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CONDUCTING A PRICE BAND: SOME DISCORDANT NOTES

by

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Abstract

The popularity of price bands adjusted for long run structural changes as market stabilization rules is no doubt due to their apparent virtues of symmetry and simplicity of operation. In fact, the possibility of structural shifts or long-run trends in prices of storable commodities poses a formidable challenge to the successful operation of such rules.

Even if trends or shifts are somehow perfectly identified, the common prescription of a symmetric price band for stabilizing prices has effects on stocks, producers, and the public budget that are counter-intuitive and not generally recognized, whereas the net effect on the price distribution can be of modest magnitude relative to the managerial challenges presented by the operation of a price band.

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Brian D. Wright and Jeffrey C. Williams

One consistent policy prescription in the history of economic advice on commodity markets has been that prices should be stabilized in a symmetric band around the mean to reduce the "boom and bust" gyrations typical of commodity prices (Keynes, Nurkse, Newbery and Stiglitz, Knudsen and Nash). Attached to this policy advice is a little proviso for completeness, to tie up a little technical loose end: Adjust the mean along the long-run trend. As Streeten (1986) puts it, "A good guideline is: keep domestic cereal prices in line with an estimated trend of future world prices (estimated by a reputable authority)..."

This piece of economic policy advice is of interest because so many stabilization schemes have tried to follow something like it (Gardner, 1985, and Gilbert, 1987, offer relevant surveys). It merits particular attention because they almost never succeed for very long—and we do not mean long in the sense of the Keynesian long run. The founders easily survive the life span of the typical scheme, physically if not financially. Why this lack of success?

Economists have contributed few insights of value. A precise argument for attempting to price the commodity at near the long-run shadow price, rather than at the short-run shadow price as usually prescribed for other problems, is rarely offered. And a frequent rationale given for this failure is "insufficient financing," which usually means not too much more than offering "lack of funds" as an explanation for bankruptcy. Failure to adjust adequately to structural change is identified less frequently as the cause of failure.

In this paper we shall focus on some elementary positive problems with following a price band buffer stock rule for a storable commodity. We shall deal in feasibility, not optimality and concentrate on two issues:

1. How easy is it to identify the appropriate price band adjustment rule to allow for secular changes in market circumstances, while smoothing short-run fluctuations?

2. What can a price band rule achieve even if no structural change ever occurs?

1. Identifying Appropriate Adjustments in the Price Band

In administering a buffer-stock scheme, the aim is, on the one hand, to smooth out short-run price deviations, while on the other, adjust to more permanent changes in equilibrium price. This would be easiest, and cheapest, if any short-run deviations tended to be quickly reversed. Then long-run shifts or trends could be identified accurately after a few years, and price bands adjusted accordingly. Unfortunately commodity price time series do not behave in so convenient a fashion.

The time series of spot prices for major commodities typically have two notable characteristics. First, there appears to be substantial positive serial correlation even at annual intervals. Second, the series sporadically exhibit upward spikes; occasionally the price shoots up, then quickly subsides to a more usual level.

Spot sugar prices, shown in Figure 1 annually for 38 years, provide a good example of both features. The tendency for the (deflated) price to spike occasionally then remain in the doldrums for years on end, such as the stretch over the mid-1980s, is unmistakable. The first-order serial correlation of the series is 0.53.

Perusal of other prices reveals commodity after commodity with these two features. For example, a plot for copper looks much the same as sugar. Spikes in copper prices transpired over 1973-74, 1979-80, and 1987-89, while the mid 1970s and early and mid 1980s had prolonged low prices. The two spikes in the 1970s also occurred in other base metals, in the principal grains, and in energy products—each time heightening concern about general inflation (Cooper and Lawrence, 1975, and Bosworth and Lawrence, 1982).

These aspects of commodity price behavior are broadly consistent with the theory of competitive commodity storage, even in markets in which the random disturbances are serially independent. For a nonstorable commodity, serial independence of any disturbances in supply and/or demand implies serial independence in prices. But storage of a commodity spreads the effects of unusually negative excess spot demand over several periods, and, to the extent that carry-in stocks are available, does the same for periods of high excess demand. Prices as high as would be seen in the absence of storage occur only if a period of high excess demand immediately follows a similar period, an unusual occurrence given serially independent disturbances. Thus the largest outliers in price are price peaks, but they tend to be rare and short-lived if the underlying shocks are independently and identically distributed (i.i.d.).

Of course, the fact that storage induces serial correlation in the market price does not imply that it is the sole empirical cause of such correlation. Indeed, recent work of Deaton and Laroque (1992) suggests that the storage model with linear demand and i.i.d. disturbances implies too little correlation at high prices relative to empirical observations; some other (unidentified) sources of serial dependence are, not surprisingly, also at work in the market. But here we shall concentrate on the phenomena associated with storage activity.

A further implication of storage is that the variance of price change is related to the current spot price. When price is low enough to justify some storage till the next period, the effect of the current stocks is to dampen the effects of high excess demand on price next period, and the higher the stocks, the more the damping effect. Variation in stocks induces heteroscedasticity in the price series. When spot price is above the level at which a stockout occurs, there is no such damping effect, and variance attains its peak level. Even then, however, the possibility of storage the next period continues to damp the prospective effect of negative excess demand shocks. So the conditional distribution of price remains skewed, and the variance is lower than in the absence of storage.

The other important endogenous variable besides current price, including consumption, produces revenues and expected price, are also serially correlated, when there is storage, even if the underlying disturbance is i.i.d. Since a large carryin stock tends to depress the spot price and encourage carryout storage, storage is highly serially correlated. The lower are storage costs, ceteris paribus, the higher the serial correlations in the model.

Figure 2 shows a series of 120 spot prices drawn from our rational expectations, competitive, profit-maximizing storage model with linear consumer demand with elasticity –0.2, supply elasticity 0.0, coefficient of variation of i.i.d. harvest disturbance of 10 percent, storage cost of 0, and interest rate r = 5% per period, with an infinite horizon. (See for example Wright and Williams 1988 or Williams and Wright 1991.) In inspecting time series like these, special features are often perceived even when the stochastic process is pure white noise. In Figure 2, however, the model's spot prices conform to the two stylized facts associated with storage, namely occasional sharp peaks and positive serial correlation. From a 10,000 period to simulation, the first-order autocorrelation is 0.67, not much different from that seen for sugar.

The presence of serial correlation makes it much more difficult to interpret recent market experience. Does a recent price slump indicate a temporary shock that the buffer stock is presumably designed to eliminate? Or does it indicate a change in the long run market environment to which the price band should adjust, for example a cost-reducing innovation or the emergence of a new competitive substitute? This type of judgment often arises with respect to decisions regarding corporate investment strategy. For example, MacAvoy (1988, p. xi) relates that for him and other members of the board of Amax Corporation "while those of other materials recovered over the 1983-1986 period, the question became that of which metals prices had remained at startlingly low levels for over five years." Had a structural shift occurred in these markets? The question had to be answered to decide whether Amax should on the one hand invest in new mines, which would not come into production for several years, or sell or abandon currently unprofitable mines, on the other. Another example is the U. S. farm bill, which is usually revised about every five years. The U. S. Congress finds itself in the role of judging whether prices in the intervening five years imply a shift in the long-run average price. But if Congress relies too heavily on the evidence from a half-decade, it risks serious error.

A natural way to test for a price shift is to calculate the average price and standard deviation over the five-year period, and construct the confidence interval from the t-statistics in the universal tables. One might imagine statements of the form: "With 99% confidence we can say the long-run mean price has shifted down from the previous average; indeed, with 90% confidence we can say the long-run price is $10 below the previous long-run mean." Every elementary statistics book recommends these techniques.

Behind Figure 3 are confidence intervals constructed in such a fashion with 50,000 samples of each length drawn from the same long series behind Figure 2. The prices of $88 or $112 are both one standard deviation from the long-run mean price of $100. Thus, Figure 3 tells the chance of concluding with 95% confidence that the long-run mean price is above $112 or below $88, using the usual t-test. Because the long-run mean price is, in fact, $100, this probability should be negligible if the procedure is performing as expected. But here we see that there above a 5% chance of falsely concluding that the long-run price is $12 from $100, for samples of up to 20, especially that the price is too low. The problem with the procedure is not in the notion of confidence intervals, but the implicit assumption of the conventional t-test that each observation is independent of the others. With a sample of spot prices from a storable commodity, that assumption is not tenable. The positive serial correlation causes the sample standard deviation to be a considerable underestimate of the population variance of the sample mean (Flavin, 1984). As a result, the confidence intervals are much too small. With positive serial correlation, a sample of size five has the information of a sample with independent observations of perhaps size three.

