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PAPER

Abolition of a Trade Barrier: the Case of the EU Milk Quota and the Chinese Market

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Abstract Milk is among the most produced and valuable agricultural commodities worldwide, representing 10% of global agricultural output and 65% of total dairy production. The global trade of milk and milk products accounts for 5% of world trade of agricultural commodities.

The European Union is the second milk producer worldwide and the largest milk exporter (with almost 30% of global exports). Because of an overall European decreasing milk consumption and a self-sufficiency rate higher than 100%, EU milk exports are increasing.

China is among the main milk-deficit countries with an estimated self-sufficiency rate around 80% in 2017. Although it is expected to increase its milk production, because of the growth in consumption, fueled by population and GDP upward trends, and the not sufficient domestic supply, it remains the largest importer of dairy products worldwide. About 20% of milk and milk products imports worldwide are represented by China. China is the top extra-EU importer of milk with a 19% share of total extra-EU exports of milk.

Among the market distortion policies, it is certainly worth mentioning the production quotas. Our case study focuses on the EU milk quotas, introduced by the CAP in 1984 to control the excess of supply in the market, and then removed in 2015 to liberalize the market.

Starting from these premises, the aim of the paper is to understand whether the drop in milk prices following the EU milk quota removal has found a tradeoff with the rise of milk exports towards China.

Keywords: milk, quotas, trade, EU, China, consumption.

JEL Classification: Q02, Q17, Q18, L66, D12.

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Introduction

Milk is one of the most produced and valuable agricultural commodities worldwide. Third only after maize and sugar cane, it represents nearly 10% of global agricultural output and about 65% of total dairy production (OECD-FAO, 2019a). Since 2010 the world production of milk has expanded by almost 16%, reaching 838 million tonnes and generating more than €350 billion in 2018 (OECD-FAO, 2019a).

The five world largest milk producers in 2018 are India, with a 20.8% share of global production, the European Union (17.9%), the United States (11.8%), Pakistan (6.6%) and Brazil (4.3%).Together they account for nearly two thirds of the world production of milk (OECD-FAO, 2019).

In the 2000s, the Asian region registered the highest milk output expansion by volume, followed by Europe, North America and Oceania. In Asia, the production of milk increased to 346.9 million tonnes in 2018, with a growth of 17.9% from 2012-2014 mainly led by India (+36.3%) and Pakistan (+17.2%). The total milk output in China, by contrast, has started recovering since 2018.

The global milk production, moreover, is forecast to further grow at a 1.7% per year, expanding to nearly 860 million tonnes in 2020 and to more than 937 tonnes in 2025 (OECD-FAO, 2019), fuelled by the stronger demand at international level, mainly driven by developing countries.

The per capita consumption of milk largely varies across the world. It is particularly high in developed markets such as Oceania, with about 105 kg per year consumed both in New Zealand and Australia in 2018, North America with 76 kg, Canada and the United States with 68 kg and the European Union with an average of 65 kg in 2018. Lower values are instead reported in BRIC countries: 46 kg per year in Brazil, 58 kg in the Russian Federation, 49 kg in India and 12.1 in China[1]. Unlike Indians and Brazilians, however, the Chinese per capita consumption is still very low.

According to the latest FAO Outlook (2019a), the global trade of milk and milk products accounts for about 5% of the world trade of total agricultural commodities. The world total exports of milk and milk products (in milk equivalents[2]) have almost reached 75 million tonnes in 2018, with a 20.8% and a 4.6% increment from 2010-2012 and from 2015-2017 respectively (FAO, 2014, 2016, 2018 and 2019).

Almost 70% of the world exports of milk and milk products come from the EU28 (27.4%, 20.5 million tonnes for a worth of €20 billion, mainly driven by Germany and the Netherlands), New Zealand (25.1%, 18.7 million tonnes) and the United States (15.7%, 11.8 million tonnes).

World imports of milk and milk products (in milk equivalents), have consistently expanded to almost 75 million tonnes in 2018, with an increase of 15.4 million tonnes (25.8%) from 2010-2012 and of 3.4 million tonnes (4.8%) from 2015-2017 (FAO, 2014, 2016, 2018 and 2019). About 60% of milk and milk products imports come from Asian countries in 2018. China, with 14.6 million tonnes (20%), is currently the major milk

[1] Data on per capita consumption of milk is collected from CLAL (2019), for China is collected from the National Bureau of Statistics of China (2018).

[2] Milk equivalent is the amount of fluid milk used in a processed dairy product.

importer worldwide. Chinese milk imports have risen by 79.2% from 2010-2012 to 2018 and are expected to further grow, even if at a slower pace (OECD-FAO, 2018).
The international dairy sector is among the most distorted agricultural sectors because it is characterized by a large number of tariffs and quotas. Our case study focuses on the EU milk production quotas introduced in the EU by the Common Agricultural Policy (CAP) in 1984 to cope with the so called "milk lakes and butter mountains" resulting from a guaranteed price for EU dairy farmers, higher than the world price market (European Parliament, 2018).

Milk quotas were, therefore, aimed to control the excess of supply in the market and to manage international conflicts rising due to export subsidies and import levies. The quotas, based on "historic" milk production, set a yearly limit to the maximum amount of milk that could be delivered to dairies and the amount of countries' direct sales. Countries could produce more than their quota by paying a high levy. The result was a clear distinction between EU milk producing and consuming countries.

