SOME ASPECTS OF INCOME STABILIZATION FOR PRIMARY PRODUCERS

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The objectives of this paper are two-fold. The first is to discuss the basic economics of an aggregate industry income stabilization policy for primary producers. The second is to examine post-World War II income instability in Australian wool, wheat, and beef and to apportion it into its price and output components. This analysis provides a basis for discussing income stabilization in the Australian context.

Primary commodity markets have a built-in tendency to be unstable. This assertion surely is no shock to agricultural economists, especially in Australia. This inherent instability may appear as widely-fluctuating producer prices from period to period, as large production changes from season to season, as gyrating incomes, or as some combination of all three. Naturally, these phenomena are closely interconnected. It is the instability of producer income which will be emphasized in this paper. In particular, the paper will focus on the economics of aggregate income stabilization viewed as a policy objective. Then some Australian data will be used to illustrate a few of the analytical ideas.

Inherent market instability is widely-judged to be an economic problem to primary producers and to the community at large. The supporting arguments rest on both efficiency and welfare grounds. The efficiency argument against instability holds that price changes in many primary commodity markets are larger than necessary to guide (1) efficient allocation of productive resources in the short-run, and (2) efficient allocation of purchases and expenditures by users. Instability in quantities flowing through markets from period to period is argued to be unfavourable since the technical and economic efficiency of resources devoted to transporting, storing, and processing products is lowered. On welfare grounds, the argument against instability suggests that temporal uncertainty in the income flow to primary-producing industries and geographic areas poses several problems, particularly where production is specialized. These include problems of planning long-run investments and meeting regular debt repayment obligations. Widely-fluctuating incomes may undermine rational planning of family living expenses and may increase the cash and asset base needed for economically-viable properties. In a wider context, it may induce fluctuating incomes in sectors which service the productive activities and living requirements of the affected primary sectors. Each of these particular assertions is subject to debate in the professional literature.[1]

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[1] A good summary of these issues in the Australian context is provided by Campbell in [9].

But in this paper we assume that the problems raised by market instability are real or at least viewed as real by primary producers, their spokesmen, and government policy makers.

We should distinguish between problems of market stability (discussed in this paper) and problems linked with the chronic tendency for some primary markets to under-reward productive resources relative to earnings obtainable in other sectors (not discussed here). Stability in this paper refers to decreased fluctuation around long-run, open market trends in prices, outputs, and incomes. This may be an artificial distinction in any real policy context, but it is analytically helpful to adopt it.[2]

Stabilization Policy

Virtually every nation in the world with an explicit agricultural policy attempts to promote market stability in one way or another [19, 23]. The history and goals of Australian agricultural stabilization policy were summarized a few years ago in a wide-ranging article by D. H. McKay [22]. In his first paragraph, he wrote, ". . . most arrangements to assist an industry or schemes to do with the marketing of agricultural products usually have the tag 'stabilization' tacked on to them somewhere". The low-rainfall, high-risk agriculture in much of Australia, coupled with heavy dependence on uncertain foreign markets, provides the setting for policies and marketing arrangements with strong explicit or implicit stabilization objectives.[3]

Most policies for stabilizing primary markets contain dual objectives of price and income stabilization. Yet, it is clear that stable prices, even around appropriate long-run trends, do not necessarily imply stable gross incomes for the market as a whole or for individual producers [8, 9, 16, 17, 18, 26, 27].

Using relatively simple analytical models and drawing upon previous literature, Tomek illustrates the effects of price stabilization on gross income under a variety of assumed conditions [27]. He discusses price stabilization with buffer stocks, buffer funds, price and market discrimination programmes, and centralized hedging on futures markets. A wide spectrum of possible results emerges, and conclusions with broad application are difficult to draw. The matter is further complicated if stability of individuals' incomes is also considered. Analysis of almost each separate case is needed since results change dramatically with differences in demand and supply elasticities, the source of shifts in the functions, types of programmes adopted, and relationships between individuals and the market. Other work suggests that under some conditions even costless stabilization of prices may reduce annual income below the average value occurring in an open, uncontrolled market [1, 13, 16, 25, 26, 27].

[2] Most economists attempt to make this analytical distinction in their work. It is not easy. Government policies, marketing boards, and international organizations almost always mix the two inextricably together. Tomek provides a useful catalogue of these problems in [27]. See also [17, Chap. 1].

[3] One of the strengths of Australian agricultural economics literature is its long tradition of dealing with questions of economic stability in primary markets. A listing of the important contributions in this field in addition to those cited in the references section would be too voluminous for inclusion here.

Much of the available research on market stabilization begins by investigating the price-stabilizing potential of various schemes. Then the consequences for quantity and income flows are evaluated.[4] Generally, this is sensible since most actual stabilization schemes focus on price stabilization in some form. Moreover, central intervention in primary markets for stabilization purposes almost always is designed to alter the price or quantity movements from those which would otherwise occur. Implications for income stability (or instability) are largely secondary consequences of programme operation even though a stated policy goal may be to enhance income stability.

