FORECASTING SYSTEMS FOR THE PORK INDUSTRY - THE ROLE OF PRODUCERS

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SUMMARY

This paper starts from the observation that in the context of forecasting agricultural markets, the cost-benefit relation is an ambiguous one. Thus costs are a function of the forecasting method to be used, whereas the method in turn depends on industry requirements which also determine the assessment of benefits through the setting of objectives.

Examples of the pork industry in New Zealand and the Federal Republic of Germany are used to illustrate how the setting of forecasting objectives is related to given industry structures. The most obvious difference between both industries is in their respective size, especially if that is measured by the number of industry participants. Production forecasts are used in both cases, price forecasts only in the Federal Republic of Germany, whereas demand forecasts have not been attempted yet. Producers play an active role only in New Zealand.

Key Words: Funding, Pork Industry, Forecasting, Industry Organisation

INTRODUCTION

As far as the issue of market forecasts is concerned, agricultural producers, i.e. farmers and growers, are inclined to play a twofold role. Firstly, producers will be seen as beneficiaries at least to the extent that the published forecast is suitable to protect them against the consequences of erroneous decision making. Secondly, producers may also act as suppliers of data, at least to the extent to which their own decisions regarding investment or disinvestment into certain product lines form an integral part of the forecast itself. At this point one might argue that producers, in their role as supposed beneficiaries would act in their own best interest by making the maximum contribution towards the establishment of agricultural forecasts. Reality does not always confirm this.

Reservations made in the initial statements, show already that the role of producers is conditioned by other prerequisites, and thus it would be conceivable - at least in theory - to have forecasts which either do not require the contribution of producers, or worse, which leave producers without any noticeable benefit. Hence I would like to start with some general comments about the assessment of costs and benefits in conjunction with industry structures and forecasting methods.

THE COST-BENEFIT ASPECT

From a forecaster's point of view, the cost-benefit relation is an asymmetric one. Thus the costs tend to be immediately obvious, because any person or organisation embarking on forecasts, will face visible expenditures in terms of staff salaries, computing outfit and other commitments. Exceptions of this rule may only be given through hidden government support, which will be discussed later.

Benefits though, do not need to be immediately obvious. The major benefit must be seen in better profitability through market-lead decision making, which is caused by the time lag between the decision on a specific product and the availability of that product. The time passing between sowing and harvesting would be an example. Quite naturally, the real gain in profitability will accrue only after many of such "better" decisions have been made, which may well take several years. Even when this state is achieved, it may be difficult again to assess the benefits of that given situation against the hypothetic situation where no forecasting takes place. Lindner (1987) who uses examples from the wheat industry, hence comes to the conclusion:

"Thus even if benefits to individual decision makers are very small and "adoption" levels correspondingly low, net research returns are likely to be positive notwithstanding the ephemeral value of the information

produced. In contrast to wheat, the value of equivalent surveys for minor crops may be too low because the number of potential data users will be correspondingly smaller. For some crops this may be compensated for by a less rigid marketing system which increases decision makers' flexibility of actions and with it the value of information per decision."

It is certainly correct to say that a "minor" industry needs different forecasting approaches as opposed to a "major" industry, albeit this wording leaves room for some ambiguities. Thus the size of an industry can be measured either by the number of participants, or by the volume of production. Apparently there is a difference between an industry with few participants each of which handling large amounts of produce; and an industry with many participants, each of which offering only small amounts. As far as forecasting is concerned, individual benefits should be stressed in the first case, and collective benefits in the latter.

A second moot point is the flexibility of a given industry. Certainly it is true that the absence of forecasting may be compensated for by a less rigid marketing system. More important though is the existence of a sufficiently large number of product options, each of which can be realised on fairly short notice. Flexibility in this sense does not deny the necessity of forecasting, albeit the emphasis in this case would be on the short term rather than on long term forecasts. A less flexible industry in turn is more likely to require long term forecasting suitable to guide investment decisions. From the cost benefit point of view it is important to realise that short term forecasts can be fairly accurate even by using conventional methods, which speaks in favour of their cost-effectiveness. In the case of long term forecasts, however, accuracy and reliability is still a matter of debate. The only exception might be early warning systems, where forecasting is reduced to the question of whether surpluses of unsaleable produce is a likely or an unlikely threat in future.

This passage was designed to show that industries may be categorised by size and flexibility, which leads to different cases with differing forecasting requirements. By the same token, forecasting methods may be further differentiated by the purpose to be served, the desired level of accuracy, and the respective time horizon. The purpose of this paper itself is to show links between a given industry structure and the resulting information requirements. Cost-effectiveness of forecasting then becomes a question of choosing the most appropriate method.

Ideally, the corresponding recommendations should be derived from a sufficiently large number of examples. Due to technical limitations though, I have to confine myself to two industries, namely the pork industry in New

Zealand and in the Federal Republic of Germany. The assessment of similarities and differences is to show whether or not the different application of forecasting methods in each respective industry can be explained by factors imminent to the nature of that very industry. This is an heuristic approach and the results should be seen as an encouragement for future research rather than as final statements.

