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A SUMMARY OF ECONOMIC ANALYSIS
OF COMMODITY PRICE STABILIZATION

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A SUMMARY OF ECONOMIC ANALYSIS OF COMMODITY PRICE STABILIZATION

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The merits of stabilizing commodity prices have been discussed by economists for decades. Advances in theory have come in pieces and often have clouded previously accepted analyses. This paper will attempt to summarize the current theory of commodity price stabilization as well as highlight past contributions from which the current theory has developed. Throughout most of this paper it will be assumed that price stabilization is achieved through commodity storage only (i.e., with publicly or privately held stocks) and without any explicit restrictions on producer output.

The effects of price stabilization on producer and consumer welfare have been demonstrated by Newbery and Stiglitz (1981, 1982) to be highly sensitive to the specifications of supply and demand relationships. Almost any welfare result can be derived given an appropriate set of assumptions. The ambiguity of these theoretical results thus focuses interest on characteristics of individual commodities, the plausibility of the assumptions used in the analysis, and the goals of the stabilization program.

THE BASIC ARGUMENTS

The effects of stabilizing the price of a single commodity were developed by Waugh (1944) and Oi (1961) and were synthesized by Massell (1969, 1970). Their approach, which like most of the literature is a partial equilibrium analysis, evaluates the benefits of price stabilization

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by examining changes in producer and consumer surplus. Waugh-Oi-Massell assume "linear demand and supply schedules, instantaneous reaction of supply and demand to changes in market prices, additive stochastic disturbances and price stabilization at the mean of prices that would have prevailed in an unstabilized market (World Bank, 1977)". Their analysis of the case of variable supply is shown in Figure 1. The results are:

1) Producers gain (lose) and consumers lose (gain) from price stabilization if the source of instability is on the supply (demand) side; and,

2) In both cases of supply or demand instability, total net gain to price stabilization is positive, that is, gainers can compensate losers.

The linearity assumptions of the Waugh-Oi-Massell analysis are very restrictive. Among other results, linearity implies that the appropriate price at which to stabilize fluctuations through stock adjustments is the mean price. If the supply and demand relationships are not linear, stabilizing price at its mean will lead to quantities consumed less than the mean quantity supplied to the market at mean price. Figure 2 illustrates this dilemma. Unless the buffer stock authority is willing to continually remove or restrict supplies from the market to be stabilized, the level at which price is stabilized generally must be less than mean price.

Another conventional approach to the welfare effects of price stabilization evaluates welfare changes in terms of changes in the mean and variance of producer income and consumer expenditure. People are assumed to benefit from increased income (decreased expenditure) and decreased income (expenditure) variance. This approach allows for nonlinearities
Figure 1. The Waugh-Oi-Massell Analysis, variable supply example.
Figure 2. Effects of Price Stabilization at Mean Price when Demand is Non-Linear

\[ \bar{P} = \text{mean price} \]

\[ \bar{Q} = \text{average consumption} \]

\[ Q(\bar{P}) < \bar{Q} \]

To keep average consumption constant stabilized price must be less than \( \bar{P} \).
in supply and demand as well as for multiplicative stochastic disturbances. Again, mean prices are preserved, and, in its simplest form, instantaneous adjustments to changes in market prices are assumed. The latter assumption obviates the need for specifying a theory of price expectations and the former assumption rules out any changes in supply or demand distributions that may occur as a result of price stabilization.

Evaluating incomes and expenditures directly reveals another difficulty with the price stabilization results above. Price stabilization will often lead to increased variability in incomes and expenditures because prices and quantities are negatively correlated. For example, if demand is stable, supply is variable, and (without loss of generality) the demand curve is log linear, price stabilization will increase the variability in producer incomes if the elasticity of demand is less than -0.5 (e.g. -0.6).

Analyses which use the income-expenditure criteria derive the distributional effects of stabilization schemes. The effects of price stabilization on mean income are shown in Figures 3 and 4. In Figure 3, demand is elastic, income is a convex function of price, and price stabilization lowers average income. When income is a concave function of price (demand is inelastic), price stabilization raises average income (Figure 4).

Various combinations of these two approaches to analyzing the welfare effects of price stabilization have been used to examine specific situations. Turnovsky (1973) analyzed the distribution of welfare gains following price stabilization with consumer-producer surplus analysis under assumptions of nonlinearity in supply and demand relationships and multiplicative stochastic disturbances. Just, et. al. (1979) modelled gains and losses
Figure 3. The Effect of Price Stabilization on Revenue When Demand is Elastic.

Price Stabilization Lowers Average Revenue.

Price

Total Revenue

Figure 4. The Effect of Price Stabilization on Revenue When Demand is Inelastic.

Price Stabilization Increases Average Returns.

Price

Total Revenue
from price stabilization in an international trade context using Turnovsky's methodology. These studies conclude that while the shapes of the supply and demand curves influence the distribution of gains from price stabilization, the net benefits are always positive.