Another view of the implications of storage for decision-making by Amax is shown in Figure 4. This figure shows, conditional on a starting point in period 0 with a price of $100, the long-run average, the chance of a run of prices below $100 of various lengths, over the next 10 year interval. The concern of Amax's board that a run of five years of depressed prices indicates a structural change would be valid in a market for a nonstorable commodity subject to i.i.d. market disturbances. For in that case the probability of a run of five or more years within say a decade of observations appears negligible. If, on the other hand, the commodity is storable, the chance of a 5-year run of low prices is much higher, more than 15%. Hence part of the explanation for the persistent slump in metals prices in the mis-1980's is that frequent price depressions should be expected in markets for storable commodities.

Even with a much longer time series and the most modern methods, empirically identifying the trend in a time series of commodity prices would be no easy task for a buffer stock manager. The point is well illustrated by a case which has attracted much attention and generated many studies over its long history. This is the statistical debate on the trend in the net barter terms of trade between primary commodities and manufactures (see Figure 5), initiated by Prebisch (1950) and Singer (1950), which acquired renewed urgency in the mid-1980s.

Despite a recent flurry of empirical studies on long term movements in commodity prices, the debate has been difficult to resolve. Spraos (1980) fitted a simple log-linear time trend variable to the data in a regression estimated via OLS, and found no trend in the postwar period. Sapsford (1985), interpreted the results of Spraos in the light of a possible "omitted" structural break in 1950. By introducing a dummy variable and correcting for serial correlation through the Cochrane-Orcutt technique, Sapsford was able to recover a negative trend in the net barter terms of trade on post-war data. Thirlwall and Bergevin (1985), using quarterly data for disaggregated commodity price indices on the postwar period, also fitted exponential time trend models, finding evidence of either constant or deteriorating terms of trade. Grilli and Yang (1988), constructed new price indices and estimated a simple time trend model (correcting for serial correlation). They found significant downward trends in the net barter terms of trade.

As Cuddington and Urzúa (1987, 1989) noted, in the absence of any inspection of the statistical properties of the univariate representations of the series, all inferences that have been drawn are potentially subject to spurious regression problems. In a regression of a variable against a time trend and a constant, the distribution of the OLS estimator does not have finite moments and is not consistent if the error process is nonstationary (Plosser and Schwert (1978)), and tests of a time trend are biased towards finding one when none is present (Nelson and Kang (1984)).

The problem appears thus to be the appropriate description of the error process and, therefore, of the series at hand. Cuddington and Urzúa (1987, 1989), following the identification approach suggested by Box and Jenkins (1976), find that the series they analyze appear to be nonstationary in the mean. In their study of the Grilli and Yang indices (deflating by the United Nations Manufacturing Unit Value) they reject the deterministic trend model in favor of a stochastic trend by testing the null hypothesis of non-stationarity in the price series using the tests proposed by Dickey and Fuller (1979) and Perron (1988). Excluding a one-time drop that they assume occurred in 1920, they conclude that no deterioration has occurred in the net barter terms of trade from 1900 to 1983. On the other hand Ardeni and Wright (1990) use the structural time series approach of Harvey (see for example Harvey and Todd (1983) that requires no prior testing for stationarity, thus avoiding the well-known problem of the low power of the Dickey-Fuller tests. They find that the Grilli and Yang series appears to be trend stationary, with the trend declining at about –0.6 percent per year. If the 1920 dummy is arbitrarily added as in Cuddington and Urzúa, the series remains trend stationary, but the magnitude of the annual trend falls to –0.14 percent.

Therefore after more than fifty years of statistical measurement and research effort, economists can confidently say that the net barter terms of trade has stationary mean and negative trend. Or it has a unique and unexplained structural break in 1920 and is either nonstationary and trendless or it is stationary with weak trend. Then, of course, there are the cycles to consider. With this kind of advice, "adjusting for trend" in running a buffer stock for a sustained period from the end of this series would clearly be a piece of cake.

So far we have been considering the problem of inferring an appropriate location for a price band from price data in a market where such intervention neither exists nor is anticipated. If a price band scheme were already in effect, the price process would of course be quite different. But as we shall now see, the nature of the differences are not necessarily so obvious.

2. What can we expect from price band schemes?

Analysts of public market stabilization programs and actual managers of those programs tend to agree that a price band is the appropriate rule for the operation of a storage-based market stabilization scheme. ~~is centered around price band~~ schemes, ~~from the~~ econometric ~~exercises to the~~ policy simulations. The more recent analytical examples of an analytical focus on price bands following in the footsteps of earlier writers such as Keynes (1974) include Gardner (1979), Hallwood (1979), Gardner (1982), Ghosh, Gilbert, and Hughes Hallet (1987), Miranda and Helmberger (1988), and Gilbert (1988). In many actual international commodity agreements, the manager of the public stockpile is charged with keeping price within some band, with rules mandating accumulation of stocks at the bottom of the band and release at the top, often with some management discretion within an intermediate price range (Gilbert, 1987 and Gardner, 1985). For example, the various International Cocoa Agreements have had a ceiling and a floor price symmetric about an "indicator" price, with this price band decomposed into a trigger range in which the buffer stock's manager can intervene at his discretion, and a nonintervention range. The U. S. farmer-owned reserve program has had what amounts to a floor price and a much higher "call" price at which the stock is surrendered, with an intermediate "release" price at which government storage payments cease.

Price-band schemes seem at first glance to be simple and efficacious means of stabilization. It seems obvious that, the disruptions of price changes are reduced by efforts to keep prices in a narrow band. The symmetry of the band around the long-term mean price appears to favor neither consumers nor producers and to guarantee no great stock buildup. The symmetry of the band would seem to imply a corresponding symmetry in the distribution of observed prices, and that accumulated net profits should hover around zero. On the other hand, intuition might suggest that supply response to the program may cause problems of excess stocks, so supply is best made unresponsive, if possible. Most obvious, the restriction on the release of public stocks to a price at lease equal to the top of the band seems a judicious and feasible storage policy.

None of these beliefs is valid in general. Most important, price-band schemes have an inherent tendency for a rapid and enormous accumulation of stocks, *unless* supply is responsive to price. Their effect on the distribution of price is by no means symmetric. Moreover, the requirement that public stocks be released only at the top of the band frequently leaves them in store when they would have higher social value if consumed immediately. Thus, price-band schemes have substantial deadweight losses compared to other market-stabilizing schemes such as deficiency payments or price floors. Nor does it seem that a coalition of producers alone would prefer them.

Some of the analytical support for public storage under a price-band scheme stems from a failure to specify the alternatives to such a program. Many authors write as if they suppose the only way to operate a buffer stock is with different floor and release prices. A buffer stock is more general and can be taken as synonymous with public storage whatever the rule for public intervention.

Within the broader category of public buffer stocks, a price-band scheme involves two prices—P^F, the floor price at which the government is willing to buy any amount offered to it, and P^B, the minimum price at which the government will release anything from its buffer stock. Naturally, P^B is greater than or equal to P^F.

Conventional price-band schemes, with P^B and P^F symmetric around a plausible long-run price, have an intrinsic tendency to accumulate very large stocks. Indeed, a stochastic steady state may not exist; in expectation, accumulation of stocks may continue indefinitely. These properties are not the result of the interaction of private storage or production with the public policy. Nor are they the result of misidentifying trends in production or consumption. Rather, they result from the prescribed inflexibility of a buffer stock, which can only release its stocks at P^B or higher.

These general observations are best illustrated with a relatively simple example. Consider a specification of our model as described above where the consumption demand curve is linear, new production is perfectly inelastic with a mean of 100 units, the harvest is normally distributed with coefficient of variation = 10 units, and there are no trends to average yields or to demand. The long-run average price without storage is \$100. Also suppose only the government can store in this closed economy and that it uses a price-band scheme. Without elastic supply and private storage, any strange behavior must be attributed to the government's storage policy.

As the top of the price band, P^B, is raised for a given P^F, the average amount stored increases explosively. This feature of price-band schemes can be seen starkly in Figure 6, which each P^B was simulated for 100,000 periods. With P^F set at \$80, a symmetric P^B is \$120. Yet, if P^B is set at even \$117, average storage is enormous compared to the average under a simple floor scheme (see the observation for P^B = \$80). At the symmetric P^B of \$120, average storage in that particular run of 100,000 periods is close to 15 times average production.

Average storage in a simulation of 100,000 periods is very large compared to the average storage under a floor-price scheme that stands ready to buy at the same P^F and sell at any price no less than P^F, as in Wright and Williams (1988). Periods without any storage still occur but become extremely rare, merely 0.14% in the case of the band scheme of 90–110% of P^N, the mean price.

