Zeitschrift für Wirtschafts- u. Sozialwissenschaften (ZWS) 108 (1988), S. 423 - 438
Duncker & Humblot, Berlin 41

An Econometric Model for the World Market Price of Sugar with Price Expectations

By Joachim Frohn*

In this paper an econometric model for the world market price of sugar, based on the decisions of the main sugar importing and exporting countries is discussed. For the incorporation of price expectations a model on the basis of expert information has been specified. In the estimation of the model quarterly data, ranging from 1971,1 to 1985,3, have been used.

1. Introduction

In this paper an econometric model for the world market price of sugar is discussed. The features of this model are very similar to an earlier specification[1] with the main difference that now price expectations have been incorporated in the model. In contrast to the greater number of today's econometric models with expectation variables, which usually make use of mainly theoretical concepts like, for instance, adaptive or rational expectations, in this study a concept of price expectations is taken into account which is based on empirical information.

The model is specified and estimated on the basis of quarterly data from 1971,1 to 1985,3, taken from *[Licht's International Sugar Report "Sugar Balances"]* and *[International Sugar Organisation "Sugar Yearbook", "Statistical Bulletin"]*.

It is intended to reestimate the model with recent data and to use it for price forecasts for about two to three quarters.

2. The World Market of Sugar

As there is a detailed description of the features of the world market of sugar in *United Nations* (1980), only the most important aspects for the specification of the model shall be stated here.

Although the production process of sugar made from beet and from cane is different, the final product is homogeneous so that in this study, where the production of sugar is regarded as exogenous, no difference has to be made between countries producing sugar on the basis of beet or cane.

* The author would like to thank two unknown referees for helpful comments.

[1] See *Frohn* (1984).

Over the last decades there has been a strong tendency of sugar importing countries to reach a level of production high enough for their own consumption. This is shown by the fact that while 1930 about 50% of worldwide sugar production was traded on the world market, today the volume of the world trade of sugar is less than 25%.

The main sugar producers and exporters are the European Community (EC), which had been a net importer of sugar until 1965 (!), Brazil and Cuba. Large parts of the Cuban sugar are sold to the USSR under special trade conditions. The five largest sugar importers are the United States, USSR, China, Japan and Canada. Unfortunately, reliable quarterly data for China and the USSR are not available.

During the period this study is concerned with, two international sugar agreements were signed (1968, 1977). The intention of these agreements was to ensure a sufficient sugar supply at "acceptable" prices. The development of the sugar price on the world market from 1971 to 1985 (see Fig. 1) makes clear, that these attempts have not been successful. In this context it should be mentioned that the USA as the most important sugar importing country had not joined the 1968-agreement and became a member of the 1977-agreement only in 1980; and the EC with the highest sugar export has not joined the two agreements at all.

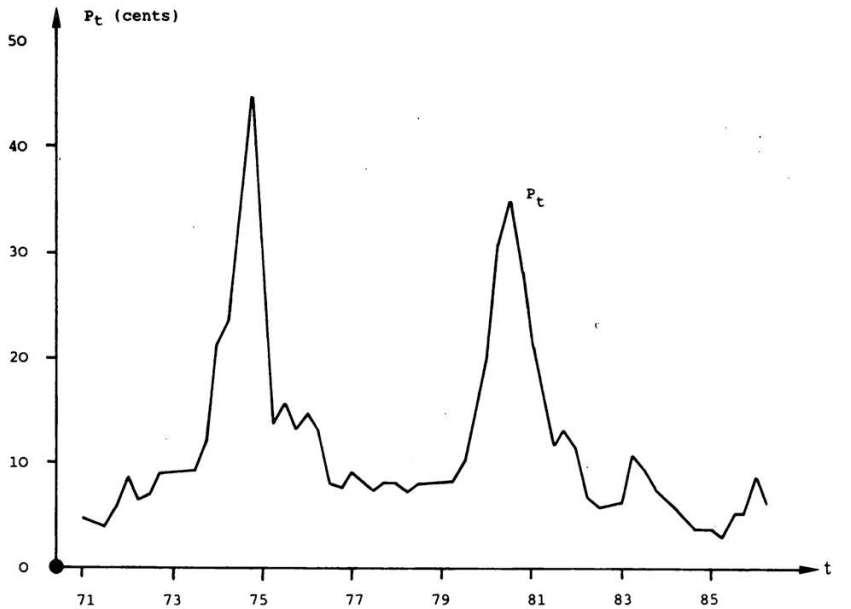

Fig. 1: Nominal spot price of sugar (P_t) in cents, quarterly values 1971,I to 1985,III

It is a wellknown fact that the internal sugar policy of the EC has strong influences on the world market: According to the A- and B-sugar-quotas more European sugar is produced than can be consumed; therefore large amounts of the European sugar have to be sold on the world market, thus effecting the world market price.

