

7

Dairy and dairy products

This chapter describes market developments and medium-term projections for world dairy markets for the period 2022-31. Projections cover consumption, production, trade and prices for milk, fresh dairy products, butter, cheese, skim milk powder and whole milk powder. The chapter concludes with a discussion of key risks and uncertainties which could have implications for world dairy markets over the next decade.

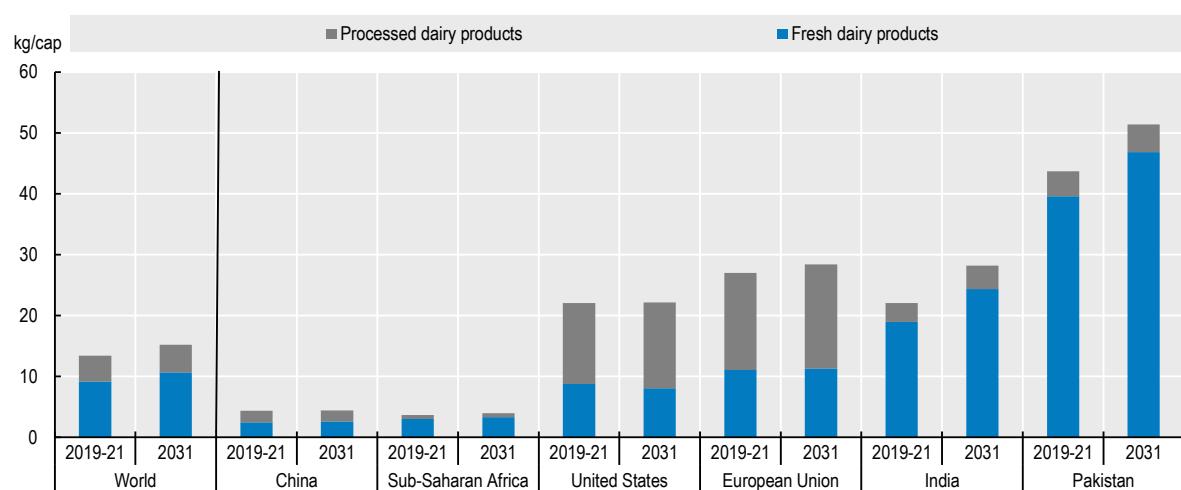
7.1. Projection highlights

Buoyant prospects for dairy sector, but challenges to adapt to changing consumer preferences

Milk and dairy products are vital sources of nutrition and provide livelihoods for millions of people in the dairy value chain across the world. World milk production (roughly 81% cow milk, 15% buffalo milk, and 4% for goat, sheep and camel milk combined) increased by 1.1% to about 887 Mt in 2021, primarily driven by an expansion in output in India and Pakistan due to a continued increase in dairy herd numbers and fodder availability helped by favourable monsoon rains. Milk production in the three major dairy exporters, New Zealand, the United States, and the European Union varied from a marginal to modest increase to a slight decline, respectively. Increases in dairy world trade were mainly driven by strong demand in the People's Republic of China (hereafter "China"), the world's largest importer of dairy products.

As incomes and population increase, more dairy products are expected to be consumed over the medium term. Overall, per capita consumption is expected to increase 0.4% p.a. to 21.9 kg (milk solids equivalent) by 2031 in high-income countries compared to 2.0% p.a. (21.2 kg) and 1.5% p.a. (5.4 kg) in low-middle income and low-income countries, respectively. Most dairy production is consumed in the form of fresh dairy products,¹ which are unprocessed or only slightly processed (i.e. pasteurised or fermented) and their share in world consumption is expected to increase over the next decade. The key drivers for this are strong demand growth in India, Pakistan and Africa. In low and middle-income countries, fresh dairy products comprise over two-thirds of the average per capita dairy consumption (milk solids), while consumers in high income countries tend toward processed products (Figure 7.1).

Figure 7.1. Per capita consumption of processed and fresh dairy products in milk solids



Note: Milk solids are calculated by adding the amount of fat and non-fat solids for each product; Processed dairy products include butter, cheese, skim milk powder and whole milk powder.

Source: OECD/FAO (2022), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-outl-data-en>.

StatLink <https://stat.link/obj571>

There is substantial regional variation in the *consumption* of processed dairy products. Cheese is the second most important dairy product (after fresh dairy products) consumed in terms of milk solids. Consumption of cheese primarily occurs in Europe and North America, exhibiting a growing trend in both regions. In Asia, butter is not only the most consumed processed dairy product, accounting for almost half of all processed dairy consumption in terms of milk solids, but it also has the strongest projected growth in

consumption. In Africa, cheese and whole milk powder (WMP) account for the majority of processed dairy consumption. Over the coming decade, however, skim milk powder (SMP) is expected to record the highest consumption growth, although from a lower base.