It should also be emphasized that these values in Figure 6 for average storage under symmetric bands are not steady-state values because a steady state does not exist. Simulations 10,000 periods long would show lower average stocks, while simulations 1,000,000 periods long would tend to indicate substantially higher averages. The tendency is for continuous accumulation of stock and reduction of consumption below mean output, in contrast to simulations of a price floor below P^N, or purely private storage, both of which converge to a stochastic steady state.

When planned production is elastic, its response to the negative effect of current accumulation on returns to output next period can put a bound on the expected accumulation as in the path for supply elasticity = 1.0 illustrated in Figure 7. Storage is expected to approach, after many periods, its steady-state mean of 31.4 units. Because a stochastic steady state exists, the long-run effects of a price-band scheme on price distributions, mean consumption, and producers' welfare can be studied. (Of course, the more elastic supply is, the more stable is the free market price and the weaker is the case for government stabilization in the first place.) Accordingly, in the remainder of this paper only cases with elastic supply will be examined.

When we turn attention to the welfare significance of price-band schemes, the assumption of no private storage, convenient for demonstrating the tendency for large accumulations of stocks, must be dropped. No welfare analysis without private storage can purport to be accurate, for the welfare effects of purely private storage will be misattributed to the price-band scheme. Modeling of private storage, depending as it does on expectations of future behavior, requires stochastic dynamic programming.

More generally, when the public carryin is positive, private storage is distorted, sometimes upwards and sometimes downward, relative to the socially optimal level given the public storage behavior. This happens because a price-band scheme by definition imposes inflexible management on the public stockpile. Room is left in our example for flexible private storage. Consider public behavior in period t when the public carry in, S^{g}_{t-1} is 10 units and the new harvest is such that price is $110. Because $110 is just below the top of the band, $112.50, none of the 10 units is released. Nevertheless, the price expected for the next period, t+2, is below $110, $102.29 to be exact. Any private stocks are therefore sold. Such conditions should also be a message to release some of the public stockpile immediately, because its current marginal value is higher than its expected marginal value the next period.[1] Because in this and similar instances the carryin of 10 units is not released (from the perspective of the preceding period, t-1), price in the current period, t, is higher than it would otherwise be. This higher expected price induces private storage in period t-1, despite the existence of a public carryout.[2]

Thus, this price-band scheme constrains the public stockpile to store even when the current marginal social value of its holdings is higher than the *undiscounted* expected future marginal value. A floor-price scheme with the same P^F never does this. Hence, a price-band scheme has a higher social deadweight loss. Figure 8 makes this clear. In that figure is plotted the deadweight loss as a function of P^B. The excess burden of a symmetric price band—$87.50 and $112.50—is some 17 times that of a price floor scheme at $87.50.

Moreover, the present value of public expenditures on the scheme increases considerably as P^B is raised, as can also bee seen in Figure 8. With the competition of private storage, the expected profits from public storage is at best zero under all circumstances. The rule that the public agency can release stocks only at P^B, above P^F, exacerbates the cost of interest payments and warehousing.

Figure 8 also shows the capitalized value of the change in the stream of net revenues to producers compared to solely private storage. This capitalized value, equivalent to "producer wealth" if producers are taken to own their land and the initial private stocks, is shown net of the present value of public expenditures on storage.[3] This information can answer whether producers would be willing to tax themselves (lump sum) to run a price-band scheme. The answer is yes, but a price-band scheme is only slightly preferable to a straight price-floor scheme. More surprising, the P^B that most favors producers is not at all close to the level symmetric with P^F. Such a symmetric scheme is usually what people have in mind when they recommend price-band schemes. Producers in this instance of linear demand and supply elasticity almost surely would prefer some scheme other than a price band—destruction of stocks, deficiency payments, a price floor—given that the government is prepared to spend some set amount (in present value). In as much as a linear demand curve makes stabilization especially attractive to producers, the conclusion appears inescapable that for less favorable demand curves price-band schemes are far from producers' first choice.

Of course, price-band schemes are rarely put forward with the explicit objective of increasing producers' wealth. Generally, the immediate objective is presented as a reduction in the variance of price. The way in which this benefits producers and/or consumers is not directly discussed.

Price-band schemes do reduce the variance of price. Nevertheless, that simple characterization misses the complex alteration in the probability distribution of price. The distribution of price for three cases are plotted in Figure 9. One is the distribution with no public intervention, to serve as a frame of reference. The important comparison is between the price floor scheme with P^F = \$87.50 and the price-band scheme with P^F = \$87.50 and the symmetric P^B = \$112.50. Although the price-band scheme reduces the percentage of prices above \$112.50 from 14.9% to 6%, it primarily rearranges the distribution within the range \$87.50 through \$112.50. By far the most common price becomes P^B, where there is a mass point shown high on the diagram. The frequency of P^F, in contrast, falls from that under the price floor scheme. Because of private storage, which coexists with a price below about \$97, the distribution in the range between \$87.50 and \$112.50 is highly skewed.

A different perspective on the effects of a price band on the prices in a market is furnished in Figure 10, which shows representative time series with the same underlying disturbances for markets with no storage, private storage, and private storage with a price band, respectively. (The market has linear supply and consumption demand with elasticities of 0.2 and -0.2, respectively, and an additive supply disturbance with coefficient of variation of 0.1.) Note that private storage achieves most of the stabilizing effect of a price band. But the price behavior is interestingly different, especially in the second half of the sample. It is not at all obvious that the price band does a better job of keeping the price near the long-run mean of 100.

Finally, in Figure 11 we show for the same model results of tests for mean price, ignoring serial correlation, an issue similar to that addressed in Figure 3 above. These tests can clearly be hazardous whether or not a buffer stock is in operation. Of course the sophisticated manager would want to use observations on the stock and on serial correlation in making inferences regarding changes in the price process. If he or she is sufficiently patient to wait a long time before adjusting the band to an apparently changed mean, spurious adjustments of the mean can be minimized. Note that if the mean had indeed fallen, the scheme could be in severe disequilibrium by then, with a serious overhang of stocks to as a burden on the market for years to come. Management of a buffer stock when there is significant probability of structural change is a topic that clearly needs more analysis. Any advocate of price band schemes should be required to explain how the challenge will be met, before any public funds are expended on them.

3. Conclusion

The popularity of price bands adjusted for long run structural changes as means of operating a public market stabilization policy is no doubt due to their apparent virtues of symmetry and simplicity of operation. In fact timely identification of structural shifts or long-run trends in prices of storable commodities is a formidable challenge.

Even if trends or shifts are somehow perfectly identified, the common prescription of a symmetric price band for stabilizing prices has effects on stocks, producers, and the public budget that are counter-intuitive and not generally recognized. At least not until it is too late. On the other hand the effect on the price distribution, net of what can be furnished by profit-maximizing private storage, though complex and interesting, can be of modest magnitude relative to the managerial challenges presented by the operation of a price band.

Footnotes

[1]The signal is similar with the true marginal social value rather than the expected price.

[2]The private storage industry's attention to these opportunities persists until expected profits are zero. From that fact it follows that, in expectation, the price-band scheme must run a deficit.

[3]The present value of the stream loss of consumer surplus can be inferred as the curve for the social deadweight loss plus the curve for producer wealth.

