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SHIFTING FOUNDATIONS OF AGRICULTURAL POLICY ANALYSIS:

WELFARE ECONOMICS WHEN RISK MARKETS ARE INCOMPLETE

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Shifting Foundations of Agricultural Policy Analysis: Welfare Economics When Risk Markets are Incomplete*

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It is not unusual to see economic theory and reality described as polar opposites, implying that theory has little to offer those actually involved in the policymaking process. This view is reflected in Jeremy Bernstein's satire, The Faculty Meeting (1982, p. 35):

> The first piece of business, it turned out, was a proposal to merge the astrophysics and economics departments. A joint degree in "astronomics" would be offered, thus, in Praeger's words, 'unifying two areas of fecund speculation.' The proposal passed unanimously.

Theoretical welfare economics has received particular criticism in this regard. Cochrane's (1980) rejection of the usefulness of surplus measures likens welfare economics to a chess game - amusing in its own right but irrelevant to actual issues of agricultural policy analysis. In a similar vein, Brandow (1977, p. 271) questions the model of perfect competition which underlies much welfare analysis of agricultural policy:

> The neat alignment of resources, output, and prices specified by the perfect competition model is far from duplicated in free markets, and the equally neat alignment assumed under the constraints of a program is not experienced when programs are in effect. In particular, areas under empirically determined supply curves are unlikely to represent opportunity costs. The basic theory is invaluable in providing a conceptual orientation for the analysis of programs, but the assumptions implicit in the literal use of simple forms of it for policy conclusions are breathtakingly heroic.

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Welfare economics has also been criticized on grounds other than mere irrelevance. Some have claimed that the "new welfare economics" is not value free and is therefore unscientific.[1/] Others have noted that it is based on concepts, such as measurable utility, which are difficult to quantify (Graaff, 1984). There have also been several well known attacks on the logical consistency of the new welfare economics.

Given these criticisms, why is it that the new welfare economics continues to provide the principle framework within which many economists evaluate agricultural policies? In our view, it is due to a lack of acceptable alternatives. The pluralistic nature of policymaking in democratic societies results in opposing views about the desirability of government interventions in agriculture. This creates a demand for an analytical framework capable of providing estimates of the costs and benefits of policy decisions. The new welfare economics provides a paradigm that allows these estimates to be made using tools familiar to most economists. Despite its failings, this paradigm will continue to be used until an improved paradigm has been presented and supported. Hence, dismissing welfare economics as unrealistic or erroneous is not enough to improve policy analysis. An improved paradigm within which agricultural policies can be analyzed must be provided.

In this paper, we argue that an improved paradigm is being developed and that, while many problems of implementing policy analyses based on this paradigm remain, the approach shows considerable promise of shifting the foundations of agricultural policy analysis in a more realistic direction. This improved paradigm extends the framework of the new welfare economics by recognizing that uncertainty is a pervasive feature of actual economies and that information is costly and imperfect. Furthermore, informational problems such as moral hazard and adverse selection may restrict the for-

mation and workings of risk markets.[2/] When there are gains from trading risks but because of high transactions costs, moral hazard, and adverse selection, the requisite trades do not occur, then risk markets are said to be incomplete. The insights provided by welfare economics when risk markets are incomplete are fundamentally different from those of the new welfare economics, and involve a variety of issues of direct concern to agricultural economists and policymakers.

The remainder of this paper is organized as follows. In the next section, attention is given to some of the main difficulties and weaknesses of the new welfare economics. This is followed by a discussion of the improved paradigm which Stiglitz (1985) terms the "new new welfare economics" but which we shall call welfare economics when risk markets are incomplete. Finally, a brief review of some of the literature on the theory of commodity price stabilization is provided. This literature represents an interesting case study in welfare economics when risk markets are incomplete.

The New Welfare Economics

The new welfare economics arose with ordinal utility theory in the 1930s and early 1940s, and was designed to facilitate welfare judgements without resort to interpersonal comparisons of utility. To achieve this goal, the new welfare economics makes use of two controversial principles. The first is that an empirical measure of an individual's utility level can be determined by observing the choices made in alternative situations (the measurable utility principle). Second, a policy is welfare increasing if it can be combined with some redistribution scheme so that it is possible to make at least one individual better off without making any worse off (the compensation principle). Applications of these principles in agricultural policy analysis have involved estimation of consumer and producer surplus levels under various policy alternatives using empirically estimated demand

and supply functions. These surpluses are then added. The policy with the highest net surplus is said to have the highest welfare.