During the last years sugar substitutes have become more important, especially high fructose corn syrup (HFCS), a liquid sweetener which cannot be produced as cristalline sugar. It can be expected that such sugar substitutes will strongly influence the sugar market in the near future; during the estimation period of this model they have not yet played a very significant role.

3. The Model

3.1. Introduction

The basic structure of the model is that of a usual market model: The decisions of the importing and exporting countries determine the price.

Because of lack of data only important importing and exporting countries could be included in the analysis: the EC, Brazil and Cuba as exporters, the USA, Japan and Canada as importers.[2] Although the model therefore is incomplete, the main influencing decisions are included. Furthermore, the decisions of the six countries in the model may be considered as representative for those of the other countries not included in the model.

The model consists of two parts: country models to describe the "behaviour" of the mentioned sugar exporters and importers; as their decisions are very likely to be influenced by price expectations, an assumption of how such expectations are formed has to be included.

The second element of the model is concerned with the price determination on the basis of the import- and export-decisions.

In the country models, production and consumption are regarded as given: A specification of production functions for sugar is not possible because of lack of data on the input side; but sugar production can be predicted quite reliably by experts. As only short period predictions are intended and changes in sugar consumption will not occur very rapidly, the consumption variables, too, were considered to be determined outside the model. With production and consumption given, the two main endogenous variables of the country models are imports and exports respectively, and the inven-

[2] While sugar exporters are well represented by the three largest exporters, this is not to the same extent true for sugar importers: the USSR and China (number two and three of the importers) could not be included because of missing data.

tories. With respect to these variables one has to take into account that the following identity must hold:

$$I_{it} = I_{it-1} + V_{it} - C_{it} + M_{it} \qquad (3.1)$$
$$I_{it} = I_{it-1} + V_{it} - C_{it} - X_{it}$$

with I_{it}, V_{it}, C_{it}, M_{it}, X_{it}: inventories at the end of period t, production, consumption, net-imports and net-exports of country i in period t.

(3.1) shows that – with V_{it} and C_{it} given – only one of the two remaining variables (M_{it} or X_{it}, and I_{it}) can be "explained" by a behavioural equation; the other one is determined by (3.1). As in many other commodity models it was decided to specify inventory equations, which in connection with (3.1) will determine the net-imports and -exports of the respective countries.

We shall now discuss the concepts underlying the inventory equations, price determination, and price expectation.

3.2. Specification of the Countries' Inventory Equations

There are three main aspects which are of importance for inventory decisions:

- inventories have to be kept to meet the demand for sugar;
- the level of inventories may be effected by economic regulations;
- an "optimal" level of inventories can be determined on the basis of present and future prices and production.

The main factors with respect to the first aspect are sugar consumption and the relation of sugar consumption to the actual production of sugar.

The second aspect is very much connected with regulations within international sugar agreements and/or economic measures taken by individual countries. As already mentioned, there have been two international sugar agreements during the period the empirical study is based on. As an analysis showed that these agreements had only very little effect on the behaviour of the countries, variables representing the contents of these agreements were not included in the model.[3]

As far as measures of individual countries are concerned, the EC-sugar policy based on production quota, intervention- and threshold-prices

[3] This was different in case of the former study: There some dummy variables had to be introduced to take into account regulations of these agreements (see *Frohn* (1984)); for the new model with the longer estimation period such variables were not significant.

strongly influences EC-sugar inventories.[4] Therefore the EC A- and B-sugar quota had to be included as an explanatory variable in the inventory equation.

The rationale behind optimal storing of commodities has recently been discussed in a number of papers.[5] In these papers, optimal strategies for storing the respective commodities and for the behaviour on the futures market are determined.[6]

We shall only make use of the basic reasoning behind these models to determine those variables which influence an inventory holder's behaviour (see footnote 6) and therefore should be included in the empirical analysis. As there is no empirical information on the positions on the futures market (f_t) these variables are: the spot price (P_t), the futures price (P_t^f), the expected spot price (P_{t+1}^e), actual and expected production (V_t, V_{t+1}^e), and lagged inventories (I_{t-1}).

Together with sugar consumption, seasonal variables, and the EC quota, these variables had to be investigated in the specification analysis of the countries' inventory equations.

3.3. Price Determination

If all countries participating in worldwide sugar trade were included in the model and if the worldmarket of sugar can be assumed to be in equilibrium, the estimated worldmarket price could be calculated directly from the estimated model.[7] As only the countries mentioned above are included and as there have been quite a few political disturbances of the sugar market (f.i. the reluctance of the USA to buy Cuban sugar) so that there is – at least in the short run – considerable doubt whether the world sugar market can be regarded as being in equilibrium, the model has to be closed by a general price determination equation.

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[4] See *United Nations* (1980), Chapter 4.

[5] See for instance *Turnovsky* (1983), *Kawai* (1983), *Palm* (1986).