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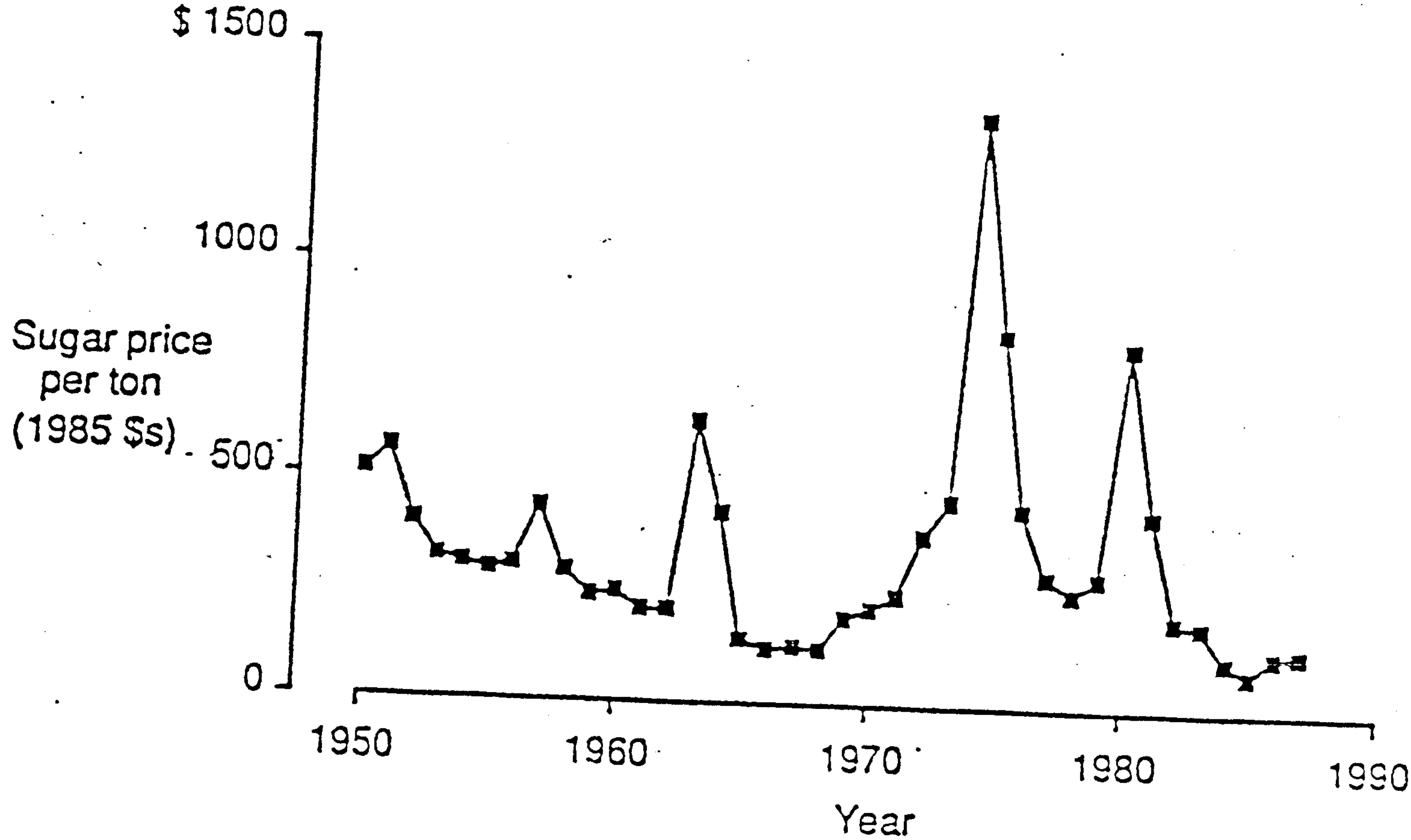


"World" price, f.o.b.s. Caribbean ports, deflated by U.S. GNP deflator
Source: World Bank (1989, p. 74, vol. 2)

Figure 1 Spot price of sugar, annually 1950-1987

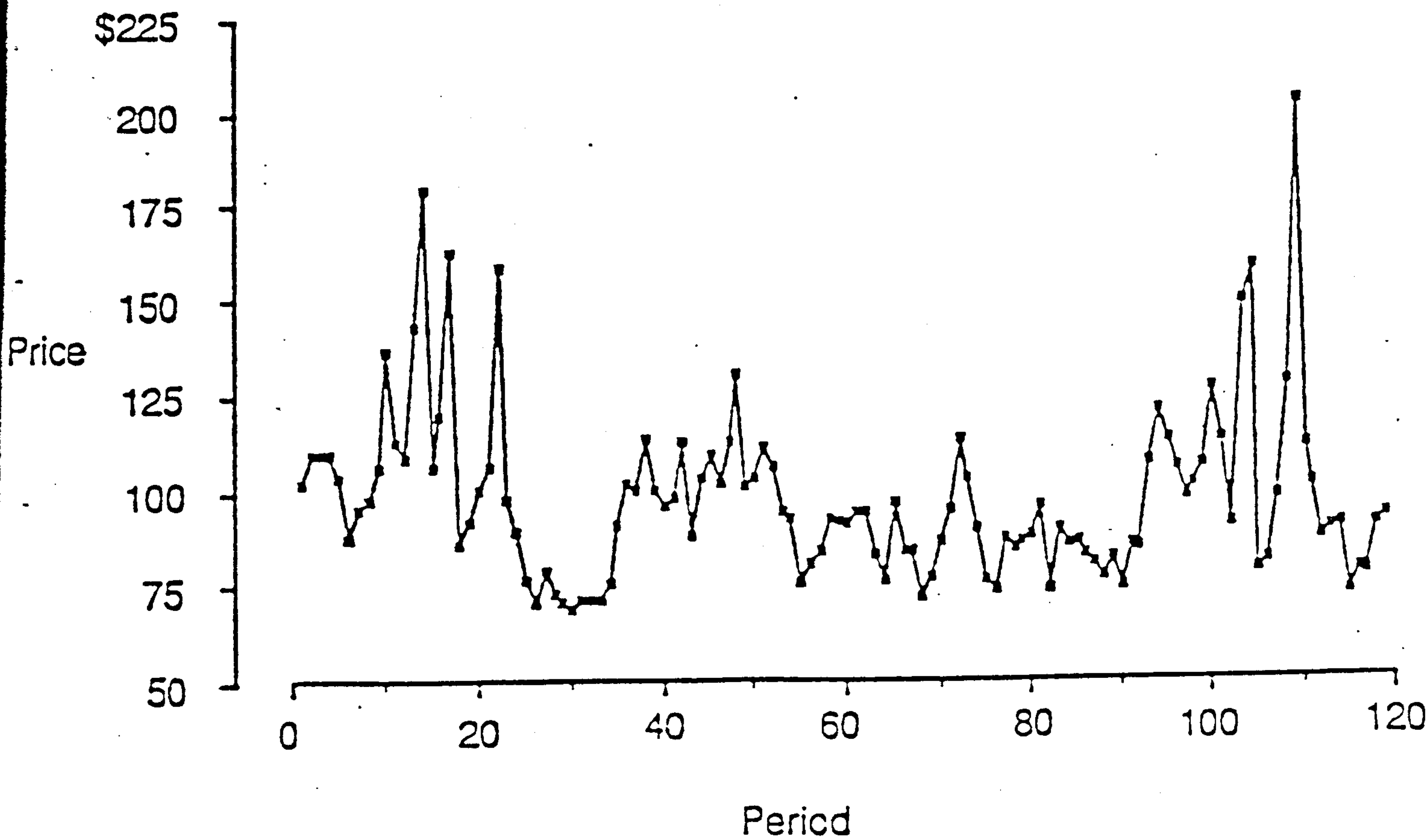


Figure 2 A time series of price

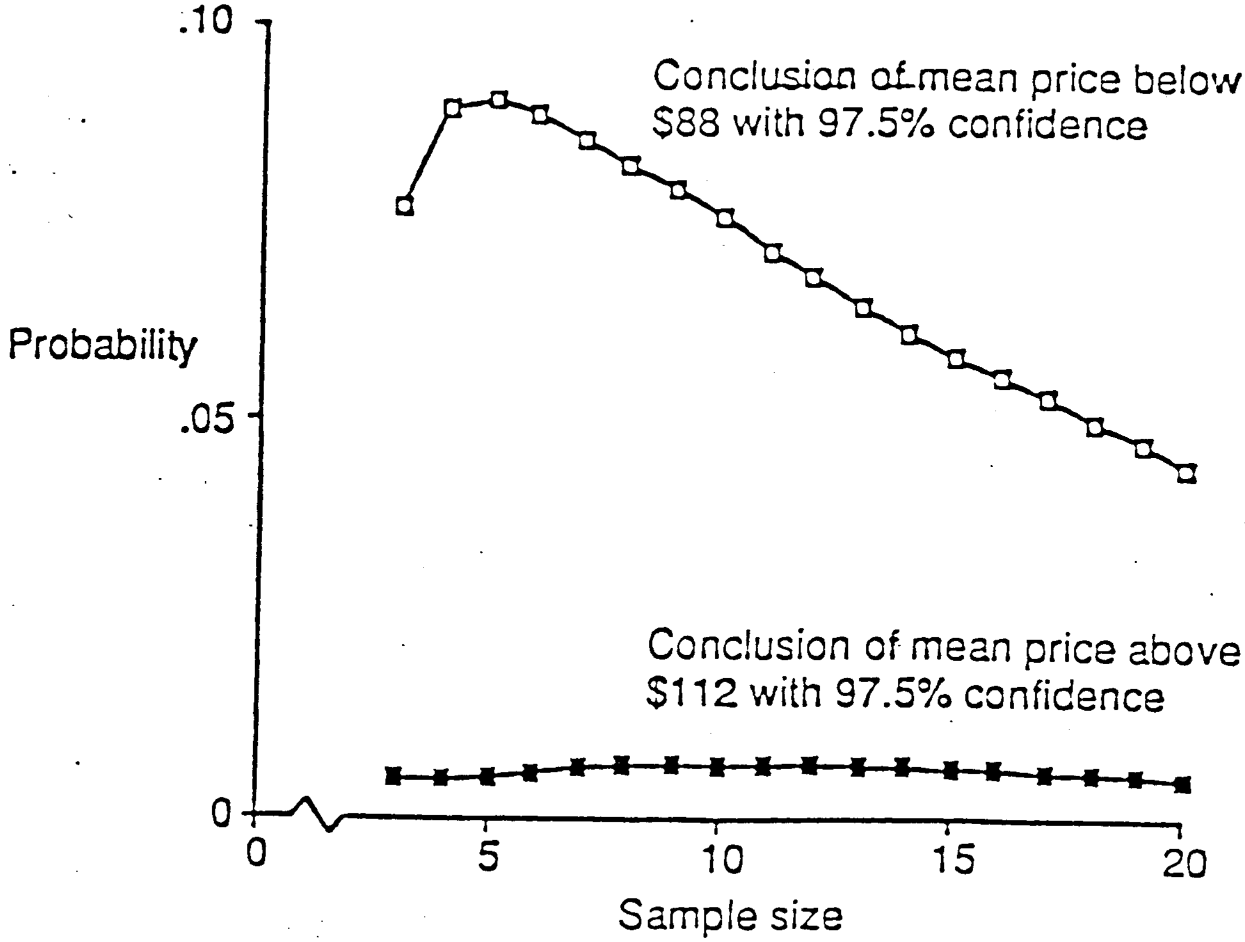


Figure 3 Effect of ignoring storage-induced serial correlation on estimates of long-rum mean price (true mean is $100)

