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The Normative Analysis of (Agricultural) Policy: A General Framework and Review

David S. Bullock*), Klaus Salhofer), Jukka Kola***)**

Since agricultural economics is mainly an applied science, assessing, comparing, or ranking agricultural programs has a long tradition (Griliches, Nerlove, Wallace). Whenever researchers try to measure the social costs of a program or compare the efficiencies of alternative programs, they must impose value judgment criteria, and hence are conducting normative analysis. Here we provide a general framework of normative policy analysis. With this framework we attempt to unify forty years of literature on the normative analysis of agricultural policy and provide a "big picture" of the development and accomplishments of this area of research.

Normative policy analysis is built upon three principals of social value judgment: *welfarism, the Pareto principal,* and *distributive equity*. We present a general framework of normative policy analysis based on welfarism. Within this framework we show how a government's ability to create, destroy and redistribute welfare is constrained by resource scarcity and the economic behavior of individuals. Additionally, we discuss how policy analysis is limited by researchers' abilities to identify and model the ability of government to create, destroy and redistribute welfare. It is well known that the Pareto principle does not provide a complete social preference ordering. We discuss how in efforts to complete a social preference ordering, many researchers have assumed various forms of distributive equity

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criteria, either imposing these criteria as constraints to social welfare function (SWF) maximization problems, or directly incorporating these criteria in the functional form of the SWF. Our framework provides a clearer view of the obstacles policy analysts face, and enables us to discuss directions for future research in normative policy analysis.

Welfarism, the Constraints of Policy, and the Constraints of Policy Analysis

Government can influence an economic system in many ways. Alternative government actions imply alternative outcomes for individuals and hence society. The goal of normative policy analysis is to obtain a social ordering of these alternative actions. A basic value judgment criterion (VJC) commonly assumed in normative policy analysis is *welfarism* (Sen, 1977), defined as

(VJC.1) $\langle$The ranking of social states depends solely on the welfare of individuals.$\rangle$.

No additional information (about individual liberty, for example) is needed to rank policy outcomes. Social values, such as liberty, count because of the contribution they make to individual welfare. Though not undisputed, this basic value judgment criterion is widely agreed upon among economists.

Following this welfaristic view of society, normative policy analysis is frequently conducted by modeling government as having some number *m* policy instruments to create, destroy, or redistribute welfare among some number *n* individuals (Bullock, 1994). Formally, let $\mathbf{x} = (x_1, . . . , x_m)$ be a vector of policy instrument variables available to government. For example, policy instrument variable x_1 could be an import tariff, x_2 a production subsidy, x_3 an environmental regulation, etc. Each of these policy instrument variables can take on different specific values, and we denote a specific policy instrument value with a superscript, e.g. x_1^A is an import tariff of $0.25 per unit, x_2^A is a production subsidy of $0.50 per unit, etc. If a policy instrument is not used by government we denote it by superscript *0*, e.g. x_1^0 is an import tariff of $0.00 per unit. A specific government *policy* is described by the values of all available policy instruments, e.g. $\mathbf{x}^A = (x_1^A, x_2^A, \ldots, x_m^A)$. One policy often of interest is "nonintervention," here denoted by $\mathbf{x}^0 = (x_1^0, x_2^0, \ldots, x_m^0)$, which is the policy of simply not using any of the available instruments.

Each government policy affects the welfare of some number *n* individuals, as described by the vector $\mathbf{u} = (u_1, u_2, \ldots, u_n)$. In the extreme case *n* is the number of people in society. For tractability and/or because interest groups are often assumed to play an important role in the social decision making process, policy analysts usually aggregate individuals into groups. The agricultural economics literature has often focused on the welfare of farmers, which we denote u_1. We use $u_2, \ldots, u_n$ to denote the welfare of interest groups of nonfarmers, e.g. consumers, taxpayers, input suppliers, etc. Different policies imply different welfare levels (policy outcomes) for interest groups and society, e. g. $\mathbf{x}^A$ implies $\mathbf{u}^A = (u_1^A, u_2^A, \ldots, u_n^A)$, $\mathbf{x}^B$ implies $\mathbf{u}^B = (u_1^B, u_2^B, \ldots, u_n^B)$, and the nonintervention policy $\mathbf{x}^0$ implies the free market outcome $\mathbf{u}^0 = (u_1^0, u_2^0, \ldots, u_n^0)$.

Though government has various policy instruments to derive various policy outcomes, what government can do in creating, destroying, or redistributing welfare is limited by the realities economic markets.[1] In economic models limits imposed by economic market realities are implicit in the model parameters (typically, for example, supply and demand elasticities). Ultimately, these parameters reflect the way economists model human behavior (with preferences and maximizing behavior) and the technological relationship between scarce resources and production. Let $\mathbf{b} = (b_1, \ldots, b_z)$ be such a vector of model parameters. Then groups' welfare measures are usually (explicitly or implicitly) functions of government policy and market conditions: $\mathbf{u} = (u_1, u_2, \ldots, u_n) = (h_1(\mathbf{x}, \mathbf{b}), h_2(\mathbf{x}, \mathbf{b}), \ldots, h_n(\mathbf{x}, \mathbf{b})) = \mathbf{h}(\mathbf{x}, \mathbf{b})$.

Assuming modeled market conditions are described by **b**', that some specific policy $\mathbf{x}^A = (x_1^A, \ldots, x_m^A)$ is considered, and that some specific welfare measure $\mathbf{h}(\cdot)$ is used, a specific modeled policy outcome $\mathbf{u}^A = (u_1^A, u_2^A, \ldots, u_n^A) = (h_1(\mathbf{x}^A, \mathbf{b}'), h_2(\mathbf{x}^A, \mathbf{b}'), \ldots, h_n(\mathbf{x}^A, \mathbf{b}')) = \mathbf{h}(\mathbf{x}^A, \mathbf{b}')$ can be obtained.

Government's ability to create, destroy and redistribute welfare is also limited since government can choose only from a limited set of policies, for not all values of **x** are technically feasible. It makes little sense, for instance, to think about a negative import quota, or about a per-unit production subsidy greater than the gross domestic product. Given some vector of policy instruments $\mathbf{x} = (x_1, \ldots, x_m)$ modeled as available, we will denote $X \subseteq R^m$ as the model's *set of technically feasible policies*.[2] Often an analyst does not consider the effects of all the policies in his or her model's set of technically feasible policies. We will denote the *set of examined policies* as X', where of course $X' \subseteq X$.

The examination of how government is technically constrained in the creation, destruction, and redistribution of economic welfare has been of primary interest to normative agricultural policy analysts over the last forty years. Welfarism implies that to conduct such an examination, it is necessary to find for each policy in the set of examined polices X' the values of the $\mathbf{h}(\mathbf{x}, \mathbf{b})$ vector of functions, which describes how policy affects interest group welfare. Therefore all studies conducting such examinations have faced three challenges: (i) to define and estimate the parameters **b** of a model of economic markets; (ii) to obtain a welfare measure $\mathbf{h}(\cdot)$; and (iii) to choose a set of policies to be examined, X'. Challenge (i) above is of course the focus of the study of econometrics, and (ii) is the focus of applied welfare economics. Here we focus on (iii) to discuss how the agricultural economics literature covering the effects of government policy on welfare has developed largely by broadening X', the set of examined policies.

Finding the welfare effects of a policy: mapping from policy space to interest group welfare space

The simplest case: mapping when X' is discrete

The basic framework most often used in the economics literature to map from policy space to interest group welfare space follows the pioneering work of Marshall. This basic framework uses an econometrically estimated model of agricultural markets to obtain **b**, and then examines a set of policies X′ which is discrete, for example $X' = \{\mathbf{x}^A, \mathbf{x}^B, \mathbf{x}^C, \mathbf{x}^0\}$. (In this example normative comparison is made among four separate policies, one of them the nonintervention policy).[3] Typically, geometric areas behind estimated supply and demand curves (producer and consumer surpluses) are used to obtain the values of $\mathbf{h}(\mathbf{x}^i, \mathbf{b})$ with i = A, B, C, 0.

In terms of our general framework this standard procedure of normative policy analysis can be represented in figure 1 for the example of $m = 2$ policy instruments (x_1 is a target price and x_2 a fertilizer tax/subsidy) and $n = 2$ interest groups (farmers and consumers-taxpayers or nonfarmers). The left-hand panel shows the policy instrument space. Four policies, $\mathbf{x}^A$, $\mathbf{x}^B$, $\mathbf{x}^C$, $\mathbf{x}^0$ are depicted. Policy $\mathbf{x}^A$ sets the target price at some positive level x_1^A, and does not use the fertilizer tax/subsidy (i.e., sets it at $x_2^0 = 0$), so $\mathbf{x}^A = (x_1^A, x_2^0)$. Policy $\mathbf{x}^B$ does not use the target price and sets some positive level x_2^B for the fertilizer tax, so $\mathbf{x}^B = (x_1^0, x_2^B)$. Policy $\mathbf{x}^C$ sets the target price at a positive level x_1^C and simultaneously sets a positive fertilizer tax x_2^C, so $\mathbf{x}^C = (x_1^C, x_2^C)$. Nonintervention policy, $\mathbf{x}^0 = (x_1^0, x_2^0)$ uses neither of the two instruments. We will call policies like $\mathbf{x}^A$ and $\mathbf{x}^B$ that use only one instrument *simple policies*. We will call policies like $\mathbf{x}^C$ that use multiple instruments simultaneously *combined policies*.

