A SIMULATION ANALYSIS OF A BUFFER FUND SCHEME IN THE TAIWAN HOG MARKET
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ABSTRACT
This paper presents the results of the simulation of a buffer fund scheme for hogs in Taiwan. The simulation is based on a 4-equation model developed from the combination of a structural economic model and time series analysis. A buffer fund scheme is found where producer revenues become more stable, consumer expenditures are reduced and become more stable and government subsidies are not required.

I. INTRODUCTION
With the changing economic environment, hog production and prices in Taiwan have become more unstable in recent years. Using the Michaely [1962] index which is designed to evaluate changes in variability, the index for monthly hog prices increased from 1.98 for 1967-1973 to 5.07 for 1974-1983. Correspondingly, the index for monthly Taiwan hog production increased from 7.90 to 9.18 over the same respective periods of time. Such increased instability has caused farm incomes to fluctuate and the uncertainty has made decision making more difficult for both producers and consumers.

This situation has had significant impacts on the Taiwan Agricultural economy because hogs and pork are vital to the nation's producers and consumers. Hog production, which yielded an annual gross product of NT$37,911 million in 1983,

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accounted for 18.5 percent of the total value of agricultural production, ranking second only to rice (23.7 percent) [PDAF, 1984]. Cash receipts to farmers from the sale of hogs in 1981 averaged 22.4 percent of the total cash farm income, the largest single source of cash income [PDAF, 1981]. Pork consumption, second only to fish consumption, accounted for around 53 percent of the total red meat consumption in 1983 in Taiwan. Annual per capita consumption in 1983 was 23.38 kilograms (51.4 pounds), just below the 61.5 pounds in the U.S. that same year.

The economic importance of hogs and pork and the history of gradually widening fluctuations in monthly hog and pork prices have caused the government to consider intervention in the market in order to reduce the degree of instability. Before the food and energy crisis, most government policies were designed to stimulate hog production and to increase productivity in order to increase the meat supply for nutritional needs. There was little government intervention in the output market.

However, in 1972 the government began adopting different kinds of price control measures to slow down the hyperinflation, such as ceiling prices, negotiated prices, and posted prices on pork and other products. Because the government intervention price was much lower than the market price, excess demand was strong and black market prices were much higher than the ceiling price, negotiated price and posted price. As a result, the market mechanism was distorted and a welfare distribution problem arose. Hence, the price control policies were terminated, and a price subsidy for consumers was used to substitute for the price control. The fund came from levies on exporters and suppliers, and the consumer gained from the program while producers neither gained nor lost.

An export quota policy was also considered as well as subsidy programs toward feed inputs. In general, these policies have tended to protect consumers rather than producers.
Therefore, farmer's revenue and price have not been guaranteed, or in other words, the policies did not reduce the degree of uncertainty which producers faced with respect to long-term investment decision.

Taiwan needs more information regarding the nature of the monthly supply and demand relationships for live hogs and pork. Knowledge of the short-term structure of the hog-pork economy and a better understanding of the economic forces which influence prices and quantities at various levels of the marketing channels are needed to evaluate consequences of alternative policies and to assess alternative allocations of resources. It is the purpose of this paper to present an econometric model which will describe the monthly supply and demand characteristics of Taiwan hog and pork markets, and then to simulate a buffer fund scheme that the government might use to stabilize hog and pork prices for producers and consumers. The impact of the scheme on all market aspects will be assessed.

First, the literature on the theory of price stabilization will be reviewed, followed by a discussion of the features of buffer fund schemes. Then an econometric model will be developed and estimated, followed by the results of a stabilization scenario. Concluding comments will be presented at the end.

II. THEORY OF PRICE STABILIZATION

The literature on the effects of price instability and the social benefits and costs of stabilization programs dates back to Waugh [1944], with refinements by Oi [1961] and Waugh [1966]. These models were based on conventional consumer and producer surplus concepts and linear demand and supply curves.