CROSS-NATIONAL COMPARISON OF TWO PORK INDUSTRIES

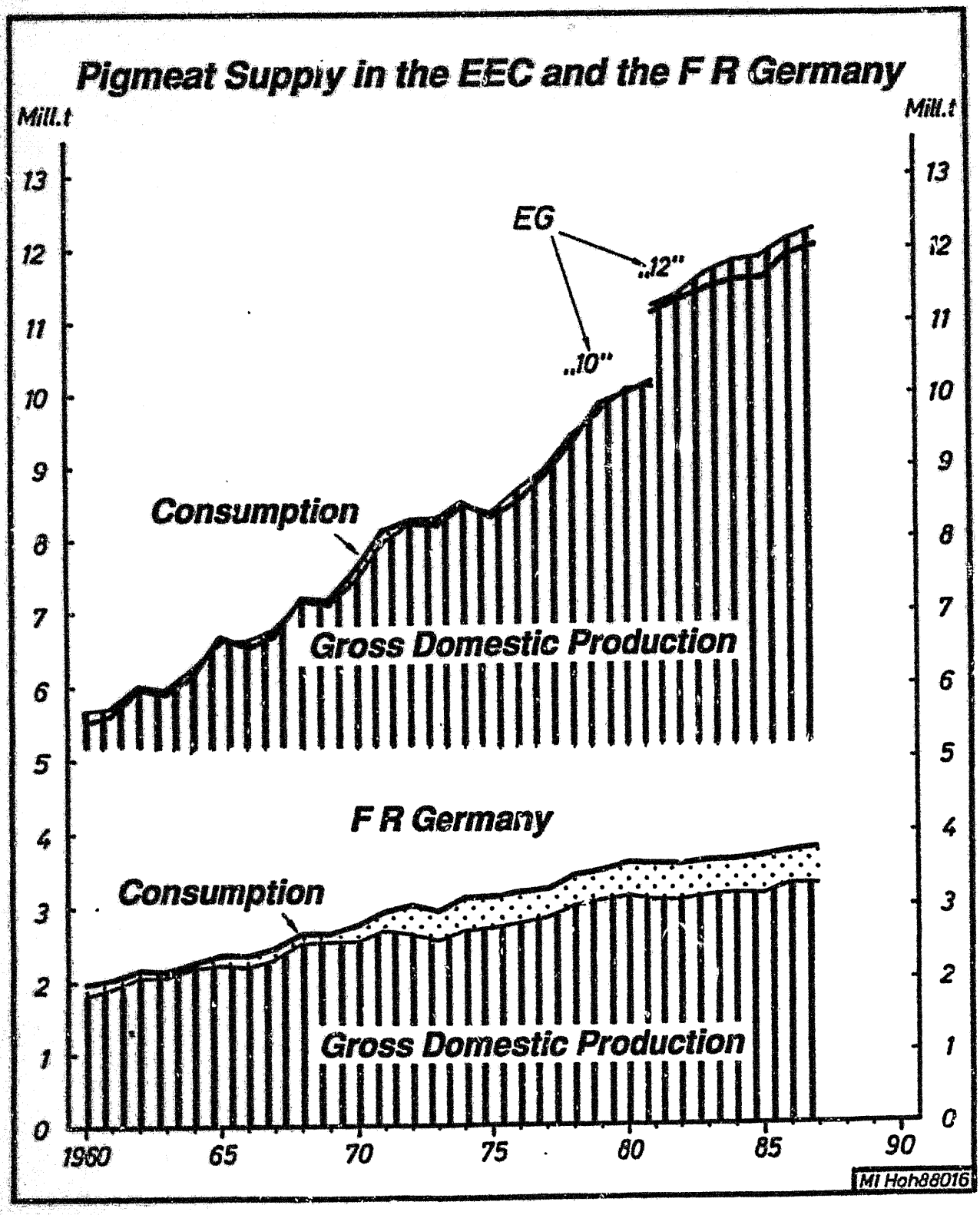
Similarities

In both countries, the production cycle (from conception to delivery) is approximately 10 months. This is shorter than in the case of most other agricultural products with the exception of some field crops and vegetables. In both countries there is a classification by weight (cf. "porkers" and "baconers" in New Zealand), so that adaptation to demand may also take place by varying the time of delivery. It is also important to note that both industries are undertaking initiatives in marketing (cf. the "trim pork" campaign in New Zealand), which tend to further increase the number of product options. Thus, compared to primary production in general, both pork industries must be regarded as being fairly flexible.

Imports of pork (and live animals as well in the Federal Republic of Germany) take place in both countries with considerable annual variations. Thus, New Zealand imported 2,559 tonnes in 1986/87, yet only 734 tonnes in the preceding year (NZ Pork Industry Board, 1987). Hence the degree of self-sufficiency oscillates between 94% and 98%. Self-sufficiency in the Federal Republic of Germany is fluctuating between 85% and 89% (BML(1)). For the development in the EEC and the Federal Republic over the last 20 years see Figure 1. A monthly breakdown would show even wider oscillations in both cases. Since the changing demand for imports is related to annual and seasonal fluctuations in domestic production, forecasting could be used as a tool for steering the timing and amount of imports. This favours the concentration on production forecasts - in stark contrast to export-oriented industries, where demand estimates should be a prime objective.

(1) BML = Federal Ministry of Food, Agriculture and Forestry - several yearbooks.

FIGURE 1


Pigmeat Supply in the EEC and the F R Germany
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Gross Domestic Production
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Differences

Differences in Industry Size:

Regarding the above-mentioned fluctuations, a more comprehensive analysis of each respective industry would require time-series of more than a decade. The purpose here though, is just to show the difference in proportion, so that the most recent data over a three year period should be sufficient. Apart from the total output, measured as the number of pigs slaughtered, Table 1 also shows the stocks of breeding sows and the number of farms, both of which may lead to differing results regarding the size of the industry.

Table 1: Comparison in Size of the German and the New Zealand Pork Industries

FEDERAL REPUBLIC OF GERMANY	NEW ZEALAND
Pigs Slaughtered (in '000 head)	
35,750 (1985)	852 (1984/85)
36,720 (1986)	843 (1985/86)
36,630 (1987)	775 (1986/87)
36,367 Average	823 Average
Breeding Sows (in '000 head)	
2,850 (1985)	51 (1985)
2,910 (1986)	48 (1986)
2,800 (1987)	47 (1987)
2,853 Average	49 Average
Farm Numbers	
432,000 (1984)	5,191 (1984)
432,000 (1985)	5,021 (1985)
390,000 (1986)	5,407 (1986)
418,667 Average	5,206 Average

Sources: N.Z. Pork Industry Board (1987); Boeckenhoff (1988); Eurostat; Federal Ministry of Food, Agriculture and Forestry.

A comparison of average figures shows that the Federal Republic of Germany has 80 times as many pig-farms as New Zealand, yet the amount of pigs slaughtered is only 44 times that of New Zealand. Thus, apart from the obvious difference in proportion, these figures show clearly that the New Zealand pork industry is more heavily concentrated in terms of output per farm. Part of the explanation is that 43% of the farms in the Federal Republic are "compound farms" which produce pigs alongside field crops - sometimes to the extent that pigs are only seen as a sideline business.

Any more specific comparison of herd sizes in both countries is inhibited by the fact that national statistics use different cutting marks in their classification of herd size groups. The only comparable group is very large herds of more than 1,000 pigs, which is used in the same manner in both countries. In New Zealand, 2% of the pork producers have such large herds, whereas the corresponding figure for the Federal Republic of Germany is only 0.3%. In New Zealand there are 226 farms with more than 500 pigs, these farms owning 61% of sows and producing 75% of the pigs. Although the corresponding category in the Federal Republic of Germany starts already at 400 pigs per farm, producers of that size own only 33% of total stock.(2) Comparison with other European countries who use the same category of 400+, is even more revealing. Thus 86% of stock in Ireland, 84% in the United Kingdom, and 72% in the Netherlands is owned by large-scale producers according to the above definition. In summary, the New Zealand pork industry is conspicuous by its concentration on a small number of large-scale producers, whereas the German pork industry is characterized by its comparatively huge number of small-scale participants.

Differences in Industry Organisation:

The differences in industry structure alone would be sufficient to have implications on the organisation of each respective industry. In the case of New Zealand, the almost historic tradition of Producer Boards plays an additional role. Kneebone (1987) illustrates this by speaking about "a large group of farm-oriented statutory groups representing town milk, pork, honey, vegetables, deer, kiwifruit and wheat, to name a few ...". The main characteristic of such Producer Boards is that they are entitled by act of Parliament to charge a compulsory levy from the group of farmers they represent. The pork industry in this case is represented by the New Zealand Pork Industry Board which is mainly financed by a levy computed according to the number of pigs delivered and/or slaughtered by each farm. The exact amount of levy may

(2) Latest available figures: 1986 for New Zealand and 1985 for the Federal Republic of Germany

vary from year to year depending on changing requirements. The Board co-ordinates and integrates all activities which are important from an industry point of view; i.e., breeding and stock improvement, disease control, other research and consulting, forecasting, marketing and promotion of the product.

