

CONTEXTUALIZING DAIRY INFLATION IN PAKISTAN

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Abstract

This study explores the structural challenges contributing to persistent dairy price inflation in Pakistan over the past two decades. Despite being among the world's top milk producers, Pakistan suffers from low milk yields due to a fragmented supply chain dominated by smallholders, poor animal health services, limited access to credit, and weak infrastructure. Rising demand for milk and meat, driven by population growth, income increases, and exports, has worsened supply shortages. Additionally, urbanization and shrinking landholdings are pushing small farmers out of dairy farming. The role of middlemen, who control pricing and often engage in adulteration, further distorts the market. Karachi's unique challenges, such as high herd maintenance costs, also significantly influence national dairy inflation. The study recommends both short-term measures—such as creating awareness against slaughter of useful animals, and strengthening veterinary services—and long-term reforms, including large-scale corporate farming, breed development, and formalizing cooperatives. Further research is needed to evaluate the effects of meat demand and government price controls on milk production.

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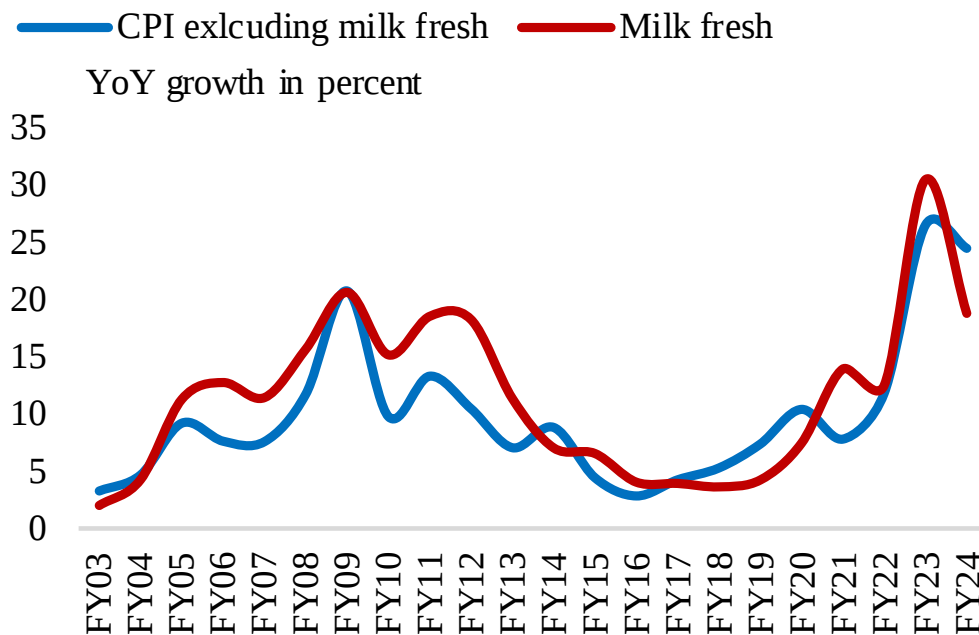
1. Introduction

Dairy products, with a combined weight of 8 percent in NCPI, have remained among the major drivers of food inflation in Pakistan for about two decades. Specifically, the increase in milk prices have remained above the CPI inflation in the past two decades with the exception of few years (**Figure 1 and 2**). In the recent inflationary episode, when multiple domestic and global supply shocks and their second round effects pushed inflation to a historic high in FY23, dairy products maintained their position among top five contributors to inflation. In this background, this note attempts to investigate the factors responsible for persistent uptrend in dairy prices and suggests policy interventions to address the

underlying issues. The analysis shows that a weak supply chain is mainly responsible for price pressures in the dairy sector.¹ Specifically, a high degree of informality, a fragmented supply chain, feed shortages and rising cost of inputs are some key factors behind the lackluster performance of the dairy sector. Furthermore, lack of focus on breed development alongside inefficient breeding practices have also contributed to erosion of animals' genetic traits leading to low milk yields. On the other hand, rising meat demand for domestic consumption and for exports, animal losses due to rampant animal diseases, and illegal slaughtering of animals, have also created supply shortages of livestock.

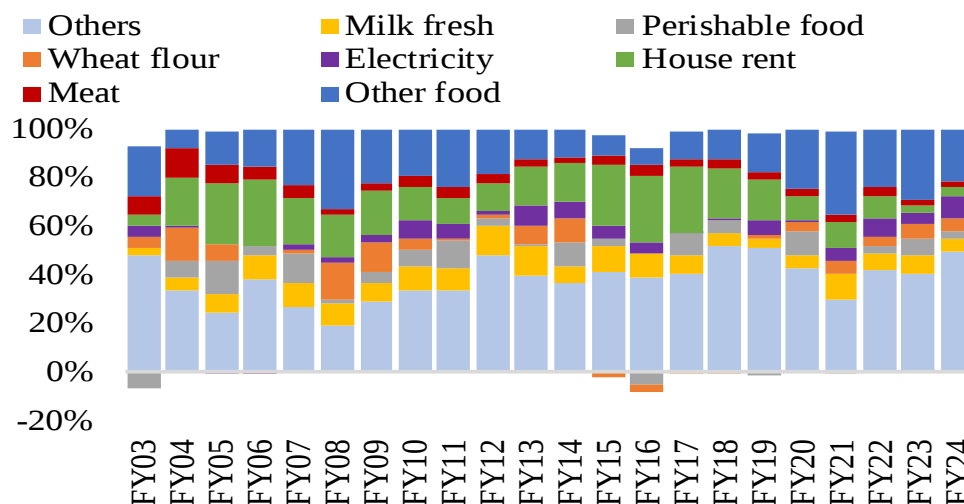
¹The main data used for analysis is sourced from PBS, Foods & Agriculture Organization of the United Nations (FAO) and Ministry of Finance (MoF). The analysis is

corroborated by interviews with major players in the sector (dairy associations, small farmers, retailers and middle men).

Figure 1: Inflation Trends in CPI and Milk Fresh

Note: Inflation indices are based on following base years: FY02-08 on base year of FY00, FY09-16 on FY08, and FY17-24 on FY16.

Source: Pakistan Bureau of Statistics

Figure 2: Milk Fresh is among the Top Five Contributors to CPI Inflation

Note: Inflation indices are based on following base years: FY02-08 on base year of FY00, FY09-16 on FY08, and FY17-24 on FY16.

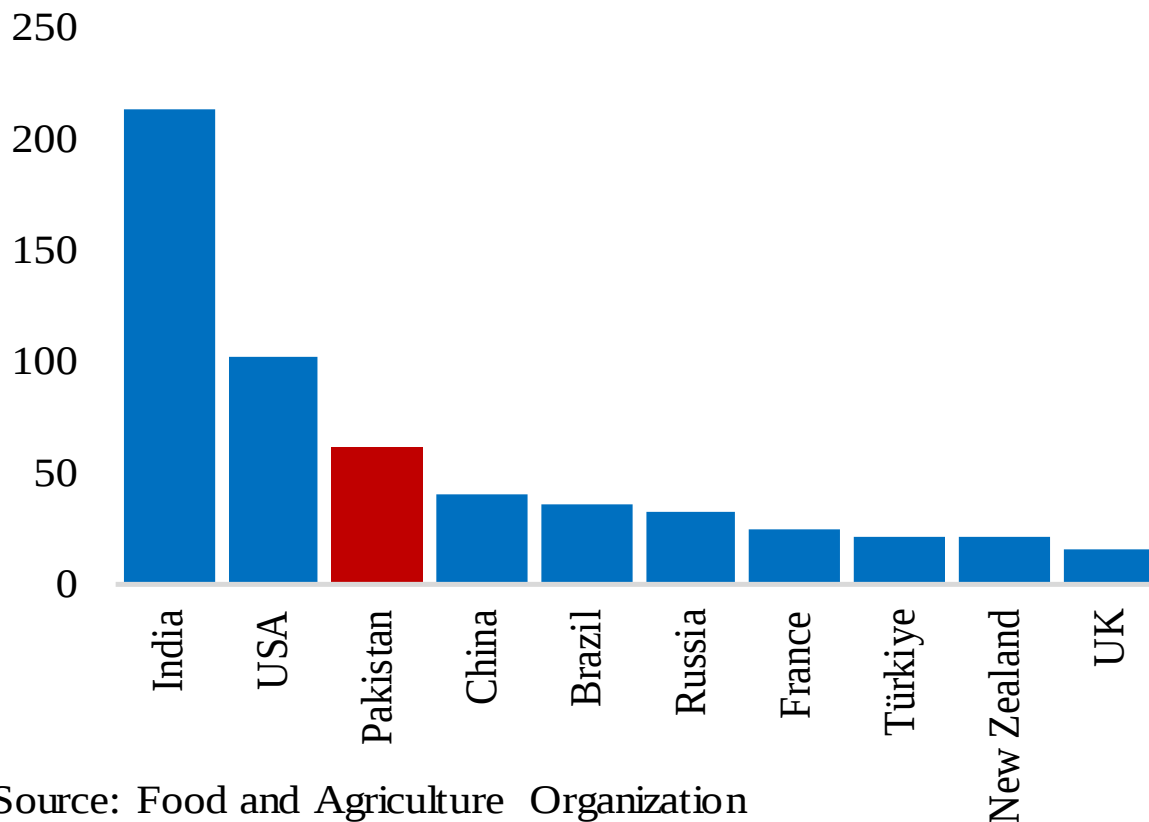
Source: Pakistan Bureau of Statistics

Addressing these issues requires reforms aimed at improving the hackneyed state of the dairy sector of the country. In the absence of urgent policy attention, the country may need to increase reliance on milk imports to meet the rising demand in the medium to long-run. The note is structured as follows. Section 2 discusses key trends in Pakistan's dairy sector in detail. After analyzing trends in milk production and consumption data published by PBS, the section gives international comparison of milk yields. The section also contains discussion on trend of milk prices in the country in the past two decades. The last part of this section gives brief description of milk supply chain and compares share of informal vs formal actors in overall milk supplies.

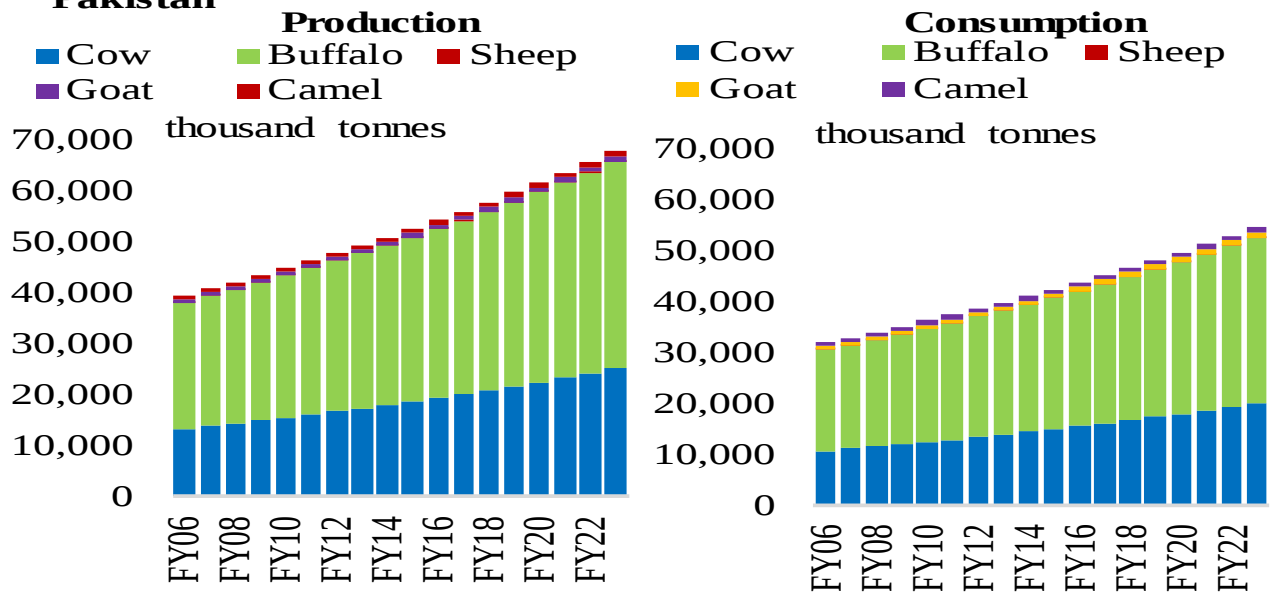
Section 3 sheds light on various supply side issues that have pared the potential of country's dairy sector. Specifically, the predominant role of middlemen, worsening shortages of livestock feed, rising cost of inputs, inadequate focus on breed development and rampant livestock diseases amid sub optimal extension services are some of the key themes discussed in this part.

