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INSTABILITY AND RISK AS RATIONALES FOR GOVERNMENT INTERVENTION IN AGRICULTURE

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A large literature has argued that instability and risk cause special problems in the agricultural sector, problems that can be solved only through appropriate government intervention. (Schultz, 1945; Johnson, 1947; Cochrane, 1958; Hazell and Scandizzo, 1975; Anderson, Dillon and Hardaker, 1977; Schmitz, 1984). The central idea is that unregulated markets are inadequate for dealing with instability and risk, so the result is market failure and economic inefficiency unless governments engage in corrective stabilization policies. "Stability" has become an almost universally stated goal for the many government interventions in agriculture. Yet despite all of the attention given to stabilization and risk reduction policies for agriculture, there remains a great deal of confusion over the mechanisms by which instability and risk can actually lead to economic inefficiency. An understanding of these mechanisms is crucial to the making of informed agricultural policy decisions.

The objective of this paper is to survey and interpret the ways in which instability and risk can lead to inefficient resource use in agriculture, and how stabilization and risk reduction policies may improve economic efficiency. We recognize explicitly that for instability and risk to be sources of economic inefficiency, they must indicate some form of market failure. In the paper, we examine three ways in which instability and risk can lead to market failure: disequilibrium, incomplete forward markets, and incomplete contingency markets. Furthermore, we argue that incomplete market structures are the primary rationale for government intervention in agriculture since many of the microeconomic foundations for disequilibrium rely heavily on the incompleteness of the market structure.[1] The conclusion of the paper is that government intervention in

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[1] Price instability in agriculture may indicate market failure due to imperfect competition because a monopolist-monopsonist middleman has an incentive to artificially introduce price variability in its input market (Bieri and Schmitz, 1974). There are two problems with using this argument to rationalize government intervention in agriculture. First, the hypothesis of a monopolist-monopsonist middleman in agricultural markets is not supported by empirical observations. Second, the relevant government policy in this case would be to eliminate the middleman rather than engage in the kinds of price support and price stabilization policies that have been so prevalent.

agriculture can, in principle, correct for these market failures but that in practice the potential efficiency gains may be small and are very difficult to realize.

The next three sections contain an overview of the three market failures mentioned above. This is followed by a discussion of whether governments have incentives to correct these market failures when they are found to exist. The paper then concludes with comments on key issues concerning the role of stabilization and risk reduction policies in agriculture.

1. Disequilibrium Rationales for Government Intervention

Disequilibrium occurs when prices fail to adjust to differences between quantity demanded and quantity supplied. Thus, markets in disequilibrium are quantity rationed and fail to clear. And since resources and commodities are allocated by a rationing mechanism rather than a flexible price system, disequilibrium distorts the ideal market system and leads to economic inefficiency. Thus disequilibrium may require corrective action from an efficiency minded government.

Instability in the agricultural sector has been linked directly to the existence of disequilibrium. For example, Schultz (1945) argued that the migration of resources between agriculture and the rest of the economy is inhibited by "rigidities" (disequilibria) in factor markets. In particular he argued that the labor market in the non-agricultural sector is quantity rationed. As a result, any shock or disturbance to the economy cannot be accomodated by a migration of labor from agriculture to industry because of implicit quantity rationing at the rigid non-agricultural wage. Instead, the adjustment has to be borne by agricultural prices and factor returns. Thus, prices are more volatile than they need to be and the resulting price instability is indicative of disequilibria in factor markets.

In modern form, the disequilibrium rationale for government regulation of agriculture is called the fixed-price flex-price model. The idea is that agricultural

markets adjust to shocks almost instantaneously but there are disequilibria in non-agricultural markets which cause non-agricultural prices to be rigid and exhibit "price stickiness" (Bosworth and Lawrence, 1982; Frankel, 1984). Markets with sticky prices are quantity rationed and cannot adjust rapidly to changing economic conditions, thus placing the burden of adjustment on the agricultural markets and their flexible prices. In this case, agricultural markets are called auction or flex-price markets while non-agricultural markets are called customer or fixed-price markets (Okun, 1975).

The existence of both flex-price and fixed-price markets leads to a phenomenon called "overshooting": adjustment of agricultural prices to economic shocks is so great that these prices fluctuate beyond their equilibrium levels (Dornbusch, 1976; Rausser et.al., 1986). The reason for overshooting is the inability of fixed-price markets to bear any of the adjustment. Thus price instability in agriculture is a result of disequilibrium, and government intervention may improve efficiency (Rausser, 1985; Frankel, 1986).