The German pork industry, in contrast, is not co-ordinated by a single body. Part of the explanation is that the idea of Producer Boards never gained a firm footing in Continental Europe, yet in some part it is also explained by the diversity of interests among producers themselves (cf. compound farms versus specialised farms). The closest the Federal Republic has to a Producer Board is the CMA or German Agricultural Marketing Board which represents all sectors of primary production and whose activities are mainly confined to the promotion of food products from Germany. The CMA is funded by a compulsory levy which is computed on a product-by-product basis, depending on how much emphasis is enjoyed by each product in the promotional campaign. Research is only commissioned in as much as it contributes to the planning of promotional campaigns. Forecasting is not among the Board's duties, yet a sister organisation, the ZMP (central market intelligence and price reporting agency) collects data, mainly price quotations, which is used for subsequent forecasts. Other industry organisations, namely co-operatives and community organisations for specific functions, are regional, based on voluntary membership and not normally involved in forecasting. Forecasting in itself is mainly carried out by university staff, whereas bodies like the ZMP, the Ministry of Agriculture, and the Department of Statistics play an auxiliary role through the provision of data.

FORECASTING THE PIG MARKET SITUATION

The Case of New Zealand

The attempt of forecasting the pig market situation in New Zealand is now approximately one year old - a fact that needs to be mentioned because there are forecasting techniques which include a considerable element of personal judgment, a factor which can only be used if judgment is based on a sufficient amount of experience. In this case, the forecasting technique is being kept straightforward; a plausible approach because it also minimises the danger of judgmental error. By the same token, forecasting is confined to production only.

The forward projection itself is carried out by a private research-house, namely MRL Research Agriculture, which is part of the Market Research Ltd Group. Funding is derived from the levy collected by the NZ Pork Industry Board. The fact that the levy is based on the number of pigs delivered means that forecasting is mainly financed by large-scale producers. An argument for justification

would be that such producers tend to be specialised and hence exposed to a higher risk in the market place.

The basis of projection is a panel of 82 pig farmers which were selected in a way that multiplication with the factor five yields in the total kill, per month, for New Zealand. Panel members are approached in two-monthly intervals with questionnaires which consist basically of the following two questions:

- Q.1. How many slaughter pigs in each of the following weight ranges do you anticipate you will sell for slaughter during _____?

- Q.2. And how many in each of the two weight ranges were actually sent for slaughter during _____?

The mentioned two weight ranges refer to porkers whose weight is less than 50 kg and baconers weighing more than 50 kg. Predictions of individual slaughter figures are asked for each of the next six months to follow the date of survey; actual figures of the number of pigs sold are asked for the latest three months preceding that date. Overlaps, which quite naturally occur with this method are used for cross-reference. An example of results achieved through this technique is shown in Table 2:

Table 2: Actual and Forecast Production of Slaughter Pigs in New Zealand

	1988					
	FEB	MARCH	APRIL	MAY	JUNE	JULY
Actual Kill	61255	69964	62274	69153	68629	63802
Forecast Technique Kill Figures						
Feb	64985	6%+				
Mar	69360	0.8%-				
Apr	69830	12.1%+	65680	5.4%+		
May	69415	0.1%+	68930	0.3%-		
Jun	69340	0.1%+	67895	0.1%-	66670	2.8%-
Jul	68525	7.4%+	68315	7.0%+	63075	1.1%-
Aug			68215		62005	
Sep			67830		62690	
Oct					61175	
Nov					62260	

NB: The percentage figures and the plus and minus signs show how far out the forecast was from the actual kill.

Source: Pork Industry Board Newsletter, October 1988

Responsibility of the research agency goes as far as the stage of computer evaluation. Interpretation and publication of results fall under the Board's authority. Regarding the accuracy of results, the Board's comment reads as follows:

"The results so far are very promising, as can be seen from the chart (Table 2). The results meant that for the first time, I could foresee, with some confidence, in which direction the total kill is going. The division between under and over 50 kg is still not very accurate. I think this will always be a variable, due to the demands of the market; i.e. if demand is down then pigs destined to be killed under 50 kg may well enter the over 50 kg category, because they have not been released from the farm."(3).

The Case of the Federal Republic of Germany

The following passages are mainly derived from an essay compiled by the chairman of the Department of Agricultural Marketing at the University of Hohenheim, (Boeckenhoff and Pflugfelder, 1989), who, at the same time is actively involved in the technicalities of establishing this very forecast. Hence it is fair to say that the task carried out by a private agency in New Zealand would fall under the obligation of a university department in the case of the Federal Republic. The choice of method is influenced by this organisational difference.

The history of forecasting pig meat production dates back to the 1950's (Plate and Boeckenhoff, 1961). In consequences there exists a rich body of experience, which makes it possible to use judgmental approaches if the data basis proves to be insufficient. The idea of using producer panels has not been pursued in Germany, partly because a wealth of statistical data is available from official sources and partly because of the heavy reliance on personal judgments. The technique itself is a sequence of the following six steps:

(1) The procedure starts invariably with an assessment of the last quarterly projection, where special attention is paid on the cause and magnitude of deviations between estimated and actual figures. Similar as in New Zealand, the tendency of farmers to change their decisions as to when they deliver pigs for slaughter, is the major source of error.

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(3) J. Henshall, Pork Industry Board Newsletter, October 1988.

(2) Assessment of the accuracy of data. This is necessary because a number of organisations are involved in collecting the data, so that the danger of transmission errors must not be ignored.

(3) Mating is seen as the start of the production period, yet it should be borne in mind that it is under the producer's discretion to decide when the covering of sows takes place. This decision is mainly influenced by the prices paid for piglets, and econometric analysis has shown a three months lag correlation between piglet prices and covering of sows. This formula is used to forecast the number of pregnant breeding sows.

(4) Once the production cycle has been initiated, the subsequent development of various age groups can be deducted from a simulation model. A very simplified version of this model is illustrated in Figure 2. The true model is designed to follow as closely as possible the normal production cycle on an average farm. Age group classification is consistent with official statistics, so this data can be used for verification. For the sake of contingency, however, the model does incorporate possible variations of the production cycle which may be used if there is sufficient evidence that the normal cycle does not apply. Crucial parameters are the ratio of pregnant sows to young pigs, and the various ratios between specific age groups and numbers of pigs slaughtered. These ratios are normally derived from past time observations, yet they may be modified if necessary. Decisions on the exact quantification of parameters are the most sensitive part of this exercise and will be the responsibility of the most senior person involved.

