International commodity policy

A quantitative analysis

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2 The economics of stabilization

A historical survey

INTRODUCTION

In this chapter we provide a survey of how economists have looked at the problem of instability. We shall distinguish between macroeconomics and microeconomics. The macroeconomic literature, focusing on benefits of stabilization at the country level, is reviewed in the following section. The microeconomic literature is discussed in the third section, where we start with the Waugh–Oi–Massell framework and then discuss nine reasons why this framework is too simple.

Whereas the earlier approaches, like Keynes's, dealt specifically with variability, i.e. changes over time, the later microeconomic approaches looked at the issue as being one of uncertainty. We shall first discuss some contributions in the field of macroeconomics or development economics. Although stability is probably among the goals of any government, its advantages are not clearly specified, let alone quantified. The early focus of the publications on primary commodity price stabilization appears to be on its contribution to mitigating the amplitude of the trade cycle and during the 1950s and 1960s on raising the purchasing power of the less developed countries. More recent contributions have focused on the optimal response to permanent and – still later – transitory shocks to the economy. While the older papers consider countries as the unit of analysis, these contributions clearly distinguish between the government and private sectors, thus providing a much richer picture. In addition, it appears that authors in the 1950s and 1960s looked at governments of less developed countries benevolently, contrary to present-day authors who consider the private sector as much more resembling *homo economicus* than the government.

Initially the microeconomics literature measured benefits from stabilization as Marshallian surpluses, and later used a more sophisticated expected-utility framework. The microeconomics of uncertainty

is a strongly growing field of research and the development of adequate models, able to capture the individual's attitude towards present and future uncertainty, appears not to have reached maturity yet, fed as it is by a host of experiments in a mixed field of psychology and economics (see Machina's (1987) survey). Although the expected-utility approach lends itself perfectly to the analysis of stabilization issues, it is doubtful whether substantial arguments for or against world market price stabilization can be derived from it. This is not only because so many outcomes of this type of analysis can be of either sign, nor because eventual benefits are estimated to be so small, but rather because (a) individual producers do not experience as much variability as suggested by the variability of the prices, (b) what is experienced is the outcome of microeconomic and macroeconomic interaction of various economic agents, including the government and random events, and (c) the economic and social environment in which individuals find themselves (access to information, infrastructure, financial facilities, etc.) is much more important (see Kanbur 1984). This is not to say that stabilization of prices is unimportant. On the contrary, we think that the development of provisions that would enable individuals to mitigate the economic risks goes hand in hand with price stabilization.

MACROECONOMICS AND DEVELOPMENT ECONOMICS

When Keynes wrote in 1942 that 'we should aim at combining a short-period stability of prices with a long-period price policy which balances supply and demand and allows a steady rate of expansion to the cheaper-cost producers' (Keynes 1974: 301), he based his arguments on the experiences in the then recent past, in which prices had fluctuated enormously. The average annual price range (yearly high over yearly low) observed in the period 1928–37 for (natural) rubber, cotton, lead and wheat amounted in his calculations to no less than 67 per cent. The most volatile price, that of rubber, had a score of less than 70 per cent only in one year. When we compare this with present-day figures, it appears that 'the extent of the evil' has been much reduced: the highest scores for natural rubber in the recent past are 63 per cent in 1981 and 50 per cent in 1988.[1] Keynes suggests that the cause of the fluctuations in prices is on the supply side and that major contributors to the instability of prices are the reluctance of traders, manufacturers and retailers to hold stocks, because of uncertainty and high storage costs, and the practices of speculators. Compared with the 1930s, many improvements have been made in the ...eld of information, futures markets have developed and specialized traders can benefit from economies of scale in storage. This must have been a major contribution to reducing the extent of short-term price fluctuations. Keynes mentions two advantages of price stabilization: it would enable an 'orderly programme of output' both of the raw materials and of their manufactured products and it would reduce the amplitude of the trade cycle by keeping up effective demand during the slump. The ideal was to combine short-term stability and medium-term stability via the contribution to effective demand in recessionary years and a 'long-period price policy which balances supply and demand'. But Keynes himself admitted that a great deal of trial and error would be required to find out what the equilibrium price should be.

The short-term aspects appear to have been back-stage in the 1950s and 1960s. After the Havana Charter of 1948 (which did actually recommend the introduction of buffer stocks, export restrictions and trade at fixed prices), the emphasis was on the supposedly declining terms of trade of developing countries, and Kaldor wrote in 1962, at the request of Raoul Prebisch, then Executive Secretary of the Economic Commission for Latin America, a proposal in which it was suggested that prices be 'stabilized at, say, 10% above their current level' (Kaldor 1964: 114). He also considered the sugar, tin and coffee agreements successful in 'stabilizing prices at a higher level than would have been attained without them' (p. 115). Enzo Grilli and Maw Cheng Yang (1988) have recently returned to the issue of the trend in terms of trade. They have shown that there is a long-run tendency for primary commodity prices, especially of agricultural raw materials, to decline over time relative to the price of manufactures, thus confirming the Prebisch–Singer findings, but that the increased demand for and production of these goods more than compensate for the relative decline in prices. Scandizzo and Diakosavvas (see Scandizzo and Diakosavvas 1987 and Diakosavvas and Scandizzo 1991) addressed the same issue and concluded that 'there is some justification in suspecting a negative bias in the movement of international trade in primary commodities and that the evidence is insufficient to warrant firm conclusions on the matter' (1987: 161).