Using a supply curve S(P, **b**) and a demand curve D(P, **b**), where the notation implies that a change in market conditions **b** may alter the shapes of supply and demand, the welfare effects of each examined policy are estimated by geometric areas in the supply-demand-diagram in the middle panel.[4] In the case of policy $\mathbf{x}^A$, for example, a target price of x_1^A results in a consumer price of e, Marshallian consumer surplus of CS^A = area gde, producer surplus of PS^A = area x_1^Acf, and taxes of TX^A = area x_1^Acde. The sizes of all three of these geometric areas depend on market conditions **b** and the chosen policy $\mathbf{x}^A$.[5] Similarly, the welfare effects of all other policies of the discrete set $X' = \{\mathbf{x}^A, \mathbf{x}^B, \mathbf{x}^C, \mathbf{x}^0\}$ can be estimated from geometric areas in the supply-demand diagram. Using the $\mathbf{h}(\mathbf{x}, \mathbf{b})$ thusly estimated and some additional value judgment criteria described later, it is possible to obtain a social preference ordering of such a discrete set of examined policies.

Griliches, Nerlove, and Wallace introduced this basic framework to analyze a discrete set of simple agricultural policies. Josling (1969) and Dardis and Dennison were early studies of the welfare effects of a discrete set of combined agricultural policies.[6] Since then, various studies have conducted normative policy analysis by comparing the welfare effects of a discrete set of policies (e.g. Otsuka and Hayami; Lichtenberg and Zilberman; Babcock, Carter and Schmitz; Constantine, Alston, and Smith).[7]

Josling (1974) recommended mapping the market space model typified by the middle panel of figure 1 into interest groups welfare space to gain further insights when discussing the choice of policy instruments.[8] The right-hand panel of figure 1 shows the welfare space, of two interest groups (farmers, consumer-taxpayers) and what government can and cannot do to interest group welfare if it has available policies $\mathbf{x}^A$, $\mathbf{x}^B$, $\mathbf{x}^C$ and $\mathbf{x}^0$. The point $\mathbf{u}^A = \mathbf{h}(\mathbf{x}^A, \mathbf{b}) = (PS^A, CS^A - TX^A)$, is found by the calculation of geometric areas in the middle panel. Similarly, points $\mathbf{u}^B = \mathbf{h}(\mathbf{x}^B, \mathbf{b})$, $\mathbf{u}^C = \mathbf{h}(\mathbf{x}^C, \mathbf{b})$, and $\mathbf{u}^0 = \mathbf{h}(\mathbf{x}^0, \mathbf{b})$ can be calculated using the supply and demand model as well, and mapped as shown. The examination of these policy outcomes $\mathbf{u}^A$, $\mathbf{u}^B$, $\mathbf{u}^C$, and $\mathbf{u}^0$ might prove helpful in judging between policies $\mathbf{x}^A$, $\mathbf{x}^B$, $\mathbf{x}^C$, and $\mathbf{x}^0$, as will be discussed later.

Broadening the set of examined policies: X' continuous

In general, a model's set of technically feasible policies X is continuous, meaning that if a policy $(x_1^A, \ldots, x_n^A)$ can be imposed, then so can some $(x_1^A + e_1, \ldots, x_n^A + e_n)$, where $e_1, \ldots, e_n$ are arbitrarily small numbers in absolute value. Recognizing that when X′ is discrete only a very partial view of what is technically feasible for government is provided, Josling (1974) observed that by continuously changing the level of the instrument of a simple policy a *curve* could be mapped in interest group welfare space and thus provide a broader picture of how government is constrained in creating, destroying, or redistributing welfare using a single policy instrument. Gardner (1983) took up Josling's basic idea and presented it in a more systematic framework, calling Josling's curves *surplus transformation curves* (STCs).

The mapping procedure which produces Josling-Gardner surplus transformation curves assumes that X′ is made up of *line segments* in R^m, as is illustrated in the left-hand panel of figure 2. In figure 2, point e shows the nonintervention policy (x_1^0, x_2^0).[9] Function $\mathbf{h}(\mathbf{x}, \mathbf{b})$ maps point e onto the nonintervention policy outcome $\mathbf{u}^0$ at point E in the right-hand panel. Point d shows a simple policy (x_1^A, x_2^0) which is mapped by $\mathbf{h}(\mathbf{x}, \mathbf{b})$ onto point D in the right-hand panel. The thick line segment between e and d shows a set of simple policies in which x_1 is used and x_2 is not used. Using $\mathbf{h}(\mathbf{x}, \mathbf{b})$ to map line segment ed onto interest group welfare space creates a curve passing through points E and D, perhaps shaped like $STC(x_1, x_2^0, \mathbf{b})$ in the right-hand panel. $STC(x_1, x_2^0, \mathbf{b})$ is the curve made up of points $(h_1(x_1, x_2^0, \mathbf{b}), h_2(x_1, x_2^0, \mathbf{b}))$ generated parametrically by changing x_1 continuously from x_1^0 to x_1^A, maintaining $x_2 = x_2^0$ all the while. Similarly, $STC(x_1^0, x_2, \mathbf{b})$ is the locus of points $(h_1(x_1^0, x_2, \mathbf{b}), h_2(x_1^0, x_2, \mathbf{b}))$ generated parametrically by changing x_2 continuously from x_2^0 to x_2^B, maintaining $x_1 = x_1^0$ all the while. Surplus transformation curves usefully depict the welfare effects of policy *instruments,* as opposed to simply providing a view of the effects of discrete *policies*. For example, in figure 2 STC(x_1, x_2^0, **b**) shows what government can and cannot do if it has available policy instrument x_1 only. Studies using this framework are for example Just, Gardner (1983, 1985, 1987, 1991), and de Gorter, Nielson, and Rausser.

Bullock (1992) followed Gardner's (1983) approach to show how multiple surplus transformation curves can be combined to study the welfare effects of combined policies. Bullock's procedure is illustrated in figure 2, where point g in the left-hand panel represents a combined policy (x_1^C, x_2^C), and point G in the right-hand panel shows the policy outcome of this policy. Because two policy instruments are used in policy (x_1^C, x_2^C), the welfare effects of the combined policy can be traced along two surplus transformation curves; changing policy from nonintervention (x_1^0, x_2^0) to (x_1^C, x_2^0) in the left-hand panel changes welfare from point E to point F along STC(x_1, x_2^0, **b**) in the right-hand panel. Then changing policy from (x_1^C, x_2^0) to (x_1^C, x_2^C) keeping $x_1 = x_1^C$ constant in the left-hand panel changes welfare from point F to point G along STC(x_1^C, x_2, **b**) in the right-hand panel. Kola (1991, 1993), Gardner (1992), Isosaari, and Garcia and Lothe employed similar techniques.

A complete view of what a model's government can and cannot do in creating, destroying, or redistributing welfare is represented in figure 2. Given the set of technically feasible policies X in the left-hand panel and the constraints imposed by market conditions represented by **b**, F(**b**) in the right-hand panel represents the model's *set of technically feasible policy outcomes*. F(**b**) is the mapping of the model's set of technically feasible policies X onto the model's interest group welfare space (Bullock, 1995, p. 1239). Following Bullock (1994) F(**b**) is defined as

$$F(\mathbf{b}) = \{\mathbf{u} \mid \mathbf{u} = \mathbf{h}(\mathbf{x}, \mathbf{b}), \mathbf{x} \in X\}. \qquad (1)$$

Note that sets of simple policies, such as line segments ec and ed, are subsets of X.

Since the STCs result from mapping subsets of X onto interest group welfare space, then the STCs must be contained in F(**b**). Note also that many technically feasible policy outcomes, such as at point G, can only be obtained by way of combined policies.

The Pareto Principle and Pareto Efficiency

Having analyzed government's abilities to influence the social state, and given the basic value judgment criterion of welfarism, we can discuss how to rank feasible policies using additional value judgment criteria. A value judgment criterion commonly accepted among economists is the *Pareto principle*. According to this value judgment criterion, a policy $\mathbf{x}^A$ is preferred (or *Pareto superior*) to a policy $\mathbf{x}^B$ if $\mathbf{x}^A$ makes at least one person (or group) better off than he or she is under $\mathbf{x}^B$, while no one is made worse off. That is, under the Pareto principle

(VJC.2) $$\left\langle \begin{array}{l} \text{for any } \mathbf{x}^A, \mathbf{x}^B \in X, \mathbf{x}^A \succ \mathbf{x}^B \Leftarrow h_i(\mathbf{x}^A, \mathbf{b}) \geq h_i(\mathbf{x}^B, \mathbf{b}), i = 1, 2, \ldots, n, \\ \text{with at least one inequality strict} \end{array} \right\rangle.$$

A policy $\mathbf{x}^*$ is said to be *Pareto efficient* (or Pareto optimal) if there is no technically feasible policy Pareto superior to $\mathbf{x}^*$. As in figure 2, we denote a model's set of Pareto efficient policies by XE(**b**), where the *Pareto frontier* P(**b**) is the result of using **h**(**x**, **b**) to map XE(**b**) onto interest group welfare space. Clearly P(**b**), the "northeast" boundary of the set of feasible policy outcomes F(**b**), is of interest to policy analysts.

