

African Swine Fever a global issue affecting all protein chains

Rabobank's view on opportunities and threats

Strictly confidential

9 April 2019



Summary – ASF Now Endemic in China; Global Industry to Respond

Hog losses in China have reached critical levels, surpassing the world's ability to make up the difference. As African Swine Fever moves into additional geographies the disruption will intensify.



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Herd losses in China are severe; expected to take years to fully recover

- *We expect production losses of 25-35% in 2019; reports of extreme losses (>50%) are limited to small areas and are likely overstated.*
- *Movement of pork/hogs works against containment of ASF, but has helped balance pork supplies in deficit regions.*
- *Sizable breeding herd losses will take longer to restore. Retaining gilts for breeding will not only drive productivity losses, but further reduce available pork supplies.*
- *Rebuilding efforts will be complicated by the risk of recontamination, despite sizable financial resources available.*

ASF is now endemic in China and is moving to neighboring nations poorly equipped to respond

- *There remains no way to stop the spread of ASF in China; only to mitigate its impacts.*
- *ASF has moved into Vietnam and is expected to spread through SE Asia. Up to 80% of Asia's pork production is at risk.*
- *Ongoing animal health challenges in the region are stretching available resources and increasing herd vulnerability.*
- *Export-dependent nations remain on high alert as trade disruption could have disastrous consequences, discoveries of contaminated meat products are alarming.*

ASF is a multi-year event that will create structural shifts in the global protein industry

- *Chinese pork consumption in structural decline; production will shift toward large-scale commercial model.*
- *China and other import-dependent nations are trying to form long-term trade alliances in an effort to secure supply.*
- *Markets will turn to other proteins (beef, poultry, seafood) to meet pork deficit, driving global protein inflation.*
- *Expect increased interest in plant-based and lab grown protein alternatives.*

Available global protein supplies will be insufficient to meet China's protein deficit

- *Pork inventories and depressed Chinese demand on food safety concerns may cushion China's immediate need for imports.*
- *Based on pork losses of 11-16MMT, global protein availability will fall short of China's expected need.*
- *Demand for animal proteins (beef, poultry, seafood), branded pork and plant-based protein are expected to increase.*
- *A global protein shortage is expected until production can respond. Prices will ration demand and trade flows will change.*

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China – ASF situation update and potential implications



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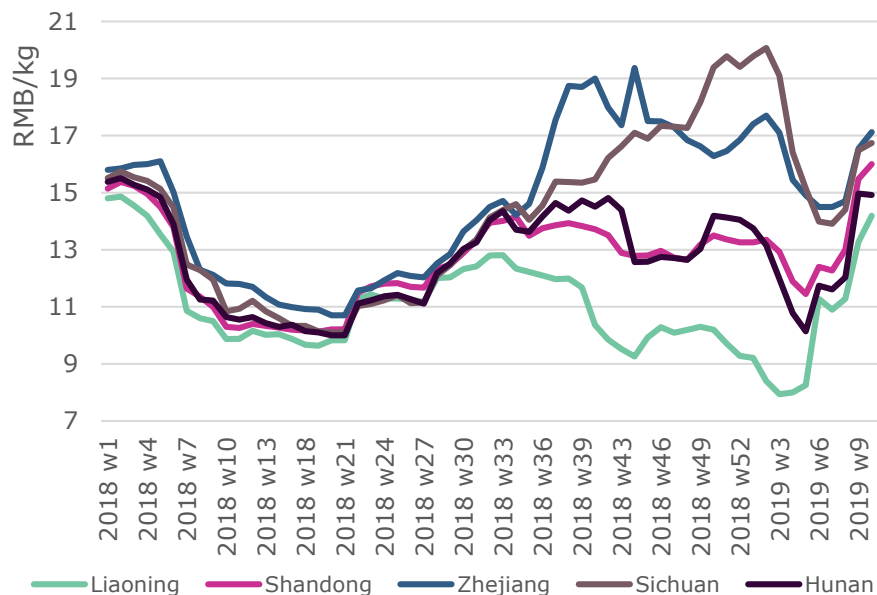
African Swine Fever spans 30 provinces in China

The disease keeps spreading and now affects the whole country. Changes in government response means the north-south price differential has closed.

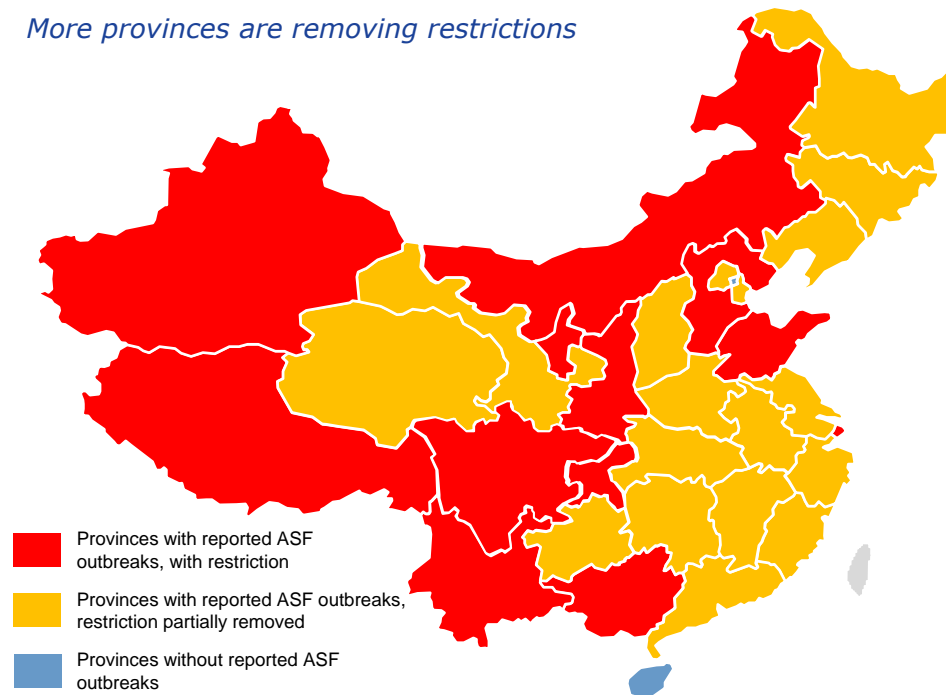


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Policies impact hog prices in different provinces to diverge in 2H 2018 and converge entering Mar 2019



More provinces are removing restrictions



- African Swine Fever swept various farms, including modern and large scale farms and backyard farms. For small to medium farms, the disease outbreak is devastating as the whole herd might be infected or culled. Many small farms have exited the market due to losses or government actions to manage biosecurity. Improving biosecurity is the top priority for existing farms.
- Disease impact varies: North China has been hit hard given its high density of hogs, while South China has been less affected. MARA announced the sow herd declined by 19% YOY to end Feb 2019, and hog herd by 16.6%. Losses could be considerably higher.
- Hog prices started to move up in March 2019. Between 9 Jan and 15 March, hog prices increased 50% in Northeast, and 20% in North China. The price gap between north and south has narrowed.
- Reporting of new cases has slowed, and more provinces are removing transport restrictions. However, some provinces continue to block transport of hogs and pork from other disease infected regions, for biosecurity reasons.