[6] For instance, for an inventory holder who is a sugar producer and a sugar exporter the net revenue for period $t(\pi_t)$ consists of two parts: $\pi_t = \pi_{ot} + \partial \pi_{1t}$ (∂ being a discount factor), with

$$\pi_{ot} = P_t(V_t - f_{t-1}) - P_t(I_t - I_{t-1}) + P_t^f f_t - \text{Costs}(I_t)\,; \text{ and}$$

$$\pi_{1t} = P_{t+1}^e (V_{t+1}^e - f_t) + P_{t+1}^e I_t\,.$$

($P_t, P_t^f, f_t, P_{t+1}^e, V_{t+1}^e$ being spot price, futures price, position on the futures market, expected spot price, expected production, respectively). For solving the problem with respect to I_t and f_t, one has to add an assumption on the risk-behaviour of the agent: Maximize $U(\pi_t)$ with respect to I_t and f_t, with $U(\pi_t)$ an appropriately chosen utility function (See *Palm*, (1986), 2ff., where in addition to the above set up holding of alternative assets was also included).

[7] See *Frohn* (1984), 9ff.

Actually, this equation should contain all factors which are of influence for the imports and the exports of the six countries of the model. Obviously an incorporation of all these variables is not possible because of their number. Therefore, aggregates of these variables had to be used.

For simulation purposes a special assumption was needed with respect to the futures price. Like in almost all commodity markets, the futures price of sugar is highly correlated with the actual spot price (the correlation coefficient for these variables from 1971 to 1985 is 0.99). Therefore, for simplicity, no joint explanation of the futures price and the spot price is provided. Instead, for simulation purposes the development of P_t^f was approximated on the basis of a recursive relation, i.e. it was assumed that the futures price very closely follows the development of the actual spot price.

3.4. Price Expectations

In order to be able to use the model for predictions of the spot price, one has to endogenize price expectations. There are at least three main concepts for the incorporation of endogenous expectations in econometric models:

- adaptive expectations;
- rational expectations;
- expectation models based on empirical information.

As adaptive expectations obviously do not make as extensively use of the available information as probably will be the case in economic reality, this concept was not discussed any further.

With respect to rational expectations there are two general objections as far as empirical studies are concerned[8]:

1. the implied identity of the basic model and the expectation model is questioned;
2. the estimation of all parameters of the model on the basis of all data points of the time series of the variables is not in accordance with reality.

With respect to the first objection, let us assume that the basic econometric model can be regarded as an adequate description of the phenomenon in question. Still the expectation model can be different from this model: As there are costs of information, a rational economic agent can decide not to use some of the information built into the model. And there is also the possibility that part of the information involuntarily is not used because of lack of knowledge.[9]

[8] For the general concept of rational expectations see for instance (*Begg* (1982)); for a critical view of the underlying assumptions see for instance (*Friedman* (1979), *Frohn* (1985).

As far as the estimation of the parameters is concerned it seems to be doubtful to estimate all parameters of the model from all data points of the respective time series: What certainly is correct with respect to the estimation of equations stating the general relations between economic variables does not seem to be adequate for the formation of expectations; there the economic agents can only use the information available up to that point where the process of expectation formation takes place.

Because of these basic objections against rational expectations it was decided to incorporate an expectation model on the basis of empirical information. According to experts who have observed the worldmarket of sugar over a very long time, the following variables are considered to be of great importance for the development of the spot price of sugar and therefore also for the formation of expectations of this price:[10]

- the most recent spot price
- worldwide sugar production as expected for the future
- recent changes in the futures price
- recent changes in the level of sugar inventories as compared with the development of sugar consumption.

On the basis of this information the price expectation equation was defined as follows:

$$(3.2) \qquad P^e_{t+1} = a_0 + a_1 P_t + a_2 V^e_{t+1} + a_3 \left(\frac{C^6_t}{I^6_t} - \frac{C^6_{t-1}}{I^6_{t-1}} \right) + a_4 (P^f_t - P^f_{t-1}) + \text{Season} + u^e_t \,.$$

The relation of consumption to inventories had to be limited to the six countries included in the empirical study; otherwise predictions of expectations and consequently price predictions would not have been possible. The introduction of seasonal variables was necessary to take care of seasonal dependencies of production, consumption and inventories of sugar.

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[9] In contrast to the assumptions within the concept of rational expectations, the economic agent in reality may not become aware of this fact and therefore will not change the way he forms his expectations, because he either may regard the resulting errors of expectations acceptable or may change the successive models of expectations so rapidly that he will not find out about their deficiencies.

[10] In this respect I am very grateful for the help of Dr. H. Ahlfeld from F. O. Licht, Sugar Economic Publisher, Ratzeburg.

4. The Empirical Study[11]

Before the specification analysis of the country models and the price determination equation could be started, a time series of the expected spot price had to be established.

It was assumed that in forming their price expectations, the economic agents would use the expectation equation without any reference to the other equations of the model.