In the agricultural economics literature of the past decade, the importance of the Pareto frontier as a limit to what government can do in the creation and redistribution of welfare has been considered by several researchers in independent work. Just (pp. 58, 130) and Alston and Hurd used a graphical technique to derive a Pareto frontier for a simple model of two interest groups (farmers and consumers-taxpayers) and two policy instruments (a production quota and a production subsidy).

Innes and Rausser numerically derived one point of the Pareto frontier by maximizing a social welfare function. Alston, Carter, and Smith formalized the approach of Just and Alston and Hurd by solving a problem in which two policy instruments are chosen to maximize consumer-taxpayer welfare subject to a predetermined change in farm welfare from the nonintervention level (or what is the same a predetermined level of farm welfare). The problem they solved may be written in our paper's notation as,

$$\max_{\mathbf{x} \in X'} \left\{ h_2(\mathbf{x},\mathbf{b}) : h_1(\mathbf{x},\mathbf{b}) = u^{pre} \right\}, \tag{2}$$

where u^{pre} is the predetermined level of farm welfare. As the authors note (footnote 7, p. 1002), their approach may be thought of as a procedure for defining an "efficient surplus transformation curve" (a Pareto frontier) for a given set of available policy instruments. In a similar analysis, Salhofer found Pareto efficient policies by minimizing social costs (which is equivalent to maximizing social welfare) subject to a given change of producer welfare. Unlike Alston, Carter, and Smith , Salhofer developed and presented an STC-type diagram in interest group welfare space.

Bullock (1991, 1996) developed a technique for finding Pareto efficient policies and policy outcomes on the Pareto frontier for the general *m*-policy instrument, *n*-interest group model. Bullock (1991) formally proved that a policy $\mathbf{x}^*$ is Pareto efficient if and only if it solves simultaneously the *n* constrained maximization problems:

$$\max_{\mathbf{x} \in X'} \left\{ h_i(\mathbf{x},\mathbf{b}) : h_j(\mathbf{x},\mathbf{b}) \geq h_j(\mathbf{x}^*,\mathbf{b}) \right\}, \; i = 1, 2, \ldots, n; \quad j = 1, 2, \ldots, n; \quad j \neq i. \tag{3}$$

Bullock (1994, 1996) briefly discussed how the envelope theorem implies that the Pareto frontier envelopes all Josling-Gardner surplus transformation curves, and how at points along the Pareto frontier all surplus transformation curves are tangent to a common hyperplane.[10]

Completing the Social Preference Ordering: Distributive Equity and Social Welfare Functions

The Pareto principle is a weak criterion for value judgment. Indeed, this weakness accounts for its wide acceptance as a tool for establishing a social preference ordering of policies. For the Pareto principle does not establish a complete ordering; under the Pareto principle policy $\mathbf{x}^A$ is (Pareto) noncomparable to $\mathbf{x}^B$ if $h_i(\mathbf{x}^A, \mathbf{b}) > h_i(\mathbf{x}^B, \mathbf{b})$, for at least one $i \in \{1, 2, \ldots, n\}$, and $h_j(\mathbf{x}^A, \mathbf{b}) < h_j(\mathbf{x}^B, \mathbf{b})$, for at least one $j \in \{1, 2, \ldots, n\}$. To obtain a complete social preference ordering of X, additional value judgment criteria must be employed. There is little doubt that human behavior is affected by equity considerations (Sen, 1987, 1992). In efforts to complete the social preference ordering, agricultural economists have assumed various forms of distributive equity criteria, either imposing these criteria as constraints to an SWF maximization problem, or directly incorporating these criteria in the functional form of the SWF.

A Bergson-Samuelson social welfare function *W* assigns numerical values to policy outcomes: $W\colon \mathbf{u} \to R$. Since the arguments of an SWF are interest groups welfare levels $\mathbf{u}$, clearly SWFs are welfaristic constructs, consistent with (VJC.1). By using an SWF one can obtain a complete social preference ordering of X, since W assigns a number to every technically feasible policy outcome ($W\colon F(\mathbf{b}) \to R$). A policy $\mathbf{x}^A$ which results in a higher (equal, lower) SWF level W is socially superior (equal, inferior) to policy $\mathbf{x}^B$ with a lower (equal, higher) SWF level: $[\mathbf{x}^A \underset{\prec}{\overset{\succ}{-}} \mathbf{x}^B \Leftrightarrow W(\mathbf{h}(\mathbf{x}^A, \mathbf{b}) \gtreqless W(\mathbf{h}(\mathbf{x}^B, \mathbf{b})]$. Under the social welfare function criterion, a policy $\mathbf{x}^*$ is said to be socially optimal for a model if it maximizes the SWF given the constraints outlined in the last section, that is, if it solves $\max_{\mathbf{x}\in X} W(\mathbf{h}(\mathbf{x}, \mathbf{b}))$, or equivalently, $\max_{\mathbf{u}\in F(\mathbf{b})} W(\mathbf{u})$. Provided that the SWF is assumed increasing in **u**, (i.e., *ceteris paribus* society is assumed to benefit if an interest group becomes better off), then if $\mathbf{x}^*$ maximizes the SWF, $\mathbf{x}^*$ is Pareto efficient (see Varian, p. 333), but not necessarily vice versa.

In applied work the most common specific functional form of a Bergson-Samuelson SWF and hence the most common value judgment criterion used to derive a complete ranking of social states is a utilitarian or Benthamite SWF $W(u_1, u_2, \ldots, u_n) = u_1 + u_2 + \ldots + u_n = h_1(\mathbf{x}, \mathbf{b}) + h_2(\mathbf{x}, \mathbf{b}) + \ldots + h_n(\mathbf{x}, \mathbf{b})$. The value judgment criterion for finding the "best" policy $\mathbf{x}^*$ implied by the Benthamite SWF is,

$$\text{(VJC.3-1)} \qquad \left\langle \mathbf{x}^* \text{ solves } \max_{\mathbf{x}\in X'} W(\mathbf{h}(\mathbf{x}, \mathbf{b})) = h_1(\mathbf{x}, \mathbf{b}) + h_2(\mathbf{x}, \mathbf{b}) + \ldots + h_n(\mathbf{x}, \mathbf{b}) \right\rangle.$$

Instead of using the maximum sum of welfare to find $\mathbf{x}^*$ it is also common to use the minimum social costs (or deadweight loss) value judgment criterion (Hotelling; Harberger), where social cost (SC) are defined as: $SC(\mathbf{x}, \mathbf{b}) = -[\Delta u_1 + \Delta u_2 + \ldots + \Delta u_n] = -([h_1(\mathbf{x}, \mathbf{b}) - h_1(\mathbf{x}^0, \mathbf{b})] + [h_2(\mathbf{x}, \mathbf{b}) - h_2(\mathbf{x}^0, \mathbf{b})] + \ldots + [h_n(\mathbf{x}, \mathbf{b}) - h_n(\mathbf{x}^0, \mathbf{b})])$. However, it is easily shown that minimizing SC implies the same social preference ordering as does maximizing the Benthamite SWF since $-SC(\mathbf{x}, \mathbf{b}) = h_1(\mathbf{x}, \mathbf{b}) + h_2(\mathbf{x}, \mathbf{b}) + \ldots + h_n(\mathbf{x}, \mathbf{b}) - E$, where $E = h_1(\mathbf{x}^0, \mathbf{b}) + h_2(\mathbf{x}^0, \mathbf{b}) + \ldots + h_n(\mathbf{x}^0, \mathbf{b})$ is the sum of nonintervention welfare levels, and is a constant.

While the utilitarian value judgment criterion (VJC.3-1), completes the social preference ordering of policies, ranking policy options by summing welfare levels is based on the assumption that increasing the welfare of a wealthy person by one unit is of equal social value as is increasing the welfare of a poor person by one unit. Hence, (VJC.3-1) has been criticized by many notable agricultural economists over a long period of time for failing to consider distributive equity (Nerlove; Josling, 1974; Rausser; Gardner, 1983; Just). However, (VJC.3-1) still remains the most often used value judgment criterion (e.g. Otsuka and Hayami; Lichtenberg and Zilberman; Leu, Schmitz, and Knutson; Murphy, Furtan, and Schmitz).