Massell [1969] integrated their ideas into a single market framework and showed the following: (1) for society as a whole, welfare gains from price stabilization are always positive if gainers compensate the losers; (2) consumers gain (lose) from
stabilization if the source of price variability is predominately random fluctuations in demand (supply); and (3) producers gain (lose) from stabilization if the source of disturbance is mainly in the supply (demand) function. Samuelson [1972] also recognized the infeasibility of the Waugh-Oi results occurring simultaneously in a closed economy. Adopting a static general equilibrium model and using utility areas, he concluded that for consumers and producers taken together, "price stability is, other things equal, in itself, a definite virtue". Society cannot be made better off by manufacturing instability.

Turnovsky [1974, 1976] made two important extensions of the Massell model. First, he relaxed the unrealistic assumption that producers respond fully and instantaneously to current prices and showed that where producers make decisions on output levels, ex ante, on the basis of rational expectations, Massell's basic conclusions remained unaltered. The distribution of gains from stabilization may, in certain cases, become dependent on the autoregressive properties of the random disturbances and the slopes of the supply and demand curves. Turnovsky [1976] also relaxed Massell's linearity and stochastic additivity assumptions and noted some fundamentally different conclusions. In a nonlinear closed market system, the source of random variation becomes irrelevant, and the distribution of welfare gains and overall gains from stabilization (which remain positive) depend instead on the shapes and elasticities of the supply and demand functions.

The conclusions of this literature, similar to that originally reached by Massell, is that price stabilization benefits those groups whose economic activity is the main source of price variability. Overall, stability is to be preferred, provided compensation from gainers to losers is paid. Thus, producers in aggregate stand to gain most from a buffer fund scheme, say, in the hog market if it is assumed that price variation stems primarily from supply fluctuation. In other words, whether producers gain or lose depends on the source of price fluctuation, and whether compensation is paid.
III. BUFFER FUND SCHEME

Methods of attempting to achieve policy goals may take a wide variety of forms. First, there are those which operate by altering the flow of product to the market. Buffer stock is an example. Second, prices received by producers and/or consumers can be stabilized by means of subsidies and taxes which can be tied to a buffer fund. In this regard, some distinction needs to be made between subsidy policies and self financing stabilization schemes. Third, there are schemes which directly affect the stability of producers' incomes, leaving unimpaired the operations of the market, at least in the short term. Deficiency payment schemes come under this category.

Pork is a nonstorable or semi-storable commodity. The E.E.C. has used buffer stocks as a means of stabilizing from below producer prices for beef and dairy products, but their experiences with large frozen beef stocks in 1974 and 1975 suggests that this instrument cannot be seriously considered as feasible in Taiwan. Japan has used this scheme successfully for stabilizing domestic pork price for several years by means of imposing variable levies on imported pork based on domestic supply and demand. But Japan is a pork importing country which is quite different from Taiwan’s hog-pork self-sufficient economy. Taiwan has the resources to increase hog production, but because of the large amount of corn imported, and the problem of waste pollution, self-sufficient supply of domestic consumption is its production policy. Therefore, “product flow” price stabilization schemes cannot be seriously considered as a feasible scheme in Taiwan.

The domestic hog market is self-sufficient and any price support program implemented in Taiwan’s hog industry would stimulate hog production, which is not the purpose of its hog production policy. Also, the subsidies for large hog farms are undesirable in income policy. Therefore, a deficiency payment scheme is not appropriate in Taiwan since it would result in a production surplus.
Based on the nature of the commodity and market, price adjustment schemes are the most appropriate instrument to stabilize hog prices in Taiwan. Under a buffer fund scheme price bands are established and publicly announced. The purpose of the scheme is to eliminate or narrow cyclical and extreme short-term fluctuation. The smoothing of major movements in pork prices should allow producers to make better long-term investment decisions because they would see prices sufficiently guaranteed into the future. The scheme may also remove some of the short-run seasonal uncertainty from planning the marketing program. Empirical analysis will tell us if producers and consumers can gain from the stabilization resulting from a hog buffer fund scheme in Taiwan.

