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INTERNATIONAL TRADE IN INTERMEDIATE AND FINAL GOODS: SOME WELFARE IMPLICATIONS OF DESTABILIZED PRICES *

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I. INTRODUCTION

In an earlier paper, Waugh demonstrated that consumers gain from price fluctuations and accordingly lose from price stabilization.[1] Likewise, Oi demonstrated that producers also gain from price fluctuations and, hence, lose from price stabilization.[2] Recently, Massell integrated both of those results and concluded that, if compensation were actually paid, consumers and producers would prefer price stability.[3]

In this paper we employ the framework used by the above authors to examine explicitly internationally traded goods. First, we consider international trade in final goods only. Then we consider trade in both intermediate and final goods and show the effects of instability in both markets on the consumers and producers of

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1. Frederick V. Waugh, "Does the Consumer Benefit from Price Instability?" this *Journal*, LVIII, No. 4 (Aug. 1944), 602–14; and *idem*, "Consumer Aspects of Price Instability," *Econometrica*, XXXIV, No. 2 (April 1966), 504–08.

2. Walter Y. Oi, "The Desirability of Price Instability Under Perfect Competition," *Econometrica*, XXIX, No. 1 (1961), 58–64.

3. Benton F. Massell, "Price Stabilization and Welfare," this *Journal*, LXXXIII, No. 2 (May 1969), 285–97.

final goods. Our analysis shows that whether or not an individual country benefits from price stability depends critically on the source of the instability.[4]

We begin in the following section with a review of the results obtained by Massell. Then in Section III we consider two-country, one-commodity models in which price instability is generated in the foreign market from shifts in supply and demand. This also creates instability in the domestic market, but production and consumption changes are brought about by movements along supply and demand curves rather than because of shifts in these schedules. In Section IV we consider the question of international welfare as well as that for individual countries. In Section V we generalize the results from Sections III and IV. In Section VI we formulate models in which trade occurs in both intermediate and final goods. Again, we assume that in one of the sectors price instability occurs because of movements along supply and demand schedules rather than because of shifts in these schedules. Section VII presents some concluding remarks.

II. The Massell Results

Massell's analysis of the welfare effects of price stabilization in a single market is illustrated in Figure I. In Figure Ia price fluctuations are due to shifts in supply; the corresponding prices are p_1 and p_2. Each price occurs with 0.5 probability. The price p_a is an alternative that can be achieved through a costless storage activity.[5] Buying and selling occurs at p_a via a buffer stock, thereby establishing the market price at this level. If price is increased from p_1 to p_a, producers gain $(c+d+e)$ and consumers lose $(c+d)$, resulting in a net gain of area e. When the price is reduced from p_2 to p_a, consumers gain $(a+b)$ and producers lose area a; this results in a net gain of b. Thus, stabilizing price at p_a yields a net gain to producers of $(c+d+e)-a$ and a net loss to consumers of $(c+d)-(a+b)$ and, therefore, a net gain of $(b+e)$ to consumers and producers jointly.[6] Producers are able to compensate consumers so as to leave both

4. In a different area of inquiry, Richard E. Caves ("Flexible Exchange Rates," *American Economic Review*, LIII, No. 1-2 (March-May 1963), 120-29) has pointed out that the argument for or against flexible exchange rates depends on the source of the disturbance that causes the balance of payments disequilibrium. He has argued that the strongest case for flexible exchange rates can be made when disturbances in a country's balance of payments are generated outside of the country.

5. $p_a=1/2(p_1+p_2)$.

6. The net effect of price stabilization on consumers over the two periods — that is, the net loss to consumers of $(c+d)-(c+b)$ from price stabilization — is the Waugh result.

groups better off from price stability. However, actual compensation is necessary before it can be concluded that price stability is preferred to price instability. This is a point that should be kept in mind throughout the paper.