Putting constraints on an SWF to implement equity considerations

Nerlove and Wallace were among the first to use welfare economics to assess agricultural policies. Also, because they were partly dissatisfied with (VJC.3-1), they were the first to depart from the utilitarian value judgment criterion. Nerlove wrote (p. 223): "If we take as an axiom that government programs are designed to benefit the producer, the benefit to producers resulting from a program becomes an important magnitude." Nerlove and Wallace first tried to capture this by fixing the instrument levels so that all examined policies guaranteed the same predetermined "fair" producer price level (or equally, the same increase in price level compared to the nonintervention price). So, the social decision making problem underlying their work can be represented as finding a policy $\mathbf{x}^*$ which meets the following set of value judgment criteria:

$$\text{(VJC.3-2)} \qquad \left\langle \begin{array}{c} \mathbf{x}^* \text{ solves } \max\limits_{\mathbf{x}\in X'} W(\mathbf{h}(\mathbf{x},\mathbf{b})) = h_1(\mathbf{x},\mathbf{b}) + h_2(\mathbf{x},\mathbf{b}) + \ldots + h_n(\mathbf{x},\mathbf{b}) \\ \mathbf{x}^* \text{ results in a predetermined "fair" price} \end{array} \right\rangle .$$

Thus, Nerlove and Wallace's method implied the assumption of a Benthamite SWF maximized subject to the distributive equity constraint that a predetermined "fair" price be achieved.

Wallace (p. 586) recognized that the predetermined "fair" price value judgment criterion may be misleading if the goal of a policy is to increase total farm revenue. Hence in essence he suggested the use of a predetermined level of total farm revenue (or equally changes in total farm revenue) as a value judgment criterion to replace the predetermined price value judgment criterion. In the last part of his paper Wallace argued that "[n]either of the two bases for comparison are proper if one assumes the goal of agricultural policy to be one of increasing farmers' disposable income" (p. 589), and "[p]erhaps a more relevant basis for comparing two plans is for equal changes in producer surplus" (p. 586). So in essence Wallace used an alternative set of value judgment criteria which can be stated in very general terms as

$$\text{(VJC.3-3a)} \quad \left\langle \begin{array}{l} \mathbf{x}^* \text{ solves } \max_{\mathbf{x} \in X'} W(\mathbf{h}(\mathbf{x},\mathbf{b})) = h_1(\mathbf{x},\mathbf{b}) + h_2(\mathbf{x},\mathbf{b}) + \ldots + h_n(\mathbf{x},\mathbf{b}) \\ h_i(\mathbf{x}^*,\mathbf{b}) = u_i^{pre}, \text{ the predetermined welfare level of group i} \end{array} \right\rangle,$$

where in Wallace's case i = 1. Hence, Wallace imposed distributive equity while attempting to maintain greater consistency with the welfarism criterion (VJC.1). Thus, from the point of view of welfarism, (VJC.3-3a) improves on (VJC.3-2), since producer price (and also total producer revenues) are probably poorer measures of producer welfare than is the geometric area "producer surplus" below the price and above the supply curve.

Examples of studies using (VJC.3-3a) with i = 1 are Josling (1974), Alston and Hurd, de Gorter and Meilke, Alston, Carter, and Smith, Gisser, de Gorter and Swinnen, Moschini and Sckokai, and Salhofer. Josling (1974, p. 245) also discussed a predetermined consumer welfare level value judgment criterion-- the case where i in (VJC.3-3a) represents consumers.

When *n* - 1 of the *n* welfare levels are predetermined, the same ranking is derived when these predetermined welfare levels are combined with the Pareto principle instead of with an SWF. Hence, we could have equivalently described (VJC.3-3a) as

$$\text{(VJC.3-3b)} \quad \left\langle \begin{array}{c} \mathbf{x}^* \text{ is Pareto efficient} \\ h_i(\mathbf{x}^*, \mathbf{b}) = u_i^{pre}, \ i = 1, 2, \ldots, n-1 \end{array} \right\rangle .$$

This is illustrated in figure 3 for the case of two interest groups. Only some polices result in a predetermined farm welfare. Calling the set of such policies $X_{PW}(\mathbf{b}) \subseteq X$, using the $\mathbf{h}(\mathbf{x}, \mathbf{b})$ function to map $X_{PW}(\mathbf{b})$ onto interest group welfare space results in a line segment like the one labeled $F_{PW}(\mathbf{b}) \subseteq F(\mathbf{b})$. Since the subset $F_{PW}(\mathbf{b})$ has only one Pareto efficient solution, this solution is obtained whether the Pareto principle (as in (VJC-3.3b)) or maximization of some form of an SWF is applied (as with the Benthamite SWF in (VJC-3.3a)).

Nerlove also used an alternative value judgment criterion to rank policies. For any policy $\mathbf{x}$, he defined relative social cost (RSC) as

$$RSC = \frac{SC}{\Delta u_1} = -\frac{\left(\left[h_1(\mathbf{x},\mathbf{b}) - h_1(\mathbf{x}^0,\mathbf{b})\right] + \left[h_2(\mathbf{x},\mathbf{b}) - h_2(\mathbf{x}^0,\mathbf{b})\right] + \ldots + \left[h_n(\mathbf{x},\mathbf{b}) - h_n(\mathbf{x}^0,\mathbf{b})\right]\right)}{\left[h_1(\mathbf{x},\mathbf{b}) - h_1(\mathbf{x}^0,\mathbf{b})\right]}, \quad (4)$$

and called a policy preferable to another if the former has lower RSC given a predetermined "fair" price. Josling (1969) and Dardis and Dennison first compared policies using RSC combined with the more appropriate constraint of a predetermined farm welfare. As with the SC value judgment criterion, it is easily shown that minimizing the RSC implies the same social preference ordering as does maximizing the SWF: $W(u_1, u_2, \ldots, u_n) = (u_1 + u_2 + \ldots + u_n - E)/(u_1 - u_1^0)$. So, this social decision making problem can be represented as finding a policy $\mathbf{x}^*$ which meets the following set of value judgment criteria:

$$\text{(VJC.3-3c)}\quad \left\langle \begin{array}{c} \mathbf{x}^* \text{ solves } \max_{\mathbf{x}\in X'} W\big(\mathbf{h}(\mathbf{x},\mathbf{b})\big) = \dfrac{h_1(\mathbf{x},\mathbf{b}) + h_2(\mathbf{x},\mathbf{b}) + \ldots + h_n(\mathbf{x},\mathbf{b}) - E}{h_i(\mathbf{x},\mathbf{b}) - h_i(\mathbf{x}^0,\mathbf{b})} \\ h_i(\mathbf{x}^*,\mathbf{b}) = u_i^{pre} \end{array} \right\rangle,$$

where in their studies i = 1. The ranking derived from (VJC.3-3c) is identical to that derived from (VJC.3-3a), since E, $h_i(\mathbf{x}^0, \mathbf{b})$, and $h_i(\mathbf{x}, \mathbf{b})$ are constants.

Josling (1974) as well as Gardner (1983, p. 228-229) also recommended a predetermined ratio of group welfare levels value judgment criterion, very generally defined as

$$\text{(VJC.3-4a)}\quad \left\langle \begin{array}{l} \mathbf{x}^* \text{ solves } \max_{\mathbf{x}\in X'} W\big(\mathbf{h}(\mathbf{x},\mathbf{b})\big) = h_1(\mathbf{x},\mathbf{b}) + h_2(\mathbf{x},\mathbf{b}) + \ldots + h_n(\mathbf{x},\mathbf{b}) \\ \dfrac{h_i(\mathbf{x}^*,\mathbf{b})}{h_j(\mathbf{x}^*,\mathbf{b})} = r^{pre}, \text{ the predetermined ratio of welfare levels between groups} \end{array} \right\rangle,$$

where in Josling and Gardner's case i = farmers and j = nonfarmers. With this set of value judgment criteria they sought to find the highest attainable point on a fixed ray through the origin (such as at $\mathbf{u}^F$ in figure 3).

Placing distributive equity considerations directly into the SWF

Just showed that (VJC.3-4a) can also be represented by an SWF with right-angled SICs (figure 3). Such an SWF can be expressed by a Leontief-type function. The value judgment criteria (VJC.3-4a) can also be expressed as finding a policy $\mathbf{x}^*$ such that

$$\text{(VJC.3-4b)}\quad \left\langle \mathbf{x}^* \text{ solves } \max_{\mathbf{x}\in X'} W\big(\mathbf{h}(\mathbf{x},\mathbf{b})\big) = \min\{\theta_1 h_1(\mathbf{x},\mathbf{b}), \theta_2 h_2(\mathbf{x},\mathbf{b}), \ldots, \theta_n h_n(\mathbf{x},\mathbf{b})\} \right\rangle,$$

where $\theta_i/\theta_j = r^{pre}$ is the welfare distribution ratio between group i and group j. If the welfare ratio $r^{pre} = 1$ for all i, j, then (VJC.3-4b) is the Rawlsian maximin criterion (Tuomala).

Dardis (1967a, 1967b) used Nerlove's RSC alone to judge policy outcomes. Hence her value judgment criterion can be expressed as

$$\text{(VJC.3-5)} \qquad \left\langle \mathbf{x}^* \text{ solves } \max_{\mathbf{x}\in X} W(\mathbf{h}(\mathbf{x},\mathbf{b})) = \frac{h_1(\mathbf{x},\mathbf{b}) + h_2(\mathbf{x},\mathbf{b}) + \ldots + h_n(\mathbf{x},\mathbf{b}) - E}{h_i(\mathbf{x},\mathbf{b}) - h_i(\mathbf{x}^0,\mathbf{b})} \right\rangle,$$

where i = 1. More recent applications of (VJC.3-5) are Cramer et al. and Sawar and Fox.

