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The Welfare Gains from Price Stabilization under Risk Response*

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1. Introduction and Review of the Literature

The stabilization literature started with Waugh (1944); and some of the contributions to this fast-growing body of literature were later made by Oi (1961), Massell (1969), Hueth and Schmitz (1972), Turnovsky (1974, 1976), and Just, Lutz, Schmitz, and Turnovsky (1977, 1978). All these models were based on the assumption of risk neutrality. The welfare gains from price stabilization under risk neutrality could be referred to as "Massell-type gains" or they could be called "direct welfare gains." In this paper the welfare gains from price stabilization are derived with explicit consideration of the possibility of risk response. Thus, the total gains from stabilization can be divided into direct welfare gains and those due to increased efficiency because of the risk response. We call these latter gains "efficiency gains."

Risk is important in supply analysis and hence should be considered in the research on price stabilization. As an example, the empirical study in Appendix A

* Much of the research for this paper was undertaken while the author was a Postgraduate Research Agricultural Economist in the Department of Agricultural and Resource Economics at the University of California, Berkeley, and is related to a chapter of *Lutz* (1977). The author is indebted to Professor Richard E. Just for ideas, advice, and discussions; to Professor A. Schmitz for comments and discussions (both at the University of California, Berkeley); and to the Giannini Foundation of Agricultural Economics for financial support. The views expressed in this paper are those of the author and not necessarily those of the institution with which he is associated.

shows that risk response by farmers has a significant effect on the supply of wheat in the countries considered. This paper surveys the literature, theoretically develops the concept of efficiency gains within a two-country free-trade model, and tries to quantify them. Since the optimal degree of stabilization is found where the net benefits are at a maximum, the neglect of efficiency gains would result in insufficient and hence non-optimal degrees of stabilization.

Some authors have recently discussed the qualitative aspects of the efficiency gains from stabilization. Batra (1975) argued for a two-sector economy that the marginal rate of transformation does not equal the price ratio when firms are risk averse and when there is uncertainty in one sector and certainty in the other. Hence, he concluded that this is a distortion resulting in a less than potential income. Just (1975) wrote:

> "My hypothesis is that this kind of uncertainty leads to considerable allocative inefficiency in the agricultural sector (as well as in the rest of the economy) by creating a diversifying and lagged response to environmental and market forces. This would be especially true with respect to investment decisions."

He also argued that stabilization increases risk-responsive supply since the higher degree of certainty makes the adoption of a more specialized technology possible. Within a trade context, Feder, Just, and Schmitz (1977) found that uncertainty causes a reduction in trade and a reduction in social welfare for all risk-averse importers and exporters.

In a less formal manner, Hathaway (1976) noted that Johnson (1947) had pointed out already that risk and uncertainty reduce production efficiency in several ways. Risk of price changes leads to both internal and external capital rationing, thus resulting in a less than optimal combination of resource use and a shift of the supply curve to the left. In addition, the uncertainty arising from unstable prices makes it difficult for producers to plan their resource allocation, which also reduces the efficiency of resource allocation within firms and reduces specialization between farms, another source of potential production efficiency. Hathaway (1976) expanded on this line of thought and applied it to the question of grain reserves. He stated that a grain price stabilization policy would appear to be a major element in any program to increase the growth rate and productivity in agriculture and should therefore be an important element in production policy (in particular for underdeveloped countries). Also, reserves would moderate price swings since they discourage private actions, such as speculation and hoarding, which are opposite to what is needed in times of shortage. Hathaway (1976) also pointed out the gains from stabilization through a reduction in what he called social risk which includes the risk of inflation, of actual starvation, of a major slowdown in economic growth rates, and of political upheaval. This social risk of instability is evaluated differently in various countries; but generally it is small