A stabilization price band is fixed about the stabilization price. When the market price exceeds the upper limit of the band, payments will be made to the fund. When the market price is less than the lower limit of the band, payments will be made from the fund. No payments to or from the fund are made when the market price falls within the band. The relationship between the market price \((\text{PH}_t)\), stabilization price \((\text{SP}_t)\), effective price \((\text{EP}_t)\) and payment per kilogram to or from the fund is illustrated in Figure 1. When the market price exceeds the upper limit of the stabilization price band, the effective price is the upper limit of the band. However, when the market price falls within the band, the effective price \((\text{EP}_t)\) is equal to the market price \((\text{PH}_t)\). Finally, when market price is less than the lower limit of the stabilization price band, the effective price equals the lower limit of the band.

Algebraically
\[
\text{PAY}_t^+ = \text{SP}_t (1-\beta) - \text{PH}_t, \text{ for } \text{PH}_t < \text{SP}_t (1-\beta)
\]
\[
\text{PAY}_t^- = \text{SP}_t (1+\beta) - \text{PH}_t, \text{ for } \text{PH}_t > \text{SP}_t (1+\beta)
\]
\[
\text{PAY}_t = 0, \text{ for } \text{SP}_t (1-\beta) \leq \text{PH}_t \leq \text{SP}_t (1+\beta)
\]
and \(\text{EP}_t = \text{PH}_t + \text{PAY}_t\)
Figure 1. Relationship between Market Price, Stabilization Price, Effective Price and Payments of Fund
where $\text{PAY}_t =$ payment to (−) or from (+) fund (NT$/100kg)

$\beta =$ coefficient defining half of the width of the stabilization band as a proportion of $SP_t$.

Buffer fund schemes guarantee the producers' price via levies and subsidies, but let the consumers face the free market price. The benefits to various groups in society depend on the level the guaranteed price is set. However, such schemes do not stifle price variability due to systematic changes in exogeneous variables, such as technological change, weather and tastes and preferences. The long-run effects should be an increase in industry output which would benefit consumers, and an improved efficiency of resource allocation.

Finally, there are three general approaches to evaluate policy alternatives utilizing an estimated econometric model combined with explicit or implicit information on objective of policy [Intriligator, 1978]. They are the instruments-targets approach, the optimal control approach, and the simulation approach.

We chose the simulation approach because it avoids the necessity of assuming either the existence of desired levels of endogenous variables, or the existence of desired levels of endogenous variables, or the existence of a well defined objective function to be maximized. In general, simulation refers to the determination of the behavior of a system by the calculation of values from an estimated systems model. The model is assumed to be sufficiently explicit so that it can be programmed for numerical study.

IV. AN ECONOMETRIC MODEL OF THE TAIWAN HOG MARKET

The model developed for hogs is a combination of a structural economic model and time series analysis as outlined by Zellner [1979]. Standard structural econometric models are based on economic theory and knowledge of the industry. But analysts recently have realized that these models may not
always be consistent with the information in the sample data, and that there may be room for improvement. That is, time series models may contain information about the stochastic structure of the data not reflected in the econometric model. Time series analysis can aid the model builder in determining appropriate lags, examining functional form, and testing the assumptions about exogeneity of variables [Newbold, 1979]. We have followed this approach of synthesizing the two techniques. We outline a structural economic model, and then let time series analysis indicate the lags involved and test for simultaneity among variables.

Observation of the cycles, producer behavior, and structure of the hog sector in Taiwan suggests a cobweb-like model is the most appropriate. The system appears recursive, producers are price "takers", a time lag exists between price and production changes, and the quantity supplied is cleared off the market. Of course, the simple cobweb model is too elementary, but a modified model is formulated to represent the monthly structure of the hog-pork economy.

Supply equations. Due to the biological nature of hog production, there exist time lagged adjustments in the production process. Once sows are bred, pork production is essentially determined for one year later. Variation can come between breeding and pork production because of changes in pig crop size, disease, or altering slaughter weight. Assuming hog producers attempt to maximize expected profits, the number of sows bred will depend on the expected prices of hogs and feed. These expectations will be represented by lagged values of the variables.