World milk *production* is projected to grow at 1.8% p.a. over the next decade (to 1 060 Mt in 2031), faster than most other main agricultural commodities. The projected growth in the number of milk-producing animals is expected to be strong (1.1% p.a.), especially in regions with low yields such as Sub-Saharan Africa and in major milk-producing countries such as India and Pakistan. Over the projection period, yields across the world are expected to grow steadily with the strongest growth expected in Southeast Asia and North Africa where average yield growth is around 2% p.a. Over half of the increase in total milk production is anticipated to come from India and Pakistan, which will jointly account for over 30% of world production in 2031. Production in the second largest global milk producer, the European Union, is expected to grow at a slightly higher rate than Oceania but more slowly than in North America as a result of EU policies targeted to sustainable production, the expansion of organic production, and pasture-based production systems.

Milk is *traded* internationally mainly in the form of processed dairy products. China is expected to remain the most important importer of milk products despite a slight increase in domestic milk production relative to the past decade. The projected increase in import demand for dairy products in Asian countries will be driven by economic and population growth and a shift towards livestock products. However, per capita consumption is projected to remain low relative to traditional dairy consumer markets. The Russian Federation (hereafter “Russia”), Mexico, the Near East and North Africa (NENA) will also continue to be important net importers of dairy products. Over the medium term, the European Union, New Zealand and the United States will remain the key exporters of processed dairy product and are projected to jointly account for around 65% of cheese, 71% of WMP, 74% of butter, and 80% of SMP exports in 2031.

Dairy trade flows could be substantially altered by changes in the trade policy environment. International trade agreements (e.g. Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and Comprehensive Economic and Trade Agreement (CETA)) create opportunities for further trade growth for dairy products. While the EU-UK Trade and Cooperation Agreement stabilised bilateral trade between the two countries, some frictions and uncertainties regarding future border controls remain. Elsewhere, Argentina could have the potential to become a competitor in the global WMP market due to rising milk production and below-average domestic demand growth, though it currently accounts for a relatively small share of trade. To date, the big milk consuming countries, India and Pakistan, are largely self-sufficient with production growing in parallel with domestic consumption. However, a potential increase in the consumption of processed dairy products like cheese and milk powders may drive an expansion of processed dairy imports during the coming decade.

Since 2015, the price of butter has been considerably higher than for SMP. This development is attributed to stronger demand for milk fat compared to other milk solids on the international market. Although the gap between the price of butter and SMP is assumed to remain a defining feature over the coming decade, it is expected to narrow over the period. Demand for SMP, particularly in middle- and low-income countries, will outpace demand for milk fat on the international market, narrowing the price gap.

Sustainable production policies and consumer concerns expressed in the market could alter the projections for the dairy sector. In some countries, dairy production accounts for a substantial share of overall greenhouse gas emissions (GHG), resulting in discussions on how adjustments to dairy production could contribute to reducing such emissions. Policies to address GHGs could have a significant effect on dairy farming in regions with high stocking densities, notably in the Netherlands, Denmark, and Germany. On the other hand, these pressures could lead to innovative solutions improving productivity and competitiveness in the long term. The global level of GHG emissions will largely depend on efficiency gains in India and other countries with high cattle population and extensive production.

Continued consumer interest in vegan diets and concerns about the environmental effects of dairy production and animal welfare are expected to bolster the consumption of plant-based dairy replacements in the liquid market especially in East Asia, Europe, Oceania and North America, albeit from low volumes. Although the growth rate of plant-based replacements is strong in certain regions, contested views regarding their environmental impact and health benefits lead to uncertainties about their long-term impact on dairy demand.

7.2. Current market trends

The dairy market is robust and resilient

The effect of the COVID-19 pandemic on the dairy sector was relatively modest, in contrast to the initial concerns that it was particularly vulnerable. Among dairy products, the pandemic had the largest effect on world butter prices due to the loss of demand for milk fat from the hospitality sector. Butter prices fell the most sharply in 2020 but have registered increases since mid-2020. In 2021 the FAO Dairy Price Index value increased by 17% with increases across all dairy products, with butter, SMP and WMP rising by 30%, 22% and 27%, respectively, while cheese recorded an 8.8% rise. Strong global demand, especially from Asia and, to a lesser extent from the Middle East, drove those price increases.

Global exports and imports had been growing steadily in previous years but slowed down in 2020. Transportation slowdowns, disruptions in the value chain, and decreased demand all contributed to the change in export and import growth. Global exportable supplies were constrained, reflecting lower milk deliveries in Europe and less-than-expected growth in output. Overall, however, the sector adapted quickly and mitigated many of the severe effects seen in the earlier months of the pandemic, while exports rebounded in 2021.

World milk production grew by 1.1% in 2021 to about 887 Mt. In India, the world's largest milk producer, production increased by 2.2% to 195 Mt. India, however, has little impact on the world dairy market as they trade only marginal quantities of milk and dairy products. Moreover, Indian production was relatively unaffected by the pandemic, with any excess milk being processed into milk powder.

