



International comparison of pig production costs 2022

Results of InterPIG

Robert Hoste and Mariël Benus

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The cost of pig production in Northwest Europe in 2022 amounted to €2.03 per kg hot carcass weight. This was an increase of 26% compared to 2021. The main reason was the rising feed cost. Pig production in the Netherlands had just above average costs compared to neighbouring countries with €2.08 per kg. In piglet production it had a cost advantage compared to e.g., Germany, however, this advantage did not apply to finishing. Non-European countries Brazil and the USA had some 20% lower production costs than European countries. Findings come from InterPIG, an international network of experts in the economy of pig production in 18 countries with 20 years of experience in harmonised cost comparison.

Key words: pigs, cost of production, international, manure disposal costs, supply chain cooperation

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P.O. Box 29703, 2502 LS The Hague, The Netherlands, T +31 (0)70 335 83 30,
E communications.ssg@wur.nl, <http://www.wur.eu/economic-research>. Wageningen Economic Research is part of Wageningen University & Research.



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Erratum for Report 2023-144

On page 14 in the last paragraph there is an incorrect number for Belgium, which has been changed from 2.78 to 2.87.

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Preface

The Dutch pig production operates within the context of the European and global markets. To gain insight into its competitive position, an international cost comparison was conducted based on the data of the international InterPIG network, which includes members from various countries, including Wageningen Economic Research. InterPIG has been producing several annual comparisons of pig production costs, allowing for a better understanding of differences among countries. Since zootechnical performance, economic efficiency, and sustainable production are interlinked, this report not only provides valuable insights into the competitive position of countries' pig sectors in economic terms but also into differences in contributing factors for sustainable pig production.

The international forum InterPIG has existed now for 20 years, after its start in 2003. A lot of experience was built up in the methodology of data collection and cost calculation and comparison. Members exchange information on their national pig production, which leads to a better understanding of reasons for differences among countries. We are happy to have joined this group from the very beginning.

We thank the companies involved in the Dutch company network for their financial support: ABAB, Agrifirm, Ceva, DAC Zuid-Oost, Hendrix Genetics, Rabobank, and Westfort Vleesproducten. Yet, to be clear, they have had no influence on the input data or outcomes.



Ir. O. (Olaf) Hietbrink
Business Unit Manager Wageningen Economic Research
Wageningen University & Research

Summary

S.1 Key findings

Cost of pig production in European countries in 2022 varied from €1.86 (Denmark) to €2.89 (Italy) per kg hot carcass weight (Figure S.1). Compared to the other European countries in InterPIG, the Netherlands scored average, with €2.08 per kg. When compared with a selected group of countries, including Germany, Denmark, Belgium, France and Spain, the Dutch cost position can be seen as relatively high (see Section 2.1). Denmark and France had the lowest production cost in 2022, which can be attributed to a relatively large domestic feed production with lower feed prices. Italy, Great Britain, Sweden, and Finland were amongst the most expensive producers in this group for various reasons. Italy's high costs are mainly due to the high slaughter weight, while for Great Britain it is caused by high feed prices. For Sweden the high building and capital costs were the main reason, and for Finland both welfare requirements and relatively small farms contributed to the high costs. The Netherlands has a high zootechnical performance, but feed costs are moderate and manure disposal costs are a relatively high burden. The Spanish pig sector is suffering a severe outbreak of Porcine Reproductive and Respiratory Syndrome (PRRS), resulting in high mortalities and consequently an increased cost of production.

The non-European countries in the comparison have lower costs than the European countries. Notably Brazil (Mato Grosso) had low costs, which were mainly caused by low feed prices, low building and labour costs and a high efficiency.

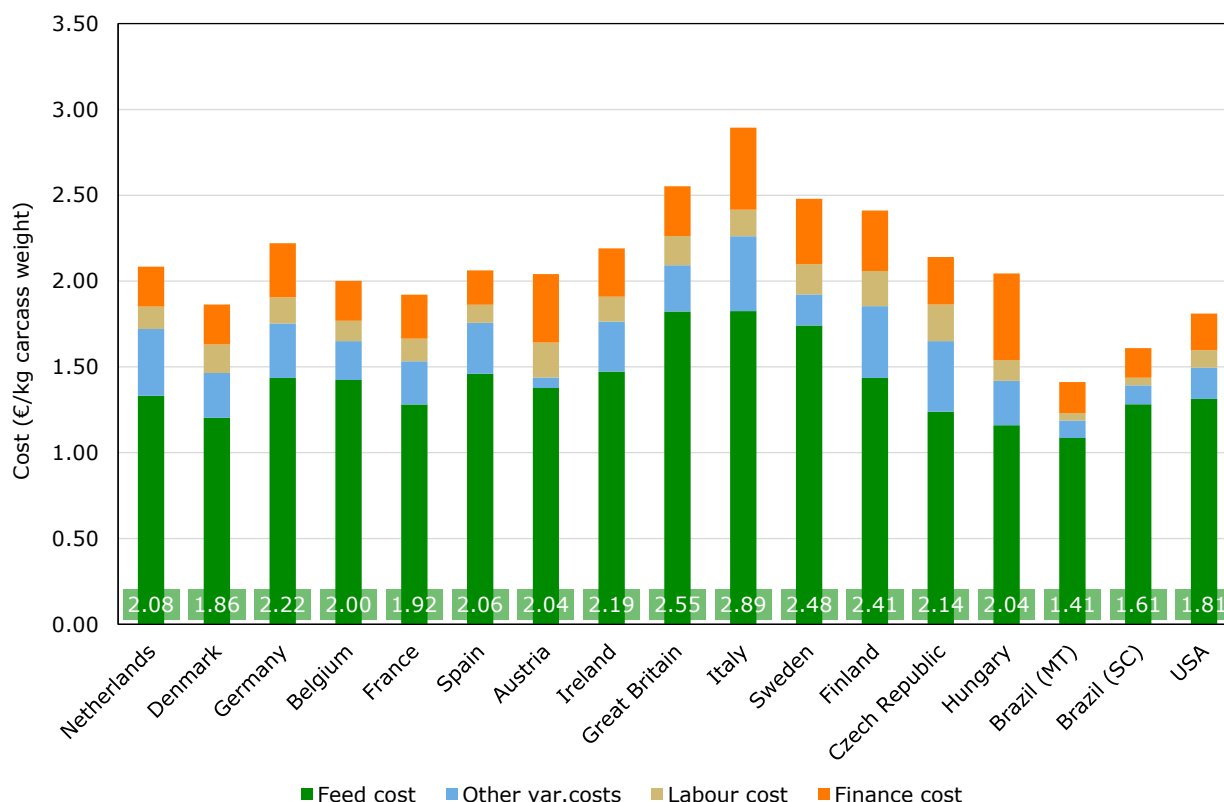


Figure S.1 Cost of production compared (€/kg hot carcass weight), split into cost categories, for a closed cycle pig farm in 2022, per country

Note: Brazil (MT) refers to the region of Mato Grosso; Brazil (SC) to the region of Santa Catarina.

S.2 Complementary results

Compared to 2021, the cost of production in 2022 has risen by 26% on average in Northwest Europe. This is especially caused by a strong increase in feed prices (see Section 2.2).

In Western Europe, the production cost of a 30-kg piglet in 2022 ranged from €68 in Denmark to €79 in Germany (Section 2.3). The relative cost advantage of Denmark, but also of the Netherlands, over Germany explain the substantial piglet influx into Germany from both supplying countries. Spanish piglet imports have a more temporary character, and are meant to compensate for losses caused by the PRRS. In finishing, the Netherlands had a cost disadvantage compared to e.g., Denmark or France, due to relatively high feed costs and high manure disposal costs. Based on an additional analysis of monthly feed prices, the feed price advantage in Denmark and France is likely to become smaller in 2023.

S.3 Methodology

InterPIG is a group of pig production economists from 18 countries, including Europe, the USA, Canada,¹ and Brazil. They have developed and standardised methods for data collection, parameter definitions, and cost comparisons over time. The cost comparison focuses on conventional pig production. In this report, the latest pig cost data (year 2022) is presented and analysed, see Annex 3.

¹ Canada didn't provide data for 2022.

1 Gaining insight into the production cost of pigs

1.1 Cost calculation to determine the competitive position

The cost of pig production fluctuates over time and shows differences among farmers and among countries. It influences the competitive position of the national pig meat production. Insight into production costs can support the search for cost reduction options and, thus, for improving the competitiveness. Moreover, an analysis of production costs also gives insight into the sustainability of pig production, as these are interlinked.

This analysis is based on the international InterPIG network, which currently has members in 18 countries. Wageningen Economic Research has been a member from the start in 2003. Each year, InterPIG produces a comparison of the cost of pig production on farm level. The analysis in this report focuses mainly on the competitiveness from a Dutch perspective.

1.2 Harmonised method necessary

To make an international comparison of production costs, a harmonised approach is necessary. This, however, is quite a challenge, as countries have different farming systems, farm sizes, data collection, and calculation methods, as well as different sector representations in common data sets. This is one reason for the existence of InterPIG. Main methodological assumptions used by InterPIG to calculate the production costs are:

- Farm-gate production costs: costs made on the farm are included, as well as (e.g.) direct subsidies. Levies and taxes in the abattoir are not seen as on-farm costs but taken into account as deductions of the sales price.
- Opportunity cost method. For inputs such as labour, own capital or farm-produced feed stuffs we take the current market value.
- Costs are expressed excluding VAT.

Further information on the network and used method is given in Annex 3.

1.3 Comparison

As the European market has a self-sufficiency degree of about 125%, the main sales volume from European producers goes to the European market, and this also counts for the competition. Therefore, a cost comparison for European countries is described separately in Section 2. The global cost comparison for both European and non-European countries is described in Section 3, but in less detail.

2 Production costs vary between European countries and over time

2.1 The 2022 production costs vary between countries

Section 2 shows the pig production costs in the following European countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Hungary, Ireland, Italy, the Netherlands, Spain, and Sweden. After the first comparison of all these European countries, a more detailed analysis is presented for a limited number of countries: the Netherlands and its main competitors, which are Denmark, Germany, Belgium, France and Spain. This group is referred to as 'selected countries'.

The cost comparison in Figure 2.1 shows a bandwidth of costs in European countries from €1.86 per kg hot carcass weight in Denmark to €2.89 per kg in Italy. The selected countries in Northwest Europe had a calculated cost of €2.03 per kg on average. The Netherlands is more expensive, with €2.08 per kg. The most expensive producers in this group are Italy, because of the typically high slaughter weight, Great Britain, and Sweden. Great Britain and Sweden have high feed prices and consequently high feed costs. Sweden also has high building and capital costs, due to high welfare requirements and rather small farms.