These procedures have continued to be used despite substantial criticisms of both underlying principles. It has been shown that Marshallian consumer surplus is generally not well defined and so cannot be a monetary measure of a consumer's utility, except under the special circumstances outlined in Chipman and Moore (1976). It has also been shown that orderings of alternatives induced by the compensation principle can lead to reversals and intransitivities (Scitovsky, 1941; Gorman 1955). Perhaps more importantly, if policymakers find it impracticable to make lump sum transfers of wealth, compensatory payments cannot be made and even policies which result in a positive net surplus usually have some losers. In these circumstances, application of the compensation principle implies a specific value judgement about distribution, namely, that society is indifferent between any distribution of the level of aggregate income (Chipman and Moore, 1978).

In response to the criticisms of Marshallian consumer surplus, an alternative monetary measure of utility, the "money metric," has been developed (Chipman and Moore, 1980; McKenzie and Pearce, 1982; McKenzie, 1983). The money metric is a cardinal utility index with all of the properties desired for an individual's welfare indicator. If $v(p,y)$ is an indirect utility function at price vector p and income y, and (p_o,y_o) is a vector of current prices and income, the money metric, M, of the utility derived from outcome (p, y) is defined by

$$v(p_o,M) = v(p, y)$$

or, solving for M,

$$M = m(p, y; p_o).$$

Since m is a monotone increasing transformation of v, it is a utility function in its own right. Moreover, if $(p, y) = (p_o, y_o)$ then $M = y_o$ (the

money metric maps the current level of utility into current income). Finally, note that equivalent variation, E, is defined

$$E = M - y_o$$

and that any number of different (p, y) vectors (policies) can be compared using M or E. For reasons that will not be entered into here, this feature is generally not shared by the compensating variation measure (Chipman and Moore, 1980).

It is important to emphasize that the money metric is not only an appealing conceptual monetary measure of utility, but can also be estimated empirically using no more data than are required to estimate Marshallian consumer surplus (McKenzie, 1983). Although we are unaware of any applications in the area of agricultural policy analysis, we expect the money metric to begin playing a more prominent role in future applied work.

The difficulties associated with using the compensation principle have proven more resilient. The central difficulty is the general impracticality of non-distorting lump sum transfers. The information on which to base these transfers is generally unavailable because individuals have incentives to misrepresent whether they would gain or lose from a policy outcome. This lack of information is not generally acknowledged in the new welfare economics and lump sum transfers are treated as feasible, allowing the separation of efficiency and distributional considerations. As we shall argue below, this difficulty with the compensation principle is highlighted by including uncertainty and imperfect information explicitly in the framework for analysis.

To this point, we have dealt with some of the limitations and logical difficulties of the new welfare economics. But criticism of welfare analysis of agricultural policies runs deeper. We would argue that the main factor leading to rejection of welfare economics as "unrealistic" has little to

do with welfare economics per se. Rather, it is a result of the economic model often used to carry out applied welfare analysis.

The model most often used for welfare evaluations of the commodity programs in agriculture is a version of the standard Arrow-Debreu model in which there are no externalities, public goods, or other difficulties, and therefore in which the first theorem of welfare economics holds - competitive equilibrium is Pareto optimal. If the framework is partial equilibrium then this is usually called the perfect competition model.

The key feature of the model is that there are a complete set of private markets which lead to a Pareto optimal outcome. Using the competitive equilibrium as a base and applying the compensation principle means that no policy, no matter how well thought out and administered, can ever be welfare improving. Policy analysis reduces to estimating the welfare losses from policies that distort the competitive equilibrium.[3/]

This is the straightjacket that those who reject welfare economics often find most objectionable (see, for example, the quotation from Brandow above). Actual economies may have markets which are not competitive, are in disequilibrium, and/or simply do not exist (as in the case of externalities and public goods). In addition, there may be uncertainty and imperfect information which lead to forecast errors and incomplete risk markets. These features bear little resemblance to the standard Arrow-Debreu model. Yet welfare analyses of the major commodity programs in agriculture have generally used a competitive equilibrium which is Pareto optimal as the base against which to compare program performance (Gardner, 1981). This procedure is justified by arguing that the major commodity programs are not designed specifically to overcome traditional forms of market failures such as externalities and public goods. In the next section, however, we argue that imperfect information and incomplete risk

markets may be an additional source of market failure in agriculture that has not yet been given due consideration.