This section also covers the government policy support measures for the dairy sector. Section 4 briefly discusses the impact of the government administered prices on the dairy sector. The note then moves on to present policy recommendations in Section 5, whereas last section gives conclusion of the study.

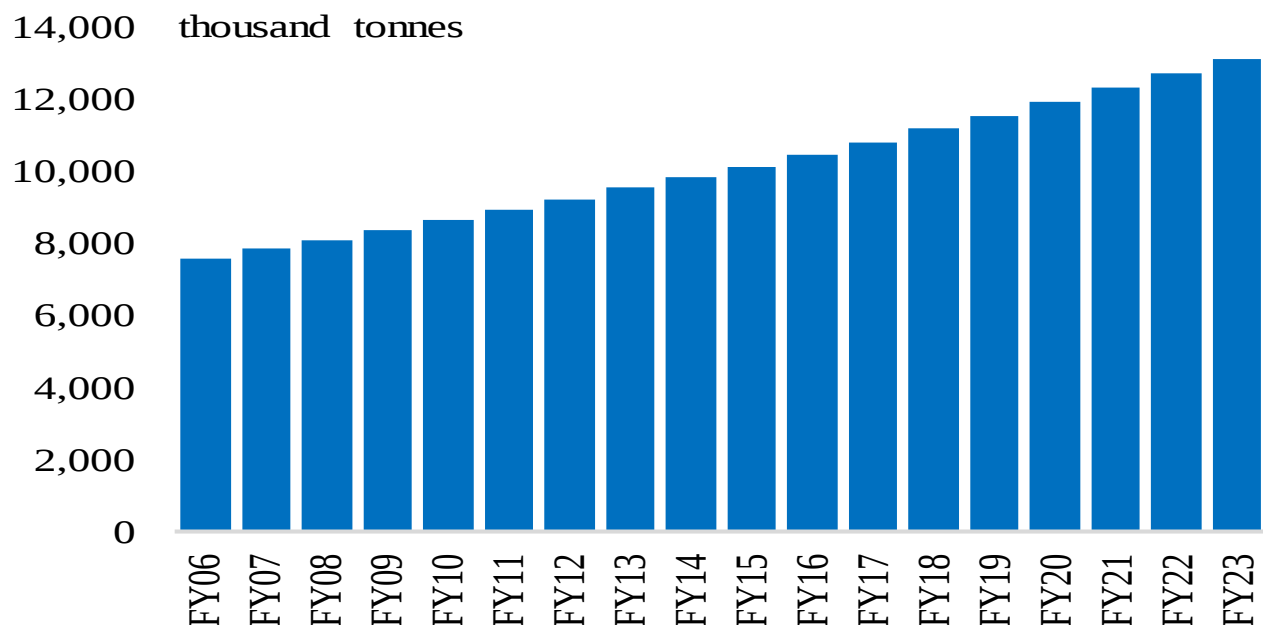
Figure 3: Top Ten Milk Producers in World (2022)
million tonnes



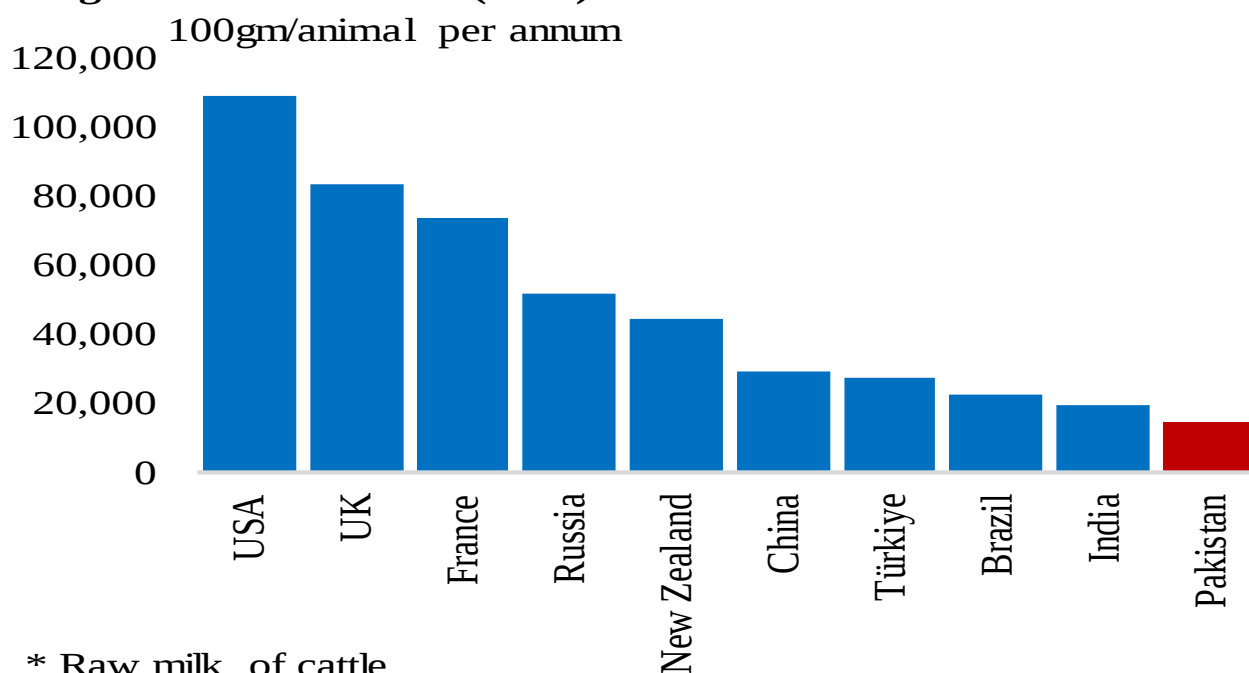
Source: Food and Agriculture Organization

Figure 4: Composition of Supply and Demand of Milk in Pakistan

Source: Economic Survey (2023)

Figure 5: Excess Supply of Milk

Source: Economic Survey (2023)

Figure 6: Milk* Yield (2022)

* Raw milk of cattle

Source: Food and Agriculture Organization

2. Trends in Pakistan's Dairy Sector

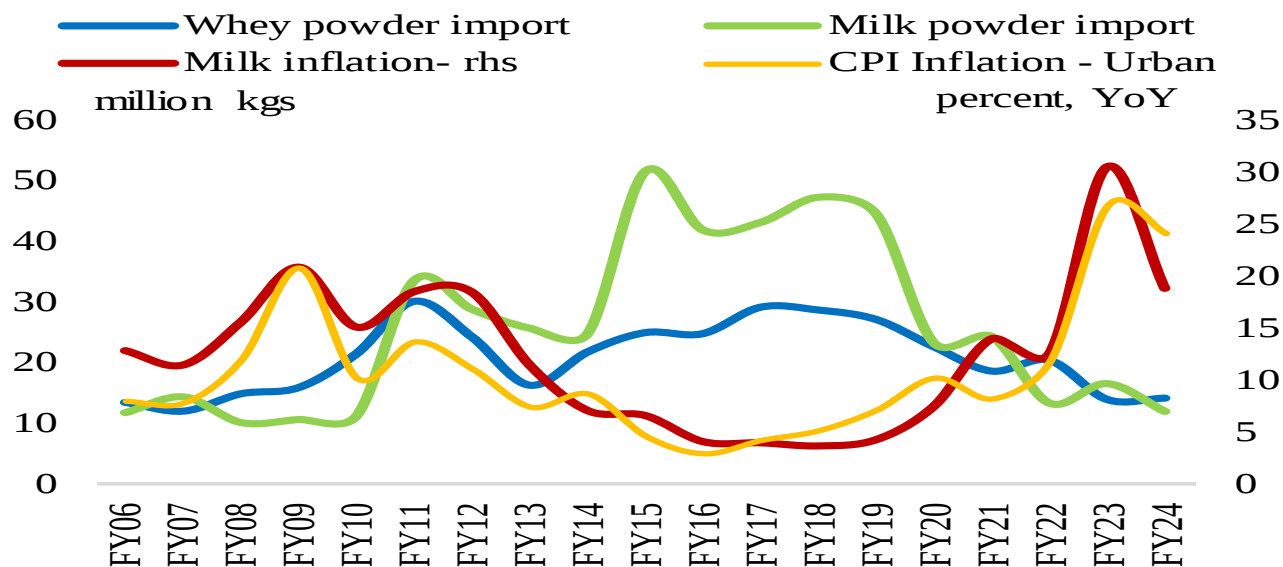
2.1 Production and Consumption of Milk

Pakistan produced an estimated 59.06 million tonnes of milk in 2022, establishing its position among top five milk producers globally (Figure 3 & 4). The production and consumption of milk in Pakistan is estimated by applying constant inter census growth during 1996 and 2006. According to the PBS data, the supply of fresh milk consistently outweighs its consumption since FY06 (Figure 5). With the emergence of a robust middle class, the consumption of dairy products has also witnessed a sustained increase over the years [USDA (2020)]. According to an international comparison, milk consumption in Pakistan is one of the highest. As per market experts, high consumption of tea mainly explains this trend. Notwithstanding its placement among world's largest milk producers, milk yield – milk produced in 100 grams per animal – is one of the lowest in Pakistan as of 2022 estimates (Figure 6). Here it is important to note that as per FAO statistics, while the number of milking buffaloes increased from 2.6 million to 16.3 million in around six decades (1961-2022) in

Pakistan; the milk yield increased by merely 0.7 tonnes, which is alarming as the higher number of animals with low milk yields indicate rising input costs of dairy sector. The case was similar for the milch cows where the milk yield only increased by 0.6 tonnes in the same period. This reveals that increase in number of cattle mainly explains expansion in milk production, whereas milk yields almost remained stagnant.

On average, the cattle produce around 4 kg milk per day in Pakistan. In contrast, cattle in developed economies is crossbred with exotic breeds which are capable of producing high volumes of milk. For instance, cattle in USA and UK produce 30 and 23 kg of milk per day. This implies that roughly seven milch cows in Pakistan produce milk equalizing the yield of one milking animal in the developed world [FAOSTAT (2022)].

One of the important factors behind the low yield is the lower genetic potential of the local breeds in Pakistan. In addition, the confluence of a long-range of supply chain issues as discussed in the following sections, and weak financial position of small dairy farmers also contribute to lower milk yield of dairy animals in Pakistan [Sattar (2022)]. As a result of these issues, a

Figure 7: Import of Powdered Milk and Inflation

Source: Pakistan Bureau of Statistics

notable supply-demand gap has emerged in the market, causing upward pressures on the milk prices.

2.2 Trends in the Prices of Dairy Products

Pakistan's Consumer Price Index (CPI) includes prices of milk and its products i.e., *milk fresh* (unboiled and tetra pack milk), curd, and *milk powder* -infant milk formula such as Lactogen and other milk powder like NIDO. Given the nutrient value and consumption pattern of households, fresh milk has the largest weight in the CPI's food basket. The increase in prices of fresh milk not only remained the major contributor to food inflation in last two decades but also to headline CPI inflation that also contribute to milk poverty in Pakistan (Box 1). Specifically, amid the flood related shortages of feed inputs and the increase in energy and fuel charges, the milk prices surged around four times in FY23 compared to the average levels in the last five years (FY18-FY22).²

A strong and consistent increase in the prices of livestock products indicates issues in the management of milk supply chain. On the other hand, amid rising population and urbanization trends the demand for milk is increasing rapidly in the country. In the absence

of a commensurate increase in supplies on account of various factors as discussed in the following sections, huge supply-demand gap of milk exists in the country, ranging between 3 to 3.6 billion liters of milk [SBP (2015); MDF (2017)], which is an important driver of consistent price pressures of fresh milk.

The key players in dairy supply chain (middlemen and packaged milk industry) meet this gap through import of milk powder and whey powder to reformulate liquid milk. In addition, the middle men also resort to adding various adulterants to milk to increase its volume. Importantly, an increase in milk powder imports helped stabilize milk prices in the country during FY15-19 (Figure 7). A considerable decline in international prices of powdered milk led to a spike in milk imports during this period.

Box 1: State of Milk Poverty: A Global Comparison

The intake of dairy products among children in numerous low- and middle-income countries is notably limited. This low consumption can be attributed to factors such as poverty, elevated dairy costs, inadequate access to clean water, insufficient refrigeration facilities, and substandard nutritional awareness [Headey (2023)]. An international comparison in terms of milk poverty

²Food inflation excluding milk fresh also rose by 4 times in FY23 compared to the average levels in the last five years.