The number of hogs ready for slaughter will depend upon the number of sows bred a year earlier and the number of pigs raised per sow. Also, hog slaughter will be influenced by short-run marketing decisions which will be based on the current or previous month's prices of hogs and feed. Monthly hog supply will be influenced by certain seasonal factors and Chinese
holidays. Hog slaughter is always much higher during the month of the Chinese New Year, January, and then it falls to a level much below normal the following month, February. These phenomenon will be represented by dummy variables.

Unfortunately, only annual data on sows and pig crop exist for Taiwan, so the above hypothesized relationships collapse into a generalized single supply-response equation:

$$H_t = f_1 (PH_{t-x}, PF_{t-x}, D_1, D_2)$$

where

- $H_t = \text{number of slaughter hogs in month } t \text{ (head)}$
- $PH_{t-x} = \text{deflated price of hogs for certain lagged months (NT$/100kg)}$
- $PF_{t-x} = \text{deflated price of mixed feed for certain lagged months (NT$/kg)}$
- $D_1 = \text{intercept dummy variable for January}$
- $D_2 = \text{intercept dummy variable for February}$.

The retail supply of pork, or the amount of pork available for consumption, depends upon the number of hogs slaughtered, their average weight, levels of export, and the dressing percentage, which in Taiwan remains stable at 80 percent of total liveweight. The average slaughter weight is a function of current and expected prices, but farmers' decisions regarding this are taken into account in the above supply response equation. Thus, average slaughter weight is treated as exogeneous at the retail level.

Consumers in Taiwan do not have a preference for frozen pork, so stocks do not affect domestic supply. In fact, if a surplus exists domestically, the government will export it, usually to Japan. Thus, the retail pork supply function is hypothesized as an identity, and is written as:

$$QP_t = \left[ (H_t - EX_t) W_t \right]^{0.8}$$

where:

- $QP_t = \text{the quantity of pork produced in month } t \text{ (metric ton)}$
- $EX_t = \text{the number of hogs exported in month } t \text{ (head)}$
- $W_t = \text{the average slaughter weight for month } t \text{ (metric ton/head)}$.
\[ 0.8 = 80 \text{ percent dressing percentage.} \]

**Demand equations.** The demand side of the model is composed of two equations - the retail demand for pork and a marketing margin function. Utilizing classical theory, the demand for pork is assumed to be a function of the price of pork, prices of close substitutes (fish and chicken) and consumer income. However, since storage is not an important factor in Taiwan, total meat consumed is largely dictated by the available supply. Production and consumption may be used almost interchangeably in statistical analysis. Therefore, it is assumed that pork consumption is given, and that the price is the dependent variable. In order to obtain own and cross flexibilities, this price is hypothesized to be a function of the quantity consumed of pork, chicken and fish. However, consumption data for chicken are not available, so the price of chicken is used in the demand equation. Deflating prices and income, and expressing quantities on a percapita basis, the retail demand function is written as:

\[
PP_t = f_2(QP/P_t, QF_t, PC_t, I_t)
\]

where:

- \( PP_t \) = deflated retail price of pork (NT$/kg)
- \( QP/P_t \) = per capita consumption of pork (kg/person)
- \( QF_t \) = per capita consumption of fish (kg/person)
- \( PC_t \) = deflated retail price of chicken (NT$/kg)
- \( I_t \) = deflated personal income (NT$/person).

The retail demand function is the final demand, while farm demand is a derived demand. The relationship between these two complete the model, and tie it back to the supply response equation. Following Harlow [1962], marketing margins are assumed to be influenced by cost factors and price levels. The margin function is expressed here as:

\[
PH_t = f_3(PP_t, WR_t)
\]

where

- \( WR_t \) = deflated wage rate in the slaughter industry (NT$/month).
Time series analysis of the Box-Jenkins [1970] type showed hog slaughter to be highly autocorrelated. In fact, a model of hog slaughter as a function of itself lagged three time periods is suggested. Cross-correlation analysis found that changes in the price of hogs causes slaughter numbers to change at $t+1$, $t+2$ and $t+24$ with no feedback. Similarly, the price of feed leads slaughter numbers by $t+12$ with no feedback. In both cases there was no instantaneous correlation.

However, cross-correlation of white noise residuals showed the prices of hogs and pork to be simultaneously related. Also, the price of pork is autocorrelated for two lagged periods as is the price of hogs.