A major drawback of the relatively simple models presented above is that they overlook much that theoretically effects societal welfare. At one extreme the conventional models can be criticized for ignoring the well-known welfare result that a competitive equilibrium is Pareto-optimal. Given the appropriate circumstances with regard to risk-markets, the utility maximizing behavior of individuals and price flexibilities, Arrow (1972), Debreu (1959) and Hanoch (1974), among others, have shown that Pareto-optimality is achieved by the market alone; that is, interventions such as price stabilization are Pareto-inferior. At the other extreme the simple models can be criticized for failing to consider the impediments to market-achieved Pareto-optimum in the absence of price stabilization. These impediments include the facts that individuals are usually risk averse, a complete set of risk markets does not exist, and all markets are not perfectly competitive. The effects of price stabilization must then be analyzed in light of these arguments.

As but one example, most analyses do not include the effects of commodity storage which might be undertaken by private traders. In 1953 Gustafson showed that an optimal public storage rule is equivalent to market supplied private storage under assumptions of risk neutrality, rational expectations, and perfect competition. Under these conditions, a government storage program is unnecessary and simply substitutes for
private storage. Helmberger and Weaver (1977) confirm Gustafson's result and also stress the importance of considering private storage activities when analyzing price stabilization effects under conditions where the requirements for Gustafson's result do not hold. Peck (1977) uses data from the U.S. wheat market to demonstrate the effectiveness of commercial storage, the substitution of public for private storage, and the important role futures markets perform in providing price stability.

CURRENT ANALYSIS

Newbery and Stiglitz (1981) provide a method for analyzing the effects of price stabilization that incorporates the key impediments to a market-achieved optimal level of price stabilization. Their approach also has the attraction of including long run responses to price stabilization. The theoretical foundations of the analysis are built on rational expectations and an expected utility framework and thus include direct consideration of the effects of risk. Their framework can be shown to include virtually all the currently popular specifications of supply and demand relationships.

The analysis clearly demonstrates how the specifications of supply and demand relations often bias and predetermine the results of an analysis of price stabilization. They conclude: "The methods used in the evaluation of the costs and benefits employed in many of the early studies are seriously flawed; the costs tend to be underestimated and, although the direct benefits of risk reduction are usually completely ignored, the total benefits of stabilization are probably overestimated (N-S, 1981, p. 12)." The major results of their analysis are briefly summarized below.

N-S first distinguish between the transfer and efficiency effects
that may result from a price stabilization program. Transfer effects pertain to the distribution of welfare between producers and consumers, efficiency effects pertain to net societal benefits from price stabilization. Their main conclusion is that efficiency gains are usually small, even considering risk-reduction benefits, and, under most plausible circumstances, distributional effects usually favor consumers at the expense of producers.

Individuals are averse to fluctuations in income, c. more specifically consumption, and not to fluctuations in price per se. N-S demonstrate that price stabilization may exacerbate variability in income and consumption, thereby also increasing the level of income risk. If, for instance, producers are widely diversified and the variability of their income from the crop to be stabilized is not correlated with other sources of income, then stabilizing the price of just one commodity may have a negligible effect on producer welfare. When correlations between income sources are negative the effect is deleterious. The more diversified an economy, the smaller the gains from price stabilization.

Further, individuals are concerned with the stability of their real income rather than nominal income—assuming no money illusion. Because the changes in prices in an economy are usually correlated, the variance in real income is usually less than the variance in nominal income. By stabilizing the price of one commodity and not others, price stabilization may increase the variance of real income.

N-S also find instances where consumers lose as a result of price stabilization. If, for example, the source of price instability arises from demand fluctuations, consumption must be destabilized to stabilize price.
Analyses of price stabilization usually overlook the responses of individuals to a reduction in price variance by means of a government storage program. This oversight seriously biases any analysis of the benefits and costs of a price stabilization program. N-S analyze many of the possible responses to price stabilization, though their primary concern is producer response. Analyses of price stabilization often assume that producers make no change in mean output in response to decreased price variance. N-S show that, aside from risk-reduction effects, if mean output is preserved, changes in mean income are only distributional—there is no net change in the sum of producer and consumer income. However, the assumption that mean output remains constant following price stabilization is untenable in the more general analytic framework.

Potential changes in production relationships are largely dependent on income risk effects of price stabilization and producers' attitudes toward income risk. The net result may be an increase or decrease in output variability as well as an increase or decrease in mean output. Plausible output scenarios abound. Reduction in price risk may cause producers to increase production in response to perceived higher returns. Alternatively, production may decrease in response to more assured returns for the stabilized crop. Producers may change technology, input use and cropping decisions. Increased production, the most likely result, could diminish producer welfare when lower mean prices result. In the course of these events producers may be slow to learn. They may expect higher prices than they rationally should. Welfare losses are then incurred as producers overcommit resources to the stabilized crop.
Beside producer response, price stabilization will also have an impact on the storage decisions of commercial firms. Private storage may become unprofitable as the difference in prices over time is reduced. Interestingly, if the government attempts to totally stabilize price, private storage may increase as individuals speculate on the probability that government stocks (or funds) will be insufficient to defend stated goals. This sort of speculative private storage would increase price variability in the long run.