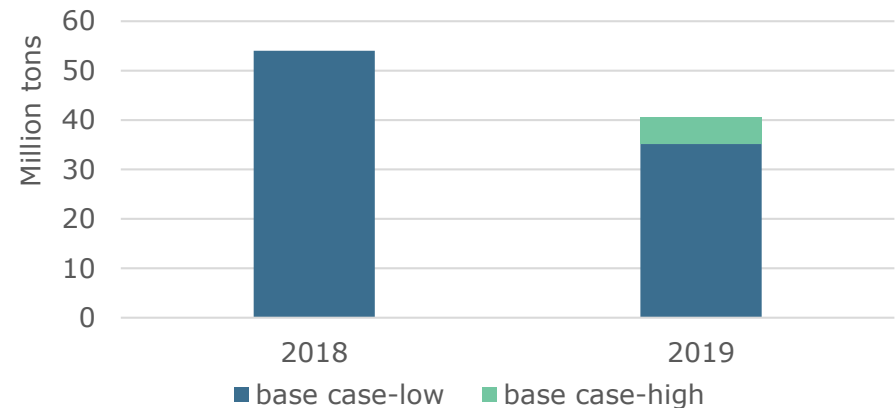
We expect China's pork production to drop by 25-35% in 2019

The scale of the decline expected in China in 2019 is unprecedented, and could lead to even lower production in the first half of 2020. This will have effects into the coming years.

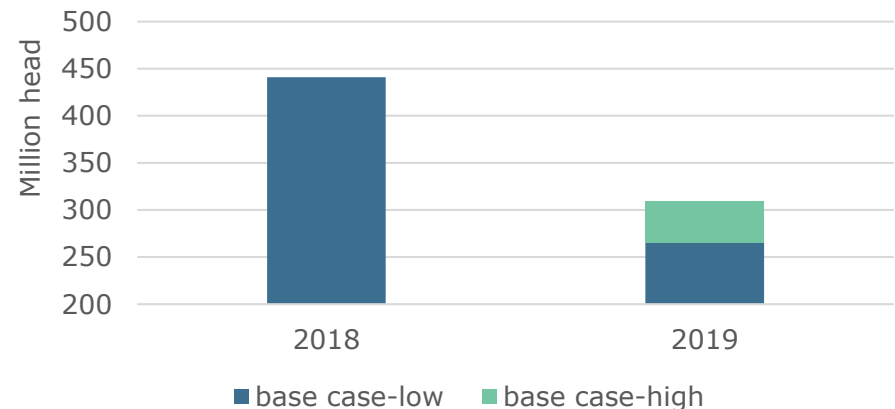


- *Our base case is for pork meat production to drop by 25-35% in 2019, with China's hog herd to drop by 30-40%.*
- *Eradicating ASF is not very likely in the near term, given China's high density of hogs, the dominance of small farms, and the wide spreading of the virus to date. China will likely need a longer time than other countries to control the disease.*
- *We expect herd losses to slow in 2H 2019 as biosecurity improves and vulnerable operations are exposed or liquidated. Limited indemnification payments in some regions may prolong disease impact.*
- *Freezer inventories have grown in response to liquidation in Q4 2018 and Q1 2019. Processors and distributors are building their inventories in anticipation of higher prices in 2H 2019. We estimate the inventories are sufficient to support frozen pork demand, which is mainly from food processors and food service, for Q2 and perhaps into Q3 2019.*
- *For the next few years, pork supply will struggle to recover. The low point in pork production may be seen in 1H 2020, due to losses in the sow herd in 2019.*
- *We expect a rapid transition in the farming structure, with more integrated production replacing small individual farming. From a biosecurity and supply security perspective, downstream companies (pork processors, foodservice and food retail companies) are beginning to align/partner with the state-of-the-art production and processing operations.*

Unprecedented decline forecast in China's pork production



Herd decline drives production losses



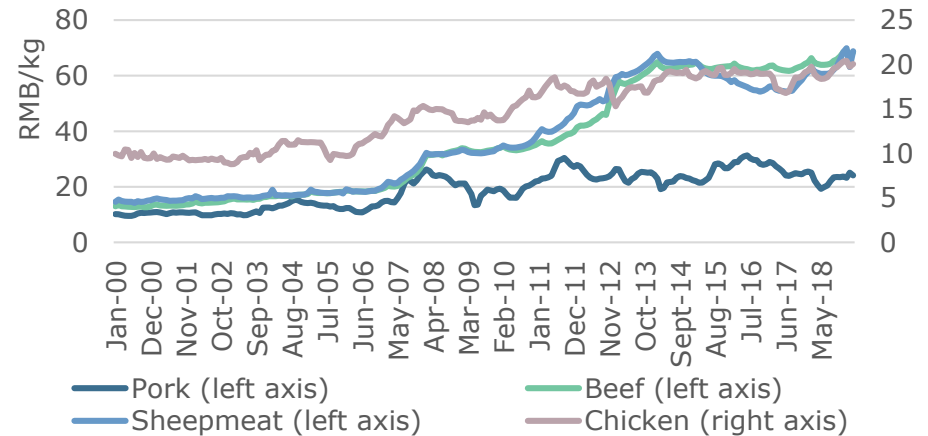
Pork consumption to fall; all other proteins to rise

Pork consumption will drop in 2019. Poultry will benefit most from pork substitution, although we expect production and prices for all animal proteins to rise in 2019 and into 2020.

