Appropriate methods for economic evaluation of programmes with costs and effects extending across sectors

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Introduction

Public policies and policy interventions impact on many areas of activity including areas beyond the main focus of the policy/intervention ; the costs and (dis)benefits falling on other areas of the economy, government and/or private sector, and on different individuals. For example, a policy of improving the nutritional value school meals may generate health benefits, the primary objective of health care and public health services, but impose costs on the educational sector. However, there is still no consensus on the most appropriate way to analyse such interventions to decide which policies are beneficial and should be implemented [1-4]. It seems reasonable that any decision made should be made with some claim to legitimacy, however that shall be defined. To support this legitimacy the methods used should make the scientific and value judgements inherent in the decisions explicit, to allow for transparency but also so that they are open to debate, alternative formulation and falsification [4].

Economic evaluation has been used as a tool to examine whether policies or interventions should be implemented, and has been described as "the comparative analysis of alternative courses of action in terms of both their costs and consequences" [5]. One form of economic evaluation, cost-effectiveness analysis, has been widely used to inform decisions on policies or interventions which affect only a single sector of an economy or are assumed as such. Where there is a single agreed output this can be relatively simple, for example in the case of the National Institute for Health and Clinical Excellence's (NICE's) Technology Appraisal Programme, the simple rule is that the benefit must outweigh the opportunity cost (that is the benefit of any interventions which will be displaced

by the introduction of a new (more costly) intervention) which is determined by the shadow price of the budget constraint [6-9].

Cost-benefit analysis (CBA), another form of economic evaluation but based more explicitly on the principles of welfare economics, has been proposed as a method which allows the evaluation of policies and interventions where costs and benefits fall on several sectors. This is achieved by simply aggregating costs and benefits into a given numeraire, normally consumption. However, a key weakness of CBA is that it fails to acknowledge budget constraints faced by different sectors and, instead, treats them as not relevant to the analysis and to be ignored. This is not in keeping with the political and economic environments of most countries where, *de facto,* the budgets of many government sectors can be seen as fixed, at least on an annual basis, and can be viewed as constraints on the expenditure of that sector. Furthermore, these budgets are set through a complex political process and could be viewed as a legitimate outcome of the social democratic process. Therefore, it can be argued that they cannot simply be ignored when evaluating policies or interventions which impact on several sectors. In other words, public sector budgets in democratic societies may be viewed as reflecting public preferences, albeit in an indirect and probably imperfect manner.

This paper considers how resource allocation decisions relating to policies or interventions with potential multi-sectoral impacts could most appropriately be informed by economic evaluation. Two possible options are considered: first, where there is an implied or explicit social welfare function (SWF) (which could be based on the principles of welfarism or extra-welfarism [10]); and second, a societal decision making approach [4, 11]. The paper aims to demonstrate that trade-offs are inevitable and have to be made, but budget constraints cannot simply be ignored and shadow prices on budget constraints are central to evaluation no matter which approach is accepted. The paper also considers whether compensation payments between 'losing' and 'gaining' sectors are a potential means of understanding the net benefit associated with policies with multi-sectoral effects, and whether it is possible, necessary or even appropriate in practice to make such payments.

An implied or explicit social welfare function

To take account formally of effects in different sectors when making decisions some means of valuing the outputs gained and foregone within a given sector, relative to those in the other sectors, is required [3]. The rate at which society is willing to trade such outputs is commonly described as a social welfare function (SWF). Typically, economic analysis has adopted an approach to decisions based on one or other of two broad normative frameworks: welfarism and extra-welfarism

(sometimes referred to as non-welfarism). These frameworks and their foundations have been discussed in detail elsewhere although we consider them briefly below [1].

The welfarist approach can be seen as a framework built on explicit normative principles, and has four key tenets [12]: (i) the utility principle, whereby individuals rationally maximise their welfare by ordering options and choosing their preferred option; (ii) individual sovereignty, whereby individuals are the best judges of their own utility; (iii) consequentalism, whereby utility is derived from the outcomes of behaviour and processes; and (iv) welfarism , whereby the 'goodness', or 'social value', of any situation is based solely on the utility levels attained by individuals in that situation.

There is almost universal agreement that, as part of this framework, the Pareto principle should apply: if a policy change makes at least one person better-off, in terms of their own self-assessed utility, and no one worse off, again in terms of their own self assessed utility, it should be adopted. More contentious is the welfare theoretic basis upon which orthodox cost-benefit analysis is based whereby policies conferring *potential* Pareto improvements are accepted, where a policy or intervention is judged to improve social welfare if those who gain from a change can potentially compensate those who lose (leaving them no worse-off than before the policy or intervention was introduced) and still remain better-off than before the change. A contentious feature of this normative principle relates to how it should be interpreted as a guide to social decision making if the compensation is unpaid (i.e. it remains a *potential* improvement) [4].

The extra-welfarist approach has been described as differing from the welfarist approach in four main ways [1]: (i) it permits the use of outcomes other than utility; (ii) it permits the use of sources of valuation other than the affected individuals; (iii) it permits the use of weightings of outcomes according to principles that need not be preference based; and (iv) it permits interpersonal comparisons of well-being in a variety of dimensions, thus enabling the analyst to move beyond Paretian principles (be these strict or potential). In other words, the extra-welfarist approach can be based on a welfarist framework (i.e. based on individuals' self assessed utility) but be modified to include additional values instead of being based solely on individual preferences, for example concepts of equity and justice[13]. Alternatively, it can attempt the specification of a more complete objective, not based on individual preferences, but this requires the specification of the arguments to be included, the weights attached to them (or some ordering of possible allocations) and a means by which the legitimacy of the function can be claimed [4].