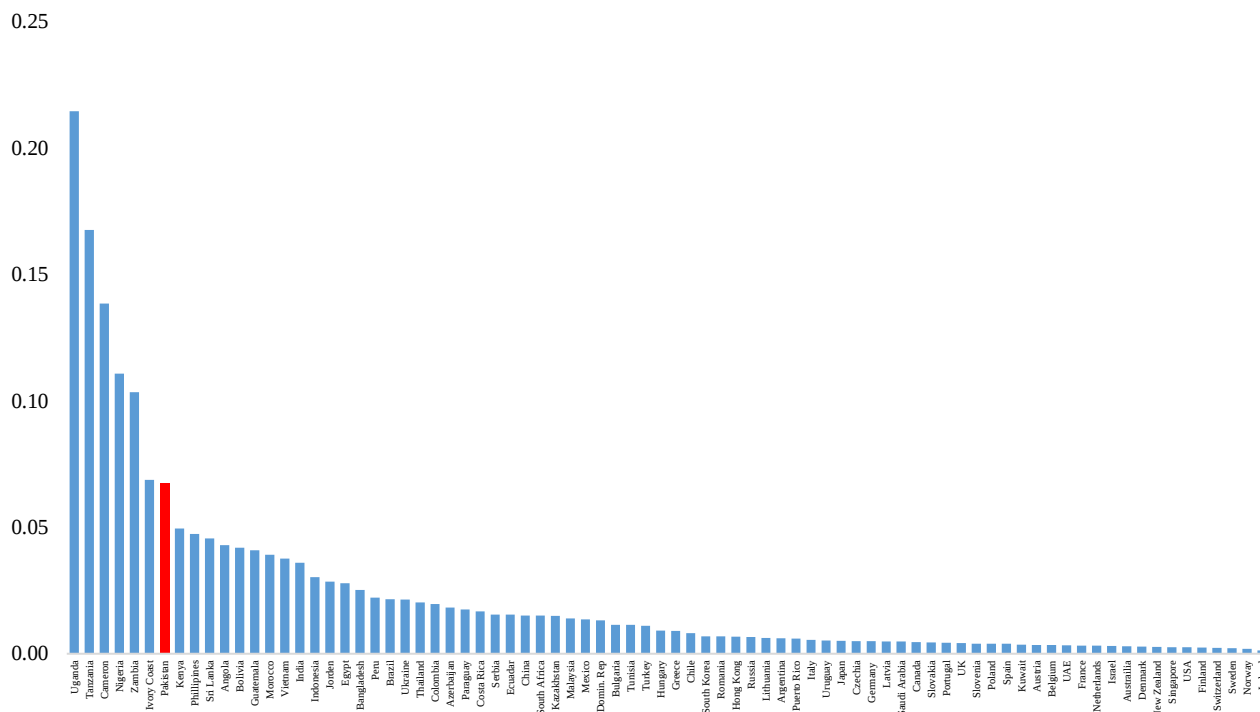
and prices, in this regard, reflects that the milk prices in Pakistan fall among the lowest when measured in terms of US dollar per liter. However, in terms of affordability as measured by the ratio of per liter milk price with per capita GDP, Pakistan ranks among the lowest 10 countries (**Figure 1.1**). This indicates that milk is relatively costlier for the average person in Pakistan compared to other countries with a similar level of economic output per person. This factor also partly explains a high level of milk poverty in the country. Burki and Khan (2019) find that around three-fourth of urban and rural population in the country, mainly in the age group of 10-14 years, falls below the estimated milk poverty line.

Thus, addressing dairy sector issues in the country will be contributing to achieving Sustainable Development Goals (SDGs) 1 and 2, which target poverty alleviation, hunger eradication, attainment of food security, and fostering sustainable agricultural practices.

2.3 Supply Dynamics

The informal sector dominates the dairy sector in Pakistan, with around 97 percent share in the total milk supplies, whereas formal sector captures only around 3 percent share.^{3,4} Although there are around 12,000 commercial dairy farms in the country, about three-fourth of these are small-scale [Tahir (2022)]. Corporate farms, with a herd size of over 50 animals constitute hardly 1 percent of total livestock farms, whereas farms with over 25 animals have around 2 percent share (**Figure 8**) According to FAO (2011), around 64 percent of entire milk production is mostly kept for meeting household requirements in the country (**Figure 9**). In the absence of other sustainable means of income, the small scale farmers also sell a part of this produce to nearby areas to generate some returns. Small-scale subsistence farmers with up to five buffalos have a predominant share in milk supplies.⁵ This group of farmers mainly include landless peasants who engage

Figure 1.1: Milk Price as Ratio of Per Capita GDP* (%)

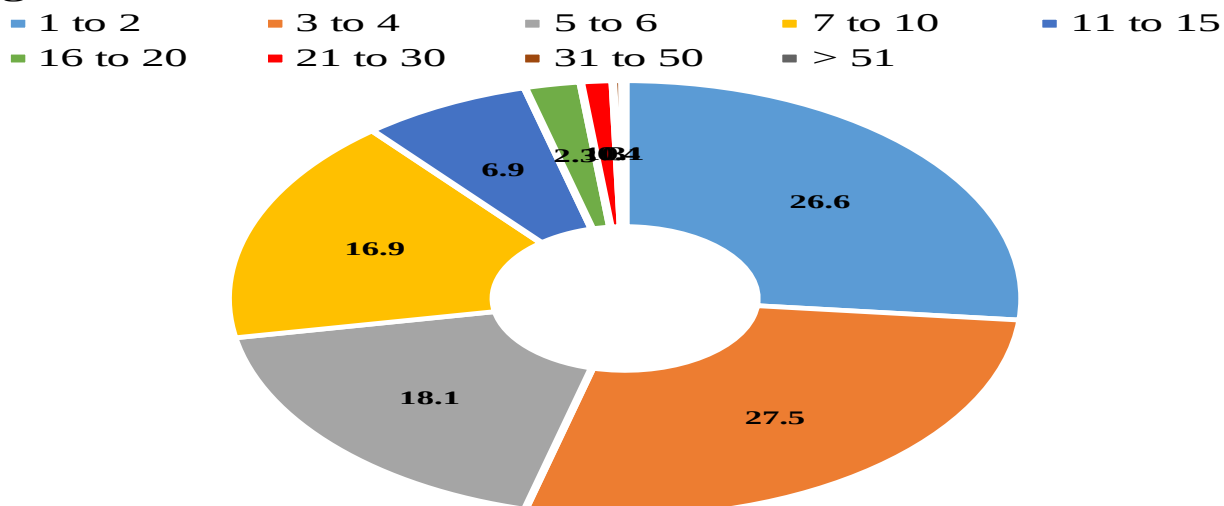


* Recent values of milk prices (2023) and GDP (2022)

³ [FAO (2011)].

⁴ The presence of a robust storage infrastructure mainly explains the difference between the two systems [FAO (2011)].

⁵ [MDF (2022)]

Figure 8: Share of Herd-Farm Households

Source: Agriculture Census-2010

family labor for the maintenance of herd, which provides them some economic benefit by lowering cash expenses on labor.

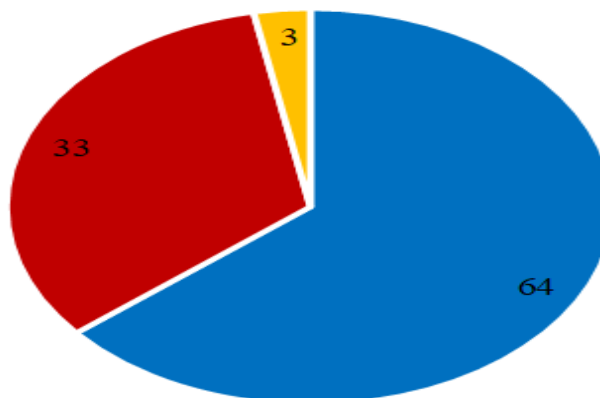
Most of the tradeable milk, which constitutes about 36 percent of the total production, is sold to milkman (wholesalers known as *dhodis* and *gwallas*, contractors, assemblers) for onward distribution to retailers and households and the remaining is processed for pasteurization and UHT treatment and less than one percent is used for other value added packaged milk products. Of the entire milk produced, around fifteen percent is wasted due to inappropriate means of

transportation and lack of proper storage facilities [Pakistan Economic Survey (2021)].

As per discussion with the market sources, the role of various players in the milk supply chain, has undergone a slight shift over the last two decades. These sources report an increase in the share of milk supplied to processing and packaging industry to the range of 5-10 percent, with a gradual reduction in the share of milk kept for self-consumption and distribution to local milk shops and households. Furthermore, overtime the share of small scale subsistence farmers is being replaced with small-scale market oriented system, which have 5-7 animals [ZTBL (2022)]. Given a relatively large number

Figure 9: Supply of Fresh Milk

- Domestic consumption, neighborhood and local markets (through *gwallas*)
- Consumption through *dodhis* (wholesalers, contractors, retailers)
- Processing sector



Source: FAO (2011)

of animals, this system provides excess milk for marketable supplies. In addition, out of the entire milk production, 80 percent comes from rural areas⁶, the rest is contributed by peri-urban and urban set ups. These farms are located in the close vicinity of urban areas, and rely on hired labor and purchased feed, which inflates cost of production. However, the larger farms still generate better returns as they produce greater volume of high quality milk (in terms of fat content), which attracts better prices.

3. Structural Issues in Pakistan's Dairy Sector

This section is based on a survey of relevant literature and interviews with the key stakeholders in the Pakistan's dairy sector.⁷ According to these sources, a range of lingering structural issues have marred the performance of Pakistan's dairy sector over the years, leading to a widening supply-demand gap, which has led to increase in milk prices for past many years. To address the supply chain issues in the dairy sector, the government has introduced various policy interventions over the years (**Box 2**). Specifically, the policy incentives for encouraging corporate farming boosted private investment in dairy sector for some time. Also the 'Save the Calf' scheme announced by the provincial government of Punjab during FY19-23, was helpful in reducing pressures on livestock supplies. Moreover, the government efforts to introduce livestock yields through breed development are expected to bear fruit in the medium to long-term.

According to market sources, low milk yields, inadequate availability and rising prices of fodder and other animal feed, rising cost of production, frequent prevalence of diseases, lack of knowhow about proper husbandry practices, indiscriminate slaughtering of female and young animals, and lack of appropriate financial infrastructure have squeezed milk supply below demand. This, together with a strong position of the middlemen, who exploit financial vulnerability of the small scale producers by offering low farm gate prices, have marred the ability of the subsistence farmers to

invest in improving milk yields of animals. These factors are discussed in detail in the following sections.

Box 2: Government's Role in Dairy Sector Development

The government's efforts to support the dairy sector encompass a wide array of initiatives taken over the years. The initial measures focused on improving breeding centers, hospitals, and dispensaries to curtail the spread of contagious diseases amongst animals, were laid down in the First Five-Year Plan (1955-60). The subsequent plans shifted focus to large-scale manufacturing (1960-65) and crop agriculture (1965-70), sidelining dairy development and causing a setback for the sector [Burki and Khan (2019)].

During the late 1970s and early 1980s, the government supported the dairy sector with tax exemptions, duty-free machinery imports, and financing options. In 2007, the Livestock Development Policy promoted large corporate dairy farms through various tax incentives. High-yield animals, embryos, and semen were imported, and local embryo transfer centers were established. These measures boosted private investment in dairy farming and processing, but high startup costs led to losses, casting doubt on their long-term viability [Burki and Khan (2019)].

Over the past decade, the government rolled out a number of initiatives in dairy sector [Livestock Punjab-Government of Punjab, Livestock & Fisheries Department- Government of Sindh].

Some recent initiatives aimed at achieving improvements in the near future include:

Preventive Measures: Government department is proactively adopting preventive measures, including vaccination against diseases like Hemorrhagic Septicemia, Foot and Mouth Disease, and others across Punjab. It is also developing a vaccination policy, titration schedule, and disease surveillance

(Lahore), Dairy and Cattle Farmers association (Karachi) and Pakistan Agriculture and Dairy Farmers Association (Faisalabad). In addition, views of 30 livestock farmers containing various herd sizes were also sought.

⁶ FAO (2011). Dairy Development in Pakistan

⁷ Interviews were conducted with city and state level dairy associations, milk shops in Rawalpindi, Lahore and Karachi and Livetsock farmers and farm owners. In particular, detailed discussions were held with the management team of Pakistan Dairy Association

plan, along with implementing research-driven initiatives. Additionally, a Foot and Mouth Disease Free Zone is being established in Bahawalpur, while anti-tick and deworming campaigns are being carried out throughout the province.