Finally, close examination of the data revealed some extreme observations due to the oil crisis and abnormal weather and that the model could not track these. So, two additional dummy variables in the hog supply equation were used to account for these external disturbances:

\[ D_3 = \text{intercept dummy for October 1978 - December 1979} \]
\[ D_4 = \text{intercept dummy for June 1974 - November 1975}. \]

Estimating problems caused us to drop $PH_{t-24}$ from the slaughter equation and $PH_{t-2}$ from the marketing margin equation.

Thus, the final supply-response equation is:

\[ H_t = f_4(H_{t-1}, H_{t-2}, H_{t-3}, PH_{t-1}, PH_{t-12}, PF_{t-12}, D_1, D_2) \]  \hspace{1cm} (5)

Which can be estimated by ordinary least squares. QP is completely determined by equation 2 above. In the demand submatrix the price of retail pork and the price of hogs are determined simultaneously. This subsystem is overidentified and to gain asymptotic efficiency over 2-stage least squares where the variance-covariance matrix is not diagonal, 3-stage least squares is selected as the estimating technique. This submodel is as follows:

\[ PP_t = f_5(QP_t, QF_t, PC_t, P_t, PH_t, PP_{t-1}, PP_{t-2}) \]  \hspace{1cm} (6)
\[ PH_t = f_6(PP_t, PH_{t-1}, WR_t). \]  \hspace{1cm} (7)
Hence, the system reflecting the Taiwan hog subsector is block recursive.

Estimation. The above model was estimated with monthly data from January 1971 to December 1979. When simulating, the stochastic nature of the disturbance terms must be determined. In this study the probability distribution of the disturbance terms are based on the corresponding estimation distribution, referred to as shock of Type I. This information is included in the following estimated and simulation model (with t-ratios in parentheses below the coefficients):

**Slaughter Equation**

\[
H_t = 180010 + 0.355 H_{t-1} + 0.243 H_{t-2} + 0.103 H_{t-3}
+ 15.833 PH_{t-1} + 8.013 PH_{t-12} - 389.18 PF_{t-12} + 58759 D_1
- 66289 D_2 + 69196 D_3 - 25916 D_4 + \epsilon
\]

\(R^2 = 0.82\) \(R^2 = 0.80\) \(F = 36.39\)

**Retail Pork Supply**

\[
QP_t = [(H_t - \hat{X}_t) W_t]^{0.8}
\]

**Retail Demand**

\[
PP_t = 4.1080 + 0.574 QF_t + 0.077 PC_t + 0.0001 I_t
- 0.913 QP/P_t + 0.727 PP_{t-2} - 0.187 PP_{t-2}
+ 0.005 PH_t + \epsilon
\]

\(R^2 = 0.8\) \(R^2 = 0.80\) \(F = 36.39\)

**Marketing Margin**

\[
PH_t = -642.832 - 0.126 WR_t + 0.356 PH_{t-1} + 48.038 PP_t
\]

\(R^2 = 0.8\) \(R^2 = 0.80\) \(F = 36.39\)
where \( R(0, \sigma) \) are random variable generators with a distribution of mean, 0, and standard deviation of the endogenous variables.

The coefficients of the hog slaughter equation are generally significant and all the coefficients have the correct sign. Current slaughter is influenced by the previous three months of slaughter, reflecting the time lag between breeding and slaughtering and that the current month slaughter numbers have been strongly influenced by the position of the hog cycle. The effect is that of a distributed lag as the coefficient for each succeeding lag of \( H_t \) becomes smaller.

Once producers have hogs which reach slaughter weight, they can sell them, hold them for another month, or retain them for breeding purposes. The negative coefficient for \( PH_{t-12} \) reflects that if prices decrease this month, producers will hold animals back and market more then ext month, and vice-versa. The positive sign for \( PH_{t-12} \) and negative sign for \( PF_{t-12} \) reflect previous production response decisions by producers. The dummy variables all have expected signs.

