



# Key Performance Indicators in Pork Production: An International Comparison Using 2022 Data

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This is the fifth in a series of annual reports from the Global Swine Benchmarking project that benchmarks international pork production. The first report was based on 2018 data, and this report updates the analysis to data for 2022. The series of reports allowed us to document and describe the roller-coaster impact of the 2018 outbreak of African swine fever virus (ASFV) in China on the finances of pork producers worldwide. These reports have also spanned the COVID-19 pandemic and ASFV in several other countries in the Global Swine Benchmarking project including Germany, the Czech Republic, Hungary, Italy, South Korea, and Vietnam. In 2022, global inflation reached its highest level since the mid-1990s. In recent years, inflation, the pandemic, supply chain disruptions, a tight labor supply, rising interest rates, and geopolitical uncertainty made the economic environment anything but stable.

Prior reports have consistently shown an impressive level of animal productivity in Denmark and the Netherlands and documented the lowest production costs in Brazil and the USA. The reports also include estimates of the value of improving key performance indicators in each country and describe the key indicators that drive financial performance. In this report, we also compare changes in key indicators between 2021 and 2022.

The raw data comes primarily from an international benchmarking network known as InterPIG. The representatives of the seventeen participating countries listed in Appendix A come from scientific institutions and extension services of producer organizations and have built the database over several years<sup>1</sup>. Members meet once per year to update and actualize the dataset and ensure that the cross-country comparisons are accurate. They use production and financial data from farm records to measure the countrywide average performance of representative pork farms. Definitions have been standardized across countries using a glossary of terms so, for instance, a "gilt" is defined in the same way in every data set, and carcass weights are adjusted to reflect whether the head is left on or removed. The InterPIG network also functions as a forum for information exchange.

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1. The structure of the InterPIG network means that it is open to members of all important pig producing countries. But, access presupposes that each member contributes all data from his/her country required by the network.

Several key pork-importing countries do not participate in InterPIG. Representative data for four of them, China, Japan, South Korea, and Vietnam, was obtained with help from industry consultants in each country and MSD Animal Health (Merck Animal Health in the United States and Canada) technical, marketing, and sales staff. The intention is to add additional countries in future years.

The compiled data for the countries in Asia do not necessarily represent averages for all farms in each country. The data for Japan are for modern commercial farms of various sizes. The data for Vietnam and South Korea are for modern commercial farms of various sizes free of ASFV. The data for China is for modern, large-scale, single-story, non-filtered farms that were free of ASFV. While the data for China, Vietnam, and South Korea was representative of farms free of ASFV, several values, such as market pig and feed prices, were significantly affected by the presence of the virus in those countries from 2019 through 2022. Once the Chinese swine herd recovered from ASFV, Chinese pork imports and world pig prices plunged. Productivity on farms free of ASFV, but where the disease was present in a country, was affected due to changes in the use of animal health products, marketing decisions, the source of gilts for breeding, and other changes made in response to the presence of the virus in each country.

The source of data for the countries in Asia is from published and unpublished farm records and other sources. In some cases, estimates were made from personal communication with consultants familiar with production in each country.

## Outline of the Report

This report begins with a look at the raw data. All comparisons are for 2022, and the results are presented in U.S. dollars. Much of the information is available from reports written by InterPIG members, so the value-added here is the inclusion of China, Japan, South Korea, and Vietnam and the approach we use to compare pig production across countries. Namely, we analyze which factors gave each country a competitive advantage or disadvantage. These calculations, which provide a novel approach to evaluating competitiveness, help us isolate how much advantage or disadvantage each factor conveys to each country. Year-over-year comparisons were made to compare changes in key indicators between 2021 and 2022. We then calculated the marginal value of changes in key performance indicators.

There is no consensus on how performance should be measured. Breeding companies are interested in performance per breeding female, pig farmers evaluate performance per pig produced, and those interested in international trade measure performance based on kilograms of pork. We, therefore, present results using all three measures. Most of the values are presented based on a breed-to-market system, where the breeding, nursery (rearing), and finishing (fattening) phases are combined. However, some values, such as feed prices, are presented individually for the breeding and wean-to-market (nursery and finishing combined) production phases.

## Part 1: The Raw Data

**Figure 1** shows the total carcass weight produced per breeding female, the average live weight per pig marketed, and the number of pigs marketed per year. As was true in previous years, Italy had the heaviest live weight and led in carcass weight marketed per breeding female. The Netherlands, the Czech Republic, and Germany produced the next highest total carcass weight per breeding female. Denmark, the Czech Republic, and the Netherlands all exceeded 30 pigs marketed per female per year. Countries in Asia lagged in terms of productivity and marketed the least total carcass weight per breeding female. Major exporters such as the USA and Canada have relatively poor animal productivity when compared to many countries in the European Union.

**Figures 2, 3, and 4** show the revenue, cost, and profit for each country in 2022. The results are presented on a per kg of carcass weight sold, per pig sold, and per breeding female basis in **Figures 2, 3, and 4**, respectively. **Figure 2 (bars)** shows that Japan and South Korea had the highest production costs per kg of pork sold. Vietnam and China also had very high production costs. The states of Mato Grosso (MT) and Santa Catarina (SC) in Brazil, the USA, and Denmark had the lowest overall costs. Brazil has two data points because of the vast differences between the traditional pig farming state of Santa Catarina and the new frontier in Brazilian pork production, Mato Grosso. Santa Catarina is recognized by the World Organization for Animal Health as free of foot and mouth disease virus (FMDV) without vaccination and is eligible to export to a wide range of countries. In 2022, Mato Grosso was recognized as free of FMDV with vaccination and could only export to a very limited list of importers. During the COVID-19 pandemic in 2020, the Brazilian currency (Real) fell by about 25%, and had not recovered in 2022. As a consequence, Brazilian prices expressed in U.S. dollars are lower than

they would have been had the value of the Real not fallen relative to the U.S. dollar. Brazil is also free of porcine reproductive and respiratory syndrome virus (PRRSV), which is the most costly disease of the global swine industry. Consequently, Brazil is now the world's low-cost supplier. In earlier comparisons, the USA was about even or slightly lower than Santa Catarina.

**Figure 2** also shows the market pig price (line) and net profit (shaded area) for each country. Market pig prices were highest in Japan, South Korea, Vietnam, and China. Net profit was positive in South Korea, China and the USA. All other countries experienced negative profits in 2022 as Chinese pork output recovered and exports from these countries fell. Losses in 2022 were particularly severe in Europe. Germany, the Czech Republic, Hungary and Italy continued to suffer from their infected ASFV status in 2022. The USA was not as dependent on China as other countries because it faces a 25% retaliatory duty left over from the trade war. Inflation pushed many country's pig prices higher in 2022, but inflation and higher interest rates also increased production costs. The horizontal red line shows the average net profit across all countries, calculated as a simple average of profitability in all countries. In 2022, producers lost an average of US\$0.26 per kg of carcass down from a loss of US\$0.10 per kg of carcass weight in 2021.

**Figure 3** shows that Italy, Japan, South Korea, and China had the highest costs when measured on a per pig sold basis. This reflects the heavy carcass weights, low productivity, and high feed costs in Italy and low productivity and high feed costs in South Korea and Japan. **Figure 4** shows the same data but on a per breeding female basis. Italy and Japan had the highest costs per breeding female. China is more competitive in this measure. As can be seen in **Figure 1**, Chinese breeding females were less productive than in other countries, with the second fewest pigs marketed per breeding female, which explains why China is ranked so poorly in terms of the cost per pig sold or per kg of carcass weight and yet is more competitive when the cost is expressed on a per breeding female basis.

**Figures 5, 6, and 7 (bars)** provide additional detail on the breakdown of costs. Feed made up a large portion of costs in all countries, particularly in Asia. All of the countries in Asia import feed, and their feed markets are at import parity, which is determined by the import price plus tariffs and transport costs. Low feed costs in the USA and Brazil provided these two countries with a significant advantage in the cost of production. This advantage was enhanced by lower energy, labor, and fixed costs. Brazilian costs are low because of a climate that

allows for low-cost construction. This cost advantage for Brazil was offset, to a certain degree, by relatively low market pig prices. USA pig prices were relatively strong in large part because of government stimulus programs that stimulated pork demand. The negative miscellaneous cost for Austria is not a typo. In 2021 and 2022 Austria had a state payment for market losses due to COVID-19 restrictions. The two payments were made for losses in 2020 and 2021 and were disbursed in subsequent years. Also, the increase in commercial fertilizer prices in 2022 provided a high manure value and a net manure disposal cost entered as a credit that helped offset pig farm operating expenses. The one-time payment for market losses due to COVID-19 restrictions, which was entered as a negative cost, and the negative net manure disposal cost resulted in a negative miscellaneous cost for Austria in 2022.