In Figure Ib price fluctuations are caused by shifts in demand. It can be shown that there is a net gain to consumers of $(c+d+e)-a$, a net loss to producers of $(c+d)-(a+b)$, and a net gain to both groups jointly of $(b+e)$.[7] In this case the gain is sufficiently large for the consumers to be better off under price sta-

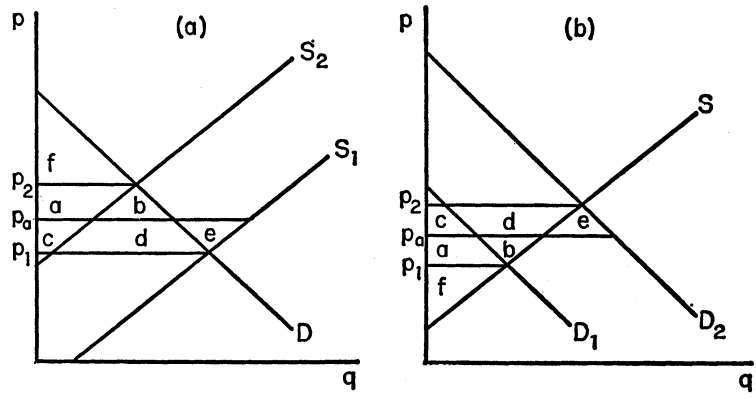

FIGURE I

Price Instability in a Closed Model

bility even after compensation is paid to producers. Again, however, compensation is needed before a conclusion can be reached as to whether price stability is the preferred situation.

When considering international price stabilization, Massell also used an analytical framework that involved maximization of a producer's welfare function.[8] The welfare function contained as arguments the mean and variance of income and was assumed to be increasing in the former argument and decreasing in the latter. Under the additional assumption of increasing marginal risk aversion, the degree of price stabilization was determined that maximized producer welfare. However, no attempt was made in the analysis to determine whether or not price stabilization or destabilization is socially desirable for individual trading nations in the absence of

7. The net loss to producers of $(c+d)-(a+b)$ from stabilizing prices is the Oi result.

8. Massell, "Some Welfare Implications of International Price Stabilization," *Journal of Political Economy*, LXXVIII, No. 2 (March–April 1970), 404–17.

either domestic or international compensation. A major objective of this paper is to deal with this issue for international trade in both final and intermediate goods. In both the Massell papers, only trade in final goods was considered.

III. Final Product Spatial Price Models

In Figure II we present a final commodity, two-country spatial price equilibrium model.[9] The excess supply, $E^s(p)$, and demand,

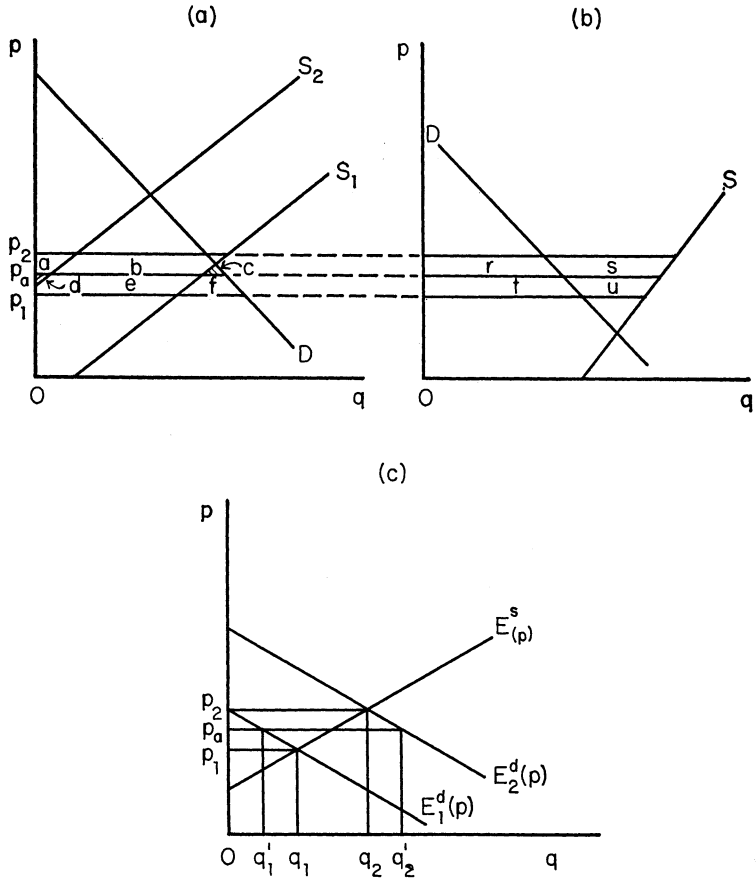

FIGURE II

Price Instability Generated in Foreign Markets

9. It is assumed that each country is in balance of payments equilibrium and that the industry considered is so small relative to the total economy that