Kaldor, Hart and Tinbergen, in 1964, emphasized again the contribution to attenuation of trade cycle effects in their paper on an international commodity reserve currency, reproduced in Kaldor (1964). Such a currency, expressed in the prices of a range of primary commodities, would provide stability to the export earnings of primary commodity producers and thereby enhance their purchasing

power in recessionary periods. The effects would be 'supermultiplied' by induced investments in the primary producing sector during those years (p. 164). Although this idea came up from time to time in later years, it has never gained substantial political support from the developed countries.

With the establishment of the United Nations Conference on Trade and Development (UNCTAD) in 1965, numerous studies have been made on the potential contribution that stabilized export earnings could make to the economic growth of developing countries. In 1966, MacBean published his results on whether or not fluctuating export earnings are harmful to the growth of developing countries. His findings that no hard case could be made for positive effects of stability aroused great interest and the research has been replicated many times: see Knudsen and Parnes (1975), Adams and Behrman (1982) and Behrman (1987). Herrmann (1981, 1988a) provides a thorough discussion; a comprehensive overview of the literature on instability and economic growth is given by Love (1987). Most authors are reluctant to admit that stability would not contribute and gave stabilization the 'benefit of the doubt'. The discussion often centres on how investments are affected by instability of export earnings. On the one hand a more uncertain future deters investments, but on the other hand unstable income might induce more savings and thereby more investments. Lim (1991) surveys the issue again and concludes (again) that 'the results do not overwhelmingly support the case for or against export instability' (p. 49).

After the enormous changes in prices and exchange rates that occurred in the early 1970s, emphasis appears to have shifted from analyses in which less developed countries were treated as one block towards more disaggregated studies in which a further distinction was made within the country models themselves. In particular, the role of the government in reaction to a sudden change was emphasized more than before. The 'Dutch Disease' type of analysis dealt with the effects of a sudden change that was to be permanent, like the discovery of oil resources. See Corden (1984) for a good survey.

More relevant to the non-oil primary commodities is the 'trade shock theory', which is a further extension of the earlier analysis and is applicable to temporary changes. A recent survey of the issue is given by Bevan *et al.* (1990a). While the 'Dutch Disease' analysis distinguishes between a 'tradable' sector and a 'non-tradable' sector in addition to the booming sector, a further distinction is introduced in the trade shocks literature. Whereas the permanent shock theory would predict a price increase in all non-tradables, following a permanent positive shock in foreign exchange earnings, trade shock theory predicts a further increase in the price of non-tradable capital goods relative to non-tradable consumer goods. In particular, 'a temporary trade boom will generate large profits in the construction industry' (Bevan *et al.* 1990a: 39). Private agents are considered to recognize the shock as temporary and to adjust their consumption only marginally (in contrast to the case of permanent shocks). A large proportion of the windfall profits will then be saved, which leads to investments on the one hand and (temporary) foreign asset accumulation (if possible) on the other. The government will normally see its revenues rise, and more so if these revenues are collected from export taxes. If a government cannot recognize the temporary character, it will expand consumption by employing more people, but the correct response would be to save a substantial part (in foreign financial assets) and run them down gradually by means of government investments. Excessive investments immediately following a boom would be inefficient, as they will normally increase prices of investment goods.

In a survey of responses to positive trade shocks (in coffee prices) in the second half of the 1970s, J.M. Davis (1983) summarizes: 'the increase in producer prices was restricted, allowing substantial sums to accrue to the central government and commodity organizations. The counter-cyclical impact of fiscal policy was often limited by the rise in development spending.' By the end of 1978, he concludes, the reserve position of many of the countries was little better than before the windfall gain, and these countries were not in a position to buffer any further reductions in export proceeds. Cuddington (1989) in a later survey states that the few countries that managed booms well were those that limited increases in government spending to levels consistent with long-term trends in revenue collection and 'avoided indulging in wasteful investments'. Balassa (1986) notes that inward-oriented countries initially mitigated the shocks brought about by higher oil prices in the early 1970s and high interest rates around 1980. Outward-oriented countries suffered larger shocks but avoided reliance on foreign debts. Eventually, the countries that had an outward-oriented policy were much better off.