If the important stabilization problems in an industry are judged to involve short-run resource allocation or capacity utilization, then price or volume stabilization may be an appropriate goal. Any increased income instability then would be a disadvantage either to be tolerated or ameliorated by other means. On the other hand, if an unstable flow of total returns into a sector or an industry over time is viewed as the problem, then income stabilization may be most appropriate. The secondary effects of such a scheme on price and volume stability then would be of substantial interest. However, economic analysis and debate on this aspect of market stabilization is not widely available in the literature.[5]

Income Stabilization

Income stabilization measures can be divided into two broad groups, (a) schemes that operate outside the market and help producers to adjust to income fluctuations without directly altering the market mechanism, and (b) schemes that attempt to stabilize income by changing the workings of the market.

The first category includes a variety of policy devices to ameliorate income instability. Any modestly-sophisticated economy naturally will evolve devices to offset some effects of income instability for the economy as a whole, and in sectors where it is a problem. Some rather automatic and general policy devices for stability in category (a) include:

1. Progressive income tax rate structures.
2. Income-averaging provisions over two or more years for tax purposes.
3. Formal and informal flexibility in debt repayment schedules linked to income experience.
4. Formal and informal flexibility in credit availability for production purposes and family living expenses.

High-risk sectors such as agriculture often attract specific and specialized measures in category (a) such as:

1. Specialized credit agencies.
2. Hail, crop damage, and livestock insurance.
3. Drought bonds.[6]

[4] A recent article by Massell [21] summarizes and extends the arguments concerning welfare implications of price stabilization schemes. The welfare economics aspects of market stabilization are not directly analyzed here.

[5] For discussion on this topic see [18, Chaps. 12–13, and 2].

[6] A recent discussion of the drought bond in Australia is provided by Glau in [14].

4. Direct payments to individual producers to offset drought, flood, etc.[7]
5. Strategic roads and railways.

Now consider category (b). Stabilization schemes which operate through a market seldom attempt to stabilize income flowing into the sector in any direct way. How might an income-stabilizing scheme operate? First, assume that the government decides, as a matter of national policy, to reduce income instability in one or more primary commodity markets.[8] Immediately it must identify the measure of income to be stabilized, the extent of stability to be achieved, and the distribution of the stabilized income among participants in the market. These questions are clearly linked to the schemes adopted and to the values which define acceptable limits of stability.

Assume that the aggregate annual or marketing season gross income for the commodity in question is to be stabilized. Thus, intra-year phenomena are ignored.[9] The issue of how the stabilized aggregate income is distributed among individuals or regions is set aside for the moment. However, this is an important question to which we will return.

The level around which gross income is stabilized is assumed to be the long-run open market trend value of price multiplied by the similar value of output. Thus, there is no objective of net taxation or subsidization through the programme—except possibly as programme costs are either provided by government or charged to the scheme. Naturally, it will be difficult to determine long-run trend values of gross income, but fundamentally little more difficult than assessing the long-run prices on which to base a price stabilization scheme.

Further suppose that the stabilization authority attempts to alter the income flow only if it threatens to exceed or fall short of some acceptable 'zone'. The zone is narrow or wide depending upon the scheme's ambitiousness and resources available to its operators.

Suppose that for a given year, the stabilization authority identifies (by political or analytical means) a zone into which the gross income for the commodity should fall. The locus of market prices to producers and quantities sold by producers consistent with the upper level of this zone is the rectangular hyperbola UU in Figure 1. All combinations of prices (P) and quantities (Q) on UU yield the *maximum* acceptable income. All combinations of P and Q on the similar rectangular hyperbola LL yield the *minimum* acceptable income. All combinations

[7] Schemes of this type for wheat and wool in Australia have been proposed by Campbell [7] and Campbell and Glau [10] and Glau [14]. Strictly speaking, these proposals suggest ironing out only downward income fluctuations. Their costs would be borne by the government. The authors argue that they could be made stabilizing for upward income fluctuations, but at the cost of political and administrative feasibility.

[8] It is implicit in this analysis that we are discussing economies with well-organized markets and only limited subsistence consumption of primary products. In addition, the governments are assumed to be financially and administratively capable of conducting a stabilization programme.

[9] Of course, gross income is an imperfect indicator of net returns or profits. Since prices and quantities of inputs used in a primary sector typically fluctuate much less than prices received or output, the use of gross income as the stabilization objective can be defended.