The Health Check Reform of 2008 was the starting point to the removal of milk quotas. The scope of the European Commission was to liberalize the market by developing a more competitive and market-oriented dairy sector able to meet the increasing demand worldwide (Salou et al., 2017). Milk quota abolition become effective from 1st April 2015; however, to gradually prepare farmers, they were increased by 1% per year from 2008 to 2013.

Starting from these premises, the aim of the paper is to understand whether EU milk quota removal, and the consequent drop of milk prices due to the higher amount of milk available in the market, has found a tradeoff with the rise of milk exports.

China (the largest milk importer worldwide), specifically, is particularly relevant for the EU (the largest milk exporter worldwide) because of the progressive increase in milk consumption, due to insufficient domestic production, population and per capita income growth and changes in diets (increase in animal protein intake).

The paper is structured as follows: section 2 and 3 provide an overview of the EU and of the Chinese milk sectors, respectively, while Section 4 goes more deeply into the milk trade relationship between EU and China. Lastly, the final conclusions are in section 5.

2. EU milk sector

The dairy sector is the second biggest agricultural sector in the European Union (after vegetable and horticultural plants and before cereals), representing more than 12% of total agricultural output (European Parliament, 2018).

The EU milk production has grown by 13.7 million tonnes from 2010 to 2018, reaching 150 million tonnes and generating about €48 billion (Table 1). The larger share of milk produced is delivered to dairies for further processing; the rest is either consumed, directly marketed or used as feed.

Table 1. EU milk production and producer prices, 2010-2018

	EU milk production		EU milk production		Producer price
Year	**(1,000 Tonnes)**	**Δ(1,000 Tonnes)**	**(MM€)**	**Δ(MM€)**	**(€/Tonnes)**
2010	136,471		41,484		304.0
2011	138,301	1,830	46,813	5,328	338.5
2012	138,869	568	45,056	-1,757	324.4
2013	139,995	1,126	51,183	6,127	365.6
2014	144,628	4,632	53,279	2,096	368.4
2015	147,502	2,874	45,024	-8,255	305.2
2016	148,606	1,104	41,766	-3,258	281.1
2017	148,907	300	50,965	9,199	342.3
2018	150,142	1,235	47,975	-2,990	319.5

Note: Δ indicates the difference with respect to the previous year
Source: authors' elaboration on OECD-FAO data (2019)

In 2018 the largest six European producers are Germany, France, the United Kingdom, the Netherlands, Poland and Italy, which together account for nearly 70% of total EU production.

In 2010-2014 (pre milk quota abolition), milk output increased by 8.2 million tonnes with a surplus of almost €11.8 billion, driven by the sharp rise of producer prices. National milk quotas, in fact, increased by 1% per year from 2008 to 2013 to allow dairy farms to adjust and prepare for quota removal. In 2015-2018, total milk production is incremented by 2.6 million tonnes, and the worth created has increased by about €3 billion (Table 1).

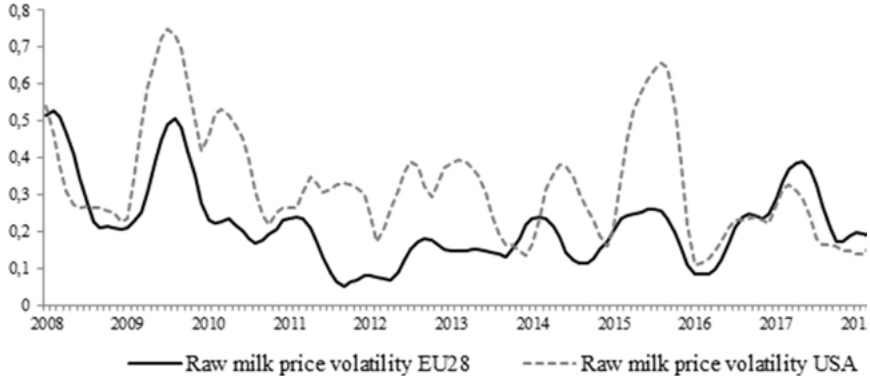
The most significant and rapid growth in real terms, however, occurred in the transition period; from 2013 to 2015 EU milk production rose from 140 to 147.5 million tonnes. Because there was not a quota increase between 2014 and 2015, some countries (e.g. Germany, the Netherlands, Poland) decided to build up their production capacity, risking to pay the super levy fines, and produce above their milk quota (Klootwijk et al., 2016). Giles (2015) states that the ending of milk quota in Europe is having an impact on milk production varying across countries. The policy tool of quota removal is, in fact, leading to a more pronounced concentration of production within the most competitive countries, those that were already producing in accordance with their allocated quotas or exceeding their limits.

The increase by around 7.5 million tonnes in the production between 2013 and 2015 was one of the main causes of the milk sector crisis that took place from 2014 to 2016 when EU milk prices dropped dramatically from €368.4 to €281.1 per tonne, affecting farmers' incomes (European Commission, 2019). The higher expectation of milk exports on the supply side after the milk quota abolition, the ban imposed by Russia to many dairy

products, and the increased volatility of raw milk price since 2007, are other drivers that have contributed to this milk sector crisis (European Parliament, 2018).