Brouwer *et al* [1] state that the main difference between welfarism and extra-welfarism relates to the “delineation of the relevant evaluative space”, where welfarism limits itself by definition to

individual utility, whilst extra-welfarism broadens the evaluative space to include other relevant outcomes such as health. However, both require a full specification, be it implied or explicit, of the arguments of the objective function and the weights and tradeoffs which must be made.

Outcomes

As stated previously welfarism focuses solely on the comparison of individual utilities, although to operationalise its use in economic evaluation these are normally measured through the use of willingness to pay. This is either inferred from market prices or, in the case of non-marketed goods, through the use of other methods which attempt to identify what price would be paid if a market existed (e.g. contingent valuation).

Extra welfarism allows the introduction of other arguments/outcomes, and does not focus solely on individual utilities, although neither does it have to completely ignore them [1]. Others have described extra-welfarism as incorporating additional non utility arguments into the SWF that reflect a broader value to society other than via individual utility [14]. However, Brouwer *et al* describe this as an unnecessarily restrictive view. They argue that there need not just be additional arguments in the function but also a shift of focus away from individual utility to arguments and types of value that are not preference-based [1]. This is an approach which heath economists have adopted in treating health, rather than the utility derived from health, as the assumed maximand in the health care system. Quality-adjusted life-years (QALYs) have become a staple tool in economic evaluation of health care [5], and whilst they have some theoretical link to individual preferences under particular conditions [15], they are more routinely viewed as a measure of health. Other non-preference based outcome measures including happiness, which has received much attention, are dealt with briefly later. Within the public sector, many other methods have been used to assess the efficiency and value of the outputs from different sectors. These include many different performance indicators [16]. We will return to these later when discussing the societal decision making approach.

Analytical framework

This paper focuses on the use of a SWF, which could be viewed as the "true" underlying SWF or an approximation of an unspecifiable "true" SWF. This could be based on either welfarist or extra-welfarist principles, and could be derived from individual preferences, using Pareto or potential Pareto criteria, or be based on the views of policy makers [1]. In general, a SWF can be written as:

1) $W(x_1 \dots \dots x_n)$

For simplicity it is assumed that all the outputs are separable and additive in the SWF and that social welfare, whether based on welfarist or extra-welfarist principles, can be expressed in the common numeraire of consumption. We also assume that the budget for each part of the public sector is fixed, any new policies being considered for introduction in a given sector have only marginal impact on budgets and that we only consider costs and benefits falling in single period. The generalisation to multiple periods has been dealt with elsewhere [2, 17]. For simplicity we consider a 3 sector economy, with the sectors being health (h), education (e) and consumption (c), although the analysis is generalisable to multiple (n) sectors. Therefore we have the SWF:

2) $W(h, e, c)$

Where social welfare is increasing in h, e and c. The above assumptions facilitate the use of simple net benefit decision rules which have been widely used in economic evaluation [17]. Table 1 presents the notation which will be used throughout and is based on previous publications [2-3, 17]. Δh and Δe represent the changes in health and education, respectively, from a new policy or intervention; Δc_h, Δc_e and Δc_c represent the costs of the new policy or intervention to the health, education and consumption sectors, respectively; v_h and $v_e$represent the willingness to give up consumption for health and education respectively (i.e. the consumption value of units of health and education); and k_h and k_e represent the cost-effectiveness thresholds for health and education, respectively (i.e. how many extra pounds spent on a new policy or intervention in the health or education sector are required to displace one unit of health or education elsewhere in that sector as a result of a fixed budget constraint). k_h and k_e represent the inverses of the shadow prices of the budget constraints, the importance of these and how they can be derived have been discussed in detail elsewhere [3, 6, 9]. v_h and v_e can be based on the aggregated willingness to give up consumption for health and education of individuals, or it could be based on policy makers' views of what individuals should be willing to give up.

Δh	Change in health in units of health
Δe	Change in education in units of education
Δc_c	Change in consumption costs
v_i	Willingness to give up consumption for publicly produced good by sector i
k_i	Cost-effectiveness threshold for sector i (shadow price)
Δc_i	Change in costs in sector i

Table 1: Notation for the analytical framework

An implied or explicit social welfare function (continued)

We now return to considering a SWF, which allows us to define $v_h$and v_e (i.e. it allows us to value units of health and education in the common numeraire of consumption). It should be noted that k_h and k_e are questions of fact, representing the health or education units foregone at the margin as additional costs to the sectors displace other activities. Methods to estimate these 'thresholds' have been presented elsewhere [18-19]. It is thus possible to express the net monetary benefit of a new policy or intervention as:

3) $$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) + v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) - \Delta c_c$$

Within the first bracket is the net health benefit (NHB) to the health care sector in units of health output, the health generated directly as a result of the new policy or intervention (Δh) less the health displaced elsewhere as a result of the cost to the health care sector ($\frac{\Delta c_h}{k_h}$) (or generated elsewhere if the policy/intervention is cost saving in the health care sector, i.e. $\Delta c_c < 0$) . Based on the same idea, the second bracket represents the net education benefit (NEB) to the education sector in units of education output. These net health and education benefits can then be expressed in terms of units of consumption by multiplying through by their respective values of willingness to give up consumption for the good (i.e. v_h and v_e). These can then be summed and compared with the change in consumption costs (the costs of a policy/intervention which fall on individuals or the private sector and not the government constrained sectors) as a result of the new policy or intervention (Δc_c) to calculate its overall net monetary benefit (NMB) in the common numeraire of a pound spent in consumption. If the NMB of a new policy or intervention is positive, then it can be seen as being beneficial to society, i.e. it results in a gain in social welfare as defined by the SWF ($W(h, e, c)$).