The great diversity in the types of policy and control regimes in the developing countries thus may provide an explanation of the weak regression results of the cross-country comparisons *à la* MacBean. Booms have often proved to be 'a mixed blessing' (Cuddington 1989). In the traditional analyses of fluctuating export revenues, booms were supposed to compensate for slumps. If the potential

economic advantages of a boom are in general so badly exploited by the countries concerned, they can hardly be believed to play that role. In fact, both booms and slumps will be very demanding as far as government policy is concerned. And the optimal policy in the case of a boom is not symmetrical with that in the case of a slump. This is because saving foreign currency (the boom case) is not restricted, but borrowing hard currency in the situation with low export earnings often is. Furthermore, the interaction between government and private sector is important: as Bevan *et al.* (1990a) point out, the perception by the private sector of the signals provided by the government, such as changes in taxes or import licensing, can make a substantial difference to the allocation of their income. Even if government follows the prescriptions for optimal policy, if the private sector does not believe that this will be continued for some time to come, the effects may be drastically different from the optimal case. Calvo (1988) shows this in respect of trade liberalization without full credibility.

In a detailed analysis of the responses to the coffee boom in Kenya and Tanzania, Bevan *et al.* (1990b) conclude that the responses by the private sector are in general efficient, but that governments appear to react unwisely. In an epilogue, they make the suggestion that the private sector should be shielded from the government. At the micro-level shocks appear to be treated quite well, but not so at the macro-level. This would suggest that, if there must be fluctuations in world market prices, they should be transmitted to the producers, but at the same time government earnings should be stabilized. Actual practice is quite different, with producers more often than not 'protected' against price fluctuations at the cost of government exposure.

This being so, direct stabilization of revenues would have the advantage that a government would not need to go through all the difficulties of suddenly adjusting its policy. This suggests that prices might be left to the market if the balance of payments is stabilized. Financial compensation of countries for export shortfalls is the appropriate way to do this, rather than price stabilization. Export earnings stabilization is different from price stabilization because it cannot be captured in a demand–supply framework. Export earnings stabilization should aim at avoiding those year-by-year changes which would necessitate sudden changes of policy. This might imply extension of credit facilities and, in some instances, perhaps contraction of borrowing facilities. But as Eaton *et al.* (1986) argue, a major problem is the enforcement of a loan contract.

MICROECONOMICS

The pure microeconomics of stabilization has developed substantially since the first exercises along the lines of Marshallian surplus. The newer approach is the expected-utility approach. In the former approach, the basic framework is a demand–supply model where welfare calculations are used to assess desirability of stabilization; in the latter approach, which in general is more algebraic, consuming and producing agents are expected-utility maximizers and desirability of stabilization is dependent on whether a higher level of expected utility is achieved.

In the Marshallian approach, the basic reference is Massell (1969) who combined two earlier papers by Waugh (1944) and Oi (1961) into one framework. Massell's results can be summarized as follows.

1 Producers lose (gain) and consumers gain (lose) from price stabilization if the source of price instability is random shifts in demand (supply).
2 Total gains from stabilization are positive.

This is based on the graphical analysis shown in Figure 2.1. In Figure 2.1(a), the market price p can take on two values, depending on whether supply is high (S_2) or low (S_1). Given buffer stock intervention and equal probability for the two cases, prices can be stabilized at p_m. Without stabilization, consumer surplus over the cycle is $f+a+b+c+d+f$; with stabilization, this becomes $2(a+b+f)$; hence the gain from stabilization is $a+b-(c+d)$, which is

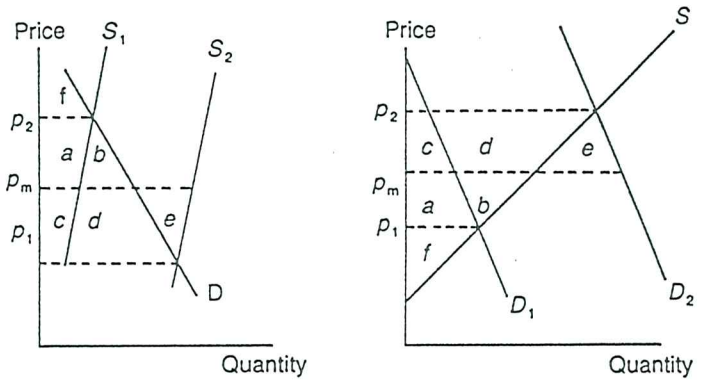

Figure 2.1 The Waugh–Oi–Massell diagram

negative. The change in producer surplus from the situation without stabilization to the stabilized case is $-a$ when supply is low and $c+d+e$ when supply is high. The gains to producers over the cycle are therefore $c+d+e-a$, which is positive. Total gains are therefore $b+e$ and positive.

In Figure 2.1(b), the source of uncertainty is on the demand side, with the demand taking the shape of D_1 or D_2 with equal probability. The gains from stabilization to the consumer over the cycle are now $c+d+e-a$, which is positive, and to the producers $a+b-(c+d)$, which is negative. Total gains over the cycle are again $b+e$ and positive.

However, the assumptions needed for these results are very strong:

1 linear demand curves and additive disturbances
2 free storage by the buffer stock and no private storage
3 prices are known at the time of consumption or production
4 the welfare measures are appropriate
5 homogeneous groups of producers and consumers
6 no other sources of instability
7 no dynamics
8 no general equilibrium effects
9 market equilibrium known

Subsequent literature has dealt with many of these assumptions and we shall discuss them one by one.