In particular, price volatility[3] on international market is one of the main concerns for the dairy sector, especially with its opening to global markets. Raw milk price volatility in the EU is in general lower than in other markets, although they follow rather similar patterns. The comparison with the US, for instance, confirms this trend (Figure 1) and shows how the two curves are similar, although the EU one is less pronounced, smoothed and lower. From 2016, differences in volatility have attenuated, a sign of greater market integration.

Figure 1. Raw milk price volatility[4] in the EU28 and USA, 2008-2019 (monthly)



Source: authors' elaboration on European Commission (2019a), updated March 2019

This situation led the European Commission to implement two aid packages, in September 2015 and in July 2016, which included the adoption of public intervention[5] and storage[6] measures and other specific measures to contain the crisis in the short run, for instance incentives for farmers to reduce production (European Parliament, 2018). The recovery of the EU dairy sector started in 2017, supported by a growing global demand and the rise of milk prices.

From the demand side, the overall per capita consumption of milk in Europe is slightly reducing (European Parliament, 2018). Milk consumption, however, varies significantly between European regions and countries: it is higher in the North of Europe; in fact, in 2017, the top five European countries in terms of per capita consumption of fluid milk are Finland (119.7 kg), Ireland (110.6 kg), UK and Estonia (101 kg) and Denmark (85 kg).

[3] Volatility measures the intensity of price changes in percentage terms with respect to the usual average value in a given period of time. High volatility corresponds to more pronounced price changes (positive or negative).

[4] Standard deviation of milk prices of the last 12 months divided by the average price over the same period.

[5] The European Commission bought a specific amount of products at a set price when prices were low to provide a minimum floor.

[6] The European Commission supported private operators through the storage of the products. In this way private operators could temporarily take products off the market but keep ownership so they can sell them when the storage period expires.

CLAL (2019a) has estimated that the European milk self-sufficiency rate[7] in 2018 is about 114% and is increasing over time: from 2010 to 2018 it has grown by 3.2%. The self-sufficiency rate is greater than 100% in Central (125%), Northern (136%) and Eastern European countries (111%). This means that, on average, these are exporter countries, while it is equal to about 75% in the South of Europe where countries are mainly importers. In other terms, countries that were exporters before the milk quota abolition continue being exporters (e.g. Germany, France, the Netherlands). Countries that were importers are still defined in this way, however their self-sufficiency rate is increased, so their dependency on imports is decreased.

With an overall European decreasing demand for milk and a self-sufficiency rate higher than 100%, it is inevitable that a large part of additional milk production is redirected into trade flows. According to Eurostat, about 20 million tonnes of milk (SITC 022[8]), equal to 13% of EU milk production, was put directly on the market in 2018.

As expected, intra-EU exports represent the largest part of total EU exports of milk[9] (16.5 million tonnes in 2018), even if their share of total milk exports is decreasing (from 88% in 2010 to 83% in 2018).

By contrast, total extra-EU exports are following an increasing trend, intensified since the milk quota abolition. The share of extra-EU exports in total EU exports of milk has risen from 11.4% in 2010 to 17.0% in 2018, reaching 3.4 million tonnes. Over the transition period (2013-2015), they grew by more than 30% (by 740 thousand tonnes). China is the top extra-EU importer of milk with a 19% share of total extra-EU exports of milk in 2018. The main extra-EU exporters are Germany (share of 20.6%), France (17.2%), the Netherlands (15.8%) Belgium (8.5%) and Poland (8.2%), with a total volume of exports equal to 2.1 million tonnes in 2018. From 2013 to 2015, extra-EU exports of milk experienced a concentration among these countries, rising by almost 40%, especially in Germany, the Netherlands and Poland.

For countries like Germany and France, the largest EU milk producers, extra-EU milk exports are becoming more convenient than intra-EU exports. First, a tonne of milk sold within the EU is worth less than a tonne sold outside the EU, mainly because the typology of milk exported is different (e.g. fluid, dry, condensed). Second, provided that the demand for milk in Europe is covered in most countries, huge additional quantities, not needed internally, are more likely to promise extra profits if sold where there is a larger market for European dairy products.

3. The Chinese milk sector

Very few countries worldwide are self-sufficient with regard to milk. China is among the main milk-deficit countries with an estimated self-sufficiency rate around 80% in

[7] The self-sufficiency rate indicates to which extent a country relies on its own production resources. It is equal to the ratio between the total cow's milk delivered to diaries and the sum of the total cow's milk delivered to diaries and the difference between total milk imports and exports.

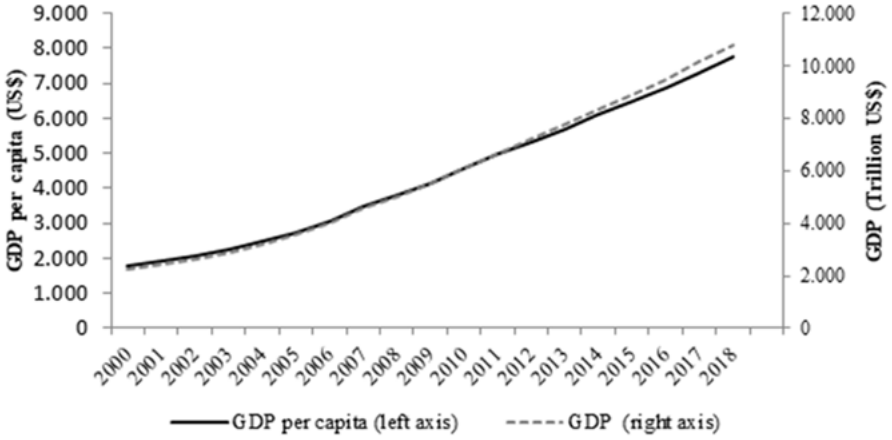
[8] SITC (Standard International Trade Classification) 022: Milk, cream and milk products (excluding butter, cheese).