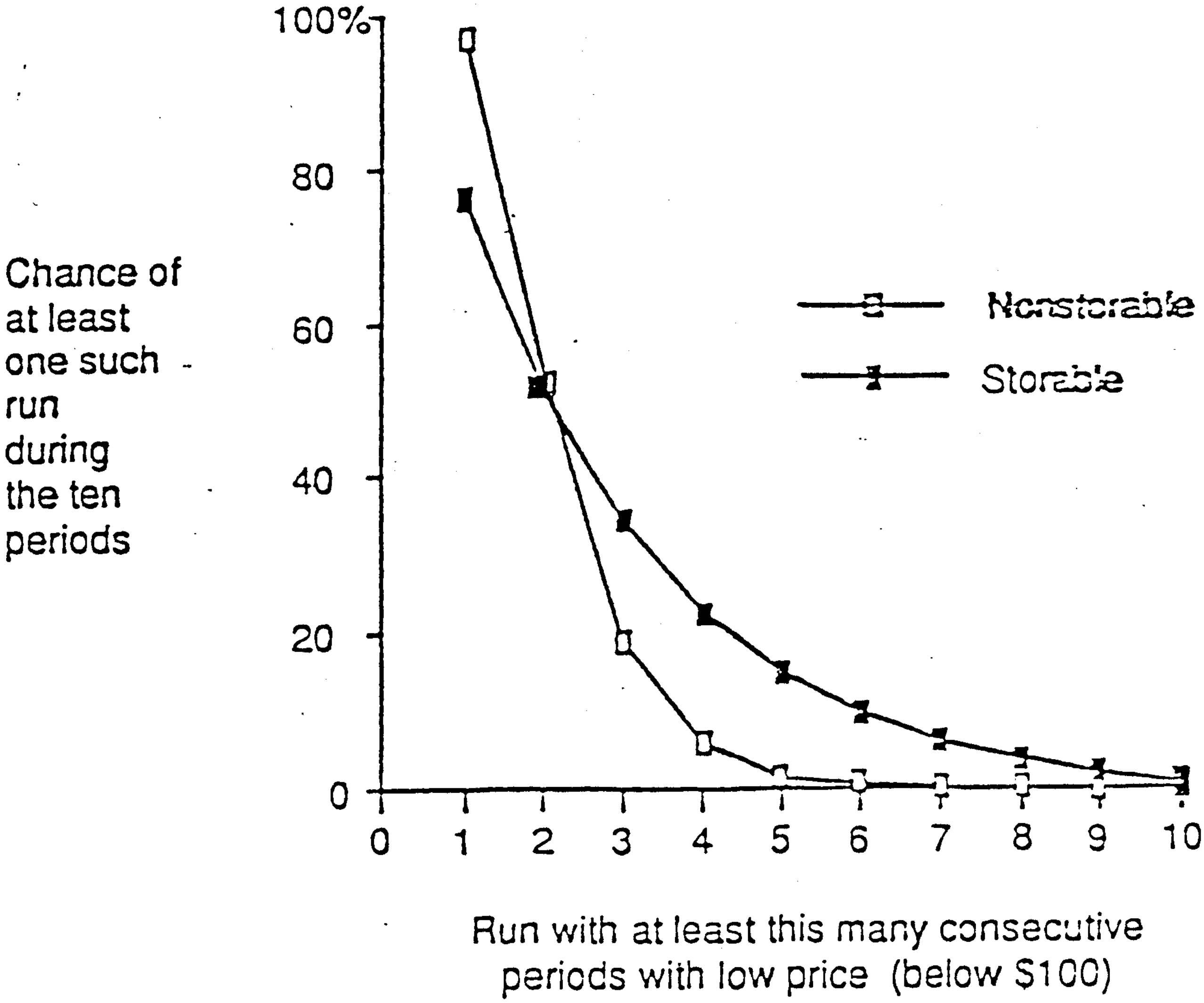
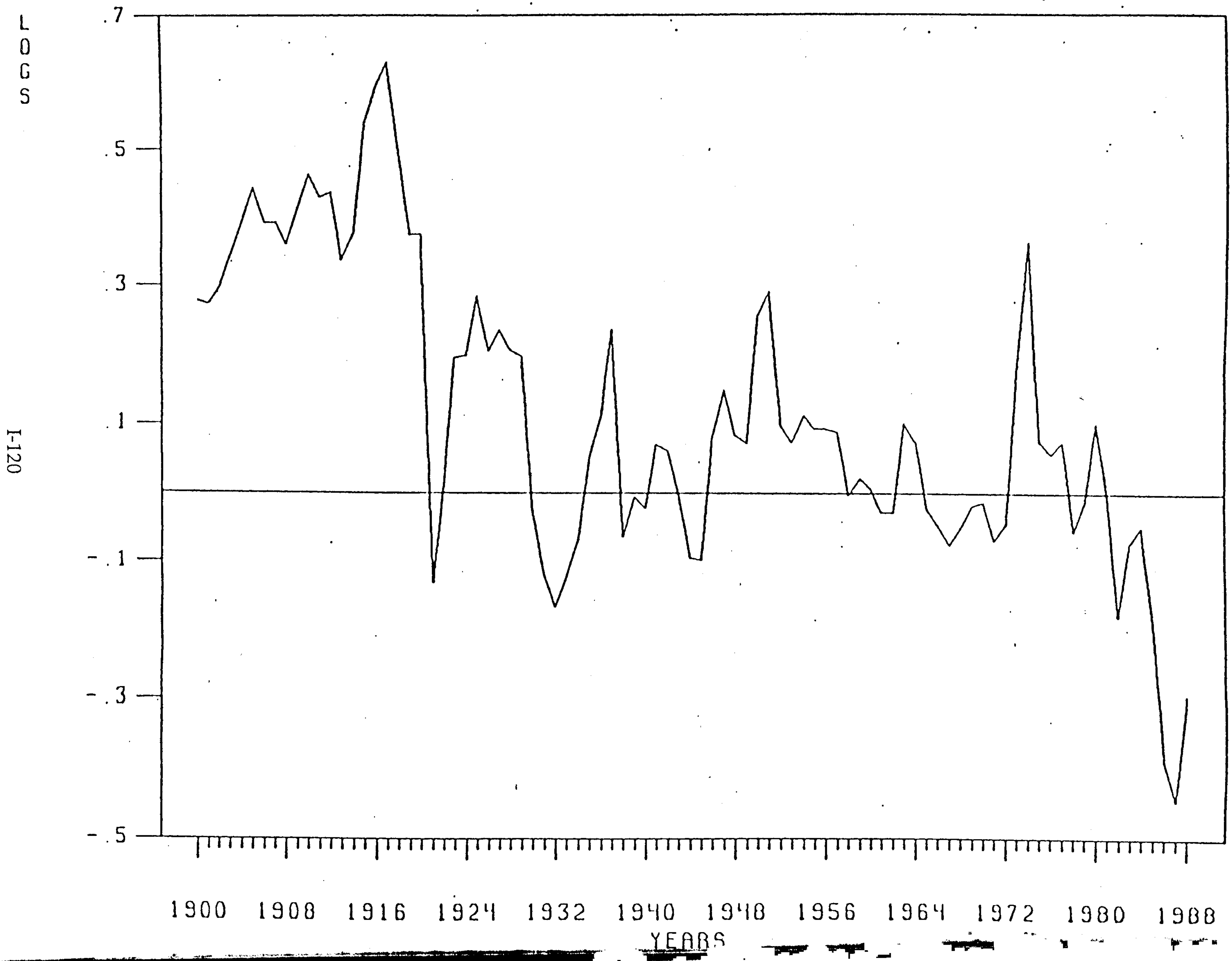