$E^d(p)$, curves are represented in Figure IIc. We assume that price instability is generated by a shift in the supply curve in the importing country only, and that this brings about consumption and production changes in the exporting country via movements along the country's supply and demand schedules.[1] In Figure IIc the equilibrium volumes of trade q_1 and q_2 in each of the periods under conditions of price instability are determined. As in the Waugh, Oi, and Massell analysis, a 0.5 probability to the corresponding prices p_1 and p_2 is assigned. If price is stabilized at p_a through the creation of a buffer stock, q'_1 will be traded in period one; and $E^s(p_a) - E_1{}^d(p_a)$, which is equal to $E_2{}^d(p_a) - E^s(p_a)$, is stored. In period 2, q'_2 is traded at p_a, leaving zero excess supply in the buffer stock inventory.

For the exporting country, price destabilization results in

(1) $C_g = t - r > 0 (C_g = \text{net consumer gain})$

(2) $P_g = (r+s) - (t+u) > 0 (P_g = \text{net producer gain})$

(3) $S_g = s - u > 0 (S_g = \text{net social gain}).$[2]

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the equilibrium is not disturbed by price instability. Hence, it is immaterial whether fixed or flexible exchange rates are assumed. However, the approach using the concept of economic surplus has been employed (for example, by John C. Hause, "The Welfare Costs of Disequilibrium Exchange Rates," *Journal of Political Economy*, LXXIV, No. 4 (Aug. 1966), 333–52) to determine the welfare costs of disequilibrium exchange rates. Within the commodity model framework, one could consider both an export and an import market for each country. If price instability is generated abroad in both markets, the producers and consumers of both the imported and exported good gain in the domestic country. Given particular types of disturbances, there would be balance of payments disequilibrium (for example, in one period the price increases in both the export and import markets, and it falls in the next period) that can be compared to an equilibrium situation brought about by central bank activity. Unless one considers, in addition to the goods market (that is, the balance of trade account), short-term and long-term capital flows, an extension of the models in this paper can lead to an argument for fixed exchange rates. However, to develop this case further is beyond the scope of this paper and should be attempted on some other occasion.

1. To us, it is not unrealistic to assume cases where price instability in a particular country is generated from abroad by shifts in supply, demand, or both. For example, much of the price instability in the Canadian wheat economy has resulted from sizable shifts in the demands for Canadian wheat by the USSR and Communist China. It is this particular case that stimulated the development of this paper.

2. We should remind ourselves that the Marshallian measure of consumer surplus is used, as it was in the previous studies, and that this corresponds to the Hicksian measures only if the income effect is zero. A constant marginal utility of money is not necessary for a zero income effect. It is not necessary since a zero income effect merely implies a constant marginal rate of substitution between the commodity and money at any given quantity of the good. A zero income effect is thus consistent with an increasing, decreasing, or constant marginal utility of money. On the other hand, the producer surplus measure requires that the industry supply curve be of a short-run nature, determined by summing each firm's marginal cost curve. Also, the variable factors must be perfectly elastic in supply.

Interestingly, both producers and consumers prefer price instability to price stability; hence, compensation either from abroad or from domestic sources is not required to reach the conclusion that price instability is preferred to stabilized prices. Thus, in this case the Waugh and Oi results that both producers and consumers prefer price instability hold. As noted earlier, the Massell result that price stability is desirable required compensation, since one group gained from price stability while the other group lost. The conclusion, therefore, as to whether in a given market both consumers and producers, when taken together, prefer price stability, depends on whether price instability is generated by shifts in the supply or demand schedule or movements along these schedules. The Waugh and Oi results hold in the absence of compensation when price instability is due to the latter.