In addition, it is impossible to totally stabilize price for an indefinite time period. Given random stochastic supply or demand disturbances, stocks of any finite size will be depleted eventually. Therefore, a reasonable stabilization scheme must be designed to set a low probability of running out of stocks in N years. Yet, even with reasonable probability limits, the design of a good stabilization program is complex. The objectives of attaining a high benefit-to-cost ratio are difficult to meet with uncertainty about long run responses to the program. Unless these are accurately estimated, the costs of any stabilization program are likely to be underestimated.

Beside changes in microeconomic efficiency, price stabilization may have significant macro effects for certain economies, even if micro benefits are small. If commodity prices are volatile but the prices of manufactured goods are sticky, economies that rely heavily on income from flexible price commodities may experience large fluctuations in employment and GNP. Stabilizing these prices would therefore improve macroeconomic efficiency. However, the specification and quantification of any such macro gains heretofore been vague and incomplete.
N-S offer some "tentative macro models to remedy the imprecision of earlier discussions (p. 36)." They conclude that macro benefits may indeed be real, but also vague. They also question the use of price stabilization programs for smoothing income fluctuations when other more efficient countercyclical government policies are available.

ALTERNATIVES TO PRICE STABILIZATION

Other mechanisms for achieving price, income or consumption stability may be more efficient than government storage programs aimed at stabilizing prices. The availability of many of these mechanisms strengthens the arguments against direct stabilization schemes.

If simple insurance against adverse price movements or price volatility is sought, voluntary long term contracts where price is fixed may be superior to a program that directly manipulates market price. Long term contracts may be drawn on a broad basis, such as government to government, or between private parties. A drawback to long term contracts is that they leave the rest of the market subject to greater price swings as the residual market becomes thinner. However, if these contracts are made negotiable, this problem is alleviated.

Futures contracts are essentially negotiable contracts for delivery of a commodity in the future. Prices can be fixed today thereby avoiding the risks of price volatility in the intervening period. Unlike long term, negotiated contracts, futures markets require a deposit of money before the position can be established. These margin monies are used to settle accounts on a daily basis. If initial margin monies are sufficiently depleted, more
will be required. Thus, futures positions may entail significant interim financing costs.

Besides transferring price level risk, futures markets provide incentives to store commodities in times of surplus and release stocks in times of shortage. The incentive to store or release is determined by the market in the form of price differences, or carrying charges, between delivery months. Thus, futures trading promotes efficient intertemporal allocation of commodities thereby also promoting price stability.

Futures markets do not appear to solve long run price stability problems because contracts are only traded a year ahead. However, longer term positions can be established in near term, actively traded contracts and moved forward (reestablished) when those contracts expire. Under this scheme, price insurance is not as certain as in the example above since the eventual price is dependent upon the difference in prices between futures contracts when the position is rolled forward. Nevertheless, the uncertain costs of maintaining a longer term futures position will always be less than those of maintaining an equivalent-sized reserve of the physical commodity (Peck, 1982). Finally, both the futures trading and the long term contract alternatives stabilize prices and not incomes (or total consumption expenditures).

Income and or consumption instability can be more effectively reduced with insurance programs. However, straightforward insurance programs have a "moral hazard" shortcoming. Efficiency incentives are reduced when individuals face an insured income. N-S suggest a scheme whereby producers are guaranteed a price inversely proportional to total market supply. In this way, producers would still have an incentive to be efficient and income would be stabilized. However, the effectiveness of this scheme depends
upon a strong correlation between individual and total market supplies.

The most attractive method for coping with variability in imports (and hence total consumption) of major importing countries is through better capital market access and use. International borrowing and lending facilities, such as the Compensatory Finance Facility of the IMF and the Stabex program of the Lomé Convention provide increased macroeconomic stability to countries faced with variability in foreign exchange earnings. However, these programs offer little direct assistance to individual producers and consumers. The establishment of better domestic credit markets is needed so that individuals can spread income variations over time.

Lastly, programs to improve market information may succeed in reducing, if not eliminating, unexpected variabilities in supply and demand which cause price variability. Demand forecasts made available before planting may help farmers make better cropping decisions. Likewise, supply forecasts may improve intertemporal storage decisions. Better data collection procedures and estimation techniques can improve forecasting accuracy. Improving market information cannot reduce weather variability and the occurrence of other unpredictable events, but it can help the market and prices adjust to such shocks in a more orderly fashion.
BIBLIOGRAPHY