While a condition for a social welfare gain of a policy or intervention is that the NMB is positive, some policies may involve one sector benefiting from a new policy but another losing. For example, the NHB is positive so there is an increase in the number of units of health produced, but the NEB is negative so there is a decrease in the number of units of education produced. This raises issues when one decision maker is tasked with addressing one sector, and another decision maker has responsibility for the other (most, if not all, countries would separate responsibilities for health and education). It may be hard to gain agreement to allow implementation of a policy which, despite having an overall positive NMB, has a negative impact on one sector, as the decision maker with responsibility for this sector may be unwilling to incur such an impact on their sector. Should a compensation payment or transfer be made from the “winning” sector to the “losing” sector to make the policy attractive to both sectors, or could a transfer take place which would actually

increase social welfare further? Such issues become even more important when there is an apparent inconsistency between the budgets set and the tradeoffs implied in the SWF.

In Appendix A, three examples are considered in detail looking at new policies which offer different benefits to different sectors. In all examples the public sectors appear underfunded (i.e. the willingness to give up consumption for a unit of output is greater than the cost-effectiveness threshold of the sector, $v_i > k_i$). However, the health sector is more underfunded than the education sector (i.e. $\frac{v_h}{k_h} > \frac{v_e}{k_e}$, or the relative value of a unit of health, as defined by its consumption value, compared to the cost of producing it is greater for the health sector than its counterpart for the education sector, so that a pound spent in the health sector produces more 'social value' than a pound spent in the education sector). The first example considers a policy which results in consumption benefits, health losses and no impact on education. Whilst the policy is desirable in the sense that it increases social welfare, as defined by the SWF, it is demonstrated that a transfer from consumption back to health care, based on a compensation test whereby the losing sector is returned to its original position (i.e. there is no gain or loss in this sector) would actually increase social welfare even more, as the value of a pound spent in health care ($\frac{v_h}{k_h}$), as defined by the SWF and the budget constrained health care sector, exceeds the value of a pound spent in consumption (1) (i.e. the policy is dominated by a transfer).

Example 2 considers a policy which results in health gains, consumption losses, and again no impact on education. Again, the policy is desirable in that it increases social welfare. However, it is demonstrated that a transfer from health care back to consumption would never be desirable for the same reason that a transfer from consumption back to health care is desirable, i.e. that the value of a pound spent in health care ($\frac{v_h}{k_h}$) exceeds the value of a pound spent in consumption (1). Example 3 considers a policy with health benefits, education losses and no impact on consumption. As with the first two examples, the policy would be deemed beneficial as it increases social welfare, as defined by the SWF. However, a transfer from health care to education would not be deemed beneficial, the value of a pound spent in health care ($\frac{v_h}{k_h}$) exceeds the value of a pound spent in education ($\frac{v_e}{k_e}$), again defined by the SWF and their respective budget constraints.

These examples all raise the same issue, the apparent conflict between the defined SWF and the budgets allocated to each sector. It might be argued that it is appropriate simply to transfer more resources from consumption or education to health care as there is an apparent mismatch in the

value/productivity of a pound spent in the different sectors? We return to this apparent conflict later.

Compensation tests in a 3-sector economy with an explicit social welfare function

Following on from the three policy examples shown in appendix A, Tables 1 and 2 briefly set out what decisions should be taken when using an explicit SWF to evaluate policies and the rules for when compensation should be considered in the case of policies impacting on the health and consumption sectors (Table 2) and the health and education sectors (Table 3). Compensation is only considered when it will result in an increase in social welfare, measured by NMB, as defined by the SWF. These can be expanded to consider policies which impact on all three sectors, or multiple sectors.

	Impact on health	Impact on consumption	Overall impact on social welfare	Decision	Potential compensation of
1	$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) > 0$	$\Delta c_c < 0$	$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) - \Delta c_c \geq 0$	Accept	None required
2	<0	<0	>0	Accept	$-k_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right)$
3	>0	<0	>0	Accept	None if v>k
4	$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) < 0$	$\Delta c_c > 0$	$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) - \Delta c_c < 0$	Reject	
5	>0	>0	<0	Reject	
6	<0	<0	<0	Reject	

Table 2- Compensation tests between health and consumption

	Impact on health	Impact on education	Overall impact on social welfare	Decision	Potential compensation of :
1	$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) > 0$	$v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) > 0$	$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) + v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) > 0$	Accept	None required
2	<0	>0	>0	Accept	If $\frac{v_h}{k_h} > \frac{v_e}{k_e}$ then compensation of –NHB/ k_h
3	>0	<0	>0	Accept	If $\frac{v_h}{k_h} < \frac{v_e}{k_e}$ then

					compensation of –NEB/k_e
4	$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) < 0$	$v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) < 0$	$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) + v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) < 0$	Reject	
5	<0	>0	<0	Reject	
6	>0	<0	<0	Reject	

Table 3- Compensation tests between health and education

In all cases the policy should only be accepted if the overall NMB is positive (i.e. the policy results in an increase in social welfare as determined by the SWF). As shown in the examples, transfers between sectors should only occur if the relative value of the outputs of the sector compared to their productivity is greater than that of the sector which requires compensating (e.g. for it to be worth education compensating health care the following condition must hold $\frac{v_h}{k_h} > \frac{v_e}{k_e}$).