The information in **Figures 5, 6, and 7** can also be expressed in percentage terms available in Appendix B. Each cost component as a percentage of the total cost does not vary when the results are reported on a per kg of carcass weight, per pig sold, or per breeding female basis. Therefore a single table with the breakdown of costs by component as a percentage of the total cost is provided.

**Figure 8** compares feed prices on a dollars per metric tonne basis for feed in the breeding and wean-to-market phases of production. Feed prices were highest in Asia, especially in Japan, Vietnam, and China, and lowest in Mato Grosso, Hungary, the Czech Republic, and the USA. Feed prices for countries in Europe generally fell in the middle. It seems possible that the low feed prices in Hungary and the Czech Republic were due to duty free imports from the Ukraine.

Countries with lower feed prices also had lower market pig prices; here again, the USA is an exception in 2022 because of strong domestic pork demand. In general, low feed prices will stimulate production in these countries until pig prices fall to equal the cost of production. It is also true that countries with high feed prices erect trade barriers to protect domestic production.

**Figure 9** compares labor cost per hour, or wage rate, against labor productivity, measured as the hours of labor used per breeding female for all production phases (breed-to-market). The Netherlands, Denmark, and Sweden had the highest labor cost per hour, and Spain, the Netherlands, and the USA had the highest labor productivity (lowest labor usage). Vietnam, the Czech Republic, Hungary, China and Brazil (SC) had low labor productivity (high labor usage) but also had

low hourly labor costs. Brazil (MT and SC) stands out as having extremely low labor cost per hour which was magnified by the devaluation of the Real in 2020 that remained in 2022. Generally, the higher the cost of labor per hour in a country, the lower the labor usage (higher labor productivity). The major exporting countries of Spain, the USA, Canada and Brazil all have significantly higher labor productivity than countries with similar wage rates.

**Figure 10** shows whole herd feed conversion which is calculated as kilograms of feed in all phases of production per kilogram of carcass weight sold. Italy, South Korea, China, Japan, the USA, Sweden, and Canada performed poorly on this measure. Higher sow, suckling piglet, and wean-to-market mortality were a drag on whole herd feed conversion in these countries. The heavy market weight of pigs in Italy contributes to the very poor whole herd feed conversion in that country.

**Figure 11** shows mortality rates of pigs and breeding females. Birth-to-market mortality is reported as the number of pig deaths from birth-to-market expressed as a percentage of the number of pigs born alive. Spain, the USA, Canada, South Korea, Denmark, and Japan performed poorly on this measure while producers in Brazil (SC and MT) and Vietnam performed the best. Spain, the USA, and Denmark also had relatively high breeding female mortality rates. Mortality rates in Spain, especially wean-to-market mortality, increased significantly in 2022 compared to 2021 as the country dealt with swine health issues related to highly virulent isolates of PRRSV.

## Part 2. Sources of Competitive Advantage

Here we explore the factors that gave producers a leg up, measured by profit, over producers in other countries. We did this by setting each country's costs, prices, and productivity to the same value—the average for all countries. The only values that varied for each country were those for the factor evaluated. Each factor was evaluated alone, one at a time. Therefore, any differences in profitability are due strictly to the country's differences in the values for that factor. As an example, one of the factors evaluated was feed prices. For that factor, feed prices in the breeding, nursery (rearing), and finishing (fattening) phases of production were set to the values reported for each country. All other values were the same for every country, set to the average value of all countries. For each factor, the relative advantage or disadvantage is measured as the

difference in profitability relative to a hypothetical country with average values for the factor evaluated. An advantage (disadvantage) is reported as a positive (negative) contribution to profitability above (below) the hypothetical average country. This data is color-coded with dark green shading representing the greatest advantage and dark red shading the greatest disadvantage. In order to reduce the number of figures to evaluate, we present results on a dollars per kg sold basis (**Table 1**). The table is sorted according to the second column, which is the overall profit advantage (disadvantage) of each country compared to the average profitability of all the countries in 2022. The results expressed on a per pig sold (**Table C.1**) and per breeding female (**Table C.2**) basis are in Appendix C.

The factors that contributed to the highest relative advantage or disadvantage were market pig prices, feed prices, and productivity. The relative advantage or disadvantage for the other factors evaluated, wage rates, labor productivity, and fixed costs were lower but still important.

The **third column in Table 1** evaluates the contribution of market pig prices to profitability in 2022. Countries in Asia benefited from high market pig prices in 2022. Brazil (MT and SC), Denmark, the Netherlands, Belgium, and the Czech Republic lost out in this regard. High market pig prices in South Korea and Japan gave producers there a respective US\$1.87 and US\$1.84 per kg of carcass weight advantage over a country with average market pig prices. South Korea's advantage over Brazil (MT) was US\$2.56 since Brazil (MT) had a US\$0.69 disadvantage relative to the average. This means that, if somehow producers in South Korea and Brazil (MT) were made equal by every measure except market pig prices, with the same costs, same productivity, etc., producers in South Korea would have earned US\$2.56 per kg of carcass weight more than those in Brazil (MT) in 2022 because of the higher market pig prices they received.

The **fourth column in Table 1** provides the same comparison for feed prices. Brazil (MT), the USA, and Canada in the Americas, as well as Hungary, Denmark, the Czech Republic, and France benefited from low feed prices, while countries in Asia fared poorly on this measure. Low feed prices in Brazil (MT) and Hungary gave producers a respective US\$0.35 per kg of carcass weight advantage over a country with average feed prices. Producers in Japan had the highest feed prices, which placed them at a US\$0.98 per kg of carcass weight disadvantage to a country with average feed prices.



The **fifth column in Table 1** evaluates the importance of genetics, health, nutrition, and animal husbandry, (i.e., productivity in breeding, nursery (rearing), and finishing (fattening)). Here Denmark, the Czech Republic, the Netherlands, Brazil (SC and MT), and Ireland led while China, South Korea, and Japan lagged. Producers in Denmark had the highest productivity giving them a US\$0.32 per kg of carcass weight advantage over a country with average productivity. Producers in China were at a US\$0.73 per kg of carcass weight disadvantage to a country with average productivity.

The **sixth column in Table 1** evaluates the impact of fixed costs, which are determined primarily by building costs, estimated lifetime of buildings and equipment, and maintenance costs, on relative profitability. Low fixed costs provided the greatest competitive advantage to producers in the Americas, Japan, China, and Spain. Higher fixed costs provided the largest competitive disadvantage to producers in Italy, South Korea, and Austria. Producers in Brazil (SC and MT) had the lowest fixed costs giving them a US\$0.17 per kg of carcass weight advantage over a country with average fixed costs.

The **seventh column in Table 1** evaluates labor productivity, measured as the hours of labor used per breeding female for all phases of production (breed-to-market). The Netherlands, the USA, Spain, France, Denmark, and Canada performed well under this measure, while Vietnam, China, Hungary, and the Czech Republic lagged.

The **eighth column in Table 1** shows the other part of the labor equation by comparing the cost of labor per hour or wage rate. Countries with low labor productivity, including Vietnam, Brazil (SC and MT), China, and Hungary had low wage rates. The Netherlands, Denmark, and Sweden had the highest wage rates. To evaluate labor costs, labor productivity and wage rate are evaluated together (ninth column). Vietnam fared well on this measure because very high labor usage was more than offset by the low cost of labor per hour in that country. Brazil (MT and SC), Spain, the USA, and Canada also fared well, and the Czech Republic, Italy, Finland, Austria, Japan, and South Korea did poorly. Producers in the state of Mato Grosso in Brazil had the lowest labor costs giving them a US\$0.11 per kg of carcass weight advantage over a country with average labor costs.

The USA benefited from relatively low feed costs, fixed costs, labor usage and wage rates and yet did better than average on market pig prices. In 2022,

productivity was the only factor that placed producers in the USA at a relative disadvantage. Overall, the USA had an overall US\$0.48 profit advantage over the world average.

### Part 3. Year over Year Comparisons 2022 versus 2021

**Table 2** compares several key productivity and financial measures between 2021 and 2022. Spain, Denmark, Vietnam, and Belgium saw the largest decreases in total carcass weight per female. Italy, China, and Canada saw an increase in the number of pigs marketed. The values for Italy and Canada may be due to changes in the data sample. While this may improve the representativeness of the data, it makes year-over-year comparisons of the data challenging. The value for China is likely due to a recovery from ASFV.

The financial measures on the right-hand side of **Table 2** show that 2022 was a bad year compared to 2021, with higher costs more than offsetting higher market pig prices in many countries. The simple average of profitability across all countries fell by US\$0.15. Total cost and feed prices increased by US\$0.19 and US\$0.18, per kg of carcass weight, respectively, in 2022 compared to 2021.