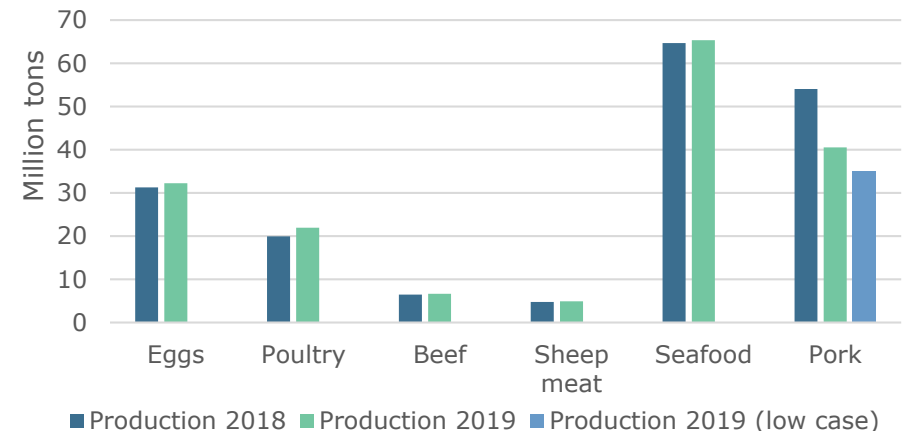


- Chinese pork consumption has already fallen in response to a general concern about food safety. This trend strengthened in Q1 when ASF-contaminated meat was found in processed food.
- We believe food processing, group dining, and foodservice have reduced pork procurement. Retail markets are less reactive to ASF, yet remain volatile.
- Pork consumption also faces the challenge of higher prices, which we expect to be a bigger issue as we head into 2H 2019.
- Consumers have started substituting pork, mainly with poultry meat and eggs, followed by seafood, beef and sheepmeat. Rising consumption and higher prices of other proteins in China will send a signal to increase production.
- Poultry will be the main beneficiary. Poultry prices reached record highs in Nov 2018, and rose again in March 2019.
- We estimate the production of all other proteins, including poultry, eggs, seafood, beef and sheepmeat, to grow by 4 million tons in 2019. Poultry will contribute the majority of the increase.
- Imports of other animal proteins will also rise. We see scope for an additional 1.5 million tons of poultry, seafood, beef and sheepmeat imports in 2019.
- Even with the supply growth of all other proteins, there will still be significant gap between demand and supply. Growth in pork imports are expected to close some of this gap.
- We expect Chinese consumers to reduce total animal protein consumption in 2019 and 2020, given pork shortages, food safety concerns and higher prices.

Pork prices correlate with poultry prices in retail market



Production of all animal protein's to rise in 2019 – except pork



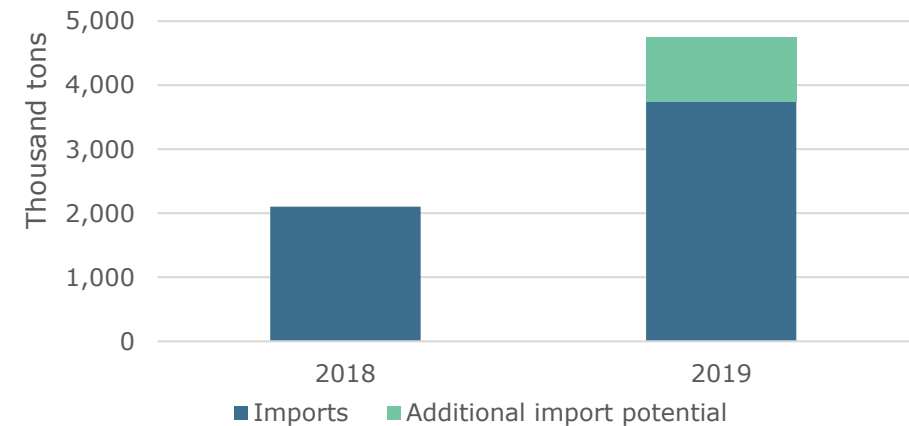
China's pork imports to grow for 2-3 years, on slow herd rebuilding

Additional pork imports are already expected in China, but higher prices are going to be needed to direct additional trade flows to China in 2H 2019.

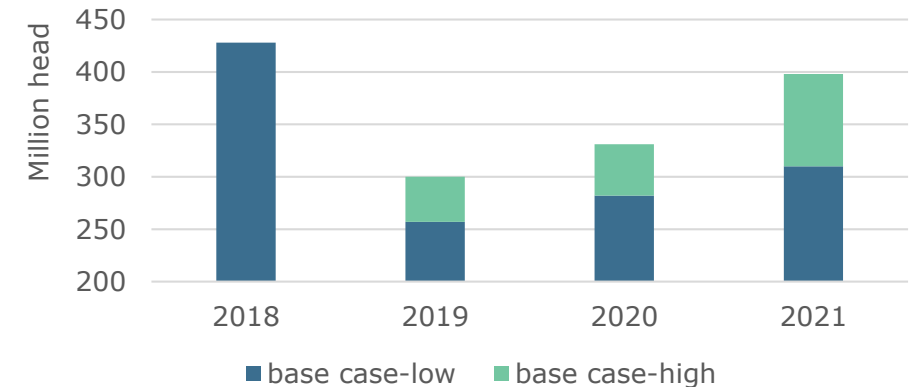


- We expect a sizable increase in China's pork imports in 2019 and 2020. Large shipments are not likely until 2H 2019. Imports in 2019 will likely exceed the historic high seen in 2016. If China removes the retaliatory tariffs on the US pork, the additional imports will increase further.
- Existing exporting regions, including the EU, Canada, and Brazil, are not likely to have sufficient supply for China, and will divert part of the shipments for other countries to China.
- We see scope for China to import an additional 1.5 to 2.0 million tons of pork (meat and product/variety meat) in 2019.
- International prices started increasing in March 2019. Prices will be pushed up further when more trade contracts are completed. However, considerable price volatility is expected.
- Pork prices in China will need to rise to very high levels to capture a larger share of global pork supply. Should this happen, additional import potential likely exists.
- China's herd rebuilding will be slow in 2019. Rising hog prices and prospects of hog prices rising further still in 2H 2019 may attract some specialized farms to rebuild herds, but the scale is small, as farmers are cautious given ongoing disease risks.
- Large scale rebuilding will be limited in 2019; most large sized farms are focusing their efforts on biosecurity improvements. Government policies/financial assistance will have limited impact on rebuilding, as companies are carrying the bulk of the risk.
- Given the risk of recontamination, the breeding base will be difficult to replace in near term and will force producers to retain gilts to rebuild. Gilt retention in 2019 would exacerbate production shortfalls and drive a sharp decline in productivity.

China to import more pork in 2019, pushing up prices



Herd rebuilding may start to recover in 2H 2020



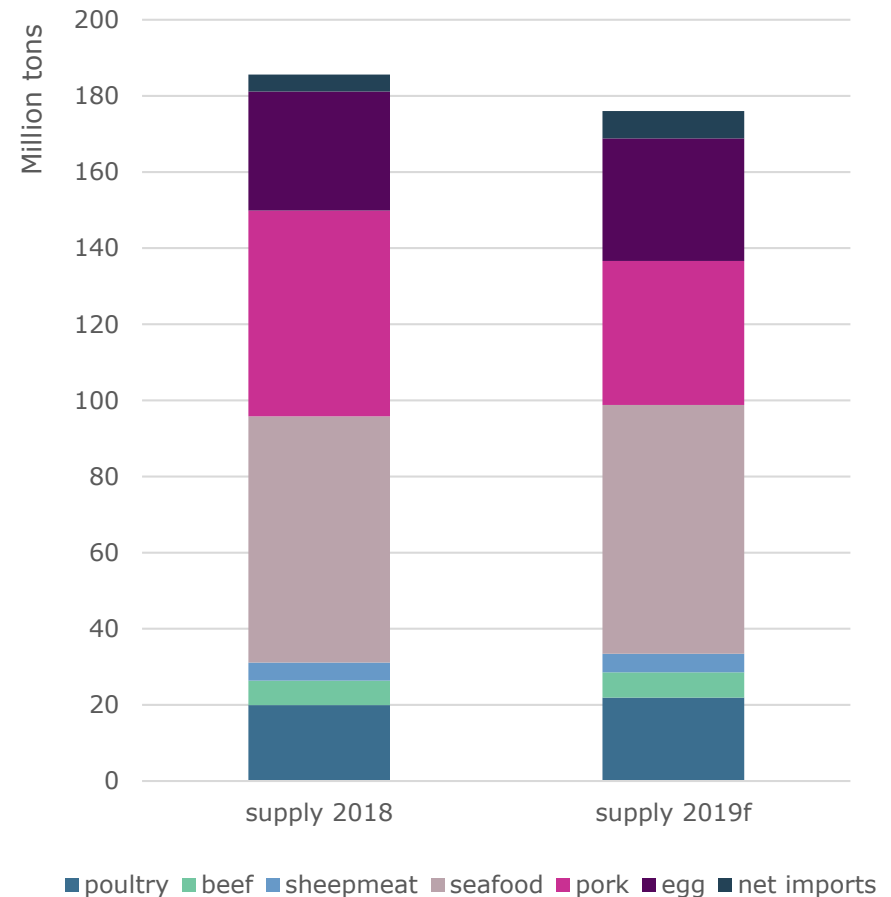
China's animal protein supply balance in 2019 to decline

Total animal protein availability will decline in China in 2019, pushing up prices. We expect this will have broader implications for food security and economic growth.