Analytically, static models with sticky prices generally have a demand function of the form

(1) $$d_i = f(p_i/p, m/p),$$

where p_i is the price of good i, p is the aggregate price level, m is nominal money balances, and d_i is the demand for good i (Rotemberg, 1987). The quantity demanded will decline as the relative price rises and will increase as real cash balances increase, so that $f_1 < 0$ and $f_2 > 0$. Consider an economy with two goods, a manufactured good and an agricultural good. Suppose that the money supply increases. In the absence of price increases this would increase real cash balances, and hence the demand for output. The increased demand puts upward pressure on prices, and the aggregate price level will rise until some combination of a supply response and decreased demand (from lower real cash balances due to the rise in p) achieves equilibrium. However, if the price of the manufactured good is sticky, then the entire rise in p must be accomplished by a change in the price of the agricultural good. In this case the additional upward pressure on the

price of the agricultural good causes an "overshooting" of this price past its flex-price equilibrium level, and hence agricultural prices will appear to be excessively volatile relative to either the sticky manufactured goods price or to the flex-price equilibrium.

Disequilibrium rationales for government regulation of agriculture make the crucial assumption that price instability is a result of disequilibrium behavior. As a result, standard welfare propositions do not apply and one is left free to argue that any regulation designed to stabilize agriculture close to its "equilibrium path" is clearly justified. Proponents of intervention are thus released from the burden of justifying intervention on the basis of a traditional form of market failure, such as an externality or a public good. Instability is defined to be market failure, stability becomes an end desired for its own sake, and stabilization begins to take on a life of its own as a separate policy objective. This is exactly what has happened with discussions of stabilization within the context of U.S agricultural policy.

Disequilibrium rationales for government intervention have been strongly criticized on theoretical grounds (Sargent and Wallace, 1976; R. Lucas, 1977, 1979). These authors argue that economic models ought not violate the principle that markets clear because the disequilibrium assumption avoids the fundamental question of why people would choose not to engage in mutually advantageous trades. Put another way, disequilibrium models do not have adequate microeconomic foundations because the cause of the disequilibrium remains an unexplained postulate.

Policy analysis based on models that lack adequate microeconomic foundations can lead to serious errors and give an incorrect ranking of policy alternatives (R. Lucas, 1976). The difficulty is that evaluating policies usually involves determining how people will act in situations that have never actually been observed. To do this successfully, one must not only know how past decisions were made but also how decisions will change due to the hypothetical change in policy. But when markets fail to clear, the change in behavior will depend not only on the change in policy but also on whatever quantity

rationing is going on. Thus when disequilibrium is an unexplained postulate rather than the outcome of an explicit behavioral model, then behavioral responses to policy changes cannot be accounted for and the task of policy analysis becomes difficult or even impossible.

The response to these criticisms has been a growing literature on the microfoundations of disequilibrium models. This literature generally cites three reasons why manufactured or consumer goods prices are sticky: noncompetitive market structures, high costs of changing prices, and the prevalence of long-term, fixed nominal wage, labor contracts in the manufacturing sector. We caution the reader that most of this literature examines disequilibrium behavior, such as Keynesian wage rigidity, in a one sector economy. Thus, implications for agriculture in a two sector economy with quantity rationing in the non-agricultural sector are tenuous.[2]

Price rigidities result from noncompetitive market structures when price signals are used to maintain noncooperative collusive agreements (Stiglitz, 1979). For example, a collusive agreement may take the form of all firms setting a single price. If any firm were to charge a different price then all firms would behave competitively and lose their share of monopoly profits (Friedman, 1986). Thus each firm has an incentive to maintain its price, even in the face of demand shocks, and some form of quantity rationing will be imposed. Empirical support for this theory is given by Carlton (1986), who found significant price rigidity in some industries and a strong correlation between industry concentration and rigidity.

The second type of microfoundation for sticky prices is that price changes are costly and will only be made when the benefits of changing the price exceed the costs (Mussa, 1981; Taylor, 1979, 1980; Sheshinski and Weiss, 1977). When costs are high it is

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[2] For an example of a two sector model examining price rigidity and overshooting see McTaggart (1987). For a good discussion of the Keynesian literature, see Rotemberg (1987).

less likely that prices will respond to a shock to the economy, even if this shock means that there are some benefits to changing a price. This lack of response is exactly what characterizes a sticky or fixed-price market.