[9] Few EU countries have a milk-deficit and products can move freely and easily within the EU.

2017 (CLAL, 2019).

Despite China's population representing almost 20% of the total word population, its milk production accounts for only 4.3% of world total production. The Chinese milk industry, however, has been rapidly developing since the beginning of the 2000s. Milk production has grown by 22.8 million tonnes (190%) from 2000 to 2018, rising from 12.0 to 34.8 million tonnes (Figure 2).

Figure 2. Milk production and growth rate in China, 2000-2025



Note: from 2018 data are estimated

Source: authors' elaboration on OECD-FAO data (2019)

After the sharp increase experienced at the beginning of 2000s, since 2004 the growth rate of Chinese milk production slowed down because of less developed dairy industry and epidemic diseases (Tao et al., 2016). In late 2013, the domestic production saw a significant drop, caused by a disease which led farmers leaving the industry; as a consequence, milk prices jumped. China's shrinking dairy herd, especially due to the retreat of small-scale farms from the market because of increasing feed costs, together with stricter environmental regulations and lower international milk prices, are other important determinants of the slowdown of the growth rate (USDA, 2019).

Supported by a growing demand, the Chinese production of milk is recovering since 2018 and it is projected to further expand in the next years, reaching 36.5 million tonnes in 2025 (+4.7% from 2018) (OECD-FAO, 2019a). Its share of world production, however, will remain at the same level (around 4%).

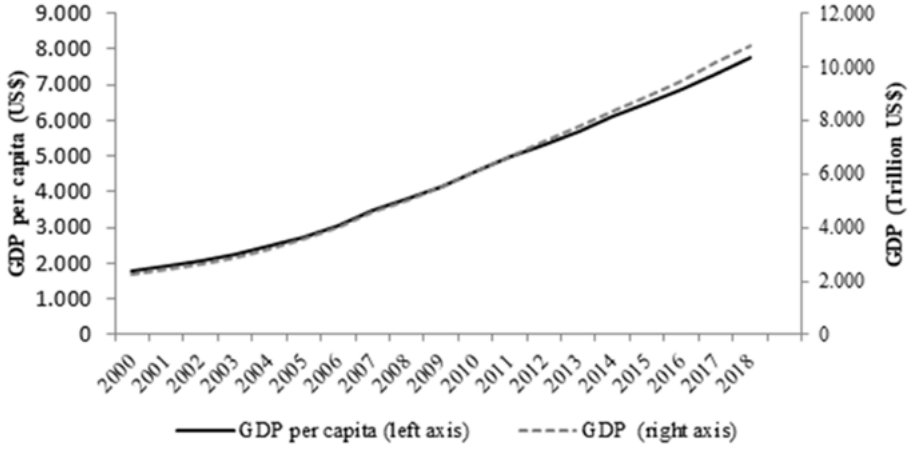
With approximately 1.4 billion people in 2018, China continues being the most populous country in the world. However, its population is currently ageing at a rapid rate (Li et al., 2009; Zhang et al., 2012). The age group of 60 years and over will, in fact, represent the largest share of population by 2050.

Along with population growth and ageing, China is characterized by substantial internal migration flows. According to the World Bank, barely 20% of the Chinese population was living in urban areas in the 1980s. Since then, the urbanization process

has been dominant; in fact, in 2018 nearly 60% of the Chinese population is registered in urban areas. From 2010 to 2018 Chinese rural population reduced by about 95 million people (-13.7%) against an increment of more than 151 million people living in urban regions (+21.9%). This trend is expected to continue over time together with population growth, although at a lower rate.

The distinction between urban and rural areas is associated with substantial income inequalities. The Chinese GDP per capita (constant prices 2010, US$) increased from $1,767 in 2000 to $4,455 in 2010 and to $7,755 in 2018 (Figure 3). Despite the fact that the per capita income available has grown in both urban and rural regions, income inequality remains significant. In 2017, the ratio between urban and rural per capita disposal income was still equal to 2.7 (National Bureau of Statistics of China, 2018).

Figure 3. Chinese GDP and per capita GDP[10] (constant 2010 US$), 2000-2018



Source: authors' elaboration on Word Bank data (2019)

Likewise China's milk production, also the domestic consumption of milk and milk products is progressively growing since the 2000s. Total Chinese milk consumption increased from 12.6 billion kg in 2010 to 18 billion kg in 2017. Per capita consumption nationwide grew from 9.1 to 12.1 kg per year in the same period, registering an increment of 33% (National Bureau of Statistics of China, 2018).

Fluid milk is the most consumed typology of milk. The rapid development of fluid milk is the result of the rapid growth in consumption of UHT (ultra-high temperature) milk because of its longer shelf life. The UHT milk market, nowadays, represents more than 60% of total fluid milk consumed in China (Transparency Market Research, 2014). In spite of its impressive overall growing milk consumption, China has still one of the lowest levels of per capita milk consumption worldwide, also compared to other Asian countries (e.g. India 47.3 kg, Japan 30.1 kg in 2017).