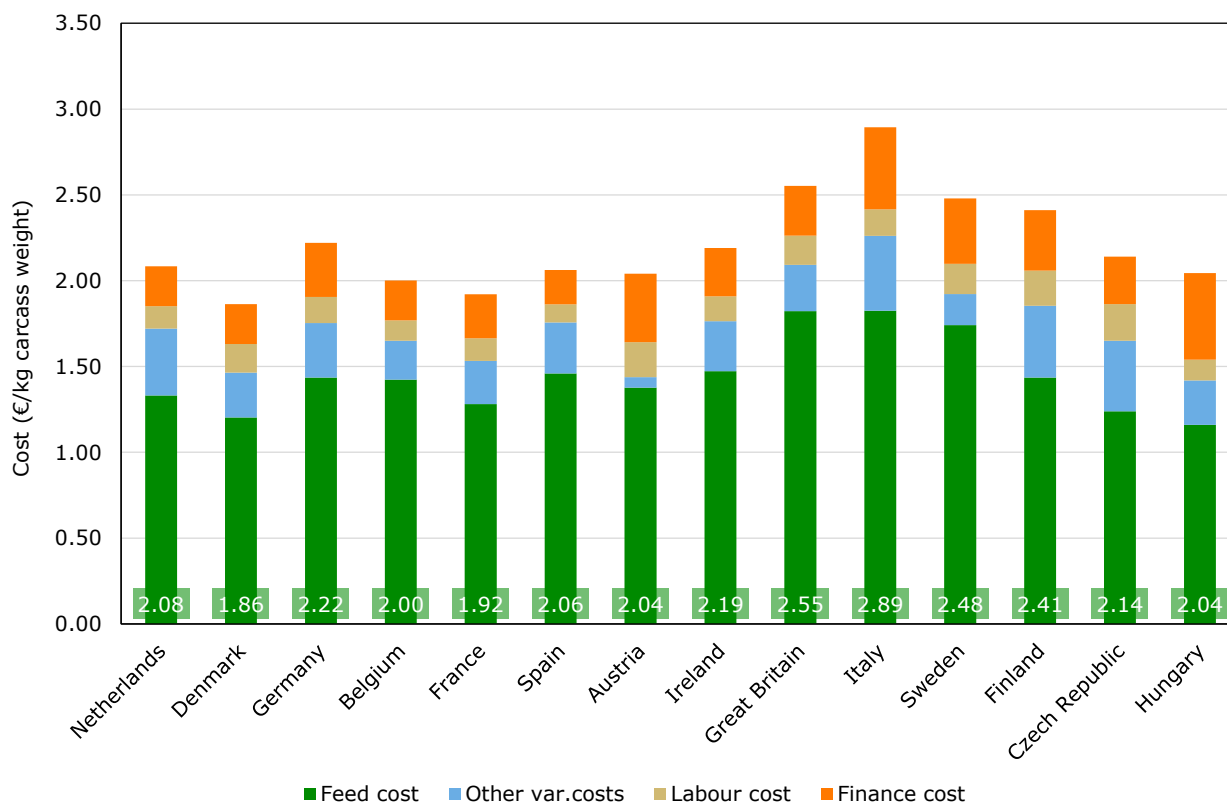


Figure 2.1 Cost of production compared (€/kg hot carcass weight), split into cost categories in European countries, for a closed cycle pig farm

Table 2.1 shows costs of selected countries, the Netherlands and its most important competitors, in more detail, split into four categories: feed, other variable costs, labour and other fixed costs (See Annex 1 for the data for all countries). Among these countries, Germany has the highest costs, resulting from relatively high feed costs, and high building costs. Denmark has the lowest production cost of these countries with a combination of very low feed costs and limited other variable costs. Also France has low feed costs, due to a large domestic crop production. Spain's cost is just below the Dutch costs; in earlier years the gap was bigger, but the country now suffers from a severe outbreak of PRRS.

Table 2.1 Costs in detail for some selected countries (€/kg hot carcass weight)

Cost category	Netherlands	Denmark	Germany	Belgium	France	Spain
Feed costs	1.33	1.20	1.44	1.42	1.28	1.46
Other variable costs	0.39	0.26	0.32	0.23	0.25	0.30
Labour costs	0.13	0.17	0.15	0.12	0.13	0.11
Building and capital costs	0.23	0.23	0.31	0.23	0.26	0.20
Total costs	2.08	1.86	2.22	2.00	1.92	2.06

Feed costs

The overall feed conversion ratio (OFCR), which measures the feed efficiency of the entire farm from farrow to finish, is the lowest in Denmark and the Netherlands (Table 2.2), which is an advantage in terms of environmental sustainability. The OFCR is the highest in Belgium, which is partly explained by the common ad libitum feeding regime in finishing. The OFCR not only reflects the feed efficiency per finishing pig or per sow, but also the sow performance: with a high sow production, the total sow feed is lower per finished pig.

Feed prices are in the range of €349-416 per tonne (total feed for closed cycle farm; Table 2.2). Denmark and France have the lowest prices due to the high supply of domestic crops. This benefit outweighs the advantages in the Netherlands of easy access to imports and good logistics, and use of feed by-products. In terms of feed prices, the Netherlands is positioned in the middle (See Section 4 for a discussion on feed prices and domestic production).

Table 2.2 Costs in detail for some selected countries (€/kg carcass weight)

Cost category	Netherlands	Denmark	Germany	Belgium	France	Spain
Average feed price (€/tonne)	401	349	399	414	360	416
Overall Feed Conversion Ratio ²	2.64	2.63	2.83	2.87	2.80	2.69

Other variable costs

Other variable costs comprise artificial insemination costs, replacement costs, health costs, energy costs, maintenance costs, levies, manure disposal costs, costs for production rights, and miscellaneous variable costs. These are higher in the Netherlands compared to other countries. This is primarily caused by significant manure disposal costs (Figure 2.2).

² The overall feed conversion ratio is calculated as the total feed consumption on a closed cycle farm, divided by the total output (live weight) of the farm.

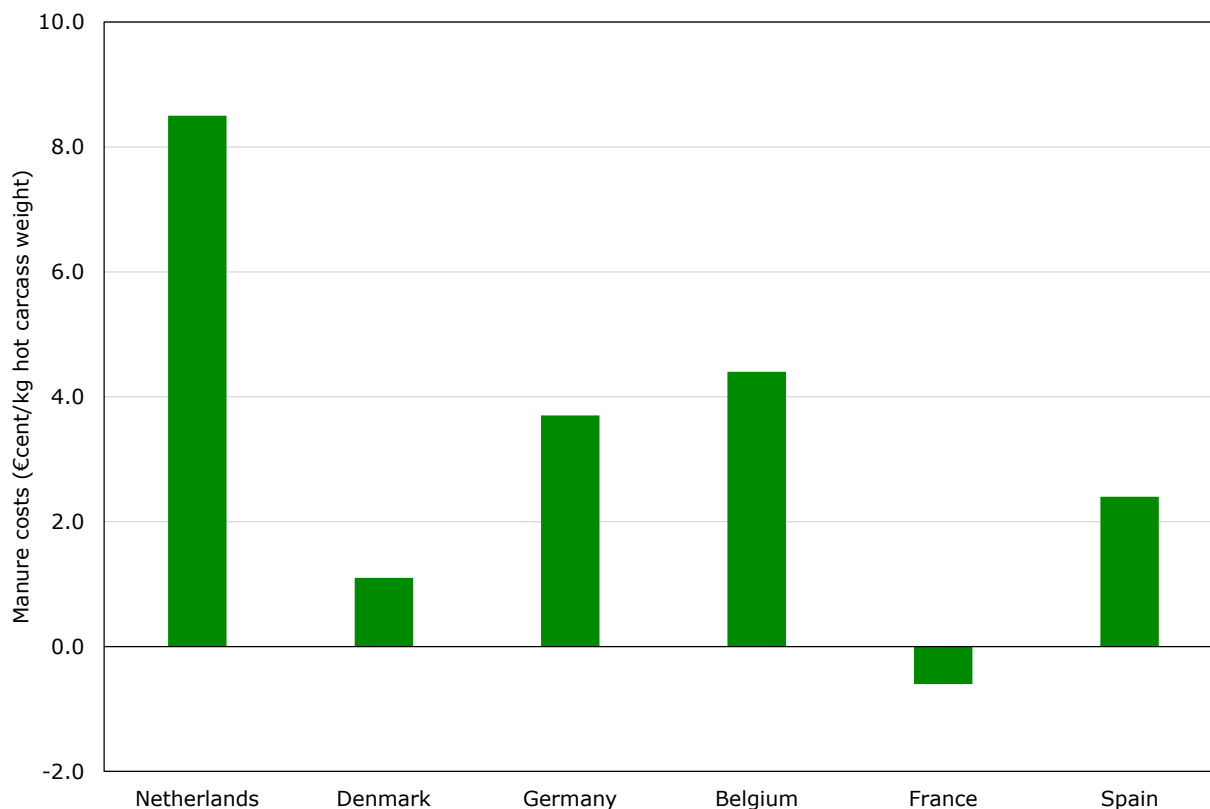


Figure 2.2 Average manure disposal costs (eurocent/kg carcass weight)

Labour costs

Labour costs cover both paid labour (employees) and non-paid labour (entrepreneur and family workers). Differences in labour costs among countries are due to variation in both labour input and labour tariff (hourly wages) (Table 2.3). Countries with high labour tariffs tend to have lower labour input, apparently encouraging labour efficiency. In the Netherlands, the high labour tariff (almost €28/h) is partly compensated by high efficiency (4.7 h/tonne carcass weight produced).

Table 2.3 Labour per sow, per slaughter pig, and per tonne hot carcass weight and labour costs in selected countries

Cost category	Netherlands	Denmark	Germany	Belgium	France	Spain
Labour per sow (h/year)	8.3	11.9	12.0	10.0	12.3	9.0
Labour per slaughter pig (h)	0.20	0.19	0.32	0.30	0.14	0.22
Labour input (h/tonne hot carcass weight)	4.7	6.5	7.4	6.6	6.1	6.8
Cost of labour (€/h)	27.9	25.8	20.5	18.0	21.7	15.5

Buildings and capital costs

The total investment per sow place, including the corresponding places for rearing piglets and finishing pigs, amounts to €9,300-12,600 in Northwestern countries and only €5,700 in Spain (Table 2.4). The total investment amount relates to the number of rearing and finishing places; with a high performance level, these numbers would increase. However, this is also related to the typical transition weights of the piglets and pigs, as well as to daily gain. As an example, Denmark has 7.6 finishing places per sow place, much lower than 10.1 in the Netherlands. This is explained by a high daily gain, but especially by a higher start weight (31 kg DK, vs 25.9 in NL) and lower hot carcass weight at slaughter (87.6 kg DK vs 98.9 kg NL). This results in lower total investment per sow place.