It was decided that the first value of P^e_{t+1} should be calculated for the first quarter of 1975, thus leaving 15 data points from 1971,2 to 1974,4 for a first estimation of the price expectation equation. The price expected for 1975,1 in 1974,4 ($P^e{}_{75,1}$) was determined as follows: First, equation (3.2) was delayed by one quarter and the endogenous variable P^e_{t+1} was replaced by P_t:

$$(4.1) \qquad P_t = a_0 + a_1 P_{t-1} + a_2 V^e_t + a_3 \left(\frac{C^6_{t-1}}{I^6_{t-1}} - \frac{C^6_{t-2}}{I^6_{t-2}} \right) + \\ + a_4 (P^f_{t-1} - P^f_{t-2}) + \text{Season} + u^{e*}_t, \; t = 71{,}2; \ldots; \; T = 74{,}4 \; .$$

This equation was estimated by OLS, using the data from 1971,2 to 1974,4. The resulting estimates of the parameters ($\hat{a}_o, \ldots$) where then used to calculate $\hat{P}^e_{75,1}$ from

$$(4.2) \qquad \hat{P}^e_{75,1} = \hat{a}_0 + \hat{a}_1 P_{74,4} + \hat{a}_2 V^e_{75,1} + \hat{a}_3 \left(\frac{C^6_{74,4}}{I^6_{74,4}} - \frac{C^6_{74,3}}{I^6_{74,3}} \right) + \\ + \hat{a}_4 (P^f_{74,4} - P^f_{74,3}) + \widehat{\text{Season}} \; .$$

The assumption underlying this calculation is the following: The economic agents will use the data information about the relation between the price and the price-influencing factors from the past to attribute appropriate weights to the variables on the r.h. side of the price expectation equation.[12]

To calculate the expected price for 1975,2 the same procedure was applied, now first estimating (4.1) with $T = 75{,}1$ and then calculating $\hat{P}^e_{75,2}$ from an estimated equation like (4.2).

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[11] Up to 1981,4 all data can be found in *Frohn* (1984), the time series are completed from *(International Sugar Organisation)*.

[12] One could have applied some other estimation procedure instead of OLS, for instance a method that would put higher weights on the latest observations; such a procedure may come closer to the way economic agents make use of the information of the past. But for such an assumption one needs further information about the process of expectation formation.

In this way the whole time series for $\hat{P}^e_{t+1}$ was established for the period from 1975,1 to 1985,3, with the exception of two quarters where the expected price would have been negative according to (3.2); in these two quarters $\hat{P}^e_{t+1}$ was set equal to one ct.

Fig. 2 shows the development of the expected price against the development of the actual price for the last seven years. The performance of equation (3.2) seems to be quite good. Fig. 3 shows the expectation errors calculated as the difference between P_t and $\hat{P}^e_t$. Obviously, $\hat{P}^e_t$ on the average underestimates P_t (the average expectation error is + 0.33 cts. with a standard deviation of 1.35 cts.; there is no indication of autocorrelation up to 4th order of the expectation errors).

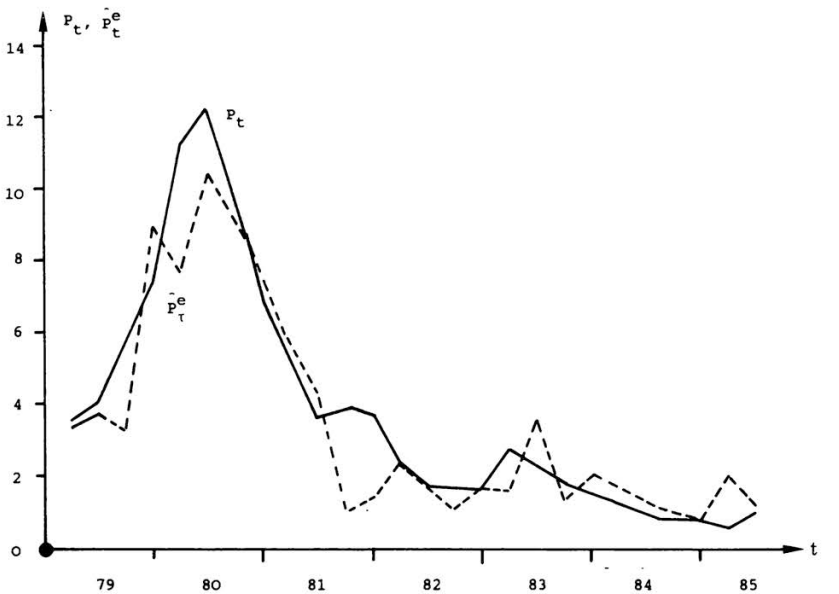

Fig. 2: Actual real spot price (P_t) and expected real spot price ($\hat{P}^e_t$) in cents, quarterly values 1979,II to 1985,III

[13] Although the model is of a recursive structure, 3SLS was applied to take care of likely correlations between the residuals of different equations.