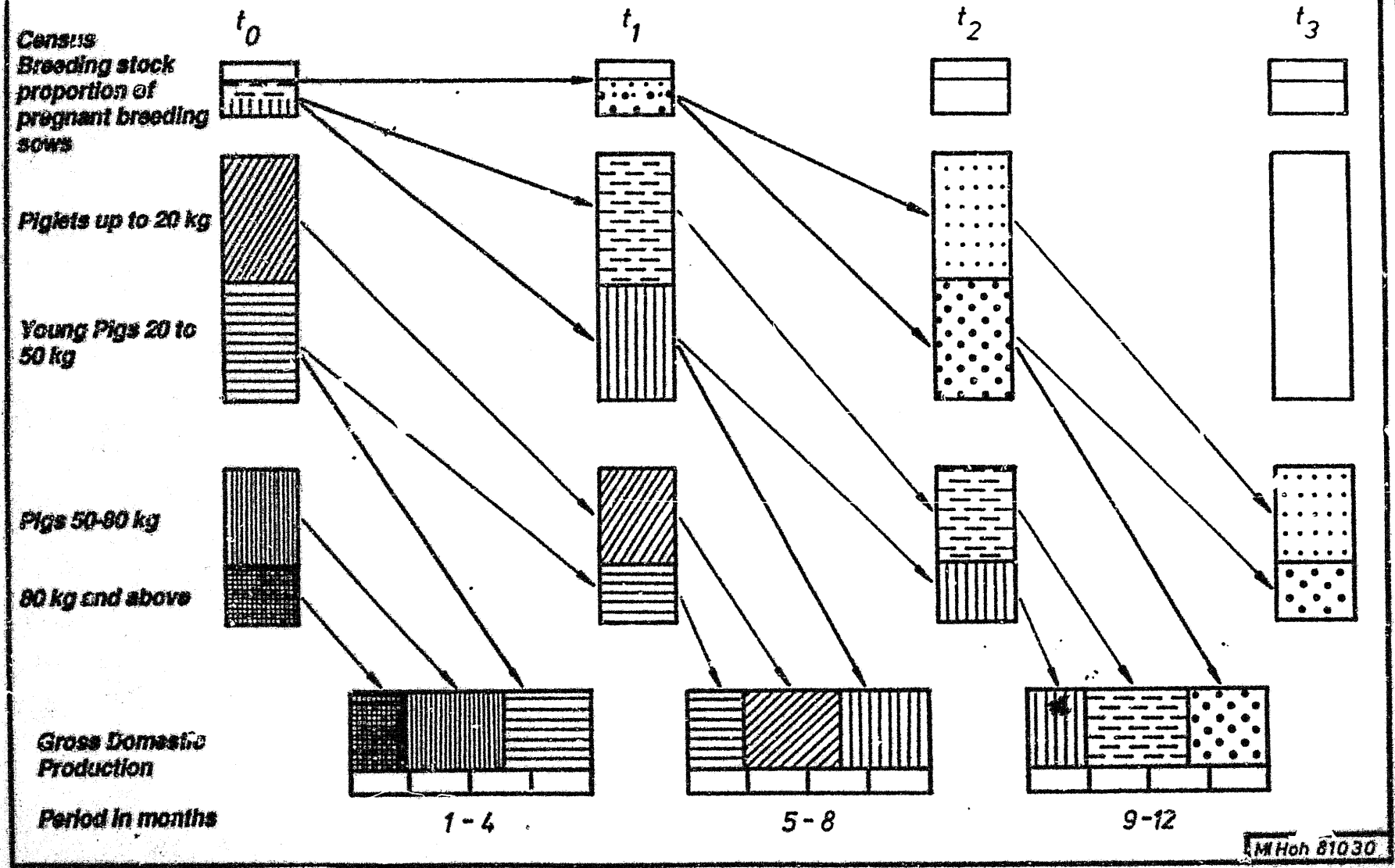
(5) Due to the nature of the production cycle, the above-mentioned model yields four-monthly results, whereas the general audience is used to quarterly projections. The necessary transformation is based on mathematics.

(6) Reconciling of results. This final step may be described as a mixture of brain-storming and use of the Delphi method. The purpose is to make sure that any further considerations, brought up by key persons in the German pork industry, will be taken into account before drawing final conclusions.

There can be little doubt that production forecasts are the most developed form of future projections, because of the opportunity to use well established cause-effect relationships for the setting up of econometric models. Similar attempts have been made for price projections with the only difference that paucity of data and spurious assumptions about causes and effects render the results less valid than in the previously mentioned case. Any detailed description of a price forecasting model

Forecasting the Amount of Pigs For Slaughter

(simple version)



would be beyond the scope of this paper. Suffice it to say that in the Federal Republic of Germany a combination is used which consists of past-trend extrapolation and expert judgments about factors causing a change in prices. Figure 3 gives a rough illustration. In this case, the diverging trends in prices for different types of meat can be explained by changing consumer preferences as well as by changing cost-structures. Thus, if any trend-extrapolation takes place, these factors would be analyzed in depth, and used as a corrective if necessary. It should be noted, however, that while production forecasts used to be published regularly, researchers are still reluctant to publish any specific prediction of prices.

The long history of forecasting in the Federal Republic of Germany made it possible to compare estimated and actual figures over a period of - now - 27 years. The results are compiled by regression, as shown in Figure 4. Without entering further details, it should be obvious that price-projections show far more deviations than those of production. This had to be expected, and it is rather surprising to see that at least a fair proportion of price-estimates proved to be fairly accurate; albeit this reflects, at least to my understanding, more on the soundness of expert judgments than on the benefits of any particular model.

SUMMARY AND CONCLUSIONS

In a nutshell, projections concerning future events, to be relevant in agricultural industries, can be grouped, according to their respective purpose, into the following three categories:

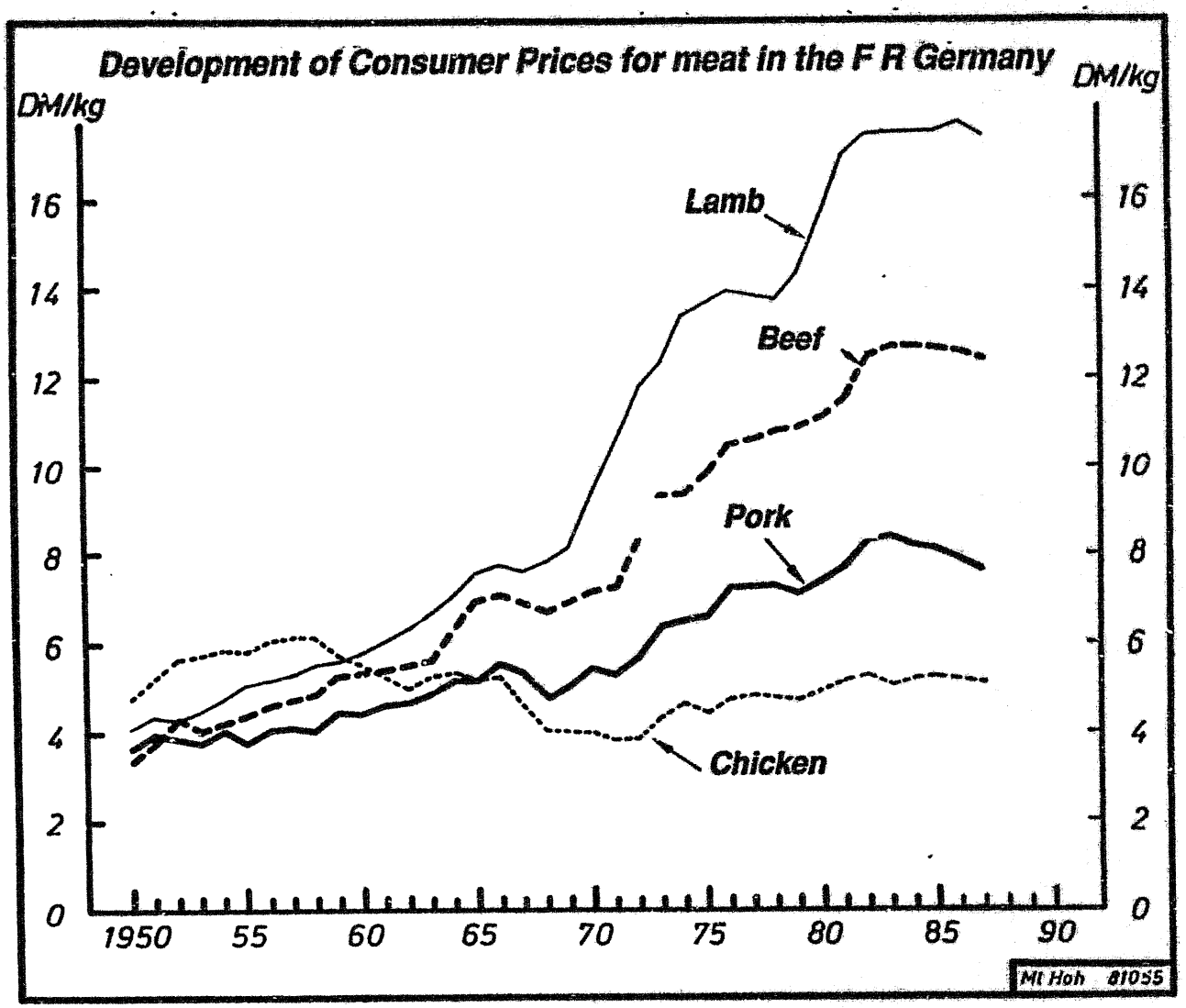
a) Projections of future trends in production.

b) Projections of future trends in prices.

c) Projections of future trends in demand.

This is an ascending order if measured by the proportion of "soft" information which goes into the forecast. This is to say that production forecasts contain relatively little soft information, as long as it can be relied upon that farmers strive for economic efficiency and that they do this by using proven methods of production. This assumption certainly applies to pork industries in both New Zealand and Germany, which makes production forecasts a very cost-effective solution. Price forecasts contain already soft elements to a certain degree, as exemplified by the shift in demand pattern shown in Figure 3, which has an obvious impact on prices, although such changing preferences are both difficult to control and difficult to predict. Finally, in case of a demand forecast, there are only two hard facts included, namely the physical need for certain products which determines the floor, or minimum level of

FIGURE 3


Development of Consumer Prices for meat in the F R Germany
DM/kg
DM/kg
16
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Lamb
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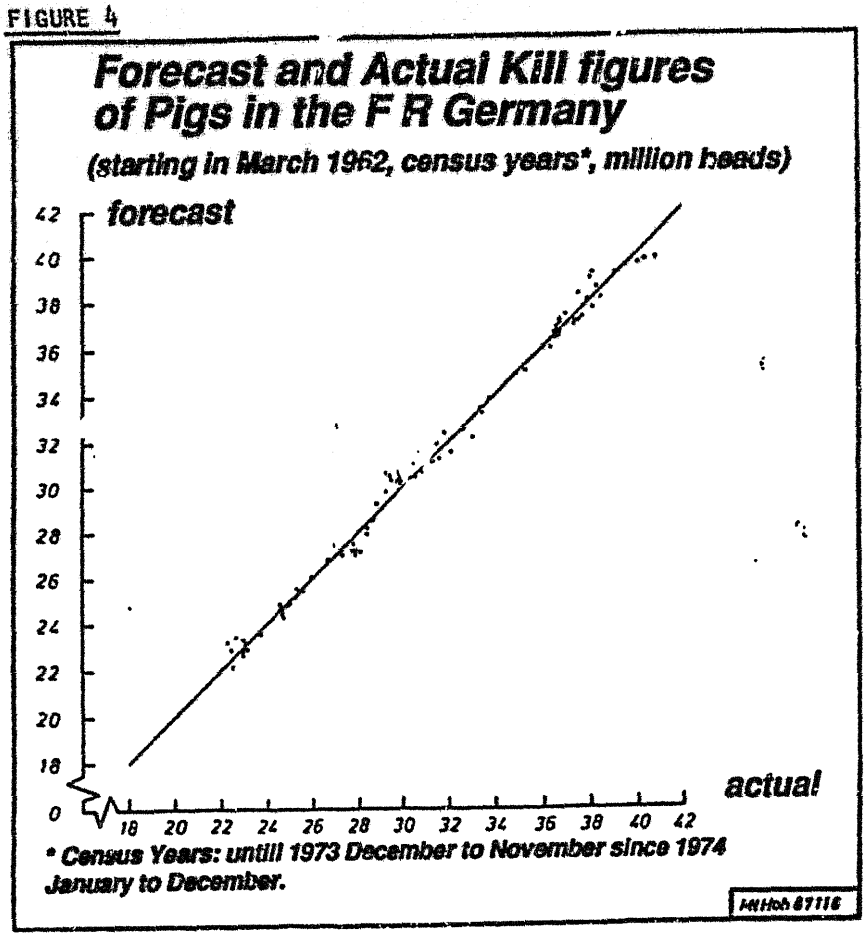
FIGURE 4


Forecast and Actual Kill figures of Pigs in the F R Germany
(starting in March 1962, census years*, million heads)
forecast
42
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actual
* Census Years: untill 1973 December to November since 1974 January to December.
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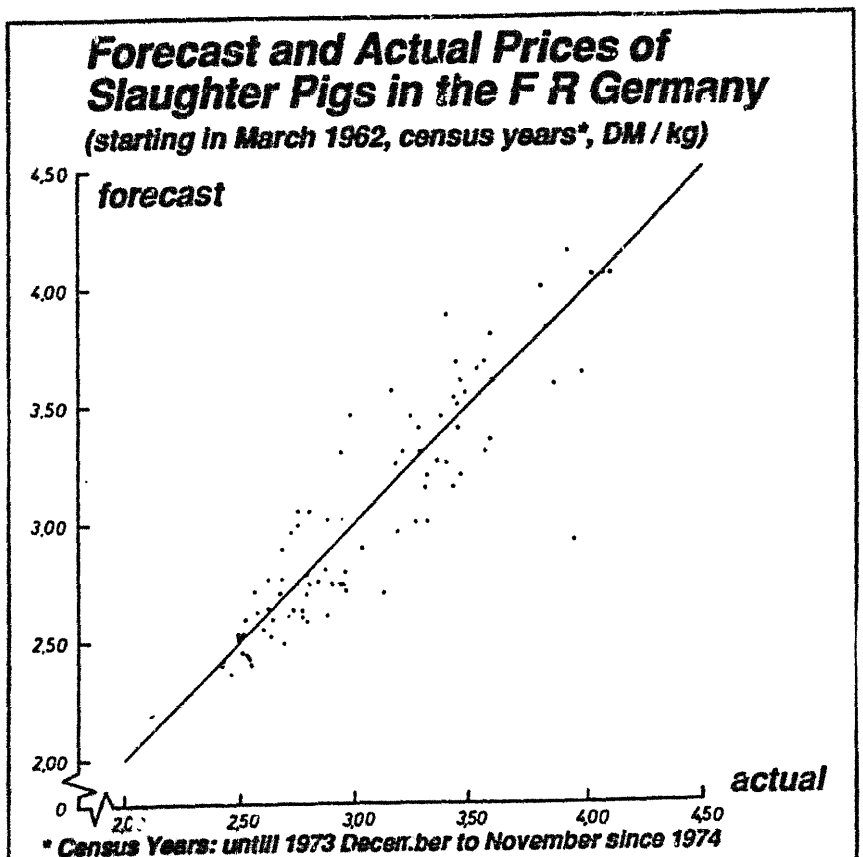
Forecast and Actual Prices of Slaughter Pigs in the F R Germany
(starting in March 1962, census years*, DM / kg)
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3,50
4,00
4,50
actual
* Census Years: untill 1973 Decem.ber to November since 1974