The low investment level in Spain is remarkable. This is on the one hand related to lower construction costs per place (especially in finishing), on the other by a lower hot carcass weight (88.6 kg ES vs 98.9 kg NL).

Total housing costs in Spain are lower than in the other countries in the analysis (Table 2.1); the gap is smaller than could be expected from the investment level, as depreciation is relatively higher.

Germany has the highest investment level per sow place including offspring. This was the case in earlier years, but the investment level has also increased a bit faster than in the other countries, with a 35% higher required investment in 2022 than in 2018 (+31% in the Netherlands).

The investment amounts have increased due to various factors such as inflation, rising costs of materials and equipment, changes in regulations, and market demand for higher quality facilities. Investment amounts in InterPIG reflect the requirements according to the actual legal standard. A further increase in investment level per place is to be expected, not only due to general rising construction costs, but also once welfare (such as living surface requirements, or free farrowing) and other legal requirements (e.g., related to manure storage or emission reduction) come into place.

Table 2.4 Investment per sow place including corresponding places for rearing piglets and finishing pigs in selected countries (€)

Cost category	Netherlands	Denmark	Germany	Belgium	France	Spain
Investment per sow place incl. offspring	10,400	9,300	12,600	10,400	9,900	5,700

Zootechnical performance

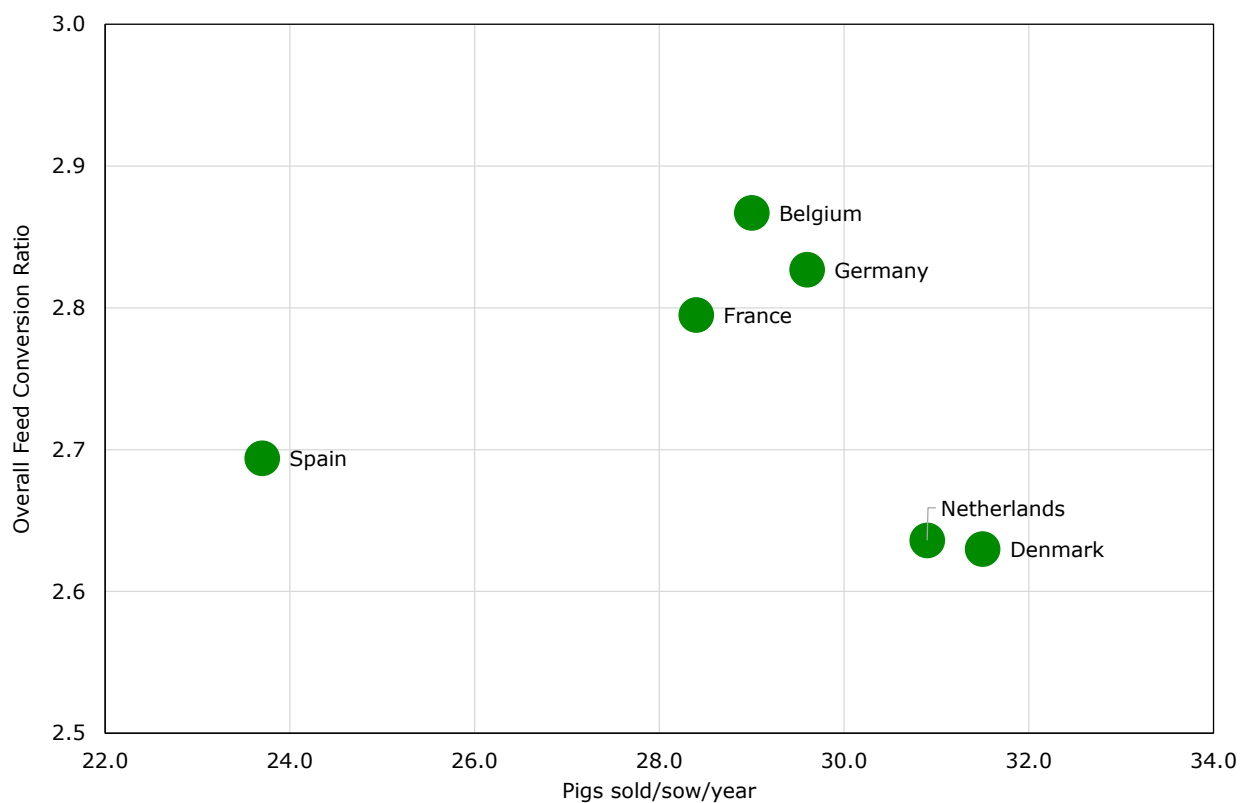


Figure 2.3 Pigs sold per sow/year versus overall feed conversion ratio in several countries

The average zootechnical performance, expressed as the number of pigs sold per sow and year, varies between 23.7 in Spain and 31.5 in Denmark (Figure 2.3). The overall feed conversion ratio (OFCR) varies between 2.63 in Denmark and 2.87 in Belgium. This OFCR reflects the feed efficiency of the entire production: sow, piglet rearing and finishing. There is some interrelationship among both figures, as the feed consumption per sow is to be divided by the output. Another factor that influences the OFCR is the slaughter weight of the pigs.

The lifelong production of sows in number of pigs varies due to different replacement rates, annual sow performance, and carcass weight of the slaughter pigs. Table 2.5 shows the total production per sow per country. Germany and the Netherlands have the highest lifelong sow production. Spain is severely hit by PRRS, which has been leading to high mortalities, resulting in a low lifelong sow production. The relatively low lifelong production in Denmark is related to a high sow replacement rate of 54%, and a limited carcass weight of the slaughter pigs.

Table 2.5 Lifelong production of sows (kg carcass weight of the finished pigs produced per sow)

Cost category	Netherlands	Denmark	Germany	Belgium	France	Spain
Lifelong production per sow	7,100	5,100	7,400	6,300	5,700	4,800

2.2 Continued higher production cost in the Netherlands compared to selected countries

Section 2.2 focuses on developments of costs and performance over time. Compared to 2021, the cost of production in 2022 has risen by 26% on average over the six countries (Figure 2.4). This is especially caused by an increase in feed prices. In 2022, Germany’s pig sector had a cost disadvantage of 14 eurocents compared to the Netherlands. Since 2019 the cost gap between Spain and the Netherlands has decreased from a price difference of 14 eurocents in 2019 to approximately zero in 2022. The reason is a lagging zootechnical performance in Spain after the PRRS outbreak. The cost advantage of Denmark over the Netherlands has increased to 22 eurocents per kg hot carcass weight. The most important factor here is the relative low feed price in Denmark, but also the improved feed efficiency.

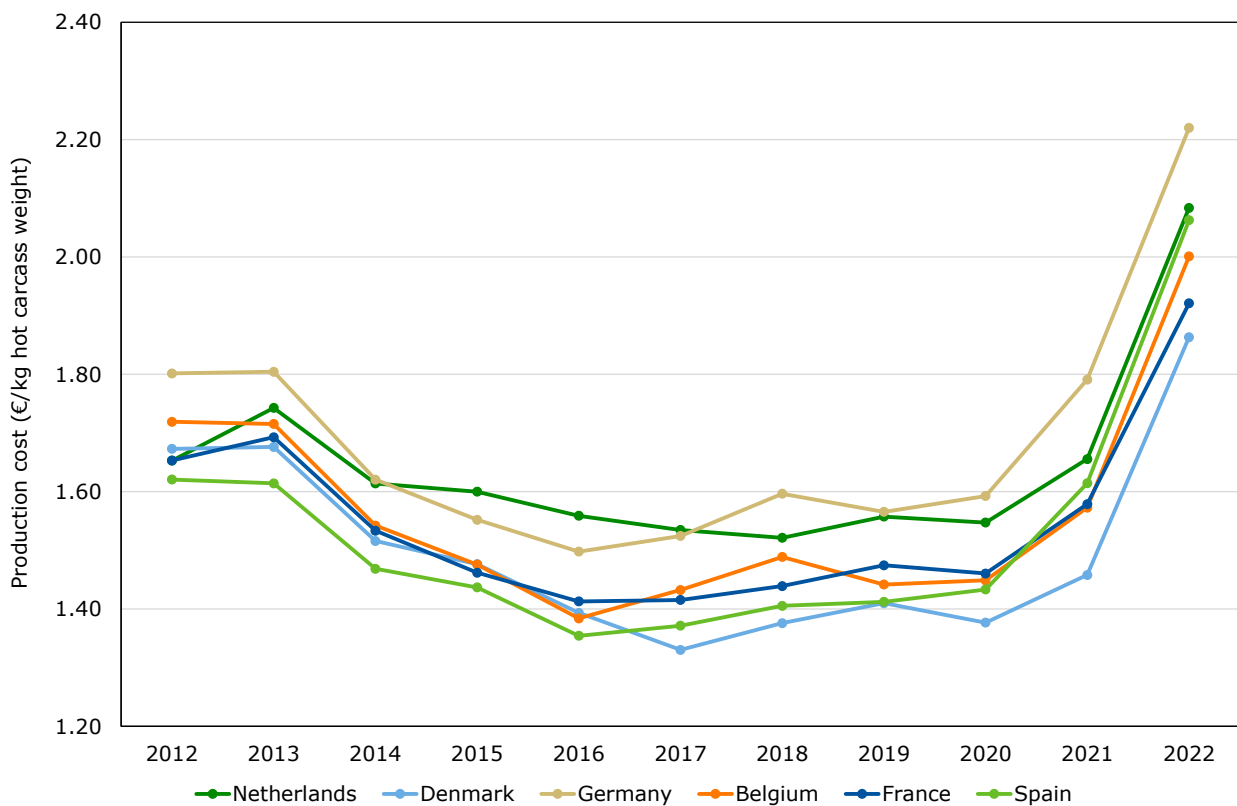


Figure 2.4 Development of cost of production of selected countries (€/kg hot carcass weight), 2012-2022

Feed costs

Feed costs are the major part of the total production costs (64% in the Netherlands in 2022); moreover, they fluctuate over time due to fluctuating feed prices. The feed costs have risen faster in the Netherlands than in the other selected countries. The increase in feed costs is partly caused by the sharply increased feed prices: 34% in 2022 compared to 2021 on average for the selected countries (Figure 2.5). Differences in development of the feed price from 2021 to 2022 explain the variations in the feed cost increase between countries (Figure 2.4). Meanwhile the feed efficiency has not improved further in the last couple of years (Figure 2.6). In 2022 the OFCR developed upward in Belgium, Spain and the Netherlands, but not in Denmark, France and Germany. The latter countries have quite a large domestic feed crop production. Given the sharply increased feed prices, it is conceivable that cheaper alternative ingredients have been used to some extent in the import-dependent countries.