The costs of changing prices can include a fixed or "menu" cost, often associated with printing new price lists and menus or retagging consumer items, and a variable cost that is sometimes used to represent the loss of customers due to price increases (Rotemberg, 1982). High menu costs appear to be more important in consumer markets than in agricultural markets due to different trading procedures. Contracts for raw agricultural products are negotiated verbally on exchanges such as the Chicago Board of Trade and changing the price entails little more than calling out the desired price. Changing the prices of consumer goods is more complicated since the prices are usually marked on the items, sometimes indelibly on the container, and packages usually contain relatively small quantities so that a large amount of retagging is required. The implication is that menu costs will reduce price flexibility more in consumer markets than in agricultural markets, resulting in the usual fixed-price flex-price classification. Moreover, it is argued that relatively small menu costs can give rise to price fluctuations of observed magnitudes and to other changes in behavior that cause welfare effects (Akerlof and Yellen, 1985; Parkin, 1986; Mankiw, 1985). However, Rotemberg (1987) argues that menu costs are more intuitively interpreted as losses in customers dissatisfied by price increases. If this is correct, then it becomes more difficult to argue that purchases of agricultural goods respond less to price changes than do purchases of consumer goods.

The third microeconomic explanation of fixed prices is that the manufacturing sector depends on long term, fixed nominal wage, labor contracts. This factor market fixity can lead to rigid output prices in the manufacturing sector. For example, most sticky wage models assume a monopolistically competitive economy (Rotemberg, 1987),

which leads to a pricing function that can be written as

(2) $$p_i = g(w_i),$$

where w_i is the nominal wage in sector i and $g_1 > 0$. If the wage in sector i is sticky, then clearly the price will also be sticky. These rigid prices in turn lead to price overshooting in the flex-price sector (Taylor, 1980; D. Lucas, 1986).

Most of this literature proceeds from the empirical observation that long term, fixed nominal wage contracts do exist (D. Lucas, 1986; Rotemberg, 1982; Gordon, 1981; Gray, 1976). However, models assuming the existence of fixed wage contracts do not in themselves provide a microfoundation for sticky prices because they do not explain why agents would agree to a fixed wage contract (Azariadis and Stiglitz, 1983). Possible microfoundations for fixed wage contracts have been based on union intervention (Chen, 1987), asymmetric information between the firm and worker (Gray, 1976), and implicit contracting with asymmetric information (Rosen, 1985).

Despite the significant advances in the microeconomic foundations of disequilibrium, there are still many problems to be overcome before an adequate theoretical explanation can be claimed. For example, the asymmetric information microfoundations for sticky nominal wages usually assume that each individual's information set is exogenously given (e.g. Townsend, 1982), whereas a satisfactory explanation must realize that each agent endogenously determines his information set based on the expected costs and benefits of acquiring that information. Moreover, once an adequate microeconomic foundation for sticky prices has been found, the implication that price fixity implies market failure may no longer hold. For example, Rosen (1985) finds that the implicit contract labor models "... allocate resources through a subtle and 'flexible' nonlinear pricing mechanism, which sometimes gives the outward appearance of rigidities in observed real wages and prices. But these observed rigidities signal little about market failure (p. 1145)." Finally, very few fixed price models have been developed to the point where they are empirically testable.

On empirical grounds, there are arguments both for and against disequilibrium rationales for government intervention in agriculture. Some argue there is no sound evidence that disequilibrium is a persistent feature of agricultural factor markets. They point to the massive intersectoral resource adjustments that have occurred, with labor moving out of agriculture and capital moving in, as evidence that disequilibrium is at most a short run phenomenon (Gardner, 1981). Others argue that persistently low factor returns in agriculture indicate disequilibrium is pervasive (Brandow, 1977). Additional evidence often cited in favor of disequilibrium rationales for government intervention is the relative variability of agricultural prices compared to most non-agricultural prices (Andrews and Rausser, 1986) and the relatively rapid response of agricultural prices to economic shocks such as monetary disturbances (Frankel, 1986).