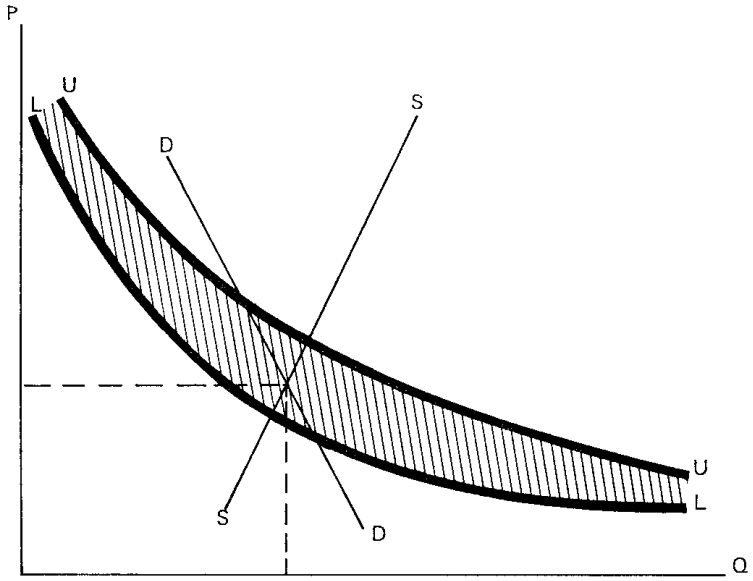

FIGURE 1—Income Stabilization Zone.

of P and Q inside the area bounded by UU and LL yield incomes within the acceptable zone. If the annual intersection of the partial equilibrium supply (SS) and demand (DD) occurs inside the zone as in Figure 1, then the authority does nothing to alter open market operations. The stabilization problem is to intervene in the market only when the open market intersection of supply and demand is outside the zone.

To illustrate such a scheme, consider that an existing buffer stock or buffer fund programme is designed to stabilize aggregate gross income rather than producer price.[10] Further assume that the annual producer supply of the commodity is completely or nearly price inelastic, a plausible assumption for many primary commodities. Figure 2 indicates how income instability caused solely by a fluctuating inelastic demand curve might be controlled.[11] In a period of low demand, suggested by DD, the open market equilibrium would be at point f. However, the higher price at e is consistent with the minimum income goal represented by LL. Point e could be achieved by a buffer stock authority acquiring an amount equal to de in the market or by a buffer fund authority making per unit payments to producers equal to ef. With a buffer stock, the entire market would be lifted. With a buffer fund, only the realized price for producers would be adjusted; the market would clear at f.[12]

[10] The usual distinction between buffer stocks and funds is made here. The buffer stock agency buys and sells the actual commodity in the open market to influence prices and earnings. The buffer fund agency imposes levies on or makes supplementary payments to sellers to influence realized prices and earnings. See [16, 17, 27].

[11] These demand fluctuations might be the result of changes in incomes or business activity, changes in prices of substitutes, fads and fancies in consumption, and changes in the outputs of competing suppliers.

[12] The intricacies of private inventory holding are side-stepped here for convenience. The net demand for stocks can be viewed as part of DD or D'D'.

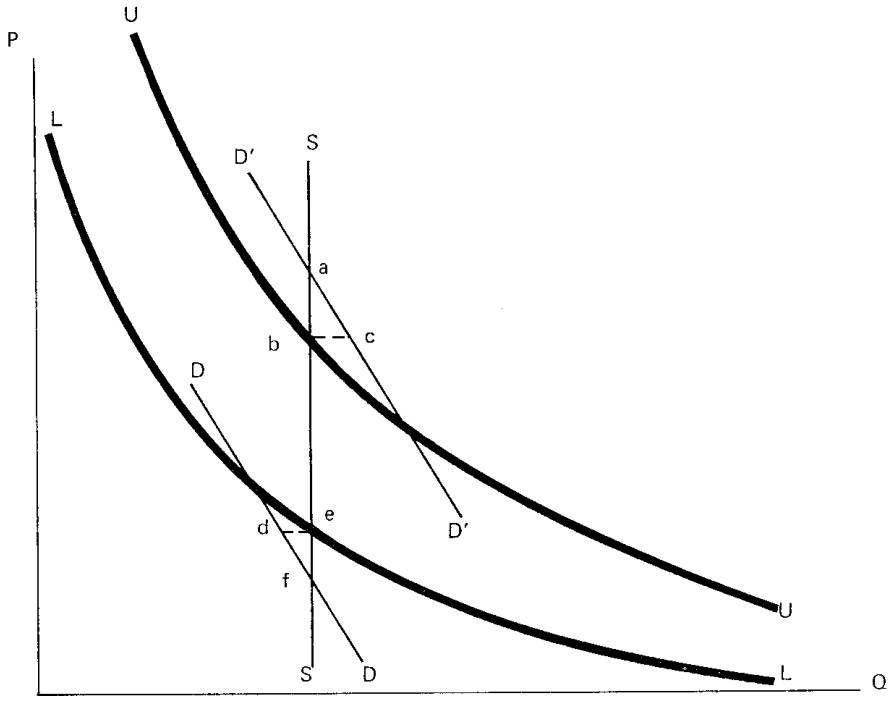

FIGURE 2—Income Stabilization with Constant Supply and Fluctuating Demand.