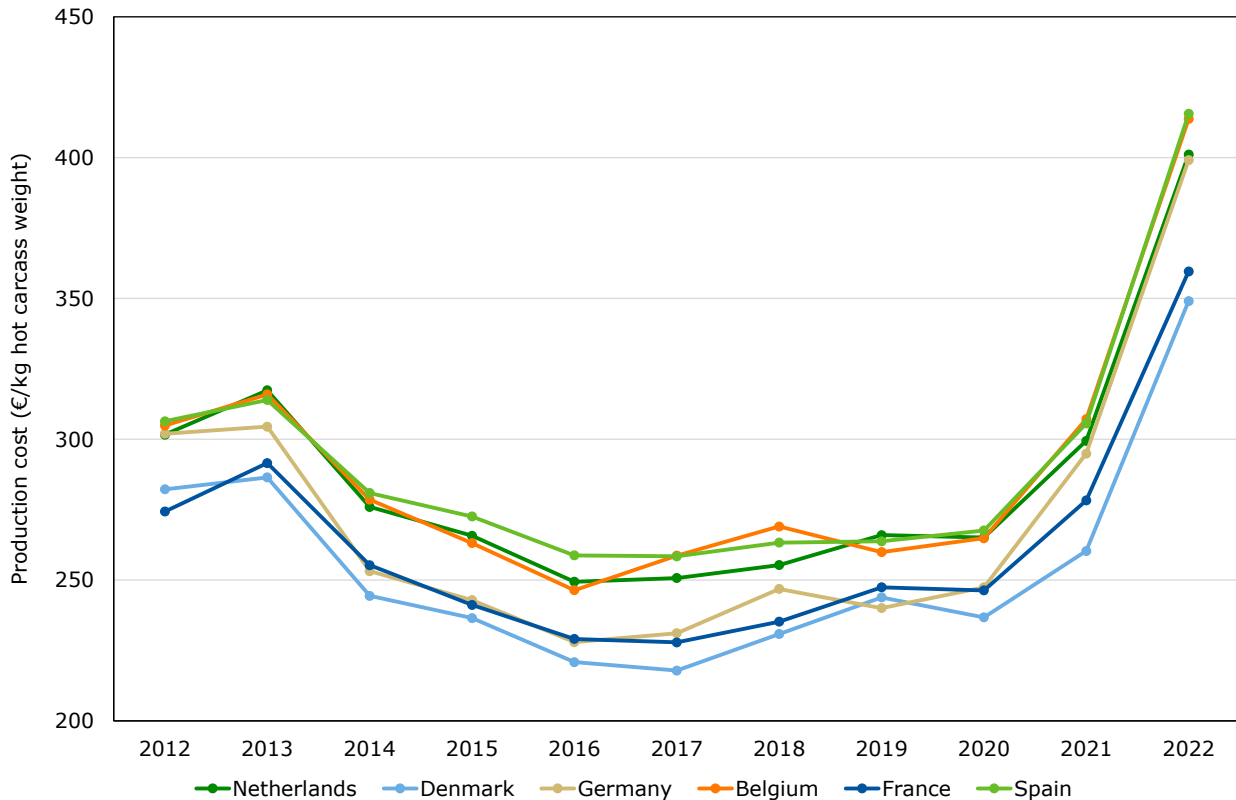


Figure 2.5 Development of compound feed prices in selected countries

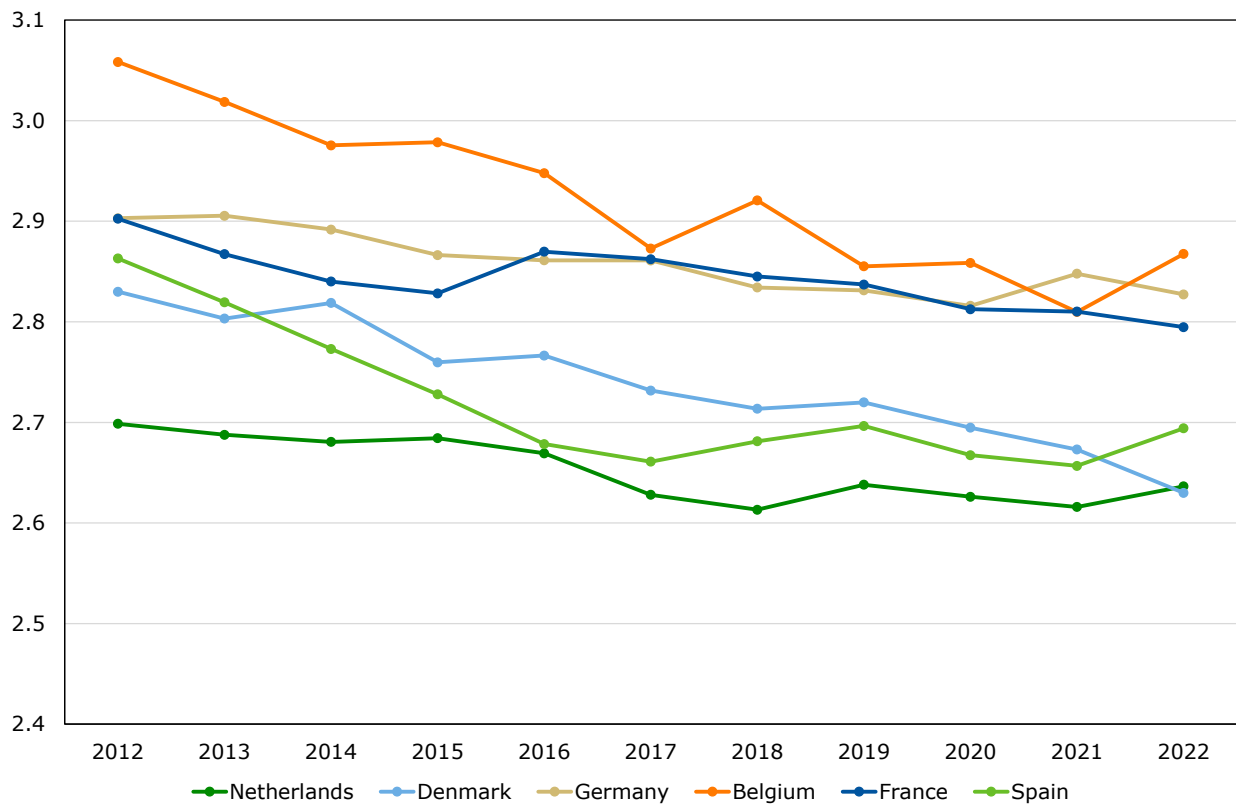


Figure 2.6 Development of overall feed conversion ratio³ in selected countries

Sow performance

The production performance, expressed by the number of slaughter pigs produced per sow and year shows an upward trend (Figure 2.7). However, the increase differs between countries, with Belgium leading with an annual increase of 0.49 pigs per sow and year increase since 2012, followed by Germany with 0.45 pigs per sow and year. The Netherlands (0.39) and Denmark (0.37) show a modest increase; however, these already had quite a high performance level in 2012. The Danish performance level has been more or less constant since 2017, as the Danish genetics companies are focusing on vital pigs rather than on maximising the number of liveborn pigs. It seems that the focus also has shifted towards feed efficiency (Figure 2.6). The reduced performance in Spain is mainly caused by PRRS, especially the severe Rosalia variety. Sow mortality in Spain has increased from 9.9% in 2018 to 12.6% in 2021 and 14% in 2022.

³ The overall feed conversion ratio is calculated as the total feed consumption on a closed cycle farm, divided by the total carcass weight (live weight) production of the farm.

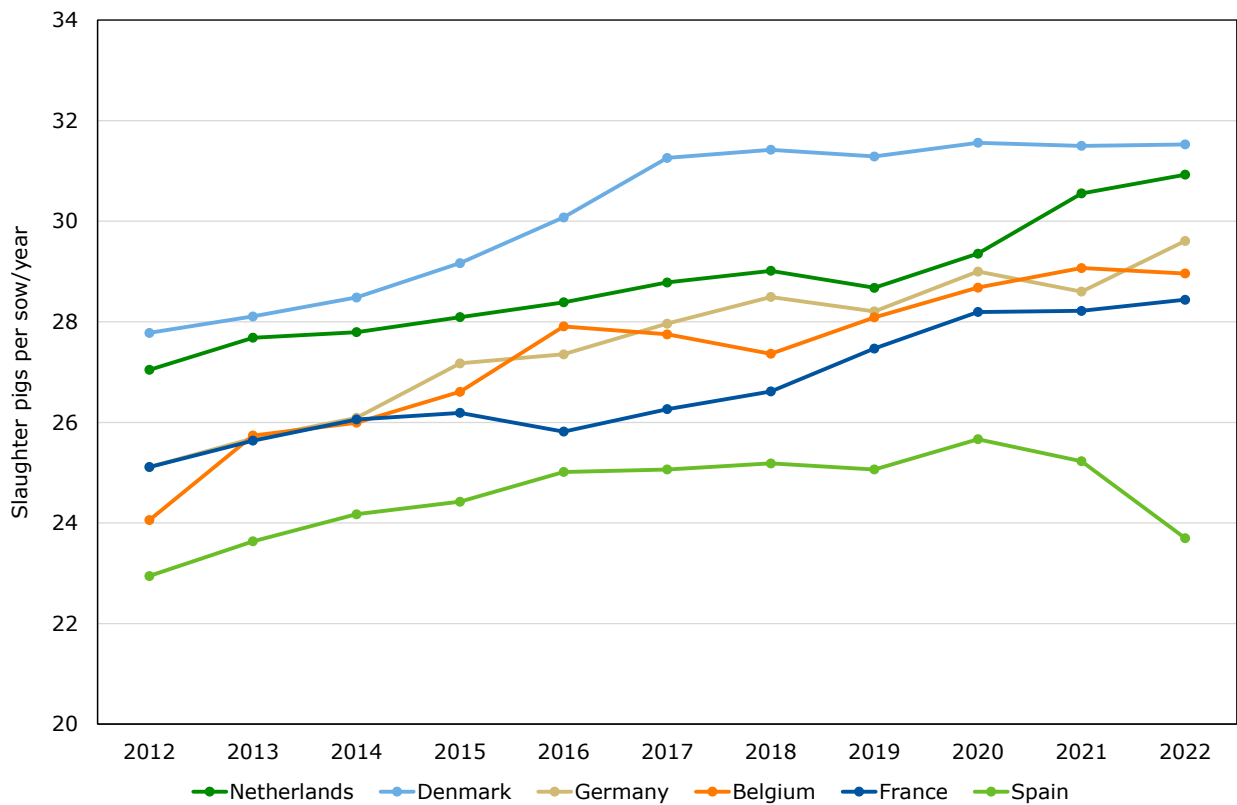


Figure 2.7 Development of slaughter pigs produced per sow and year in some selected countries

Health costs

Health expenses are a minor part of the cost of production, varying from 2.2% in Denmark to 4.5% in Spain. These costs do not include the hidden costs of underperforming animals due to diseases. Several countries however face a shift in health costs from finishing to piglet production (Figure 2.8).