The assumption of linear curves and additive disturbances

Turnovsky (1976) has investigated what the effects are when non-linear functions are assumed together with multiplicative disturbances. As is also pointed out in Newbery and Stiglitz (1981), this is the more natural specification both of the random influence and of the curves themselves. The most important effect is the shift in the average price. It has been shown that a buffer stock cannot in general – in this environment – stabilize the price at the pre-stabilization mean price. Depending on the sizes of demand and supply elasticities and frequency distributions of the random factors, the stable price will lie above or below the original average. This and the curvature of the functions themselves are the causes for transfers to take place when prices are stabilized. In very general terms, if supply elasticity is low and demand elasticity is relatively high, producers tend to gain from stabilization. Turnovsky (1978: 127) 'hastens to add' that this will not hold in particular cases. If, for example, both demand and supply curves are loglinear (as they commonly are assumed to be), producers would gain only if the size of the demand elasticity exceeds unity, which is rare. Newbery and Stiglitz (1981: 125) examine this case more closely. If supply is random but not responsive to price changes and if demand has constant price elasticity $-e$ where e is positive, then the size of the transfers from producers to consumers relative to total sales equals approximately $\frac{1}{2}(1-e)$ times the squared coefficient of variation of the prices.

A further outcome in the non-linear case is that the source of instability no longer plays a role in the distribution of any welfare gains. But, as pointed out by Ghosh *et al.* (1987), these welfare gains are now measured by comparing the situation without buffer stock with a situation where the buffer stock stabilizes prices at a feasible price, i.e. a price where expected sales from the buffer stock equal expected purchases. The above mentioned distribution refers only to the welfare gains not counting the transfer effects.

The assumption of costless storage and the role of private stockholders

A further comment by Ghosh *et al.* on the Turnovsky results refers to the surmised efficiency gains from stabilization. If there are benefits to derive from stabilization, why would these not be captured by private stockholders? A commodity that can be held in buffer stocks can certainly be held in private stocks. Wright and Williams (1982) have analysed the effects that private stock holding has on the distribution of the prices. Unlike, for example, A. Schmitz (1984: 18), but following Gustafson (1958), they include a non-negativity constraint in their analysis (stocks cannot be negative) and this has profound effects on the market prices. A rational stockholder will have an incentive to buy at prices below the expected price (minus storage costs) for the next period, but no incentive to buy when prices are above this level. Hence, in the above framework, there will be additional market demand when supply is high, but no change in demand when supply is low. This by itself will decrease the frequency of low prices and will increase the frequency of prices just below the average price. In addition, the frequency distribution of market supply will change. Extremely low production can still occur with the same probability, but there will now be extra supply coming from private stocks. Hence, the occurrence of very low market supply will be less frequent, whereas higher market supplies will occur more frequently. If there is no production response, the market supply distribution will be shifted to the right. Hence, the originally highest prices will occur

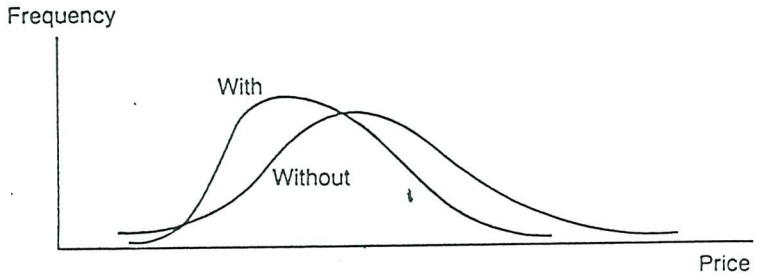

Figure 2.2 Price distribution with and without storage

less frequently. The overall price distribution will become more skewed to the right and moderately low prices will occur far more frequently than high prices, whereas very low prices are ruled out. See Figure 2.2 for a graphical illustration.

The asymmetry in the market-demand schedules that is introduced by private stockholders is also relevant for a buffer stock. When storage is costless, it may be reasonable to assume that very large stocks are held, so that a buffer stock will 'always' be able to intervene, but this is no longer true in the more realistic situation in which stocks are not held without cost. In this case, the positive chance that the buffer stock will lack stock to prevent prices from rising should be incorporated. This by itself enhances the skewedness of the price distribution, because low prices may still be avoided through intervention but high prices may not. If the buffer stock does not have unlimited funds available for purchases, a positive chance will exist that the authority is not able to make purchases, so that low prices are possible.

The effects of private storage are quite difficult to ascertain. On the one hand, the market-demand curve is now more curved than it was before. This would increase the potential gains from stabilization to consumers and indeed Wright and Williams suggest that the mere introduction of storage works to the advantage of consumers and to the disadvantage of producers. On the other hand, the change in frequency distributions makes it difficult to assess the expected values of consumer and producer benefits.

Recently, Deaton and Laroque (1990) have again analysed this problem. Assuming – in line with Wright and Williams – rational expectations held by private stockholders but no supply response, they arrive at frequency distributions of prices that resemble actual

distributions of commodity prices fairly closely. This provides an explanation for the occurrence of sharp peaks and wide valleys (statistically expressed as positive skewedness) of many commodity price series.