Empirical examinations of labor contracts in manufacturing sectors are consistent with the rigid wage rationale for the fixed-price flex-price model. (Poterba, Rotemberg and Summers, 1986; Rotemberg, 1982; Taylor, 1980; Gray, 1976). However, there is little evidence quantifying the influence of these fixities on commodity prices in either the manufacturing sector or in the agricultural sector. Moreover, the increasing use of cost of living adjustments and other indexing arrangements suggests that the prevalence of fixed nominal wage contracts is decreasing. If sticky manufactured goods prices are a source of economic inefficiency in agriculture, we have not been able to find any empirical evidence on the magnitude of the implied efficiency losses in the agricultural sector. Thus, while disequilibrium could theoretically justify government intervention in agriculture, there have been no empirical demonstrations of the benefits that could be expected from such intervention or the form that an optimal intervention should take.

Finally, we note that there is a strong relationship between the microfoundations of disequilibrium and incomplete contingency markets. For example, in the asymmetric information collusive price-setting arrangement, it is not possible to write a contract in which the price charged by one of the colluding firms is contingent upon the realization

of the demand for that firm's product (nor would it be easy to legally enforce such a contract). The reason is that this demand is not observable to other firms. This lack of a contingent contract is the main impetus behind the sticky prices that emerge from these collusion models. Similarly, the incompletely indexed labor contracts that can lead to agricultural price instability are simply contracts that are not fully contingent on monetary supply shocks or other economic events. In Section 3 we discuss the incomplete contingency markets rationale for government intervention more completely.

2. Incomplete Forward Markets

A second reason why an unregulated market economy might fail to be economically efficient is the absence of a complete set of forward markets.[3] Without a complete set of forward markets producers and consumers may be unable to coordinate future plans, thus leading to an inefficient allocation of current resources and commodities. That is, the current actions of producers and consumers may be incompatible with markets clearing at all future dates and this lack of coordination is a source of inefficiency.

As a simple example, consider a standard model of commodity market equilibrium with risk neutral producers and consumers.[4] Resource allocation decisions are made before output price is realized so producers face output price uncertainty. Producers are expected profit maximizers, so supply is a function of expected price, $s(p^*)$, where p^* denotes expected price. Consumers purchase the commodity after the price is realized

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[3] A complete set of forwards markets would span all the possible forward claims that agents would wish to write. From a theoretical viewpoint, there is little difference between missing forward markets and missing contingency markets. For interpretive purposes we discuss each type of incomplete market situation separately.

[4] The risk neutrality assumption is made to isolate the effects of incomplete forward markets without complicating matters by involving the possibility of incomplete contingency markets as well. Incomplete contingency markets are discussed in the next section.

and have a demand function d(p). At the time producers are making their resource allocation decisions, the consumer demand function can be thought of as a consumption plan that describes the quantity that consumers will purchase at each price realization.

The production plans of producers are compatible with the consumption plans of consumers if

(3) $$s(p^*) = d(p^*).$$

That is, planned supply must equal planned demand at the price that producers expect when they allocate resources. If this condition does not hold then production and consumption plans are incompatible because they are not consistent with market clearing at the trading date. When plans are compatible, the market equilibrium is efficient because the expected consumer welfare gain from a marginal increment in output is just equal to the cost of producing that marginal increment. This is illustrated in Figure 1. At expected price $p^* = p^1$, plans are incompatible and there is a net welfare loss equal to the shaded area. At expected price $p^* = p^2$, plans are compatible and the market equilibrium is fully efficient, even if p^* is not actually realized due to random shocks to supply or demand.

Suppose there is no forward market in the commodity. Further suppose that producer price expectations are formed according to an expectation function,

(4) $$p^* = g(v)$$

where v is a signal containing information available to producers at the time resource allocation decisions are made. Without a forward market and without restrictions on the nature of the expectation function, it is clear that production and consumption plans are generally incompatible because there is no mechanism for coordinating plans. In this case, the type of inefficiency illustrated in Figure 1 may result.

A forward market would coordinate plans and lead to an efficient equilibrium. Under the assumption of risk neutrality, it is easy to show that the equilibrium forward price would equal p^* and that the compatibility condition, (3), is now satisfied as a result of market clearing on the forward market. The forward price acts as a signal which coordinates the plans of producers and consumers.

There are many forward markets in agriculture. Examples include futures markets and forward contracting. Nevertheless, it is clear that a complete set of forward markets does not exist. Even futures markets only extend a little over a year into the future and many commodities have neither futures markets nor forward contracting. Thus, forward markets in agriculture are incomplete. The usual explanations for this are high transactions costs and the increased uncertainty associated with trading on markets for delivery at dates well into the future.