Consider now the importing country in which the price instability is generated due to the shift of the supply schedule in that country. Price destabilization gives

$$C_g = (d+e+f) - (a+b+c) > 0 \tag{4}$$

$$P_g = a - (d+e) < 0 \tag{5}$$

$$S_g = f - (b+c) < 0. \tag{6}$$

Hence,[3] in the importing country the consumers also gain from price instability while the producers benefit from price stabilization. However, the producers could compensate the consumers such that both would prefer price stability in the importing country.

At this point a caveat is in order. In cases analyzed within this framework, the country in which the price instability arises will always prefer stabilized prices if domestic compensation is paid. Thus, the Massell results hold. Its trading partner, which does not contribute to instability, will always prefer price instability. In the latter case, price instability is Pareto superior. Here, the Waugh and Oi results apply.

In Figure III we illustrate the case in which price instability is generated in the exporting country by a shift in the supply schedule, and quantity changes in the importing country result from movements along the supply and demand schedules. In Figure IIIb a shift in domestic supply shifts the excess supply curve in Figure IIIc to $E_2^s(p)$. If price is stabilized at p_a, an amount q'_1 is provided to the importing country in each time period. Buffer stocks amount

3. For a proof of equation (6), observe: $(b+c) = 1/2(p_2 - p_a)[(D(p_2) - S_2(p_2)) + (D(p_a) - S_2(p_2))]$, $f = 1/2(p_a - p_1)[(D(p_a) - S_1(p_a)) + (D(p_1) - S_1(p_1))]$, $D(p_2) - S_2(p_2) > D(p_1) - S_1(p_1)$, and $p_2 - p_a = p_a - p_1 > 0$. It follows that $(b+c) > f$.

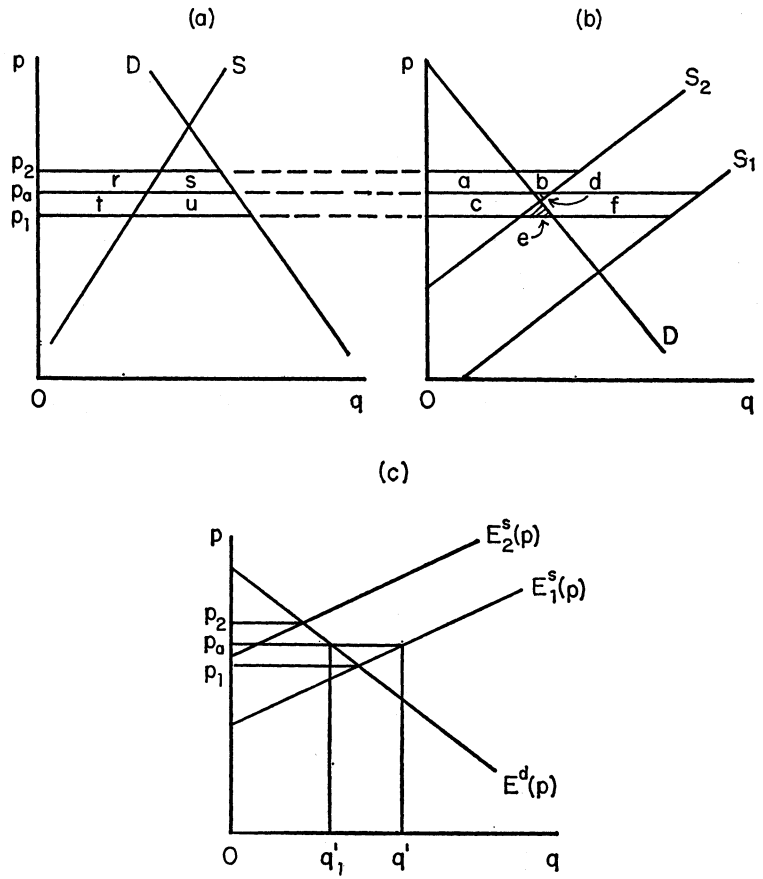

FIGURE III

Price Instability Generated in Domestic Markets

to $q'-q'_1$. The welfare effects of destabilization on the exporting country are

(7) $C_g=(c+e)-a>0$

(8) $P_g=(a+b)-(c+d+e+f)<0$

(9) $S_g=b-(d+f)<0.$

For the importing country, we have

(10) $C_g=(t+u)-(r+s)>0$

(11) $P_g=(r-t)>0$

(12) $S_g=(u-s)>0.$

The results show that, in the importing country, price destabiliza-

tion is Pareto superior to stabilized prices and, in the exporting country, application of the compensation criterion indicates a preference for price stabilization.