A single outcome measure?

Some have advocated the use of a single all encompassing outcome measure when considering the economic evaluation of public projects. However, even with the use of a single measure of outcome, similar problems to the use of SWFs are exhibited when government sectors are budget constrained. It could also be argued that if there is a single outcome of interest what is the point for splitting budgets across different sectors. Use of a single common outcome would imply that the efficiency of a pound spent in each sector should be equalised, and if this is not the case then budgets should be adjusted (i.e. so that the k_i values are equalised across sectors). There is the possibility that with different k_i it might just be a practical issue of identifying efficiency of cross-sector interventions if we cannot apportion outcomes to different sectors, i.e. we cannot judge relative efficiency.

Issues arising from the use of an explicit or implied social welfare functions

In the highly stylized policy examples the ease of using SWFs to make decisions on policies which affect multiple sectors was demonstrated. The issues around transfers and the relative value of the outputs of sectors compared to their productivities/shadow prices raises certain issues, however. This is especially true in the presence of what can be viewed as "legitimate" budget constraints set through the social democratic process. If the specified SWF is considered correct, i.e. that it truly

reflects society's willingness to trade-off the various arguments, then the budgets are, at least to some extent, just a nuisance to be ignored. However, if the SWF is set to accurately reflect social preferences, then the question has to be asked as to why sector-specific budgets were set non-optimally?

Let us briefly consider why v_i might not equal k_i, and why $\frac{v_h}{k_h}$ might not equal $\frac{v_e}{k_e}$, before returning to the discussion of the use of SWFs. One view of v_i is as an expression of how much consumption individuals are willing to give up to receive a unit of output of sector i when making individual choices about their own consumption (based on a welfarist view). Alternatively, it can be seen as an expression of how some principal/decision maker (i.e. the one who defines the SWF) thinks consumption should be traded for health (based on a particular extra-welfarist view). There is no reason to suppose that a social democratic process will deliver budget allocations which precisely match individual preferences or how the principal/decision maker thinks health and consumption should be traded, i.e. funding to the point where $v_i = k_i$.

For now we focus on the welfarist view, but the arguments can easily be extended to the extra-welfarist view. In health care there are empirical observations of $v_h \neq k_h$ [19-21]. There are also good reasons why k_i is likely to be less than v_i, particularly if v_i is an average value across a highly skewed distribution of income. Firstly, social decisions will take into account a wide range of different social arguments. Many of these are not separable from the outcomes of budget constrained government sectors and consumption and conflict with individual preferences, e.g., equity, social solidarity and cohesion (i.e. the SWF is overly simplistic). Secondly, collectively funded provision of a good, e.g. health or education, may be regarded as ensuring a socially acceptable provision whilst leaving individuals free to make their own consumption choices including whether to invest in receiving more of the good (i.e. that v_i and k_i are valuing different things). Thirdly, the acceptability and inefficiency of increasing socially acceptable forms of taxation to expand collectively funded provision to the point where $v_i = k_i$ may not be desirable even if other social arguments were not in play.

These arguments suggest several things. It may not be possible to specify a complete SWF which captures all of the necessary arguments. Observing $v_i > k_i$ does not imply sector i is underfunded, but simply that there is a difference between the implied social value of the output by collectively funded provision and the amount of consumption on average an individual is willing to give up to improve their own health (or in an extra-welfarist view, the amount of consumption the principal thinks the individual should be willing to give up) [3]. Observing $v_i > k_i$ might also just reflect

inefficiencies in taxation. As with $v_i \neq k_i$, similar reasons can be posited for why $\frac{v_h}{k_h} \neq \frac{v_e}{k_e}$. For example, socially acceptable provision levels may differ or the skewed distribution of income may impact the average willingness to give up consumption for one good more than another.

The fact that $v_i \neq k_i$ and $\frac{v_h}{k_h} \neq \frac{v_e}{k_e}$ raises issues around the use of SWFs, however they are defined. If budgets can be seen as being set by the social democratic process and can be viewed as legitimate, then the use of a SWF may be seen as usurping the social democratic process. It should be noted that, by using a SWF, the only values that really matter when defining social value are the consumption values of the various outputs (i.e. v_i), and the cost-effectiveness thresholds (i.e. k_i) only represent how efficiently the goods are produced at the margin based on the current budget allocations. The SWF asserts that the allocation is wrong and that social welfare, as defined by the function, could be increased by a reallocation of resources between the sectors. As a result of inefficiencies in taxation it may still be the case that $v_i \neq k_i$; however, it should not be the case that $\frac{v_h}{k_h} \neq \frac{v_e}{k_e}$. Even if a reallocation of resources is not possible, such a welfare function may lead to a budget-constrained government sector focusing on policies which confer effects outside its remit as a result of the difference in value/productivity between sectors. For instance, in the examples above, the education sector may decide to focus on policies which can result in increased health units rather than education units. Alternatively, the health sector may focus on policies which transfer costs to the education or consumption sectors. If such behaviour is considered optimal, as it would be under the stylized examples put forward previously, then it appears that the analyst should usurp the budgets allocated by the socially democratic process, despite these budgets being viewed as "legitimate". Therefore the outcomes of the social democratic process appear to be inefficient given the SWF imposed by the analyst. However, what if the SWF is wrong?