In the retail demand equation, the sign of per capita consumption of fish is positive and opposite expectations, meaning fish consumption is complementary to pork. These two are the major protein foods consumed in Taiwan. However, the price of chicken has a positive sign reflecting a substitute. The coefficients for income, pork consumption and the price of hogs are as expected. Lagged price of pork is positive for \( t-1 \) and negative for \( t-2 \), showing some cyclical affects. The coefficients result in a price flexibility for pork of \(-0.82\) and an income flexibility of \(0.83\), both at retail.

In the marketing margin, the coefficient for \( PP_t \) indicates that a one dollar per kilogram increase in retail price will induce a 48 dollar per 100 kilograms increase in farm price. An increase in wage rates will decrease farm prices.
V. SIMULATION OF THE BUFFER FUND

The simulation of the buffer fund scheme will determine the size of payments to or from the buffer fund, and from this the effects of the fund on the size and variability of industry revenue and level and variability of prices, production and consumer expense can be calculated. Of particular interest is the impact on price variability and industry revenue. The analysis is based on the use of an automatic mechanism to set the stabilization price so to avoid political or administrative pressures.

The simulation has been conducted over the period of January 1975 to December 1981. The first five years of this period is particularly appropriate because prices were very unstable, and there were four distinct different trends in prices. This allows the fund to be assessed under different circumstances and focus on how the formulae and mechanisms perform through a particular sequence of prices. The last two years of the simulation carries it beyond the period of fit of the model. In this case, various exogeneous variables had to be predicted. This was done by fitting time series models to the data for each exogeneous variable and using that as a means for projection. The details of these individual models are not shown.

**Base simulation.** Market prices were assumed to follow their historical path, and a three-year moving average of the past market is used for the stabilization price. Thus,

\[
SP_t = \frac{1}{36} \sum_{i=1}^{36} PH_{t-i}
\]

where

- \( SP_t \) = stabilization price at month \( t \) (NT$/100kg)
- \( PH_t \) = average monthly saleyard price of hogs (NT$/100kg).

This operating buffer fund scheme is assumed to affect the level of hog production. The producer's perception of demand is likely to change through time from the unstabilized market
price to the market price plus subsidy (minus levy). Since price
risk is likely to be perceived as lower under the scheme, there
may be an increase in long-run pork supply. Hence, price
expectations and production plans are assumed to be based on
the stabilization price.

A band width of 10 percent (plus and minus 5 percent) of
the stabilization price is assumed. The simulation contains no
other constraints on the size of the payment per hundredweight
that may be made to or from the fund. In addition, no con­
straints are placed on the cumulative fund size. The fund
commences with a zero balance on January 1975.

After monitoring prices at the producer and consumer level,
production, consumption and changes in the fund, aggregate
producer revenues and consumer expenditures can be calculat­
ed. These can be compared to simulating the market with no
controls given the econometric estimates above. Means and
standard deviations of the simulated values are given in Table 1.

A major effect of the buffer fund and 36-month moving
average formula for fixing a stabilization price is the reduction
of variability of the hog price and production. The standard
deviation of hog price (effective price) falls from 8.41 percent
to 5.79 percent and slaughter number variability reduces
slightly from 14.78 percent to 14.63 percent. These two
combine to reduce the standard deviation of industry revenue
from 17.01 percent to 15.66 percent. That is, industry revenue
stays virtually the same, but it is more stable.

The mean effective price is lower than for the free market
prediction. This is attributed to the lagged moving average used
for the stabilization price and the effect of the period 1971-
1973 which recorded much lower prices than the peak prices

Owing to a reduction of perceived price risk, the scheme
lead to an expansion of production as slaughter numbers
increases about 3 percent above that of the free market. This
also increased pork supply which had reduced variability.
Table 1. Results of Simulation on Buffer Fund Scheme  
(January 1975 to December 1981)