World dairy imports in 2021 are expected to have reached 10 Mt, led by cheese, milk powders and whey powder, underpinned by demand from China in particular. Leading exporters, New Zealand, the European Union, and the United States, supplied much of the higher import demand, while exports from the United States were further supported by a rebound in exports to Mexico.

7.3. Market projections

7.3.1. Consumption

Strong demand in India and Pakistan is leading the rise in global dairy consumption

Although milk is a highly perishable product which must be processed shortly after collection, most milk is consumed in the form of fresh dairy products, including those fermented and pasteurised. The share of fresh dairy products in global consumption is expected to increase over the coming decade due to stronger demand growth in India and Pakistan, which in turn is driven by income and population growth. World per capita consumption of fresh dairy products is projected to increase by 1.4% p.a. over the coming decade, slightly faster than over the past ten years, primarily driven by higher per-capita income growth.

The level of milk consumption per capita (in terms of milk solids) will vary largely worldwide (Figure 7.1). Country income per capita and the impact of regional preferences will be important factors driving this

variation. In high-income countries, per capita consumption is expected to increase 0.4% p.a. to 21.9 kg (milk solids) with the majority of consumption consumed in the form of processed products and of which stronger growth is expected. Conversely, in low-, and lower-middle income countries the majority of production is consumed in the form of fresh dairy products, where per capita consumption is expected to increase 1.5% p.a. (5.4 kg) and 2.0% p.a. (21.2 kg), respectively. The consumption of fresh dairy products is expected to be high in India and Pakistan, but low in China. The share of processed dairy products, especially cheese, in overall consumption of milk solids is expected to be closely related to incomes, with variations due to local preferences, dietary constraints, and level of urbanisation.

In Europe and North America, overall per capita demand for fresh dairy products is stable to declining but the composition of demand has been shifting over recent years towards dairy fat such as full-fat drinking milk and cream. Consumers may be influenced by recent studies that have shed a more positive light on the health benefits of dairy fat consumption, contrary to the messaging of the 1990s and 2000s. In addition, this shift may reflect increasing consumer preference for foods that are less processed, and possibly increased interest in home cooking.

The largest share of total cheese consumption, the second most consumed dairy product, occurs in Europe and North America, where per capita consumption is expected to continue to increase over the projection period. Consumption of cheese will also increase in regions where it was not traditionally part of the national diet. In Southeast Asian countries, urbanisation and income increases have resulted in more away-from-home eating, including fast food such as burgers and pizzas. It is worth noting that the pandemic has not only increased usage of e-groceries and take-away foods in these regions, but also consumer focus on foods they consider to be healthier or more wholesome. These changes in consumer consumption behaviour have been of benefit to the dairy sector.

While some regions are self-sufficient, such as India and Pakistan, total dairy consumption in Africa, Southeast Asian countries, and the NENA is expected to grow faster than production, leading to an increase in dairy imports. As liquid milk is expensive to trade (high volume/value ratio), this additional demand growth is expected to be met with milk powders, where water is added for final consumption or further processing.

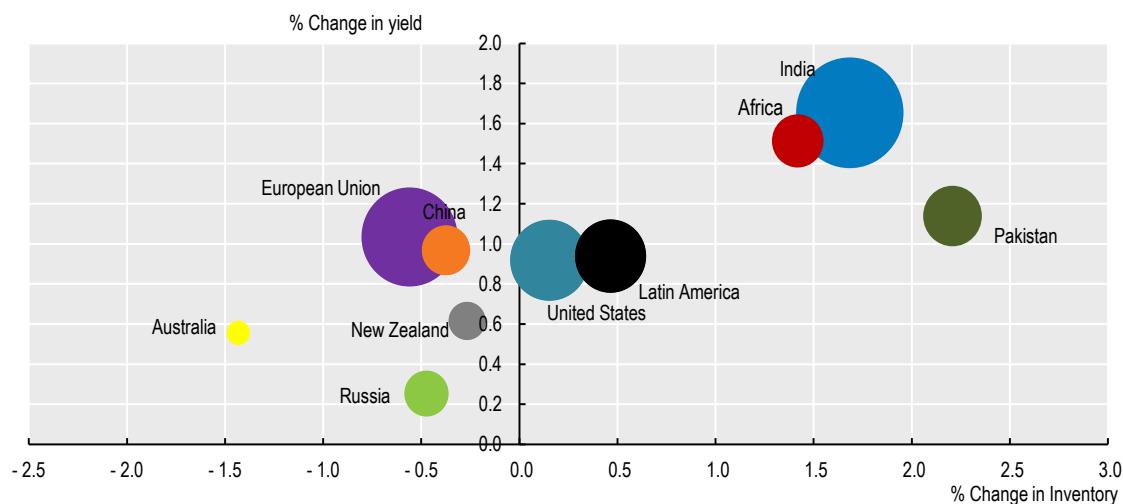
The dominant use of SMP and WMP will continue to be in the manufacturing sector, notably in confectionery, infant formulae, and bakery products. A small share of dairy products, especially SMP and whey powder, are used in animal feed. China imports both products for feeding, but the African Swine Fever (ASF) outbreak reduced demand. With the expected recovery (see Chapter 6 on meat), the feed demand for SMP and whey powder is expected to grow over the coming decade. Whey powders are gaining prominence globally as a result of its use in the processing of nutritional products, especially in clinical, infant and elderly nutrition.