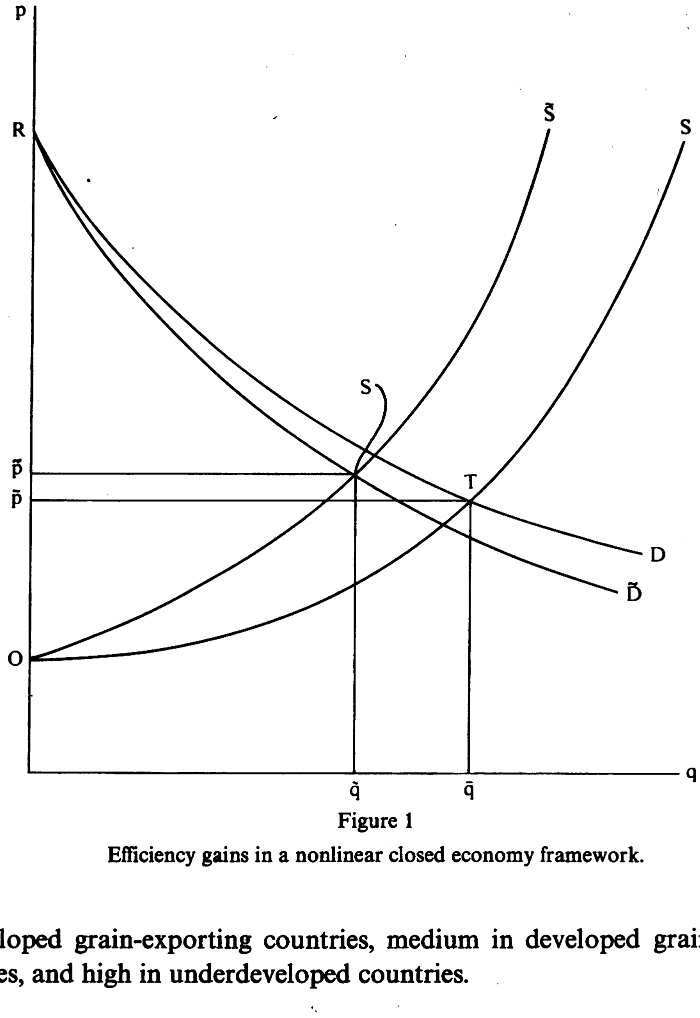

Figure 1

Efficiency gains in a nonlinear closed economy framework.

in developed grain-exporting countries, medium in developed grain-importing countries, and high in underdeveloped countries.

2. Efficiency Gains in a Nonlinear Closed Economy Framework

Figure 1 serves to conceptualize the idea of welfare gains from stabilization due to increased efficiency (efficiency gains). The mean supply and demand functions under uncertainty and under the assumption that producers and consumers are risk averse are given by $\tilde{S}$ and $\tilde{D}$, respectively. Thus, the average price in the absence of a stabilization policy is given by $\tilde{p}$. If a stabilization plan is implemented, producers and consumers respond to the reduction of uncertainty; and both demand and supply functions move to the right. We assume that the risk response is larger in the supply sector so that the resulting mean price $\bar{p}$ (or p_s for the case of complete stabilization) is below $\tilde{p}$. Given these assumptions, the efficiency gains in consumption and production are as follows: The consumer's gains are given by $\bar{p}$TR $-\tilde{p}$SR; they are always positive. The efficiency gains of producers are OT$\bar{p}$ $-$ OS$\tilde{p}$, the sign of which is uncertain. Net efficiency gains for society as a whole are given by area OTRSO which is always positive. Mathematically, we can analyze the problem by starting with the following assumptions:

$$\tilde{D}(P) = cD(P) \tag{1}$$

$$\tilde{S}(P) = \gamma S(P) \tag{2}$$

$$0<\gamma<c<1 \tag{3}$$

where γ, c are risk-response factors. Condition (3) insures that the following relationship holds:

$$\bar{p}<\tilde{p}. \tag{4}$$

We are interested in determining the size of the gains for consumers and for society as a whole as functions of the risk-response factors γ and c. Also, we would like to determine the conditions under which producers' efficiency gains are positive or negative.