Special Initiatives of Save the Calf/Calf Fattening Project (2019-2023): The project has strong potential for success by protecting infant calves to boost beef production in Punjab, encouraging livestock farmers to adopt feedlot fattening, and enhancing the skills of technical staff and farmers in managing beef farming systems for sustainable growth.

Breed Improvement: Government has adopted a new approach to breed improvement, focusing on inseminating low-yield, non-descript cattle with exotic semen and identifying animals for the progeny testing program.

Mobile Veterinary Dispensaries (MVDs): This initiative is providing quality services to the farmers at their doorsteps. These MVDs are well equipped with latest machinery and ample quantity of quality medicines. This is likely to improve animal health resulting in increased milk and meat production.

Livestock Tagging and Traceability Initiative: Tagging, Registration of animals, proper transportation and creditable database of animal to trace the animals is expected to tackle the traceability issues, one of the major barriers to exporting meat and dairy products to developing economies.

3.1 Supply Chain Issues

3.1.1 Informality in Supply Chain – Dominant role of the middleman

A high degree of informality and a fragmented supply chain are the major factors behind the lackluster performance of the dairy sector in Pakistan. Given the highly fragmented nature of the market, the small scale subsistence livestock farmers in remote rural areas marked with near absence of linkages with markets, rely on middlemen for collection and

distribution of milk [MDF (2017)]. The urban areas meet around 98 percent of milk demand from informal network of middlemen, whereas packaged milk sector only caters to 2 percent of the urban market share [ZTBL (2022)]. This large market share provides undue influence to the informal sector. Moreover, according to market sources, in large cities few middlemen dominate entire milk supplies and are thus in the position of influencing prices.⁸

Owing to the weak financial position of farmers and lack of access to and awareness about financial services, middlemen often exploit their economic vulnerability and manipulate both farmers and market prices. These agents offer low farm gate prices and binding contracts to small farmers and keep additional returns for themselves when prices are seasonally high [Tariq et al. (2008)]. The middlemen provide cash to small scale subsistence livestock farmers to purchase cattle (sometimes in the form of advance payment for the milk supplied later), and also provide other input and offer contractual prices in lieu of these services.

According to market sources, small market oriented farmers (up to 10 animals), fetch the lowest farm gate prices, compared to medium scale (with up to 30 animals) and commercial farmers (up to 200 animals). The middleman earns relatively greater margin on milk supplied from these small-scale suppliers compared to the medium and commercial counterparts. In view of low milk volume produced by these farmers, they possess low pricing power. On the other hand, medium and large commercial farmers get better farm gate prices on account of competition among middlemen to purchase large milk volumes supplied by these farmers. In addition, due to relatively better fat content of the milk supplied by the larger farmers, the middleman and retailers earn extra profits from the business of de-creaming, which more than compensates for lower margins on purchase of milk. Moreover, the middleman also adds water to increase the volume of milk as a regular practice.

In the face of low returns, the small scale farmers, who mainly dominate the milk supply chain, do not

⁸ The market sources indicated that in some large cities around 80 percent of milk is supplied by 80 people only.

have the financial means to invest in better animal management practices – improved feed, meeting seasonal feed shortages through better alternates such as silage, diseases control, construction of animal sheds, and investment in effective breeding practices – which adversely affects the overall milk yields. Likewise, a large distance from the agriculture markets to meet various input requirements is another disincentive to invest in improving milk yields. According to Mouza Census (2020), the markets for agriculture inputs are on average at a distance of 22-23 km in rural areas of Pakistan.

Although, the small scale farmers have the benefit of employing family labor, inadequate and costly availability of animal feed and low milk yields render dairy farming an unprofitable venture for them [Garcia et al. (2003)]. In addition, low bargaining power because of low volume and quality (in terms of lower fat content) of milk produced further dent profitability. Mahmood (2008) stated that the dominance of middlemen is the major cause of low milk prices for farmers, high milk prices for end consumers and inefficiencies in milk marketing.

3.1.2 Inadequate collection and distribution infrastructure

While the footprint of formal sector has increased over the years, the supply chain is mostly dominated by middlemen. Despite earning high profits, these middlemen have not introduced the desired upgradation in supply chain. A large share of the milk which is sold to households is not chilled [Tariq (2022)]. In the absence of cold supply chain, the milk collected by middlemen gets stale and unfit for consumption. On the other hand, in view of supply shortages, they resort to add various adulterants to milk including water, various thickening agents, and vegetable oil, to meet demand. According to market sources, the wholesalers mix around 2-3 liters of water per 40 liters of milk as a routine. Although the packaged milk industry has invested in establishing a robust supply chain, with collection centers at the peri-urban and rural commercial farms, these do not

have a large share in overall milk production system of the country [MDF (2017); Tahir et al. (2019)].

3.1.3 Seasonal variations amplify supply shortages

While the country is facing a widening supply-demand gap of milk, its intensity aggravates in summers and during seasonal fodder shortages. During summers, heat stress and lower feed intake by animals to reduce body temperatures, reduces milk yields. Furthermore, amid inadequate financial resources to invest in alternate fodder arrangements such as silage and other concentrates, lower feed availability during seasonal shortages also adversely impacts milk yields. Industry participants meet this gap mostly by mixing various adulterants to the milk. These practices also include import of milk and whey powder to reformulate liquid milk to meet demand.

3.1.4 Changing rural dynamics pose another peril to milk supplies

A non-conducive business environment especially for the small farmers along with a subtle change in rural dynamics, has significantly diminished the importance of milch animal rearing as an attractive profession over the years. According to the market sources, the rural areas are witnessing rising urbanization trends and a rapid construction activity in small towns and villages.⁹ The confluence of these factors have dented overall supplies of fresh milk. As quoted by the industry, a significant decline in number of milk collection centers of a large packaged milk company to 1,800 from 3,600 previously, lends credence to this development.

3.2 Supply-side Constraints

3.2.1 Poor extension services

Extension services in agriculture improve productivity of the sector by imparting knowledge about most efficient practices. In addition, rapidly emerging challenge of climate change also weighs heavily on dairy sector because of the attendant issues of shortages of water and animal feed. With continued R&D, the knowledge about effective farm techniques and optimal inputs is consistently

⁹ Pakistan has the highest rate of urbanization in South Asia. The UN Population Division estimates that, by

2025, nearly half the country's population will be living in cities [UNDP (2018)].

evolving. In addition, training also helps in improving farmers' resilience in the face of various

Table 1: Veterinary Facilities in Rural Areas (%)

	Mobile	Dispensary	Private
2008	20	12	18
2020	32	10	15

Source: Pakistan Bureau of Statistics, Mouza Census 2020

challenges such as climate change, diseases, and feed availability [Baiyegunhi et al. (2019)].

However, the relevant literature and discussion with stakeholders suggest that extension services in Pakistan have not been able to play an effective role in enhancing productivity of the dairy sector [FAO (2011), (2015), MDF (2017)]. A host of factors such as lack of effective planning, political interventions, misuse of funds, coordination and communication gaps and absence of reward mechanism contributed to ineffective performance of extension services department in the country [Ashraf et al. (2019)].

In the absence of effective outreach from the government agencies, the farmers mostly rely on informal sources such as knowledge transferred through middlemen, input suppliers and experiences of cohorts. Lacking specialized knowledge of the subject, these sources are not able to plug the required information gap.

3.2.2 Substandard breeding practices

Genetic characteristics are an important determinant of milk yields. In the case of the US, better genetic properties based on artificial insemination (AI) explain around 56 percent of the gains in milk yield of animals during the latter half of the last century [PAS (2020)]. Pakistan is home to some world famous cattle breeds such as Sahiwal, Red Sindhi, Cholistani, Ankara and Kundi buffalo. Especially, the Sahiwal breed was exported to a number of countries including the US, Australia, India and Africa and has become an international breed due to its important genetic attributes [Madalena et al. (2019)]. The well-known milking breed, Australian Friesian Sahiwal (AFS) was developed in a research program initiated in Australia in 1961 [Madalena (2002)]. However, in the case of Pakistan, Sahiwal breed has not undergone any genetic improvement [Javed et al. (2001), Rehman et al. (2013)]. According

to a census on artificial insemination in Pakistan (2008), only 20 percent of the farmers use AI

technology. Results indicate that farmers dislike this technique (around 46 percent of the farmers) followed by a large distance from the AI centers is the major cause of low usage of AI practices in Pakistan.

As per discussion with the stakeholders, practice of unmonitored cross breeding is one of the major causes of low milk yields. With around 80 percent of cattle rearing being carried out in the rural areas, which is marked with ineffective role of extension services and a large illiterate and informal labor force, the importance of animal traceability in Pakistan's dairy sector is highly underestimated. The farmers are not aware of the importance of maintaining record of cattle identification (breed) and other lifecycle events [(Marshall (2014), Azeem (2016)]. This causes incorrect assessment of animal traits, leading to ineffective cross breeding practices, which is an important contributing factor to disappearance of good genetic traits and high yielding breeds such as Sahiwal [Shahzad (2022)]. The issue is rather critical for Pakistan, where dairy sector is largely comprised of small-scale farmers who lack awareness of AI technology.

3.2.3 Compromised cattle health – high prevalence of diseases

Losses due to cattle diseases are yet another significant challenge in the dairy sector of Pakistan [Dalton et al. (2021)]. Focus on ensuring healthcare and well-being of dairy animals is highly deficient in the country, primarily due to a lack of adequate access to veterinary services. Moreover, substandard nutrition and housing conditions contribute to the overall poor health and well-being of dairy animals [Gaworski and Boćkowski (2022); Tariq (2020)], in addition to the prevalent practices of animal cruelty and abuse in Pakistan [Hussain et al. (2020)]. In addition, farmers are generally unaware about

modes of transfer of diseases, prevention and control measures. The newly emerging livestock health challenges such as viral outbreaks and the impact of climate change on animal health further amplify this issue. The primary infectious diseases impacting dairy animals in Pakistan include foot-and-mouth disease (FMD), locally known as 'Moonh Khur', Hemorrhagic Septicemia (HS), Bovine Viral Diarrhea (B.V.D), mastitis and Black Quarter [USDA (2014)]. These diseases increase animal mortality rates and a decline in both milk and meat yields. It is estimated that the spread of infectious diseases in bovine animals results in a reduction of milk and meat production by approximately 20-25 percent [Tetra Pak (2014)].

According to discussion with the stakeholders, inadequate animal disease control measures have led to a noticeable decline in the population of milking animals over the years. One such viral ailment, lumpy skin disease is transmitted through blood-feeding insects such as specific flies, mosquitoes, or ticks. This disease resulted in significant mortality among milking animals in Pakistan, especially in Punjab, in 2022. The spread of

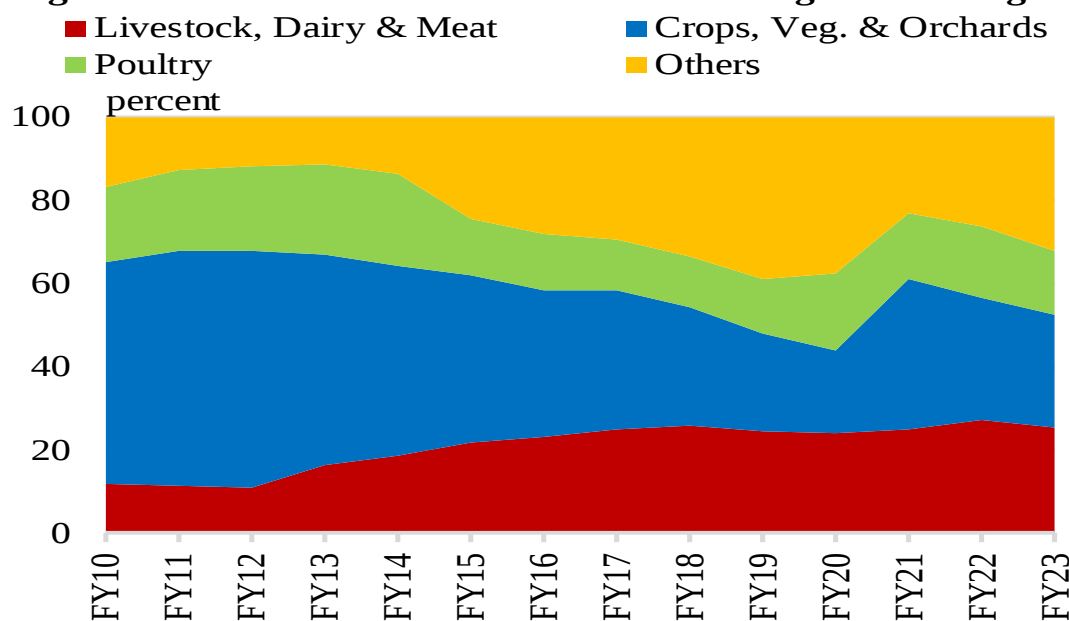
the disease remained unmanageable due to the unavailability of required vaccines in Pakistan.¹⁰

According to the Mouza Census (2020), published by the PBS, the dynamics of veterinary facilities in rural areas have undergone some shift over the last decade. Especially the availability of mobile veterinary services has improved from 20 percent of all Mouzas in the country to 32 percent in 2020. However, the presence of dispensaries and private facilities has slightly declined over this period (Table 1).