The opposite situation prevails at the high demand level of D'D'. The open market price at a is reduced by buffer stock sales of bc or by the buffer fund authority taxing or withholding an amount equal to ab per unit.

In this illustration, the supply of SS and the income goals are consistent with prices between b and e for producers. This price zone will adjust up or down (1) as SS shifts to the right or left respectively, or (2) as the UU–LL income zone itself is increased (moved to the northeast) or decreased (moved to the southwest).

In Figure 1, income stabilization also promotes a measure of price stability to sellers, depending upon the width of the UU–LL zone. However, a buffer stock operation, by buying and selling stocks would destabilize the volume moving in the marketing system in this polar case of a constant supply function. These conclusions also hold if the demand curves are more price elastic than $-1{\cdot}0$, unity obviously being the elasticity of UU and LL. Clearly, the ability of any buffer stock to stabilize either income or price is weakened as the price elasticity of the fluctuating demand curve grows absolutely larger.

Figure 3 illustrates the polar case of a constant demand curve, DD, and fluctuating supply curves, SS and S'S'.[13] At a low level of supply, SS, the open market price and quantity equilibrium is at point a, outside the UU–LL stabilization zone. A buffer stock agency would sell

[13] The supply fluctuations might result from changes in weather conditions, infestations of insects and diseases, and changes in planned production of closely competing alternative products.

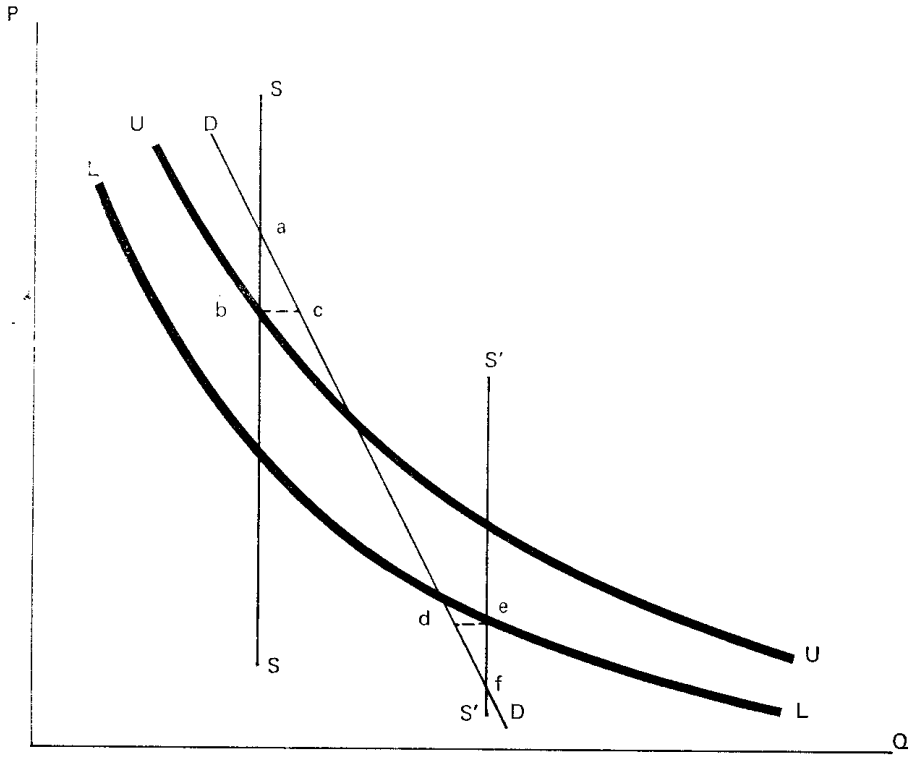

FIGURE 3—Income Stabilization with Constant Inelastic Demand and Fiuctuating Supply.

an amount equal to bc to reduce the market price by an amount equal to ab. A buffer fund authority would tax or withhold ab from the producer price in order to bring the producers' per unit return down from a to b. Similarly, in a year of large supply, S'S', the acquisition of de by the agency or the supplemental payment of fe to producers would boost per unit returns from f up to e. In this case, some price stability is introduced along with income stabilization. Buffer stock sales in short years and acquisitions in bumper years also would promote stability in market volume. Shifting supply curves and the income objectives together provide a shifting zone of 'appropriate' prices for producers, high in years of short supply and lower in years of large output.