Figure 4 Tendency for sustained low prices with and without storage, over a decade interval

Figure 5 LPV:LOG(CPI / MUV)



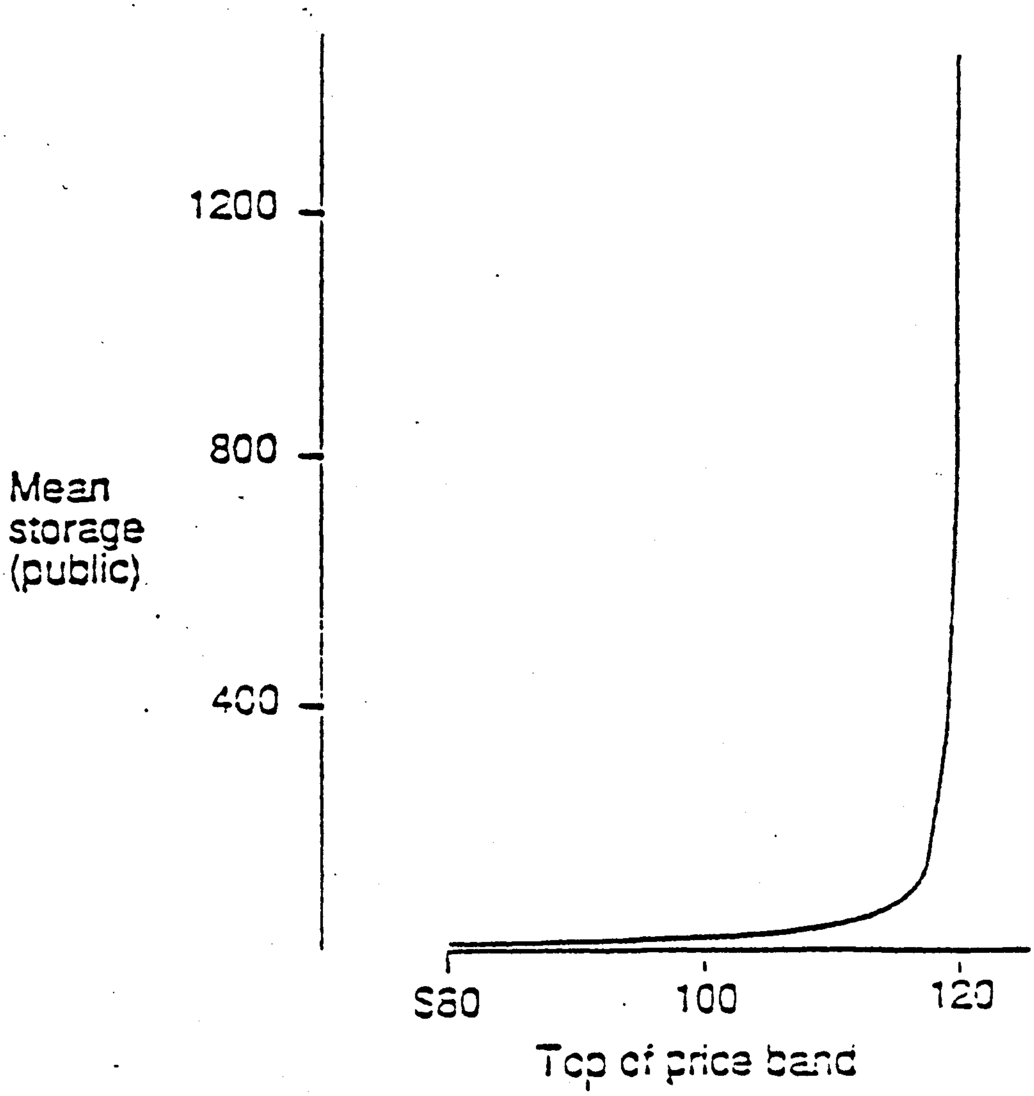


Figure 6 Explosion in quantity stored with higher top to price band and zero supply elasticity

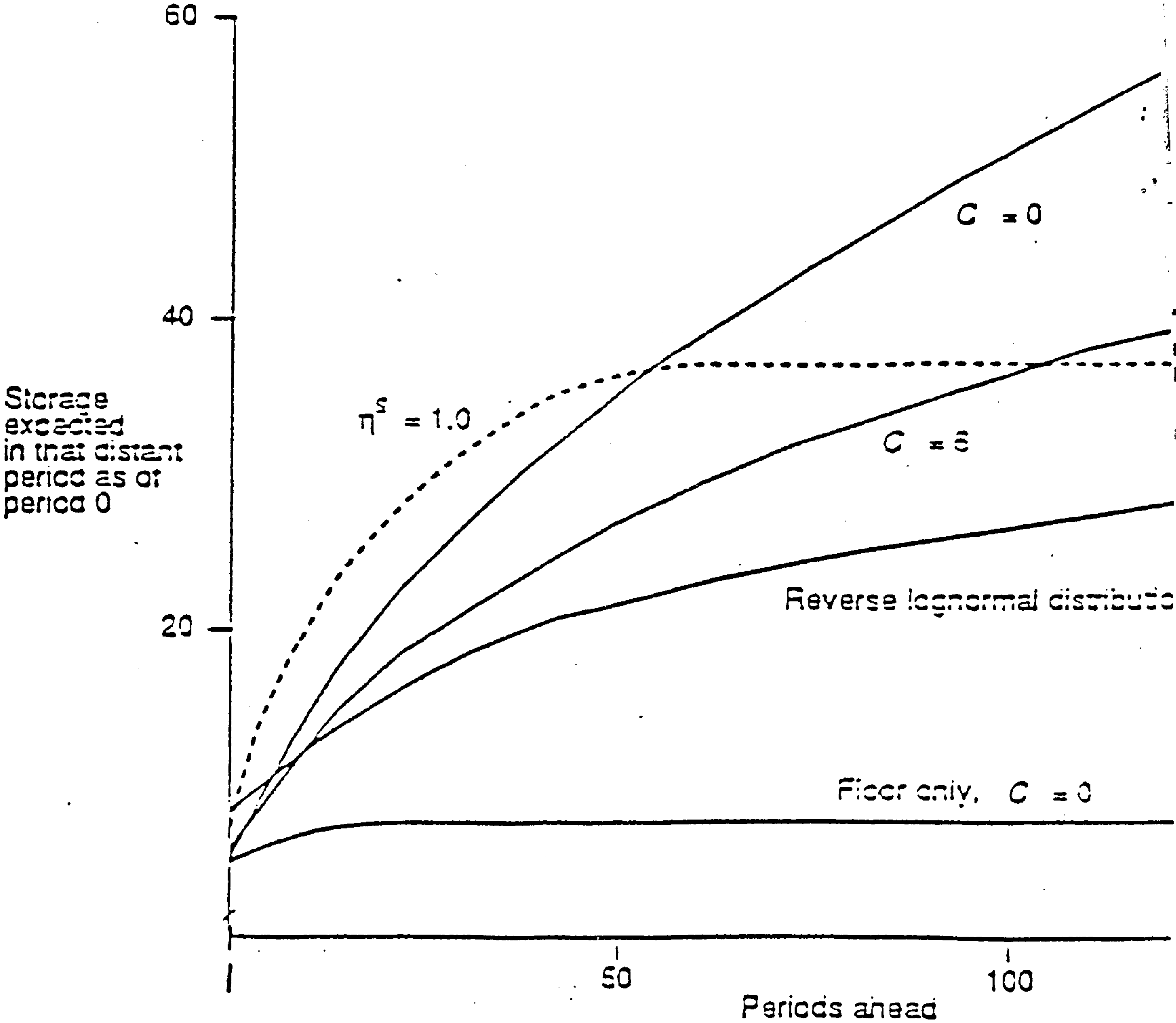
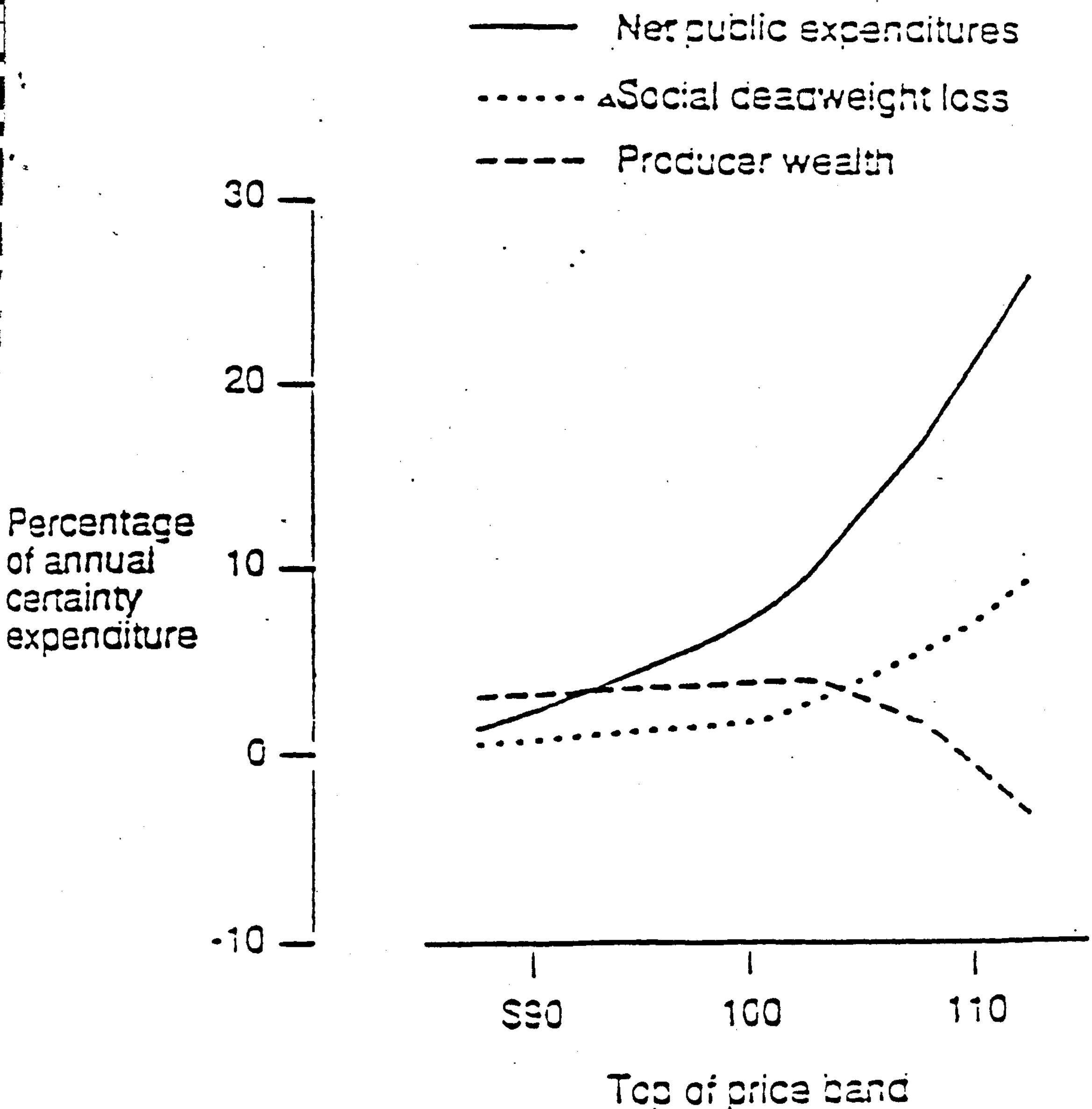