Welfare Economics When Risk Markets are Incomplete

Uncertainty is an important dimension of decisionmaking in actual economies, especially in the agricultural sector. Understanding the role of uncertainty helps explain why risk markets are incomplete. When decisions are being made under uncertainty, imperfect and differential information, together with diverse risk preferences, create a desire to trade in contingent claims to future consumption. An example is a futures exchange. But although incentives exist to form risk markets, these incentives are hindered by transaction costs and informational problems such as moral hazard and adverse selection. Moral hazard occurs when there is imperfect information concerning the actions that individuals undertake. An insurance contract is offered but the insurer cannot monitor the insurees' actions. The insurees then take less care to avoid the event being insured against, which increases the probability of its occurrence. Adverse selection occurs when there is imperfect information concerning the characteristics of individuals or commodities. An insurance contract is offered but the insurer cannot separate low and high risk individuals. Hence, the same premium must be charged to both types of individuals and this premium will reflect their average risk exposure. In either case, the incentives to trade on risk markets are distorted and may result in no trade on risk markets that are seriously affected. As a possible example, consider the abortive attempts to set up private all-risk crop insurance schemes in the early 1900s. Moral hazard and adverse selection can lead to incomplete risk markets and to distortions in existing markets that attempt to deal with uncertainty.

In applying welfare economics to models characterized by imperfect information and incomplete risk markets, a number of results and insights

have emerged which differ fundamentally from traditional welfare analysis (Stiglitz, 1985). Perhaps the most important result is that when risk markets are incomplete, the first theorem of welfare economics no longer holds: competitive equilibrium is generally no longer Pareto optimal (Borch, 1962; Hart, 1975; Stiglitz, 1982; Newbery and Stiglitz, 1982). The reason is fairly straightforward. Under uncertainty, Pareto optimality is normally characterized by the equality of marginal rates of subsitution between any two states of nature for all individuals. But with incomplete risk markets there is no way for private individuals to trade contingent claims in order to attain this equality. The implication is that there is a potential role for government to improve economic efficiency by introducing the missing risk markets (e.g., the government insures certain risks itself) or by taking the incompleteness of risk markets as a constraint and solving the second best problem (e.g., identifying a set of taxes and subsidies which could make everybody better off). Second best policies need not be taxes and subsidies and could take the form of other interventions such as price stabilization schemes (Newbery and Stiglitz, 1981).

The capacity for governments to improve over market allocations in economic efficiency terms remains only potential, however, for three reasons. First, it may not be possible (or desirable) for governments to introduce the missing risk markets. If they are missing because of moral hazard and adverse selection then government insurance schemes would presumably face these same problems, and if they are missing because of high transaction costs then an improvement in economic efficiency would require that these costs be substantially lowered by government involvement. Second, there may be no feasible second best policies that would lead to improved economic efficiency. Policies such as tax-subsidy schemes are costly and these costs must be taken into account when solving the second best problem. Third,

there is the danger of implementing "piecemeal" policies in an interdependent economy. It is not difficult to construct examples where adding one more risk market or introducing a tax-subsidy scheme in one sector leads to a loss in economic efficiency (Hart, 1975). Sufficient conditions for appropriate piecemeal policies in agriculture to improve overall economic efficiency are either that there are no distortions, market failures, or missing risk markets in other sectors, or that agriculture is "separable" from other sectors (changes in agricultural prices do not affect prices and incomes in the rest of the economy). Neither of these conditions seem likely to hold in actual economies although arguments have been made in support of the latter as an approximation.