- *Chinese pork consumption is expected to fall considerably, based on consumers' misunderstanding of food safety risks around ASF in the short run, and surging prices in the rest of 2019 and 2020.*
- *Exporting countries will respond to surging prices in China, by lifting production or shifting exports from other destinations to China.*
- *China's government will likely take a more flexible approach to encourage imports. Trade bans are likely to shift to regional OIE-approved containment zones as supply options are limited. Countries previously limited in their ability to export due to ASF (Russia, Eastern Europe) may re-enter trade with China.*
- *Due to the exit of many small farms and policy limiting small scale farming, China's pork industry will see a rapid transition to larger scale and industrialization. At the same time, the hog population density will be reduced to improve biosecurity, suggesting herd restocking will not be fast.*
- *Even with expected strong growth in the production and imports of other proteins, and a sizable increase in pork imports, China will face a protein supply gap of 6 to 11 million tons in 2019, and animal protein prices will rise in response.*
- *Food security issues could challenge the government as CPI rises and supply of a number of staple foods may be disrupted.*
- *Economic losses from the pork industry alone are likely to have a ripple effect across the entire agricultural sector, particularly for grains and oilseeds farmers and the animal feed and health industries.*

Supply balance in 2019 highlights the material decline in availability





South-East Asia – ASF situation update and potential implications



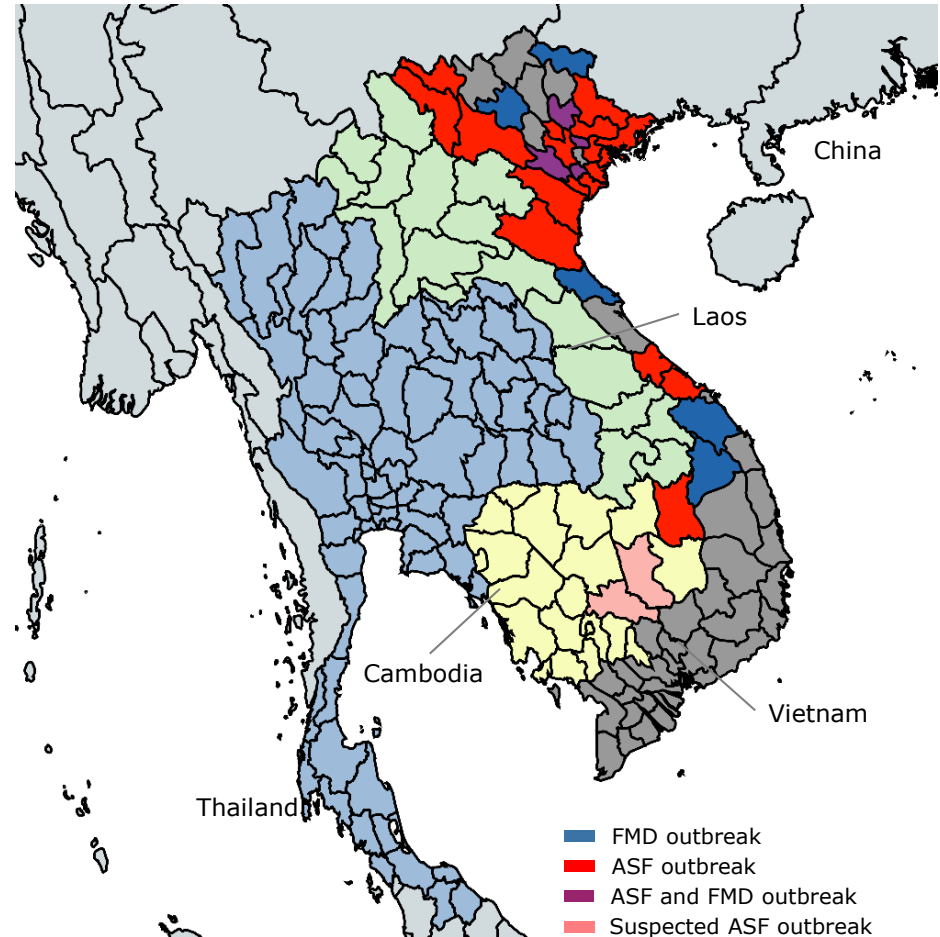
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ASF has hit 23 provinces in Vietnam since February 2019

At current pace, and given the development of ASF in China, production losses in Vietnam could exceed 10% by year-end. The disease is also spreading to neighboring countries.

- *Since the first reported outbreak in Vietnam on 19 February 2019, there have been 556 ASF outbreaks in 23 provinces, with more than 89,600 pigs culled (as at 28 March). Backyard farms with no biosecurity accounted for most outbreaks, although in late March, ASF had affected medium-scale farms in Hung Yen province.*
- *The actual number of dead pigs in affected provinces could be higher as some farmers may be reluctant to report. Compensation for lost animals (from provincial governments) takes time to be paid, and once reported, there would be a period of no income before the herd can be rebuilt (i.e. until after the area has no more outbreaks for more than 3 months).*
- *No hog movement from infected provinces is allowed. On 20 March 2019, MARD requested provincial/city people's committee to allow healthy pigs in infected area to be slaughtered for consumption within infected commune; infected district if >1 communes infected; or provinces if >1 districts infected.*
- *Piglets and sows with clean health certificates are allowed for transport for fattening/breeding purposes (to be collected by animal health officials with approved routes).*
- *Large integrated farms are still allowed to operate barns that test negative. This will still allow production to continue, and not stifle production in the affected province.*
- *With reference to how the disease has spread in China and affected the herd there, we believe Vietnam's pork production in 2019 could decline by more than 10%*