3.2.4 Lack of adequate financial access

Small herd holders-comprising less than 10 animals, that contribute around 80 percent of the total production are generally landless and hence are considered un-bankable due to insufficient requirements. This relies on informal resources such as big *beoparis* and middlemen who act as financiers to the dairy value chain [MDF (2017)]. According to the SBP (2015), around 16 percent of the farmers who own larger herd (7-50) can utilize banking credit on account of availability of land as an adequate collateral.

Figure 10: Share of Disbursements in Total Agri. Financing



Source: State Bank of Pakistan

¹⁰ Vaccines were to be imported from France, which involved high costs.

Data on agriculture disbursements reveals that the share of Livestock, Dairy and Meat in total agriculture financing has remained stagnant over the years especially after FY18 (**Figure 10**). In this regard, a detailed report was published by Agriculture Credit and Microfinance Department of SBP in 2015 aiming to facilitate banks in developing relevant Value Chain Financing (VCF) products in dairy sector. Moreover, the Agricultural Credit Advisory Committee (ACAC) of Finance Division, also brought focus of the industry towards promoting Dairy VCF and banks were advised to develop their own Dairy VCF products on similar lines back in FY19.¹¹

While the big and influential dairy farmers enjoyed credit facility, small dairy farmers are unable to access bank financing due to lengthy and complex credit mechanisms [Sattar (2021)]. In terms of loan suppliers, ZTBL is considered the major source particularly in rural areas as it accounts for around 58 percent of the utilized credit [Mouza Census (2020)]. In addition, reluctance of market participants to avail riba-based financial services is also an important constraint [MDF (2022)]. Limited financial services (credit, insurance etc.) deprives the entire dairy supply-chain of required modernization and support in exigencies.

3.3 Rising Cost of Dairy Sector

3.3.1 Feed dominates the input cost

In Pakistan, the sources of feed for dairy animals include green fodder, silage¹², concentrates¹³, along with various alternate options. Animal feed dominates the overall input cost in dairy farming. According to some estimates, feed cost (wheat straw, green grass, and compound feed) constitutes around 50 percent share for buffalo in total cost [CCP (2021)].

The un-availability of quality feed at reasonable prices particularly the specialized feed for enhancing milk yield (wanda, khal etc.) is among the key bottlenecks in the

dairy sector [USDA (2017)]. In overall terms, fodder availability falls below demand by around 70 percent in the country [MDF (2022)]. Specifically, urban and peri-urban dairy farms in Karachi face acute feed shortages due to unavailability of local feed resources (**Box 3**).

Box 3: High Operational Cost of Dairy Farming in Karachi

The intricate dynamics of the dairy sector in Karachi further compound the challenges, contributing to the increase in prices of dairy products (Annexure). Karachi stands out due to unavailability of local feed resources. A significant population of livestock farmers is landless who own smaller plots of land and primarily depend on purchased feed from the market. The livestock feed that mainly consists of concentrates and wheat straw is either imported internationally or purchased from other provinces i.e., mainly Punjab. A small amount of green fodder and wheat straw is also purchased from the market in Hyderabad and nearby districts. The unavailability of local livestock feed supplies amplifies the operational cost of dairy farming in Karachi.

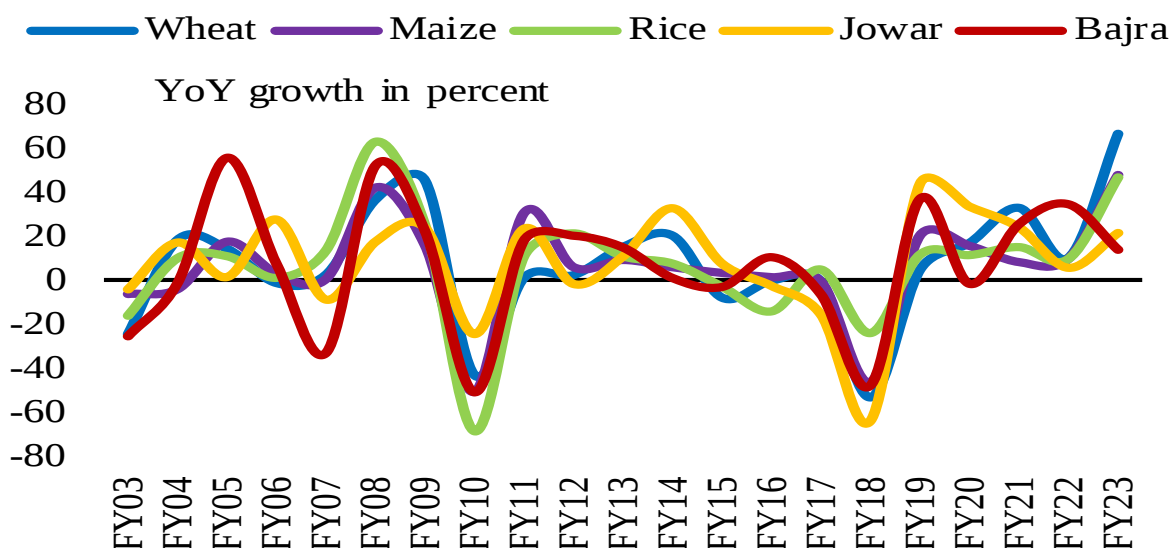
Other input costs, such as utility expenses, are notably higher in Karachi's dairy markets. Specifically, the largest cattle market in Karachi in Landhi (Bhains Colony), supplying around 80 percent of the milk, is subject to commercial electricity rates. According to the Planning Commission of Pakistan (2020), the combined cost of water, electricity and security amounts to approximately Rs 400 per animal per month in Karachi as compared to Rs 250 per animal per month in Hyderabad. Importantly, it has been corroborated in the report that Karachi incurred the highest costs among all five clusters as self-cultivated fodder, family labor and grazing practices make other clusters low-cost cattle zones.

Market sources highlight another important issue is scarcity of water in Karachi. Though city government provides water supply to some cattle colonies,

¹¹ The Agricultural Credit Advisory Committee (ACAC), setup by government's Finance Division, serves as a national-level consultative body responsible for establishing annual targets for agricultural loans and overseeing their implementation.

¹² Hay and silage refers to the preservation of green fodder by the process of fermentation and acidification for its use in time of fodder shortage.

¹³ A concentrate is the concoction of various elements including wheat bran, maize bran, rice polish, cotton seed cake, mustard seed cake, and maize oil cake, corn, soybean meal, oats, wheat, molasses, and so forth. These mixtures are high in energy and protein, low in fibre, and easily digestible. "Khal" and "Wanda" are the popular local forms of concentrates in Pakistan while *Khal* is the simplest form of energy concentrate containing mustard oil cakes.

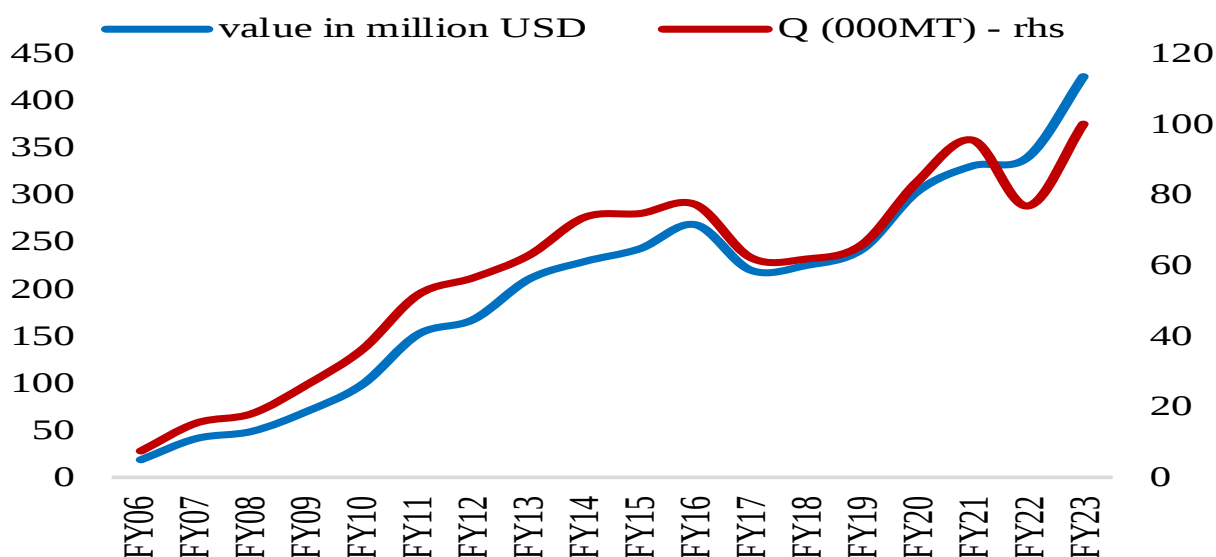
Figure 11: Wholesale Price Indices of Fodder Crops

Note: Inflation indices are based on following base years: FY02-08 on base year of FY00, FY09-16 on FY08, and FY17-23 on FY16.

Source: Pakistan Bureau of Statistics

insufficient and irregular supply compel farmers to purchase water from tankers for feeding the animals as underground water is mostly unusable in Karachi and surrounding areas. These issues further magnify the overall maintenance cost of cattle.

In addition to the substantial utility charges, labor wages further escalate the total cost for the business as per discussion with the relevant stakeholders. While in Punjab, where small scale farmers constitute a large share of milk supply chain and the farm businesses is

Figure 3.1: Pakistan Meat Export Trends

Source: Pakistan Bureau of Statistics

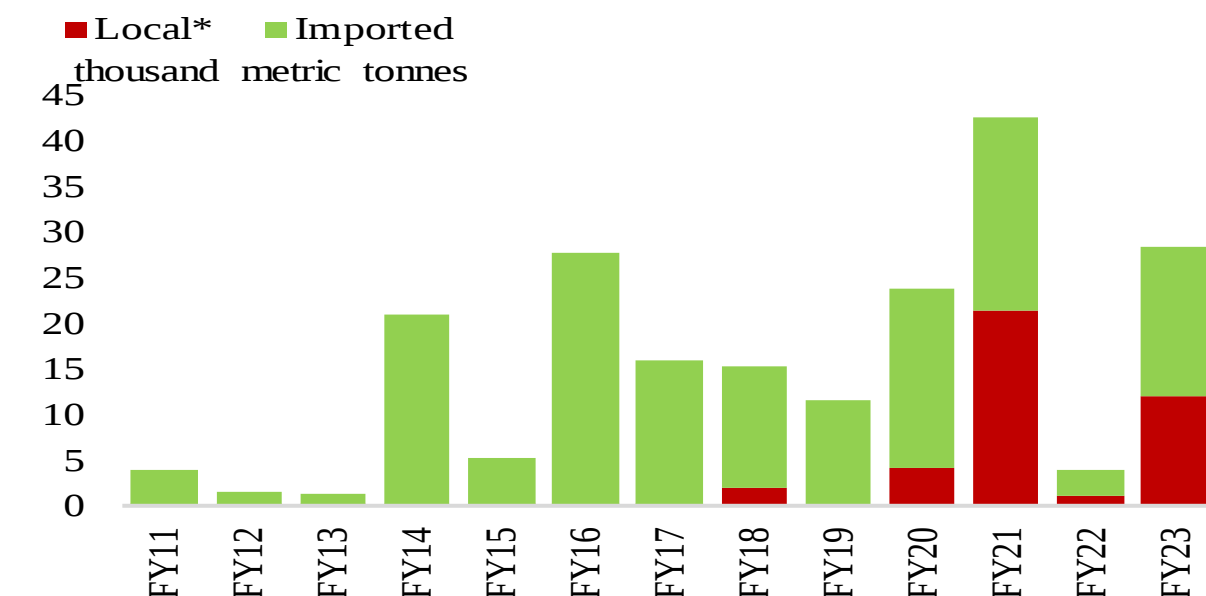
run by employing family labor, in Karachi and its surrounding areas labor is outsourced given the labor-intensive nature of the dairy sector. Furthermore, according to the market participants, meat demand is increasing sharply in the city amid rising export volumes (Figure 3.1), smuggling of animals to neighboring countries, growing population and proliferation of eateries. In the absence of a commensurate increase in supplies, Karachi is experiencing a very high slaughter rate of animals to meet the expansion in demand. Thus, as opposed to the recycling practice in Punjab, where female animals are sold for slaughtering after at least six lactation cycles (one lactation cycle is 270 days), in Karachi approximately 1.5 million female animals are culled after their first lactation period. Furthermore, amid a very high meat demand day-old calves are also subject to slaughter, with no prevalent practice of calf rearing in the city. In overall terms, between 0.7 to 0.8 million cattle are slaughtered annually, with only a few communities abstaining from this practice. The absence of recycling practice in Karachi – keeping animal alive up to at least five or six lactation period, is often attributed to costly maintenance of animal during its dry period (normally four to five months) on account of the unavailability of low-cost feed in Karachi. Hence frequent slaughtering further raises input costs because