A societal decision making approach

It must be remembered that even if there is no broad consensus or obvious social legitimacy for any particular specified or implied SWF, trade-offs between the outcomes of different activities of social value will still have to be made. There is no single, constant, identifiable SWF. Instead there is a plethora of options, none of which is known to be true or legitimate. An alternative to the use of a SWF, be it implied or explicit, be it welfarist or extra-welfarist, is the use of what has been termed a "societal decision making approach" [11]. This imposes no values on decisions, nor does it require a principal/decision maker to impose a full set of values, as with the extra-welfarist approach, and it does not require the specification of a SWF. Instead it identifies a much more modest role for

economic analysis: informing decisions within the public sector, rather than making claims about whether such decisions improve social welfare.

This approach can be likened to a combination of principal agent relationships [22]. With such a view, decision making bodies such as NICE are seen as agents of a socially legitimate higher authority which cannot express an explicit and complete SWF. Nevertheless the higher authority allocates resources and gives the agents responsibilities to pursue explicit objectives; for example, NICE is tasked with maximising health from the budget allocated to the National Health Service [23]. The higher authority then holds the agent accountable for its ability to meet these objectives/goals. The socially legitimate higher authority, or principal, is not simply the government, but instead the entire process including democracy, the public, the free press, the government, the legal system and the institutions which have evolved. The socially legitimate higher authority is itself simply an agent of society as a whole.

The societal decision making approach can be viewed as relying on the premise that, if the process is legitimate, the objectives and budgets provided to the various government sectors give a legitimate (albeit partial) expression of some unknown underlying latent welfare function which the higher authority cannot fully express. Even if it was possible that they could at one instant fully express it, the likelihood is that it is constantly evolving reflecting the changing circumstances and preferences of society.

Whilst the socially legitimate higher authority is given rein over the provision of services provided by the public sector, individuals are given free rein, at least to some extent, over the way they spend their own resources, i.e. they have “free” choice over what they choose to consume. The rein is only partly free as a result of taxes (both taxes on income, but also on expenditure) and limitations on what can be purchased, e.g. slavery, banning the purchase of illegal narcotics, taxes on certain goods to recognise externalities etc.

This role could be seen as similar to Nozick’s argument that the role of government does not determine the social ordering but, instead, sets the constraints within which a social choice is to be made [24]. Government can be seen as the overseer of these rights and also an appropriate decision making body. The two roles of government are likely to be related. For example, in providing a NHS, the government gives individuals in society access to a minimum level of care. Individuals are then entitled to purchase care outside of the NHS if they wish to do so. This provision of goods/services may be seen as rights, and the level of these rights may, in part, determine the level of funding for

each service. The legitimacy of government to act in this manner is gained through the political process [11].

How does the social decision making framework differ from extra-welfarism as some may see the higher authority described here as being similar to the decision maker who can specify the objectives in extra welfarism? Firstly, a societal decision making approach does not require the principal to fully specify the objectives and trade-offs, but instead requires them only to specify objectives and budgets for each sector. For example, in the health care sector, the principal does not specify to the agent (the health care decision maker) that they should maximise health as that is the ultimate goal for society, but because it is a simple task to assign and monitor given constraints, and that it should correspond to an extent with the overall underlying aim, i.e. improving social welfare. Secondly, the societal decision maker here is not simply the government, or an individual policy maker, but instead the entire social democratic process, which cannot specify a SWF but, through a series of principal agent relationships, can define specific goals and budgets for the various agents. The final, and perhaps key distinction, is that, with this approach, the value of a sector's output is implied by the budget and efficiency of the sector (i.e. k_i) and not by some value imposed on top of this (i.e. v_i) (it should be noted that this is also very distinct from welfarism, the individual's valuation of publicly provided goods no longer impacts on the value of outcomes, other than through their participation in the social democratic process).

In contrast with the previous analyses based on an explicit welfare function, when we now examine net benefits the overall NMB is determined in the common numeraire of a pound spent in the public sector instead of a pound spent in consumption, as we no longer consider the consumption value of the outputs of these sectors. k_h and $k_e$still represent the health or education foregone at the margin as additional costs to the sectors displace other activities, but they also represent the value of a unit of health or education as defined by the budgets and goals set through the social democratic process. For now we ignore consumption effects, and instead focus on policies which only impact on the public budget constrained sectors. Below we set out the net monetary benefit function based on an education and health care sector:

4. $(k_h \Delta h - \Delta c_h) + (k_e \Delta e - \Delta c_e)$

Or alternatively:

5. $k_h \left(\Delta h - \frac{\Delta c_h}{k_h}\right) + k_e \left(\Delta e - \frac{\Delta c_e}{k_e}\right)$

Similarly to Equation (3), in Equation (5) the first bracket still represents the net health benefit of the new policy or intervention to the health care system measured in units of health, and the second bracket the net education benefit of the new policy or intervention to the education system measured in units of education. To transform these into the common numeraire of a pound spent in the public sector they are multiplied through by their respective cost-effectiveness thresholds, rather than their consumption values to transform them into a common numeraire of consumption as in Equation (3). Now the analyst is imposing no SWFs, or values, on to decisions, and all that is required is knowledge of the shadow prices of the budget constraints (these become, at the margin, the values of the publically provided goods as determined through the social democratic process). Below we return to Example 3 but use a societal decision making approach.