IV. International Welfare

In all of the above models, four sectors are considered; one sector gains from price stability, while the other three prefer price destabilization. However, would it be possible for the sector that gains to compensate those that lose and still be better off with price stability?

In Figure IV we show the excess supply and demand curves from Figure II. For illustrative purposes, assume that Figures IIa and IIb have also been enlarged to correspond to Figure IV. From

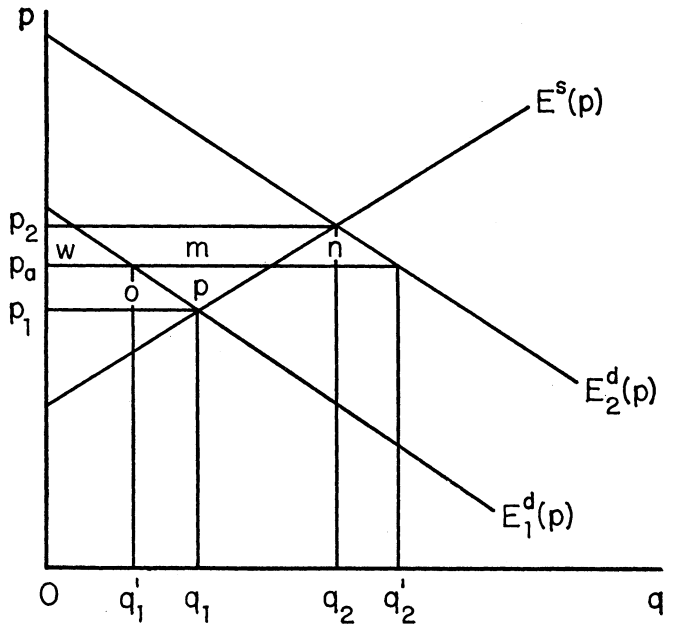

Figure IV

Price Instability and International Compensation

Figure IIb the gain from price instability is $(s-u)$, which equals $(w+m)-(o+p)$ in Figure IV. Now from Figure IIa the consumers' gain from instability is $(d+e+f)-(a+b+c)$, while the producers' loss is $(d+e)-a$. The net gain from stability in the export-

ing country is $(b+c)-f$. Since area $f=o$ and $(b+c)=(w+m+n)$, the producers in the importing country could compensate the consumers in that country and both the producers and consumers in the exporting country and still gain, in Figure IV, $(p+n)$ from price stability.

The above conclusion also holds for the model in Figure III except that now the producers in the exporting country can compensate the other three sectors and still prefer price stability. The conclusion also holds in those cases where instability is generated in one country by shifts in demand only.

Needless to say, when dealing in internationally traded goods, it is unlikely that compensation would actually be paid. Even domestically compensation is usually not made. However, theoretically it is interesting that, if international compensation is made, the above models show that it is not the total world producers who must compensate world consumers, or vice versa, in order that price stability be desirable. Rather, it is only the producers or consumers in one country who must make the compensation, and not the combined producers or combined consumers.

V. The Generalized Model

This section will generalize the results of the previous sections and obtain some results that were not deducible from the diagrammatic analysis.

In the two-country model, we let the supply and demand functions be

$$S_E = B_1 p + e_1 \tag{13}$$

$$D_E = -B_2 p + e_2 \tag{14}$$

for the exporting country and

$$S_I = B_3 p + e_3 \tag{15}$$

$$D_I = -B_4 p + e_4 \tag{16}$$

for the importing country. The vector

$$e = \begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ e_4 \end{bmatrix} \tag{17}$$

is a random vector assumed to have the following properties:

$$(18) \qquad Ee = u = \begin{bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{bmatrix} \qquad \Sigma_e = \begin{bmatrix} \sigma_1^2 & 0 & 0 & 0 \\ 0 & \sigma_2^2 & 0 & 0 \\ 0 & 0 & \sigma_3^2 & 0 \\ 0 & 0 & 0 & \sigma_4^2 \end{bmatrix}.$$