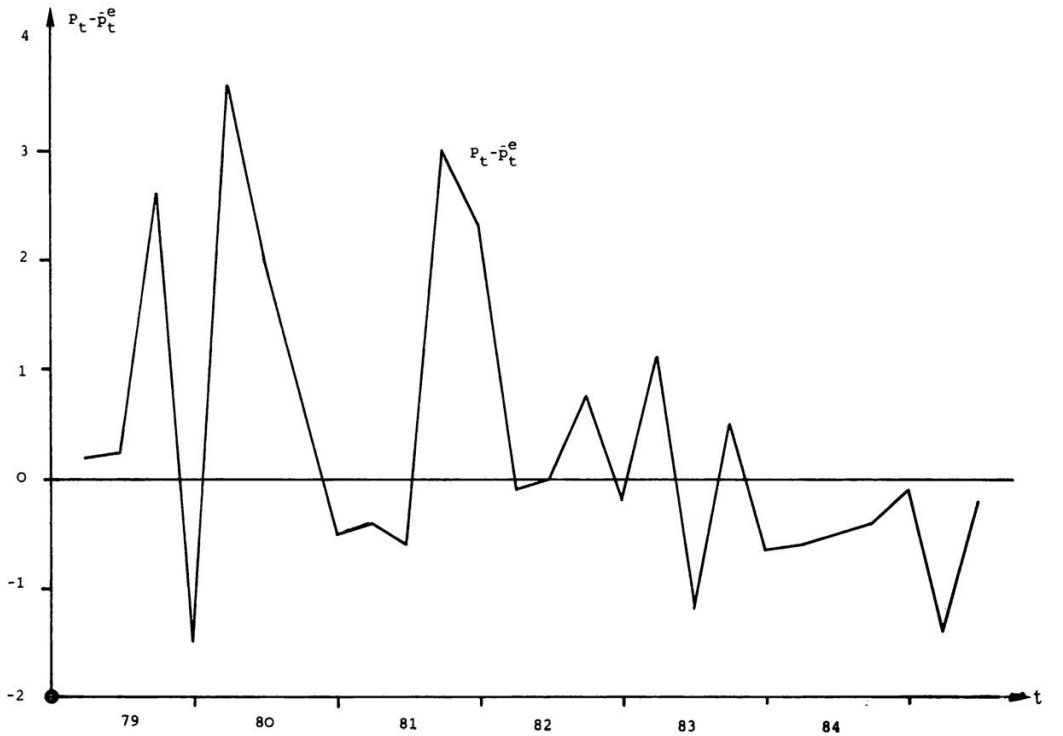

Fig. 3 Expectation Errors $P_t - \hat{p}_t^e$ in cents, 1979,II to 1985,III

The specification analysis of the six country equations and the price determination equation was carried out on the basis of OLS-estimations with predictive performance as the most important criterion. The results for the finally chosen model, estimated by 3SLS,[13] are as follows:[14]

(4 3) EC

$$I_t^{EC} = \underset{(\pm 1289.2)}{-5264.8} + \underset{(\pm 0.02)}{0.92 I_{t-1}^{EC}} + \underset{(\pm 0\,02)}{0\,95 V_t^{EC}} - \underset{(\pm 0.14)}{1.34 C_t^{EC}} + \underset{(\pm 0\,10)}{0.51 \mathrm{ECAB}_t} + \underset{(\pm 18.12)}{29.20 \hat{P}_{t+1}^e}$$

$$R^2 = 0.99;\ \mathrm{DW} = 1\,91 \quad (\text{Durbin's } h = 0.26)$$

(4 4) Cuba:

$$I_t^{Cb} = \underset{(\pm 94.5)}{-66\,74} + \underset{(\pm 0.04)}{0.45 I_{t-1}^{Cb}} + \underset{(\pm 0\,02)}{0\,48 V_t^{Cb}}$$

$$R^2 = 0\,96;\ \mathrm{DW} = 2\,05 \quad (h = -0.20)$$

[14] The values in brackets represent the estimated standard errors of the coefficients.

(4.5) Brazil:
$$I_t^{Br} = \underset{(\pm 263.1)}{118.5} + \underset{(\pm 0.04)}{0.83 I_{t-1}^{Br}} + \underset{(\pm 0.03)}{0.89 V_t^{Br}} - \underset{(\pm 0.24)}{0.97 C_t^{Br}}$$
$$R^2 = 0.96, \quad DW = 2.15 \quad (h = -0.54)$$

(4.6) USA
$$I_t^{US} = \underset{(\pm 455.5)}{2540.6} - \underset{(\pm 0.21)}{0.39 V_t^{US}} + \underset{(\pm 0.20)}{0.83 C_{t-1}^{US}} - \underset{(\pm 21.0)}{112.4 P_{t-1}}$$
$$+ \underset{(\pm 22.6)}{47.16 \hat{P}_{t+1}^{e}} + \widehat{\text{Season}}$$
$$R^2 = 0.90; \quad DW = 1.32$$