of a high cost of replacement of animals as they must acquire new milch animals through a complex process. The scarcity of quality animal feed compromises animal health and yield that has serious implications for milk production and hence milk prices. Animals are generally underfed and undernourished on account of significant supply demand gap of fodder in the country [GOP (2010)]. Around 58.8 percent of the feed supply in Pakistan comprises residuals of crops, the share of fodder is 23.8 percent while grazing constitutes around 9.2 percent. The remaining 8.2 percent of the feed come from grains and the byproducts [Habib et al. (2016)]. The inadequate availability of fodder has resulted in significantly higher prices over the last decade (Figure 11). The soaring prices of animal feed either in the form of fodder or concentrates limits the ability of livestock farmers to provide quality feed to animals, which not only hampers milk yields, but also inflates milk prices [Hemme et al. (2014)]. A range of factors are responsible for the consistent increase in feed prices as discussed in the following.

3.2 Demand-supply gap of green fodder

The country's important fodder crops include sorghum, maize, alfalfa (lucerne), and oats that cover roughly 16 to 19 percent of the total cropped area. Against an

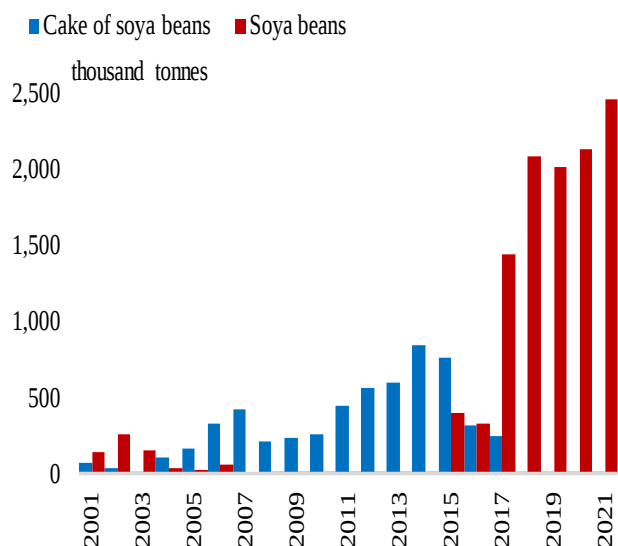
Figure 12: Sources of Seed Availability of Fodder in Pakistan



*includes public and private sources.

Source: Pakistan Economic Survey, various issues

Figure 13a: Import Quantum of Feed Inputs

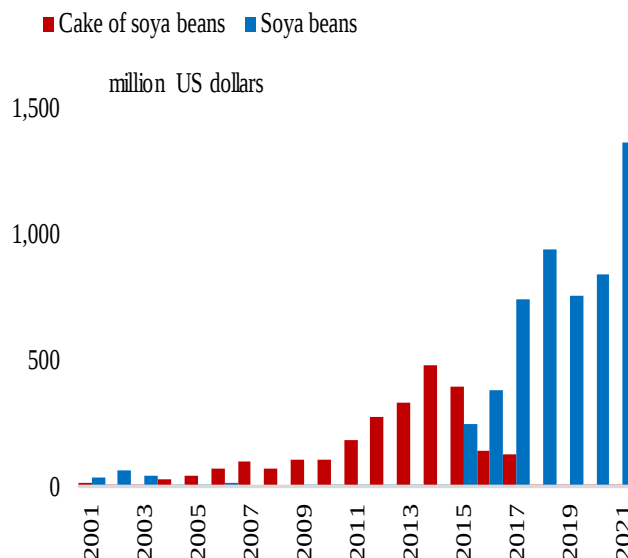


Source: Food and Agriculture Organization

estimated annual demand of 40 million tonnes, only around 0.2 million tonnes fodder is locally produced [FAO (2011)].

The sowing area of the fodder crops has been stagnant around 2 million hectares for the last six years with a constant seed requirement of around 61 thousand metric tonnes.¹⁴ On average, only one-third of this requirement was domestically available by both local (both public and private) and imported sources where the latter captured a significant share (Figure 12). Domestic unavailability of high yielding seeds is an important factor behind low production of fodder in the country. The growers mostly rely on imported seeds, however, higher cost as well as limited knowledge about crop management for these imported varieties discourage cultivation of fodder crops on large areas [MNS-UAM (2018)]. The green fodder is available for around four months during a year including mid-February to mid-April, and July-August. The small dairy farmers, mainly relying on green fodder, struggle with seasonal shortages which compromises the nourishment and performance of milking animals. On the other hand, higher cost of silage and concentrates drives these

Figure 13b: Import Value of Feed Inputs



alternates out of the reach of farmers that reduces the profitability of the dairy sector.¹⁵

3.3.3 Trade dynamics of animal feed adversely affects dairy sector

According to the major stakeholders, the dairy sector faces the double whammy of simultaneous import and export of feed inputs. Around 20 to 25 percent of the inputs of the dairy sector are imported. The imported inputs, particularly feed (soybean), frequently witness price pressures due to a weakening PKR and movements in global commodity prices. On the other hand, export of a significant portion of locally produced feed items such as wheat bran, wheat straw, and maize creates domestic shortages, which further exacerbates price increases.

¹⁴ Source: Various issues of Pakistan Economic Survey

¹⁵ Although the silage development has made its way in Pakistan, the effect remained minimal in terms of facilitating the small and landless farmers [MDF (2022)]

In order to meet the rising demand, the country imports a significant amount of concentrates such as corn gluten, soybean, and rice bran. Furthermore, a number of other crops that are used in the preparation of concentrates such as cotton seed and pulses are also imported. Imports of the feed components increased both in terms of quantity and value; in particular, the imports of soybean rose significantly over the past few years (Figure 13).¹⁶ Furthermore, import of soybean is subject to import taxes that props up the cost of inputs. Since the small farmers are unable to afford imported feed, their herds mostly rely on grazing and other concentrates and residuals of crops that have relatively lower nutrition value, which adversely affects overall milk yield in the dairy sector.

The rising exports of the indigenous animal feed such as bran of maize, wheat, and sorghum caused shortages of these commodities in the local market, leading to price increases. Furthermore, the export of home grown fodder and feed have also risen, giving rise to price pressures in the dairy inputs (Figure 14).

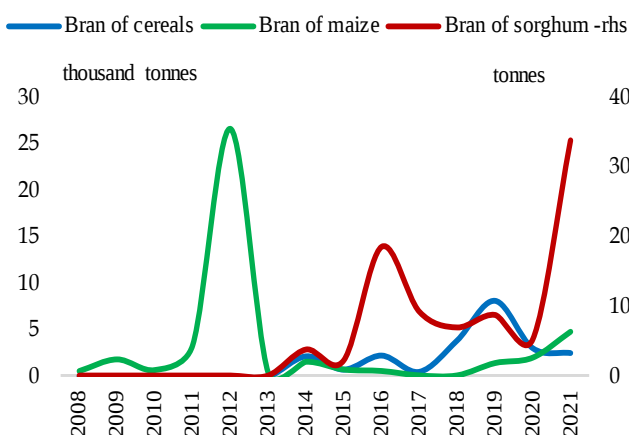
3.3.4 Indirect expenses magnify the input costs

Indirect cost is the additional burden pertaining to distribution, electricity charges and labor costs [Herath (2016)]. There are two major types of indirect costs that

are incurred by the milk producers. One is the *animal cost* which refers to the purchase of new milking animal and the other is the *utility cost* that contains electricity, gas, and water bills, and other dairy farm maintenance costs. The rising indirect costs over the years have further amplified the growth in the milk prices as discussed below.

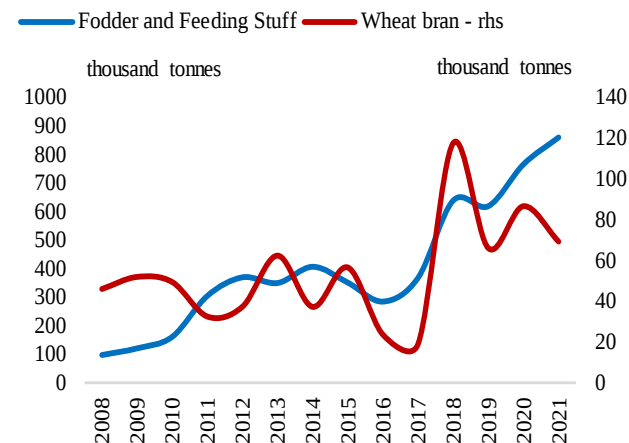
Although various provincial acts prohibit the slaughtering of useful animals, rampant slaughtering of animals raises the substitution cost of milch animals for dairy industry.¹⁷ According to the relevant stakeholders of the milk industry, the milch animals are often slaughtered to meet the meat demand of the cities [Jafri et al. (2022)] as well as to avoid the maintenance cost of animals in their dry period. Rising meat demand is one of the significant reasons behind the recurrent purchase of the milch animal on relatively higher prices. This regular slaughtering increases the depreciation cost of farmers due to the rising prices of new animals. Anecdotal evidence suggests that the price of the new animal is three times the old price.¹⁸ Similarly, the medium and large size farms, which import high yielding

Figure 14a: Export Quantums of Feed Inputs



Note: The values are not available before 2008
Source: Food and Agriculture Organization

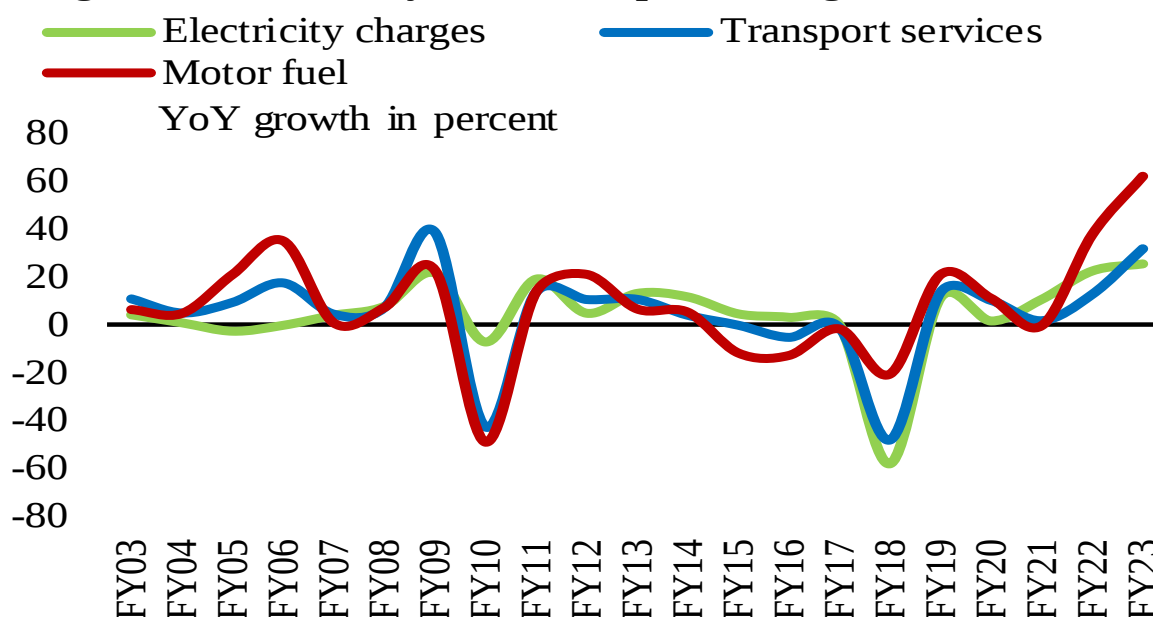
Figure 14b: Export Quantums of Wheat Bran and Feeding Stuff



¹⁶ Poultry feed constitutes about 65 percent of corn consumption, while wet milling and dairy feed account for about 15 and 10 percent, respectively. Source: USDA (2024). Report on Grain and Feed Annual, published in April 2024

¹⁷ [The Punjab Animals Slaughter Control Act, 1963 \(punjablaws.gov.pk\)](#); The Sindh Animals Slaughter Control (Amendment) Act, 2004 ([PUB-17-000008-S.pdf \(sindhlaws.gov.pk\)](#))

¹⁸ [This is particularly true for Karachi.](#)

Figure 15: Electricity and Transport Charges

Note: Inflation indices are based on following base years: FY02-08 on base year of FY00, FY09-16 on FY08, and FY17-23 on FY16.