The RSC value judgment criterion need not be consistent with the Benthamite value judgment criterion (VJC.3-2). From (VJC.3-2), the best policy of those examined is the one which results in a policy outcome on the highest contour (or "social indifference curves" (SIC)) of the unweighted linear SWF, straight lines with a slope of -1 (creating a 45° angle). Thus, in figure 4, since $SIC_2^{45^\circ}$ is higher than $SIC_1^{45^\circ}$, under (VJC.3-2) $\mathbf{u}^B$ is a policy outcome preferred to $\mathbf{u}^A$, and so $\mathbf{x}^B$ is a policy preferred to $\mathbf{x}^A$. But under the RSC criterion, since SIC_1^{RSC} is below SIC_2^{RSC}, $\mathbf{u}^A$ is preferred to $\mathbf{u}^B$, and so $\mathbf{x}^A$ is preferred to $\mathbf{x}^B$. Additionally, there are shortcomings to using the RSC value judgment criterion. First, the SWF is not defined for at any welfare outcome such that $h_i(\mathbf{x}, \mathbf{b}) = h_i(\mathbf{x}^0, \mathbf{b})$, and this of course includes the nonintervention welfare outcome. Second, since all SICs cross at $\mathbf{u}^0$ (as depicted in figure 4) the SWF only makes sense for positive welfare changes of group i. If we try to rank the policy outcomes for the whole feasible set, we get a transitivity problem. Third, since the social indifference curves are rays emanating from the nonintervention point $\mathbf{u}^0$, it is possible that the SWF will judge a Pareto inferior point as more socially valuable than a Pareto superior point. (For example, in figure 4 $\mathbf{u}^F$ is Pareto superior to $\mathbf{u}^G$, but is on a lower-valued social indifference curve.) Thus, the RSC is not necessarily consistent with the Pareto principle.

It can be shown that Gardner's measure of average transfer efficiency (ATE) defined as

ATE($\mathbf{x}$, $\mathbf{b}$) = Δu_1 / Δu_j = [h_1($\mathbf{x}$, $\mathbf{b}$) - h_1($\mathbf{x}^0$, $\mathbf{b}$)] / [h_j($\mathbf{x}$, $\mathbf{b}$) - h_j($\mathbf{x}^0$, $\mathbf{b}$)], j = 2, . . . , n implies the same ranking as Nerlove's RSC in (VJC.3.5) since ATE($\mathbf{x}$, $\mathbf{b}$) = 1/(RSC($\mathbf{x}$, $\mathbf{b}$) - 1).

Paarlberg, and Just judged policies by a linear weighted SWF:

$$\text{(VJC.3-6)} \qquad \left\langle \mathbf{x}^* \text{ solves } \max_{\mathbf{x}\in X'} W\big(\mathbf{h}(\mathbf{x},\mathbf{b})\big) = \phi_1 h_1(\mathbf{x},\mathbf{b}) + \phi_2 h_2(\mathbf{x},\mathbf{b}) + \ldots + \phi_n h_n(\mathbf{x},\mathbf{b}) \right\rangle.$$

Other applications of (VJC.3-6) were performed by Gardner (1985, 1988, 1991, 1992, 1995), Innes and Rausser, Innes, and de Gorter, Nielson, and Rausser.

Concluding Comments

We have presented a welfaristic analytical framework with which the normative policy analysis literature can be more easily understood and discussed. We have used our framework to review the development of the normative agricultural policy analysis literature, and we have shown that that development has unfolded as agricultural economists have gradually expanded X′, the set of examined policies. The literature has gone from examining a very small set of simple policies to a much broader set of policies that combine policy instruments simultaneously.

Following Josling (1974) we recommend that normative analysis be discussed in interest group welfare space, where it is convenient to show what government can and cannot do in creating, destroying, or redistributing welfare. The development of the normative policy analysis literature has been based on interest group welfare space over the past twenty-five years..[11] The literature's gradual expansion of the set of examined policies has led to a corresponding gradual expansion of the examined feasible set of policy outcomes, from welfare outcomes of a few specific policies, to Josling-Gardner surplus transformation curves, to multidimensional submanifolds of feasible policy outcomes and corresponding Pareto frontiers.

Given that government's constraints implied by the feasible set of policy outcomes are understood, it is natural next to discuss policy objectives. Pareto efficiency and distributive equity often have been proposed as policy objectives in the literature. While Pareto efficiency is a commonly accepted value judgment criterion, different methods have been used to take into account distributive equity. Since redistribution has always been a central theme in the study of agricultural policy, agricultural economists partly departed from the traditional utilitarian value judgment criterion of minimizing social costs, and tried to incorporate equity considerations. While at a glance it may seem that many different methods have been used to consider distributive equity, we show that in general all these methods can be traced back to three alternative methods consistent with welfarism and Pareto efficiency: (i) maximizing a utilitarian SWF subject to predetermined welfare levels of interest groups; (ii) maximizing a utilitarian SWF subject to predetermined welfare ratios of interest groups (or, equivalently, maximizing a Leontief-type SWF); (iii) maximizing a weighted linear SWF. In many studies, the value judgment criteria are not immediately obvious. We argue that researchers should state straight-forwardly their value judgment criteria, in the form of an SWF with or without constraints.

We advocate a more *statistical* analysis of policy as a primary direction for further research. Most studies have used "point estimates" of the market parameter vector $\mathbf{b}$ to conduct policy analysis. Since any policy outcome $\mathbf{h}(\mathbf{x}, \mathbf{b})$ depends on $\mathbf{b}$, so does the set of technically feasible policy outcomes F($\mathbf{b}$), the Pareto frontier P($\mathbf{b}$), and all surplus transformation curves. To use a point estimate of $\mathbf{b}$ to judge among policies may well be misleading, for if the standard errors of $\mathbf{b}$ are large, then any welfare measures $\mathbf{h}(\mathbf{x}, \mathbf{b})$ may be statistically unreliable. It has been standard practice in the past to conduct sensitivity analyses, assuming different "plausible" values of $\mathbf{b}$ to investigate the sensitivity of policy analysis results to changes in **b**. We suggest that new, computer-intensive statistical methods, such as bootstrapping, may be potentially useful in obtaining a fuller statistical picture of the effects of policy (Kling and Sexton; Bullock (1995); Jeong, Bullock, and Garcia, 1996a, 1996b, 1996c).

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1 We discuss only how government is constrained by economic market realities, not politics.

2 Technically feasible policies need not be politically infeasible (Bullock 1994, footnote 3).

3 Various studies in normative policy analysis try to evaluate the social costs of a policy. In terms of our framework these papers compare the nonintervention policy $\mathbf{x}^0$ to an actual or hypothetical government interventionary policy, e.g. $\mathbf{x}^A$.

4 For ease of notation throughout the rest of the paper, we do not place a superscript on **b**, but still assume that it is a vector of constant numbers rather than a vector of variables.

5 For example, say that supply and can be described as S(P, **b**) = $k_1 + k_2P$ and D(P, **b**) = $k_3 + k_4P$, where the market parameters are k_1, k_2, k_3, and k_4, and so $\mathbf{b} = (k_1, k_2, k_3, k_4)$. Then using geometric areas in figure 1 to measure the welfare of producers and consumer-taxpayers,

$$\mathbf{h}(\mathbf{x}^A, \mathbf{b}) = \left(h_1(\mathbf{x}^A, \mathbf{b}), h_2(\mathbf{x}^A, \mathbf{b})\right) = \left(PS^A, CS^A - TX^A\right)$$

$$= \left(\frac{1}{2}\left[x_1^A - \frac{k_1}{k_2}\right]\left[k_1 + k_2 x_1^A\right],\ \left[-\frac{1}{2}\frac{k_3}{k_4} - x_1^A + \frac{1}{2}\frac{(k_1 - k_3) + k_2 x_1^A}{k_4}\right]\left[k_1 + k_2 x_1^A\right] \right).$$

6 Other early applications include Johnson, Tintner and Patel, Dardis (1967a, 1967b), Welch, Peterson, French-Davis, Schmitz and Seckler, and Hushak.

7 Techniques of estimating the welfare effects $\mathbf{h}(\cdot)$ and normative policy analysis today are sometimes based on more sophisticated models taking into account multimarket effects (Just and Hueth; Just, Hueth, and Schmitz; Thurman and Wohlgenant; Bullock, 1993; Thurman; Brännlund and Kriström); or noncompetitive market structure (Just, Schmitz, and Zilberman; Wong; McCorriston and Sheldon; Peterson and Connor); or the presence of risk and uncertainty (Just et al.; Konandreas and Schmitz; Wright; Helms; Larson, 1988; Fraser; Bullock, Garcia, and Lee). Though there exist other techniques for obtaining a welfare measure $\mathbf{h}(\cdot)$ that do not calculate areas behind demand and supply curves (for example by using duality theory (Chipman and Moore; McKenzie; Cornes; Martin and Alston), using geometric areas is still most common among agricultural economists (Alston and Larson).