Figure 4 contains a variation on the previous example. Here the constant demand curve, DD, displays price elasticity greater than $-1 \cdot 0$ over the range of the fluctuating supply curves, SS and S'S'. Short production years yield open market incomes which are too low relative to the UU–LL zone. Heavy production years yield incomes too large relative to the stabilization zone. When SS occurs, the open market position of point a must be pushed to point b by acquisitions equal to cb or supplementary payments equal to ab per unit. When S'S' occurs, inventory sales equal to ed or taxes equal to fe are required to reduce growers' revenue down to the stabilization zone. Here the operation of an income stabilization scheme actually destabilizes producer price from

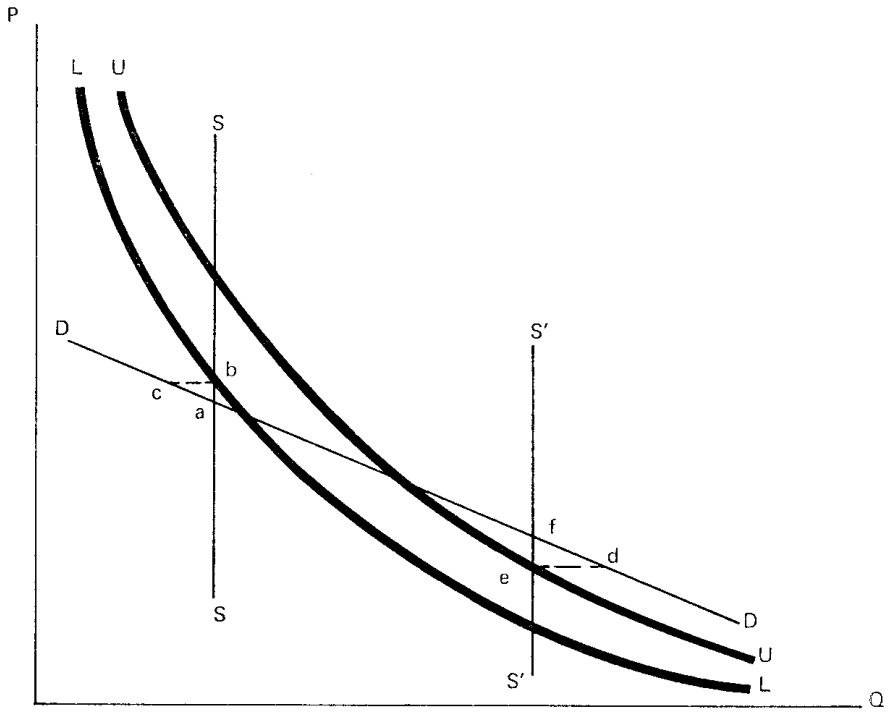

FIGURE 4—Income Stabilization with Constant Elastic Demand and Fluctuating Supply.

the high of point a and the low of point f to the high of b and the low of e. Moreover, a buffer stock would add instability to marketings by acquiring stocks in short years and selling in bumper years. Yet, gross income would be stabilized, and the larger the demand elasticity the smaller the price instability generated.

Obviously, these polar cases are not the full story. But they are suggestive of the general results to be expected from gross income stabilization. Analysis of these polar cases with positively-sloped supply curves (not shown here) shows that the basic conclusions are not changed materially.

Additional work is needed to cover the more realistic but complex situations in which *both* demand and supply functions are free to shift as in the real world. It is difficult to specify the conditions under which price and quantity movements are stabilized or not. Much depends upon the sequence and correlation of shifts in demand and supply. Generally speaking, price stability and income stability are achieved jointly when (1) demand shifts are large relative to supply shifts, and/or (2) demand is relatively inelastic at the producers' level.[14]

From an analytical viewpoint, the essence of these income stabilization schemes is to remove the effect of large short-run changes in demand upon producer prices. With such schemes price fluctuations at the farm level (apart from those occurring inside the UU–LL zone) are caused by changes in aggregate output or by deliberate changes in the stabilization zone.

[14] These general conclusions are the same as reached elsewhere [16, 17, 27].

Some Extensions

This section contains comments on some additional issues connected with income stabilization. The first is the problem of adapting an income stabilization scheme to forward (or guaranteed) pricing as may be done with price stabilization or price support schemes. In the latter two cases, all that is required is announcement of price targets before production decisions are made and the ability of the authorities to maintain these targets. With income stabilization, however, the prices to be sought in the market or by means of supplemental payments and taxes depend at least partly on the quantity produced.

With a previously-set income goal and a fairly good estimate of average-weather supply response, a preliminary announcement of stabilizing prices could be made for the coming season. Then, as the season advances, these prices could be increased or decreased in light of developing supply prospects. More abundant supplies would call for a price decrease. Short supplies would signal a price increase. These adjustments are reasonable in direction, and, in any case, producers would know that the aggregate income flowing into their industry would be stable. The problem in using income-stabilizing prices as guideposts to efficient resource allocation over time hinges upon (1) identifying appropriate income levels around which to stabilize and (2) rationally assessing both supply response and market prospects.