This factor can be partially addressed to the particular predisposition of Chinese people to lactase-deficiency; in fact, in many scientific studies, it is estimated that the percentage of lactose intolerance is higher than 85% in China, affecting 4 in 5 people

[10] Chinese GNI (constant 2010 US$) is very close to GDP.

(Yang et al., 2013; Goh et al., 2018). Also, the melamine milk scandal[11] of 2008 has seriously affected Chinese milk consumption causing a drop in the demand (Pei et al., 2011; Jia et al., 2012; Lam et al., 2013).

Chinese's lactose intolerance together with the milk scandal have also intensified the demand and consumption of milk alternatives, especially from plant sources, like milk of soy, rice, coconut, walnut and almond. Despite their great potential for the health food market, however, nutritionally they are not comparable or equivalent to animals' milk (Sethi et al., 2016). In fact, Chinese per capita milk consumption is increasing.

Aware of this, the Chinese government has been implementing policies to promote milk consumption. Some examples are the introduction of school milk programs since 2000 and the publication of official nutrition guidelines, aimed to encourage the adoption of healthier diets and raise awareness on the benefits deriving from consuming milk on a daily basis (Cheng et al., 2015).

These programs can partially explain the sharp growth in the per capita consumption of milk starting at the end of the 1990s (Fuller et al., 2006), which is still going on. Nevertheless, this upward trend can be motivated by further demographic, economic and cultural factors.

The Chinese ageing trend, for instance, is expected to deeply shape milk consumption trends (Hengyun and Allan, 2004). An ageing population with greater life expectancy would increase China's nutritional requirements. The integration of traditionally low calcium diets (especially for the elderly) with milk and milk products could have significant public health benefits (Kruger et al., 2016). Secondly, increasing the awareness in milk benefits among the younger generations, they consume more milk today but they will be also more likely to consume more milk when they become older. Finally, there will be an intergenerational effect in milk consumption habits as the younger generation of today will transmit to the next generation this greater propensity to milk.

Consumption and consumption growth rate, in addition, substantially vary depending on the household location in rural or urban areas (Table 2).

Table 2. Per-capita milk consumption in urban and rural China, 2010- 2017

Year	Urban		Rural	
	Kg	Δ(%)	Kg	Δ(%)
2010	14.0		3.6	
2011	17.7	26.4	5.2	44.4
2012	14.0	-20.9	5.3	1.9
2013	17.1	22.1	5.7	7.5
2014	18.1	5.8	6.4	12.3
2015	17.1	-5.5	6.3	-1.6
2016	16.5	-3.5	6.6	4.8
2017	16.5	0.0	6.9	4.5
Δ2010-2017	2.5	17.9	3.3	91.7

Note: Δ(%) indicates the difference with respect to the previous year

Source: authors' elaboration on National Bureau of Statistics of China (2018)

[11] It was found that milk suppliers were adding melamine to artificially increment the protein readings of milk and infant formula.

According to the National Bureau of Statistics of China (2018), Chinese per capita milk consumption in urban regions is 16.5 kg against 6.9 kg in rural ones in 2017. The overall growth rate is definitely greater in rural China, 91.7% from 2010 to 2017, than in urban China, 17.9% in the same period. Despite the higher growth rate, the level of per-capita consumption in rural areas in 2017 was lower than a half of the per-capita consumption in urban areas in 2010.

There are many concurrent factors that can contribute to explain the heterogeneity between rural and urban households in per-capita consumption levels and their evolution over time, and income is one of that.

Several studies have estimated a strong positive effect of households' income growth on the Chinese milk consumption (Fuller et al., 2006; Zheng and Henneberry, 2010). Fuller et al. (2006) highlighted that, despite demand increases occurring at all income levels, for lower-income groups (generally rural areas) demand increments are larger than income ones. It follows that milk demand estimations must take into account the existent income gap between urban and rural areas (Zheng and Henneberry, 2010). Our estimation of income elasticity of per capita milk consumption[12] in urban and rural China (Table 3) confirms what was found by Fuller et al. (2006): elasticity decreases as income grows (e.g. from rural to urban areas). In addition, income elasticity measured in urban regions is rather low, although positive (0.27) while in rural regions, it is greater than 1 (1.38); therefore, milk is considered a superior or luxury good (e.g. the per capita consumption will increase more than proportionally as income rises). Income elasticity of meat[13], on the contrary, is positive and lower than 1 for both regions; this means that Chinese consumers consider meat as a normal good (e.g. an income increase will lead to a per capita consumption increase).

