earmarking often take the form of spending tax revenue on programs that closely relate to the source of the revenue?

1.1 Examples of earmarking

Explanations must also consider when earmarking, or more generally bundling, occurs. Consider the area of transportation, where data on earmarking are more readily available than in other areas. The revenue raised from the congestion toll in London is used to improve public transportation. Revenues from cordon tolls in Norway are dedicated to improving transportation. In Germany, the revenues from the toll on trucks is supposed to finance transportation investments. And in the United States, an airport is allowed to levy a passenger facility charge to finance airport-related improvements.

In contrast, despite the almost universal use of the income tax to collect general revenues, income taxes are rarely earmarked to fund public transport systems. An important exception is the "Versement Transport" in France. An earlier case of earmarking is Vienna, Austria, which in 1970 was authorized to use the revenue from an employer tax to finance the construction of its subway. Such a charge has not been levied in other Austrian cities. A similar employee tax was introduced in Portland and Eugene, Oregon in the United States from 1970, but not elsewhere in the country.[1]

Perhaps the rarity is not surprising, given the disadvantages of earmarking. These include (i) hampering effective budgetary control; (ii) misallocating funds, giving excess revenues to some functions while others are under supported; (iii) making the revenue structure inflexible; (iv) infringing on the policy-making powers of state executives and legislatures,[2] (v) making it more difficult to monitor a governmental agency.

2 Literature

A fine survey of the theoretical and empirical literature on earmarking is Bird and Jun (2005). They make the important distinction between symbolic and substantive earmarking. Substantive earmarking has the earmarked revenues flow into a special fund, constituting the sole (or at least the incremental) source of funding for a particular spending program. Symbolic earmarking, though nominally tying the revenue source to a spending program, effectively makes no such link. For example, tolls on a highway may merely substitute for general fund revenues used to maintain highways. The model we give

[1] The information in this paragraph is based on Faber (2000).

[2] This list comes from Deran (1965).

below can explain both types of earmarking.

2.1 Demand revelation

Much of the literature on earmarking focuses on substantive earmarking. Thus, one rationale for earmarking is to reveal taxpayer preferences for the public service. (The seminal work is Buchanan (1963).) Earmarked revenues, however, signal demand only if the goods are excludable, so that a citizen who pays lower fees or taxes knows he will receive less of the good. That connection fails to hold for many goods provided by government.

A recent, game-theoretic, analysis of demand revelation, which considers monitoring by taxpayers, is given by Dhillon and Perroni (2001). In their model a spending agency has private information about costs it incurs, and citizens can, at a cost, monitor the agency. A citizen's benefit from monitoring is the reduction in the agency's costs, which reduces the taxes he pays. They show that when different individuals monitor different agencies, some of the free-rider problems in monitoring can be overcome.

Another paper which sees substantive earmarking as facilitating monitoring is Bos (2000). He considers a parliament which monitors a taxing agency and a spending agency, with the agencies having private information. Earmarking is part of an incentive contract which induces the agencies to reveal their private information.

2.2 Electoral considerations

The papers just cited consider a social planner, with earmarking having no redistributive consequences. But when people differ in their preferences, earmarking that constrains future policy can increase political support for a policy. For example, an earmarked excise tax on chemical stocks levied to finance the clean-up of toxic chemicals can appeal to jurisdictions already suffering from pollution, and to jurisdictions which anticipate a need for environmental clean up (Teja (1988)). Focusing on a different political problem, Anesi (2006) shows how a political party can use earmarking to remove an issue from an election, or how avoidance of earmarking can keep an issue alive, to the benefit of an incumbent with a popular position on that issue. (A similar idea, though not discussing earmarking, is found in Glazer and Lohmann (1999).) Brett and Keen (2000) consider earmarking as a way for a good politician to reveal his type by promising not to waste tax revenue even if this earmarking has an efficiency cost: a bad politician who wants to waste the money will never commit to earmarking.