Equilibrium requires equality of the excess supply and demand functions:

$$(19) \qquad E_s(p) = (S_E - D_E) > 0$$

$$(20) \qquad E_d(p) = (D_I - S_I) > 0.$$

Equating equations (19) and (20) and solving for the equilibrium price, we have

$$(21) \qquad p^* = \frac{e_2 - e_1 + e_4 - e_3}{\sum_i B_i},$$

which is distributed with mean

$$(22) \qquad Ep^* = p^e = \frac{u_2 - u_1 + w_2 - w_1}{\sum_i B_i}$$

and variance

$$(23) \qquad \sigma_{p^*}^2 = \frac{\sum_i \sigma_i^2}{(\sum_i B_i)^2}.$$

We can express the international gain from stabilization as

$$(24) \qquad W_g = \frac{1}{2}(p^* - p^e)\,[E_d(p^e) - E_s(p^e)\,],$$

the expected value of which is

$$(25) \qquad EW_g = \frac{\sum_i \sigma_{ei}^2}{2\sum_i B_i} > 0.$$

Also,

$$(26) \qquad \frac{\partial EW_g}{\partial \sigma_i^2} > 0, \frac{\partial EW_g}{\partial B_i} < 0 \qquad i = 1, \ldots, n.$$

These results imply that any group that loses from stabilization can be bribed into accepting stabilized prices by the gainers. As previously noted, this may require international compensation.

To investigate the effect of stabilization on only one country, we arbitrarily choose the exporting country.[4]

The gain to consumers in the exporting country,

$$(27) \qquad C_g{}^E = \frac{1}{2}(p^* - p^e)\,[D(p)^e + D(p)^*],$$

has an expected value,

$$(28) \qquad E(C_g{}^E) = \frac{1}{2\,(\sum_i B_i)^2}[\sigma_2{}^2(B_2 + 2\sum_{\substack{i \\ i\neq 2}} B_i) - B_2 \sum_{\substack{i \\ i\neq 2}} \sigma_i{}^2],$$

which is greater than zero as long as

$$(29) \qquad \sigma_2{}^2\left(1 + \frac{2}{B_2}\sum_{\substack{i \\ i\neq 2}} B_i\right) > \sum_{\substack{i \\ i\neq 2}} \sigma_i{}^2.$$

Obviously, the consumers' expected gain increases with the variance of domestic demand and decreases with the variance of domestic supply. Increases in the variance of the foreign supply and demand schedules both decreases the expected gain from price stabilization. In addition, increases in the slopes of all functions other than domestic demand increase the expected gain.

Analogously, producer gains in the exporting country may be expressed as

$$(30) \qquad P_g{}^E = \frac{1}{2}(p^e - p^*)\,[S(p^e) + S(p^*)\,]$$

with expected value

$$(31) \qquad E(P_g{}^E) = \frac{1}{2\sum B_i}[\sigma_1{}^2(B_1 + 2\sum_{i\neq 1} B_i) - B_1 \sum_{i\neq 1} \sigma_i{}^2].$$

This expression is positive when

$$(32) \qquad \sigma_1{}^2\left(1 + \frac{2}{B_1}\sum_{i\neq 1} B_i\right) > \sum_{i\neq 1} \sigma_i{}^2.$$

Domestic producers gain as the variance of their supply curve increases and the slopes of all other curves increase. They lose from increasing variances of the foreign supply and demand curves.

To consider the net effect of stabilization on the exporting country, we sum the expected gains of producers and consumers. If $ES_g{}^E$ is used to denote the expected gain to the exporting country from stabilization, we have

$$(33) \qquad ES_g{}^E = E(P_g{}^E + C_g{}^E) = EP_p{}^E + EC_g{}^E$$
$$= \frac{1}{2(\sum B_i)^2}[\sum_{i=1}^{2} \sigma_i{}^2(\sum_{i=1}^{2} B_i + 2\sum_{i=3}^{4} B_i) - \sum_{i=3}^{4} \sigma_i{}^2 \sum_{i=1}^{2} B_i],$$

4. The reader may verify that the results are identical if the importing country is chosen.

which increases with the internal variance and decreases with the external variance.