When forward markets are incomplete, the way in which expectations are formed is crucial to the efficiency of resource allocation. The example discussed above is a temporary equilibrium model since forward markets are incomplete, spot markets clear, and no restrictions were placed on the expectation functions of agents (Hicks, 1946 p. 115-140; Grandmont, 1977, 1982). Examples of temporary equilibrium models used extensively in agricultural economics research are the cobweb model (Ezekiel, 1938; Waugh, 1964) and the adaptive expectations model (Cagan, 1956; Askari and Cummings, 1977).

A key feature of temporary equilibrium models is that they have no optimality properties. Since forward markets are incomplete, plans cannot be coordinated by the price system. And since the rules that people use to forecast the future are completely arbitrary, these forecasts also fail to coordinate future plans. Thus the missing forward markets and arbitrary forecast rules are a source of economic inefficiency. A government equipped with the right model of the economy could make better forecasts than private individuals and could therefore intervene in commodity markets to improve efficiency.

An alternative way of modelling expectations when forward markets are incomplete is to assume that forecasts are formed rationally (Muth, 1961; Lucas and Sargent, 1981). Rational expectations models are special kind of temporary equilibrium model identified by a particular characteristic: instead of forecasts being made using arbitrary rules, they are formed to be consistent with the relevant economic theory represented by the model. In the example above, the rationally expected price is defined by the compatibility condition, (3), and therefore by definition leads to consistent plans and economic efficiency. Unlike in the case of arbitrary forecast rules, missing forward markets are not a source of inefficiency if expectations are formed rationally. Rational expectations link sequences of spot markets together in such a way that the missing forward markets are redundant and full economic efficiency is obtained (Prescott and Mehra, 1980). This is because future plans are now coordinated by consensus beliefs about the true structure of the economy and current actions are therefore consistent with markets clearing at all future dates. As a result there is no rationale for government regulation to correct for inefficiencies caused by incomplete forward markets, as long as individuals have rational expectations.

On theoretical grounds, the rational expectations hypothesis has some clear advantages over arbitrary forecast rules. Arbitrary forecasts ignore the incentives people have to continue updating forecast rules until all systematic errors have been eliminated. The incentive to change forecast rules will persist until forecasts are correct on average; that is, until forecasts are formed rationally. Rational expectations is therefore a theory of optimal forecasting given the economic model under consideration. Arbitrary forecast rules, such as adaptive expectations, do not use information efficiently and are suboptimal in this well defined sense.

Nevertheless, the rational expectations hypothesis has not escaped criticism on theoretical grounds. It is generally agreed that there are strong incentives to use all available information optimally but the proposition that this leads naturally to rational

expectations has been refuted (Frydman and Phelps, 1983). The difficulty is that convergence to rational expectations is problematical and requires a "consensus condition" which allows people to predict one another's behavior (Frydman, 1982). Without such a consensus condition, different people will base their forecasts on different models of the economy or market and a process of updating forecast rules may never bring convergence to rational expectations (Townsend, 1983).

Empirical studies of the way people actually form expectations when forward markets are incomplete have had mixed results. A recent paper reviewing some empirical evidence concludes that while there are exceptions, the "weight of empirical evidence is sufficiently strong to compel us to suspend belief in the hypothesis of rational expectations, pending the accumulation of additional empirical evidence" (Lovell, 1986). But the results of testing the efficient markets model of financial asset markets, commodity markets, and foreign exchange markets, are more inconclusive. For example, Mishkin (1981, 1983) and Fama (1970, 1981) find support for the efficient markets hypothesis while, Leroy and Porter(1981), Shiller(1979, 1981), and Grossman and Shiller(1981) reject the model. However, Flavin (1983) criticized the variance bounds test used by the latter authors because it is biased towards rejecting the rational expectations hypothesis in small samples. Flavin concludes that the evidence generally supports the rational expectations hypothesis. Other authors (e.g. Hoffman and Schmidt, 1981; Hansen and Hodrick, 1980; Baillie, Lippens and McMahon, 1983) use alternative tests and find mixed support for the rational expectations hypothesis.