7.3.2. Production

Greater efficiency in milk production sustaining yield and production increases

World milk production is projected to grow at 1.8% p.a. (to 1060 Mt by 2031) over the next decade, faster than most other main agricultural commodities. The projected growth in the number of milk-producing animals is expected to be strong (1.2% p.a.), especially in regions such as Sub-Saharan Africa and in major milk-producing countries such as India and Pakistan – where yields are low. While yields across the world are expected to grow steadily over the next decade, there is considerable regional variation of growth rates. The strongest growth expected in Southeast Asia and North Africa where average yield growth is around 1% p.a., whereas yields in high income countries are expected to increase by only 0.5% p.a.. In almost all regions of the world, yield growth is expected to contribute more to production increases than herd growth (Figure 7.2), the drivers of which include optimising milk production systems, improved animal health and feed efficiencies, and improved genetics.

Figure 7.2. Annual changes in inventories of dairy herd and yields between 2021 and 2031



Note: The size of the bubbles refer to the total milk production in the base period 2019-21.

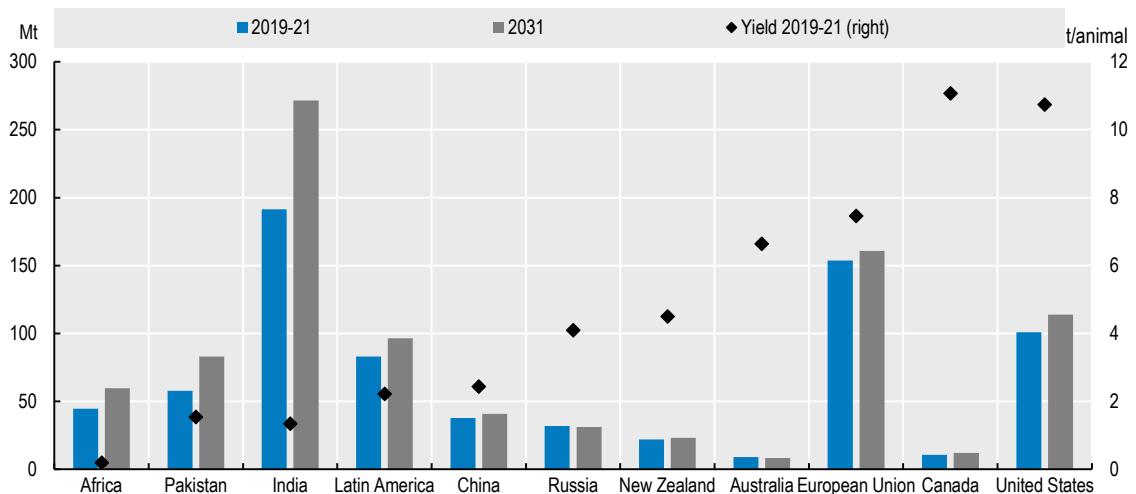
Source: OECD/FAO (2022), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-outl-data-en>.

StatLink  <https://stat.link/2t4x05>

Production in the European Union is projected to grow more slowly than the world average at 0.5% p.a., stemming from milk yields, growing at 1% p.a., while dairy herds are declining (-0.5% p.a.). Production in the European Union originates from a mix of grass- and feed-based production systems. In addition, a growing share of milk produced is expected to be organic or in other non-conventional production systems. At present, more than 10% of dairy cows are within, but not limited to, organic systems located in Austria, Denmark, Greece, Latvia, and Sweden. Germany and France have also seen an increase in organic dairy production. However, these organic farms have about a quarter lower yield than conventional production, and higher production costs, but they constitute over 3% of European Union milk production, commanding a considerable price premium. In general, domestic demand (cheese, butter, cream, and other dairy products) is expected to grow only slightly, with most additional production destined for export.

North America has some of the highest average yields per cow, as the share of grass-based production is low, and feeding is focused on high yields from specialised dairy herds (Figure 7.3). Dairy herds in the United States and Canada are expected to remain largely unchanged and production growth to originate from further yield increases. As domestic demand is projected to remain stronger for milk fats, the United States will mostly export SMP, while Canadian exports of SMP are capped under the United States-Mexico-Canada Agreement (USMCA). The United States will also export a sizable amount of cheese, whey, and lactose.

Figure 7.3. Milk production and yield in selected countries and regions



Note: The yield is calculated per milking animal (mainly cows but also buffaloes, camels, sheep and goats).

Source: OECD/FAO (2022), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-outl-data-en>.