The efficiency gains for consumers are given by

$$EG^{c} = \int_{0}^{\bar{q}} [p(D)-\bar{p}]\, dq - \int_{0}^{\tilde{q}} [p(\tilde{D})-\tilde{p}]\, dq, \tag{5}$$

and the efficiency gains for producers are

$$EG^{p} = \int_{0}^{\bar{q}} [\bar{p}-p(S)]\, dq - \int_{0}^{\tilde{q}} [\tilde{p}-p(\tilde{S})]\, dq. \tag{6}$$

We are unable to solve these integrals for the general case; neither can we take the two necessary derivatives in order to apply the method by Turnovsky (1976). Thus, in order to obtain any results, we are forced to simplify. Then, in order to be able to derive analytical results, we have to deviate from two key assumptions, namely, generality of demand and supply functions and multiplicativity of disturbances. In this paper, we have to limit ourselves to the case of linearity and to additive disturbances. The latter assumption, however, is not unduly restrictive since for large quantities the difference between additive and multiplicative disturbances becomes negligible.

3. Price Stabilization within a Two-Country Free-Trade Massell Model under Risk Response

Since we are unable to solve the question of stabilization under risk response within a nonlinear framework, we are assuming linearity in order to get analytical solutions. The original Massell model was extended to a two-country free-trade case, and risk-response factors were included.

Demand is given by

$$\tilde{p} = a_i - b_i\tilde{q} + c_i\,\sigma_p + \delta_i, \quad i = 1, 2 \tag{7a}$$

or

$$\tilde{q} = \frac{a_i - \tilde{p} + c_i\,\sigma_p + \delta_i}{b_i}, \qquad i = 1, 2 \tag{7b}$$

where

country 1 is the exporting country
country 2 is the importing country
a_i, b_i, c_i are parameters
p = price
q = quantity
σ_p = price variance
δ_i = random disturbance $N(0, \sigma_{\delta i})$.

Since we assume that consumers are risk averters,

$$c_i < 0. \tag{8}$$

For i = large, i.e., for a large number of countries, our derivations would become unmanageably complex which is why we assume $i = 1, 2$. But even then, since the division of the world into exporting and importing countries is meaningful, important conclusions can be drawn from the two-country model.

Supply is given by

$$p = \alpha_i + \beta_i\tilde{q} + \gamma_i\,\dot{\sigma}_p + \varepsilon_i, \quad i = 1, 2 \tag{9a}$$

or

$$\tilde{q} = \frac{\tilde{p} - \alpha_i - \gamma_i\,\sigma_p - \varepsilon_i}{\beta_i}, \qquad i = 1, 2 \tag{9b}$$

where α_i, β_i, γ_i are parameters and ε_i is random disturbance $N(0, \sigma_{\varepsilon i})$.

Since we assume that producers are risk averse,

$$\gamma_i > 0. \tag{10}$$

Also, we assume that production is much more risk responsive than consumption. Thus,

$$|c_i| << \gamma_i. \tag{11}$$

Excess demands are given by

$$X_i = \frac{a_i - \tilde{p} + c_i\,\sigma_p + \delta_i}{b_i} - \frac{\tilde{p} - \alpha_i - \gamma_i\,\sigma_p - \varepsilon_i}{\beta_i}, \quad i = 1, 2. \tag{12}$$

In equilibrium,

$$\Sigma X_i = 0. \tag{13}$$

From (13), the equilibrium price can be found to be

$$\tilde{p} = \frac{E + \beta_1\beta_2(L+M) + b_1b_2(N+O)}{D} \tag{14}$$

where

$$E = \beta_1\beta_2(a_1b_2 + a_2b_1) + b_1b_2(\alpha_1\beta_2 + \alpha_2\beta_1) > 0$$