One possible explanation for the discrepancy between these conclusions from tests of the rational expectations hypothesis is the different data sources and test method. For example Lovell (1986) relies on survey data while the efficient market model tests rely on market level data. Survey data are often considered unreliable because there are no strong incentives for those surveyed to make and reveal their optimal forecasts. Furthermore, even if some individuals in a market do not have rational expectations,

market level data may still be consistent with the rational expectations hypothesis. As long as previously unexploited profit opportunities are removed by the actions of some of the market participants, the market may behave as though forecasts are rational even if there are some participants using arbitrary forecast rules. Baillie (1987) provides a review of the statistical tests used to test rational expectations in exchange markets, and concludes that there is evidence either of the failure of rational expectations or of a risk premium in the market, but is unable to determine which conclusion is warranted.

Even if incomplete forward markets are a source of economic inefficiency in agriculture, there is still the question of how large the resulting economic welfare losses are. When forward markets are incomplete and forecasts are not formed rationally, the potential economic welfare gains from intervention are equal to the value of a rational expectations forecast. A number of authors have estimated economic losses from forecasting errors in agriculture (DeCanio, 1980; Antonovitz and Roe, 1984). DeCanio finds that the value of perfect information to Kansas wheat and corn farmers averaged two percent of gross income over the years 1878 through 1933. This is an estimate of the value of perfect information rather than of a rational expectations forecast. Furthermore, a component of the gain to farmers may be a transfer from consumers. Thus, this figure overestimates the net benefit from a rational expectations forecast. Antonovitz and Roe estimate the net benefit to producers and consumers of a rational expectations forecast for the fed cattle market between 1970 and 1980. Their results suggest a benefit of 0.6 percent of gross income from cattle production. As proportions, these benefits from rational expectations forecasts appear small.

3. Incomplete Contingency Markets

When the economy is subject to uncertainty and people are risk averse then full economic efficiency cannot be achieved without a complete set of contingency markets. That is, full efficiency requires that all risks be insurable given the existing

structure of market institutions. Without a complete set of contingency markets, there are inadequate instruments for pooling and transferring risks and an optimal allocation of risks cannot be attained. Examples of contingency markets are futures markets, options, insurance markets, the bond market, and the stock market.

As a simple example of the effects of incomplete contingency markets, consider an economy with two agents and two time periods. In the first period each agent is endowed with some quantity of a single commodity. They do not consume in the first period but do gain utility from consumption in the second. There are two states of nature that may be realized in the second period and utilities are state dependent. Consumption of the single good in states 1 and 2 can be thought of as consumption of different commodities. Thus, ex ante consumer preferences are represented by indifference curves in the Edgworth box diagram of Figure 2 where the axes represent consumption in different states of nature. The endowment point, e, is independent of the state of nature realized and so lies on a 45 degree certainty line between the zero consumption points of the two consumers.

It should be clear that an ex-ante efficient allocation requires that each agent's marginal rate of substitution between consumption in different states of nature be equalized. If this equality does not hold then a reallocation of contingent commodity claims would make both agents better off. The equality of marginal rates of substitution occurs at the point of tangency between agents' indifference curves in Figure 2 and this tangency point will generally lie off the 45 degree certainty line. With a complete set of contingency markets, agents can trade away from their endowment point to an efficient allocation where marginal rates of substitution are equalized. But without contingency markets, agents are stuck at their endowment point and inefficiency is the result. This is because agents have no incentive to trade on the spot market after the state of nature has been realized and so will simply consume their endowments.

It is often argued that contingency markets are incomplete even in the most developed market economies (Tobin, 1980). Usual explanations are the high costs of setting up and operating some of these markets and the imperfect information problems known as moral hazard and adverse selection[5] (Arrow, 1986). Recent theoretical advances suggest that call options and subordinated debt instruments may play an extremely important role in completing the structure of contingency markets. For example, Green and Jarrow (1987) show that in principle a firm could complete the market for contingencies associated with its payoffs by a (possibly infinite) sequence of subordinated debt issues. While subordinated debt instruments are frequently seen in today's economy, and while the number of options markets has been increasing rapidly, the number of commodities or firms for which options or debt markets do not exist remains large. That is, the requirements that are necessary to provide a theoretically complete set of contingency markets appear to be very strict. Thus today's economy appears to be a long way from having a complete set of contingency markets.