8 The importance of Josling's simple idea of mapping the policy outcomes into interest group welfare space is just recently being appreciated: "His 'framework' has in many ways become the 'dominant paradigm' in which [agricultural] policy is discussed" and "still echoes through the subsequent literature" (Peters, p. xix).

9 Note that at nonintervention policy (x_1^0, x_2^0) shown by point e in figure 2 is not (0, 0). This is because under nonintervention production quota is a positive number: $x_2^0 > 0$. That is, the quota is set high enough to be nonbinding, such that producers produce as much as they want.

10 Bullock and Salhofer proved that Bullock's (1991, 1996) method of solving *n* constrained optimization problems simultaneously is equivalent to simpler methods proposed by Alston, Carter, Smith, and Salhofer of solving a single constrained maximization problem only if the solution to their problem is unique.

11 In the orthodox theory of economic policy (Tinbergen; Theil), social welfare is a function of economic indicators, such as the rate of economic growth, the rate of employment, a satisfactory external trade balance, etc. However, such targets are not themselves ends but are only indicators of policy success.

The ends of policy are to influence the welfare of individuals, and hence our framework covers the "orthodox" view. In the case of agriculture, officially stated policy objectives are manifold, such as "to promote agricultural efficiency and the optimum utilization of factors of production," "to assure a fair farmer income," "to maintain vigorous and pleasant rural communities" or "to conserve the natural environment" (Winters, p. 291). Again, such objectives are desirable because they contribute to individual well-being.

References:

Alston, J. M., and B. H. Hurd. "Some Neglected Social Costs of Government Spending in Farm Programs." *Amer. J. Agr. Econ.* 72 (1990): 149-156.

Alston, J. M., and D. M. Larson. "Hicksian vs. Marshallian Welfare Measures: Why Do We Do What We Do?" *Amer. J. Agr. Econ.* 75 (1993): 764-769.

Alston, J. M., C. A. Carter, and V. H. Smith. "Rationalizing Agricultural Export Subsidies." *Amer. J. Agr. Econ.* 75 (1993): 1000-1009.

Babcock, B. A., C. A. Carter, and A. Schmitz. "The Political Economy of U. S. Wheat Legislation." *Economic Inquiry* 28 (1990): 335-353.

Bergson, A. "A Reformulation of Certain Aspects of Welfare Economics." *Quart. J. Econ.* 52 (1938): 310-334.

Brännlund, R., and B. Kriström. "Welfare Measurement in Single and Multimarket Models: Theory and Application." *Amer. J. Agr. Econ.* 78 (1996): 157-165.

Bullock, D. S. "Pareto Optimal Income Redistribution and Political Preference Functions: An Application to EC Common Agricultural Policy." Unpublished manuscript, Department of Agricultural Economics, University of Illinois, 1991.

Bullock, D. S.. "Redistributing Income Back to European Community Consumers and Taxpayers through the Common Agricultural Policy." *Amer. J. Agr. Econ.* 74 (1992): 59-67.

Bullock, D. S.. "Welfare Implications of Equilibrium Supply and Demand Curves in an Open Economy." *Amer. J. Agr. Econ.* 75 (1993): 52-58.

Bullock, D. S.. "In Search of Rational Government: What Political Preference Function Studies Measure and Assume." *Amer. J. Agr. Econ.* 76 (1994): 347-361.

Bullock, D. S.. "Are Government Transfers Efficient? An Alternative Test of the Efficient Redistribution Hypothesis." *J. Pol. Econ.* 103 (1995): 1236-1274.

Bullock, D. S.. "Pareto Optimal Income Redistribution and Political Preference Functions: An Application to EC Common Agricultural Policy." In Antle, J. and Sumner, D (eds.). *D. Gale Johnson on Agriculture, Vol. 2: Essays on Agricultural Policy in Honor of D. Gale Johnson.* Chicago: University of Chicago Press, 1996.

Bullock, D. S., and K. Salhofer. . "Measuring Social Costs of Inefficient Income Combination of Policy Instruments." Unpublished manuscript. Department of Agricultural and Consumer Economics, University of Illinois, 1995.

Bullock, D. S., P. Garcia, and Y.-K. Lee. "Measuring Producer Welfare in a Dynamic, Stochastic Framework: An Application to the Korean Rice Market." Unpublished manuscript. Department of Agricultural and Consumer Economics, University of Illinois, 1994.

Chipman, J. S., and J. C. Moore. "Compensating Variation, Consumer's Surplus, and Welfare." *Amer. Econ. Rev.* 70 (1980): 933-949.

Constantine, J. H., J. M. Alston, and V. H. Smith.. "Economic Impacts of the California One-Variety Cotton Law." *J. Pol. Econ.* 102 (1994): 951-974.

Cornes, R.. *Duality and Modern Economics.* Cambridge: Cambridge University Press, 1992.

Cramer, G. L., E. J. Wailes, B. L. Gardner, and W. Lin. "Regulation in the U.S. Rice Industry, 1956-89." *Amer. J. Agr. Econ.* 72 (1990): 1056-1065.

Dardis, R. "The Welfare Cost of Grain Protection in the United Kingdom." *J, Farm Econ.* 49 (1967a): 597-609.

Dardis, R. "Intermediate Goods and the Gain from Trade." *Rev. Econ. Stat.* 49 (1967b): 502-509.

Dardis, R. and J. Dennison. "The Welfare cost of Alternative Methods of Protecting Raw Wool in the United States." *Amer. J. Agr. Econ.* 51 (1969): 303-319.

de Gorter, H., and K. D. Meilke. "Efficiency of Alternative Policies for the EC's Common Agricultural Policy." *Amer. J. Agr. Econ.* 71 (1989): 592-603.

de Gorter, H., and J. F. M. Swinnen. "Can Price Support Negate the Social Gains from Public Research Expenditures in Agriculture?" Working Paper 94-06. Cornell University, Department of Agricultural, Resource, and Managerial Economics, 1994.

de Gorter, H., D. J. Nielson, and G. C. Rausser. "Productive and Predatory Public Policies: Research Expenditures and Producer Subsidies in Agriculture." *Amer. J. Agr. Econ.* 74 (1993): 27-37.

Fraser, R. W. "The Welfare Effects of Deregulating Producer Prices." *Amer. J. Agr. Econ.* 74 (1992): 21-26.

French-Davis, M., R. "Export Quotas and Allocative Efficiency Under Market Instability." *Amer. J. Agr. Econ.* 50 (1968): 643-658.

Garcia, R. J., and S. E. Lothe. "Evaluation Alternative Policies for the Norwegian Dairy Sector." Paper presented at the VIII Congress of the EAAE, Edinburgh, 3-7. September. 1996

Gardner, B. L.. "Efficient Redistribution through Commodity Markets." *Amer. J. Agr. Econ.* 65 (1983): 225-234.

Gardner, B. L.. "Export Subsidies are Still Irrational." *Agr. Econ. Res.* 37 (1985): 17-19.

Gardner, B. L. *The Economics of Agricultural Policies.* New York: McGraw-Hill, 1987.

Gardner, B. L. "Export Policy, Deficiency Payments, and a Consumption Tax." *Agr. Econ. Res.* 40 (1988): 38-41.

Gardner, B. L. "Redistribution of Income Through Commodity and Resource Policies." In: Just, R. E. and Bockstael, N. (eds.). *Commodity and Resource Policies in Agricultural Systems*. Berlin: Springer Verlag, 1991.

Gardner, B. L. "Price Supports and Optimal Spending on Agricultural Research." *Working Paper No. 92-20,* University of Maryland, Department of Agricultural and Research Economics, 1992.

Gardner, B. L. "Rationalizing Agricultural Export Subsidies: Comment." *Amer. J. Agr. Econ.* 77 (1995): 205-208.

Gisser, M. "Price Support, Acreage Controls, and Efficient Redistribution." *J. Pol. Econ.* 101 (1993): 584-611.

Griliches, Z. "Research Costs and Social Returns: Hybrid Corn and Related Innovations." *J. Pol. Econ.* 66 (1958): 419-431.

Harberger, A. C. "Monopoly and Resource Allocation." *Amer. Econ. Rev.* 44 (1954): 77-92.

Helms, L. J. "Errors in the Numerical Assessment of the Benefits of Price Stabilization." *Amer. J. Agr. Econ.* 67 (1985): 93-100.

Hotelling, H. “The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates.” *Econometrica* 6 (1938): 242-269.

Hushak, L. J. “A Welfare Analysis of the Voluntary Corn Diversion Program, 1961 to 1966.” *Amer. J. Agr. Econ.* 53 (1971): 173-181.

Innes, R. D. “Uncertainty, Incomplete Markets and Government Farm Programs.” *South. J. Econ.* 57 (1990): 47-65.

Innes, R. D., and G. C. Rausser. “Incomplete Markets and Government Agricultural Policy.” *Amer. J. Agr. Econ.* 71 (1989): 915-931.