An interesting special case previously discussed is when $\sigma_i^2 = 0 (i=1, 2)$. This implies that $ES_g^E < 0$; so this country would prefer price instability, and the compensation criterion need not be applied to obtain this result. It is apparent that other special cases can be investigated within this framework.

VI. Price Instability in Both Intermediate and Final Goods Trade

Many intermediate goods that a country imports are used in domestic industries producing final products, some of which are also imported. A good example is the United States' importation of both raw wool and final wool products where both are also produced in the United States.[5]

In Figure V a country is represented that imports both an inter-

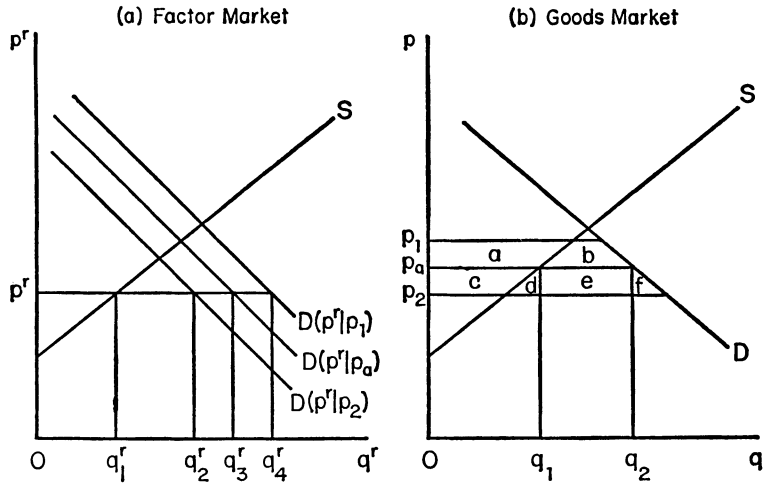

Figure V

Price Instability Generated in the Factor Market

mediate and a final good. Also, the intermediate good is used in the final goods industry. We assume that price instability is generated

5. Rachel Dardis and Janet Dennisson, "The Welfare Cost of Alternative Methods of Protecting Raw Wool in the United States," *American Journal of Agricultural Economics*, LI, No. 2 (May 1969), 303–19.

from abroad and affects the final goods market only. This results in a net gain to the consumers of $(c+d+e+f)-(a+b)$ from price instability and a gain of $(a-c)$ to the producers.

To simplify the analysis, let us assume that the country represented is too small to affect international prices of the intermediate good. Thus, the instability in the final goods market causes the demand in the intermediate goods market to shift. While under price stability, the country imports $q_1{}^r q_3{}^r$ of the good; under price instability, it imports $q_1{}^r q_2{}^r$ at the price p_2 in the final goods market and $q_1{}^r q_4{}^r$ at price p_1. In this case the domestic producers of the intermediate good are unaffected by price instability while, as pointed out, the producers in the final goods industry who use it in their production process gain.

