Selection Indices used in Germany

Horst Brandt

Introduction

To understand the different selection procedures used in Germany it is necessary to explain the structure of pig breeding and production. The commercial fattening pigs are either produced by traditional herdbook organisations or by commercial breeding companies. While in Bavaria 90 % of all fattening pigs are single crosses with Pietrain as sire and Landrace as dam, in the northern part of Germany about 90 % of all fattening pigs are three- or four-breed crosses with an F1 sow (Large White*Landrace) and a Pietrain or Hampshire*Pietrain crossbred terminal sire. The use of crossbred sows in Bavaria is increasing but still limited. The main reason is that the herdbook organisation in Bavaria is only serving about 30 % of the sow market while 70 % of replacement gilts are produced by the weaner producer themselves.

The herdbook organisations in Germany are selling F1-gilts and purebred boars and sows, mainly Pietrain boars. In 1995 a total of 20 640 Pietrain boars were sold with an average price of 1 120 DM (German marks). The Pietrain boar is used as terminal sire and to maintain the Pietrain populations. The commercial breeding companies are not selling any purebred breeding stock, their major income is from selling F1-gilts and terminal sire boars. In Table 1 the number of sows in the multiplier level and the number of crossbred sows sold are summarised.

Table 1: Number of sows in multiplier level and number of sows and boars sold

Company	Sows in multiplier level	F1-gilts sold	Terminal sires sold
Deutsche Pig	22.160	129.956	1.944
BHZP	28.319	124.316	2.449
Schaumann	6.220	38.623	307
other commercial companies	10.610	69.983	721
herdbook organisations	??	107.821	7.520

Table 1 clearly shows that the market for sows is dominated by commercial breeding companies, while the boar market is dominated by the herdbook organisations. The number of boars sold by commercial breeding companies is slightly decreasing because of an increasing amount of artificial insemination. Although the number of boar sales will further decrease, AI is highly recommended by commercial breeding companies. Special

selection programs for AI-boars, so called TOP GENETIC programs, are in place to further increase the production level by selection.

Apart from the different market products for commercial companies and herdbook organisations, the compulsory commercial product evaluation of fattening pigs (growth and carcass traits) and sows in weaner production (litter size) is the driving force for different selection procedures used. All commercial breeding companies and herdbook organisations have to take part in one of these tests every three years.

Traits in breeding goals and their economic values

Under the current market conditions in Germany for commercial fattening pigs the following traits are of interest:

> **Average daily gain**
> **Feed conversion ratio**
> **Meat content**
> **Meat quality**

Direct economic weights can be derived for the first three traits in the list. For meat quality no direct payment system is in place but a minimum meat quality is required. At the moment the market will tolerate an amount of PSE meat of about 10 to 15 % of all slaughter pigs. With increasing amounts of PSE penalties for PSE pigs could become the consequence. Thanks to the detection of the MHS (malignant hyperthermia syndrome) gene and its relation to meat quality in nearly all breeding companies and organisations, the dam lines are homozygote stress resistant and with any terminal sire (stress resistant or not) all progeny will at least be heterozygote and will meet the meat quality requirements.

For average daily gain under the current economic conditions an economic value of 0.07 DM (German Marks) per gram can be calculated. This economic value calculated as marginal gain per unit increase arises mainly from the higher number of slaughter pigs fattened per year with a constant number of fattening places and a constant slaughter weight. For feed conversion ratio a marginal gain of 36 DM per unit reduction in feed conversion ratio can be calculated which is directly dependent on the market price per kg of food.

The price for slaughter pigs in Germany is based directly on the meat content and the slaughter weight. Therefore the economic value can be calculated out of the payment system for slaughter pigs. In Figure 1 the current payment system in Niedersachsen in Germany (the payment systems in the other states are very similar) is shown as deviation from a base price at 55 % meat content (FOM measurement). The base price per kg slaughter weight itself is undergoing a lot of seasonal and regional fluctuations while the deviations from the base price are fixed. The figure shows that the deviation from the base price is not a linear function and therefore the economic value for FOM-meat content is dependent on the mean in the population. In Table 2 the economic values for meat percentage for different payment systems and different means are calculated