A second issue, mentioned earlier, is the relation between aggregate income stability and income stability for individual producers or regions. While aggregate income stabilization would not eliminate the opportunity for a scheme to assist primary-producing individuals or regions, it could be expected to reduce the financial and administrative burden of such a scheme.

For example, if an individual's output varies in the same direction and proportion as the aggregate, then his income will remain as stable as the aggregate. No individual assistance would be required in this special case or generally for the presumably rather large numbers of producers approximating it.[15]

If an individual's output varies in the same direction, but proportionately more than the aggregate, then more scope will exist for individual assistance. In high-risk agriculture, this group might be sizeable. In this case, the individual's income would fluctuate by increasing in large crop years and falling in small crop years. Income fluctuation would occur but would be less than that with a stabilized price.

Obviously, the reverse conclusion holds for those individuals whose output fluctuates in the same direction but proportionately less than the aggregate. These individuals will experience lower incomes in large crop years and higher incomes in short crop years. Such producers will have a more variable income than under a price-stabilizing programme, but the year-to-year income variation would not be more than the variation in *aggregate* output, though in the opposite direction. For most individuals it probably would be less. On balance, producers in this

[15] The individual income stabilization programme visualized here is the type proposed by Campbell and Glau [10]. An individual producer's income would have to change by some minimum proportion before he would qualify for the scheme.

group should not require frequent individual income-stabilizing assistance.[16]

An aggregate income scheme would aggravate stability problems of producers whose output tends to vary in opposition to the direction of total fluctuation. Such a group probably would be small over any extended period, but many individuals and regions would face this phenomenon at least occasionally. In this situation, the producer price decrease caused by aggregate output expansion would be experienced by these producers in their short seasons. Then their income would fluctuate downwards more sharply than under a price stabilization scheme. Similarly, larger crops would come at times when producer prices were high, thus providing a sharp upward fluctuation in income. Some form of individual income stabilization could be useful for producers in this group.

It is difficult to generalize about the relation between aggregate and individual income stability. Much depends upon the size and constancy over time of the groups mentioned above. In low-rainfall, high-risk agriculture, these groups (except perhaps those whose output varies opposite to the aggregate) should remain rather constant over time on a regional basis.[17] Empirical studies with disaggregated data could settle the issue for specific commodities. Surely, market-wide income stability is no guarantee of individual or regional income stability. Yet it is possible to argue that, on balance, aggregate income stability is consistent with increased individual income stability. This is most clear where individual output is at least as variable as aggregate output and positively-correlated with it — an important group in high-risk agriculture.[18]

A third issue is the possibility of using such a scheme to provide an income floor only. Obviously, this involves a net subsidy to the industry unless the scheme is financed by assessments or inventory sales independent of any upper income criterion. The analytical aspects of an income floor scheme follow directly from Figures 1–4. However, the upper stable income hyperbola UU becomes inoperative as a policy guideline.

Such a programme is really the counterpart, in an industry context, of most proposals for individual income assistance and related measures

[16] Some individuals in this group might experience infrequent but very severe downward fluctuations in production because of drought or other disaster. Then individual income assistance could be critical in staving off bankruptcy.

[17] The evidence on regional wool income instability presented by Campbell and Glau appears consistent with this view [10].

[18] D. G. Johnson devoted a chapter in his 1947 book, *Forward Prices for Agriculture*, to the relation between aggregate gross income and individual incomes [18, Chap. 13]. He used annual U.S. data for five crops over the 1903–39 period, covering national totals plus selected states and counties but no individual farm data. He points out, "Any interpretation of the results is largely a matter of personal judgement". Then he argues, "The empirical evidence does not seem to support the positon that stabilizing the total value of a crop would add an appreciable degree of income stability for the individual farmer" [18, p. 241]. My judgement of the statistical evidence is that it suggests substantially more relation between market income stability and individual income stability than Johnson indicates.

such as crop insurance and drought bonds.[19] Less analytical and administrative skill is needed to operate a floor scheme than a stabilization scheme, but access to more money and a political commitment to support are required.

Income Fluctuation in Three Major Products: Wool, Wheat, and Beef

In a discussion of income stabilization, it is useful to establish the nature and extent of income instability experienced by producers. For illustrative purposes in the Australian context, this section examines gross income instability for wool, wheat, and beef in the 1946–70 period.[20]

Wool and beef markets in this period were relatively free from direct government intervention. Wheat prices, on the other hand, were closely controlled at the producer level. Of interest are the differences in the sources and amount of income instability between rather free markets for two major livestock products and the controlled market for an important crop. The central idea was to look at gross income fluctuation, visualizing it as the product of price multiplied by quantity sold. The focus was at the producer level for the nation as a whole; more detailed data for regions or individuals surely could be examined. Widely-published, official data for the 1946–70 period were used on a marketing or fiscal year basis.