### Part 4. Marginal Values of Key Performance Indicators

When producers in any country consider changes in feed diets, genetics, or animal health interventions to improve productivity, they are conducting some sort of cost-benefit analysis, whether formal or informal. This is not easy because the value of productivity improvements depends on market pig prices, feed prices, fixed costs, and other factors and, therefore, will vary over time and from one country to another. For example, what is the value of reducing mortality from wean-to-market by one percent? The answer is different for each country depending on the market pig prices, feed prices, fixed costs, and other factors for that country in 2022. The results reported in this section are intended to help producers make better cost-benefit calculations for decision-making, such as whether to use a vaccine or antimicrobial to reduce disease and improve productivity.

The model used for this analysis links all phases of production from breeding to market. We can, therefore, change any productivity measure and calculate the impact on profits from breed-to-market. To operationalize this, we incrementally

changed litters farrowed per female per year by 0.05, pigs born alive per litter farrowed by 0.25, pre-wean mortality and wean-to-market mortality by a negative one-percentage point, average daily gain by 0.01 kg per day, and feed conversion by a negative 0.025 kg of feed per kg of gain. In order to isolate the impact of each, incremental changes in these key productivity measures were done individually, with all other factors remaining at their original values for each country. The outcome is the benefit, measured as the increase in profitability, given the incremental change in the key productivity measure for each country. The results are summarized in **Table 3**.

The differences between countries are substantial. A 0.25 pig increase in the number of pigs born alive per litter farrowed in South Korea, for example, yielded a marginal increase in profit of US\$49.15 per breeding female per year. In the Netherlands, the same incremental improvement in pigs born alive per litter farrowed yielded a marginal increase in profit of only US\$1.10 per breeding female per year. This has significant implications for resource allocation and investment decisions made by producers. To breakeven, a producer in South Korea could spend US\$49.15 on an intervention to get a 0.25 pig increase in the number of pigs born alive per litter farrowed, while producers in the Netherlands, could only spend US\$1.10 to get the same 0.25 pig increase in the number of pigs born alive per litter farrowed. Unfortunately for Italian producers, an increase in productivity had a negative impact because it meant more pigs were fed to market weight with variable costs that exceeded market prices. When market pig prices are too low to cover variable production costs, it does not pay to improve productivity to increase the number of pigs to be marketed.

The degree to which an increase in all of the key productivity measures, except the wean-to-market feed-to-gain ratio, will increase profit is a function primarily of 1) fixed costs, 2) market pig prices, and 3) feed prices (the main variable cost). When market pig prices are high relative to feed prices, the profit earned on each pig or kg of pork sold is relatively high. The marginal value of weaning extra pigs, lowering mortality, or increasing average daily gain to increase the kg of pork sold is greater when raising pigs is already profitable. As the number of pigs weaned and kg of pork sold goes up, the incremental increase in profitability will be greater in countries with higher fixed costs since those higher fixed costs are spread over more pigs, i.e., economies of scale. The extent to which an increase in the wean-to-market feed-to-gain ratio will increase profit on a per pig sold basis depends on feed prices and the weight of pigs at market. The marginal value of

improving the feed-to-gain ratio is highest when feed prices are high and when pigs are marketed at heavier weights.

The relatively large marginal values reported in **Table 3** for countries in Asia occurred because market pig prices were highest in these countries (**Figures 2, 3, and 4**). Similarly, the value of improving the wean-to-market feed-to-gain ratio is highest in Asia which have relatively high feed prices (**Figure 8**).

## Conclusions

The questions that continue to motivate this work are, who are the world's best pork producers and why? How can competitiveness best be measured? What is the value of improving key performance indicators in each country, and what are the key factors that drive financial performance? The answer to these questions is that it depends. If we compare pork producers based on profitability, as we do when we evaluate companies, then the USA and South Korea come out on top in 2022. If we use animal husbandry and productivity as a performance measure, then Denmark, the Netherlands, and the Czech Republic rank at the top. If we use production costs as a metric, Brazil is the most competitive. This latter measure makes most sense if we are interested in trade in pork meat, and in this regard, Mato Grosso can be ruled out because they are prohibited from exporting to the most lucrative import markets. The source of the competitiveness of producers in the USA is not just cheap feed. The USA has high labor productivity even though the cost of labor per hour is below that of countries that use similar amounts of labor. The USA also has low fixed costs. Understanding the competitive advantages and disadvantages of countries is an ongoing pursuit. Changes occur annually as country-specific situations change (e.g., policy directives, disease outbreaks), and global market conditions evolve.

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**Figure 1.** Total carcass weight produced per breeding female, average live weight, and number of pigs marketed—2022