Example 3 revisited- Health benefits and education losses

A new policy intervention, Policy C, produces a gain of 2 units of health, no change in health care costs, a loss of 0 units of education, and an increase in education costs of £40,000. The cost-effectiveness threshold of the health sector is £20,000 per unit of health and the cost-effectiveness threshold for the education sector is £20,000 per unit of education. Table 4 contains the parameter values for Policy C, consumption can be ignored as there is no impact on the sector. Unlike with the previous analysis of Policy C, we can now ignore the consumption values of health and education.

Δh	2 units of health
Δc_h	£0
k_h	£20,000 per unit of health
Δe	0 units of education
Δc_e	£40,000
k_e	£20,000 per unit of education
$\left(\Delta h - \frac{\Delta c_h}{k_h}\right)$	2 units of health
$(k_h \Delta h - \Delta c_h)$	£40,000
$\left(\Delta e - \frac{\Delta c_e}{k_e}\right)$	-2 units of education
$(k_e \Delta e - \Delta c_e)$	-£40,000

Table 4- Parameter values for policy C- Health benefit and education losses

The NMB for the new policy, based on Equation (5), is therefore as follows:

6) $k_h \left(\Delta h - \frac{\Delta c_h}{k_h}\right) + k_e \left(\Delta e - \frac{\Delta c_e}{k_e}\right)$

7) $£20{,}000\left(2-\frac{0}{£20{,}000}\right)+£20{,}000\left(0-\frac{£40{,}000}{£20{,}000}\right)$=£40,000-£40,000=0

Unlike under a SWF, Policy C now has a NMB of 0, so the decision maker should be indifferent between implementing the policy or not. If we now consider whether the health care sector can compensate education for the losses it incurs. As previously, as there is a loss of 2 units of education as a result of the increased cost to the health care sector, then a transfer of £40,000 is required so that education is no worse off. Such a transfer from the health care sector would result in a loss of 2 units of health, equal to the benefit of the new policy. If such a transfer occurred, both sectors would be exactly as well off as before the introduction of Policy C.

Compensation tests under a societal decision making approach

As with the use of SWFs, there will be policies where some sectors benefit whilst others lose. To get the losing sector to accept the introduction of the policy, a transfer/compensation payment from the 'winning' to the 'losing' sectors may be necessary. Table 5 briefly sets out what decisions should be taken when using a societal decision making approach.

	Health	Education		Decision	Compensation
1	$(k_h\Delta h-\Delta c_h)>0$	$(k_e\Delta e-\Delta c_e)>0$	$(k_h\Delta h-\Delta c_h)+(k_e\Delta e-\Delta c_e)>0$	Accept	None required
2	<0	>0	>0	Accept	$-(k_h\Delta h-\Delta c_h)$
3	>0	<0	>0	Accept	$-(k_e\Delta e-\Delta c_e)$
4	$(k_h\Delta h-\Delta c_h)<0$	$(k_e\Delta e-\Delta c_e)<0$	$(k_h\Delta h-\Delta c_h)+(k_e\Delta e-\Delta c_e)<0$	Reject	
5	<0	>0	<0	Reject	
6	>0	<0	<0	Reject	

Table 5- Compensation tests between health and education

As with an SWF in all cases the policy should be accepted if the overall NMB is positive. However, if this is the case, then a transfer will always be possible which will result in neither sector being worse off than before the introduction of a policy as if the overall NMB is positive then a level of compensation, then the net monetary benefit to the "winning" sector (i.e. $(k_h\Delta h-\Delta c_h)$ or $(k_e\Delta e-\Delta c_e)$) must exceed the loss in net monetary benefit to the "losing" sector.

The inclusion of consumption?

Our previous consideration of the societal decision making approach has excluded the issue of consumption/impact on the private sector. Whilst the framework would acknowledge that individuals are free to pursue their own decisions with regards to their own consumption, it is not entirely clear how the societal decision making approach would value such consumption. One rule which has been suggested for dealing with these issues is that, if a policy imposes costs on the private sector whilst providing public sector goods (e.g. health), then it should be regarded as worthwhile if the public sector is able to compensate the private sector whilst still being at least as well off as beforehand [4]. For this to be the case the private sector costs per unit of output must be less than the costs per unit of output in the public sector (i.e. k_i) . However, it is unclear if such compensation should actually be paid.