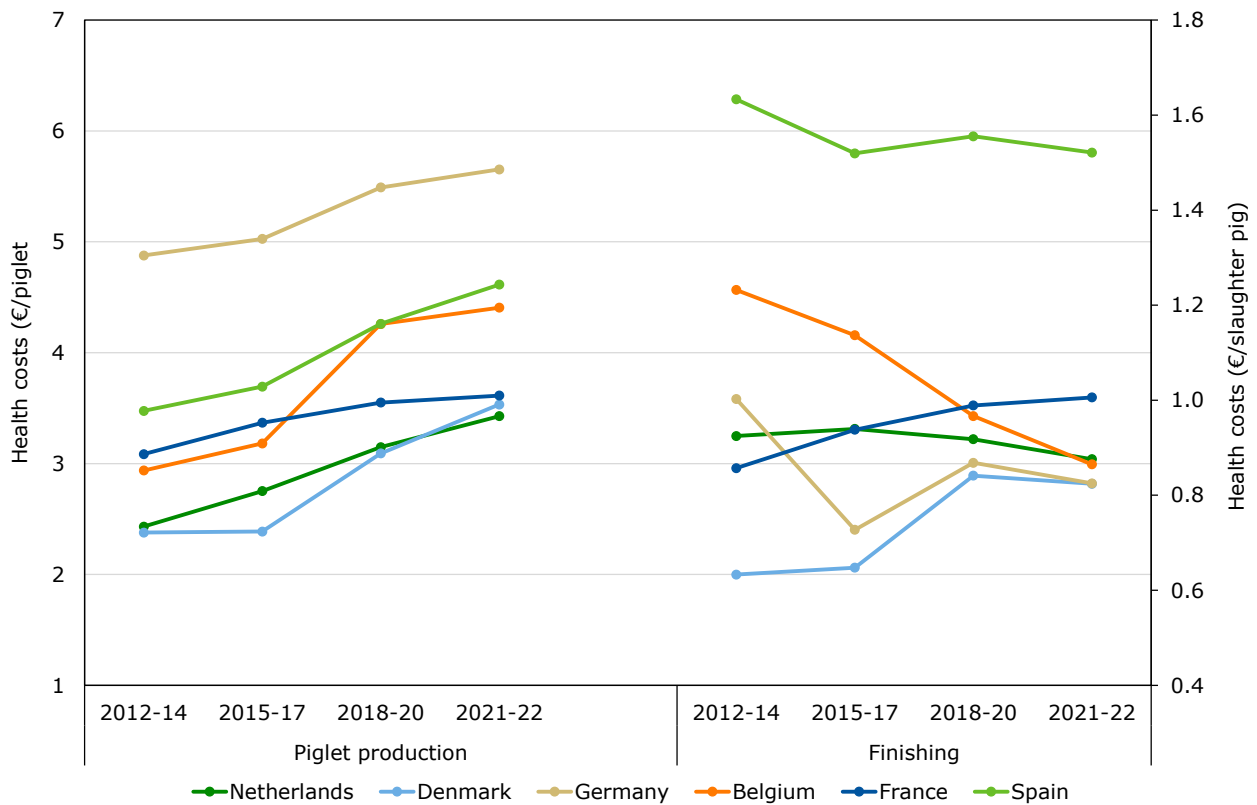


Figure 2.8 Development of health costs in piglet production (€/piglet/year) and finishing (€/slaughter pig) in four periods in selected countries

Health costs show an increase in piglet production in all countries and a differentiated pattern in finishing. The increase of costs in piglet production is related to additional costs for vaccination of sows and piglets; likely this results in lower health costs in finishing. The total health costs (calculated for a closed cycle farm, expressed per kg carcass weight) have increased over time. In the Netherlands they increased from about 4 eurocents/kg carcass weight in the years 2015-17 to almost 5 eurocents in 2022. Among countries they vary from 5 eurocents in the Netherlands, Denmark, Belgium and France, to 7 eurocents in Germany and Spain.

Health costs in this comparison refer to expenses for the veterinarian plus medicines, vaccines and disinfectants. The economic effect of suboptimal health is substantial and much higher than these expenses alone.

2.3 Lowest piglet production cost in Denmark

The sow performance shows quite a lot of differences between countries (Figure 2.7). This influences the cost of production. Costs have been split into piglet production and finishing, to enable comparison of typical costs per production phase. For a meaningful comparison, we recalculated the piglet cost of production to a comparable weight of 30 kg; in the finishing phase we calculated the marginal costs per additional kg live weight. This way, we bypass differences in typical delivery weights of reared piglets and slaughter pigs between countries (Figure 2.9). The results are an approximation. As live trade of pigs and piglets typically takes place within trade blocks (e.g., the EU), cost comparison is mainly important within these blocks. Therefore, a comparison of piglet production costs is only made for a selection of European countries.

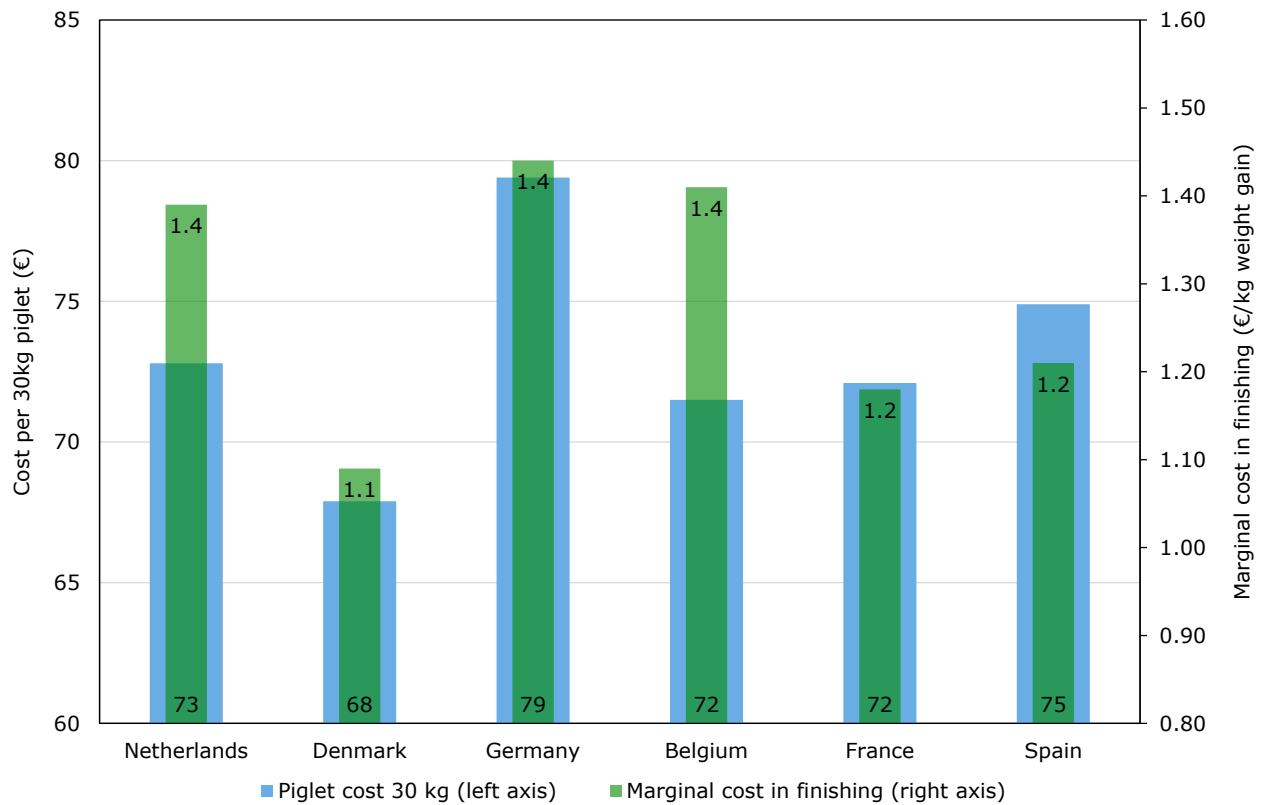


Figure 2.9 Cost of production per piglet (€/30-kg piglet) and in finishing (€/marginal kg live weight) in selected countries

In Western Europe, the price of a 30-kg piglet ranges from €68 in Denmark to €79 in Germany (Figure 2.9). The relative cost benefit of Denmark, but also of the Netherlands, over Germany is reflected in the substantial piglet influx into Germany from both these countries, with 64% of the imported piglets originating from Denmark and almost 35% from the Netherlands in the years 2021 and 2022 (source: Eurostat). Figure 2.10 shows the worsened cost position of Spain in piglet production, with a high mortality due to PRRS as a major cause. Spain strongly increased their piglet import since 2020 to fill its need for finishing stock. Spain's major supplier was the Netherlands with about 1.7 million animals in 2021 and 2022.

The cost of finishing per marginal kilogram of live weight ranges from €1.10 in Denmark to around €1.40 in the Netherlands, Germany, and Belgium. High manure disposal costs, but especially relative high feed costs are causing this difference. The difference became even bigger in 2022 compared to earlier years, because Danish feed prices grew less rapidly than in other countries. Based on an additional analysis of monthly feed prices, the price gap likely becomes smaller in 2023. However, the Netherlands has a clear cost disadvantage in finishing compared to Denmark.