Acknowledging the existence of imperfect information and incomplete risk markets also highlights the difficulty of separating questions of economic efficiency and distribution. As emphasized above, when information is imperfect, it may not be possible for the government to identify gainers and losers from a policy and so lump sum redistribution schemes become impossible. Hence, policies designed to improve efficiency will have distributional effects and policies designed to improve distribution will have efficiency effects. In other words, "the separation between equity and efficiency considerations is no longer generally valid" (Stiglitz, 1985, p. 31). In this case, policy recommendations cannot be made except on the basis of value judgments about distribution, and these value judgments should be made explicit. As stated earlier, simply summing monetary measures of individual welfare changes implies the value judgment that society is indifferent between alternative distributions of aggregate income (each individual is given equal weight). In the absence of more information about social preferences, this might seem like the only way for an economist to proceed. There are, however, several alternatives for obtaining addi-

tional information on social preferences.

Social preferences are ordinarily described in terms of a "social welfare function."[4/] Two kinds of information are important in determining explicit weights in such a social welfare function. The first is on how individuals themselves make interpersonal comparisons of utility. The second is information contained in norms of behavior conveyed by social rules and institutions (Sen, 1982). The relative share of income or wealth held under the status quo or considered "fair" by particular segments of the population may be used to deduce explicit weights for a social welfare function, utilizing such familiar tools as the Gini coefficient (Sen, 1979; 1981, pp. 185-194). These techniques are being employed with increasing frequency to estimate the distributional impacts of alternative policy regimes. However, they depend critically on the use of information which facilitates interpersonal comparisons of utility. The new welfare economics was developed explicitly to avoid such comparisons.

Even if improvements in economic efficiency are feasible and information on social preferences for alternative distributions can be obtained, however, there may be little reason to believe that improvements in social welfare will evolve out of the political process. Hence, an important component of an improved framework for evaluating agricultural policies is consideration of the critique of nonmarket allocations known as nonmarket or government failure. This critique implies that agricultural policy analysis requires market outcomes to be compared with the potential inadequacies of nonmarket institutions in ameliorating undesirable effects (Wolf, 1979). This, in turn, requires careful appraisal of legislative and administrative actions designed to alter property rights or otherwise modify market outcomes (Runge, 1984). Much of the public choice literature attempts to deal directly with these issues (see Miller and Moe, 1983).

A final point that emerges from this informational perspective on economic analysis concerns the role of subjective probability distributions. In making decisions under uncertainty, it is hypothesized that individuals form a subjective probability distribution over future events. Even if all individuals have rational expectations concerning this distribution (subjective distributions equal the actual objective distribution), the first theorem of welfare economics that competitive equilibrium is Pareto optimal fails when risk markets are incomplete. If expectations are not rational, there may be an additional potential role for government: the implementation of policies that reduce systematic errors in forecasting. Once again, however, this role is only potential because it requires that government can actually improve on market outcomes.

What are the key insights from these results? When risk markets are incomplete, there is neither a presumption that private markets will lead to Pareto optimality, nor that governments can improve on their operation. The relative capacity of market and nonmarket institutions to allocate and distribute resources effectively becomes a difficult empirical question which requires measurement of economic welfare changes under uncertainty and incomplete risk markets. Such measurements present formidable problems. As shown by Anderson (1979) and Pope, Chavas and Just (1983), however, methods for undertaking these measurements are being developed.

The Welfare Effects of Commodity Price Stabilization

Where might this new framework for policy research be applied? The evolution of the commodity price stabilization literature lends insight into this question, especially with regard to how greater realism can be brought to policy analysis by incorporating insights from welfare economics when risk markets are incomplete.

Early studies of commodity price stabilization were performed within

the framework of the new welfare economics without accounting for uncertainty - production and consumption decisions were assumed to be made after (variable) prices became known (Waugh, 1944; Oi, 1961; Massell, 1969). In addition to abstracting from uncertainty, key results of this analysis depended on the assumption that a certain market - the market for private storage - was missing. A key implication for policy was summarized by Turnovsky (1978, p. 126): "The total gains from stabilization are always positive, with the gainers in principle being able to compensate the losers." Many extensions of the basic model used to derive this result exhibit this same key implication: stabilization policies improve net social welfare (Schmitz, 1984).

The fact that the private storage market was unaccounted for provided an important criticism of this finding (Helmberger and Weaver, 1977; Gardner, 1979). Even in a world without uncertainty, assuming away the private storage market creates a presumptive role for government that may be unjustified when a private storage market actually exists. However, even if this market does exist, production and storage decisions made under uncertainty by risk responsive agents raise different sorts of questions in which the framework we have outlined becomes relevant. Private storage exists but risk markets may still be incomplete.