<table>
<thead>
<tr>
<th>Items</th>
<th>Unit</th>
<th>Free Market Prediction</th>
<th>Buffer Fund Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry revenue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>NT$m</td>
<td>1,784.20</td>
<td>1,783.80</td>
</tr>
<tr>
<td>S.D.*</td>
<td>%</td>
<td>17.01</td>
<td>15.66</td>
</tr>
<tr>
<td>Effective price</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>NT$/100kg</td>
<td>3,990.10</td>
<td>3,875.17</td>
</tr>
<tr>
<td>S.D.</td>
<td>%</td>
<td>8.41</td>
<td>5.79</td>
</tr>
<tr>
<td>Slaughter number</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>head</td>
<td>493,125</td>
<td>504,899</td>
</tr>
<tr>
<td>S.D.</td>
<td>%</td>
<td>14.78</td>
<td>14.63</td>
</tr>
<tr>
<td>Pork price</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mean</td>
<td>NT$/kg</td>
<td>66.95</td>
<td>65.97</td>
</tr>
<tr>
<td>S.D.</td>
<td>%</td>
<td>4.71</td>
<td>4.75</td>
</tr>
<tr>
<td>Prok supply</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>10mt</td>
<td>30,777.16</td>
<td>30,837.17</td>
</tr>
<tr>
<td>S.D.</td>
<td>%</td>
<td>18.33</td>
<td>17.74</td>
</tr>
<tr>
<td>Consumer expense</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>NT$m</td>
<td>2,077.20</td>
<td>2,008.90</td>
</tr>
<tr>
<td>S.D.</td>
<td>%</td>
<td>18.60</td>
<td>18.25</td>
</tr>
<tr>
<td>Fund balance at December 1981</td>
<td>NT$m</td>
<td>277.9</td>
<td></td>
</tr>
</tbody>
</table>

*S.D. is standard deviation.
Changes in pork supply and pork price result in reduced consumer expenditures which are more stable. Thus, the scheme provides benefits to consumer as well as stabilizing producer incomes.

The buffer fund builds up to a maximum in November 1978 of over NT$1,988 million dollars. This fund accumulation results from mainly payments to the fund in the years 1975-1977. The maximum payment into the fund is NT$849 per 100 kg in May 1975. The accumulation is followed by a transfer of funds back to producers so that by the end of 1981 the fund is reduced to NT$278 million dollars. Actually, the maximum payment per 100 kg to producers is NT$704 in October 1976, when added to the average saleyard price of NT$2,806 per 100 kg, the effective price is one-fourth higher than the saleyard price. The accumulate fund does not take into account interest earnings or administrative costs.

Several alternatives of the above simulation scheme were tested. These included increasing the length of the moving average, adjusting the moving average for trends in feed prices and increasing the band width of the stabilization price. Each had predictable results of affecting producer or consumer prices, or changing the amount of money flowing into or out of the fund. But in the aggregate, no alternative provided greater stability at a lower cost than the the results presented. Other alternatives also raise to question whether the fund could be self-balancing and not require government assistance. Although many alternatives are available, the results shown come closest to possessing all the desired characteristics.

VI. CONCLUSIONS

Pork is an important commodity in Taiwan, and its production is characterized by complex adjustment processes. Recent variability in prices have disrupted income flows and created considerable uncertainty in decision making by producers. This can lead to an inefficient allocation of resources.

This study has attempted to assess the feasibility of
adopting a buffer fund scheme for the hog-pork sector in Taiwan with the goal of stabilizing producer prices and revenues. A dynamic, 4-equation model of the hog-pork industry was developed from a structural economic model and information from time-series analysis.

Based on a 36-month moving average stabilization price and a 10 percent band, the simulation showed that producer revenue stayed practically the same with the buffer fund, but with more stability. Due to the lower prices in the moving average, producer prices were lower, but considerable stability in prices was gained. This would allow producers to make decisions in less risky environments. This reduced risk increased hog production.

Another beneficiary of the buffer fund scheme was the consumer. The increased pork supply at lower prices allowed consumers to reduce their expenditures. This also was done under conditions of less instability. Finally, this particular scheme was close to being self balanced and did not require government subsidies.

These results demonstrate that a buffer fund scheme has the potential for being a valuable policy tool for Taiwan. Many variations are possible, but this one shows a situation where both producers and consumers are better off and there is no government subsidy involved. It is up to the policy makers to choose which alternative is most desirable and fits best within the economic planning framework.
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