For wool, production was the total greasy equivalent of shorn wool (including crutchings), dead and fellmongered wool, and wool exported on skins [11, 3]. The wool price used was the annual average greasy price reported by the National Council of Wool Selling Brokers [3].

For wheat, national production figures were used [11, 5]. Average per-bushel crop-year returns to growers for bulk wheat (f.a.q.) were used as producer prices [3]. Annual data on planted acreage and average yields per planted acre were used in some related calculations[21] [11, 5].

For beef, the annual value of beef and veal slaughterings was used as gross income. Then the average unit values, as published, were used as prices received by producers [11, 12]. Implicit production figures were then obtained from these two series by division.

To bring the empirical analysis closer to the concept of fluctuation around long-run equilibrium trends, each data series was fitted to a linear trend by least squares and the deviations from trend computed. Although the data are not strictly comparable among the three commodities, an idea of relative variability is given by the coefficients of variation, Table 1. Even before any account is taken of covariances between prices and quantities, it seems apparent that most of the variation in wool income was linked to price fluctuation. Conversely, most of the similar-sized income variation in wheat seems to be linked to output fluctuation. The wheat production variation contained appre-

[19] A less-developed primary producing nation might impose an income *ceiling* scheme as a taxing device. Export tax and buffer fund mechanisms could be adapted to such a policy.

[20] These three commodities provided about 53 per cent of the gross value of Australian rural production in the 1965–70 period [4].

[21] Data on harvested acreage and associated yields are not readily available.

ciable components of both yield and acreage variation. In beef, the non-trend variation in income was much less than in wool or wheat and not obviously attributable to either price or quantity.

TABLE 1

Coefficients of Variation Using Deviations from Linear Trends, Annual Australian Data, 1946–1970

	Item	Coefficient of variation adjusted for linear trend[a]
		(per cent)
Wool		
	Gross income	28·0
	Price	34·1
	Production	4·8
Wheat		
	Gross income	29·2
	Price	8·9
	Production	29·3
	Acreage	22·5
	Yield/acre	16·8
Beef		
	Gross income	9·5
	Price	11·9
	Production	9·5

[a] These coefficients of variation are ratios expressed in percentage terms. The numerator of the ratio is the standard deviation of the differences between the actual observations and their linear trend. The denominator is the mean of the variable.

Variations in gross income are caused by variations in prices received (P) and/or variations in production or sales (Q). When both elements in a multiplied variable ($P \cdot Q = Y$) display statistical variation, it is generally not possible to separate the variance of the product (Y) unambiguously into parts attributable to each of the components (P and Q). This is because of (1) the tendency for any two variables (P and Q in this case) to be correlated to some extent, and (2) the multiplicative nature of the variable (Y) itself.

Some recent literature suggests that it may be possible to apportion the variance approximately in such a multiplicative case, taking due regard of any covariance that may exist [6, 15]. This approximation may be illustrated as follows. Let:

$$Y = P \cdot Q \tag{1}$$

then

$$\mathrm{var}(Y) \sim A + B + C \tag{2}$$

where

$$A = Q^{*2} \cdot \mathrm{var}(P)$$
$$B = P^{*2} \cdot \mathrm{var}(Q)$$
$$C = 2\ P^* \cdot Q^* \cdot \mathrm{cov}(P,Q)$$

and the asterisks denote mean values.

When the variances and covariance are computed with deviations from trend, the closeness of the approximation appears to be substan-

tially enhanced for most time series data [6]. Thus, all the variances and covariances used in this analysis were from trend-corrected data.

For each of the three commodities, the values of A, B, and C were calculated as indicated in equation (2). The value A was taken as the variation grossly attributable to price, B as attributable to quantity, and C as the inseparable linear interaction based on the covariance between price and quantity [6].

Following one suggested practice, A, B, and C were expressed relative to (A + B) and are shown as percentages in Table 2 [6].

Wool

The evidence in Tables 1 and 2 indicates that most of the variation in annual wool income can be attributed to price fluctuation. No matter how the small negative covariance term is handled, about 98 per cent of the trend-corrected variance in aggregate wool income is attributable to price change. These findings are consistent with Alan Powell's earlier results using a distantly-related methodology [24]. Powell points out that some of the observed wool price variation must somehow be attributed to movement along static demand curves induced by output fluctuation. However, with any plausible assumptions about demand elasticity, most of the observed income fluctuation must be caused by demand shifts. The size of the tiny interaction term shown in Table 2 confirms this conclusion.