Another way to view the issue is through the consideration of the setting of taxation at the start of any period (i.e. the amount of resources that the social democratic process allocates between public provision of goods and private consumption). At the start of any period the social democratic process sets out its funding (taxes) and spending (budgets and targets) for the period. This effectively determines the level of consumption and production of publicly provided goods for that period (ignoring any dynamic effects for simplicity), and therefore also the relative value of consumption to those publicly provided goods at the margin. If a policy is costly on one sector whilst benefitting another, then at the start of the next budgetary period it is up to the social democratic process to decide whether adjustments need to be made. However, this still does not provide a solution to which policies should be implemented when there are gainers and losers. It could be argued that the analyst should show that the policies which should be reimbursed are those that maintain the values of the publicly provided goods (the $k_i's$) and the current level of consumption. Under such a view, policies which result in reduced production of publicly provided goods but increased consumption would be rejected, as economic evaluations conducted from the perspective of the societal decision making approach would have little to say about interventions to increase consumption, i.e. it is not a specified goal for them. However, policies which increase the production of publicly provided goods at the expense of consumption may be accepted if it can be shown that the public sector could recompense consumption through altering the budget allocation at the beginning of the next budget period without resulting in worse outcomes overall in terms of publicly provided goods.

Issues arising from the use of a societal decision making approach

Unlike with an SWF taking a societal decision making approach imposes no values upon the decision making process other than those given to the agent, in terms of objectives and budgets, by a social

democratic process. k_i no longer just represent a nuisance constraint with no normative significance, now k_i represents the value of the output of the sectors as defined by the social democratic process.

The approach does assume that the budgets allocated and objectives given are optimal and there may be concern whether this is the case. This will particularly be an issue when if such measures are used the relative values of different sectors outputs at the margin that the process will reveal does not coincide with how the socially democratic process actually values such outputs, for example, as a result of a lack of information when budgets were set. However, even if the relative values do not match the true values of the social democratic process, by using such methods it makes the tradeoffs between the different outputs explicit and will therefore provide the necessary information so that they budgets can be reallocated between sectors over time.

Discussion points:

Legitimacy of budgets and objectives from the social democratic process?

Possible sources of an SWF?

How to deal with consumption under a societal decision making approach- possibility of a value of consumption based on an aggregate of the k_i s with weightings based on how public sectors budgets change with changes in taxation?

Compensation and transfers

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Appendix A: Examples

Example 1- Consumption benefits, health losses and no impact on education

A new policy intervention, Policy A, results in a direct loss of 1 unit of health, an increase of £20,000 in health care costs, no impact on the education sector and £150,000 benefit in consumption. The cost-effectiveness threshold of the health sector is £20,000 per unit of health (i.e. for every extra £20,000 spent on a new policy/intervention in the health sector one unit of health is displace elsewhere in that sector) and the willingness to give up consumption for a unit of health is £60,000 (i.e. individuals would be willing to give up £60,000 of consumption for one unit of health). Table 2 contains the parameter values for policy A, education can be ignored as there is no impact on the sector.

Δh	-1 units of health
Δc_c	-£150,000
v_h	£60,000 per unit of health
k_h	£20,000 per unit of health
Δc_h	£20,000
$\left(\Delta h - \frac{\Delta c_h}{k_h}\right)$	-2 units of health
$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right)$	-£250,000

Table 2- Parameters for policy A – Consumption benefits, health losses and no impact on education

The NMB for the new policy, based on equation (3), is therefore as follows:

1) $v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) + v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) - \Delta c_c$
2) $60{,}000\left(-1 - \frac{£20{,}000}{£20{,}000}\right) + 0 + £150{,}000 = 60{,}000(-2) + 150{,}000 = £30{,}000$

Policy A has a positive NMB and, therefore, implementing it would result in an increase in social welfare (as defined by the SWF). However, it should be noted that given the acceptance of Policy A, whilst social welfare will increase, the total amount of health produced by the health sector will decrease (by 2 units of health). Effectively, Policy A is using health care resources to produce consumption benefits at the expense of health.

If we now consider whether it would be possible for a transfer from consumption to the health care sector which would leave the health care sector no worse off than before the introduction of Policy A and would still leave consumption unchanged (similar to a so called potential Pareto improvement

but focusing on sectors rather than individuals). To compensate for a loss in health care of 2 units of health, a transfer from consumption of at least £40,000 is required (as k_h , the cost-effectiveness threshold in health, is £20,000). Given Policy A results in consumption benefits of £150,000, a transfer of £40,000 would be possible, resulting in neither sector losing from the introduction of Policy A. In fact, if such a transfer were to take place, it would result in an increase in overall NMB:

3) $v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) + v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) - \Delta c_c$
4) $60{,}000\left(-1 - \frac{£20{,}000}{£20{,}000} + \frac{£40{,}000}{£20{,}000}\right) + 0 + (£150{,}000 - £20{,}000)$
5) $60{,}000(-2 + 2) + 130{,}000 = £130{,}000$

As can be seen from (5) the transfer looks very desirable as it will result in increased social welfare (£130,000 compared to £30,000 immediately following the introduction of A). Such a transfer is desirable, as the productivity, or value, of a pound spent in the health care sector is considerably higher than one spent on consumption. A pound spent in consumption is simply valued at a pound, whilst one spent in health care is valued at £3 as a result of the relative value of the consumption value of a unit of health to the productivity of the health care sector ($\frac{v_h}{k_h} = 3$).