Table 3. Income elasticity of per-capita consumption, 2010-2017

	Urban	**Rural**
Milk	0.27	1.38
Meat	0.29	0.45

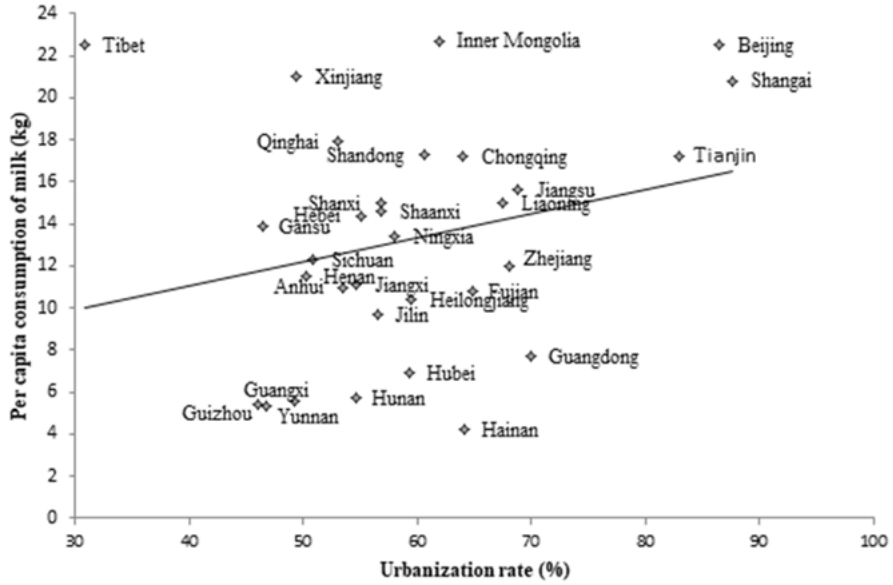
Source: authors' elaboration on National Bureau of Statistics of China data (2018)

Our estimates of income elasticities for milk (Table 3) are consistent with the evidence presented in Table 2. In Table 3 we show that the same percentage increase in income leads to a higher increase in per-capita consumption of milk in rural areas, which are actually those characterized by a more marked increase in milk per-capita consumption over the years (Table 2). It follows that the demand for milk by lower-income consumers is much more responsive to income increases than the demand by higher-income consumers.

[12] Percentage increase in per-capita consumption associated with an increase in Chinese GDP per-capita by 1%.

[13] The comparison between milk and meat income elasticities is driven by the fact that these products tend to follow a similar pattern in China, likewise other developing countries: consumption increases along with income improvement (Delgado, 2003).

Figure 4. Per-capita consumption of milk and urbanization rate in Chinese regions, 2017



Source: authors' elaboration National Bureau of Statistics of China data (2018)

There is a significant regional variation in terms of per capita consumption (Zhou, 2017) and urbanization rates. The regression line clearly shows that, on average, per capita milk consumption increases along with the rate of urbanization[14] (Figure 4). An increment of 10% in the urbanization rate is associated with a 1.2 kg increase in the per capita milk consumption, which is about 10% of the nationwide per capita consumption of milk, amounting to 12.1 kg.

The progressive urbanization process may positively affect the consumption of milk via other channels than income. Indeed, urban areas are characterized by a greater diffusion of modern marketing channels, such as supermarkets. Moreover, the opening of the Chinese society in urban areas to the influence of Western countries has changed consumers' perceptions of dairy products and led to a shift from a semi-vegetarian diet to an animal-product-dominant diet (Zhou et al., 2002; Lam et al., 2013).

On top of income as well as demographic and cultural factors, the demand for milk is, as expected, significantly influenced by price variations (Fuller et al., 2006; Cheng et al., 2015). In Cheng et al. (2015), milk demand is negatively affected by price although it is inelastic; therefore, price changes imply smaller changes in the quantity demanded. The prices of substitute goods (e.g. plant-based milk alternatives), are instead positively related to the consumption of milk.

Although China is expected to increase its milk production (OECD-FAO, 2019), it remains the largest importer of dairy products because of the growth in consumption and the insufficient domestic supply.

[14] An exception is represented by the prevalently rural region of Tibet where per capita consumption is among the highest because of the importance of Tibetan yaks.

Chinese imports of milk and milk products (in milk equivalents) reached 14.6 million tonnes in 2018, with an increment of 3.9 million tonnes (+36.3%) from 2015 and of 6.5 million tonnes (+79.1%) from 2010.

Imports of milk alone (e.g. fluid milk, Skimmed Milk Powder-SMP, Whole Milk Powder-WMP and whey), account for more than 10% of them. Chinese milk imports, in fact, reached 1.5 million tonnes, of which, 750 thousand tonnes are of fluid milk (USDA, 2019). The EU, especially driven by Germany, accounts for over 50% of the fluid milk imports into China, followed by New Zealand (35%) and Australia (12%). The trade flow is boosted by the continuous development of Chinese e-commerce. Consumers' safety concerns over domestic milk increased online sales of dairy products, besides the fact that they are often more convenient (Fok et al., 2017).

China's imports of WMP and SMP reached 520 and 275 thousand tonnes respectively in 2018. In both cases New Zealand is the largest supplier, facilitated by the preferential tariffs under the New Zealand–China Free Trade Agreement (FTA) of 2008, followed by the EU, Australia and US (USDA, 2019). Due to the US tariffs imposed in July 2018, the worth of US dairy exports to China reduced by 13% from 2017 to 2018, falling from 577 million of dollars to 500 million, after years characterized by an increasing trend (USDEC, 2019).

4. The EU-China milk trade

The EU-China trade relationship mainly consists of trade in goods; trade in food represents a relatively small share, although it has been increasing over time. By contrast with the overall trade balance between the two traders (which shows a EU deficit in favor of China), for food products, the EU has a surplus, €2.6 billion in 2018 (European Commission, 2019).

A very important share of EU food exports to China is represented by dairy products[15] (15.6%, €1.2 billion in 2018) and, in particular, milk[16] accounts for 85% of dairy exports (13.8% of EU food exports).