StatLink <https://stat.link/yz24f3>

Although the share of New Zealand in world milk production is currently only 2.5%, it is the most export-orientated country. Milk output growth has been very modest in recent years, and it is projected to grow at 0.4% p.a. over the next decade. Milk production is mainly grass-based, and yields are considerably lower than in North America and Europe. The efficiency of grass management, however, allows New Zealand to be competitive. The main constraining factors for growth are land availability and increasing environmental restrictions, but a shift to a more feed-based production is not likely.

Strong production growth is expected in Africa, mostly due to larger herds. These will usually have low yields, and a considerable share of milk production will come from goats and sheep. Most cows, goats and sheep graze and are used for other purposes such as meat production, traction, and as capital assets (savings). Additional grazing occurs on the same pasture, leading to a more intensive use which may lead to local over-grazing. Over the projection period, about a third of the worldwide herd population is projected to be located in Africa and to account for over 5.6% of world milk production.

Globally, around 30% of milk will be further processed into products such as butter, cheese, SMP, WMP, or whey powder in the coming decade. However, there is notable regional dispersion. In high-income countries, most of the milk production is transformed into dairy products. Given the considerable direct food demand for butter and, especially, cheese, these products presently account for a large share of consumption of milk solids in Europe and North America. SMP and WMP are highly traded and largely produced for trade only. Both are used in the food processing sector, notably in confectionery, infant formulae, and bakery products. In low-, and lower-middle-income countries, most of the milk production goes to fresh dairy products. Over the next decade, milk production is projected to increase by 43% and 40%, respectively, with over 85% of the increase going to fresh dairy products.

Only butter production is projected to grow at a slightly faster rate relative to overall milk production, at 1.9% p.a., reflecting strong demand for butter in some parts of Asia, the European Union and the United States. All other dairy products are projected to grow at slower rates, with SMP at 1.8% p.a., WMP at 1.5% p.a. and cheese at 1.1% p.a. The slower growth rate of WMP reflects the decreased growth in demand in

China and in Sub-Saharan Africa. The slower growth rate for cheese is due to the important share of slow-growing food markets in Europe and North America.

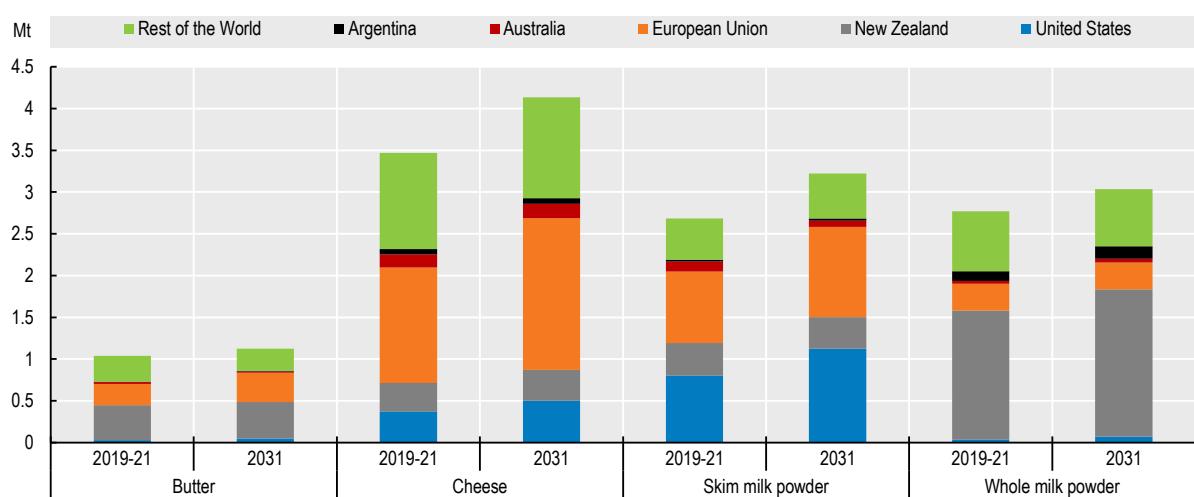
7.3.3. Trade

Dairy trade will expand from few major exporting to many dispersed importing countries

Only around 7% of world milk production is traded internationally, primarily due to its perishability and high-water content (more than 85%). The notable exceptions are the small amounts of fermented milk products traded between neighbouring dairy producers (i.e. Canada and the United States, the European Union and Switzerland) and imports of liquid milk by China. Chinese imports of liquid milk are primarily supplied by the European Union and New Zealand and have increased considerably in recent years. Trade of liquid milk is made possible primarily by the ability of Ultra-High Temperature milk and cream products to be shipped long distances, but also favourable Chinese freight rates in some cases. China's net imports of fresh dairy products over the base period reached 1.3 Mt, and this is not projected to increase much over the next decade. Over 50% of world production of WMP and SMP is traded since these products are often produced only to store and trade milk over a longer time period or distance.