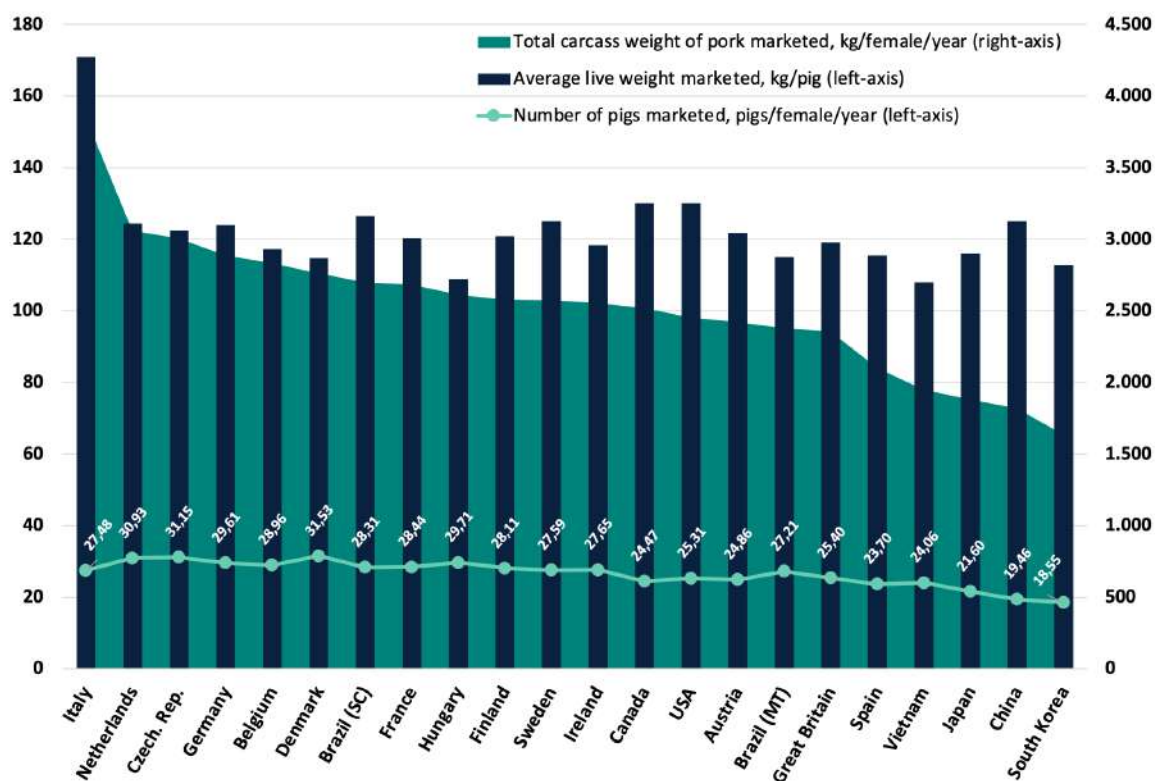


Figure 2. Revenue, cost, and profit per carcass kg sold—2022

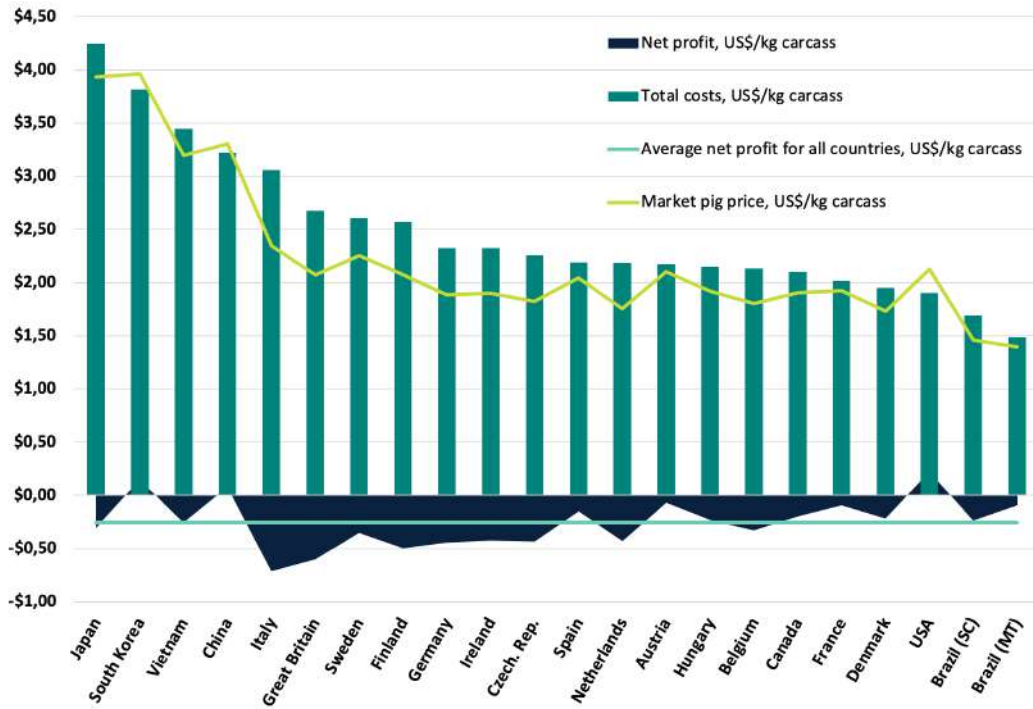


Figure 3. Revenue, cost, and profit per pig sold—2022

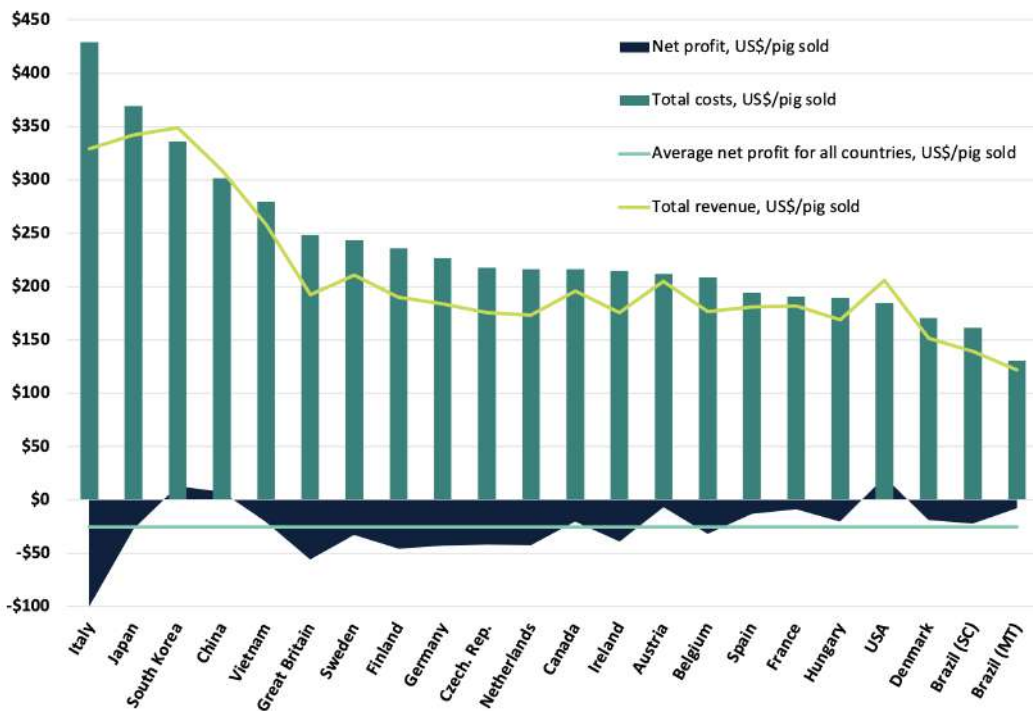


Figure 4. Revenue, cost, and profit per breeding female—2022

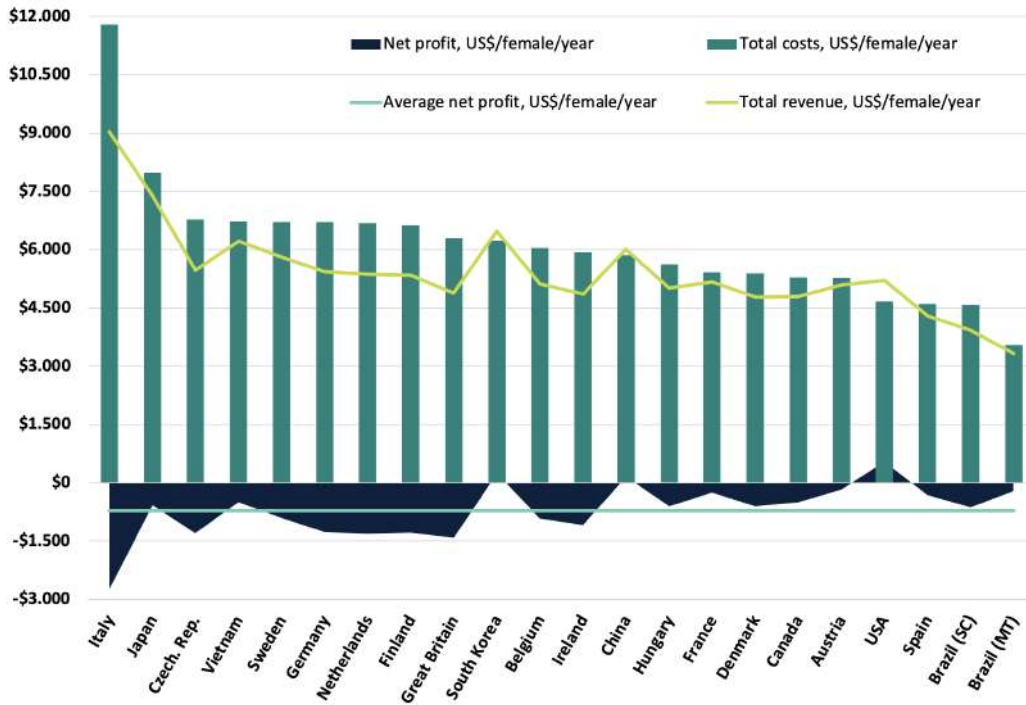


Figure 5. Detailed costs per carcass kg sold—2022

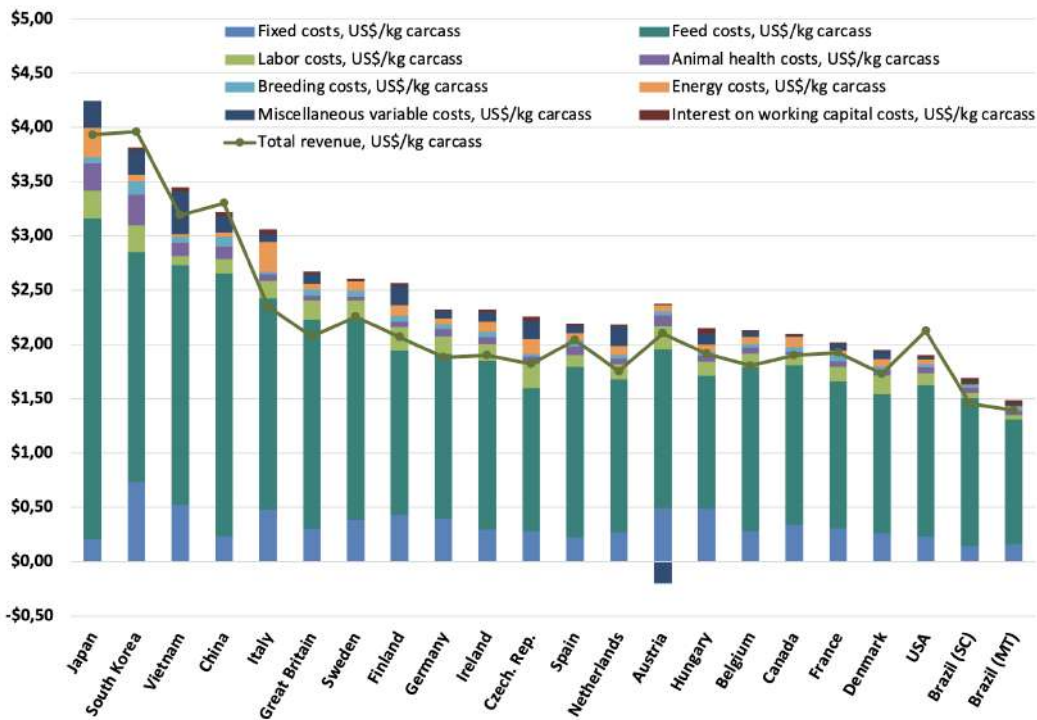


Figure 6. Detailed costs per pig sold—2022

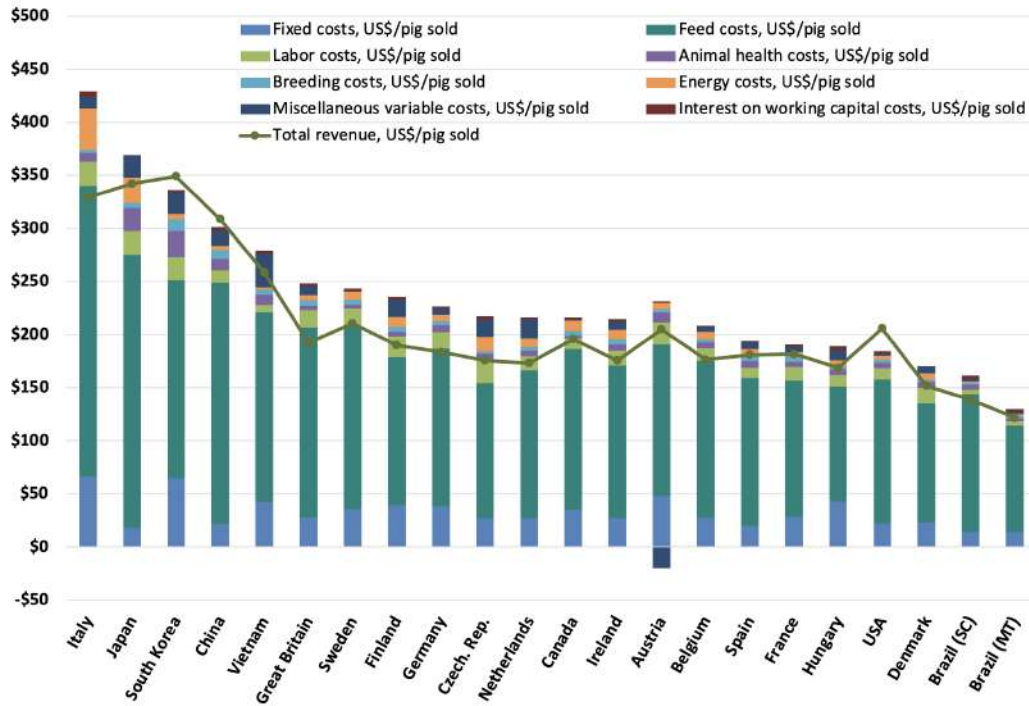


Figure 7. Detailed costs per breeding female—2022

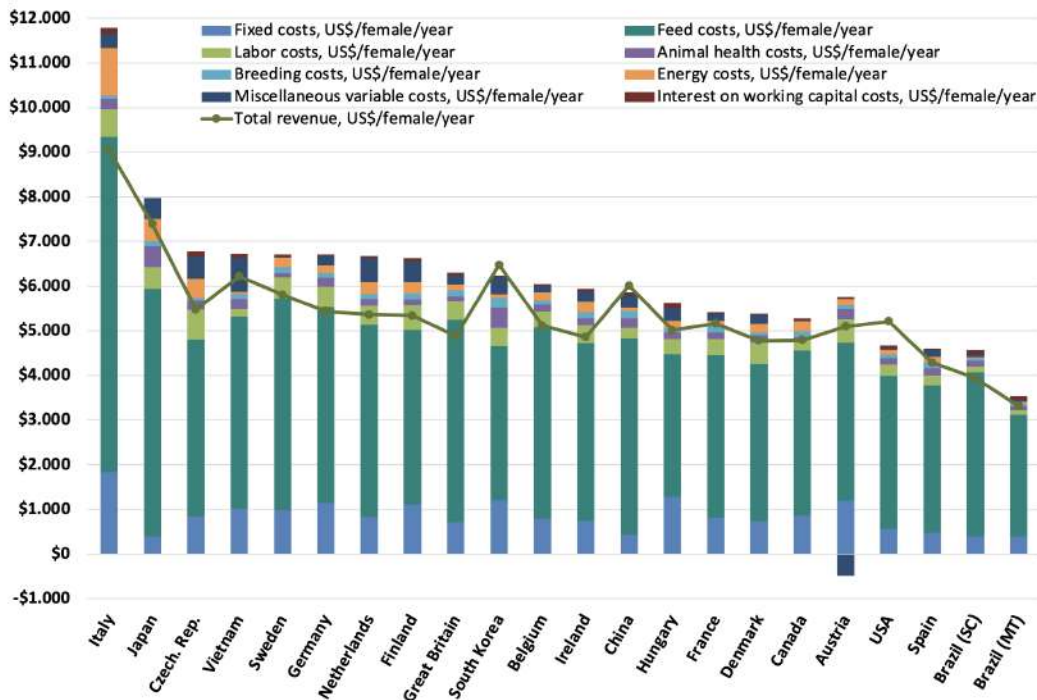




Figure 8. Feed costs by phase of production and market pig prices—2022

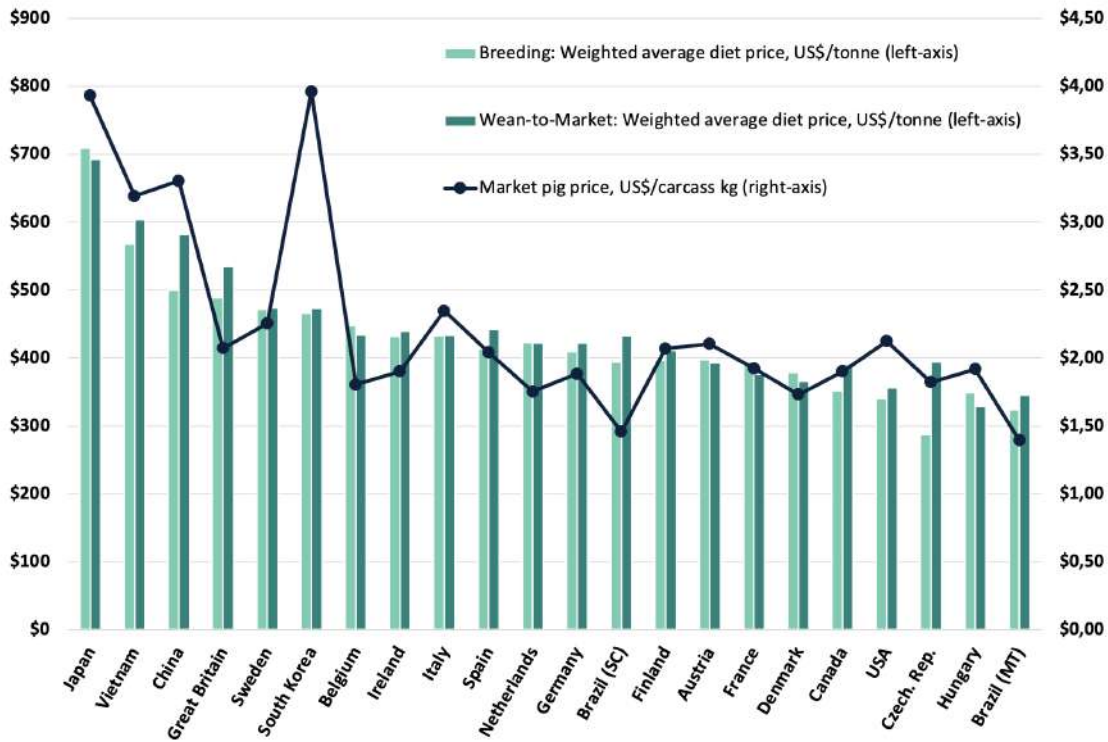


Figure 9. Labor usage and cost—2022

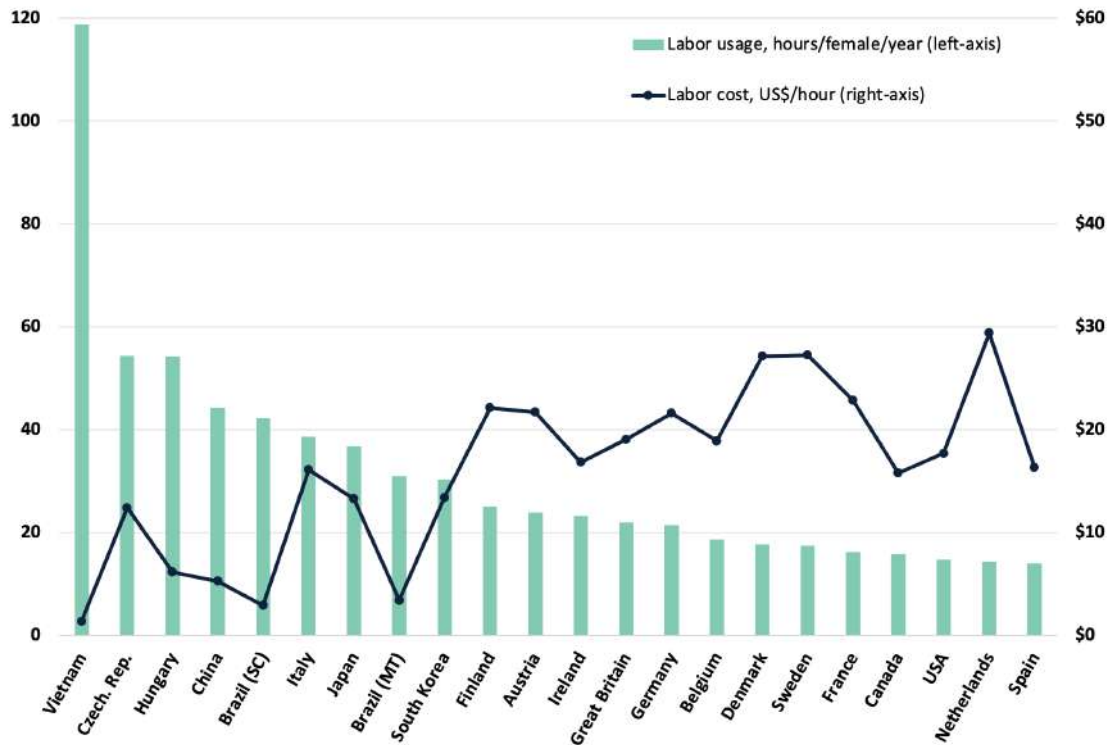


Figure 10. Whole herd feed conversion—2022

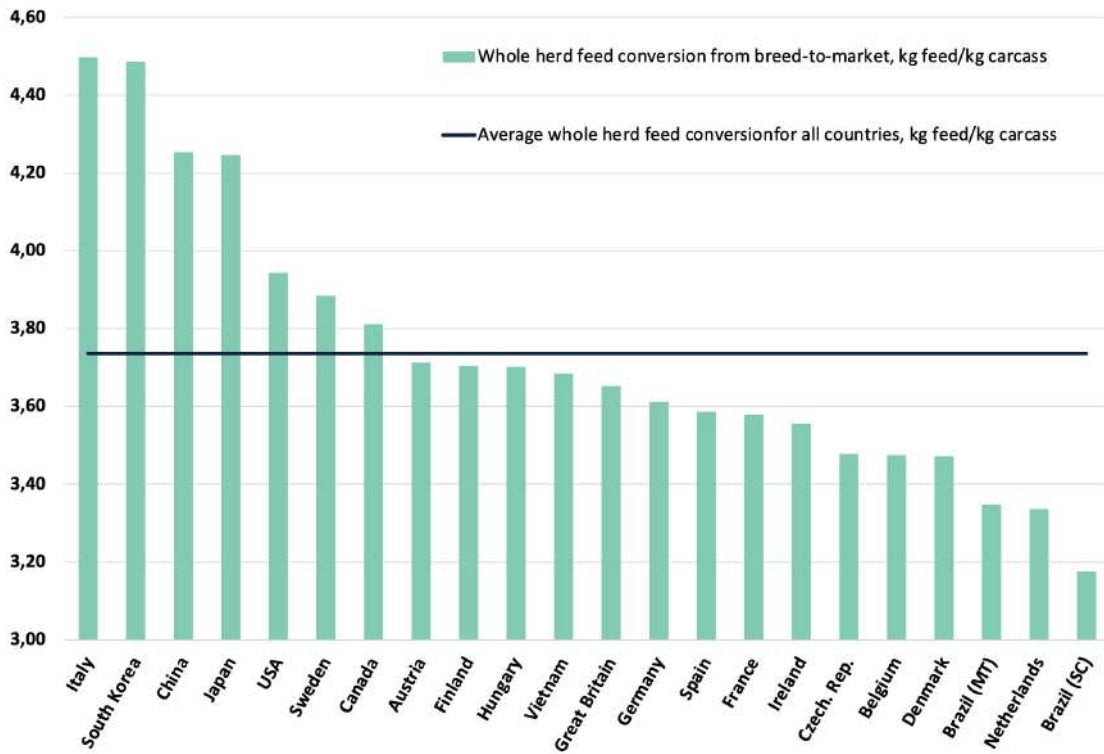