consumption, and the point of saturation which determines the ceiling, or maximum level of consumption. The span between both extremes, however, may be very broad at times and any estimate of a more specific character will have to deal with factors which are heavily influenced by subjective views and perceptions. This does not say, of course, that it is technically impossible to project prices or demand. The point to be made is rather that the latter two forms of projections require a much broader data-basis, and much more sophisticated models than the first one. These requirements are inclined to lead to a considerable increase in expenditure, which makes the cost-benefit aspect more likely to become subject to public scrutiny.

Both of the pork industries used as an example, now enjoy the situation of being fairly flexible, and of operating in markets where demand exceeds domestic production. Hence in both cases it makes good sense to concentrate on short-term production forecasts serving the purpose of allocating imports in quantity and time, as well as to emphasize or de-emphasize advertising and promotion. Costs are hidden in overheads in both cases, and although no figures are available, it is probably not unrealistic to assume that these costs used to be marginal as compared to other marketing expenditures. Differences in the organizational structure in both industries apparently reflect the difference in industry size, especially if this is measured by the number of participants.

The different forecasting approaches, however, are more likely to reflect historic rather than economic realities. Thus, forecasting in the Federal Republic began at a time when little attention was paid to the idea of producer panels, so that this option had never been seriously considered. Here, New Zealand has the advantage of having used panels from the early beginning, and the experiences gained through this exercise may well be of interest for other industries operating under similar conditions. German expertise in turn, may be of help when it comes to assessing the validity of econometric models and the setting of parameters. Consequently, some cross-fertilization in regard to forecasting techniques could benefit both of the above-mentioned industries.

REFERENCES

Boeckenhoff, E. and Pflugfelder, R. (1988). Vorausschau auf den Schweinemarkt. Agrarwirtschaft, Vol.37, No.10, pp 323-327.

Boeckenhoff, E. and Pflugfelder, R. (1989). Marktprognosen bei Schlachtschweinen. In: Handbuch der tierischen Veredlung. Kamlage (ed.), Osnabrueck (to be printed soon).

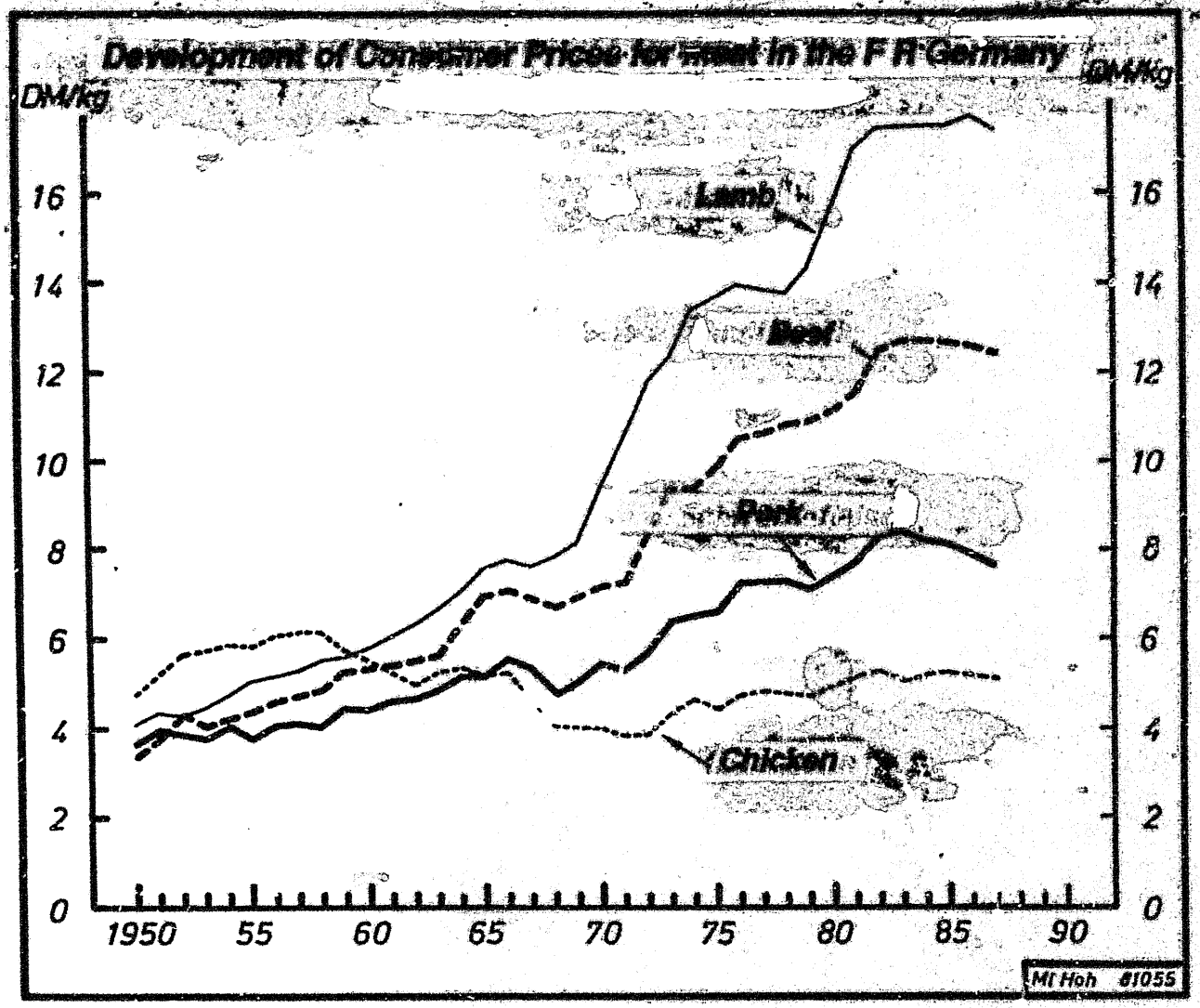
Kneebone, J. (1987). Politics and Agriculture. In: Rural New Zealand - What Next? L.T. Wallace and R. Lattimore (ed.), Ch.18, AERU, Lincoln College, Canterbury.