Additional stabilization by a buffer stock in a world with private storage (and taking its asymmetry into account) has been analysed in Wright and Williams (1988) who conclude from simulations that producers would lose. It may be expected, as in the case of Newbery and Stiglitz (1981), that the incentive for private stockholders will diminish; thus more sales or purchases by the buffer stock will be required to achieve a given price change. The enhanced skewedness in the price distribution would induce transfers, which – depending on the supply responsiveness – tend to favour consumers.

In addition to private stockholding, the (concomitant) existence of futures markets further reduces the potential benefits from price stabilization. Although the futures market can be used to hedge a certain production against the influence of a change in prices, in general the benefits of futures markets to least developed countries are limited because substantial margin payments may have to be made, requiring dear hard currency, and because this does not resolve the uncertainty of production (see Gemmill 1985; Gilbert 1985). Futures markets may, however, play an important role in reducing the uncertainties during the marketing of the products. After harvest, traders may benefit from the futures market by hedging against price changes during transport. This may have its repercussions on their willingness to buy from smallholders. Futures markets provide hardly any insurance against price changes more than one year ahead.

The assumption that prices are known at the time of consumption or production

This was assumed to be the case in the earlier analyses of Waugh and Oi. In particular, it means that producers commit expenditures to the production process only after they know what price will be realized for the product. In agriculture, as anywhere else, production takes time, especially for tree crops and the like, so that heavy commitments are made without the eventual price of the product being known with certainty. In any particular year, supply can often hardly respond to the current prices and the more appropriate model appears to be one in which consumers may still adjust their consumption pattern to the prevailing price but producers cannot similarly adjust their supply. Welfare effects of stabilization will become quite

different from the original Massell results, even under linear demand schedules. As A. Schmitz (1984) points out, with linear demand curves and additive disturbances on the demand side, but with supply now predetermined, producers may be indifferent to price stabilization, whereas consumers will gain. Both results are different from the original Massell outcome. If demand is non-random and follows a non-linear curve, but supply is random and not price responsive, consumers are likely to gain and producers may lose, both results depending on the size of the elasticities. If supply in a particular year is predetermined but can respond to price changes with a lag of one year (for annual crops) or more (for perennial crops and mining, for example), the issue is how to evaluate the effects that stabilization can have on future supply. In these cases, the supply response typically depends on how expectations of producers are affected by current price changes. This point will be taken up again in the section on the omission of dynamics.

A common and much analysed case is that of annual crops, for which yields are uncertain and decisions on resource allocation must be made well before harvesting time, so that supply is predetermined but uncertain. It may very well be the case that low overall yields coincide with high prices, thus stabilizing aggregate income to some extent. Price stabilization in this situation would only enhance income variability. Individual farmers may not be fully aware of this negative correlation between yields and prices, and may adjust their expectations of the prices according to last year's prices. Hazell and Scandizzo (1975) and Scandizzo *et al.* (1984) have shown the social inefficiency of this behaviour and use it in a plea for stabilization, not necessarily by buffer stocking but rather by the provision of adequate information to farmers about expected prices. They and others (e.g. Turnovsky 1974) also show that the gains from stabilization in this context critically depend on how expectations are formed.

As to perennial crops, very little has come out of research into the determinants of investment in tree stands. As we shall show in Chapter 7, present agreements on price stabilization can hardly be expected to add anything to the predictability of real prices, say ten years from now. Theoretically, the issue is how the provision of more stable prices in the future affects present allocation of resources. This issue will be taken up in the section on the omission of dynamics.

The assumption that these (Marshallian) welfare measures are appropriate

The measurement of consumer and producer surpluses, as the area below the demand curve and above the price line and the area between the price line and the supply curve respectively, does not take into account how the supply curve (and in some cases the demand curve) itself is affected by the uncertainty of the prices. More adequate measures are Hicks's compensating and equivalent variations. With price uncertainty, and risk-averse producers, the planned supply may be substantially lower than it would be without the uncertainty. Boussard (1990) estimates for sub-Saharan Africa that the difference between actual average gross margins and 'action certainty equivalent margins' may be as high as 50 per cent.

As the sub-title of their book (*A Study in the Economics of Risk*) suggests, Newbery and Stiglitz (1981) make clear that major benefits of commodity market stabilization could come solely from this effect of the reduction in variability of prices and income. This would be so if agents were averse to risk. Their analysis of commodity price stabilization is cast in the framework of expected-utility maximization. In the Massell framework, prices were assumed to be known at the time the relevant decisions were made. As pointed out earlier, this is hardly ever appropriate for producers and on many occasions inappropriate for consumers. If prices and/or production are not known for certain when land or other resources are allocated, such allocation must be made on the basis of expected-utility or profit maximization.