2

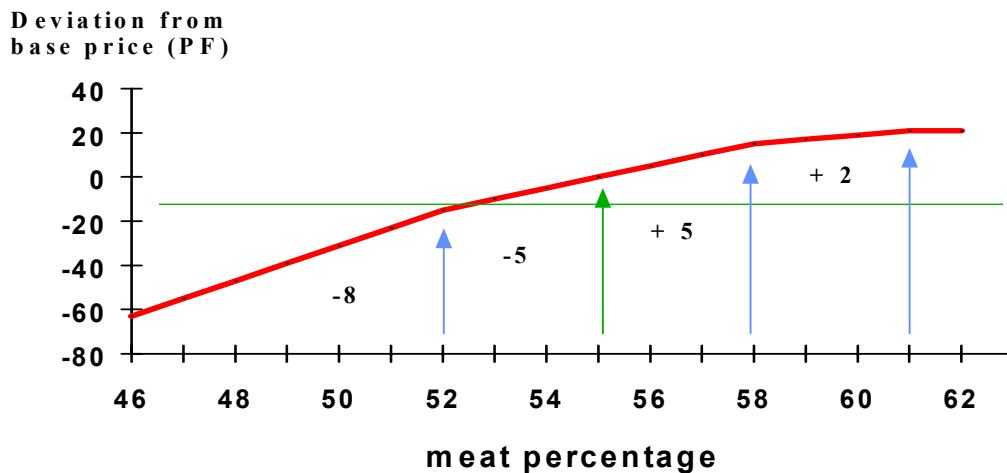**Figure 1: Payment System for Meat Percentage in Niedersachsen (Germany)**

Table 2: Economic values for meat percentage for different payment systems and different means

State	55 % FOM	56 % FOM	57 % FOM
Niedersachsen	5.03 DM	4.24 DM	3.32 DM
Westfalen new	4.56 DM	3.94 DM	3.24 DM
Westfalen old	5.64 DM	5.10 DM	4.40 DM

The results of Table 2 show that with an increasing mean in meat percentage the economic value decreases. This is mainly an effect of the upper limit for meat percentage where no extra money is paid for higher meat contents.

At the weaner production level the number of piglets weaned per litter is the most important trait. Under the current economic conditions an economic value of 7.50 DM for number of piglets weaned is derived. This value is calculated on the base of a slaughter pig.

Besides these above mentioned traits some other economically important traits like leg soundness, teat quality, longevity of sows or fattening losses have to be mentioned. For some of these traits only subjective scores are available which are not included in an overall economic index but are used for breeding decisions.

Economic values used in breeding goals

As an example of all the different economic values used in their breeding goals the herdbook organisations of Bavaria and Westfalen and the commercial breeding company BHZP are discussed here. In Tables 3 to 5 the traits in the breeding goals with their economic values are summarised.

Table 3: Traits in the breeding goal and economic values (DM per unit) in Bavaria

Trait	Sire Lines	Dam Lines	Commercial Value
Daily gain	0.15	0.12	0.07
Feed conversion	0.00	-36.00	-36.00
Meat percentage	6.00	4.50	4.25
Meat quality	1.50	1.50	0.00
Piglets born alive	0.00	7.50	0.00

The commercial value index in Bavaria is calculated with the current economic values for the traits in the breeding goal. The higher economic value for daily gain in sire lines is used with the aim to improve feed conversion ratio over the correlated response. The reason for this decision is that in the sire lines a decreasing feed intake was observed in the past. Several studies showed that this decrease could be avoided if direct selection for food conversion ratio was abandoned and a higher economic value for daily gain was used. The reduction in feed intake was mainly a result of high negative genetic correlations between feed intake and back fat and meat percentage.

The economic value for meat quality in Bavaria and in Westfalen is a strategic value which has been derived from restricted selection indices with the objective of keeping meat quality constant in sire lines and slightly improving meat quality in dam lines. In Bavaria a meat quality index including pH-values and colour is used while in Westfalen a conductivity measurement is included. In Westfalen the economic values for meat percentage are in the discussion and will be changed in the near future according to the above shown true economic values for FOM meat percentage.