ASF and FMD outbreaks in Vietnam and Cambodia



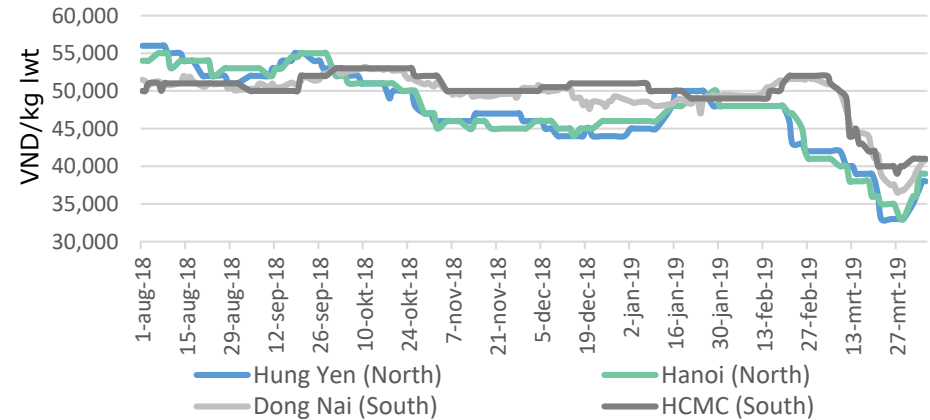
Price differential between North and South Vietnam has narrowed

Hog prices have converged after initially diverging in response to disease outbreaks in the North. Poultry prices have already increased in Q1 2019, showing signs of inevitable substitution.

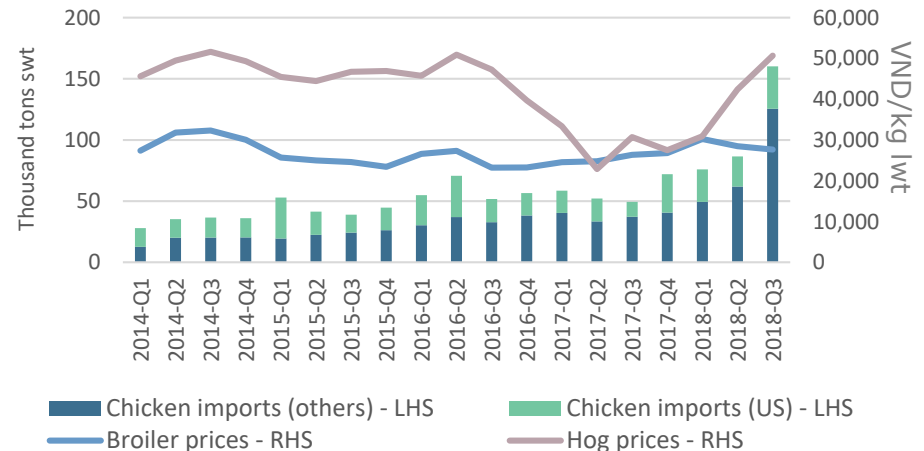


- Live hog prices had diverged between North and South Vietnam since end September 2018, as fears of contagion from China and FMD outbreaks prompted some liquidation. Further spread of ASF will increase herd liquidation in affected provinces and reduce sow herd and replacements.
- Following Tet (early-February 2019), as the first official ASF outbreak was reported, live hog prices diverged further, as prices in the North dropped steeply. At its widest, the North-South price gap reached over 20%. This prompted movements of live hogs from the North to slaughterhouses in the South – despite restrictions.
- On 14 March, a suspected ASF outbreak was also reported in Kampong Cham province in Cambodia, close to Tay Ninh and Binh Phuoc provinces in South Vietnam, north of Ho Chi Minh City. Cambodia's Ranakakiri province (bordering Vietnam) confirmed an ASF outbreak on 2 April, and a suspected ASF outbreak in Kratie province, Cambodia, was reported on 21 March. In response, live hog prices in the South of Vietnam have declined steeply. However, both North and South prices have since rebounded, closing the price gap to 6%.
- We expect hog price recovery to continue in 2H 2019, as supply tightens. This will reduce per capita pork consumption and open a significant opportunity for pork imports, if supply is available.
- Imports of chicken cuts already expanded in 2018 in response to higher live hog prices. We expect increased demand for pork and poultry imports in 2019.

Vietnam live hog prices now move in tandem



Chicken imports have increased since last year



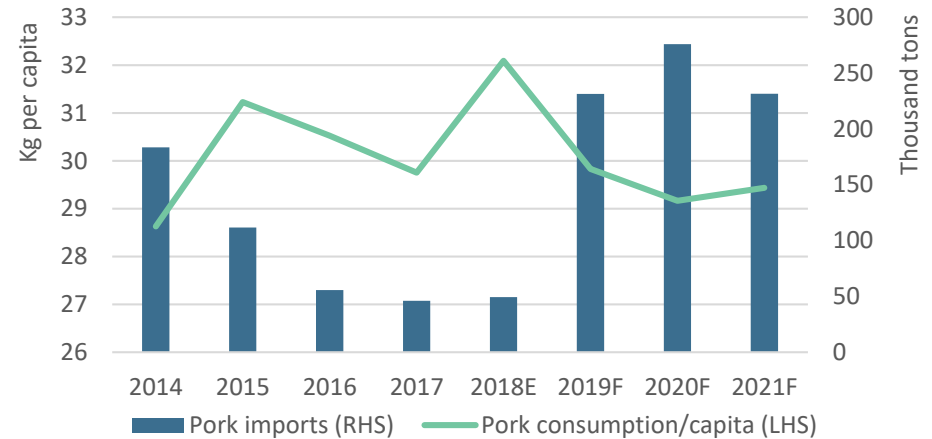
Vietnam needs more pork imports, but pricing may be an issue

Vietnam's pork consumption is expected to decline, as reduced domestic production meets tight global supply and high prices

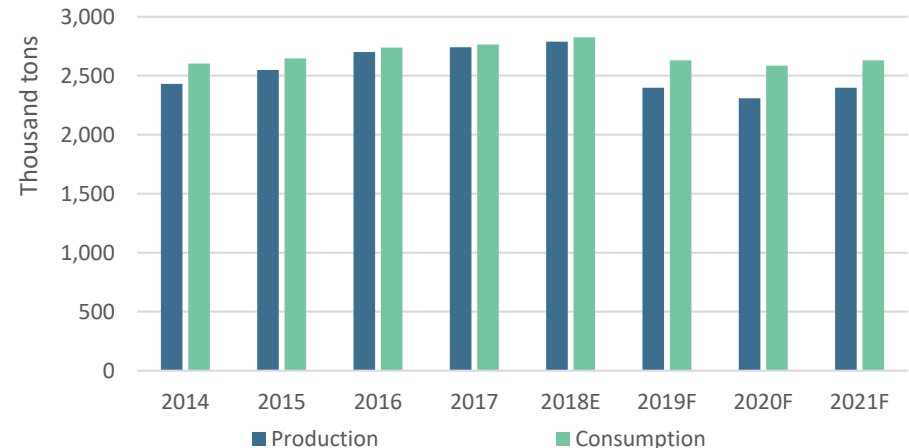


- Consumers in Vietnam are expected to reduce pork consumption, substitute for other meat, or source their pork more carefully. Pork meat sold in Hanoi and Ho Chi Minh City wet markets has already declined on food safety concerns. Consumers have substituted with chicken, beef and shrimp, or shifted from wet markets to modern retail outlets.
- Vietnam's per capita pork consumption is expected to decline this year to 27 kg – from 30 kg in 2018 – as reduced supply will increase prices in 2H 2019. This assumes imports are available. It means total pork consumption in 2019 of 2.63 million tons (-7% YOY).
- Due to lack of adequate quantities of substitutes, more pork would need to be imported. Compared to the estimated 2018 quantity of 49,300 metric tons, pork imports would need to increase toward 231,000 metric tons in 2019 – despite an anticipated decline in per capita consumption. A further 19% expansion in pork imports is also expected for 2020 – as we anticipate hog production to decline further. But as demand for imports from China picks up, pricing will become an issue for imports into Vietnam.
- In poultry, there was not a pick up in PS/GPS and DOC imports up to Q4 2018; as ASF only appeared in February. Chicken prices have though increased in recent months. Continued strength in chicken prices will provide an incentive for broiler production to increase in 2019, and again in 2020.