Lindner, B. (1987). Toward a Framework for Evaluating Agricultural Economics Research. The Australian Journal of Agricultural Economics, Vol.31, No.2, pp.95-111.

New Zealand Pork Industry Board (1987). Annual Report.

Plate, R. and Bockenhoff, E. (1961). Methods of forecasting pig meat production in O.E.C.D. member countries. Publ. by the Organization for Economic Cooperation and Development, Paris.

FIGURE 3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12
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Lamb
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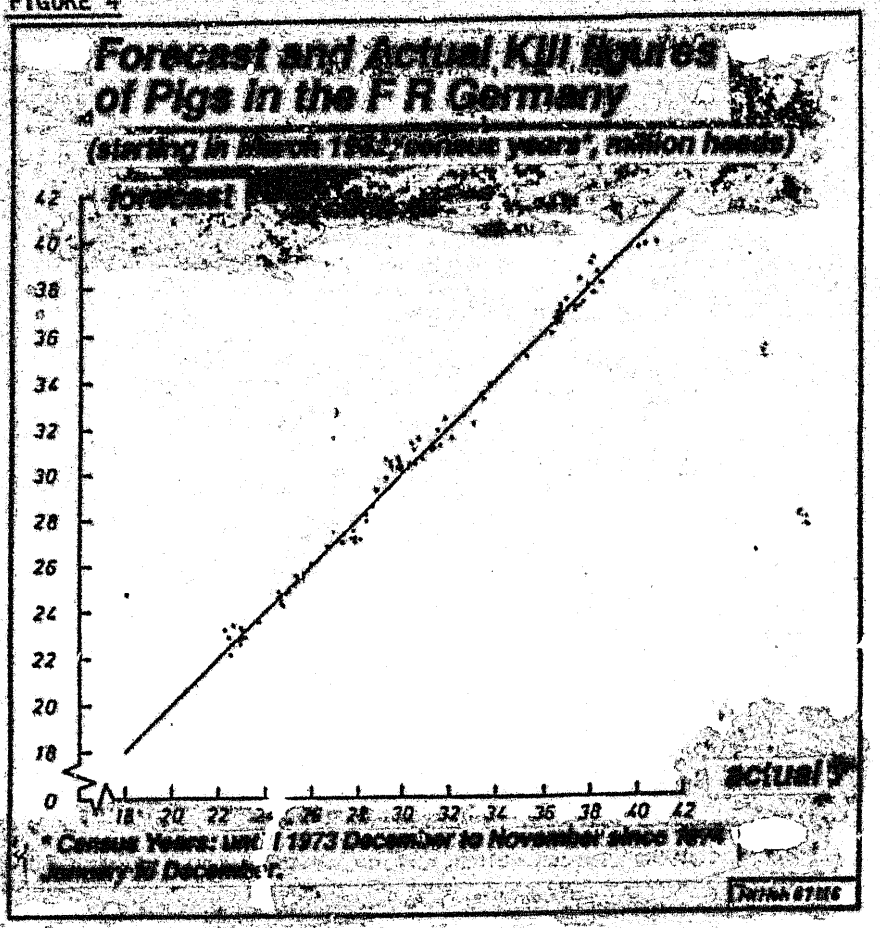
FIGURE 4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* Census Years: until 1973 December to November since 1974 January till December.

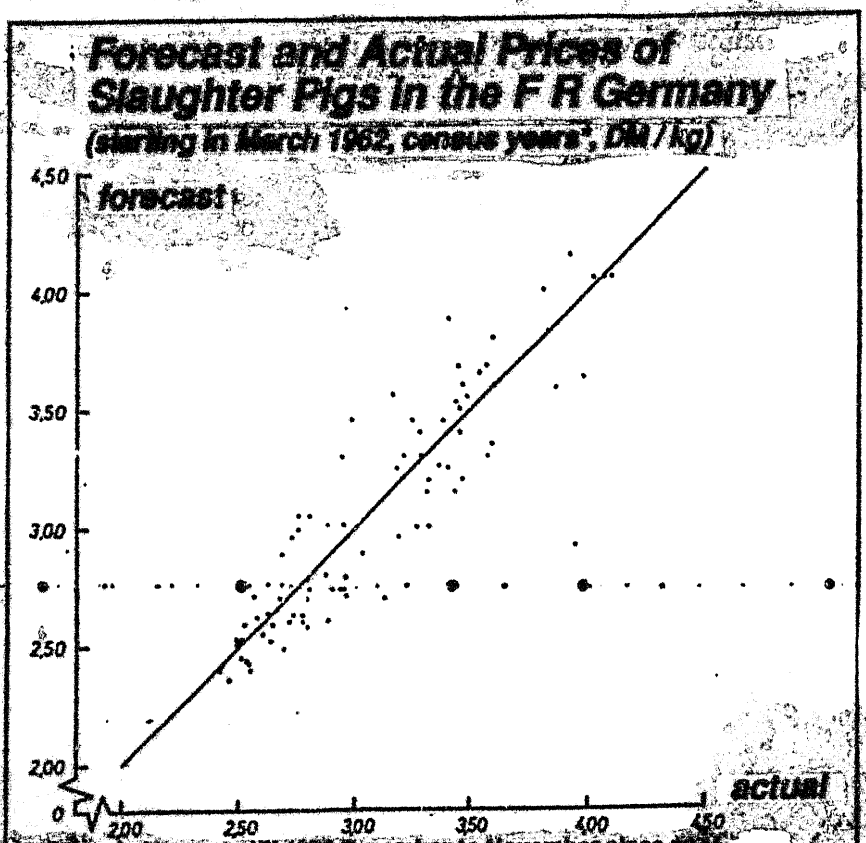

Forecast and Actual Prices of Sleughter Pigs in the F R Germany
(starting in March 1962, census years*, DM / kg)
forecast
actual
4,50
4,00
3,50
3,00
2,50
2,00
0
200 250 300 350 400 450

FIGURE 2

Forecasting the Amount of Pigs For Slaughter
(simple version)