(4.7) Japan
$$I_t^{JP} = \underset{(\pm 163.2)}{512.8} + \underset{(\pm 0.09)}{0.34 I_{t-1}^{JP}} + \underset{(\pm 0.31)}{1.42 V_t^{JP}} - \underset{(\pm 0.16)}{0.95 C_t^{JP}}$$
$$+ \underset{(\pm 5.66)}{24.19 \hat{P}_{t+1}^{e}} + \widehat{\text{Season}}$$
$$R^2 = 0.81, \quad DW = 1.64 \quad (h = +1.46)$$

(4.8) Canada
$$I_t^{Ca} = \underset{(\pm 45.2)}{71.2} + \underset{(\pm 0.10)}{0.88 I_{t-1}^{Ca}} - \underset{(\pm 0.77)}{0.41 C_t^{Ca}} - \underset{(\pm 4.46)}{4.71 P_t}$$
$$+ \underset{(\pm 4.84)}{6.97 \hat{P}_{t+1}^{e}} + \widehat{\text{Season}}$$
$$R^2 = 0.81, \quad DW = 2.04 \quad (h = -0.17)$$

(4.9)
$$P_t = \underset{(\pm 2.06)}{-7.54} + \underset{(\pm 0.05)}{0.55 P_{t-1}} + \underset{(\pm 0.05)}{0.46 \hat{P}_{t+1}^{e}} + \underset{(\pm 0.00011)}{0.00032 I_{t-1}^{Dem}} + \underset{(\pm 0.00027)}{0.00086 C_{t-1}^{6}}$$
$$R^2 = 0.94 \quad DW = 1.82 \quad (h = 0.28)$$

(4.10)
$$P_t^f = \underset{(\pm 0.13)}{0.24} + \underset{(\pm 0.02)}{0.99 P_t}$$
$$R^2 = 0.99; \quad DW = 1.55$$

As an example, the results of an OLS-estimation of the price expectation equation on the basis of data ranging from 1971, 1. quarter to 1985, 3. quarter are given:

(4.11)
$$\hat{P}_{t+1}^{e} = \underset{(\pm 3.99)}{17.61} + \underset{(\pm 0.08)}{0.67 P_t} - \underset{(\pm 0.00017)}{0.00059 V_{t+1}^{e}} + \underset{(\pm 2.29)}{6.63} \left(\frac{C_t^6}{I_t^6} - \frac{C_{t-1}^6}{I_{t-1}^6} \right)$$
$$+ \underset{(\pm 0.11)}{0.29} \; (P_t^f - P_{t-1}^f) + \widehat{\text{Season}}$$
$$R^2 = 0.86, \quad DW = 1.95$$

Definition of the variables

I_t = inventories of sugar at the end of quarter t

V_t = production of sugar in quarter t

C_t = consumption of sugar in quarter t

$ECAB_t$ = A- and B-quota for sugar in the EC

P_t = real sugar price at the end of quarter t (ISA-daily sugar price (per lb.), price basis 96°, f. o. b. and stowed Carribean port in bulk, divided by the IMF-consumer price index)

I_t^{Dem} = sum of the inventories of USA, Japan, Canada

I_t^6 = sum of the inventories of the six included countries

C_t^6 = sum of the consumption of the six included countries

P_t^f = real futures price (price of the futures market in New York for contracts three months (or if not available: six months) ahead of the end of quarter t, divided by the IMF-consumer price index)

V_{t+1}^e = worldwide sugar production, as expected for the next quarter according to F. O. Licht, Sugar Economic Publisher

$\hat{P}_{t+1}^e$ = calculated from (3.2)

R^2 = coefficient of determination

DW = value of the Durbin-Watson-Statistic

h = value of Durbin's h-Statistic

As already mentioned, predictive performance played the main role in the specification analysis; this is the reason why in some equations variables with non-significant coefficients have not been removed.

The fits of the inventory equations for the exporters is better than for the importers. The fit of the price equation is surprisingly good. The values of the Durbin-Watson-Statistic and Durbins's h-Statistic indicate that in almost all cases the hypothesis of autocorrelation (of 1. order) of the residuals can be rejected. Only in case of the US-inventory equation, the value of the DW-Statistic lies within the indifference region.

As examples, figures 4, 5, and 6 show the fits of the inventory equations for Brazil and the USA, and for the price equation.

The most striking result of the empirical analysis is, that inventory reactions to price changes are almost exclusively observed in case of sugar importers, while the storing behaviour of the exporters seems to be mainly determined by their sugar production. The estimated price equation (4.9) reflects the well known fact that the price on the world sugar market is strongly influenced by the importers: While the level of the inventories by the three importing countries is quite important for price developments, the coefficients of the inventories of the exporters were not significant. (4.9) also shows that the price is heavily influenced by price expectations.