Expected utility was given its conceptual foundation by von Neumann and Morgenstern (1944), who show under what conditions preferences concerning uncertain events can be ranked like normal utility rankings of preferences. The types of function to be used differ however. Whereas the standard utility theory allows any monotonic transformation of a utility function without changing the results of the maximization, the type to be used in expected-utility maximization may only be transformed by a linear transformation. Applicability of one utility function for a group of agents has its limitations in the standard case, but is even more troublesome with this type of function. Arrow (1965) and Pratt (1964) developed a measure for risk aversion for these utility functions, using the ratio of the second-order derivative to the first-order derivative as a relevant measure of the curvature of a function. This approach enables comparison of uncertain events. Newbery and Stiglitz (1981: 93) derive the following approximate formula for the benefits B of having income Y_0 with

mean m_0 and squared coefficient of variation (CV) s_0 instead of income Y_1 with mean m_1 and squared CV s_1:

$$B = (m_0 - m_1) - \tfrac{1}{2}m_1R(s_0 - s_1) \tag{2.1}$$

where R is the Arrow–Pratt coefficient of relative risk aversion defined as

$$R = -\frac{Yu''}{u'} \tag{2.2}$$

and where u'' and u' are the second and first derivatives of the (von Neumann–Morgenstern) utility function with respect to Y. The first term in the expression for B is the transfer benefit and the second term captures the risk benefits.

In a trading environment with a loglinear demand curve depending on income and price, non-responsive supply and no storage, and with multiplicative disturbance terms added to consumer income and supply, Newbery and Stiglitz derive the following benefits from complete price stabilization:

1 For the producers (p. 94):

$$\text{transfer benefits} = \tfrac{1}{2}Y(e-1)s \tag{2.3}$$

$$\text{risk benefits} = \tfrac{1}{2}YR^s(1-2e)s \tag{2.4}$$

where Y is the average pre-stabilization revenue from sales of the good, R^s is the producers' coefficient of relative risk aversion and s is the squared CV of the price. This squared CV is related to the two potential sources of disturbances by

$$s = \frac{s_q + f^2 s_y}{e^2} \tag{2.5}$$

where e and f are the price and income elasticity of demand and s_q and s_y are the squared CVs of production and consumers' income respectively.

2 For the consumers (p. 127):

$$\text{transfer benefits} = \tfrac{1}{2}X(1-e)s \tag{2.6}$$

$$\text{efficiency benefits} = \tfrac{1}{2}X\left(es - \frac{2R^c f s_y}{e}\right) \tag{2.7}$$

where X is the average consumer expenditure on the good, which is equal to Y, the revenues of the producers.

Welfare benefits from complete stabilization are therefore

$$\text{total welfare benefits} = \tfrac{1}{2}X\left\{[R^s(1-2e)+e]s - \frac{2R^c f s_y}{e}\right\} \tag{2.8}$$

Supposing that the coefficients of relative risk aversion are unity and that disturbances are from supply changes only, then relative total welfare benefits amount to $\frac{1}{2}(1-e)s$, which for a CV of the price of 0.25 and $e = 0.5$ (corresponding to a CV for production of 1/8) would equal only 1/64, which is 1.6 per cent. Transfer benefits accruing to consumers are in this case of the same size. If, in addition, $f = 1$ and income has a CV of 0.1, then the CV of the price increases to 0.32 ($s = 0.1025$), leading to total benefits equal to 0.56 per cent and transfers to the consumers of 2.56 per cent. These and other results have been derived by Newbery and Stiglitz for a range of commodities and their conclusion was that in general net benefits from stabilization are meagre.

The above formulae from Newbery and Stiglitz assume supply to be unstable but not responsive to prices. For the crops considered in the present book, i.e. coffee, cocoa and rubber, this is true to the extent that capacity is predetermined. The capacity utilization may still depend on the current price. If these responses were incorporated, price variability would be reduced as high prices would trigger increased production, thus reducing prices. For normal small values of the supply elasticities, the effects on transfer and risk benefits from stabilization would be mitigated, but the signs would remain the same. Producer benefits in this case, assuming all instability to be from supply disturbances, would be for a supply elasticity of z:

$$\text{relative transfer benefits} = \tfrac{1}{2}w(1-w)s_q \tag{2.9}$$

$$\text{relative risk benefits} = \tfrac{1}{2}Rw(w-2)s_q \tag{2.10}$$

$$\text{relative total benefits} = \tfrac{1}{2}ws_q[1-w+R(w-2)] \tag{2.11}$$

where $w = (1+z)/(e+z) > 1$ for $e < 1$. Total benefits are only positive if

$$R(w-2) > (w-1) \tag{2.12}$$

or, for $R > 1$,

$$z < \left(2 - \frac{1}{R}\right)e - \left(1 - \frac{1}{R}\right) \tag{2.13}$$

These benefits still do not account for changes in the supply function owing to changes in the uncertainty about future prices. As mentioned earlier, this can only be done when assumptions are made

on the formulation of expectations. Even if these are rational, i.e. if the expected price is the price generated by the model in the absence of new disturbances, Newbery and Stiglitz show that the market solution is not in general Pareto optimal. But one cannot deduce whether stabilization of prices would be beneficial. As to longer-run benefits for producers, they conclude:

> In the longer run, producers will adjust their effort, and this will affect the prices they receive. The magnitude of this response depends on the effects of price stabilization on the mean value of the marginal return to effort, and this need not move in the same direction as the mean value of utility.
>
> (Newbery and Stiglitz 1981: 334)

We shall come back to this in the section on the omission of dynamics.