In Figure VI we consider the case where, again, price instability

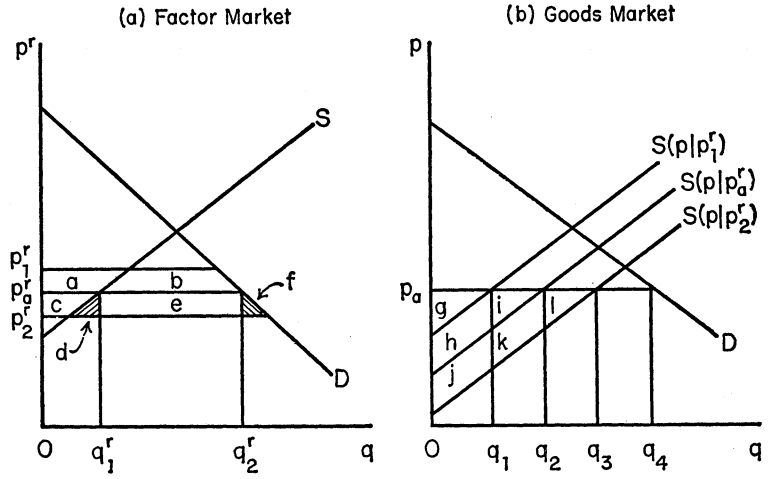

FIGURE VI

Price Instability Generated in the Goods Market

is generated from abroad by a shift in either the supply or demand schedule, but the price instability originates in the intermediate goods market. For the importing region represented, the producers of the intermediate good gain $(a-c)$ from price instability. Now, for simplicity, assume that the final goods industry cannot influence international prices; hence, the price of the final good is given. Thus, the price instability in the intermediate goods market causes the supply curve in the final goods market to shift. At price $p_2{}^r$ in the

intermediate goods market, q_3q_4 of the final product is imported, while q_1q_4 is imported at price $p_1{}^r$. Consumers of the final product are unaffected by price instability. However, the producers of the final product gain from price instability since, in the intermediate goods market, $(c+d+e+f) > (a+b)$. This can also be seen in the final goods market since $(j+k+l) > (h+i)$.

Various models could be constructed by allowing price instability to be generated domestically by shifts in supply and demand curves and also by relaxing the small country or industry assumption. However, the two examples do point out that cases can arise in which a particular country that either exports or imports both intermediate and final goods would prefer price instability in each of these markets. Also, the question of international compensation and compensation among groups in the intermediate and final goods markets need not arise. This is because, as our results show, cases can arise in which consumers and producers in both intermediate and final goods markets benefit from price instability and, hence, no compensation is needed since instability is Pareto superior.

VII. Summary and Conclusions

This paper extends the analysis concerning gains to consumers and producers from price stabilization, presented by Waugh, Oi, and Massell, to international trade in both final and intermediate goods. When one uses the expected value of the change in producer and consumer surplus as a measure of gain, price stabilization brought about by a buffer stock results in a net gain to world consumers and producers. But actual compensation is needed to obtain this result, and it must be at an international level. It is also shown that, in the absence of compensation, producers or consumers in all countries do not gain or lose from price stability. Rather, for example, producers can gain in one country from price stability while those in another country may prefer price instability. Who gains or loses from the latter depends critically on the source of price instability.

In reality, compensation is usually not paid, especially at the international level. Once actual compensation is ruled out, an interesting result is shown that supports the findings by Waugh that consumers prefer price instability and the findings by Oi that producers also prefer price instability. The results in this paper show that, even when consumers and producers are considered together, compensation is not needed because price instability is Pareto superior. In the analysis of trade in both intermediate and final goods,

without actual compensation, producers and consumers in both the intermediate and final goods market in a particular trading country can also gain by having price instability in both markets.

A reason often given for establishing international commodity agreements and marketing boards is that through these means price instability of traded products can be reduced. This appears to be a reason why, for example, the Canadian and Australian Wheat Boards were established [6] and why in 1967 the International Cereals Agreement was negotiated.[7] The important question is — should price instability be reduced? If not, the economic cases for marketing boards and international commodity agreements has to be made on other grounds. It has been shown that whether or not price stability is desirable depends critically on the source of the price instability. For example, an exporting country that experiences price instability for some commodity because of internal shifts in supply is likely to prefer arrangements that reduce price instability. On the other hand, a country that experiences price instability because of shifts in supply or demand abroad is likely to favor price instability. However, the models presented are based on somewhat restrictive assumptions and thus policy makers should interpret the results accordingly. Price certainty and the particular price behavior assumed in this paper may pertain to only certain real world cases. The actual output of agricultural products in many countries is not sold at the price expected by producers. Production activities are usually not riskless; hence, once risk is explicitly considered, the conclusions of this paper are likely to change considerably. Also, they are likely to be quite different if prices behave in a cyclical manner or steadily increase for several years and then drop substantially during a one- or two-year period.

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6. For an excellent discussion of reasons why the Canadian Wheat Board was established, see Vernon C. Fowke, *The National Policy and the Wheat Economy* (Toronto, Canada: The University of Toronto Press, 1957). Also see Charles Schwartz, *The Search for Stability* (Canada: McClelland and Stewart, Ltd., 1959).

7. The International Cereals Agreement replaced the historical Wheat Agreements.