World dairy trade is projected to expand over the next decade to reach 14.2 Mt in 2031, 15% higher than during the base period. The growth rates vary across dairy products with the strongest growth at 1.7% p.a. for SMP, 1.6% p.a. for cheese, 1.5% p.a. for whey powder, 1.3% p.a. for butter and 0.9% p.a. for WMP. Most of this growth will be met by increased exports from the United States, the European Union and New Zealand. These three countries are projected to jointly account for around 65% of cheese, 71% of WMP, 74% of butter, and 80% of SMP exports in 2031 (Figure 7.4). Australia, another exporter, has lost market shares although it remains a notable exporter of cheese and SMP. In the case of WMP, Argentina is also an important exporter and is projected to account for 5% of world exports by 2031. In recent years, Belarus has become an important exporter, orienting its exports primarily to the Russian market due to the Russian embargo on several major dairy exporters.

Figure 7.4. Exports of dairy products by region



Source: OECD/FAO (2022), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-outl-data-en>.

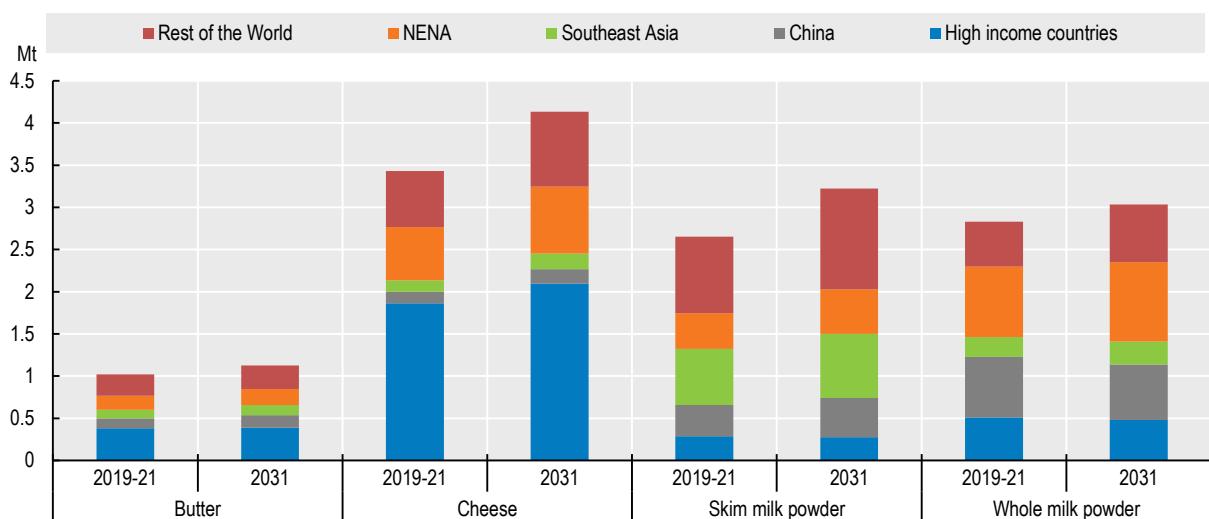
StatLink  <https://stat.link/p6wiqv>

The European Union will continue to be the main world cheese exporter, followed by the United States and New Zealand. It is projected that the European Union's share in world cheese exports will be around 44% by 2031, sustained by increased cheese exports to Canada via the CETA agreement and to Japan following the ratification of the bilateral trade agreement in 2019. The United Kingdom, Japan, Russia, the European Union, and Saudi Arabia are projected to be the top five cheese importers in 2031. These countries are often also exporters of cheese and international trade is expected to increase the choice of cheeses for consumers. In addition to the exports of final products such as cheese, recent trends point to increasing demand for value-added products intended for further processing. While exports of infant formula from the European Union to China and other destinations fell recently, exports of whey powder, which is often used as an ingredient for processing infant formula, increased.

New Zealand remains the primary source for butter and WMP on the international market, and its market shares are projected to be around 39% and 58%, respectively, by 2031. China is the principal importer of WMP from New Zealand, but trade between the two countries is projected to be less dynamic over the projection period. The expected growth in domestic milk production in China will limit the growth in WMP imports. It is expected that New Zealand will diversify and slightly increase its production of cheese over the outlook period.

Imports are spread more widely across countries, with the dominant destinations for all dairy products being the NENA, high-income countries, Southeast Asia, and China (Figure 7.5). China is expected to continue to be the world's major dairy importer, especially for WMP with imports from China projected to represent 21.6% of global imports in 2031. Per capita consumption of dairy products in China is relatively low compared to traditional markets, but there have been significant increases in demand over the past decade, with growth projected to continue. Most of its dairy imports are sourced from Oceania, although in recent years the European Union has increased its exports of butter and SMP to China. Imports by NENA are expected to originate primarily from the European Union, while United States and Oceania are expected to be the main suppliers of milk powders to Southeast Asia. Collectively, high-income countries import the largest share of cheese and butter, at around 54% and 38%, respectively, of world imports in 2019-21, but these shares are expected to decline slightly by 2031.