$$D = b_2\beta_2(b_1 + \beta_1) + b_1\beta_1(b_2 + \beta_2) > 0$$

$$L = \sigma_p(b_2c_1 + b_1c_2) < 0$$

$$M = b_2\delta_1 + b_1\delta_2$$

$$N = \sigma_p(\gamma_1\beta_2 + \gamma_2\beta_1) > 0$$

$$O = \beta_2\varepsilon_1 + \beta_1\varepsilon_2.$$

The price variance is given by

$$\sigma_p = \frac{b_2^2\beta_1^2\beta_2^2\sigma_{\delta 1} + b_1^2\beta_1^2\beta_2^2\sigma_{\delta 2} + b_1^2b_2^2\beta_2^2\sigma_{\varepsilon 1} + b_1^2b_2^2\beta_1^2\sigma_{\varepsilon 2} + \mathrm{Cov}}{D^2} \tag{15}$$

where

$$\begin{aligned}\mathrm{Cov} = 2b_1b_2\beta_1\beta_2\,[&\beta_1\beta_2\sigma(\delta_1,\delta_2) + b_2\beta_2\sigma(\delta_1,\varepsilon_1) + b_2\beta_1\sigma(\delta_1,\varepsilon_2)\\ &+ b_1\beta_2\sigma(\delta_2,\varepsilon_1) + b_1\beta_1\sigma(\delta_2,\varepsilon_2) + b_1b_2\sigma(\varepsilon_1,\varepsilon_2)].\end{aligned}$$

If the random disturbances are independent, Cov $= 0$.

By inserting (14) into (7b), the quantities demanded can be found to be

$$\tilde{q}_i = \frac{(a_i + c_i\sigma_p + \delta_i)D - E - F}{b_i D}, \quad i = 1,2 \tag{16}$$

where

$$F = \beta_1\beta_2(L+M) + b_1 b_2(N+O).$$

Similarly, by inserting (14) into (9b), the quantities supplied can be found to be

$$\tilde{q}_i = \frac{E + F - D(\alpha_i + \gamma_i\sigma_p + \varepsilon_i)}{\beta_i D}, \quad i = 1,2. \tag{17}$$

Since the derivation of results is extremely complex, it is presented separately in Appendix B.

4. Conclusions

Some of the major qualitative conclusions drawn in this paper could also possibly be found through intuition or with graphical analysis. The major purpose of this paper has been to derive quantitative estimates and conditions under which certain results hold. Since, generally, supply is considerably more risk responsive than demand, it follows that the price under stabilization is lower than the average unstable price. The total welfare gains from price stabilization were derived under risk response and include direct welfare gains as well as efficiency gains. The direct welfare gains (or Massell-type gains) are, as expected, analogous to the ones derived by Hueth and Schmitz (1972); i.e., they depend on the sources of instability and on the slopes of the demand and supply functions. Concerning efficiency gains, the following conclusions apply. Given that risk response of supply is larger than that of demand, the conditions are always satisfied under which consumers' efficiency gains in both countries are positive. These gains increase with increasing risk response of both consumers and producers. Also producers can gain, and the conditions under which this result holds are stated. From graphical inspection, it can be seen that this is less likely to be the case in a multiplicative framework. Under free trade, the efficiency gains of both countries are generally positive.

In Just, Lutz, Schmitz, and Turnovsky (1977), it was found that under nonlinearity consumers and importing countries tend to gain from stabilization whereas producers and exporting countries tend to lose. Since the efficiency gains in this paper for consumers and importing countries are found to be positive, their direction is the same as for the direct welfare gains. On the other hand, the efficiency and the direct welfare gains for producers and exporting countries can have the opposite sign. Thus, only empirical investigations could determine the appropriate sign of the gains for these two groups.

Appendix A

Stabilization and Risk Response in U.S. and Indian Agriculture – an Empirical Study

A.1. Introduction

Farmers everywhere are faced with great uncertainties. All of them experience the influence of weather, disease, or other types of damage; many also experience price uncertainty. In this study the question is asked, what impact would a reduction in price uncertainty have on the supply of wheat?