The total volume of EU milk exports towards China has rapidly risen since 2010 reaching in 2018 almost 690 thousand tonnes (about 45% of total Chinese milk imports), generating more than €1 billion (Table 4). In this period, exports increased by 552 thousand tonnes for €837 million. This trend is also reflected in the share of EU milk exports towards China in the total EU milk exports which increased from 0.5% in 2010 to 3.5% in 2018.

In 2010-2014, EU milk exports to China increased by 308.7 thousand tonnes to €526 million. After the milk quota abolition, they continued increasing by 83.6 million tonnes generating a surplus of €250 million in 2015-2018.

As a consequence of the significant EU milk production growth registered from 2013 to 2015, EU milk exports to China experienced the most rapid and largest expansion, in quantitative terms, between 2014 and 2015: more than 160 thousand tonnes (+36%) in just one year generating a surplus of €62 million. This expansion has also affected the

[15] SITC 02.
[16] SITC 022.

share of EU milk exports towards China in total EU milk exports which exceeded the 3% in 2015. After that, milk exports stabilized around 700 thousand tonnes, overcoming the billion of euro, and their share in total EU milk exports remained steady at 3.5%.

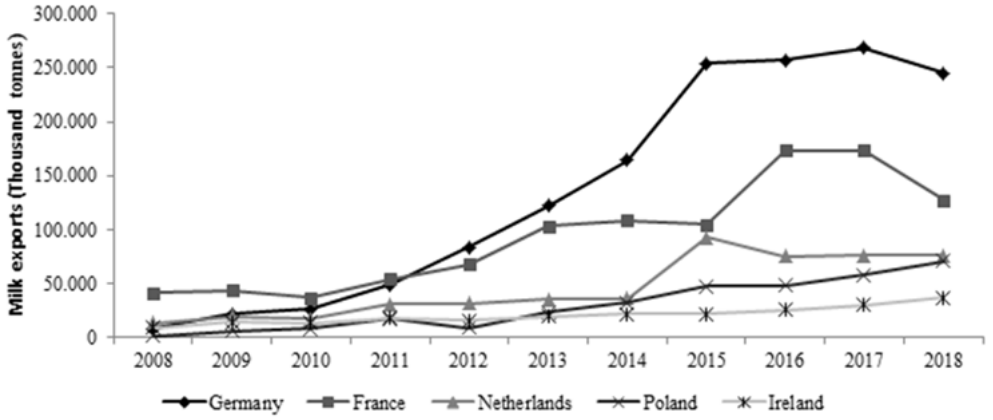
Table 4. EU milk exports (SITC 022) towards China, 2010- 2018

Year	Tonnes	Δ(Tonnes)	MM€	Δ(MM€)	Share on total EU milk exports (%)
2010	136,950		221.8		0.8
2011	209,060	72,110	328.9	107.1	1.1
2012	254,991	45,931	460.9	132.0	1.4
2013	366,108	111,117	679.0	218.1	2.0
2014	445,639	79,531	747.9	68.9	2.3
2015	606,271	160,632	809.5	61.6	3.1
2016	677,185	70,914	922.3	112.7	3.5
2017	708,293	31,108	1,108.1	185.8	3.5
2018	689,858	-18,435	1,059.1	-49.0	3.5

Note: Δ indicates the difference with respect to the previous year
Source: authors' elaboration on Eurostat data

Figure 5 considers Germany, France, the Netherlands, Poland and Ireland, which are the top five European countries for milk exports to China in 2018 in real terms. Together they account for more than 80% of EU exports, corresponding to about 557 thousand tonnes and more than €750 million. Also the main EU milk exporters towards China experienced a sharp increment of milk exports between 2014 and 2015 and, subsequently, maintained them at a higher level with respect to the quota-period. Germany, in particular, incremented its exports by 90.2 thousand tonnes (+55%) and its share of total EU milk exports to China raised from 37% to 42%. Two are the exceptions: Ireland, whose exports towards China remains constant over time, and France whose largest expansion (equal to 68.8 thousand tonnes, +65.6%) occurred between 2015 and 2016 with a share increasing from 17% to 26%.

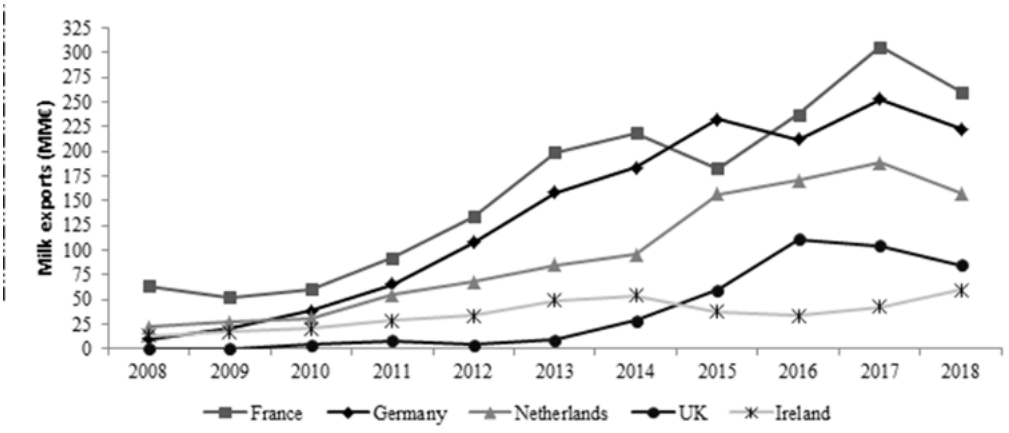
Figure 5. Milk exports (SITC 022) to China of top European countries, 2008-2018 (real terms)