The case for an international price stabilization program for primary commodities was examined in this framework by Newbery and Stiglitz (1981). Informational problems leading to incomplete risk markets, and the potential role for government intervention, were examined to determine the capacity of stabilization schemes to increase economic efficiency. A model in which private storage markets are accounted for, but in which uncertainty is prevalent and risk markets are incomplete, led Newbery and Stiglitz to conclude that there is only a limited potential for government stabilization schemes

to improve economic efficiency. Indeed, they noted that such schemes are mainly instruments of income redistribution, reinforcing the significance of distributive considerations in policy analysis. Their study was also conducted on the assumption that expectations are rational. If expectations are not rational, there may be additional gains to improved decision making if stabilization reduces sources of error and bias in forecasting (Newbery and Stiglitz, 1981, p. 22). These results may be interpreted as opening the way to more detailed empirical investigations of market and government performance in improving economic efficiency in agriculture.

Conclusion

Five main implications result from incorporating imperfect information and incomplete risk markets in a framework for evaluating agricultural policies.

(1) Risk and uncertainty are characteristic features of agriculture. Incomplete risk markets may constitute a generic form of market failure in agriculture and other sectors. This suggests a possible role for government: the implementation of corrective policies that lead to social welfare improvements.

(2) The size of the economic costs from this kind of market failure is an empirical matter and may, in fact, be quite small. Moreover, the transactions costs and informational problems which restrict the formation of a complete set of risk markets will also make it difficult for any government policy to improve social welfare, taking the feasibility and costs of government action into account. Hence, there is no presumption in favor of either market or nonmarket institutions. Detailed empirical work, of the type illustrated by Newbery and Stiglitz (1981), is called for to determine the relative virtue of markets and government in different settings.

(3) The difficulty of separating efficiency and distributional con-

siderations, both in theory and practice, suggests that distributive issues can often dominate the policy process. This highlights the importance of obtaining information about social preferences and provides a deeper explanation of the perceived irrelevance of policy analysis in which economic efficiency is the primary concern.

(4) Even if it is possible for governments to improve social welfare, the mix of policies which emerges from the political process may not be directed to such improvements. Nonmarket or government failure may cause as many, or more, problems than incomplete markets.

(5) The study of both market and nonmarket institutions requires explicit treatment of expectations and expectations formation. If expectations are not rational, a potential role for government exists in reducing systematic errors in forecasting, subject to the costs and difficulties of government attempts to do so.

Recognition of these problems and possibilities suggests a revised program of applied policy research. The first step is to develop a fully specified theory of missing markets, including missing risk markets, in agriculture. The theory should be able to distinguish cases of missing markets in which there are net gains from intervention and those cases in which there are not. As a second step, there is a need for empirical estimates of the magnitude of economic costs of market failure due to incomplete risk markets. The difficult problem of extending monetary measures of utility, such as the money metric, to decision making under uncertainty must be confronted here. The third step is to investigate alternative agricultural policies within the framework of incomplete risk markets, as well as market failure versus government failure, in order to provide a richer set of empirical estimates of the welfare effects of government actions and inactions. Application of the framework sketched above extends the analysis of

market failure by accounting explicitly for uncertainty, imperfect information, and distributional issues, thus shifting the foundations of agricultural policy analysis in a more realistic direction.

FOOTNOTES

1. See Chipman and Moore (1978) for a review of the new welfare economics and a discussion of this point.

2. Risk markets are insurance markets, futures markets, forward markets, options, and any other markets which allow individuals to trade in contingent claims to future consumption.

3. Of course, not all welfare analysis of policy is undertaken this way. In some cases, particularly in the natural resources literature, there are attempts to incorporate specific market failures, such as externalities and public goods.

4. Arrow's famous result (1951) has been argued to demonstrate that such a social welfare function is impossible to deduce from a set of individual preference orderings. Subsequent investigations suggest that it is the informational restrictions implicit in his argument that make social orderings impossible (Sen, 1982, pp. 327-52). When even weak forms of interpersonal comparison are allowed, one can demonstrate axiomatically the possibility of non-trivial social welfare functions, including, for example, Rawls' lexicographical principles of justice (Hammond, 1976; Strasnick, 1979).

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