Per capita pork consumption to decline this year



Imbalance in 2019 Vietnam pork production and consumption





Europe – ASF situation update and potential implications



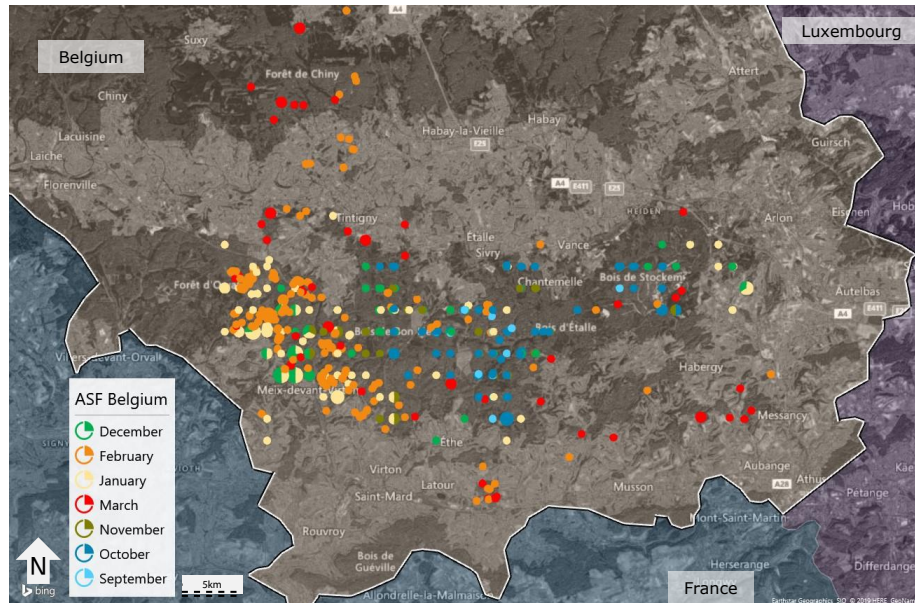
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ASF remains a threat in Eastern Europe and in Belgium

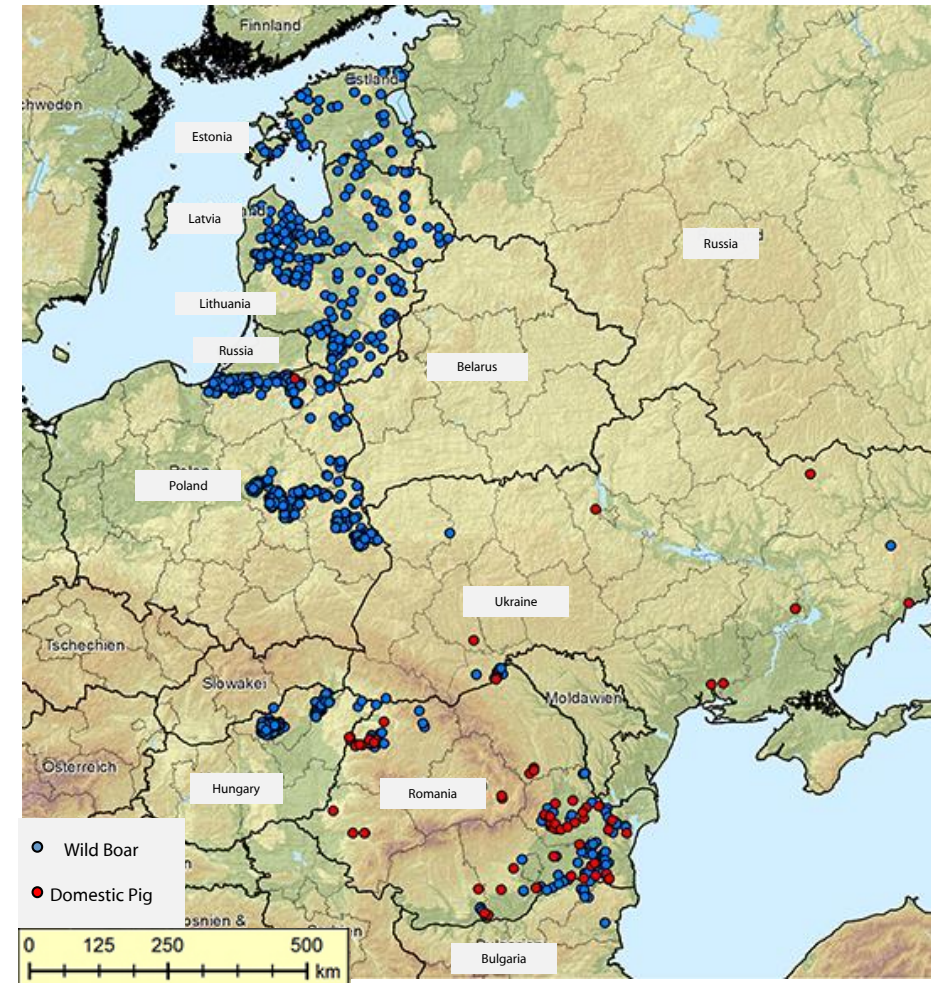
The unpredictable nature of the way the disease is spreading has made many in Europe's pork industry nervous about the potential impacts of ASF spreading further.

Risk of situation in Belgium unchanged as cases continue to be reported

- Recent cases in February and March found outside of initial containment zone.
- Newest cases in March show the spreading of the disease to the northern, southern and eastern edges of the containment zone.
- Outbreaks in Belgium are now 1 km from France, 45 km from Germany, and 150 km from the Netherlands.
- Spread to France still possible considering recent outbreaks have been reported so close to the border.