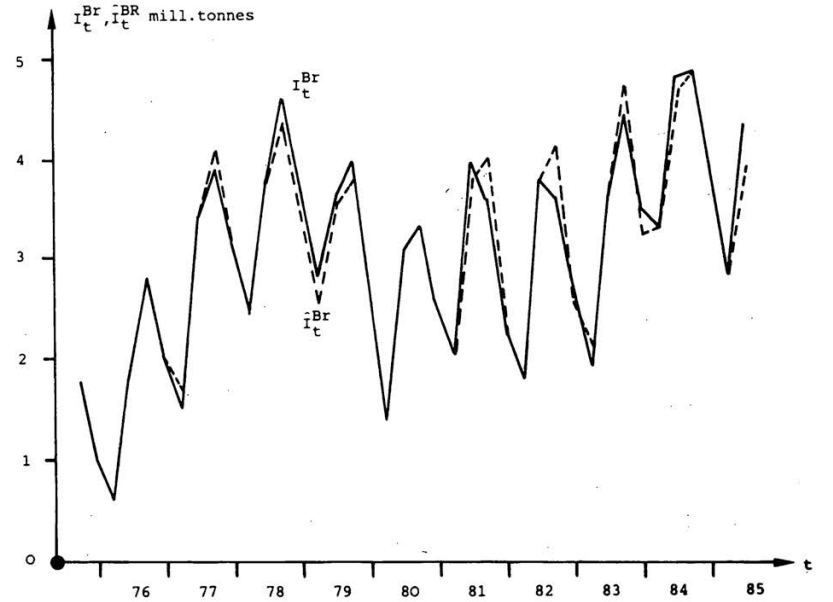

Fig. 4: Actual inventories (I_t^{Br}) and estimated inventories ($\hat{I}_t^{Br}$) of Brazil, in mill. tonnes, 1975,IV to 1985,III

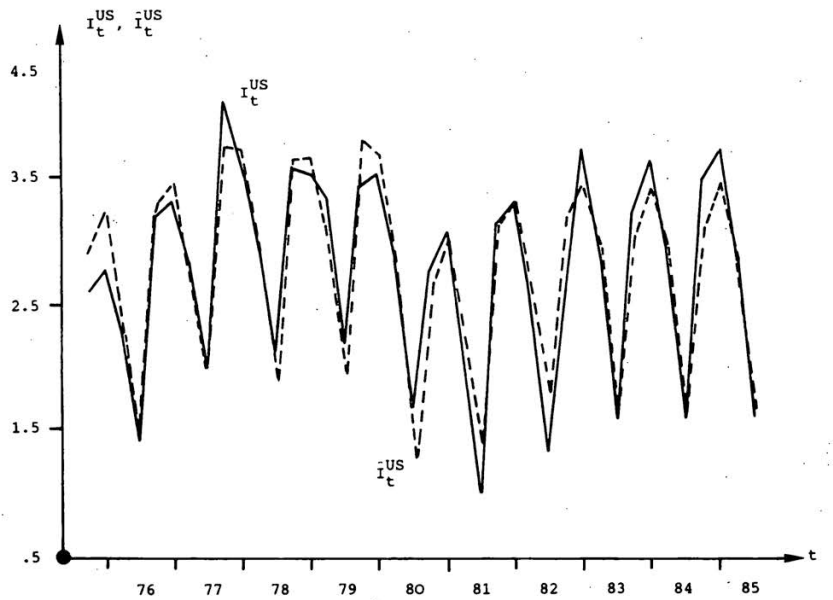

Fig. 5: Actual inventories (I_t^{US}) and estimated inventories ($\hat{I}_t^{US}$) of USA, in mill. tonnes, 1975,IV to 1985,III

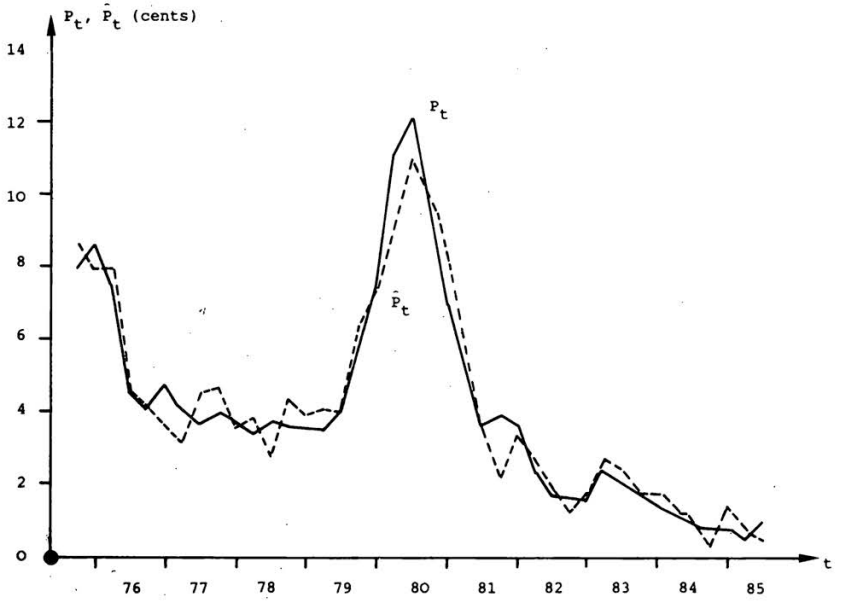

Fig. 6: Actual price (P_t) and estimated price ($\hat{P}_t$), in cents, 1975,III to 1985,III