In a situation of price instability, a farmer might be faced with a price distribution,

$$A(p_s, \sigma). \tag{A 1}$$

Under a non-priceband stabilization policy, the resulting distribution might be

$$A'(p_s, k\sigma), \tag{A 2}$$

where $0 < k < 1$. Under complete stabilization by means of buffer stocks, a stable price p_s would prevail.

Note that a single country could always set a stable price above or below p_s and export its instability. Also, other intervention policies are possible, such as the setting of a floor price or support price at which the government clears the market. In addition, an exporting country can institute export limitations as soon as the price hits the predetermined indicator price. It is clear that such policies, while not evenly reducing the price variance, reduce price instability internally as measured by some kind of index.

Since we assume that farmers are risk averse, the aggregate supply function would shift to the right in response to a reduction in the price variability. It is the purpose of this section to empirically determine the size of that shift. We are interested in knowing the effects of price stabilization on developed and underdeveloped countries; hence, we study the risk responsiveness of supply in the United States and in India. We hypothesize that the risk responsiveness and the per capita income are negatively correlated; i.e., we assume that, with a low level of income, the effects of risk aversion would be stronger than in a situation where the income level is high.

A.2. The Model

The following model was used:

$$q_t = \alpha + \beta\mu^*_{p,t} + \gamma\sigma^*_{p,t} + \varepsilon_t \tag{A3}$$

where

$$\mu^*_{p,t} = \frac{1}{k}\sum_{k=1}^{k} p_{t-k} \tag{A4}$$

and

$$\sigma^*_{p,t} = \frac{1}{k}\sum_{k=1}^{k} (p_{t-k} - \mu_{p,t-k})^2 \tag{A5}$$

where

q_t = quantity produced in year t
α, β, γ = parameters
$\mu^*_{p,t}$ = moving average price
$\sigma^*_{p,t}$ = moving average price variability index
ε_t = random disturbance.

The data used for the estimation is shown in Tables A1 and A2. Note that, because of the lag structure of the model, six years of data are lost at the beginning of the time series. The raw data was taken from U.S. Department of Agriculture (1976) and from the Food and Agriculture Organization of the United Nations (1975).

A.3. Results

The results of the estimated equations are shown in Table A3. For the United States, both price and price variance are highly significant explanatory variables for the total supply with t ratios of 9.20 and 5.41, respectively. The R^2 is .79 which is also satisfactory. Note that the coefficient for the price variance is correct in sign and highly significant but that its size is very small. Thus, price stabilization in the United States would result in only a small supply response.

For India too, both price and price variance are correct in sign and highly significant with t ratios of 9.37 and 4.45, respectively. Both variables together explain 85 percent of the total variation.

In order to be able to compare the results for the two countries, the coefficients for India have to be multiplied by a factor of 7.04068. We find that the coefficients for India are much larger than those for the United States (except for the constant term). Thus, supply seems to be much more price elastic in India, and Indian farmers are much more risk responsive than farmers in the United States.

Our results give empirical support to the hypothesis of Just (1975) that the supply schedule would move to the right as a result of price stabilization. Also, the results support the hypothesis that risk responsiveness and per capita income are negatively correlated or, in other words, price stabilization would result in larger shifts of the supply schedule and then in larger efficiency gains under low-income conditions than in high-income countries.

Table A1

United States: Production of Wheat, Moving Average of Price, and Price Variability, 1950–1975

Year	Production	Price (Moving Average)[1]	Price Variability (Moving Average)[2]
	1,000 Bushels	Cents per Bushel	Index Number
1950	1,019,344	205	1,725
1951	988,161	195	147
1952	1,306,440	200	202
1953	1,173,071	207	121
1954	983,900	208	115
1955	934,731	208	35
1956	1,004,272	205	35
1957	950,662	203	54
1958	1,461,714	196	82
1959	1,117,735	188	202
1960	1,354,749	181	228
1961	1,232,359	175	211
1962	1,091,958	178	86
1963	1,146,821	187	263
1964	1,283,371	191	248
1965	1,315,603	175	1,199
1966	1,304,889	152	1,507
1967	1,507,598	145	1,546
1968	1,556,635	146	586
1969	1,442,679	142	214
1970	1,352,558	129	270
1971	1,617,789	127	263
1972	1,544,936	131	118
1973	1,705,167	148	697
1974	1,793,322	235	21,028
1975	2,133,707	325	30,532

[1] As defined in equation (A4), $k = 3$; season average price received by farmers was used as reported in Agricultural Statistics.