Figure 7 Expected time paths of storage



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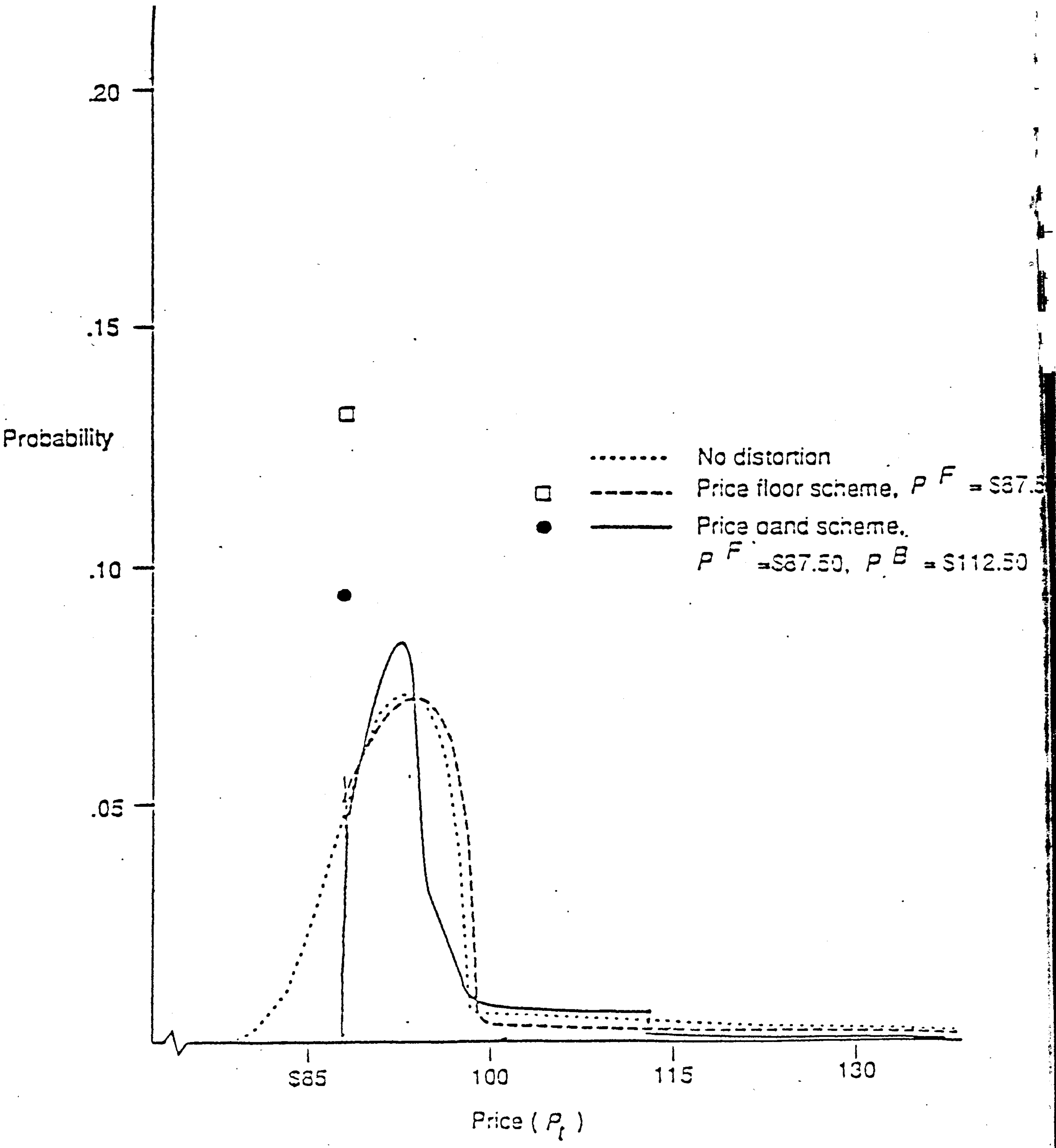