2.3 Compensation

Earmarking may sometimes arise because it offers appropriate compensation. Direct compensation can be unpopular: compensated losers feel that their votes are being bought (the "bribe effect") to allow the wealthy to benefit from the goods which are thereby made available (see Frey and Oberholzer-Gee (1996); Kunreuther and Easterling (1996)). To give a specific example, Kunreuther and Easterling (1996) consider attitudes by respondents towards a nuclear waste facility. Direct payments to individuals harmed (for example, by tax rebates) were regarded as the least important measure; providing "large grants for community facilities" or "a high-tech project with new jobs" were deemed more effective than were direct payments. The importance of remaining in the same dimension is borne out in surveys that ask road users how to allocate the revenues from road pricing schemes. Increases in road investments are by far the most popular measure (Verhoef et al., (1997)). In the public view, reduced accessibility to roads ought to be compensated with improvements of the road network. In contrast, the public views a reduction in general taxes as a bad allocation of road revenues. Thus, a program that harms some people may be politically more palatable if coupled with a program that benefits those harmed, and we would observe a form of bundling.

3 Span of control

Earmarking often has the same agency which collects some revenue being responsible for using it on some program. A more general phenomenon is bundling—one agency is responsible for several programs or projects. Which projects should be assigned to an agency relates to the literature on the span of control within a bureaucracy.

Filson (2000) considers removal of managers found to be of low quality, and how much resources to allocate to managers of different estimated quality. Our model differs from his in two main ways. First, he does not let an increased span of control improve the information available about an agent's quality. Second, he focuses on retention or replacement of managers rather than on which projects to adopt.

A different approach, which we ignore, examines how the span of control affects a manager's incentives.[3]

Several papers study how the internal organization of firms can affect information about the ability of agents. Berkovitch, Israel, and Tolkowsky (1999) study when economic units should be structured as stand-alone firms versus an integrated firm (conglomerate): an integrated firm better controls agency problems through yardstick competition between managers for project acceptance, but reduces the ability to receive division-specific project information from the market. On yardstick competition (how performance by one agent reveals information about the ability of another agent), see Besley and Case (1995). Related arguments about how the success of policy reveals information about an agent's competence are found in Rogoff and Sibert (1988), in Rogoff (1990), and in Glazer and Hassin (1988)). And, of course, our approach relates to signaling, in which an agent engages in a costly action to reveal his ability.

Meyers (1994) analyzes optimal task assignment when a firm needs to learn the abilities of employees, and when production requires the participation of a senior worker and a junior worker. If each of the two juniors divides his time equally between the two projects (the "junior-sharing mode"), then the project outcomes are very informative about which senior is more able, because the total contributions of the juniors to the two projects are perfectly correlated. On the other hand, the project outcomes provide no information about which junior is abler. If, instead, each junior works exclusively on one project (the "no-sharing mode"), then project outcomes provide more information about the relative abilities of juniors and less information about the relative abilities of seniors.

Dewatripont et al. (1999) use a career concern model to study the performance of government agencies. They find that allocating more tasks to one official typically weakens the link between his performance and his talent, and so reduces the agent's effort. The effort will be especially reduced if the agency's mission (the objective the agency gives itself) becomes fuzzy. The major problem is that a government official has difficulty revealing his talent when he must perform several tasks. The poorer revelation may even lead a

[3] The idea that agents' incentives are weaker when they incompletely control asset allocation decisions builds on work by Grossman and Hart (1986), Hart (1995), and Aghion and Tirole (1997).

high-ability agent to refuse some tasks.

4 Bundling for information

We turn next to our explanation, which considers a principal who desires to learn about the agent's competence in one area by evaluating his competence in a related area.

We view earmarks as a tie-in which provides information about the competence of the official. For example, suppose the Department of Transportation proposes a congestion toll, arguing that it is socially efficient. To know that, the Department must estimate demand, congestibility, and so on. Voters are unsure about how much the Department knows. So in addition to the congestion toll, the Department proposes some other program (such as spending on highway construction), which the voters can evaluate. Are the bottlenecks that the Department proposes the ones of greatest concern to consumers? And once the highway project is built, are the roads closed at the times which cause the least damage to drivers? Since voters know these effects, they can estimate the quality of the Department. They may favor the congestion toll combined with the other plan if they find that the Department built highways efficiently. But they may oppose a congestion toll if that is the only policy the Department proposes.