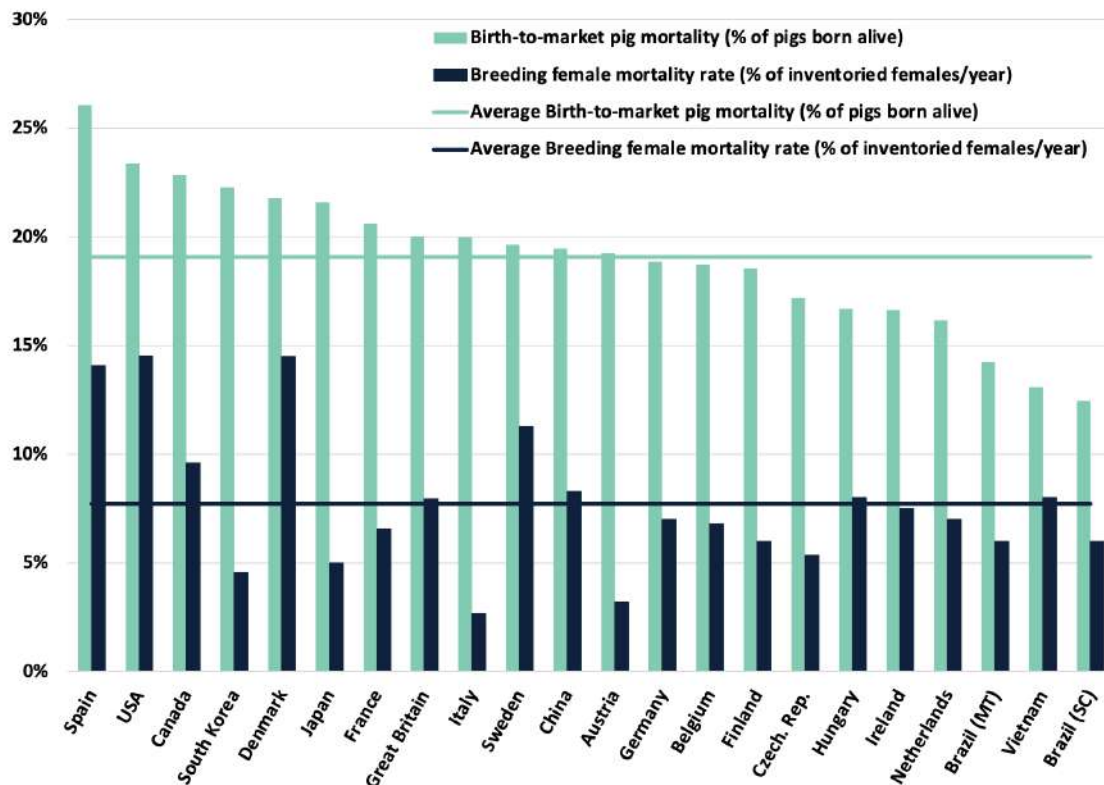


Figure 11. Mortality rates—2022



**Table 1.** Profit advantage of select factors, all other variables held constant, US\$ per carcass kg sold basis, 2022

Country	Profit advantage over average	Market pig prices	Feed prices	Productivity	Fixed costs	Labor usage	Wage rates	Labor Usage & Wage Rates
USA	\$0.48	\$0.04	\$0.24	-\$0.17	\$0.09	\$0.08	-\$0.01	\$0.05
South Korea	\$0.40	\$1.87	-\$0.15	-\$0.66	-\$0.26	-\$0.07	\$0.04	-\$0.05
China	\$0.34	\$1.22	-\$0.53	-\$0.73	\$0.11	-\$0.15	\$0.15	\$0.04
Austria	\$0.19	\$0.02	\$0.15	\$0.01	-\$0.17	\$0.02	-\$0.06	-\$0.06
Brazil (MT)	\$0.16	-\$0.69	\$0.35	\$0.19	\$0.17	-\$0.02	\$0.17	\$0.11
France	\$0.16	-\$0.16	\$0.20	\$0.09	\$0.01	\$0.07	-\$0.08	\$0.01
Spain	\$0.11	-\$0.05	-\$0.06	-\$0.18	\$0.12	\$0.08	\$0.01	\$0.06
Canada	\$0.06	-\$0.18	\$0.16	-\$0.07	-\$0.04	\$0.07	\$0.01	\$0.05
Denmark	\$0.04	-\$0.36	\$0.25	\$0.32	\$0.06	\$0.07	-\$0.13	-\$0.02