TABLE 2

Separation of Gross Income Variation for Australian Wool, Wheat, and Beef; With Linear Interaction (Covariance Term) Shown Separately

Item	Income variation attributable to: Price A/(A + B)	Quantity B/(A + B)	Linear interaction C/(A + B)
		(per cent)	
Wool	98·0	2·0	−1·0
Wheat	8·4	91·6	−2·5
Beef	60·8	39·2	−65·5

Producer price stability for wool, however achieved, would do much to stabilize aggregate wool income in Australia. Such price stability would probably ease but surely not erase income fluctuation in high-risk areas. The wool case is fairly close to the situation portrayed in Figure 2.

Wheat

Wheat displayed an almost identical degree of gross income fluctuation as wool, Table 1. However, the major cause was output rather than price. The stabilization arrangements of the Australian Wheat Board achieved a fair amount of price stability, but output fluctuation was strong.[22] As with wool, the covariance term between price and quantity was very small and negative. As indicated in Table 2, about

[22] Longworth argues that the value of this stability is questionable because of long delays in clearing the annual pools [20].

92 per cent of the gross income variation in wheat, corrected for trend, can be associated with output fluctuation.

Further computations were made to separate wheat output fluctuations into acreage and yield components. Approximate proportional separations based on equation (2) are shown in Table 3. About two-thirds of Australian wheat output variation can be attributed to acreage fluctuation. The remainder was associated with price change. The negative covariance term, although larger than its counterparts for wool and wheat income, had little impact on the attribution of output variation between acreage and yield.

TABLE 3

Separation of Output Variation for Australian Wheat Into Acreage and Yield Components

Method	Production variation attributable to: Acreage	Yield/acre	Linear interaction
		(per cent)	
Interaction kept separate	64·2	35·8	−10·1
Interaction equally apportioned[a]	65·8	34·2	—

[a] See [15] for the method used.

Thus, about 60 per cent of gross wheat *income* variation is attributable to variation in planted acreage, about 33 per cent to yield changes, and the remaining 7 per cent to price fluctuation. Variation in planted acreage may be viewed as largely a management decision variable, but the non-trend yield fluctuation can be attributed mostly to changes in environmental conditions.[23]

An industry income stabilization scheme for wheat would have to do more than stabilize producer prices—the current programmes provide some stability of this kind.[24] It would have to take into account and allow for substantial year-to-year changes in plantings and sizeable yield fluctuations. From the growers' viewpoint, the wheat case is similar to that portrayed in Figure 4. An income stabilization scheme might indeed *add* instability to wheat prices realized by producers.

Beef

Beef income was only about one-third as volatile as either wool or wheat income, Table 1. Moreover, it proved quite difficult to separate

[23] This distinction is strengthened because of the data used. Since planted acreage is used along with yields on planted acres, a large part of environmentally-caused fluctuation, including abandoned acreage, is captured by the yield variable. Moreover, about 99 per cent of the variation in planted acreage can be attributed to variation in March 31st production plans as reflected in the annual Agricultural and Pastoral Survey conducted by the Commonwealth Bureau of Census and Statistics. Incidentally, only the final two years of the data series are influenced by wheat delivery quotas imposed by the Wheat Board.

[24] Longworth also estimates the extent of income stabilization attributable to recent schemes [20].

beef income variation clearly into price and quantity components, Table 2. The large negative interaction term makes any such attribution quite tenuous. Movement along static demand curves is surely quite important here primarily because a lower proportion of national beef production was exported than wool or wheat. To some extent, beef cattle can be held off a poor market and moved quickly to a good one. This also tends to dampen price and income fluctuations. A nation-wide market for store cattle also helps to offset income fluctuation in slaughter cattle sales.

An aggregate income stabilization scheme for beef could achieve less than for wool or wheat. First, it would face much less non-trend variability at the start. Secondly, the positive slope of short-run supply curves would make the establishment of income-stabilizing prices difficult, especially if they were to be set in advance of expected marketings.

Concluding Comments

The purposes of this paper were two-fold. The first objective was to discuss the basic economics of a market-wide income stabilization policy for primary producers. The second objective was to use a recently suggested statistical technique to examine post-World War II income instability in the Australian wool, wheat, and beef industries and to apportion this instability into price and output components.

The economic analysis suggests that the operational resources needed to follow an industry-wide income stabilization policy are not very different from those required for price stabilization. The problems inherent in an income stabilization scheme are similar to those faced by a price stabilization scheme but with some important differences. An aggregate income scheme would not necessarily provide income stability to individuals or regions. However, aggregate income stabilization is consistent with increased stability for many individuals within a primary industry.

Post-World War II data show that aggregate income instability (net of trend) in the Australian wool industry can be attributed largely to fluctuations in prices. On the other hand, a similar level of income instability in wheat can be attributed mainly to production fluctuation, with two-thirds of output variation attributable to acreage change and one-third attributable to yield changes. A high level of correlation between Australian beef production and prices (net of trend) prevents the separation of income fluctuation for beef clearly into price and production components.

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