When contingency markets are incomplete, even the rational expectations equilibrium is not economically efficient, so there is a potential role for government in improving economic efficiency. As illustrated in the example above, the reason is that without a complete set of contingency markets people cannot trade risks in order to equalize marginal rates of substitution between consumption in any two states of nature. In other words, there is an inefficient allocation of risks. Since government regulations can influence probability distributions on future prices, and therefore marginal rates of substitution between states of nature, it is possible that a government

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[5] Moral hazard occurs when the purchase of insurance induces the insured to undertake risk increasing actions (or fail to undertake risk reducing actions) and these actions cannot be monitored by the insurer. Adverse selection occurs when individuals have different degrees of risk exposure but the insurer cannot distinguish between the different types of individuals. As a result, the same insurance contract must be offered to all individuals. In both cases, the incentives to trade on contingency markets are distorted and may result in no trade on markets that are seriously affected.

could improve economic efficiency by policies that reallocate risks throughout the economy (Borch, 1962; Hart, 1975; Newbery and Stiglitz, 1982).

From a theoretical perspective, the incomplete contingency markets rationale for government regulation of agriculture has to be taken seriously. It has sound microeconomic foundations in the form of theories of moral hazard and adverse selection, and there is a rich body of theoretical research into the properties of incomplete market economies. For example, Geanakoplos and Polemarchakis (1985) show that competitive equilibria exist in incomplete market economies and that such equilibria are indeed inefficient. On the question of whether governments should intervene in incomplete market economies, Arrow and Lind (1970) argued in favor of government investment in risky projects when markets are incomplete and Mayshar (1977) suggested government subsidization of risky private projects in similar circumstances. Furthermore, Polemarchakis (1979) showed that a regime of price regulation and quantity rationing can dominate competitive equilibria when markets are incomplete.

Direct empirical evidence on whether contingency markets available to agriculture are complete or incomplete is difficult to come by. Unfortunately, one cannot just scrutinize the structure of existing contingency markets looking for omissions and imperfections. The fact that individuals do not trade certain risks is not necessarily evidence of incomplete contingency markets because even if markets for trading these risks were introduced there may be no use made of them. That is, the "missing" contingency markets may be redundant and therefore not required to bring about an optimal allocation of risk bearing.

To find evidence that contingency markets are incomplete, farmer and consumer behavior must be examined for signs of uninsurable risks that influence their resource allocation and consumption decisions. There is a large body of research on the degree to which farmer decisions are influenced by uninsurable risks (Anderson, Dillon and Hardaker, 1977; Young, 1979; Traill, 1978; Myers 1986). This literature can be interpreted as indirect evidence that contingency markets in agriculture are incomplete.

Empirical evidence on the magnitude of economic welfare losses in agriculture from incomplete contingency markets is not abundant. Newbery and Stiglitz (1981) have examined the desirability of international price stabilization schemes in the presence of incomplete contingency markets. They argued that gains in economic efficiency would be small and were doubtful of the ability of governments to actually achieve improvements over the market mechanism. As a proportion of commodity revenues, Newbery and Stiglitz find the benefits of price stabilization to range from 0.2% for cotton to 4.1% for sugar. As a proportion of income these percentages would be even smaller. Myers (1987) has compared an incomplete markets equilibrium to a complete markets equilibrium in agriculture and found that economic efficiency gains from the first best policy of introducing a complete set of contingency markets are small in relative terms. The estimated net benefit from complete contingency markets ranged from 0.02% to 0.84% of income. The implication is that no second best policy designed to counteract the effects of incomplete contingency markets in agriculture can significantly improve economic efficiency. Finally, Innes (1986) has shown that price support policies in the presence of incomplete contingency markets can reduce farmer welfare but increase overall economic efficiency. These studies are preliminary and further quantification of the effects of contingency markets and second best policies are needed.

4. Government Failure

Market failure creates a potential for improvements in economic efficiency but there may be little reason to expect governments to formulate policy aimed at realizing these efficiency gains. Policy formation revolves around a complicated system of nonmarket incentives and it is not at all clear that correcting market failures is a primary objective (Peltzman, 1976; Becker 1983). And even when correcting market failures does enter into policy objectives, the incentive structure can distort policy

implementation to such an extent that the outcome is less economically efficient than with the market failure (Buchanan, 1968; Stigler, 1971; McFadden, 1975). This problem has been termed nonmarket or government failure.