Isosaari, H. “Policy Choice under Imperfect Competition with an Application to the Finnish Sugar Market.” Pellervo Economic Research Institute (PTT) Publications 14. Espoo, Finland, 1993.

Jeong, K.-S., D. S. Bullock, and P. Garcia. “A Statistical Political Preference Function Analysis of the Japanese Beef Industry.” Unpublished manuscript, University of Illinois Department of Agricultural and Consumer Economics, 1996a.

Jeong, K.-S., D. S. Bullock, and P. Garcia. “A Statistical Welfare Analysis of the Japanese Beef Policy Liberalization.” Unpublished manuscript, University of Illinois Department of Agricultural and Consumer Economics. 1996b.

Jeong, K.-S., D. S. Bullock, and P. Garcia. “A Test of the Efficient Redistribution Hypothesis for Japanese Beef Policy.” Unpublished manuscript, University of Illinois Department of Agricultural and Consumer Economics, 1996c.

Johnson, P. R. “The Social Cost of the Tobacco Program.” *Amer. J. Agr. Econ.* 47 (1965): 242-254.

Josling, T. “A Formal Approach to Agricultural Policy.” *J. Agr. Econ.* 20 (1969): 175-195

Josling, T. “Agricultural Policies in Developed Countries: A Review.” *J. Agr. Econ.* 25 (1974): 229-264.

Just, R. E. “Automatic Adjustment Rules For Agricultural Policy Controls.” AEI Occasional Papers. Washington D. C.: American Enterprise Institute for Public Policy Research, 1984.

Just, R. E., and D. L. Hueth. “Multimarket Welfare Measurement.” *Amer. Econ. Rev.* 69 (1979): 947-954.

Just, R. E., D. L. Hueth, and A. Schmitz. *Applied Welfare Economics and Public Policy.* Englewood Cliffs, New Jersey: Prentice-Hall, 1982.

Just, R. E., E. Lutz, A. Schmitz, and S. Turnovsky. “The Distribution of Welfare Gains from International Price Stabilization under Distortions.” *Amer. J. Agr. Econ.J. Agr. Econ.* 59 (1977): 652-661.

Just, R. E., A. Schmitz,and D. Zilberman. “Price Controls and Optimal Export Policies under Alternative Market Structures.” *Amer. Econ. Rev.* 69 (1979): 706-714.

Kling, C. L. and R. J. Sexton. “Bootstrapping in Applied Welfare Analysis.” *Amer. J. Agr. Econ.* 72 (1990): 406-418.

Kola, J. “Production Control in Finnish Agriculture: Determinants of Control Policy and Quantitative and Economic Efficiency of Dairy Restrictions.” Agricultural Economics Research Institute (MTTL) Publications 64. Helsinki, 1991

Kola, J. “Efficiency of Supply Control Programmes in Income Redistribution.” *Eur. Rev. Agr. Econ.* 20 (1993): 183-198.

Konandreas, P. A., and A. Schmitz. “Welfare Implications of Grain Price Stabilization: Some Empirical Evidence for the United States.” *Amer. J. Agr. Econ.* 60: 74-84.

Larson, D. M. “Exact Welfare Measurement for Producers Under Uncertainty.” *Amer. J. Agr. Econ.* 70 (1988): 597-603.

Larson, D. M. “Further Results on Willingness to Pay for Nonmarket Goods.” *J. Env. Econ. Mgt.* 23 (1992): 101-122.

Leu, G.-J. M., A. Schmitz, and R. D. Knutson. “Gains and Losses of Sugar Program Policy Options.” *Amer. J. Agr. Econ.* 69 (1987): 591-602.

Lichtenberg, E., and D. Zilberman. “The Welfare Economics of Price Supports in U.S. Agriculture.” *Amer. Econ. Rev.* 76 (1986): 1135-1141.

Marshall, A. *Principles of Economics*. 8th edition. (1st edition 1890). London: Macmillan, 1920.

Martin, W. J., and J. M. Alston. “A Dual Approach to Evaluation Research Benefits in the Presence of Trade Distortions.” *Amer. J. Agr. Econ.* 76 (1994): 26-35.

McCorriston, S., and I. M. Sheldon. “Selling Import Quota Licenses: The U.S. Cheese Case.” *Amer. J. Agr. Econ.* 76 (1994): 818-827.

McKenzie, G. W.. *Measuring Economic Welfare: New Methods.* Cambridge: Cambridge University Press, 1983.

Moschini, G., and P. Sckokai. “Efficiency of Decoupled Farm Programmes under Distortionary Taxation.” *Amer. J. Agr. Econ.* 76 (1994): 362-370.

Murphy, J. A., W. H. Furtan, and A. Schmitz. “The Gains from Agricultural Research under Distorted Trade.” *J. Pub. Econ.* 52 (1993): 161-172.

Nerlove, M.. *The Dynamic of Supply*. Baltimore: John Hopkins Press. 1958.

Otsuka, K., and Y. Hayami. “Goals and Consequences of Rice Policy in Japan, 1965-80.” *Amer. J. Agr. Econ.* 67 (1985): 529-538.

Paarlberg, P. L.. When Are Export Subsidies Rational. *Agr. Econ. Res.* 36 (1984): 1-7.

Peters, G. H. “Introduction.” In: Peters, G. H. (ed.). Agricultural Economics (International Library of Critical Writings in Economics). Aldershot: Edward Elgar, 1995.

Peterson, E. B., and J. M. Connor. “A Comparison of Oligopoly Welfare Loss Estimates for U.S. Food Manufacturing.” *Amer. J. Agr. Econ.* 77 (1995): 300-308.

Peterson, W. L. Return to Poultry Research in the United States. *J. Farm Econ.* 49 (1967): 656-669.

Rausser, G. C.. “Political Economic Markets: PERTs and PESTs in Food and Agriculture.” *Amer. J. Agr. Econ.* 64 (1982): 822-833.

Salhofer, K. “Efficient Support Policy for a Small Country Using Optimal Combined Policies.” *Agr.l Econ.s* 13 (1996): 191-199.

Samuelson, P. A.. *Foundations of Economic Analysis*. London: Harvard University Press, 1947.

Sawar, G., and G. Fox. “An Evaluation of the Redistributive Efficiency of Alternative Crow Benefit Payment Policies in Western Canada”. *Rev. of Agr. Econ.* 14 (1992): 187-204.

Schmitz, A., and D. Seckler. “Mechanized Agriculture and Social Welfare: The Case of the Tomato Harvester.” *Amer. J. Agr. Econ.* 52 (1970): 569-577.

Sen, A. K. “On Weights and Measures: Informational Constraints in Social Welfare Analysis.” *Econometrica* 45 (1977): 1539-1572.

Sen, A. K. *On Ethics and Economics.* Oxford: Blackwell, 1987.

Sen, A. K. *Inequality Reexamined*. New York: Russell Sage, 1992.

Theil, H. *Economic Forecast and Policy*. 2nd revised ed. Amsterdam: North-Holland, 1958

Thurman, W. N. "The Welfare Significance and Nonsignificance of General Equilibrium Demand and Supply Curves." *Pub. Fin. Quart.* 21 (1993): 449-469.

Thurman, W. N., and M. K. Wohlgenant. "Consistent Estimation of General Equilibrium Welfare Effects." *Amer. J. Agr. Econ.* 71 (1989): 1041-1045.

Tinbergen, J. *On the Theory of Economic Policy*. Amsterdam: North-Holland, 1952.

Tintner, G., and M. Patel. "Evaluation of Indian Fertilizer Projects: An Application of Consumer's and Producer's Surplus." *J. Farm Econ.* 48 (1966): 704-710

Tuomala, M. "Optimal Income Taxation and Redistribution." New York: Oxford University Press, 1990.

Varian, H. R. *Microeconomic Analysis*. New York: Norton, 1992.

Wallace, T. D. "Measures of Social Costs of Agricultural Programs." *J. Farm Econ.* 44 (1962): 580-594.

Welch, F. "Supply Control with Marketable Quotas: The Cost of Uncertainty." *J. Farm Econ.* 49 (1967): 584-596.

Winters, A. L. "The Political Economy of the Agricultural Policy of Industrial Countries." *Eur. Rev. Agr. Econ.* 14 (1987): 285-304.

Wong, C. M. "Welfare Implications of Price Stabilization with Monopolistic Trade." *Amer. J. Agr. Econ.* 71 (1989): 43-54.

Wright, B. D.. "The Effects of Ideal Price Stabilization: A Welfare Analysis under Rational Behavior." *J. Pol. Econ.* 87 (1979): 1011-1033.