To investigate the basic predictive ability of the model, it was simulated for the period 1980 to 1984, thus on purpose using a much longer prediction period than is intended for the actual forecasts. For this simulation, where the data for lagged endogenous variables were calculated from the model, price expectations had to be endogenized to take care of the interdependences between the spot price, the inventories of some countries and price expectations. This was done by estimating the price expectation equation by OLS with data from 1971 to 1982,2. quarter (the middle of the simulation period). This estimated equation then was added as a definition to the other equations of the model, which had been estimated by 3SLS over the whole period up to 1984. Fig. 7 shows the result of this simulation for the price variable. Inspite of the fact that the peak in 1980 is not predicted very well, the overall performance can again be regarded as quite satisfactory.

5. Conclusion

It is obvious that the predictive quality of the model depends very much on the quality of the forecasts for the important exogenous variables. Especially precise predictions for sugar production of the exporting countries and for worldwide production are needed.

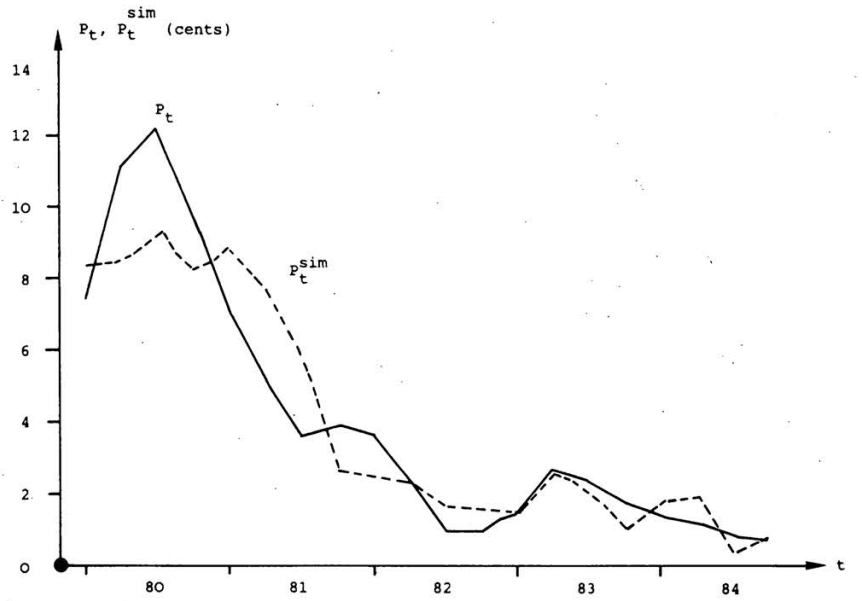

Fig. 7: Results of the simulation with P_t actual price and p_t^{sim} simulated price, in cents, 1980,I to 1984,IV

For the incorporation of expectations an empirically based expectation model has been used. The reported results seem to support this attempt, and therefore encourage investigations about the way how the main economic agents form their expectations. Perhaps this can provide a useful alternative to the theoretical concepts of expectations, which are widely used in econometric models.

Summary

In this empirical study an econometric model for the world market price of sugar, based on the decisions of main sugar importing and exporting countries is discussed. For the incorporation of price expectations a model on the basis of expert information has been specified. In the estimation of the model quarterly data, ranging from 1971, 1. quarter to 1985, 3. quarter have been used. In the paper the results of the estimation and of a simulation experiment are presented.

Zusammenfassung

In dieser empirischen Studie wird ein ökonometrisches Modell für den Weltmarktpreis für Zucker spezifiziert. Das Modell besteht aus Gleichungen für das Nachfrager- und Anbieterverhalten für die wichtigsten Zucker-Importeure und -Exporteure, zwei Preisgleichungen sowie einer Preiserwartungsgleichung. Dabei wird für die Formu-

lierung der Preiserwartungsgleichung kein ausschließlich theoretisch begründeter Ansatz gewählt, sondern auf Informationen von Experten zurückgegriffen. Zur Schätzung werden Quartalsdaten für 1971, 1. Quartal bis 1985, 3. Quartal herangezogen. Die Arbeit enthält die Ergebnisse der Schätzung sowie eines Simulationsexperiments.

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