Hungary	\$0.02	-\$0.17	\$0.35	-\$0.11	-\$0.15	-\$0.15	\$0.13	\$0.03
Brazil (SC)	\$0.02	-\$0.63	\$0.01	\$0.24	\$0.17	-\$0.09	\$0.18	\$0.10
Vietnam	\$0.00	\$1.11	-\$0.66	-\$0.15	-\$0.11	-\$0.63	\$0.20	\$0.08
Japan	-\$0.06	\$1.84	-\$0.98	-\$0.60	\$0.14	-\$0.08	\$0.04	-\$0.06
Belgium	-\$0.07	-\$0.28	-\$0.03	\$0.07	\$0.03	\$0.06	-\$0.03	\$0.02
Sweden	-\$0.10	\$0.17	-\$0.15	\$0.08	-\$0.06	\$0.06	-\$0.13	-\$0.03
Ireland	-\$0.17	-\$0.19	\$0.01	\$0.21	\$0.03	\$0.03	\$0.00	\$0.00
Netherlands	-\$0.18	-\$0.33	\$0.02	\$0.27	\$0.03	\$0.09	-\$0.16	\$0.00
Czech. Rep.	-\$0.18	-\$0.26	\$0.20	\$0.27	\$0.02	-\$0.15	\$0.06	-\$0.10
Germany	-\$0.19	-\$0.20	\$0.05	\$0.14	-\$0.10	\$0.04	-\$0.06	-\$0.02
Finland	-\$0.24	-\$0.02	\$0.10	\$0.17	-\$0.10	\$0.02	-\$0.07	-\$0.06
Great Britain	-\$0.35	-\$0.01	-\$0.32	\$0.13	\$0.03	\$0.03	-\$0.03	-\$0.02
Italy	-\$0.46	-\$0.26	-\$0.03	-\$0.33	-\$0.38	-\$0.07	\$0.01	-\$0.09