The assumption of homogeneous groups of producers and consumers

The standard analysis only includes representative agents, who are either consumers or producers. The world markets for the major commodities, however, show a far from homogeneous picture. Crops such as coffee, cocoa and natural rubber are produced in many countries, but production is heavily concentrated in some of them. For all three crops, by far the major part is produced in only a few countries. If an analysis of stabilization effects shows that income is redistributed from 'producers' to 'consumers', it does not necessarily mean that all producers would lose and all consumers would gain. In particular, it has been shown that, if the source of uncertainty is in a major producing country, price stabilization may destabilize export earnings of this country (for example, because production shortfalls would no longer be compensated by higher prices), but other – more stable – producers may see their earnings stabilized. Herrmann (1983b) has demonstrated that it is possible that world export earnings are stabilized by partial price stabilization, but that some individual countries' export earnings are destabilized. Nguyen (1990), however, argues that such cases are fairly uncommon and the partial price stabilization would usually stabilize export earnings of all participants.

In addition to the possible differential impact of price stabilization on national exports due to different market shares and market-supply elasticities, domestic policies in the countries may differ substantially. In some countries, world market price changes are passed on to the producers; in other countries, domestic prices may fluctuate far less than world market prices. Hazell *et al.* (1990) conclude that

> in most cases the variability in export unit values has not been fully transmitted to producers in the prices they receive. Real exchange rates have played a major buffering role, but so too have domestic marketing arrangements and government interventions. In fact, most export producers face price variability that appears to be largely determined by factors other than variations in the local currency value of their country's export unit values.

But, to the countries themselves, nearly all variability has been transmitted in the US dollar values of the export unit values. Knudsen and Nash (1990) consider whether variability in domestic prices has been reduced by domestic policy compared with the world market prices. They find that beverages, in particular, appear not to have benefited so much from the variety of domestic policies (export taxes, marketing boards) that were in place in various countries. In 31 per cent of the cases, the variability of real producer prices exceeded that of real border prices. Mundlak and Larson (1990), on the other hand, claim that world market price variability is a good measure of producer-price variability. However this may be, there is a great variety of domestic policies that make producers in one country experience quite different variability of the real prices than producers in another. The same may hold for government revenues or those of parastatal organizations. The implication is that one world market price stabilization scheme would work out quite differently for the individual producers and producing countries and that, in order to assess the effects of stabilization, one should take each major producing country's policies into consideration.

The assumption that there are no other sources of instability

Clearly other sources of instability affect the producers of export commodities. To the extent that these other uncertainties are correlated with the prices paid to producers of the commodity concerned they cannot be ignored. Newbery and Stiglitz mention the case of crops chosen by the farmer so as to minimize the CV of his earnings. If the price of one of these crops was stabilized, it might destabilize his overall income, if the stabilizing effects of negative correlations were removed. Changes in the exchange rates are a common source of instability which does affect export crops to a greater extent than non-traded commodities. If this was the only source of uncertainty,

producers would be faced with a random demand function with multiplicative inverse demand shifts (see Newbery and Stiglitz 1981: Figure 8.1(a)). But even in the case of uncorrelated random factors, other sources of instability can play a role. Zeckhauser and Keeler (1970) indicate that when the size of the total risk increases individuals may be prepared to pay a more than proportionally higher risk premium. This can also be understood to indicate that in a risky environment, after reduction of one risk, for example by stabilization of revenues from one commodity, individuals may be prepared to take greater risks in another, and vice versa: when forced to take one risk, they may be less prepared to take another (see Pratt and Zeckhauser 1987; Kimball 1990).

The omission of dynamics

We have considered earlier that in general prices are not known with certainty by the producers at the time when they take the relevant decisions. In the case of annual crops, this may lead to excess supplies in some years. When storage is included in the model, private stockholders carry over stocks to the next year and – if possible – to later years. Ghosh *et al.* (1987) show that permanent storage of commodities may be the outcome of the repetitive process. Shocks in supply will in this way be carried over to later years and stabilization of prices will also have longer-run effects. In the case of jute, for example, a shock of sudden high prices is followed by a huge supply one year later, yielding relatively low prices, followed by a relatively low supply but still lower prices, owing to large carry-over stocks. This is the worst year for farmers' income; later, production and prices will stabilize if no other shocks occur (see Burger and Wansink 1990).