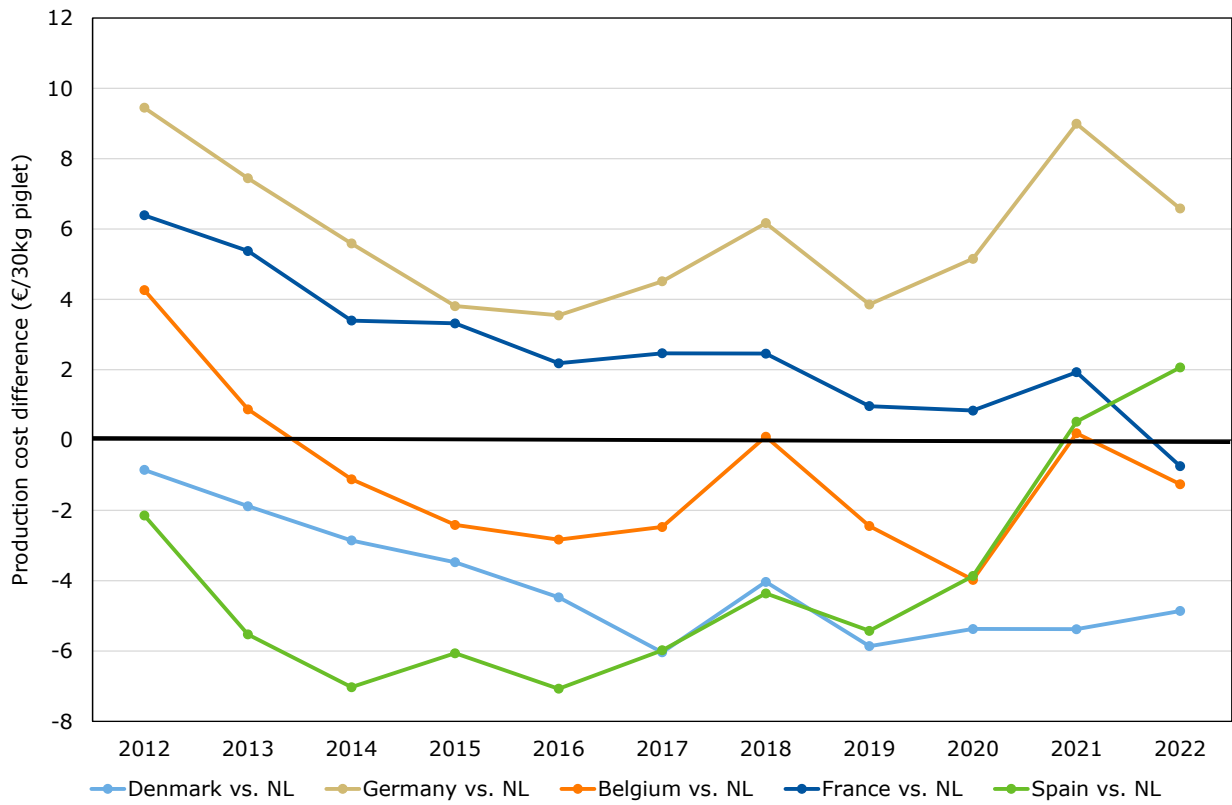


Figure 2.10 Development of differences in piglet cost of production between selected countries and the Netherlands (€/30-kg piglet)

3 Non-European countries have lower production costs than European

Production costs in the selected European countries are higher than in Brazil and the USA (Figure 3.1). Brazil (Mato Grosso) has the lowest feed costs, as a result of the abundant regional feed supply. Quite surprisingly the feed costs in the European countries are more or less comparable to those in Brazil (Santa Catarina) and the USA.

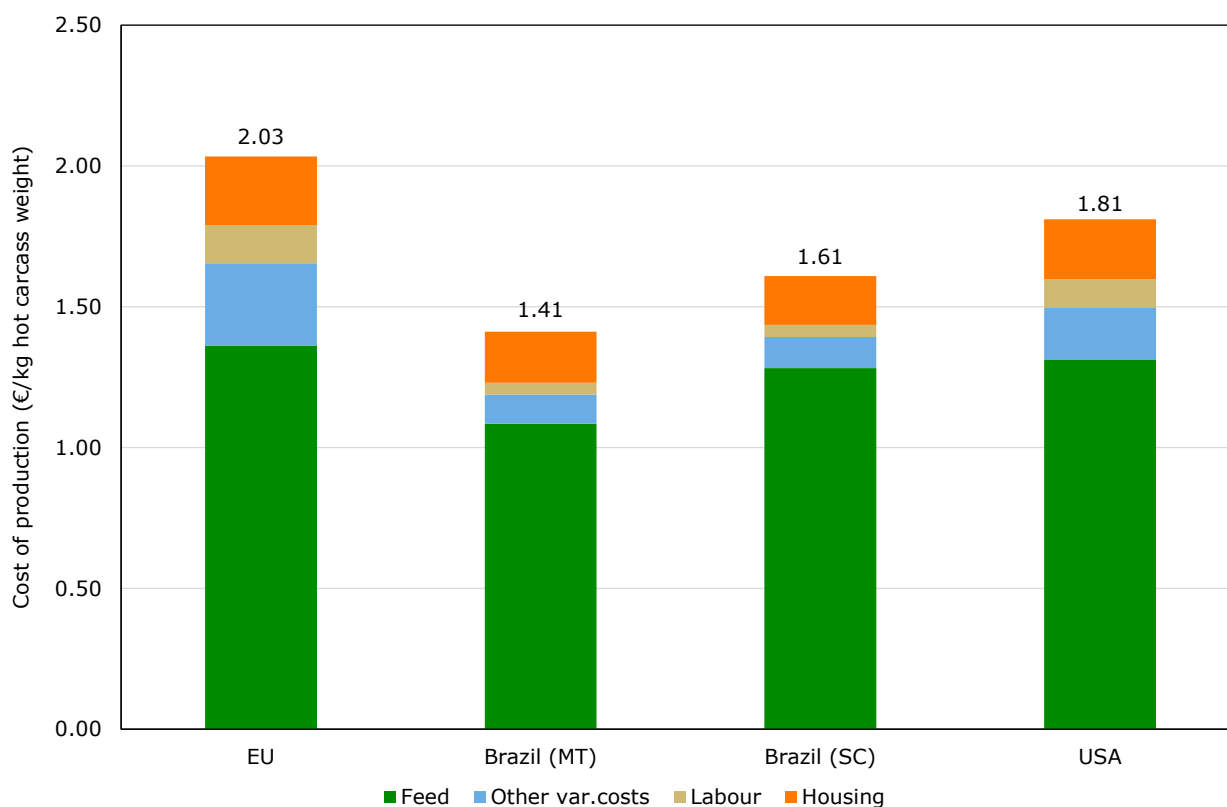


Figure 3.1 Production costs in the EU and non-EU countries compared (€/kg hot carcass weight on a closed cycle pig farm), split into cost categories
Note: EU reflects the simple average of the Netherlands, Denmark, Germany, Belgium, France and Spain. Brazil (MT) refers to the region of Mato Grosso; Brazil (SC) to the region of Santa Catarina.

Other variable costs, as well as housing and labour are all lower in Brazil and the USA compared to the European countries. Scale of production and lower investments and labour tariffs also contribute to a generally lower level of production costs. Labour is cheaper than in Western European countries, ranging from €3 per hour in Brazil (Mato Grosso) to €17 in the USA and about €22 on average in the six European countries. However, the labour input per tonne of carcass weight in Brazil amounts to 13-16 hours, which is much higher than the just over 6 hours calculated for the selected EU countries and the USA.

The non-European countries generally have fewer regulations and legislation regarding environmental protection and animal welfare. Environmental legislation is in place in Brazil and the USA, which increases cost of production. For example, California's Proposition 12 regulation that applies in the USA, and prescribes more space for sows, is likely going to have an effect on the housing costs of USA pork producers (see also Section 4). However, since the costs related to this legislation were not quantified, a comparison cannot be made with costs in the EU.

Figure 3.2 shows the development of production costs in the EU, USA and the two Brazilian regions. All countries face a cost increase, due to higher feed prices, but the US shows the steepest upward trend. This is to be explained by the PRRS outbreak, which results in high mortalities at the affected farms, and consequently in higher production costs.

Cost calculations are presented in euros, which means that cost calculations also reflect currency exchange fluctuations (Figure A2.1, Annex 2). This means that exchange currency fluctuations could partially explain the differences in cost development patterns. Annex 2 shows the development of these currency fluctuations compared to the Euro. Both the US Dollar (+12.6%) and the Brazilian Real (+16.4%) gained strength in 2022 compared to the Euro. Expressed in local currencies, the production costs in the European countries rose by 26% in 2022 compared the year before; in the USA this amounted to 22%. So, in local currencies the increase in production costs in the USA was slightly lower than in the EU. The cost increase in local currency in 2022 compared to the year before in Brazil amounted to 5% in Brazil MT and 8% Brazil SC. In local currency, the cost in Brazil did not change that much, at least compared to the European countries and the USA. This is a relative advantage for Brazil for local sales; however, international trade vendors have to deal with the international value of their currencies. A common currency is also necessary for meaningful international comparisons.

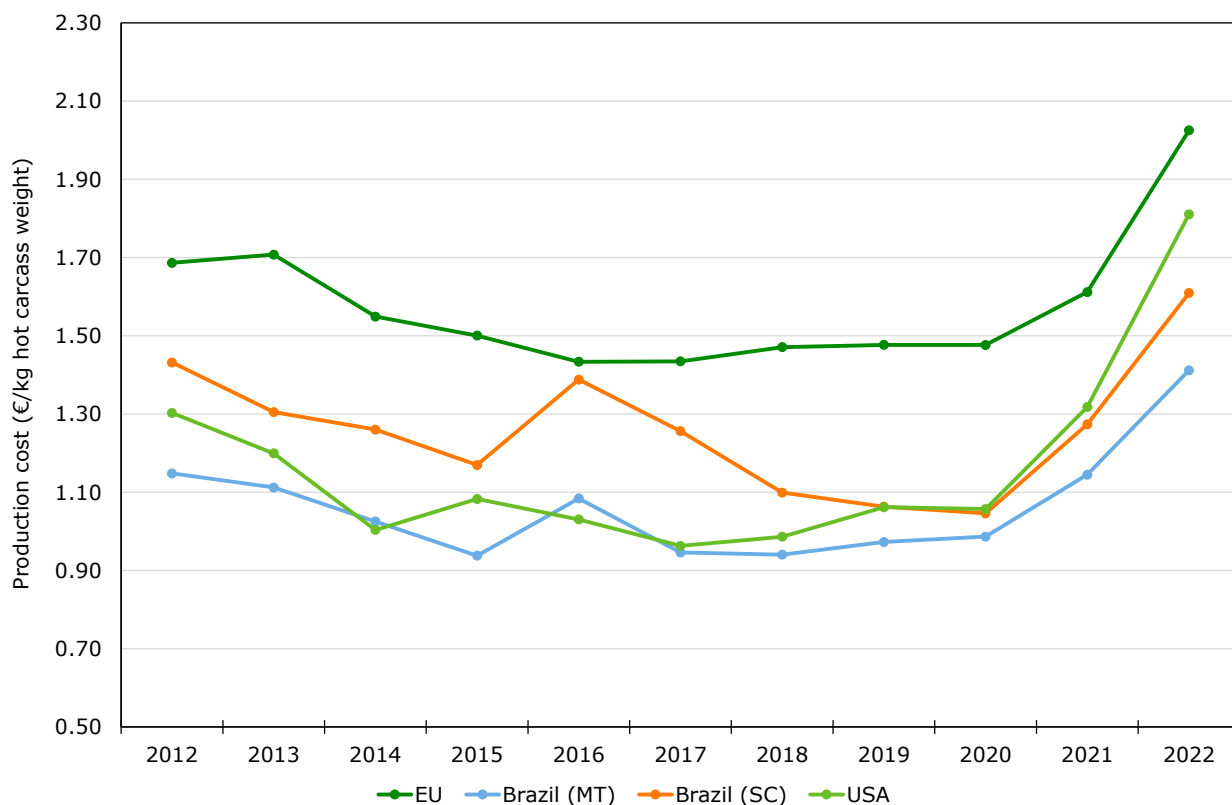


Figure 3.2 Development of the production cost in the EU, Brazil (MT and SC) and the USA (€/kg hot carcass weight)