Figure 7.5. Imports of dairy products by region



Note: NENA stands for Near East and North Africa, and is defined as in Chapter 2. Southeast Asia contains Indonesia, Malaysia, Philippines, Thailand and Viet Nam.

Source: OECD/FAO (2022), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-outl-data-en>.

StatLink <https://stat.link/espcl4>

With the effects of the pandemic subsiding, it will nevertheless have a longer lasting effect on GDP in many non-OECD nations, with per capita income growth being lower than pre-pandemic projected growth. It is likely that the income shock will disproportionately affect poorer households and reduce their consumption, especially in Central Asia, Indonesia, and the least developed African countries. Since dairy product demand, specifically processed dairy products like butter and cheese, is closely tied to rising incomes, it is projected there will be less import demand for butter from these regions.

7.3.4. Prices

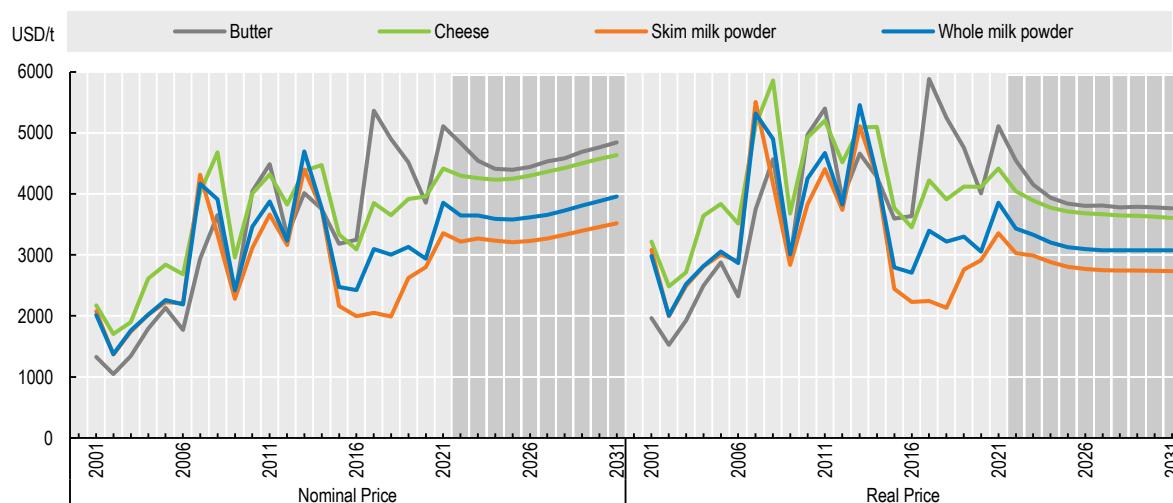
Despite current highs, international dairy prices will trend downward over the long-term

International dairy prices refer to the prices of processed products of the main exporters in Oceania and Europe. The two main reference prices for dairy are butter and SMP, where butter is the reference for milk fat and SMP for other milk solids. Milk fat and other milk solids together account for about 13% of the overall weight of milk, with the remainder being water.

The strong volatility of international dairy prices stems from its small trade share, the dominance of a few exporters, and a widely restrictive trade policy environment. Most domestic markets are only loosely connected to those prices as fresh dairy products dominate consumption, and only a small share of milk is processed as compared to that which is fermented or pasteurised.

Since 2015, the price of butter has increased considerably more than SMP. Increased demand for milk fat resulted in a price gap emerging between the two products and the price of butter will continue to be supported by stronger demand for milk fat compared to other milk solids on the international market. Therefore, the gap between the price of butter and SMP is assumed to remain a defining feature over the coming decade; although, it is expected to narrow over the period (Figure 7.6).

Figure 7.6. Dairy product prices, 2001-2031



Note: Butter, FOB export price, 82% butterfat, Oceania; Skim Milk Powder, FOB export price, non-fat dry milk, 1.25% butterfat, Oceania; Whole Milk Powder, FOB export price, 26% butterfat, Oceania; Cheese, FOB export price, cheddar cheese, 39% moisture, Oceania. Real prices are nominal world prices deflated by the US GDP deflator (2021=1).

Source: OECD/FAO (2022), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-outl-data-en>.

StatLink <https://stat.link/xp74di>

In the short term, this *Outlook* projects nominal butter and SMP prices remaining high in 2022 mainly due to high production costs and vegetable oil prices; however, prices are foreseen to return to their long-term levels and decline over the projection period as supplies respond to current price incentives. World prices for WMP and cheese are expected to be affected by butter and SMP price developments, in line with the respective content of fat and non-fat solids.