Table 4: Traits in the breeding goal and economic values (DM per unit) in Westfalen

Trait	Pietrain	Hampshire* Pietrain	Dam-lines
Daily gain	0.06	0.09	0.12
Feed conversion	-36.00	-36.00	-40.00
Meat percentage	5.00	5.00	5.00
Meat quality	2.00	2.00	2.00

The two herdbook organisations more or less use indices for buyers of breeding stock to be used in pure and crossbred production. The primary aim is not focussed on the final slaughter pig. Within all commercial breeding companies the indices used in their sire and

dam lines are primarily focussed on the final product. These companies are not selling any purebred breeding stock. The driving force for the economic values used are the current economic conditions but also the comparison with other final products from competitive products which are done in the above mentioned commercial product evaluation. It could be seen in the past after the publication of such comparisons that commercial breeding companies totally replaced their sire lines or changed their breeding goal.

The economic values for sire and dam lines in BHZP for daily gain and feed intake are derived from restricted selection indices with the aim to maintain the level of feed intake in the dam lines and a slight improvement in the sire lines. A further increase in daily gain will then be more a result of a better feed conversion ratio. Within most of the breeding companies meat quality is only controlled by MHS-status. First trials with stress resistant sire lines are done in breeding companies and the herdbook organisations. With totally stress free slaughter pigs a further reduction of PSE level and a reduction in fattening losses are expected.

Table 5: Traits in the breeding goal and economic values (DM per unit) in BHZP

Trait	Sire-lines	Dam-lines
Daily gain	0.10	0.14
Feed intake	0.10	-0.40
Meat percentage	4.60	4.20
piglets born alive	0.00	7.50

Genetic progress observed

In summary it could be seen that there was a positive genetic progress for all traits in the breeding goal observed for the breeding organisations and for the breeding companies (when published). As an example the genetic progress for some traits with a non linear gain over years are shown in figures 2 to 5.

In Figure 2 for the German Landrace (DL) after 1992 no further genetic progress for meat content was made because of the selection on MHS-status. In Figure 3 the high genetic progress at that time for meat quality is shown. These trends can be explained by the negative genetic relationship between meat content and meat quality. Within the Pietrain there is only a very small genetic progress in meat quality. Up to 1992 the Pietrain population could be seen as homozygote stress sensitive with a very poor meat quality and low variation. In recent years some heterozygote boars and sows have been used so some improvement in meat quality can be seen.