4 Cost comparison requires a wider perspective

Production costs have risen in all countries in 2022

The cost of pig production has increased in all countries. Since an earlier analysis of InterPIG outcomes (Hoste, 2017, based on 2015 costs) was issued, Covid-19, the Russian invasion in Ukraine, and African Swine Fever in many countries have had a severe effect on the world economy and the pig sector. Inflation has risen sharply and pig meat consumption has dropped in several countries. After having been detected in several eastern European countries, African Swine Fever was also reported in Belgium (2018) and Germany (2020), leading to an export ban for pig meat to most of their third-country export destinations, and a pressure on the European domestic market.

The Russian invasion in Ukraine in 2022 led to reduced availability and a strong price increase and price volatility of grains for feed, resulting in unprecedented feed price levels and pig production costs. Animal welfare standards in EU Member States have increased, such as top-ups on the European legislation. Notably the increasing legal demands in Germany (increased living area for empty sows, and free farrowing) lead to a firm reduction in pig numbers in Germany (-6.2% in May Census 2023 compared to May Census 2022; source: Eurostat). Spain has been confronted with severe outbreaks of PRRS, with high mortality. This led to lower domestic Spanish productivity and production, and increased import of piglets, mainly from the Netherlands.

Advantage of domestic feed production

Denmark and France have had a lower increase in feed price from 2022 to 2023 than other countries. These two countries have abundant domestic feed production. Based on the opportunity cost principle the feed prices in a country in InterPIG correspond to the domestic market price level. In 2022, Denmark and France had a €85/tonne higher feed price than in 2021, whereas this increase in countries that were more import dependent for feed amounted to €102/tonne in the Netherlands and to almost €110/tonne in Belgium and Spain. Germany, although producing a lot of grains, showed an equal increase as the Netherlands, apparently being unable to utilise their grain availability in feed.

Comparison however is complicated due to the fact that feed producers show different purchasing behaviour towards price fluctuations. The Dutch feed industry typically purchases feed ingredients on both spot markets and future markets, leading to a delay in price reaction of some months. Based on an analysis of monthly feed prices (Agrofoodportal, ISN and Seges, partly confidential data), it can be concluded that the feed prices in Germany are more in line with the ingredient price fluctuations than in the Netherlands. This also holds for Danish feed prices, although to a lesser extent than in Germany.

An analysis of recent monthly compound feed prices in Denmark and the Netherlands shows a relative price advantage for the Netherlands, apparently due to more favourable market circumstances for feed ingredients. This means that the feed price advantage in 2022 for Denmark does not continue in 2023 at the same level. However, in terms of cost fluctuations, the Danish farmers have the advantage of smaller feed price movements, which is even stronger if considering that most feed stuffs are produced on farm: feed is a cost but only to a limited extent is it an expense.

Investments increased by 28% compared to 2018

The investment per sow place including offspring has increased by 28% in 2022 compared to 2018 (pre-Covid-19; average of the six selected European countries). After Covid-19 the revival of the global economy led to increased prices of construction materials. Moreover, labour tariffs have increased, pressing on construction costs as well. Also, interest rates are on the rise, leading to higher housing costs. The increase in housing investment levels differs per country, e.g., German investment levels increased more than in the other Northwestern European countries. It may be assumed that in the coming years other countries' figures will follow a comparable cost increase pattern to Germany. The increase in investment level is even without taking into account a further increase due to tightening animal welfare regulations, such as

free farrowing and long tails. Such changes require amendments in living surface per animal, pen size, ventilation systems, and enrichment of the animals' living environment (Hoste et al., 2023). Further increases in capital costs are to be expected.

Market prices are lower than calculated production costs

The average cost of production in the Netherlands in the years 2018-2022 amounted to €1.67/kg hot carcass weight. The average market price however, amounted to €1.52/kg (Agrifoodportal), resulting in an average loss of 15 eurocents per kg. One may wonder how pig farmers in the Netherlands survive such negative margins. One reason is that these numbers are averages. Farm situations are very different and so are production costs: differences of 20 eurocents per kg carcass weight and more are found among farms within the Netherlands.

A farmer's reaction to negative margins is to improve their zootechnical performance, and increase their scale of production resulting in above-average economic performance. Some farmers made the transition to producing in market programmes such as 'Beter Leven' which come with a higher market price. However, typically the additional costs are being covered in such programmes and only in specific farm situations the additional payments lead to additional profits. Another part of the farmers simply cannot reduce production costs sufficiently to drop below revenues and has to quit production. Every ten years, the number of farms with pigs is reduced by 50%, and this trend has already been found since the eighties. This reflects the tough economic situation in the sector.

Housing costs in the cost analysis are based on replacement value, assuming a going-concern approach. In practice farmers have to deal with loans related to historic building investments. Historic building prices of currently used farm buildings were on average about 30% lower than actual new building investment amounts. Those farmers who are giving up production have the advantage of lower building costs, as they do not need to build up sufficient capital for re-investment. Entrepreneurs who intend to continue their farm and re-invest, need compensation for actual building prices and investments as they need to build sufficient capital to be able to re-invest. Loans will cover part of the investment, but own capital is inevitable.

Farmers keep producing as long as their facilities allow; once re-investments are needed and loans have to be renewed, this is the moment to quit production for a part of the farmers. Depreciation amounts, which should be saved for future investments in a going-concern situation, are being used for private expenses. Re-investment is a specific burden in strategic decision-making, both from a permit perspective (which can take years to finalise), and the feasibility of getting bank loans, which has become much harder in the last few decades. The age of the entrepreneur and the succession situation on the farm play a role, as well as the market situation and perspective. Lastly, also farmers' opinions on general developments in the pig sector and new requirements from government and society play a role in decision-making (Hoste et al., 2021).

Dutch above average costs position is stable

Production costs in the Netherlands are somewhat higher than their direct competitors in neighbouring countries. This is partly caused by the European environmental legislation (ammonia emission reduction, manure disposal), which has led to higher costs in an intensive footloose production system built in an already dense production area. Location advantages are still present, including the availability of feed stuffs and food by-products for feed, logistics and a knowledge and innovation system, yet these were insufficient to result in a beneficial cost position from an international perspective. Compared to an earlier analysis of InterPIG outcomes (Hoste, 2017, based in 2015 costs), the relative cost position has not changed.

We conclude that the cost position of the Netherlands in comparison to other European countries is relatively stable, with moderate production costs. Compared to competitors in Northwest Europe the Dutch production cost level is somewhat higher. Factors such as production efficiency, production scale, and environmental protection contribute to cost differences between countries. In recent years, rising global feed costs and various geopolitical events led to increased costs in all European countries. Feed costs especially, but also building and capital costs, have increased. Still, in piglet production the Netherlands has a rather good position, except compared to main competitor Denmark. In finishing, average Dutch producers can hardly compete with producers in countries such as Denmark and Spain.

Reduction in EU pig production

A general reduction of pig numbers and pig meat production is found in most of the Member States of the EU. Harsh economic circumstances as a result of high feed prices were insufficiently compensated by pig prices. This in turn led to many farmers giving up pig production. Moreover, pig farmers who produce their own feed crops were challenged to sell the feed for immediate profit, rather than feeding it to their pigs with lower profitability expectations. In an ageing farmer population this is a convenient moment to give up pig production and only continue with the arable production. In 2022, with high feed prices and still low market prices for finishing pigs, there was a reduction in sow numbers of 4.6% in the EU27 (December Census 2021 and 2022; source: Eurostat). For a stable pig production, an annual reduction of sow numbers of about 2% is necessary, to compensate for the autonomous sow performance increase. Since the reduction in sow numbers (4.6%) exceeded the annual performance increase, the total EU production of pig meat has reduced. This resulted in increasing market prices in the EU27, from a low level of €1.33/kg carcass weight in January 2022 to €2.40 in August 2023 (Source: Agridata EC, own elaboration, quality S+E).

Global competition

Given that the European Union (EU) exports about 20% of its total pig meat production (both as meat and edible offals), the higher production cost in the EU compared to Brazil and the USA is a competitive disadvantage. The global market prices have shown a serious increase in volatility, after the outbreak of African Swine Fever in East Asia, especially in China. Countries with relatively high fixed costs (housing and labour) such as in the EU are likely less resilient to such price movements. On the other hand, farms in Europe have a relatively high reliance on family labour and equity which provides them with a buffer in case of price shocks. For the future of Europe's pig production, it is advisable to stick to the family farm model for resilience reasons, in combination with strong partnerships in the supply chains. Chain partners, feed and meat industry could play a role in cushioning price volatility.

Given the high European production cost level compared to the USA and Brazil, as presented in this research, the competitive position of European countries on the third markets is relatively weak. The self-sufficiency degree of pig meat in the EU amounted to 125% (own calculation based on Eurostat and Comext). The EU would likely benefit from a model with less export dependency and a focus on the domestic European market. Environmental and animal welfare standards in the EU are higher than outside, and the consumer should be prepared to pay for this additional value. Still, export is necessary for the edible offals that are not consumed within the EU. To come to this 'smart autarky' of zero trade of pig meat and just export of edible offals volumes that are not eaten in the EU, the self-sufficiency degree would go down to some 105-110%. This holds even more as higher production costs are to be expected because of the tightening of the animal welfare rules in the EU and the foreseen European Green Deal. Consequently, an increase in the cost gap will take place.