[2] As defined in equation (A5), $k = 3$.

Source: Agricultural Statistics (1976).

Table A2

India: Production of Wheat, Moving Average of Price, and Price Variability, 1956–1974

Year	Production	Price (Moving Average)[1]	Price Variability (Moving Average)[2]
	1,000 Metric Tons	U.S. Cents per 10 Kilograms	Index Number
1056	8,760	75	55
1957	9,463	76	55
1958	7,865	82	91
1959	9,958	88	105
1960	10,251	92	112
1961	10,992	92	73
1962	12,072	93	56
1963	10,776	92	17
1964	9,853	95	14
1965	12,290	104	175
1966	10,424	113	314
1967	11,393	119	311
1968	16,540	120	150
1969	18,652	116	15
1970	20,093	119	33
1971	23,247	121	45
1972	26,410	124	36
1973	24,735	126	20
1974	22,073	118	185

[1] As defined in equation (A4), k = 3, wholesale price, Moga and Punjab.
[2] As defined in equation (A5), k = 3.
Source: FAO Production Yearbook (1975).

Table A3

Estimated Coefficients for the USA and India

Country	α	β	γ	R^2
USA	247.25	0.006982	−0.000098	.79
(standard error)	(23.16)	(0.000758)	(0.000019)	
(t-ratio)	(12.83)	(9.20)	(−5.41)	
India	−16102.19	323.19	−28.61	.85
(standard error)	(3527.65)	(34.47)	(6.43)	
(t-ratio)	(−4.56)	(9.37)	(−4.44)	

Appendix B

Derivation of the Results

The consumers' surplus in the situation without stabilization is

$$E(\tilde{S}_{ci}) = E\left(\frac{b_i}{2}\tilde{q}_i^2\right) \tag{B1}$$

$$= \frac{1}{2b_iD^2}\left[\{D(a_i+c_i\sigma_p)-E-\beta_1\beta_2L-b_1b_2N\}^2+\sum_{ci}\right]$$

where

$$\sum_{c1} = \{b_1b_2\beta_2+b_1\beta_1(b_2+\beta_2)\}^2\sigma_{\delta 1}+b_1^2\beta_1^2\beta_2^2\sigma_{\delta 2}+b_1^2b_2^2\,(\beta_2^2\sigma_{\varepsilon 1}+\beta_1^2\sigma_{\varepsilon 2})$$

and

$$\sum_{c2} = b_2^2\beta_1^2\beta_2^2\sigma_{\delta 1}+\{b_1b_2\beta_1+b_2\beta_2(b_1+\beta_1)\}^2\sigma_{\delta 2}+b_1^2b_2^2\,(\beta_2^2\sigma_{\varepsilon 1}+\beta_1^2\sigma_{\varepsilon 2}).$$

The producers' surplus under instability is

$$E(\tilde{S}_{pi}) = E\left(\frac{\beta_i}{2}\tilde{q}_i^2\right) \tag{B2}$$

$$= \frac{1}{2\beta_iD^2}\left[\{-D(\alpha_i+\gamma_i\sigma_p)+E+\beta_1\beta^2L+b_1b_2N\}^2+\sum_{pi}\right]$$

where

$$\sum_{p1} = \beta_1^2\beta_2^2(b_2^2\sigma_{\delta 1}+b_1^2\sigma_{\delta 2})+\{b_1\beta_1(b_2+\beta_2)+b_2\beta_1\beta_2\}^2\sigma_{\varepsilon 1}+b_1^2b_2^2\beta_1^2\sigma_{\varepsilon 2}$$

and

$$\sum_{p2} = \beta_1^2\beta_2^2(b_2^2\sigma_{\delta 1}+b_1^2\sigma_{\delta 2})+b_1^2b_2^2\beta_2^2\sigma_{\varepsilon 1}+\{b_2\beta_2(b_1+\beta_1)+b_1\beta_1\beta_2\}^2\sigma_{\varepsilon 2}.$$