To be more explicit, suppose nature determines whether the government official (the agent) is of high quality (good) or of low quality (bad). The prior probability that the agent is good is γ. The probability a good agent proposes a good policy is π_G; the probability a bad agent proposes a good policy is $\pi_B < \pi_G$. Policy can come in two areas, M and N. The principal (for example, the public, or a legislator) can evaluate the quality of a policy proposal in area M, but not a proposal in area N.

Let S_G be the principal's observation that policy M is good (or that the principal observed a Good signal). Then the posterior probability that the agent is good is

$$\text{pr}(G|S_G) = \frac{\text{pr}(S_G|G)\text{pr}(G)}{\text{pr}(S_G|G)\text{pr}(G) + \text{pr}(S_G|B)\text{pr}(B)} = \frac{\pi_G\gamma}{\pi_G\gamma + \pi_B(1-\gamma)}. \quad (1)$$

Thus the probability that policy N will be good given that policy M was seen to be good is the probability that the agent was revealed as good times

π_G, plus the probability that the agent was revealed as bad times π_B:

$$\frac{\pi_G\gamma}{\pi_G\gamma+\pi_B(1-\gamma)}\pi_G+\left(1-\frac{\pi_G\gamma}{\pi_G\gamma+\pi_B(1-\gamma)}\right)\pi_B. \tag{2}$$

In contrast, with no bundling, and policy N adopted with no observation of M, the probability that N will be well implemented is

$$\gamma\pi_G+(1-\gamma)\pi_B. \tag{3}$$

4.1 The benefits of bundling

We can then ask for the benefit of observing the outcome of policy M. Let the benefit from policy M when it is good be M_G, and let its benefit be M_B when it is bad. Define N_G and N_B similarly. Note that M_B or M_G may be negative. Then with no observation of policy M, expected benefits from policy N are

$$(\gamma\pi_G+(1-\gamma)\pi_B)N_G+(1-(\gamma\pi_G+(1-\gamma)\pi_B))N_B. \tag{4}$$

Now suppose that policy N is adopted only if policy M is observed to be good. The expected benefits from policy M are

$$(\gamma\pi_G+(1-\gamma)\pi_B)M_G+(1-(\gamma\pi_G+(1-\gamma)\pi_B))M_B. \tag{5}$$

Policy N will then be adopted if policy M is observed to be good. With probability $\gamma\pi_G+(1-\gamma)\pi_B$ policy M is observed to be good and policy N is adopted. Given that policy N is adopted, with probability $\frac{\pi_G\gamma}{\pi_G\gamma+\pi_B(1-\gamma)}$ the agent is good. With probability one minus this the agent is bad. Thus the expected benefit from policy N, when it is adopted only if policy M is good, is

$$(\gamma\pi_G+(1-\gamma)\pi_B) \tag{6}$$

$$\left(\frac{\pi_G\gamma}{\pi_G\gamma+\pi_B(1-\gamma)}(\pi_G N_G+(1-\pi_G)N_B)+(1-\frac{\pi_G\gamma}{\pi_G\gamma+\pi_B(1-\gamma)})(\pi_B N_G+(1-\pi_B)N_B)\right).$$

Summarizing, under no bundling, the the adoption of M is independent of the adoption of N. Expected benefits are then:

$$\text{Max}\left[(\gamma\pi_G+(1-\gamma)\pi_B)N_G+(1-(\gamma\pi_G+(1-\gamma)\pi_B))N_B,0\right]+ \tag{7}$$

$$\text{Max}\left[(\gamma\pi_G + (1-\gamma)\pi_B)M_G + (1 - (\gamma\pi_G + (1-\gamma)\pi_B))M_B, 0\right].$$

Under bundling, the benefits are either 0 (when neither M nor N are adopted, or the benefits from M alone (when it turns out bad and so N is not adopted), or the benefits from both M and N (when M turns out good and so N is adopted). Expected benefits are then

$$\text{Max}[(\gamma\pi_G + (1-\gamma)\pi_B)M_G + (1-(\gamma\pi_G + (1-\gamma)\pi_B))M_B + (\gamma\pi_G + (1-\gamma)\pi_B) \tag{8}$$
$$\left(\frac{\pi_G\gamma}{\pi_G\gamma + \pi_B(1-\gamma)}(\pi_G N_G + (1-\pi_G)N_B) + (1 - \frac{\pi_G\gamma}{\pi_G\gamma + \pi_B(1-\gamma)})(\pi_B N_G + (1-\pi_B)N_B)\right), 0].$$