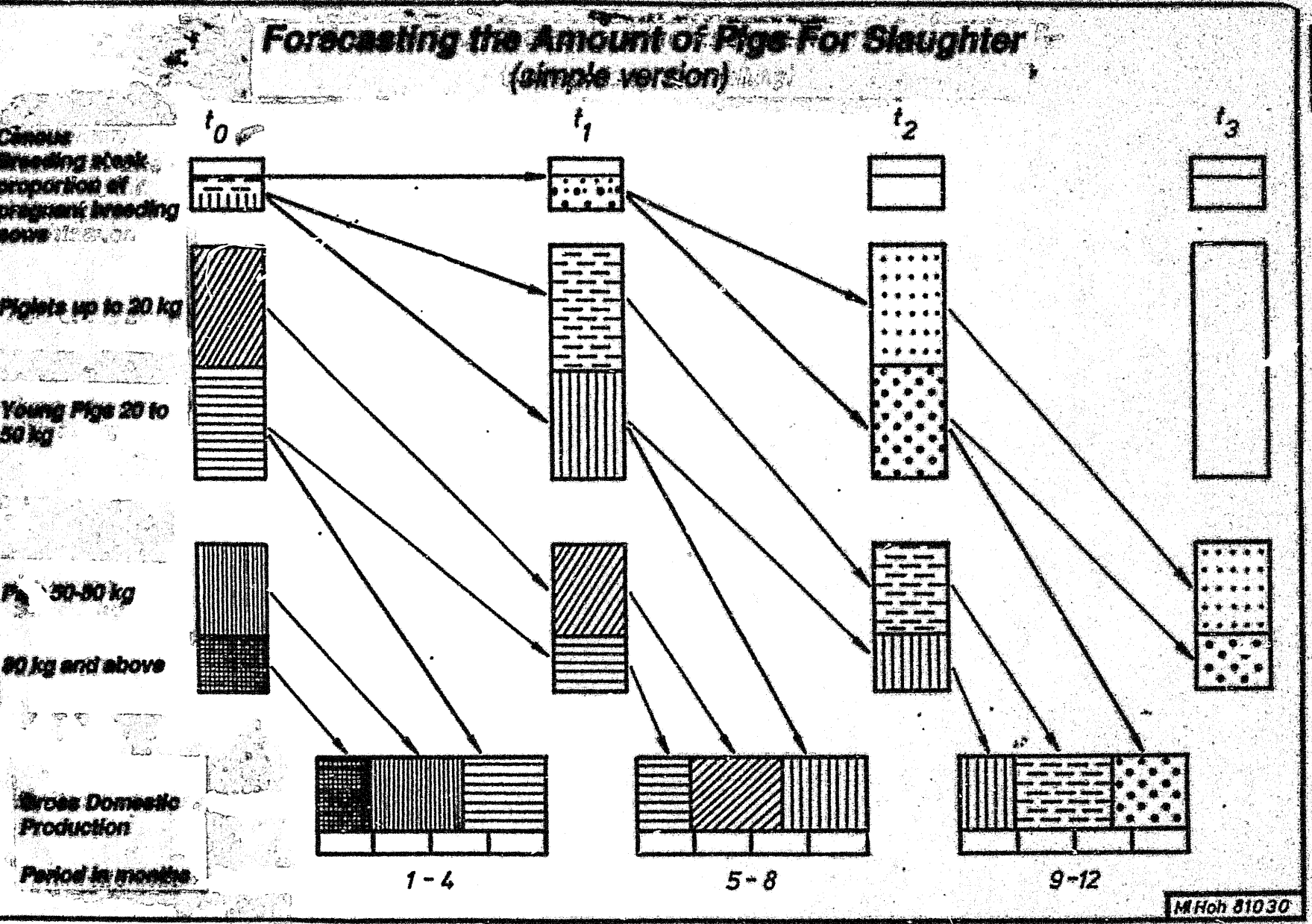
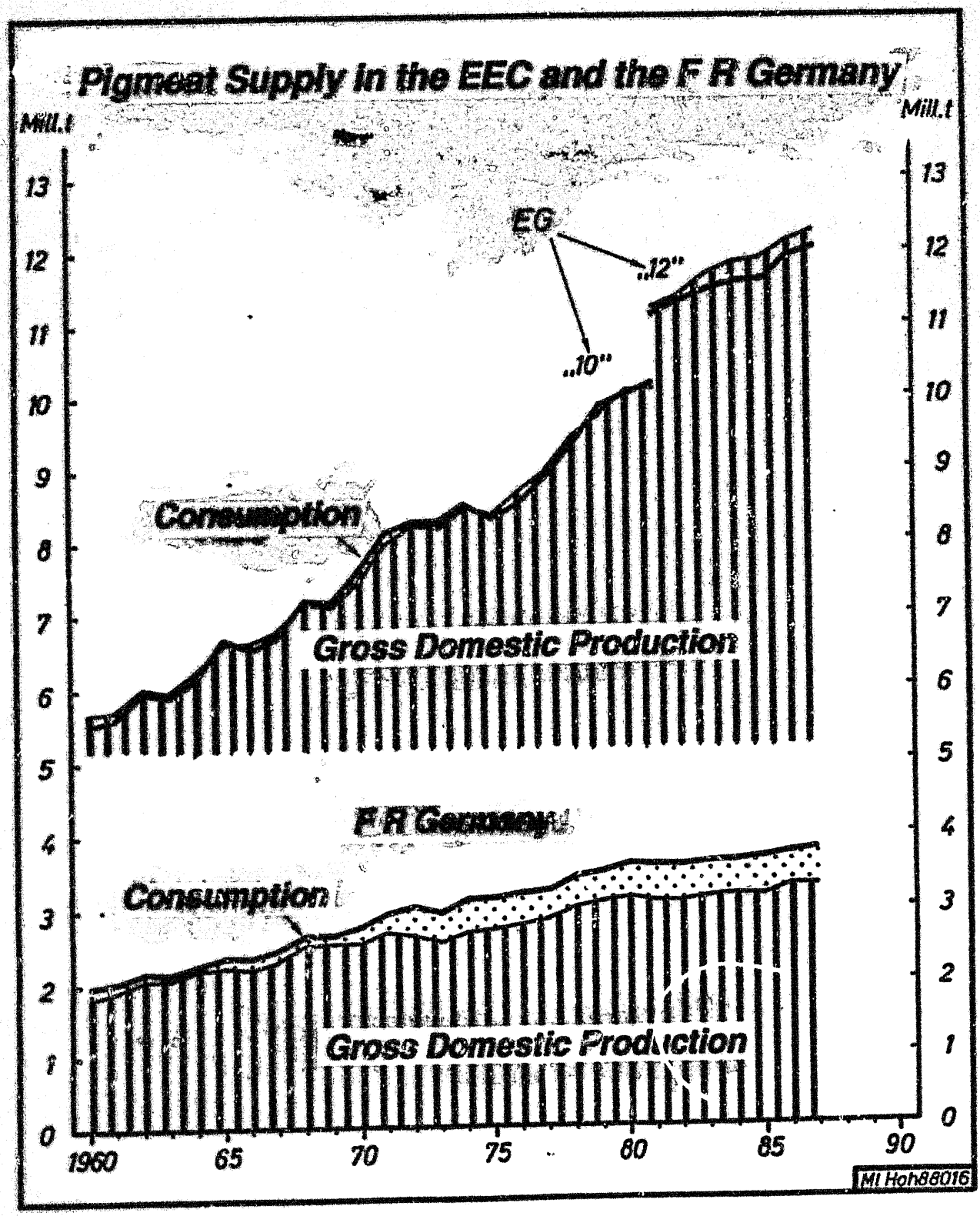


FIGURE 1


Pigmeat Supply in the EEC and the F R Germany
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„12"
„10"
Consumption
Gross Domestic Production
F R Germany
Consumption
Gross Domestic Production
1960
65
70
75
80
85
90
MI Hoh86016