Government failure implies that regulation will be oversupplied. Bureaucracies have incentives to maximize budgets and the number of workers they employ rather than to achieve economic efficiency objectives (Mueller, 1979). Furthermore, there is a tendency for technological bias in nonmarket organizations (Wolfe, 1979). In some instances the bias is towards technology as modern sophisticated technology becomes a symbol of organization performance and a cornerstone of growing budget requests. In other cases the bias is away from technology in order to protect employment numbers. There appear to be few incentives to minimize costs in government bureaucracies and production may occur inside the production possibilities frontier. Government regulation can have unanticipated negative side effects and can lead to a concentration of power in the hands of a few administrators who are then susceptible to coercion and corruption.

The government failure literature has led to the view that, far from being an efficient response to disequilibrium and incomplete markets, U.S. agricultural policy is a mechanism for income transfer to special interest groups that have captured the political process (Rausser, 1982; Oehmke and Yao, 1987). Thus there has been an oversupply of government regulation in agriculture due to the incentive structure facing politicians, bureaucrats and special interest groups. So even if there are serious market failures in agriculture, there may be little reason to expect improvements in economic efficiency to result from the political process.

5. Conclusions

Three potential sources of market failure associated directly with instability and risk in agriculture have been discussed: disequilibrium, incomplete forward markets and incomplete contingency markets. Each incorporates a theory of how an unregulated

agricultural sector may be economically inefficient, and each has a degree of empirical support in the literature. This raises three important questions. First, how large are the potential benefits from correcting these market failures? Second, are optimal agricultural policies for correcting these market failures feasible? Third, is it likely that optimal policies will result from the political process?

The first question was considered in the discussions above. The evidence was found to be limited, particularly in the case of disequilibrium where we could find no direct empirical estimates. The magnitude of potential economic welfare gains from correcting for the effects of incomplete forward and incomplete contingency markets on agriculture also remains an open question. However, research to date indicates that the gains may be relatively small.

Optimal agricultural policies for correcting the three forms of market failure may take many forms. The first best policy would be to eliminate all sources of disequilibrium and to introduce missing forward markets and contingency markets. But this may be impossible for governments to accomplish for the same reasons that private individuals find it impossible: incomplete information and high transaction costs.

When first best policies are infeasible it has been argued that second best policies are needed to improve economic efficiency. Second best policies could take the form of tax-subsidy schemes, price stabilization schemes, quotas, support price and target price schemes and so on. A major problem with such schemes is that they have prohibitive informational requirements. That is, the information a government would need in order to design and implement optimal second best policies is usually unavailable and extremely difficult, perhaps even impossible, to obtain.

Consider the case of a tax-subsidy scheme to counteract the effects of incomplete contingency markets. The optimal tax-subsidy scheme is a set of payments to or from each individual that depends, among other things, on the expected marginal utility of income of all individuals (Newbery and Stiglitz, 1982). Information on individual

marginal utilities of income will be difficult (impossible?) to obtain. To counteract incomplete forward markets in the absence of rational expectations, governments would need to introduce the missing forward markets or be able to forecast better than private individuals. But it is hard to see how this might be accomplished. If the government has access to better information than private individuals then the optimal policy is simply to make this information available to others. If the government does not have better information than it is hard to see how an optimal second best policy could ever be implemented.

In the case of disequilibrium, it is difficult to even define what an optimal second best policy would look like. The problem is that standard welfare economics does not apply in disequilibrium models so even defining, let alone implementing, the optimal second best policy defies standard economic practice. Optimal stabilization of a flex-price sector like agriculture would presumably require information on the underlying equilibrium path of the sector, information that is exceedingly difficult to obtain.

Turning to the third question, it seems clear from discussion in the previous section on government failure that few incentives exist for governments to undertake policies that correct for market failures in agriculture. Thus, even if optimal policies are feasible and would lead to significant welfare gains, two propositions that have been questioned here, there appears to be little reason to believe such policies will evolve from the political process.

It would be wrong to suggest that it is logically impossible to design optimal second best, or even first best, agricultural policies to overcome market failures caused by disequilibrium and incomplete markets. But the informational requirements of such policies make them very difficult, and perhaps very costly, to design and implement. Furthermore, the potential benefits may not be large. To argue seriously that stabilization and risk reduction policies improve economic efficiency in agriculture, we must be able to say there is a reasonable prospect of the political process implementing optimal agricultural policies in practice. Currently, this seems to be far from the case.

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