Figure 2: Genetic Progress for Meat Percentage in Bavaria for Landrace and Pietrain
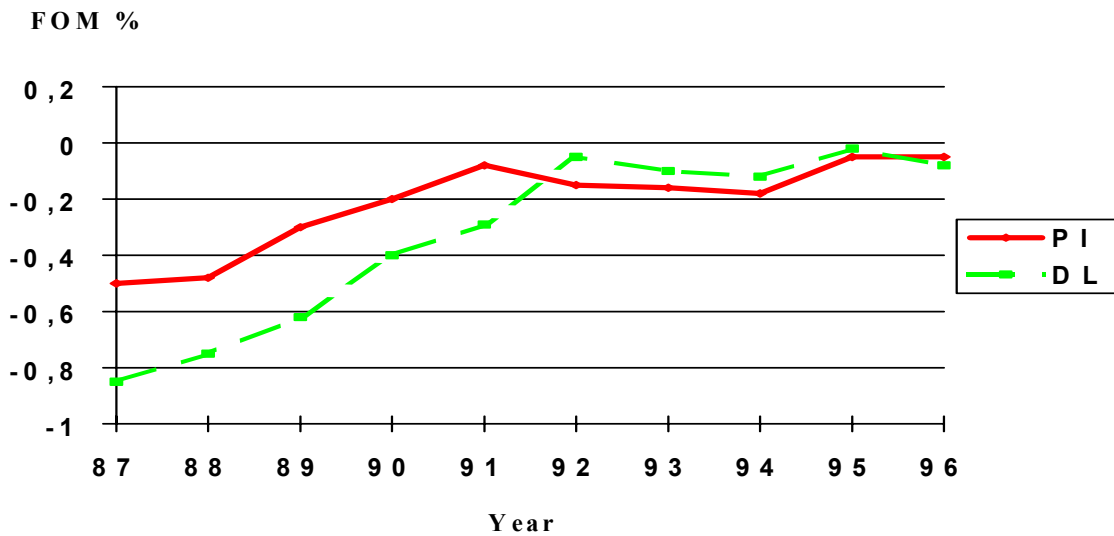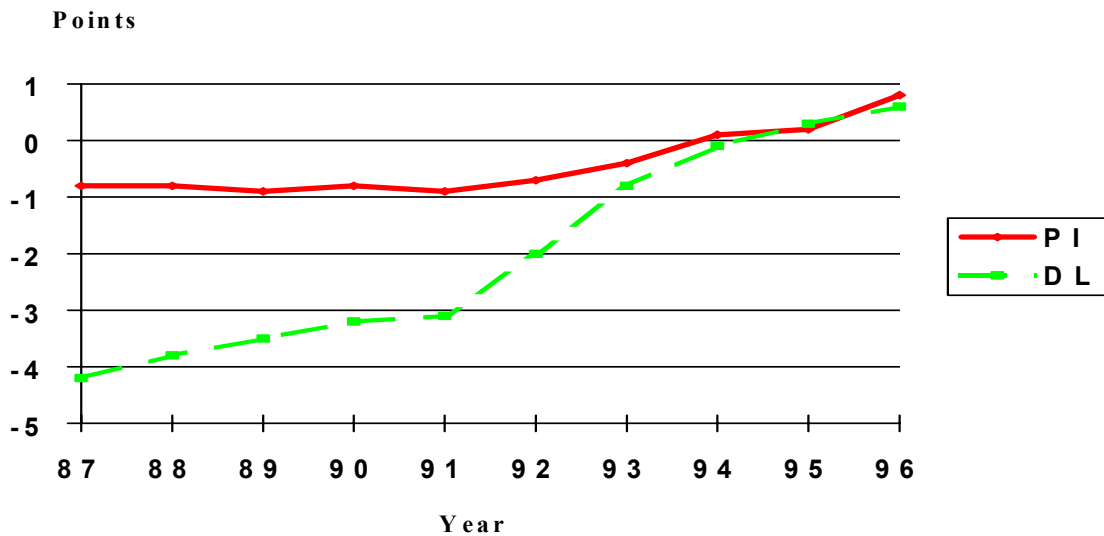

Figure 3: Genetic Progress for Meat Quality Index in Bavaria for Landrace and Pietrain

For daily gain (Figure 4) the MHS status of the population does not show any influence on the genetic progress for the German Landrace. The higher economic value for daily gain in the Pietrain which is used in the last two years seems to increase the genetic progress. Another reason for the increasing genetic progress in both populations is the use of a BLUP evaluation system in Bavaria since 1994.