Source: authors' elaboration on Eurostat data

Figure 6 focuses on the top five European countries for milk exports to China in 2018 in nominal terms, namely France, Germany, the Netherlands, the UK and Ireland. Their exports, accounting for about 75% of total worth of EU milk exports into China, have reached €786 million. For Germany, the Netherlands and the UK the increase in the volume of milk exports to China has outbalanced the drop in prices that occurred between 2014 and 2015 (Table 1) and, therefore, the worth of those exports has risen. France and Ireland, on the contrary, experienced a decrease in the total worth of milk exports from 2014 to 2015, despite the growth in the exports volume. This reduction, however, is followed by an increasing trend starting in 2016.

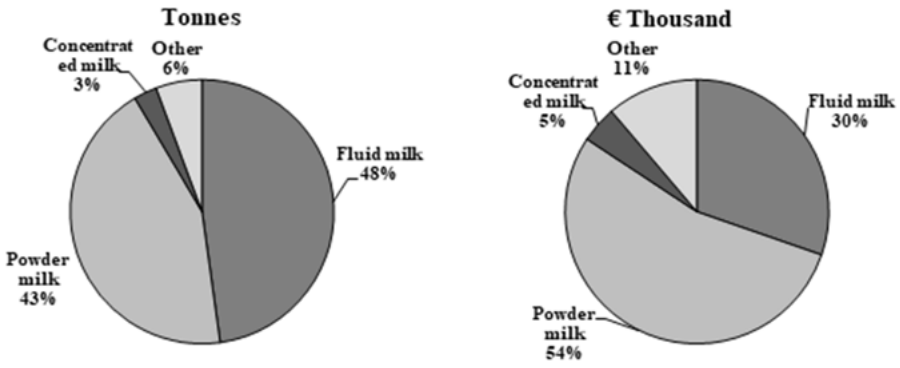
Figure 6. Milk exports (SITC 022) to China of top European countries, 2008-2018 (nominal terms)



Source: authors' elaboration on Eurostat data

In 2018, almost half of EU milk exported to China (about 330 thousand tonnes) is fluid milk, although it represents just a third of the worth of the trade flow (€321 million). Powder milk (SMP, WMP and whey powder), accounts for 43% of the overall milk exports (301 thousand tonnes) in 2018, and it generates more than half of the total revenue, about €572 million (Figure 7).

Figure 7. EU milk exports to China for milk typology, 2018



Source: authors' elaboration on Eurostat data

From 2010 to 2018 the largest increase in EU-China milk exports occurred for fluid milk: the volume increased by almost 322 thousand tonnes (+3,916%) while their worth by more than €310 million (+3,356%), despite the drop in prices registered from 2014 to 2016. Also for fluid milk the largest export increment occurred between 2014 and 2015: they expanded by 108 thousand tonnes, exceeding for the first time the 300 thousand tonnes, and generating a surplus of more than €73 million.

5. Concluding remarks

The abolition of milk quotas in the European Union led to a major production expansion from 2013-2014, when EU countries where adapting to the imminent regulation change, to 2015 when the removal of quotas became effective. In three years, EU milk production increased by 7.5 million tonnes (+5.4%). After the quota removal, the EU milk output continued increasing, although at a lower rate (less than 1% per year). The effect on milk prices, instead, manifested itself between 2014 and 2016, when the average EU milk producer price dropped by 23.7% and milk price volatility peaked.

Provided that EU countries are among the few to have a milk-surplus, this excess of production has fueled EU trade flows especially towards international markets where the level of per capita consumption is still lower than that observed in more developed economies. Extra-EU milk exports, in fact, rose by 740 thousand tonnes (+30%) in 2013-2015 and then continued increasing by 8% until 2018.

In this framework, Chinese growing demand of milk has played an important role

in price stabilization for EU farmers. Indeed, between 2014 and 2015 EU milk exports to China increased by more than 160 thousand tonnes (+36%), exceeding 600 thousand tonnes and generating a surplus of €62 million, and then stabilized around 700 thousand tonnes in the next years.

China, potentially, could be an increasingly key market for European milk producers. On the one side, the EU continues being the top milk export worldwide with a more marked growth rate than other exporting countries. On the other side, China is the world largest milk importer and its imports are increasing over time more than other importing countries. This pattern is guided by the growing domestic demand in China, driven by population and GDP trends, and it offsets the insufficient domestic production.

To answer the question whether the EU supply will be able to satisfy the rising Chinese demand in the next future, it is necessary to consider some factors.

First, livestock production is responsible for 18% of overall greenhouse gas emissions in CO2 terms, although it varies substantially across the world, of which the FAO (2010) has estimated that the dairy sector contributes with 3.0%-5.1%. An uncontrolled increase in production and, in turn, of exports will lead to further environmental damage. The EU dairy sector, therefore, faces the challenge of becoming more sustainable by doing more control on the environmental impact of the activities of milk production and processing. Second, the lack of a Free Trade Agreement (FTA) with China could advantage EU competitors in milk trade flows, such as Australia and New Zealand, which already benefit from their FTAs signed with China. Conversely, the EU could benefit from the duty war between the US and China, which has already reduced the US dairy exports to China, interrupting a long-lasting increasing trend.

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