Outbreaks in 2019 in Eastern Europe show the wide spread of the disease

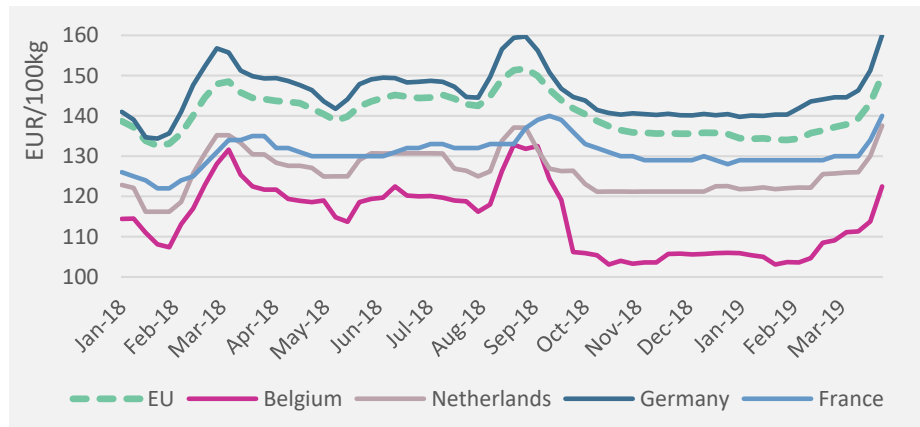


Risk of ASF spreading to other countries in Europe remains high

ASF has not been contained in Europe or Russia. However, in the Czech Republic, where the disease has been eradicated, and in Poland and Russia, which export despite ASF, give reason to be positive.



Belgian pork prices still depressed after ASF outbreak



- Pork prices in Belgium are generally lower than EU averages, by about 20%. ASF increased this price gap to 30% after the September 2018 outbreak. The latest pricing data shows this price gap may be closing.
- Recent ASF outbreaks outside of the initial containment zone highlights the risk of ASF spreading to France (<1 km), but also Germany (< 45 km).
- Both Germany and France rely on export markets outside EU. In 2018, Germany exported 16%, and France exported 10%, of production volumes outside the EU.

Poland's pork production is export oriented, despite ASF



- In 2018 exports made up 44% of total production in Poland. Some 12% of total production was exported to countries outside of the EU. This highlights what is possible despite ASF outbreaks.
- The Czech Republic has been declared free of ASF, one year after an isolated outbreak, proving successful containment and eradication is possible in certain circumstances.
- Russia continues expanding its domestic production, to more than 3.2 million tons in 2018, and close to 100% net self-sufficiency. Russia is expected to grow production further, as well as exports, in 2019, despite ongoing cases of ASF.
- The situation in Europe and Russia suggests in some cases it is possible to live with ASF, and to maintain some exports. This raises the question of how easily the learning in Europe and Russia can be transferred to China and South-East Asia.

IV

Global animal protein production and trade implications of ASF



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US shipping pork to China despite ongoing trade barriers

Despite import tariffs of 62%, the US is shipping pork to China. We see shipments rising, given positive news about the US-China trade war, but anticipate logistical constraints will challenge export flows.



US reporting stronger pork exports; changes to supply chain underway

- *We anticipate record US shipments of pork in 2019, much of which shipped as a split carcass. Packers are expected to dedicate plants to the specific needs of their Chinese customers.*
- *62% tariffs on shipments of pork to China remain in place, but have not deterred initial sales. China may need to drop these duties to ensure access to available supplies.*
- *Assuming a (partial or temporary) resolution of the trade dispute, we see the potential for the US to export an additional 550,000 tons of pork to China in 2019.*
- *Eliminating restrictions on the use of Paylean (ractopamine) would expand available US pork supply. An estimated 30% of US pork supply is ractopamine free, so near term supplies are sufficient, but longer term the policy may need reevaluation.*
- *Interest from other import-dependent nations is rising as global pork supplies are limited. Importers are aligning with dedicated US suppliers to ensure adequate long term pork supplies.*
- *Early shipments of pork (Feb/Mar 2019) did not necessarily enter China duty-free. Some shipments are idled in containers at Chinese ports waiting for tariffs to be lifted.*
- *Unless product begins to move unencumbered by tariffs, we expect container shortages to become a limiting factor. Freight rates are rising quickly and container availability will soon become an issue for the entire US industry.*

Canada and Mexico expect mixed impact

- *China has been aggressively buying Canadian pork, leaving significantly less for traditional markets. The US is expected to backfill a portion of this supply.*
- *Mexico has stepped up imports of US pork (esp. ham) anticipating a more competitive market. Mexican pork exports to Asia, while small, are expected to double year-ago levels.*

US domestic markets responding; poultry and beef prices moving up

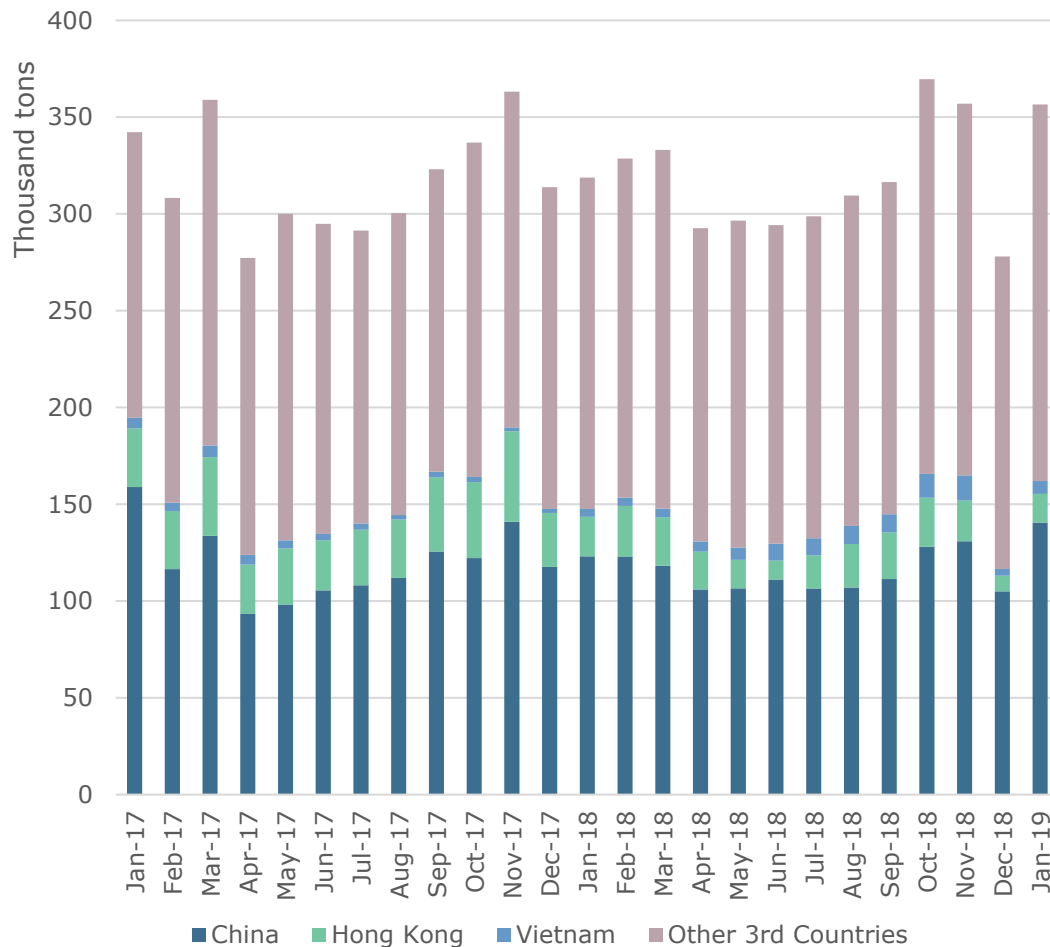
- *We expect significantly stronger US beef and poultry exports in 2H 2019 as limited global supplies are absorbed. US chicken exports remain banned in China – a measure we would expect to be lifted as part of a broader trade agreement between the two countries.*
- *US meat buyers may soon face product shortages as traditional pork supplies are moved to China. Unanticipated shortfalls may catch some off-guard and increase market volatility.*
- *We are beginning to see proactive price increases in US retail, but anticipate few changes in foodservice markets as the price impact remains limited.*
- *We expect renewed interest in alternate proteins to support aggressive investment in plant-based and lab based meats. Although many of the cellular meat products remain in the development phase, we expect financial investment to surge in this sector in the coming months.*