In the case of perennial crops, resources are allocated and fixed for many years ahead and variable costs of production are but a small proportion of total costs. This leads to very low short-run supply elasticities. In the longer run, capacity may be adjusted to a change in prices. There is a considerable debate on the effect that price stabilization can have on such longer-term decisions. The issue is how future uncertainty will affect present decisions. Consider decisions on consumption and investment. The consumption decision is affected as reduced uncertainty in the future may lead to a decrease in precautionary savings. Investments, on the other hand, may be triggered by the prospect of more certain revenues. Depending on the efficiency of the capital market, these two decisions may be closely

connected. In the development economics literature this trade-off has been extensively discussed in the analyses of the linkage between export earnings stability and economic growth. Friedman's permanent income theory provided the basis for the assumption that unstable export earnings would lead to higher saving rates (see Knudsen and Parnes 1975; Yotopoulos and Nugent 1976). In the past few years, some progress has been made in the analysis of these types of problem. The progress is in two directions.

One is the treatment of (precautionary) savings. As Leland (1968) has shown, the more uncertain future income is, the higher present savings will be (precautionary saving). This requires the third derivative of the utility function to be positive. Recently Kimball (1990) has proposed an elegant way of looking into this matter by applying the theorems concerning risk aversion to (the negative of) the marginal utility function. He derives a 'coefficient of absolute prudence' as the counterpart of the coefficient of absolute risk aversion and shows this to be related to the first derivative of the coefficient of relative risk aversion. If the coefficient of absolute risk aversion A is decreasing in Y, then the coefficient of absolute prudence H is greater than A. Kimball's coefficient governs the marginal propensity to save out of current wealth and $H > A$ can be interpreted as meaning that, if future income is uncertain, the amount of future wealth the consumer would need to bring present consumption back to levels equal to the situation with a certain future is greater than the amount that is required to compensate the consumer for accepting the future risk as such. In other words, when only comparing two 'lotteries' – one with uncertain future outcomes, the other with certain outcomes – the difference can be measured by the risk premium, compensating for the uncertainty. Kimball's contribution is to point out that, if $H > A$, this compensation still does not lead to the same level of savings in the present. To have this equivalence, more compensation should be offered.

The other direction in which advances have been made is in the distinction between a premium to compensate uncertainty and a parameter accounting for (certain) instability of income over time. If credit markets are perfect, there is no need for separate treatment of the latter, as this predictable instability can be compensated by borrowing and lending. With imperfect capital markets, this no longer holds. In the traditional analysis of intertemporal utility maximization, only one parameter accounted for the two characteristics, namely the substitution elasticity, to which the coefficient of relative risk aversion is closely linked. Attanasio and Weber (1988) and

Epstein (1988) make a distinction between, on the one hand, the substitution elasticity between the present and the certainty-equivalent future and, on the other hand, the relationship between future uncertain events and this certainty-equivalent utility. The first elasticity measures instability aversion, whereas the latter accounts for unpredictability of future situations. Stabilization of future revenues might have benefits not only in terms of increased predictability but also in terms of more stability. Powell (1990) has recently tried to estimate the combined benefits and arrives at much higher benefits from stabilization than the traditional estimates.

The omission of general equilibrium effects

At the micro-level, we have already alluded to the outside effects that commodity price stabilization may have. Other risks, other crops whose revenues may be correlated with those of the commodity concerned, prices of consumer goods – all these are excluded from the traditional analysis. In a wider economic context, there is even more that should be included. Changes in commodity prices can be so important, particularly for producers, that macroeconomic effects are far from negligible. For countries that specialize in exports of only some commodities, changes in revenues from these commodities will directly affect the balance of payments and hence exchange rates, government revenues, import demand, etc. Some recent advances in this field have been discussed in the previous section of this chapter.

The assumption that the market equilibrium is known

This aspect seems trivial, but in practice it is not. Implicit in the standard model is the assumption that an intervention authority knows at what price it should stabilize and how much it ought to buy to reach this level. In practice, the reference prices are the outcome of long and tedious negotiations between producer and consumer participants in an international agreement. Uncertainty about what is a longer-term equilibrium price leads to mechanisms such as adjustment of the reference price from time to time. This, of course, adds to the uncertainty facing producers and consumers even after commodity agreements are adopted. In an international context, the world market price is usually expressed in a number of currencies. For primary commodities the pound sterling and US dollar are commonly used. Owing to exchange rate changes and differential rates of inflation, producers and consumers in various countries will be differently affected by movements of the reference price over time. In the case of natural rubber, for example, real producer prices in Thailand were among the highest during the 1970s but among the lowest around 1990, whereas the situation for Indonesia is the opposite. For the outcome of the agreement itself, the currency chosen for the reference price can make quite a difference, as will be shown in Chapters 7 and 8.

CONCLUSION

Much progress has been made in the literature on the economics of stabilization. At the macro-level, it is now accepted that governments are often not able to deal properly with unstable income. Much domestic 'protection' of producers leads to inefficiencies and there appears to be a case for protecting governments from instabilities. Yet the economic environment of producers is more often the source of unstable incomes than are the prices of their products.

The traditional Marshallian analysis of benefits and costs of stabilization at the micro-level is too simple and therefore misleading. Important omissions are the neglect of storage, time and information. Furthermore, a realistic approach to stabilization should incorporate the economic environments of the producers and consumers. When this is done, it is unlikely that a case is left for international price stabilization or for export earnings stabilization *per se*.