Example 2- Health benefits, consumption losses and no impact on education

A new policy intervention, Policy B, produces health benefit of 2 units, no change in health care costs, consumption costs of £100,000 and no impact on education. As previously, the cost-effectiveness threshold of the health sector is £20,000 per unit of health and the willingness to give up consumption for a unit of health is £60,000. Table 3 contains the parameter values for Policy B.

Δh	2 units of health
Δc_c	£100,000
v_h	£60,000 per unit of health
k_h	£20,000 per unit of health
Δc_h	£0
$\left(\Delta h - \frac{\Delta c_h}{k_h}\right)$	2 units of health
$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right)$	£120,000

Table 3- Parameters for policy B- Health benefits and consumptions losses

The NMB for the new policy is therefore as follows:

6) $v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) + v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) - \Delta c_c$

7) $60{,}000(2-0) + 0 - £100{,}000 = £20{,}000$

Policy B, like with Policy A, has a positive NMB and, therefore, implementing it would result in an increase in social welfare (as defined by the SWF). However, unlike with Policy A, Policy B involves an increase in the amount of health produced by the health care sector, and a decrease in overall consumption.

As with Policy A, let us now consider whether a transfer is possible from health care to consumption so that neither sector is worse off after the introduction of Policy B. As Policy B results in a consumption cost of £100,000, a transfer of £100,000 from the health care sector to consumption is required for it to be at least as well off as before the introduction of the policy. However, such a transfer would result in a loss of 5 units of health to the health care sector, outweighing the benefit of the initial policy (2 units of health), thereby making the health care sector worse off. It would also result in a reduction in social welfare compared to before the introduction of the policy.

8) $v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) + v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) - \Delta c_c$

9) $60{,}000\left(2 - 0 - \frac{£100{,}000}{£20{,}000}\right) + 0 - £100{,}000 + £100{,}000$

10) $60{,}000(2-5) + 0 = \ -£180{,}000$

As can be seen from (10) the transfer looks very undesirable as it results in a large decrease in social welfare (-£180,000 compared to £20,000 immediately following the introduction of Policy B). Again, this is driven by the mismatch in the value/productivity of a pound spent in the health sector compared to consumption.

Example 3- Health benefits, education losses and no impact on consumption

A new policy intervention, Policy C, produces a gain of 2 units of health, no change in health care costs, no loss of education outcomes, an increase in education costs of £40,000 and no change in consumption. The cost-effectiveness threshold of the health sector is £20,000 per unit of health and the willingness to give up consumption for a unit of health is £60,000. The cost-effectiveness threshold for the education sector is £20,000 per unit of education, and the willingness to give up

consumption for a unit of education is £40,000. Table 4 contains the parameter values for Policy C, consumption can be ignored as there is no impact on the sector.

Δh	2 units of health
Δc_h	£0
v_h	£60,000 per unit of health
k_h	£20,000 per unit of health
Δe	0 units of education
Δc_e	£40,000
v_e	£40,000 per unit of education
k_e	£20,000 per unit of education
$\left(\Delta h - \frac{\Delta c_h}{k_h}\right)$	2 units of health
$v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right)$	£120,000
$\left(\Delta e - \frac{\Delta c_e}{k_e}\right)$	-2 units of education
$v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right)$	-£80,000

Table 4- Parameter values for Policy C- Health benefits, education losses and no impact on consumption

The NMB for the new policy is therefore as follows:

11) $v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) + v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) - \Delta c_c$

12) $60{,}000(2-0) + 40{,}000\left(0 - \frac{£40{,}000}{£20{,}000}\right) - 0 = £120{,}000 - £80{,}000 = £40{,}000$

Unlike with Policies A and B, with the introduction of Policy C both of the budget constrained government sectors are affected. The policy results in an increase in health produced by the health care sector but a decrease in education produced by the education sector. Overall the introduction of Policy C results in a positive NMB and, therefore, introducing it would result in an increase in social welfare (as defined by the explicit SWF).

Let us now consider whether the health care sector can compensate the education sector for the losses inflicted as a result of Policy C. The education section loses 2 units of education and, given $k_e$is £20,000 per unit of education, a transfer payment of £40,000 from health to education is required for the education sector to be no worse off than before the introduction of Policy C. Such a transfer

would result in a loss of 2 units of health care to the health care sector, nullifying the gain of 2 units of health that Policy C introduced. Therefore, neither sector would be worse off than before the introduction of Policy C but neither would they be better off. However, if we consider the impact that such a transfer would have on the overall societal benefit, the NMB, we can observe that such a transfer would result in a loss in NMB compared to immediately following the introduction of Policy C. This is shown in equations 13 to 15:

13) $v_h\left(\Delta h - \frac{\Delta c_h}{k_h}\right) + v_e\left(\Delta e - \frac{\Delta c_e}{k_e}\right) - \Delta c_c$

14) $60{,}000\left(2 - 0 - \frac{£40{,}000}{£20{,}000}\right) + 40{,}000\left(0 - \frac{£40{,}000}{£20{,}000} + \frac{£40{,}000}{£20{,}000}\right) - 0$

15) $0 - 0 = 0$

As with Policy B, a transfer is not desirable because the value/productivity of a pound spent in health care is higher than that spent in education (i.e. the relative consumption value of a unit of health compared to the cost of producing it is higher than for education ($\frac{v_h}{k_h} > \frac{v_e}{k_e}$)). Such a difference between value/productivity between government sectors has previously been referred to as the relative underfunding of one government sector to another [3].