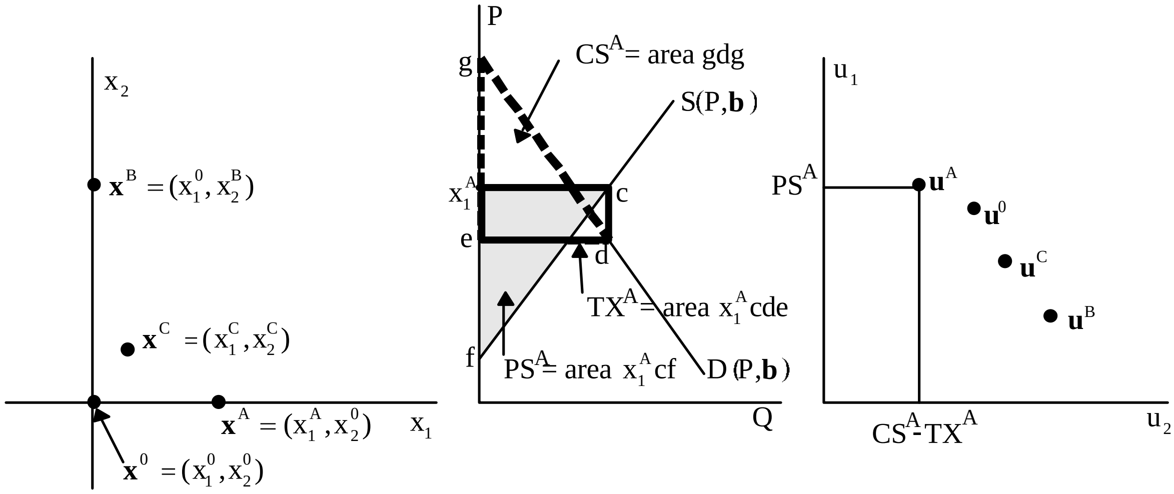

Figure 1. **Using supply and demand curves to map from policy space to interest group welfare space.**

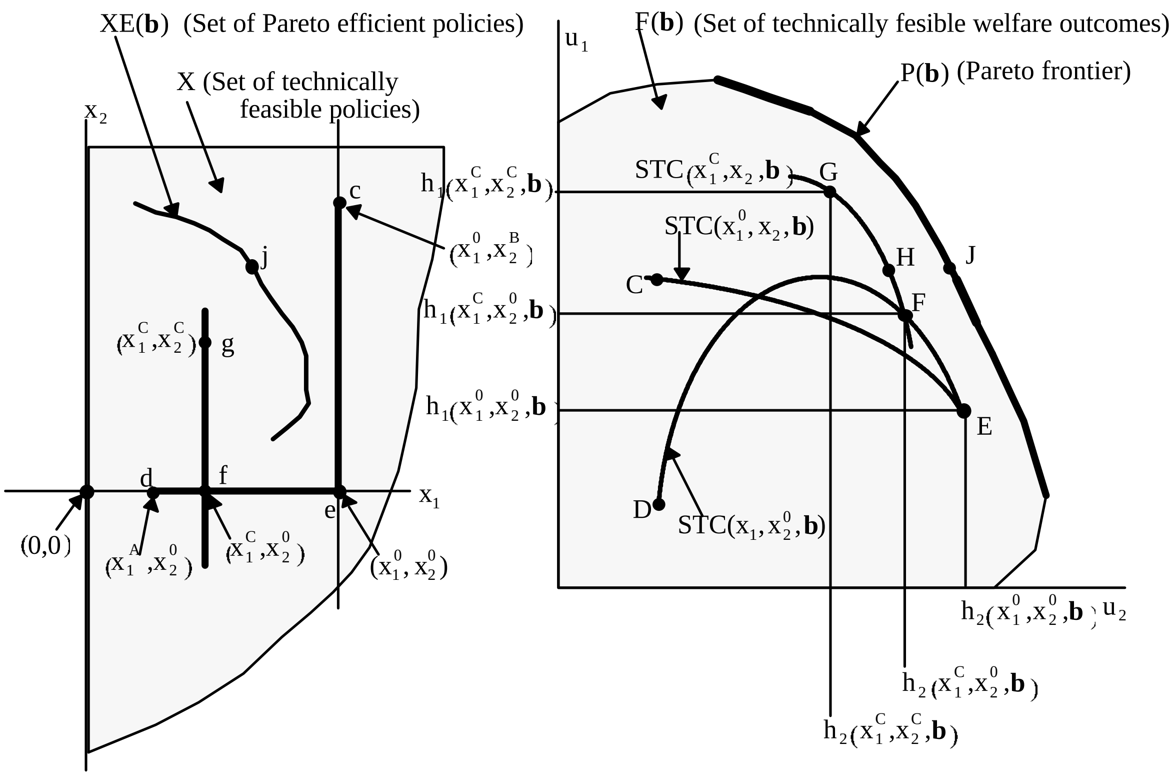

Figure 2. **Surplus transformation curves and Pareto efficiency**

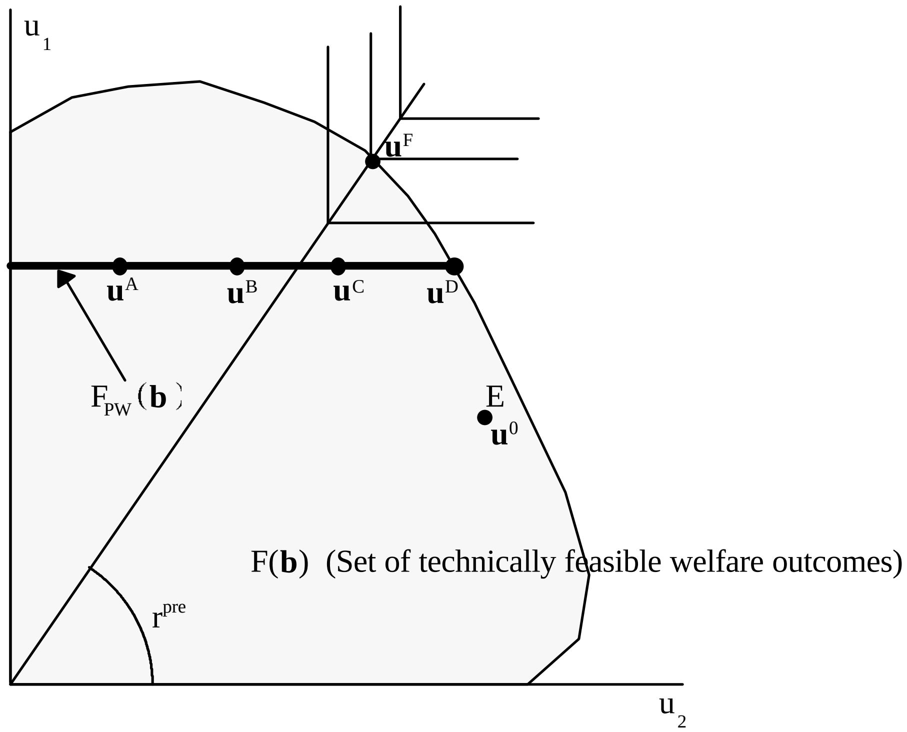

Figure 3. Social welfare and the predetermined welfare level and predetermined welfare ratio criteria.

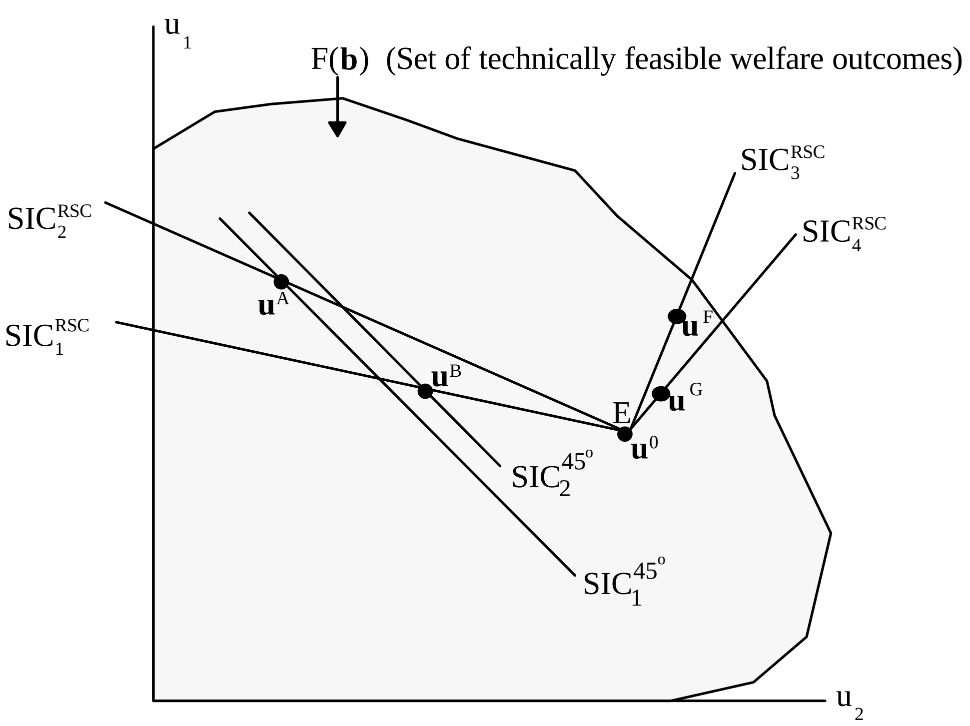

Figure 4. Using the relative social cost value judgment criterion.