Table 2. Year-over-year comparisons of key indicators, 2022 vs. 2021

Country	\$/kg carcass weight						
	Total carcass weight of pork marketed (kg/female/year)	Average live weight marketed (kg/pig)	Number of pigs marketed (pigs/female/year)	Net profit	Market pig price	Total cost	Total feed cost
Vietnam	-84.90	1.46	0.70	-0.73	-0.28	0.45	0.14
Sweden	73.19	0.76	0.78	-0.37	0.00	0.37	0.51
Finland	-13.64	-0.24	-0.19	-0.36	0.24	0.59	0.54
Italy	479.76	3.42	3.65	-0.35	0.19	0.53	0.21
Brazil (SC)	-7.42	-0.17	-0.03	-0.33	-0.14	0.19	0.10
China	305.30	2.64	2.79	-0.30	-0.90	-0.60	-0.23
Canada	138.74	0.51	1.72	-0.28	0.01	0.29	0.16
Denmark	-91.93	0.03	0.14	-0.28	-0.04	0.24	0.19
USA	45.17	0.34	0.46	-0.22	0.13	0.35	0.24
Spain	-166.45	-1.53	-0.63	-0.17	0.15	0.32	0.30
South Korea	-62.48	-0.73	-1.07	-0.15	-0.46	-0.31	0.05
Great Britain	33.65	-0.16	-0.07	-0.12	0.16	0.28	0.24
Ireland	-42.92	-0.43	-0.15	-0.12	0.03	0.15	0.19
Brazil (MT)	0.00	0.00	0.00	-0.09	0.09	0.13	0.08
Netherlands	27.61	0.37	0.36	-0.06	0.17	0.23	0.22
Belgium	-84.25	-0.80	-0.53	-0.03	0.25	0.28	0.27
Czech. Rep.	93.78	0.68	0.99	0.00	0.27	0.27	0.21
Hungary	-20.55	0.30	0.44	0.02	0.35	0.33	0.08
France	3.33	0.22	0.27	0.03	0.19	0.16	0.17
Austria	8.63	0.14	0.34	0.08	0.19	0.11	0.25
Germany	49.74	1.01	0.94	0.09	0.32	0.23	0.25
Japan	130.68	-1.50	-1.40	0.36	-0.11	-0.47	-0.13
<b>Average</b>	<b>37.05</b>	<b>0.29</b>	<b>0.43</b>	<b>-\$0.15</b>	<b>\$0.03</b>	<b>\$0.19</b>	<b>\$0.18</b>

**Table 3.** Marginal value of incremental changes in key productivity indicators (KPI),\* 2022

	US\$/breeding female/year			US\$/pig placed		
	Litters farrowed / female / year	Pigs born alive / litter farrowed	Prewean mortality (% of pigs born alive)	Wean-to-market Mortality (% of pigs placed)	Wean-to-market Average daily gain (kg / day)	Wean-to-market Feed-to-gain ratio (kg feed / kg gain)
<b>Increment</b>	<b>0.05</b>	<b>0.25</b>	<b>-1.0%</b>	<b>-1.0%</b>	<b>0.01</b>	<b>-0.025</b>
South Korea	\$52.21	\$49.15	\$24.54	\$1.75	\$2.45	\$1.15
China	\$31.85	\$26.63	\$14.35	\$1.36	\$1.42	\$1.63
Japan	\$25.35	\$22.29	\$13.00	\$1.27	\$1.69	\$1.79
USA	\$32.05	\$27.48	\$18.12	\$1.03	\$0.92	\$1.05
Austria	\$26.82	\$22.90	\$14.35	\$0.92	\$0.92	\$1.09
Vietnam	\$15.44	\$15.53	\$8.00	\$0.84	\$1.16	\$1.50
France	\$24.07	\$18.17	\$13.20	\$0.77	\$0.83	\$1.03
Spain	\$17.60	\$13.85	\$9.31	\$0.77	\$0.71	\$1.11
Sweden	\$16.64	\$12.05	\$8.90	\$0.76	\$0.56	\$1.35
Hungary	\$18.54	\$14.00	\$9.78	\$0.62	\$0.94	\$0.83
Canada	\$12.44	\$10.83	\$6.86	\$0.71	\$0.65	\$1.14
Denmark	\$17.53	\$10.90	\$9.27	\$0.58	\$0.56	\$0.95
Finland	\$8.00	\$5.97	\$4.24	\$0.54	\$0.72	\$1.14
Ireland	\$9.02	\$6.82	\$4.55	\$0.57	\$0.53	\$1.18
Belgium	\$7.36	\$5.75	\$3.95	\$0.57	\$0.55	\$1.14
Brazil (MT)	\$11.69	\$10.79	\$6.32	\$0.51	\$0.36	\$0.93
Czech. Rep.	\$6.28	\$4.47	\$3.25	\$0.50	\$0.59	\$1.10
Germany	\$4.40	\$3.22	\$2.38	\$0.51	\$0.56	\$1.20
Great Britain	\$2.40	\$1.84	\$1.22	\$0.58	\$0.34	\$1.43
Netherlands	\$1.49	\$1.10	\$0.79	\$0.44	\$0.53	\$1.21
Brazil (SC)	\$2.68	\$2.27	\$1.36	\$0.44	\$0.16	\$1.27
Italy	-\$25.09	-\$21.04	-\$13.91	\$0.45	\$0.87	\$1.71
<b>Average</b>	<b>\$14.49</b>	<b>\$12.04</b>	<b>\$7.45</b>	<b>\$0.75</b>	<b>\$0.82</b>	<b>\$1.22</b>

\*The marginal value of the incremental changes in KPI is measured as the change in profit as each KPI is changed by the increment indicated while holding all other values constant. Wean-to-market values on a per pig placed basis.

## Appendix A. InterPig membership

InterPIG is a collaborative network involving the following organizations and countries:

<b>Austria - VLV Upper Austria</b>
<b>Belgium - Flemish Government and Boerenbond Belgie</b>
<b>Brazil (Two data sets: Mato Grosso (MT) and Santa Catarina (SC)) - Embrapa Swine and Poultry</b>
<b>Canada - Canadian Pork Council</b>
<b>Czech Republic - Institute of Agricultural Economics and Information (UZEI)</b>
<b>Denmark - SEGES</b>
<b>Finland - Atria</b>
<b>France - IFIP</b>
<b>Germany - Thuenen Institute and Interessengemeinschaft der Schweinehalter (ISN)</b>
<b>Great Britain - Agriculture and Horticulture Development Board (AHDB)</b>
<b>Hungary - AKI Research Institute of Agricultural Economics</b>
<b>Ireland - Teagasc</b>
<b>Italy - Research Centre for Animal Production (CRPA)</b>
<b>Netherlands - Wageningen Economic Research</b>
<b>Spain - SIP Consultors</b>
<b>Sweden - Svenska Pig</b>
<b>USA - Iowa State University</b>