7.4. Risks and uncertainties

Environmental and health concerns and alternatives to milk are becoming more significant

In the short term, projections may be affected by Russia's war against Ukraine which have significantly heightened the uncertainty of agricultural supply and demand conditions and may slow down economic growth. Market impacts could be felt in related sectors such as dairy through increased input costs such as fertiliser and feed. Disruptions in global fertiliser trade could lead to higher input costs across the world. It could also increase the interest in circular agriculture with focus on less external inputs.

In addition, the emergence of new COVID-19 variants and subsequent policy measures may further impact economic recovery. While the dairy sector was relatively stable in the wake of the pandemic and has shown resilience, there may be structural changes that will have long-term effects. The pandemic has also lowered the projected overall GDP level in many countries. This has implications for the dairy sector, as increased dairy consumption is closely linked to per capita income growth in many regions. The effects of a staggered global recovery are also unclear, as there may be longer lasting implications for supply chains that span diverse regions.

The role of *plant-based replacements* for dairy (e.g. soya, almond, rice and oat drinks) in the fluid milk sector has increased in many regions, especially in North America, Europe and East Asia. Available replacements have continued to expand beyond the more traditional options, branching into various nuts, legumes and other crops. Key drivers of the expansion include health and consumer concerns regarding the environmental impact of dairy production, and lactose intolerance. The growth rates of plant-based replacements for dairy products are strong, albeit from a low base, although the evidence regarding their environmental impact and relative health benefits is contested. The sustainability of popular substitutes such as almond and soya drinks have been questioned as more consumers consider other environmental issues in addition to GHG emissions, such as water usage and deforestation. Similarly, lactose intolerance is a concern for some consumers with a range of lactose-free dairy products becoming available for those who do not prefer plant-based replacements. Overall, there is uncertainty surrounding the long-term impact of plant-based replacements on the dairy sector.

Environmental legislation could have a strong impact on the future development of dairy production. GHG emissions from dairy activities make up a high share of total emissions in some countries (e.g. New Zealand and Ireland) and more stringent environmental policies and initiatives such as the Pathways to Dairy Net Zero launched in September 2021 by the dairy industry could affect the level and nature of dairy production in order to curb such emissions. The increasing trend towards sustainable practices such as water access and manure management are associated areas where policy changes could impact. Nevertheless, stricter environmental legislation could also lead to innovative solutions that improve the long-term competitiveness of the sector. Overall, the global level of GHG emissions will largely depend on efficiency gains in India and other countries with high cattle populations and extensive production. In addition, climate change and extreme weather events, already experienced in some countries and regions, could aggravate the viability of milk production in the affected countries.

Animal diseases and their spread could impact milk production, especially low-, and middle-income countries. Mastitis is the most common infectious disease in dairy cattle worldwide and across all types of farm sizes. It is also the most damaging from an economic point of view, with a significant impact on milk

yield and milk quality. Future improvements in awareness, identification, and treatment of this disease could lead to significant increases in milk production through smaller losses. Treatments to control many diseases, including mastitis, are based on commonly used antimicrobials. This has raised increasing concerns on their overuse and the risk of antimicrobial resistance, which would reduce the effectiveness of existing treatments, impact on yields and milk supply, and depend on the development of new treatments and herd management practices. However, the evolution of this process is currently uncertain.

Dairy trade flows could be substantially altered by *changes in the trade environment*. Modifications to existing, or the creation of new trade agreements would affect dairy demand and trade flows. While the Russian import ban on several dairy products from major exporting countries was partially lifted in 2020, specifically for whey powder, the ban was subsequently extended until the end of 2022. The embargo was one of the drivers of increased Russian milk production over the last decade (0.7% p.a.) which not only reduced its import dependency but has altered the sources of imports from the European Union to Belarus following the sanctions from 2014 onwards. USMCA is expected to influence dairy trade flows in North America, with members gaining increased access to each other's dairy markets. The United Kingdom's trade policy after its exit from the European Union is likely to impact dairy trade flows. Historically, large amounts of cheese and other dairy products have been traded between the two regions, but there have been increased trade frictions as importers and exporters navigate the new and changing trade environment. Moreover, the country's new agreements with Australia and New Zealand, which, after a transitional quota, allow tariff-free imports of butter and cheese could impact the dairy trade and the competitiveness of the dairy sector in the United Kingdom. To date, India and Pakistan, the big dairy consuming countries, have not been integrated into the international dairy market as domestic production is projected to expand fast to respond to growing internal demand. Future investment in cold chain infrastructure in these regions will increase their degree of self-sufficiency in dairy.

Changes in domestic policies remain an uncertainty. In particular, under USMCA, Canada has capped SMP exports, allowed increased market access, and eliminated their Class 7 designation, which was initially introduced to comply with the World Trade Organization Nairobi Decision on the removal of export subsidies. In the European Union, intervention buying of SMP and butter at fixed prices remains possible under certain circumstances, and this has already had a considerable market impact in recent years.

Note

¹ Fresh dairy products contain all dairy products and milk which are not included in processed products (butter, cheese skim milk powder, whole milk powder, whey powder and, for few cases casein). The quantities are in cow milk equivalent.