Farmers in the USA are facing the Proposition 12 regulation, or the Farm Animal Confinement Initiative, implemented by the state of California. This state has 12% of the USA's inhabitants and a share of 15% in both national GDP and pig meat consumption. Now this state requires specific welfare rules applied in the production of pork that is sold in the state. Practically this means a living surface for sows from 6 months of age of 24 ft² (now typically 20 ft²), or 2.23 m² per sow. Farmers are required to be certified from 1 January 2024 onwards. Since the state has only 0.1% of the USA production volume, it imports from several other states in the USA. Nine other States are also preparing regulations against individual housing of pregnant sows. Pig farmers elsewhere in the USA fear a price deduction for non-Prop-12 compliant pig meat. According to farmers, housing according to Prop 12 will lead to higher housing costs and increased sow mortality. Moreover, farmers have been losing money with pig production in 2023, which complicates re-investments. The USA meat industry fears for import from countries that are Prop-12 compliant, such as Mexico (Sources: CDFA, 2023; Communication Dave Wade, June 2023).

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Annex 1 Cost breakdown and some parameters and prices per country

Table A1.1 Cost of pig production per country, split into cost categories (€/kg hot carcass weight, excluding VAT)

Cost type	NL	DK	DE	BE	FR	ES	AT	IE	GB	IT	SW	FI	CZ	HU	BR-MT	BR-SC	US
Feed	1.33	1.20	1.44	1.42	1.28	1.46	1.38	1.47	1.82	1.83	1.74	1.44	1.24	1.16	1.09	1.28	1.31
Other variable costs	0.39	0.26	0.32	0.23	0.25	0.30	0.06	0.29	0.27	0.44	0.18	0.42	0.41	0.26	0.10	0.11	0.18
Labour	0.13	0.17	0.15	0.12	0.13	0.11	0.20	0.15	0.17	0.15	0.18	0.20	0.21	0.12	0.04	0.04	0.10
Building and capital costs	0.23	0.23	0.31	0.23	0.26	0.20	0.40	0.28	0.29	0.48	0.38	0.35	0.28	0.50	0.18	0.17	0.21
Total costs	2.08	1.86	2.22	2.00	1.92	2.06	2.04	2.19	2.55	2.89	2.48	2.41	2.14	2.04	1.41	1.61	1.81

Table A1.2 Some production parameters and prices in pig production per country (for an explanation see below)

Parameter	NL	DK	DE	BE	FR	ES	AT	IE	GB	IT	SW	FI	CZ	HU	BR-MT	BR-SC	US
Finished pigs per sow/year	30.9	31.5	29.6	29.0	28.4	23.7	24.9	27.7	25.4	27.5	27.6	28.1	31.1	29.7	27.2	28.3	25.3
Average feed price	401	349	399	414	360	416	374	416	501	411	450	389	360	315	325	406	336
Overall FCR	2.64	2.63	2.83	2.87	2.80	2.69	2.94	2.76	2.83	3.64	2.89	2.81	2.71	2.98	2.54	2.38	2.91
Labour tariff	27.9	25.8	20.5	18.0	21.7	15.5	20.6	16.0	18.1	15.3	25.9	21.0	11.8	5.9	3.2	2.8	16.8
Labour input	4.7	6.5	7.4	6.6	6.1	6.8	9.9	9.1	9.4	10.1	6.8	9.7	18.2	20.8	13.0	15.7	6.1
Manure disposal costs	8.5	1.1	3.7	4.4	-0.6	2.4	-12.1	1.2	1.2	2.2	-2.4	4.0	0.0	0.0	0.0	0.1	0.0
Investment per place	10,400	9,300	12,600	10,400	9,900	5,700	13,200	7,000	6,800	18,600	10,300	14,100	7,200	14,600	2,800	2,900	5,300

Explanation: Finished pigs per sow/year is the total number of finished pigs for slaughter per sow and year; Average feed price (€/tonne) relates to the entire feed consumption on a closed cycle farm and includes cost savings by home-mixing; Overall FCR is the overall Feed conversion ratio, reflecting the entire feed consumption on a closed cycle farm divided by the total live weight production of slaughter pigs; Labour tariff (€/hour); Labour input (hour per tonne carcass weight); Manure disposal costs (eurocent/kg carcass weight); Investment is the total amount for one sow place including corresponding places for rearing piglets and finishing pigs (€/place).

Annex 2 Currency exchange ratios

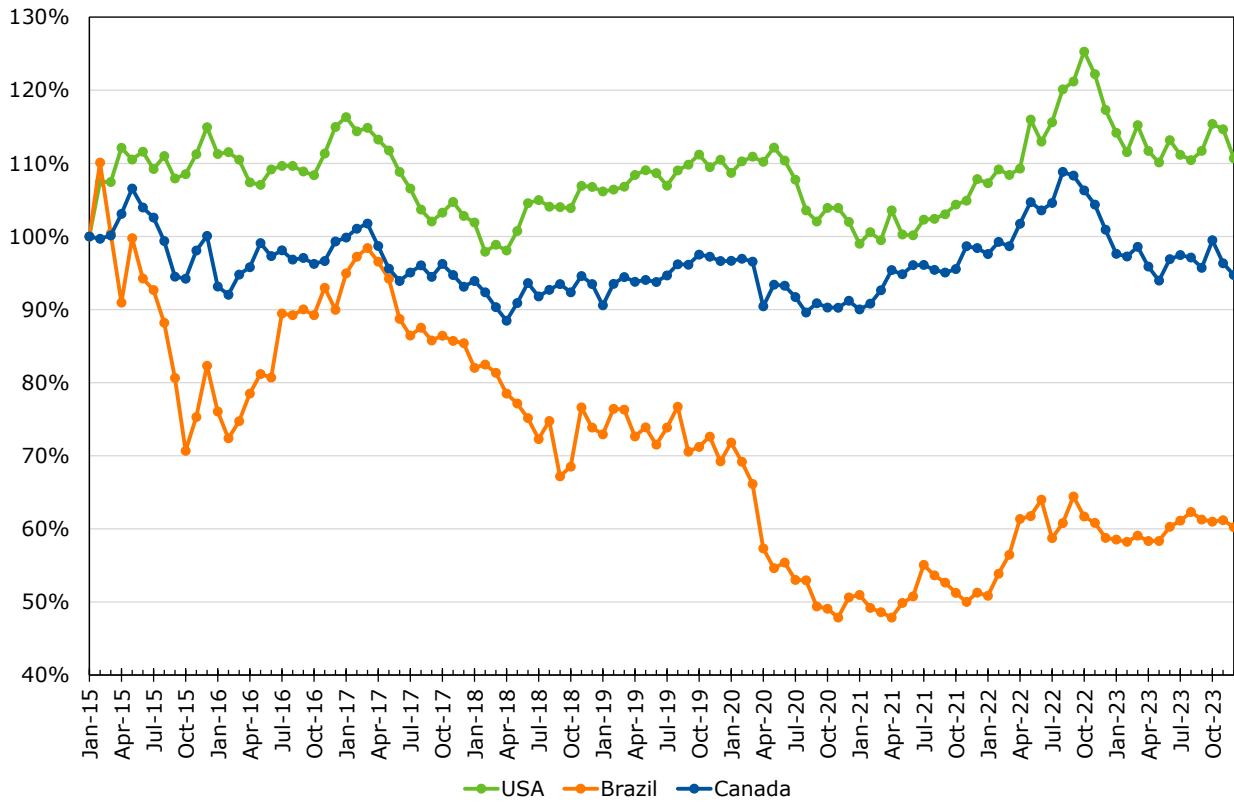


Figure A2.1 Currency exchange ratios of US Dollar, Brazilian Real and Canadian Dollar compared to the euro (Index January 2015=100%)

Source: InforEuro, processing Wageningen Economic Research.

Annex 3 What is InterPIG?

InterPIG is an independent forum of pig production economists in 18 countries, mainly in Europe, but also in the USA, Canada and Brazil. The network started in 2003 with six European countries and expanded since then. InterPIG aims to compare costs of professional pig production, based on a representative sample per country and typically reflecting the conventional pig production.

Members select samples and data sources for their country. InterPIG organises an annual meeting where data, and developments in the pig production per country, are being presented and discussed. Besides, collected data are peer-reviewed among members.

The method of data collection, parameter definitions and cost comparison have been developed and harmonised over time. Main methodological assumptions are:

- Farm-gate production costs: costs on the farm are included, as well as (e.g.) direct subsidies. Levies and taxes in the abattoir are not seen as on-farm costs but taken into account as deductions of the sales price.
- Opportunity cost method. Supplies from the farm such as labour, own capital or farm-produced feed stuffs are being appreciated as if these inputs had to be purchased against market prices.
- Costs are expressed excluding VAT.

Still, due to limitations in available data and sometimes arbitrary choices, the cost comparison is merely indicative for cost differences between countries and cost developments over time. The InterPIG group also functions as a forum for information exchange.

Abbreviations

Eighteen countries are member of InterPIG, in alphabetic order (with abbreviations): Austria (AT), Belgium (BE), Brazil (BR), Canada (CA), Czech Republic (CZ), Denmark (DK), Finland (FI), France (FR), Germany (DE), Great Britain (GB), Hungary (HU), Ireland (IE), Italy (IT), the Netherlands (NL), Portugal (forthcoming, PT), Spain (ES), Sweden (SW), and the USA (US). As differences in production systems and costs within Brazil are huge, Brazil is represented as two different regions, Mato Grosso (BR-MT) and Santa Catarina (BR-SC).

Forum and Board

InterPIG is an informal forum, without legal status, yet with a Board. Meetings are being held annually in one of the member countries. The InterPIG Board has members from the Netherlands (chairman), France (secretary), UK, Denmark (data management), Brazil and Spain, plus the representative of the host country for the upcoming annual meeting. Membership for new countries is possible under the precondition of sufficient (quality of) data supply. InterPIG does not produce a joint publication; however, some members do so individually.

Other methodological assumptions

For the Netherlands a number of sources are used, e.g., data from management information systems, Farm Accountancy data Network, Agrofoodportal (Wageningen Economic Research), Biggenprijzenschema (Vermeij, 2023) and KWIN Veehouderij (Vermeij et al., 2023), as well as some market quotations for animal prices.

Costs in this report are being expressed per kg hot carcass weight. Costs are calculated for a closed-cycle farm (piglet production, rearing and finishing). Additionally a split is made between costs of piglet production and finishing. However, the split is mainly of interest to countries such as the Netherlands, Denmark and Germany and has little focus on other countries; therefore the results in such countries might be less comparable.



Wageningen Economic Research
P.O. Box 29703
2502 LS The Hague
The Netherlands
T +31 (0)70 335 83 30
E communications.ssg@wur.nl
wur.eu/economic-research

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Wageningen Economic Research
P.O. Box 29703
2502 LS Den Haag
The Netherlands
T +31 (0) 70 335 83 30
E communications.ssg@wur.nl
wur.eu/economic-research

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