Under complete price stabilization, there is no risk response. Hence,

$$\gamma_i, c_i = 0, \quad i = 1,2. \tag{B3}$$

The stable world market price can be found where

$$\delta_i, \varepsilon_i = 0, \quad i = 1,2. \tag{B4}$$

Thus,

$$p_s = \frac{E}{D}. \tag{B5}$$

We assume that the risk response by producers is sufficiently larger than that of consumers so that

$$\beta_1\beta_2L+b_1b_2N > 0. \tag{B6}$$

Given (B6), we find from comparing (B5) and (14) that

$$p_s < \bar{\bar{p}}. \tag{B7}$$

Under price stability, the quantities demanded are

$$q_i = \frac{(a_i+\delta_i)D-E}{b_iD}, \tag{B8}$$

and the quantities produced are

$$q_i = \frac{-(\alpha_i+\varepsilon_i)D+E}{\beta_iD}. \tag{B9}$$

Under price stability, the consumers' surplus is given by

$$E(S_{Ci}) = E\left(\frac{b_i}{2}q_i^2\right) = \frac{1}{2b_iD^2}[\{a_iD-E\}^2+D^2\sigma_{\delta i}]. \tag{B10}$$

Similarly, the producers' surplus under stability is

$$E(S_{Pi}) = E\left(\frac{\beta_i}{2}q_i^2\right) = \frac{1}{2\beta_iD^2}[\{-\alpha_iD+E\}^2+D^2\sigma_{\varepsilon i}]. \tag{B11}$$

The welfare gains from price stabilization consist of the differences between the expected surpluses under price stability and those under instability. Thus, the gains from stabilization for consumers are

$$G_{Ci} = E(S_{Ci})-E(\tilde{S}_{Ci}) = \frac{1}{2b_iD^2}[-2(\alpha_iD-E)R_i-R_i^2-\textstyle\sum_{Ci}+D^2\sigma_{\delta i}] \tag{B12}$$

where

$$R_i = c_i\sigma_pD-\beta_1\beta_2L-b_1b_2N < 0, \quad i = 1,2.$$

The efficiency gains for consumers in country i are

$$EG_{Ci} = \frac{1}{2b_iD^2}[-2(a_iD-E)R_i-R_i^2], \quad i = 1,2. \tag{B13}$$

Thus,

$$EG_{Ci} > 0 \quad \text{for} \quad a_iD-E < \frac{R_i}{2}, \tag{B14}$$

which can be shown to be given. EG_{Ci} increases for increasing $|c_i|, \gamma_i$.

The Massell-type gains from price stabilization for consumers in country i are given by

$$MG_{Ci} = \sum_{Ci} + D^2\sigma_{\delta i}. \tag{B15}$$

It can be shown that MG_{Ci} depends on the origin of the disturbances and the slopes of the supply and demand functions.

The gains from stabilization for producers are given by

$$G_{Pi} = E(S_{Pi}) - E(\tilde{S}_{Pi}) = \frac{1}{2\beta_i D^2}\left[-2(a_i D + E)Q_i - Q_i^2 - \sum_{Pi} + D^2\sigma_{\varepsilon i}\right] \tag{B16}$$

where

$$Q_i = -\gamma_i\sigma_p D + \beta_1\beta_2 L + b_1 b_2 N < 0, \quad i = 1,2.$$

The efficiency gains from price stabilization for producers in country i are given by

$$EG_{Pi} = -2\ (a_i D + E)Q_i - Q_i^2, \quad i = 1,2, \tag{B17}$$

where

$$a_i D + E > 0.$$

Thus,

$$EG_{Pi} > 0$$

for

$$Q_i > -2(a_i D + E). \tag{B18}$$

If γ_i increases, Q_i decreases and, thus, EG_{Pi} also decreases. For the Massell-type gains, MG_{Pi}, the same comment applies as for MG_{Ci}.