## Appendix B. Breakdown of total costs by component, 2022

Country	Fixed costs	Feed cost	Labor costs	Animal health costs	Breeding costs	Energy costs	Miscellaneous variable costs	Interest on working capital costs
Italy	15.6%	63.7%	5.3%	1.9%	0.7%	9.0%	2.5%	1.3%
Japan	4.9%	69.6%	6.1%	5.9%	1.3%	6.3%	5.9%	0.0%
Czech. Rep.	12.4%	58.5%	9.9%	3.0%	0.9%	6.3%	7.3%	1.6%
Vietnam	15.2%	64.0%	2.4%	3.5%	1.7%	0.7%	11.3%	1.2%
Sweden	14.7%	70.6%	7.1%	1.3%	2.1%	3.1%	0.2%	0.9%
Germany	17.1%	65.3%	6.9%	3.0%	1.6%	2.5%	3.1%	0.6%
Netherlands	12.4%	64.5%	6.3%	2.3%	1.6%	3.9%	8.3%	0.7%
Finland	16.8%	59.0%	8.3%	1.9%	2.0%	3.9%	7.1%	1.0%
Great Britain	11.3%	72.1%	6.6%	1.6%	2.1%	2.0%	3.4%	1.0%
South Korea	19.3%	55.5%	6.5%	7.3%	3.3%	1.4%	6.1%	0.6%
Belgium	13.1%	71.0%	5.8%	2.5%	1.6%	3.0%	2.5%	0.4%
Ireland	12.6%	67.0%	6.6%	2.7%	2.3%	4.0%	3.8%	1.1%
China	7.2%	75.2%	4.0%	3.6%	2.8%	1.3%	4.7%	1.2%
Hungary	22.7%	57.0%	5.9%	2.8%	1.5%	3.1%	4.9%	2.0%
France	15.0%	67.2%	6.8%	2.6%	2.9%	2.0%	2.9%	0.6%
Denmark	13.6%	65.5%	8.9%	2.9%	1.4%	3.5%	3.8%	0.5%
Canada	16.2%	70.0%	4.7%	1.1%	2.2%	4.4%	0.4%	0.9%
Austria	22.7%	67.3%	9.8%	4.5%	1.6%	2.6%	-9.3%	0.8%
USA	12.1%	73.4%	5.6%	3.0%	1.6%	2.1%	0.9%	1.4%
Spain	10.3%	71.7%	5.0%	3.5%	2.8%	2.8%	3.2%	0.7%
Brazil (SC)	8.7%	80.3%	2.7%	3.2%	1.2%	0.5%	1.4%	2.1%
Brazil (MT)	11.0%	77.1%	3.0%	2.4%	1.8%	1.2%	1.4%	2.2%

## Appendix C. Sources of competitive advantage on a per pig sold and per female basis.

Table C1. Profit advantage of select factors, all other variables held constant, per pig sold basis, 2022

Country	Profit advantage over average (\$/pig sold)	Market pig					Labor Usage and Wage Rates	
		prices	Feed prices	Productivity	Fixed costs	Labor usage	Wage rates	Rates
USA	\$46.75	-\$1.32	\$22.59	-\$13.68	\$9.69	\$8.11	\$2.19	\$6.30
South Korea	\$38.26	\$224.72	-\$30.85	-\$49.36	-\$59.26	-\$3.51	-\$3.59	-\$10.26
China	\$32.90	\$204.47	-\$79.01	-\$62.25	\$3.77	-\$16.11	\$14.48	\$3.40
Austria	\$18.53	-\$9.02	\$16.14	\$1.23	-\$20.09	\$1.63	-\$4.81	-\$4.99
Brazil (MT)	\$17.30	-\$61.76	\$19.04	\$16.12	\$13.66	-\$2.13	\$17.70	\$11.20
France	\$16.56	-\$26.15	\$14.81	\$7.62	\$0.59	\$7.91	-\$8.00	\$1.52
Spain	\$12.15	-\$10.89	\$0.28	-\$7.56	\$7.10	\$7.95	-\$0.63	\$4.88
Denmark	\$6.26	-\$22.72	\$23.20	\$29.12	\$2.86	\$7.60	-\$13.88	-\$1.66
Canada	\$5.12	-\$11.53	\$14.50	-\$11.82	\$15.09	\$0.54	\$2.30	-\$0.66
Hungary	\$4.95	-\$41.46	\$22.98	-\$10.67	-\$1.41	-\$15.42	\$13.92	\$2.76
Vietnam	\$4.69	\$135.71	-\$75.89	-\$4.02	\$3.87	-\$75.45	\$19.71	\$6.16
Brazil (SC)	\$2.84	-\$38.34	-\$4.92	\$15.68	\$13.65	-\$9.13	\$18.34	\$10.68
Japan	-\$1.74	\$188.95	-\$95.50	-\$57.42	\$2.02	-\$8.00	\$3.73	-\$6.83
Belgium	-\$6.56	-\$43.06	\$1.46	\$10.21	-\$0.64	\$6.12	-\$3.30	\$1.51
Sweden	-\$7.50	\$23.01	\$10.36	\$5.94	-\$18.55	\$6.38	-\$17.33	-\$5.55
Ireland	-\$13.83	-\$13.36	-\$5.59	\$26.19	-\$2.14	\$2.90	-\$1.35	-\$0.99
Czech. Rep.	-\$16.39	-\$42.95	\$19.09	\$25.98	\$4.80	-\$10.48	\$9.41	-\$1.40
Netherlands	-\$17.28	-\$39.96	\$4.69	\$23.49	-\$0.08	\$8.86	-\$16.95	-\$0.77
Germany	-\$17.67	-\$41.35	\$7.27	\$9.79	-\$12.68	\$4.48	-\$7.09	-\$2.79
Finland	-\$20.32	-\$16.90	\$40.07	\$17.15	-\$8.41	\$2.78	-\$6.39	-\$4.63
Great Britain	-\$30.48	-\$9.41	-\$25.93	\$6.68	\$3.17	\$3.09	-\$2.04	-\$1.26
Italy	-\$74.54	\$13.75	-\$5.52	-\$31.80	-\$12.41	-\$7.08	-\$0.27	-\$10.71



**Table C2.** Profit advantage of select factors, all other variables held constant, per breeding female basis, 2022

Country	Profit advantage over average (\$/female/year)	Market pig prices	Feed prices	Productivity	Fixed costs	Labor usage	Wage rates	Labor Usage and Wage Rates
USA	\$1,255.20	-\$35.73	\$610.55	-\$421.60	\$261.87	\$219.28	\$59.10	\$170.27
South Korea	\$953.20	\$6,073.40	-\$833.69	-\$1,023.47	-\$1,601.73	-\$94.73	-\$96.94	-\$277.37
China	\$860.63	\$5,526.20	-\$2,135.45	-\$1,112.78	\$101.86	-\$435.31	\$391.35	\$91.94
Austria	\$544.06	-\$243.79	\$436.21	-\$24.25	-\$542.88	\$44.06	-\$129.98	-\$134.76
Brazil (MT)	\$494.65	-\$1,669.28	\$514.60	\$375.21	\$369.16	-\$57.50	\$478.37	\$302.72
France	\$463.55	-\$706.77	\$400.18	\$138.71	\$16.07	\$213.80	-\$216.16	\$41.04
Spain	\$400.83	-\$294.21	\$7.51	-\$263.14	\$191.79	\$214.74	-\$17.16	\$131.78
Canada	\$218.47	-\$311.71	\$392.00	-\$346.44	\$407.89	\$14.52	\$62.12	-\$17.85
Vietnam	\$216.48	\$3,667.74	-\$2,050.98	-\$138.46	\$104.47	-\$2,039.17	\$532.58	\$166.56
Japan	\$128.48	\$5,106.62	-\$2,581.02	-\$1,370.92	\$54.71	-\$216.34	\$100.73	-\$184.71
Denmark	\$111.54	-\$614.12	\$627.06	\$843.23	\$77.40	\$205.46	-\$375.01	-\$44.77
Hungary	\$107.50	-\$1,120.42	\$621.12	-\$415.92	-\$38.00	-\$416.79	\$376.18	\$74.56
Brazil (SC)	\$76.22	-\$1,036.21	-\$133.09	\$372.89	\$368.88	-\$246.66	\$495.70	\$288.70
Sweden	-\$192.67	\$621.84	\$279.88	\$91.79	-\$501.46	\$172.35	-\$468.47	-\$149.94
Belgium	-\$210.57	-\$1,163.73	\$39.43	\$218.64	-\$17.31	\$165.51	-\$89.13	\$40.73
Ireland	-\$370.06	-\$361.12	-\$151.13	\$674.14	-\$57.93	\$78.51	-\$36.61	-\$26.77
Germany	-\$560.13	-\$1,117.53	\$196.50	\$202.47	-\$342.62	\$121.02	-\$191.74	-\$75.41
Finland	-\$570.15	-\$456.68	\$1,083.07	\$415.74	-\$227.23	\$75.14	-\$172.78	-\$125.23
Czech. Rep.	-\$586.55	-\$1,160.76	\$515.92	\$711.60	\$129.78	-\$283.32	\$254.33	-\$37.95
Netherlands	-\$604.97	-\$1,079.98	\$126.63	\$636.55	-\$2.16	\$239.42	-\$458.21	-\$20.88
Great Britain	-\$704.74	-\$254.26	-\$700.77	\$112.35	\$85.59	\$83.41	-\$55.19	-\$34.04
Italy	-\$2,030.96	\$371.65	-\$149.19	-\$838.26	-\$335.44	-\$191.30	-\$7.43	-\$289.42