Source: Pakistan Bureau of Statistics

breeds from Australia and US have to incur additional cost because of weakening PKR.¹⁹

Furthermore, the rising cost of utilities also play a significant role in fanning increase in milk prices. Importantly, the electricity tariffs and fuel prices have almost tripled during the past few years (Figure 15). Also the higher fuel cost for transportation of animal feed as well as milk further raises the retail milk prices. In addition, elevated cost of medicine and labor wages are also responsible for the uptrend in milk prices.

4. Role of Administered Prices

Milk pricing is regulated by local governments across various districts in accordance with the Price Control Prevention of Profiteering and Hoarding Act of 1977.²⁰ While price caps are enforced uniformly across districts within a province, the impact is greater on milk

producers in Karachi and Hyderabad, due to high production costs discussed earlier. According to market sources, to comply with the price notifications issued by district commissioners, lower quality milk is being sold in the market as prices set by the government authorities are even below the breakeven points of the farmers.²¹ Conversely, consumers are facing higher prices under the guise of quality,²² in contrast to the administered prices. Market sources indicate ongoing conflicts between milk producers and price setting authorities, as there is a significant disparity between actual prices and the administered prices. This has led to legal disputes for market players who fail to adhere to the announced prices.

Specifically, numerous affiliations, formed by multiple private sector stakeholders, are identified in the dairy

¹⁹ The import prices of pure breed cows surged by 62.2 percent and 47.3 percent in FY23 as compared to FY19 and FY22, respectively. Source: Pakistan Bureau of Statistics

²⁰ The Act extends to the whole Pakistan.

²¹ Practices of milk adulteration, and mixing milk of different animals compromises milk quality.

²² Practices of milk pasteurization, proper packaging, chemical free and nutrient rich content defines milk quality.

sector in Karachi.²³ The presence of these associations can significantly influence prices through cartelization and non-competitive behavior. According to the PCP (2020), among the five clusters examined, only Cluster 4 (Peri-urban Sindh) has Traders' associations. A detailed inquiry by the CCP (2021) about price fixation behavior of these associations, revealed evidence of price manipulation in Karachi from July 2019 to July 2020, violating the fair price competition clause.

5. Policy Recommendations

The analysis of the key trends in the dairy sector, discussion with market participants and the review of literature underscores the need to address structural issues in the dairy sector, which are behind pressures on milk prices through widening of supply-demand gap. The required reforms should aim at enhancing milk yields through facilitating corporate farming, breed development, policy interventions in the animals' feed sector, and strengthening extension services departments, which will help stabilize milk prices in the medium to long term. In addition, there is also a need to direct policy efforts towards improvement in milk supply chain through investment in infrastructure, formalizing the role of the middle man, and better access to finance. In this regard, the practice of fixation of milk prices by the government may be reviewed from the perspective of encouraging private sector investment in the milk supply chain through effective price signals. Furthermore, in the short term, creating awareness against slaughter of useful animal may also alleviate pressures on livestock supply.

The success of these policy efforts hinges on availability of accurate information about key trends in the dairy sector by conducting a fresh livestock census. Recently, the results of a fresh livestock census are published after a gap of around eighteen years. In view of rapidly changing supply and demand dynamics in the sector, there is a need to ensure that in future the survey of livestock population is held without delays within stipulated timelines.

Reviewing government intervention in fixation of milk prices.

Currently fresh milk is included in the list of essential commodities, for which the government announces administered prices under the "Price Control and Prevention of Profiteering and Hoarding Act of 1977". The packaged UHT treated milk sector is not subject to these fixed prices. In the absence of controls on input prices, the attempt to regulate milk prices not only creates frictions between the district governments and milk suppliers, but may also hurt profitability of the sector, leading to provision of low quality milk to consumers.

There is a need to conduct an in-depth analysis to evaluate the impact of government fixation of milk prices on milk production in the country. The current study has assessed the impact of government measures through market research. However, in view of wide ranging impact of milk prices for inflation, welfare and dairy supply chain, this area offers scope of further research.

Creating awareness against slaughtering of useful animals.

Shortage of milch animals is one of the important factors behind the higher price of milk in the past couple of years. The government has introduced various initiatives to discourage illegal slaughtering of livestock. The provincial government of Punjab introduced 'Save the Calf' scheme during 2019-2023. According to anecdotal evidence, this scheme was helpful in reducing pressures on supply of animals in the province. Furthermore, the slaughter of animals is subject to 'Animal Slaughter Control Act', which prohibits the slaughter of useful animals. In this context, it is suggested to ensure strict enforcement of these provincial acts through monitoring and introduction of legal action and penalties. Moreover, there is a need to assess the impact of meat exports on overall milk supplies and prices of livestock products. Apart from these factors, strict border control to curb smuggling of a large number of animals to neighboring countries will also help ease pressure on supply of animals.

²³ As per discussion with Stakeholders, 11 associations are reported in Karachi.

Besides rising meat demand, high cost of feed to maintain cows during calving intervals also leads livestock farmers to sell animals for slaughtering after first lactation cycle. In the absence of local sources of livestock feed, this issue especially assumes greater importance in Karachi. In this regard, facilitating transportation of animals to Punjab (due to its favorable terrain) from Karachi, through Pakistan Railways may encourage farmers to retain animals for an optimal period of five to six lactation cycles. The combined effect of these measures is expected to have a visible impact on supply of milch animals in the short to medium term.

Addressing issues in the availability of livestock feed.

Pakistan's livestock sector faces scarcity of animal feed. The government can introduce a number of measures to improve supply situation of fodder crops. In the short term, this can be achieved through reducing import taxes on soybean, ensuring domestic availability of maize for the feed industry and subsidized availability of agriculture machinery required for producing silage. Furthermore, the government may encourage production of fodder crops through policy incentives. The long-term solution involves strengthening seed sector R&D, encouraging public-private partnership and attracting FDI in the seed sector [Jafri, S. K. et al. (2022)]. Local development of high yielding, and heat resistant fodder crop varieties with low requirement of irrigation water is likely to improve yield and quality of fodder crops in the country.

Upgrading the state of extension and veterinary services departments.

Extension services departments in Pakistan play a limited role in enhancing the productivity of dairy sector. While the public sector extension departments face dearth of trained staff, the extension services provided by the private milk processing sector mostly target large farmers.

To address these concerns, there is a need to align the curriculum in educational institutes with the latest evolving challenges in livestock management. The government should strengthen the resource base of the public sector R&D institutes for development and production of vaccines for livestock. The state of veterinary facilities also needs to be upgraded by ensuring availability of required medicines, well trained

staff and other physical infrastructure. Targeted extension programs to check spread of contagious diseases in animals may also help in mitigating health challenges. There is also a need to ensure skill development programs and trainings for extension workers. In addition, a reward-based performance management system may also incentivize extension workers to improve service delivery.

Encouraging corporate farming in the private sector.

There is a need to incentivize private sector to enter large scale corporate farming for livestock, to benefit from the economies of scale. The medium and large scale corporate farmers can have better access to finance as well as ability to import high yielding livestock breeds, farm machinery, and vaccines. This will not only lower cost of production through economies of scale, but will also improve milk yields through effective animal husbandry practices, and will aid in stabilizing milk prices in the medium to long-term.

Discouraging supply of adulterated milk through quality testing.

The current collection and marketing system of milk in the informal sector is mainly based on quantity, whereas quality assumes secondary importance. To meet the supply shortages, the middlemen, retail outlets, and even the packaged milk sector resort to adding various adulterants to milk. The middlemen and retail shops also add water to milk as a routine practice to increase their earnings. In absence of routine quality inspections, these practices remain unchecked. The government should devise a plan to ensure strict enforcement of food safety laws through routine checks, inspections, and surveys. This will not only limit the unchecked distribution of adulterated milk but will create awareness among farmers about the importance of improving quality of milk. The pricing of milk according to its quality standard is likely to encourage farmers to invest in animal wellbeing, especially livestock good quality feed and breed development.

Improving milk yields through breed development.

To foster breed development, it is essential to further strengthen the collaborative efforts between agricultural universities and the private sector, focusing on research and development tailored to the specific climatic

conditions of Pakistan. Recognizing successful breeding programs undertaken by universities with financial incentives can further incentivize progress in this direction.

Likewise, creating awareness about the advantages of artificial insemination, through extension services, along with offering various incentives to encourage widespread acceptance and utilization of this method, has the potential to achieve the overarching objective of enhancing dairy animal productivity.

Initiation of a dairy cooperative model with robust government and private sector collaboration.

In an effort to increase the share of formal dairy sector, development of cooperatives is of extreme importance in country's current dairy dynamics.

Currently few dairy cooperatives have been operational, which are handled by big dairy enterprises (Nestle Pakistan Dairy Cooperative Society, Anhaar Milk Producers Cooperative Society, Engro Foods Dairy Farmers Cooperative Society etc.). However, evidence of community-based cooperatives is scant. According to the market sources, attempts to initiate community based cooperatives, could not yield results in absence of chilling and milk preservation infrastructure and lack of collaboration among the policy-making institutes.

In this regard, following the example of successful model of dairy cooperatives in India (**Box 4**) has the potential to bring the much needed improvement in the dairy supply chain in Pakistan. This model is based on effective coordination between various tiers of collaborative community based dairy cooperatives and state level public organizations with an objective to ensure effective management of dairy supply chain in India. A similar model can be developed with active participation of provincial governments in Pakistan. The existing structure of policymaking bodies and private investor (middlemen) can be utilized to initiate and formalize the baseline requirements of adopting community based cooperative model in the country. The provincial governments may allocate provincial development budgets in their Annual Budget Plans to invest in the basic infrastructure (dairy plants containing chilling centers and milk processing facilities, veterinary services, quality checking stations, and AI services). Although the current emphasis of provincial governments is upon providing veterinary services and

capacity building in dairy sector, exclusive focus on building cooperative infrastructure is imperative. These setups should also ensure availability of quality feed.

In order to establish village and tehsil level cooperatives, the government may facilitate establishment of milk collection centers. The availability of these public facilities will incentivize middlemen to be a part of this formal network. Given their link with small scale farmers in the far flung areas, these middle men can help integrate this informal network into the formal setup. Moreover, the efforts to improve milk quality should be rewarded by offering better prices instead of setting a fixed price by grading the milk supply as per the fat content (quality).

Box 4: Introduction of Dairy Cooperatives' Model of India

India is the largest milk producer in the world recording milk production of 230.6 million tonnes in 2023 with a CAGR of around 5 percent in last ten years. Also, it captures almost 13 percent share in the global milk production [NDBB (2023); FAOSTAT (2022)]. The milk value chain in India constitutes 54 percent of self-consumption along with almost 23 percent informal milk marketing chain. The remaining 23 percent of the formal channels includes dairy cooperatives as well as domestic and multinational private processors [Birthal et al. (2017)]. In view of substantial improvement of dairy cooperatives over a couple of decades, these account for approximately 60 percent of processed fluid milk in India [USDA (2017)]. The existing dairy cooperative structure in India follows a three-tier model that connects the milk producers via cooperatives to the state level.

At the first tier, the model constitutes village level dairy cooperative societies that are managed by the dairy farmers themselves who collect milk with quality-based payments to members. These societies coordinate to provide essential local-level support services, including veterinary first aid and Artificial Insemination (AI). Additionally, they engage in providing balanced cattle feed, fodder seeds, and milk products.