The total gains from price stabilization for country i are given by

$$\begin{aligned} G_i = G_{Ci} + G_{Pi} = \frac{1}{2b_i\beta_i D^2}[&-2a_i D(b_i Q_i + \beta_i R_i) - 2E(b_i Q_i - \beta_i R_i) \\ &- b_i Q_i^2 - \beta_i R_i^2 + \beta_i(D^2\sigma_{\delta i} - \textstyle\sum_{Ci}) + b_i(D^2\sigma_{\varepsilon i} - \textstyle\sum_{Pi})]. \end{aligned} \tag{B19}$$

Thus, the efficiency gains from price stabilization for country i are given by

$$EG_i = \frac{1}{2b_i\beta_i D^2}[-2a_i D(b_i Q_i + \beta_i R_i) - 2E(b_i Q_i - \beta_i R_i) - b_i Q_i^2 - \beta_i R_i^2]. \tag{B20}$$

From (B20), it is clear that EG_i depends on all four risk-response factors and on the slopes and position of the demand and supply functions in both countries.

The total welfare gains from stabilization (including Massell-type or direct gains and efficiency gains) for the world as a whole are given by

$$G_w = \sum G_i, \quad i = 1,2. \tag{B21}$$

It can be shown that both the Massell-type gains, as well as the efficiency gains from stabilization, are always positive for the world as a whole.

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Zusammenfassung

Die Wohlfahrtseffekte einer Preisstabilisierung unter Berücksichtigung von Risikoreaktionen

Die Wohlfahrtseffekte einer internationalen Preisstabilisierung werden anhand eines Freihandelsmodells mit zwei Regionen analysiert. Da Risikoreaktionen berücksichtigt werden, ergibt sich zusätzlich zu den direkten Wohlfahrtsgewinnen auch ein Wohlfahrtseffekt dank besserer Effizienz im Produktions- und möglicherweise auch im Verbrauchssektor. Die «Effizienzgewinne» sind positiv für Konsumenten und Importländer, und unter gewissen Bedingungen sind sie auch positiv für Produzenten und Exportländer. Der empirische Teil zeigt, dass die Risikoeffektkoeffizienten der Angebotsfunktionen von Weizen in den Vereinigten Staaten und in Indien signifikant sind.

Résumé

Les gains de bien-être découlant de la stabilisation des prix internationaux en tenant compte des réactions aux risques

Un modèle de libre échange entre deux régions est utilisé pour déterminer la répartition des gains de bien-être découlant de la stabilisation des prix internationaux. La réaction aux risques étant prise en ligne de compte, la stabilisation se traduit également, en sus des gains directs de bien-être, par des gains de bien-être attribuables à l'efficacité accrue de la production et, éventuellement, de la consommation. Les «gains d'efficacité» sont positifs pour les consommateurs et les pays importateur, et, dans certaines conditions, ils peuvent être également positifs pour les producteurs et les pays exportateurs. La partie empirique indique que les coefficients de réactions aux risques sont significatifs dans les fonctions d'approvisionnement en blé des Etats-Unis comme de l'Inde.

Summary

The Welfare Gains from Price Stabilization under Risk Response

A two-country free trade model is used to determine the distribution of the welfare gains from international price stabilization. Since risk response is taken into consideration, stabilization results, in addition to the direct welfare gains, also in welfare gains due to increased efficiency in production and possibly also in consumption. The "efficiency gains" are positive for consumers and importing countries, and under certain conditions they can also be positive for producers and exporting countries. The empirical part shows that the risk response coefficients are significant in wheat supply functions of the United States as well as of India.