6

Figure 4: Genetic Progress for Daily Gain in Bavaria for Landrace and Pietrain
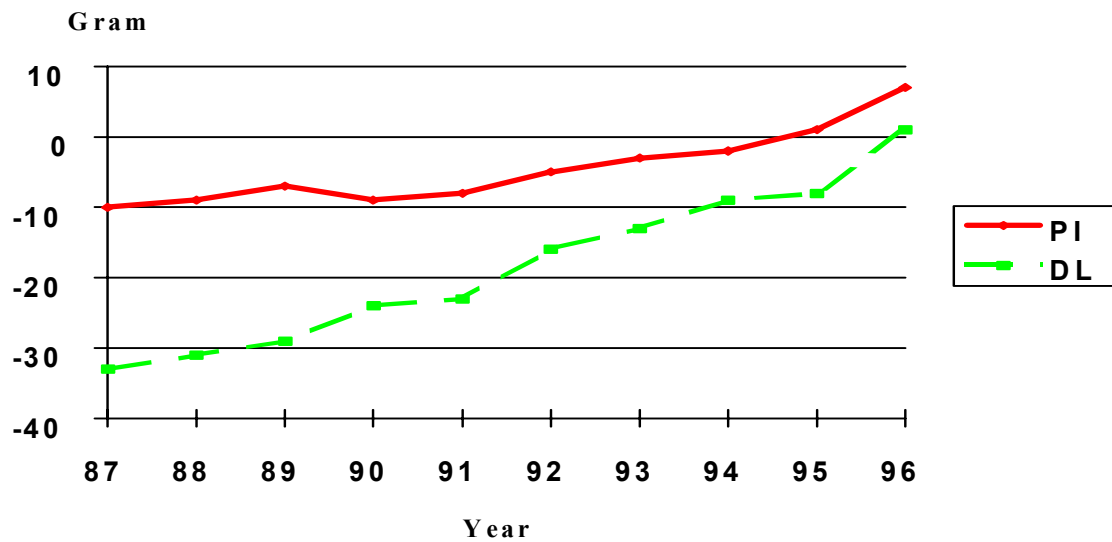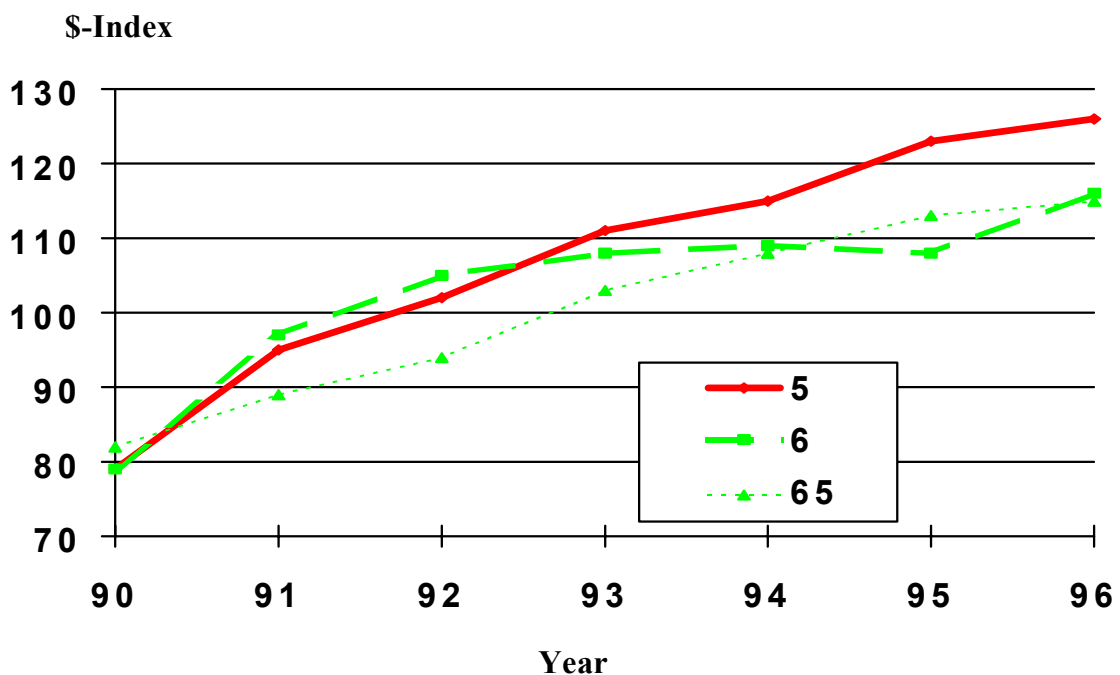

Figure 5: Genetic Progress for $-Index for Sire Lines of BHZP

In Figure 5 the genetic progress for the sire lines in the BHZP are shown. For the Hampshire line (line 5) a constant improvement for the $-Index can be observed. For the Pietrain line (line 6) from 1992 to 1995 a lower or no progress can be seen. In 1991 and 1992 the company bought two new nucleus farms with a Pietrain population which was mixed with the existing nucleus population. These introduced animals did have a lower genetic level in meat content, which reduced the $-Index value. Since 1995 the selection for meat percentage started to increase the genetic progress for the $-Index again.

The line 65 is the Hampshire*Pietrain terminal sire line which shows the expected time lag of one generation in the genetic level. However, with 100 % artificial insemination in the nucleus and multiplier level, the AI-boars are used at the same time in the nucleus and for the production of terminal sire boars. So this time lag has its reason mainly in the replacement strategy on the sow side. The replacement sows for the production of line 65 boars are produced within the multiplier farm and do not come from the nucleus herd.