Europe's export opportunities likely to result in production growth

EU exports to China jumped in January 2019, and are expected to show ongoing growth through 2019. Resulting higher prices are expected to trigger a gradual production response in 2H 2019.



Monthly EU pork exports to China and Vietnam are in dynamic mode



- January 2019 saw an increase in exports from the EU to China with a YoY increase of 14% reported, along with a YoY increase of 73% to Vietnam.
- The 2018 herd reduction in the EU was the main reason Rabobank had forecast a 0.5% decline in production in 2019.
- However, current price and trade dynamics challenge this baseline forecast, and we now allow for production expansion in Q4 2019.
- Growing production is supported by the herd expansion that took place in 2017 compared to 2016. After declining by 1% in 2016 the EU pig herd increased by 2.1% in 2017. It showed that the EU pork sector is able to respond to market dynamics, although this happens slowly.
- In contrast to the EU average, the Spanish herd expanded by 3.9% in 2018. The country continues to be well placed to leverage this comparative advantage in 2019, although rising labor costs and a tight pig supply could constrain Spain's growth.

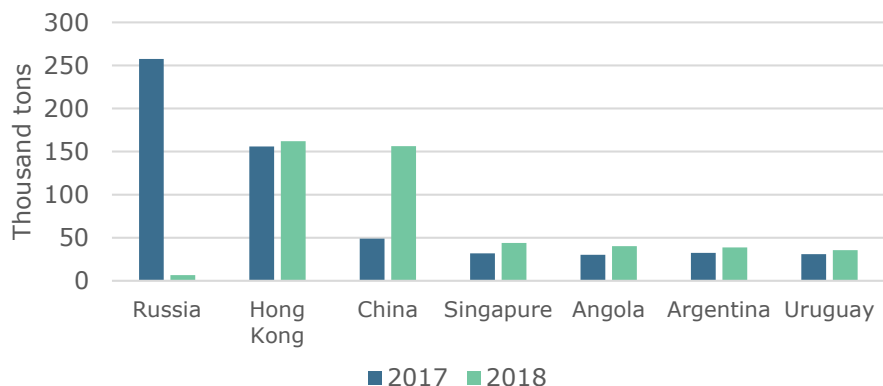
Brazilian pork exports to China limited by supply growth capacity

Despite the negative start in 2019, Brazilian pork exports to China are expected to increase strongly during the year.

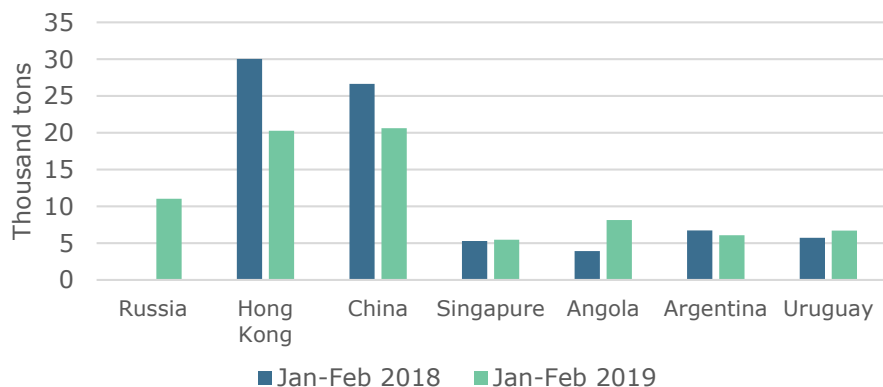


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Brazil's pork exports in 2018 show how China took over from Russia



Brazil's pork exports show Russia rising in Jan and Feb 2019



Brazilian pork exports to China increased strongly in 2018

- After having increased by around 220% in 2018, reaching more than 155,000 tons, Brazilian pork exports to China have declined by around 20% YTD, in the first two months of 2019.

Russia partially lifted the embargo on Brazilian pork exports

- Russia lifted the embargo on certain Brazilian pork in November 2018. As a result, Brazil exported over 10,000 tons of pork to Russia in the first two months of 2019 (Russia imported around 250,000 tons of pork from Brazil in 2017).

Brazilian pork production to increase during 2019, but with limited capacity

- Pork production in Brazil could rise between 4% and 5% in 2019, representing an additional 200,000 tons. Improving prices in global markets, and the improved domestic demand, would enable production to expand.
- With additional production, Brazil has the potential to export around 260,000 tons of pork to China in 2019.
- A faster expansion of production and exports would mainly depend on higher prices, along with improved margin opportunities from lower feed prices.
- Notwithstanding, Brazilian pork players have faced challenging conditions in recent years, which could discourage faster capacity expansions in the short term.

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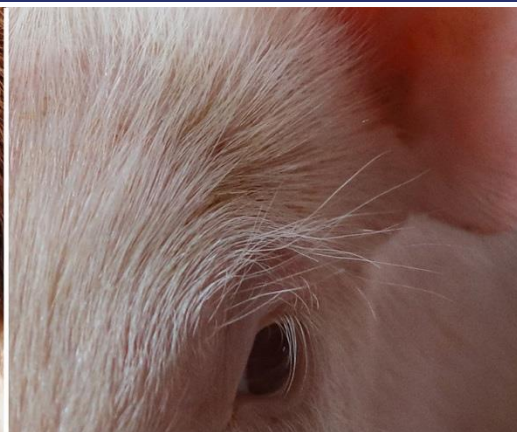
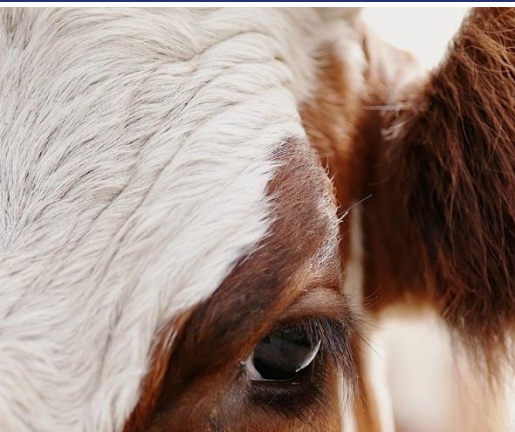
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