

Principles of Future Payment of Pigs

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SUMMARY: By using the statistical software programme SAS, it is possible to build a model of calculation to establish formulae for estimating the value of the pig carcasses. The formulae use classification measurements and can be used for calculating payments. The purpose is to pay as much as possible for the pigs relative to their value. The model of calculation is based on a representative selection of pigs and products.

The impact on payment of potential new classification measurements can be tested in the model.

INTRODUCTION: Introduction of the Classification Centre (CC) in the Danish slaughterhouses permits a more detailed classification of the carcasses. The CC measures the thickness of fat and meat in all parts of the carcass. The lean meat contents of the entire carcass, as well as parts such as fore-end, middle, and ham, are calculated based on the CC measurements and the weight of the carcass.

Future expansion of the CC is expected to also measure meat quality. Classification will then become even more detailed.

The more detailed classification can then form the basis of improved payment methods relative to the value of the carcass. This will make payment more suitable as a tool of raw material management. Besides, payment to the producers would be more equitable.

When including additional classification measurements in the calculation of payment, it will become increasingly difficult to establish the weighting of each individual classification measurement as they will be interdependent.

The current project attempts to establish a method of calculation of the value of the carcass and of establishing methods of payment commensurate with the value of the carcass.

As of now the project is still in progress. Completion is expected during the summer of 1991.

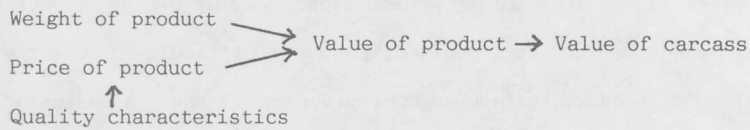
MATERIALS AND METHODS: The Danish Meat Research Institute has completed a study to establish the value of pig breeds: Danish Landrace, Yorkshire, Duroc, and Hampshire. The present project uses data from that study to test methods of calculation of the value of the carcass and of establishing methods of payment. All data from the study have been transferred to the statistical software programme SAS.

Due to their composition, the results of the data are not suitable for direct application to new methods of payment calculation. The present project treats development and test of principles and methods of payment calculation.

The value of each carcass is calculated from the above data. The basis of the calculation is weight and price of several products. The products have been chosen to represent the Danish pork production. The product prices have been determined in concert with the Danish slaughterhouses. The value of deviating quality of the individual products has been incorporated in the price determination. Quality characteristics have been determined for each product group for each carcass. Characteristics are colour, meat/fat distribution, pigmentation, etc.

For each carcass the value of the products has been calculated by multiplying weight by price. The value of the carcass is the sum of the value of all products. Figure 1 shows the method of calculation of the value of the carcass.

FIGURE 1. CALCULATION OF THE VALUE OF THE CARCASS



The value of the products and thus of the carcass can always be recalculated by changing the prices. Thus the system becomes dynamic.

The value of the carcass can now be compared to the classification measurements. By using statistical methods like stepwise regression, formulae can be established that estimate the value of the carcass through the use of the classification measurements so that classification data can be employed in the calculation of payment.

Figure 2 shows the construction of the formula of value in principle.

FIGURE 2. CONSTRUCTION OF THE FORMULA OF VALUE IN PRINCIPLE

$$\text{Value} = a \cdot x_1 + b \cdot x_2 + c \cdot x_3 \dots + k$$

Where value: Estimated value of the carcass

$x_1, x_2, x_3 \dots$: Classification measurements

$a, b, c \dots$: Weighting of the measurements in the formula

k : constant

Regression presupposes linear correlations between classification data and value of the carcass. Investigations of such linear correlations have therefore been included in the study. The easiest and most efficient way to do this is to study plottings of the value of the carcass and the individual classification measurements.

The formula of value will in general ensure the best possible correlation between the estimated value and the actual value of the carcasses. That means that the determination of the value by the formula will always carry some uncertainty for the individual pig. It is therefore interesting to study the consequences of a given formula on all pigs and on different groups of pigs. The correlation of the calculated value to the actual value, average deviation from the actual value, and the residual standard deviation (RSD) can reveal how accurate a given formula is.

For various reasons it may be desirable to attribute a higher or lower weighting to one or several measurements than those indicated by the statistical methods; i.e. change the value of $a, b,$ or c in figure 2. Such changes in formulae of value can also be evaluated with regard to the consequences for all pigs or different groups of pigs. This has also been tested.

Formulae derived in other ways can also be used to calculate the value of a carcass. For example, the present Danish method of calculating payment has been used and compared to the statistical formulae.

In order to study methods of testing possible future classification measurements, characteristics such as pigmentation, protein, and fat marbling have been included in the data. The characteristics have been measured according to the current classification, but by using them as if they were classification measurements it can be studied whether they can be advantageously included in the formula of payment. The result may contribute to the decision to establish new classification measurements.

RESULTS AND DISCUSSION: It has become apparent that establishing product prices is quite complicated when the formula include quality characteristics. Both sale prices and impact on sale prices by quality characteristics vary substantially from market to market and over time. Besides, it can be difficult to weight a characteristic of a product unit if the product is sold in bulk. It is therefore an advantage that the value of the carcass can be calculated quickly.

Different ways of calculating the value of the carcass can of course result in different formulae of calculation. Calculations with the current data indicate that the weighting of the quality characteristics greatly influences which classification measurements the formula should include. The general price level influences almost all the constant of the formula.

Whether future classification measurements like pigmentation, protein, and fat marbling should be included in the formula of value totally depends on the corresponding contribution of the quality characteristics to the product price and thus to the value of the carcass.

Generally, it appears that linear models are suitable for describing the value of the carcass based on classification measurements. Therefore regression analyses are appropriate. This might not always be the case. The weighting of some quality characteristics of the products might cause jumps in the value of carcass. Implementing two or more linear formulae (one for each jump) can in some cases solve the problem. In other cases more sophisticated models may be necessary.

The data used make it possible to establish linear formulae that yield a reasonable estimate of the value of the carcass based on the current classification measurements of the CC ($R^2 = 0.68$ and $RSD = 56$, mean = 1303). Future classification measurements may improve the formula to $R^2 > 0.80$, depending on the accuracy of the new classification measurements. Especially weight of parts, pigmentation and protein seems important.

The separation of the pigs into groups can result in large differences in the suitability of the formula of estimating the value. For example, it appeared that the current Danish way of calculating payment would pay much more accurately for the gilts than for the male pigs included in the data. Such discrepancies can be corrected by including sex in the formula of value.

CONCLUSIONS: It is possible to build a model of calculation which dynamically calculates the value of the carcass for a representative selection of pigs. Value of the carcass is based on a representative product selection. Value of the products is based on weight and price, where price is the dynamic quantity that is dependent on both quality characteristics and general market conditions.

By using regression models, formulae can be established that estimate the value of the carcass based on classification measurements. The formulae can be used in calculating payment to the producers.

The consequences of using alternative formulae for all pigs or for different groups of pigs can be calculated.

The impact of potential future classification measurements on the calculation of payment can be tested before developing classification methods.

The accuracy of the model of calculation is completely determined by: 1) the representative selection of the pigs, 2) that the products included reflect the actual production, and 3) that product prices are determined so that they reflect market conditions. If above three conditions are not met, then methods of calculating payment cannot expect to have a strong correlation to the value of use of the pigs.

Especially point 3 has caused problems, and further work needs to be done on methods to establish the value of the pigs before a final model of calculation can be established.

REFERENCES:

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