The second tier involves the district-level dairy unions, which are associations of primary dairy cooperatives in a given district or cluster of districts that procure milk from village level cooperatives, process, and distribute that to larger markets. Other significant responsibilities

include offering technical expertise and support services, enhancing the dairy cooperative movement, coordinating extension services via diverse training initiatives and rural development projects. Typically, the Union possesses and manages a dairy plant, a cattle feed production facility, farms for fodder and breeding bulls, semen stations, and a hub for animal husbandry initiatives. Moreover, the Union conducts research, development, and promotional endeavors to aid households engaged in milk production. Additionally, it supplies macro-level resources such as compound cattle feed, fodder seeds, and veterinary assistance, including 24/7 emergency visits to farmers' premises [Sajja and Dave (2019)].

The third tier is State Cooperative Milk Marketing Federation which is formed by the district cooperative dairy unions to market their products. The Federation is responsible for developing and implementing policies, marketing milk products and allied services pertaining to breeding and AI. At the national level, the National Co-operative Dairy Federation (NCDFI) along with the collaboration of National Dairy Development Board (NDBB), coordinates the marketing endeavors of all state-level cooperatives while supporting and developing dairy cooperatives in the country. The core responsibilities of the NCDFI entail working together with stakeholders to develop cooperative-focused policies and programs. It plays a role in coordinating, managing, monitoring, and predicting the interstate and inter-regional flow of milk, milk products, and various agricultural items. Moreover, it engages in fostering trade and overseeing the interstate and inter-regional marketing of diverse dairy goods. Additionally, aside from coordination efforts, the NCDFI conducts capacity-building initiatives for cooperative workforce development, including training sessions, conferences, seminars, conventions, and similar activities [Sajja and Dave (2019)].

The milk pricing incentivizes the farmer to produce high quality milk. All farmers get standard farm gate price on supply of milk which meets basic quality standard as per fat and solid nonfat content (SNF). However, the farmers meeting quality standards and providing high quality milk are offered premium price that is in addition to the base price [Meena et al. (2023)].

Moreover, the district union allocates dividends to producers based on their shares and bonuses proportional to the quantity of milk they supplied in the year. This system incentivizes primary producers to maintain quality milk production with the backing of village and district cooperatives. Importantly, the government does not fix milk prices in India; instead, dairy cooperatives and private dairies establish prices based on production costs and national milk demand [Government of India (2019)].

6. Conclusion

Persistent increase in prices of dairy products have remained the largest contributor to food inflation in Pakistan for over two decades. While Pakistan is ranked among world's top five milk producers according to the data released by the PBS, milk yields in the country are one of the lowest globally. A fragmented supply chain with concentration of small holders, is the primary challenge faced by the dairy sector in Pakistan that prevents it from benefiting from economies of scale, leading to low yields and poor-quality milk. In addition, a confluence of a long-range of supply chain issues, including scarcity of animal feed, huge reliance on imported feed, inadequate focus on breed development, absence of value chain infrastructure, extensive role of middlemen, below par animal health facilities, lack of awareness about effective animal husbandry practices, limited credit opportunities, and weak financial position of small dairy farmers also contribute to lower livestock milk yields in Pakistan.

While these structural issues have squeezed milk supplies, a consistent expansion in meat demand for domestic consumption and for exports has given rise to supply shortages of milch animals. Moreover, the rising income levels have also spurred consumption of livestock products (milk and meat) over the years. This situation indicates a widening gap between supply and demand of fresh milk in the country, which has contributed to persistent price pressures of milk since last two decades. The players in dairy supply chain (middlemen and packaged milk industry), meet this gap through import of powdered milk and whey powder to reconstitute liquid milk. Few big middlemen capture the biggest chunk of the market and are in the position to manipulate prices, indulge in milk adulteration

practices, and exploit resource-deficient small-scale farmers.

Moreover, increase in urbanization trends and decline in land holding are also compelling small farmers to quit this profession, putting upward pressure to milk prices over squeezed milk supplies. In addition to the overall structural issues, dairy dynamics of Karachi (high maintenance cost of herd amid non-availability of green fodder and expensive utilities and labor), also have a significant role in pushing dairy inflation on account of its statistical importance in the construction of CPI.

Addressing these issues require prompt policy attention to improve the dilapidated state of the dairy sector. In the short-term, stabilizing milk prices could involve reducing duties on feed imports. Creating awareness about regulations against the slaughter of useful animals and ensuring milk quality standards is also important to stabilize milk prices. Moreover, upgrading extension and veterinary services' departments can significantly boost milk yields.

To enhance milk production in the long term, key areas of reforms include focus on encouraging private sector

investment in large-scale corporate farming for livestock to increase milk yields and benefit from economies of scale. Furthermore, there is need to strengthen policy focus on breed development and research for introducing local fodder varieties. Additionally, efforts should be made to formalize the roles of small farmers and middlemen by facilitating the creation of dairy sector cooperatives, funded by provincial development budgets, to establish milk collection and processing infrastructure. In this regard, reviewing government involvement in price fixation of milk may also encourage greater participation of the private sector.

This study has mainly investigated the structural issues in the milk supply chain, responsible for persistent pressures in milk prices. However, the impact of evolving dynamics of domestic and export demand for meat and its impact on milk prices offers potential of further research. Similarly, there is a need to conduct an in-depth analysis to evaluate the impact of government involvement in the market by fixation of milk prices on milk production in the country to suggest policy advice.



Annexure

	Islamabad	Rawalpindi	Gujranwala	Sialkot	Lahore	Faisalabad	Sargodha	Multan	Bahawalpur	Karachi	Hyderabad	Sukkur	Larkana	Peshawar	Bannu	Quetta	Khuzdar
Average Inflation																	
FY16	7.5	6.3	0.7	0.0	3.7	2.1	6.4	0.5	3.5	-0.4	0.3	0.0	0.0	10.8	4.3	0.4	0.0
FY17	3.3	6.0	3.5	1.2	0.1	13.1	2.0	4.7	8.7	0.8	2.7	7.2	1.6	3.9	6.4	0.8	0.0
FY18	3.8	1.8	-1.0	9.4	-0.1	-0.3	5.6	5.0	0.0	3.6	5.3	-0.5	-0.8	-0.9	2.3	0.5	0.0
FY19	0.7	4.5	6.8	3.2	0.5	8.8	0.0	0.9	0.0	8.1	8.7	4.4	14.3	10.4	1.7	8.7	0.8
FY20	6.7	7.8	5.4	1.8	3.9	7.1	7.3	4.1	8.4	10.9	1.7	19.7	17.5	11.4	10.8	9.4	12.4
FY21	11.7	11.7	23.2	13.6	18.0	9.0	10.9	10.1	14.7	21.8	19.0	7.9	6.6	17.5	15.8	10.4	16.8
FY22	15.5	15.4	22.9	25.5	21.4	17.3	21.3	19.7	23.4	16.4	15.8	14.8	10.2	14.5	9.7	10.0	16.5
FY23	23.4	23.1	16.0	7.7	17.6	20.7	16.5	19.0	14.9	28.0	27.2	27.7	48.5	24.5	21.5	24.5	19.1
YoY Inflation																	
FY16	8.3	7.2	3.2	0.0	0.0	14.3	1.0	0.0	12.5	-1.5	0.0	0.0	0.0	0.0	9.0	0.0	0.0
FY17	1.9	3.6	0.0	0.0	0.0	0.0	7.7	5.8	0.0	2.7	5.0	6.7	0.0	3.0	1.3	0.0	0.0
FY18	3.1	0.0	0.0	14.3	0.0	6.3	0.0	4.0	0.0	10.8	11.9	0.0	9.4	2.9	3.1	5.6	0.0
FY19	4.6	6.7	12.5	0.0	1.0	5.9	0.0	1.3	0.0	0.7	0.0	15.6	8.6	12.4	3.0	15.8	9.4
FY20	4.8	6.1	11.1	12.5	6.7	7.3	9.5	5.5	16.0	14.8	3.2	8.1	7.4	17.8	17.6	0.0	11.3
FY21	15.3	14.2	20.0	11.1	15.5	6.9	15.8	10.8	14.9	17.9	18.2	10.0	14.2	9.2	6.6	9.1	12.9
FY22	14.1	16.5	25.0	20.0	22.5	23.6	11.8	19.8	19.9	28.2	21.1	19.9	19.4	19.8	9.4	4.2	9.1
FY23	33.5	34.6	33.3	16.7	25.6	25.4	41.0	30.0	23.5	30.9	42.8	43.8	53.1	27.5	30.0	60.0	47.2
Average Price																	
FY15	88.7	83.9	77.5	70.0	74.5	70.0	61.1	74.6	60.0	84.0	79.8	75.0	80.0	74.5	72.5	89.7	80.0
FY16	95.4	89.2	78.1	70.0	77.2	71.5	65.0	75.0	62.1	83.6	80.0	75.0	80.0	82.5	75.6	90.0	80.0
FY17	98.5	94.6	80.8	70.8	77.3	80.8	66.3	78.6	67.5	84.3	82.2	80.4	81.3	85.8	80.4	90.7	80.0
FY18	102.2	96.3	80.0	77.5	77.2	80.6	70.0	82.4	67.5	87.3	86.5	80.0	80.6	85.0	82.3	91.1	80.0
FY19	102.9	100.6	85.4	80.0	77.6	87.7	70.0	83.2	67.5	94.3	94.0	83.5	92.2	93.8	83.7	99.1	80.6
FY20	109.8	108.4	90.0	81.4	80.6	94.0	75.1	86.6	73.1	104.6	95.6	100.0	108.3	104.5	92.7	108.3	90.6
FY21	122.7	121.1	110.8	92.5	95.0	102.4	83.3	95.4	83.9	127.4	113.8	107.9	115.5	122.8	107.4	119.6	105.8
FY22	141.7	139.7	136.2	116.1	115.4	120.2	101.0	114.2	103.6	148.4	131.8	123.8	127.3	140.6	117.9	131.6	123.3
FY23	174.7	172.1	158.0	125.0	135.7	145.0	117.6	136.0	119.0	190.0	167.6	158.1	189.1	175.0	143.2	163.8	146.8
Volatility																	
FY15	0.01	0.02	0.00	0.00	0.06	0.00	0.02	0.02	0.00	0.00	0.01	0.00	0.00	0.05	0.00	0.01	0.00
FY16	0.02	0.02	0.01	0.00	0.00	0.05	0.00	0.00	0.05	0.01	0.00	0.00	0.00	0.00	0.03	0.00	0.00
FY17	0.02	0.03	0.04	0.04	0.00	0.04	0.03	0.02	0.00	0.04	0.05	0.04	0.05	0.03	0.02	0.03	0.00
FY18	0.01	0.00	0.00	0.06	0.00	0.02	0.00	0.00	0.00	0.05	0.05	0.00	0.03	0.01	0.01	0.02	0.00
FY19	0.01	0.01	0.06	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.06	0.03	0.03	0.02	0.07	0.03
FY20	0.01	0.02	0.07	0.04	0.02	0.02	0.01	0.01	0.05	0.06	0.03	0.00	0.03	0.05	0.06	0.04	0.02
FY21	0.05	0.04	0.05	0.05	0.08	0.03	0.11	0.07	0.06	0.17	0.13	0.05	0.02	0.03	0.04	0.05	0.06
FY22	0.18	0.19	0.17	0.26	0.25	0.25	0.33	0.28	0.33	0.21	0.25	0.32	0.20	0.19	0.30	0.25	0.35
FY23	0.10	0.09	0.10	0.07	0.05	0.05	0.09	0.08	0.06	0.09	0.07	0.10	0.10	0.08	0.04	0.17	0.14

Our analysis reveals that fresh milk prices remained higher in Sindh, particularly Karachi since FY20.²⁴

Sindh dominated overall inflation trend:

Heat map of average inflation shows that Sindh registered higher inflation compared to other provinces, on average, maintaining the top two positions after FY20. Likewise, Sindh experienced more incidences of higher inflation where Karachi posting highest inflation in FY22.

Trend of average inflation diverted after 2020's:

²⁴ Since the city wide data (urban and rural) for thirty-five (35) cities is not in public domain, our analysis is limited to the available published information for seventeen (17)

Following FY20, Karachi consistently recorded the highest price levels, replacing Islamabad, which had held the top rank registering highest average inflation for many years. Although Islamabad exhibited the highest prices, it never fell within the top three ranks in terms of inflation. Conversely, Karachi has now begun to consistently register one of the highest inflation rates in this category, alongside maintaining a high price level.

Sindh depicted higher volatility in fresh milk prices:

cities collected by PBS for the purpose of calculating Sensitive Price Index (SPI).

The measure of instability, gauged by the coefficient of variation, has consistently been higher for Sindh. While certain cities in Punjab occasionally exhibited elevated coefficients of variation, these instances were isolated. Karachi and Hyderabad consistently ranked among the top three cities most affected by unstable inflation for a period exceeding 3 year

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