4.2 Interpretation

To gain insight into the benefits of bundling we make simplifying assumptions. Let a bad project be the exact opposite of a good project, or let $N_B = -N_G$. Normalize $N_G = 1$. Let the probability that a bad agent proposes a good policy be zero ($\pi_B = 0$). Lastly, suppose that project M and project N are each, in isolation, worthwhile in expected terms (the values of expressions (4) and (5) are positive). As it is now anyway worthwhile to undertake project M, the net benefit of bundling, Δ, equals the difference between expressions (6) and (4):

$$\Delta = 2\gamma\pi_G^2 - 3\gamma\pi_G + 1, \tag{9}$$

with $\frac{\partial\Delta}{\partial\gamma} \leq 0$ and $\frac{\partial\Delta}{\partial\pi_G} = \gamma\,(4\pi_G - 3)$.

The net benefit of bundling, Δ, declines with γ: the smaller is the share of good agents, the higher the benefit of knowing the type of the agent before deciding on project N. When $\pi_G = 1$ (a good agent always adopts a good project), the outcome of project M perfectly predicts the type of the agent. The net benefit of bundling becomes $(1-\gamma)$. A decline in π_G reduces the benefit of bundling: the false negatives reduce the information value from seeing the outcome of project M.[4]

Sometimes bundling is inadvisable (or put differently, project N should be adopted even if project M turned out bad). A sufficient condition to have a net benefit in our stylized case is that $\gamma \leq 0.88$.[5] The net benefit

[4] The net benefit of bundling reaches a minimum at $\pi_G = 3/4$.

[5] This result can be seen by setting $\pi_G = 3/4$, the value that minimizes Δ, and solving the equation $\Delta = 0$ for the corresponding γ.

of bundling can become negative when γ is high and $\pi_G < 1$. The loss can occur because bundling means erroneously rejecting project N when project M turns out bad.

Note that for bundling to be worthwhile, neither project M nor N, when considered in isolation need be beneficial in expected terms. Consider first the case where the "informative" project M has a negative expected benefit Γ. Then we need to add this cost to our net benefit of bundling Δ as given by (9) to know whether bundling is worthwhile. What matters is then not only the relative cost Γ but also the value of Δ; this value depends on γ and π_G; the lower is γ and the higher is π_G the more informative project M will be, and the greater the gains from bundling.

Consider next a project N that, in isolation, has a negative expected benefit (the value in expression (4) is negative). The expected benefit from bundling now becomes

$$\Delta_N = \gamma\pi_G\left(2\pi_G - 1\right) - \Gamma. \tag{10}$$

A necessary condition for this expression to be positive is that $\pi_G > 1/2$: only when the information of project M on the type of the agent has a high probability of generating a good N project is the information valuable. The net benefit of project N in isolation (($2\gamma\pi_G - 1$) is negative; if $\pi_G > 1/2$ then γ must be sufficiently small to make bundling worthwhile. A small value of γ, is precisely what we would expect to make information revelation via project M worthwhile. Obviously, there are no miracles; a negative expected benefit for project N can produce a positive benefit when bundled; but the expected benefit will remain small as the benefits appear only when good agents are rare.

Also note that our approach can apply to symbolic earmarking, rather than only to substantive earmarking—the information provided by policy M does not require that revenue raised from policy M fund policy N. And note that our approach does require that the two policies (M and N) be connected in the sense that the agent's performance in one area gives some useful information about his performance in another area. So an agency's proposal about where to build highways may be informative about its competence in a related area, how to price congestion, whereas the connection between highway constructions and social security taxes is weak. We would therefore predict earmarking to be more appealing in one case than in the other.

Moreover, our argument suggests that agencies should not be specialized, but instead be given a bundle of responsibilities so that the principal can use performance on projects he can evaluate to predict performance on projects which are harder to evaluate.

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5 Notation

π_G Probability a good official proposes a good policy

π_B Probability a good official proposes a good policy

γ Prior probability that worker is good