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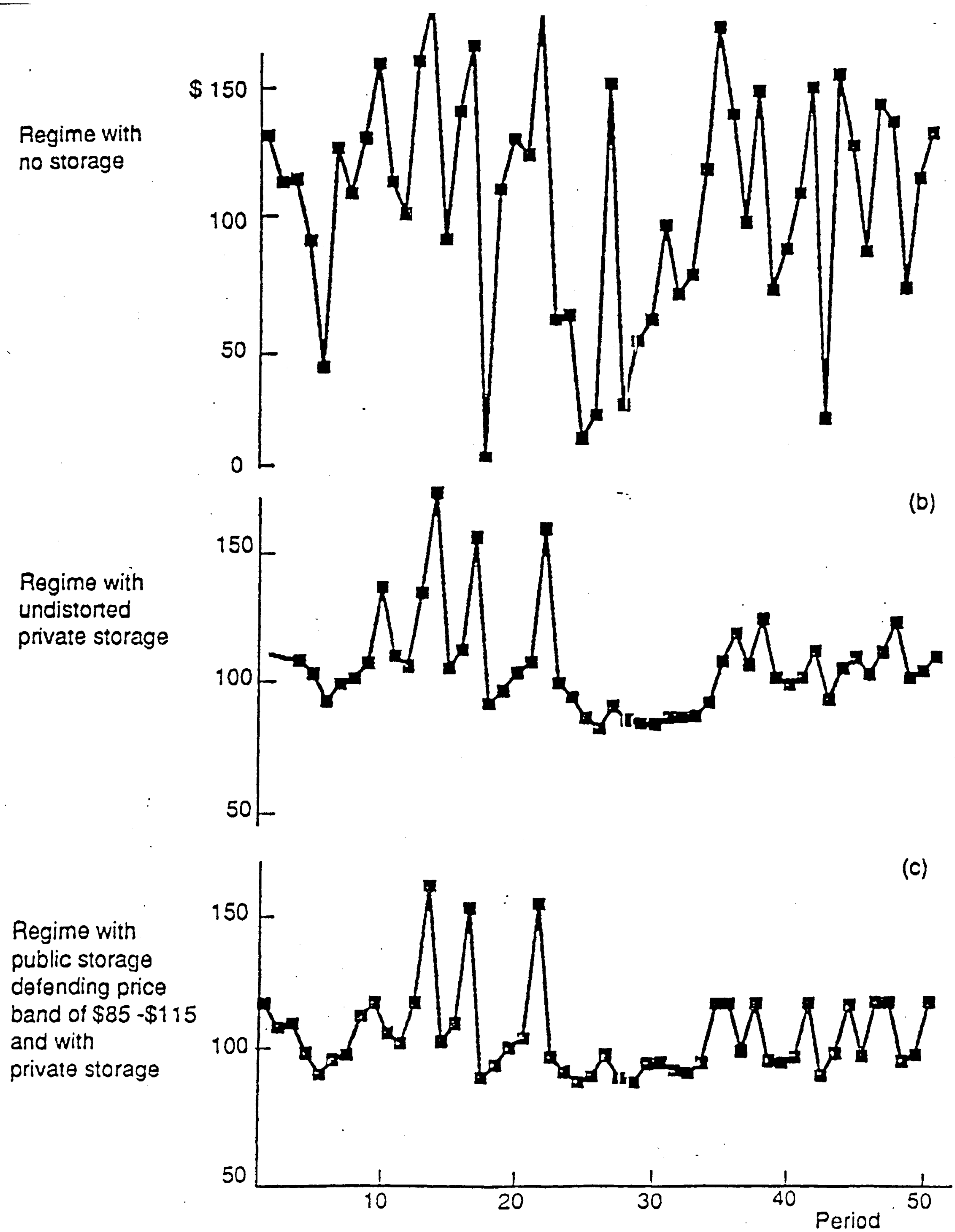

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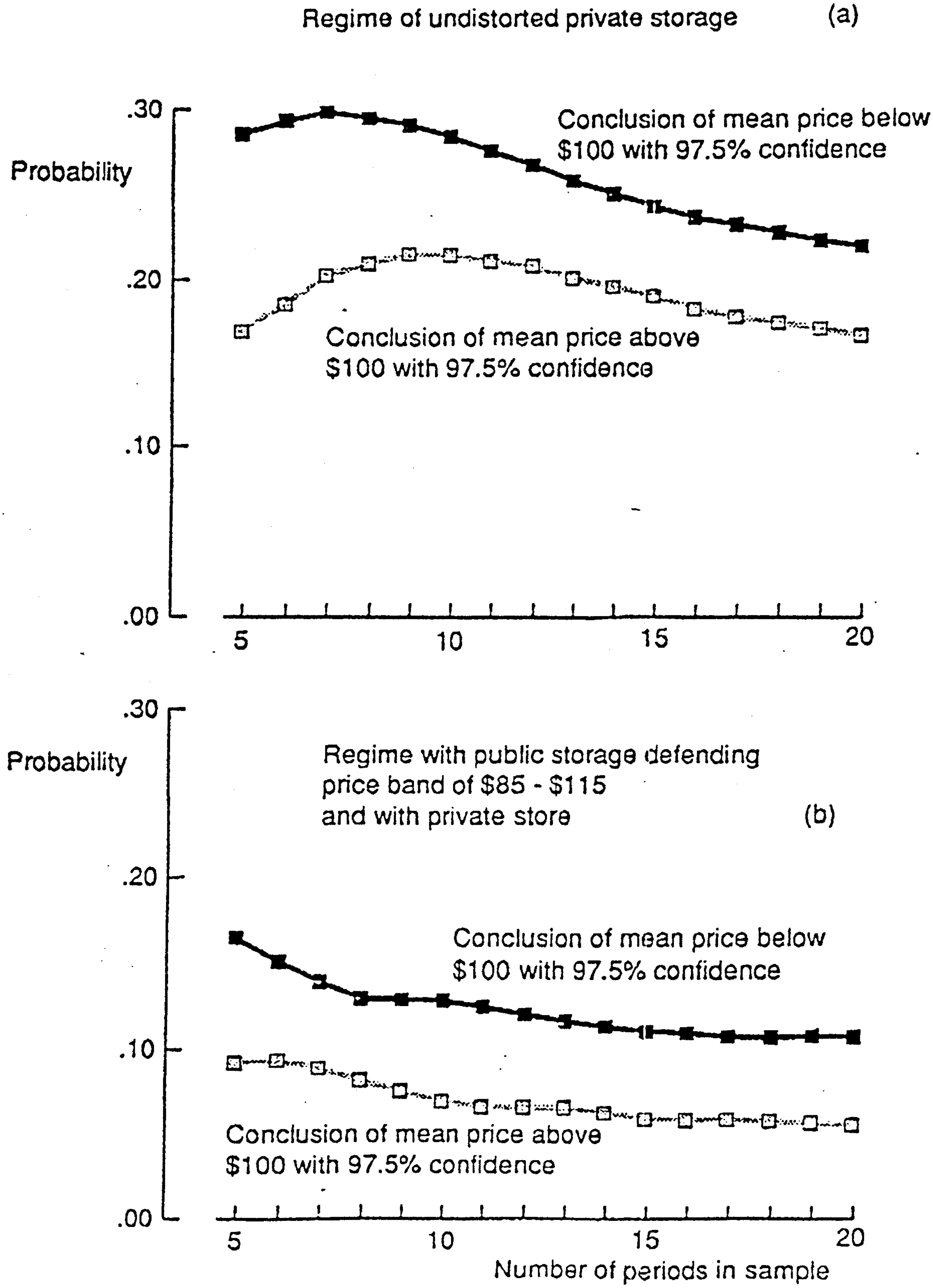

Figure 11 Effect of storage on estimates of long-run mean price
(True mean is virtually $100.)

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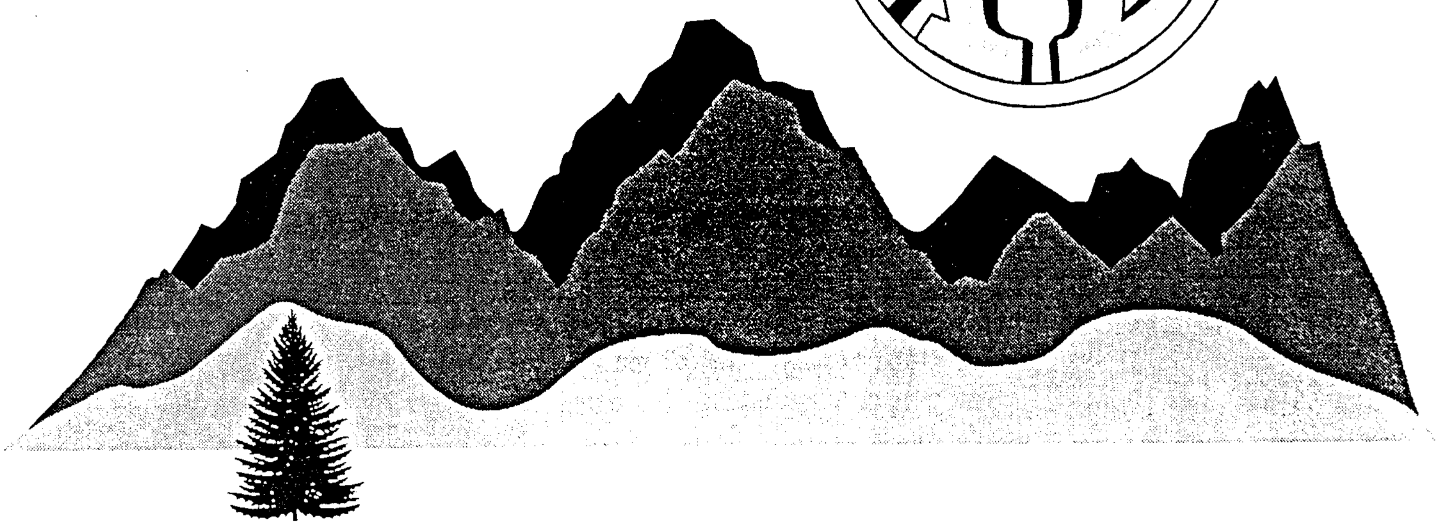

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Preface

The papers in this volume were reproduced from the invited and selected papers of the 1993 annual meetings of the Western Agricultural Economics Association. This volume does not represent publication. Papers contained herein were not edited by WAEA editors and were not reviewed for publication by the WAEA.

Harry W. Ayer
WAEA Vice President
University of Arizona

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