Cross-Border Factors and Trade Agreements Affecting Meat, Milk and Fisheries Exports from Pakistan: Evidence from the Gravity Model Analysis

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Abstract

The livestock and fishery sectors of Pakistan, not only contributes to GDP but can also considerably boosts export revenue for the country. This study identifies the cross-border factors and trade agreements affecting meat, milk, and fisheries exports from Pakistan. To accomplish this objective, the study used three different panel dataset of countries that import milk, meat, and fish from Pakistan. Results from commodity-specific gravity models show that increase in income in importing countries increases exports of the three products from Pakistan. Moreover, distance between Pakistan, and milk and milk products importing countries significantly reduces milk and milk products exports from Pakistan. Furthermore, an increase in the population of the age group of 65 and above increases milk and milk products exports. Besides, an increase in exchange rate in importing countries also decreases Pakistani meat and fishery exports. Countries who signed TIFA with Pakistan received higher exports of milk and milk products from Pakistan. The free trade agreements of other countries with Pakistan results in lower meat exports as compared to transit trade agreements. Finally, countries who signed preferential trade agreements with Pakistan received higher fishery exports. Findings of this study would provide valuable input for policymakers which in turn will enable them to devise appropriate commercial policies for milk, meat, and fishery products.

Keywords: Milk, Meat, Fisheries, Exports, Trade agreements, Panel data, Gravity model, Fixed effect regression

JEL Classification: F100, F130, F140

1.   Introduction

Meat, milk, and fish are all significant sources of protein, iron, calcium, zinc, vitamin B12, and other nutrients. A diet rich in the recommended proportions of dairy, meat, and fish may improve human health, lengthen life expectancy, and lower the occurrence of cardiovascular diseases (Obeid et al., 2019). Currently, the

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largest consumer market for meat is China. From the early 1990s, China has seen a steady rise in its meat consumption. Chinese consumers consumed about 100 million tons of meat in 2021, which is 27% of global consumption and twice as much as what Americans consume overall (Wang, 2022). Similarly, the demand for milk is currently increasing by 15 million tons annually, primarily in developing nations. In developing countries, small-scale dairy farmers are producing milk, which might result in the creation of millions of new jobs annually in primary agriculture (Rehman et al., 2017). Indian drank over 85 million metric tons of milk in 2022, which was the highest in the world. With 23.8 million metric tons, the European Union had the second-highest milk consumption region (Statista, 2023). Likewise, China is the country that consumes the most seafood globally, and as a result, imports the most. 65 million tons out of the 144 million tons of fish is consumed worldwide, in which 45%, are consumed in China. The European Union comes in second with 13 million tons, followed by Japan with 7.4 million tons, the US with 7.1 million tons, and India with 4.8 million tons (Rodaint, 2020). This evidence shows increasing trends in meat, milk, and fisheries demand.

Southern Asia's population accounts for 24.9% of the global population. Over the past ten years, South Asia's total dairy product consumption has increased twice than the annual global average dairy products consumption (Worldometers, 2023). Smallholder dairy farmers in the South Asian region, on average own 2 to 10 cows and they provide a significant portion of the region's milk production. Although the number of milking animals in South Asia is high but the region produces significantly fewer dairy products than what is needed for domestic consumption (Rehman et al., 2017). Furthermore, the food and livelihood stability of millions of people in South Asia depends on fisheries resources. Many South Asian nations have a great potential to increase their fish production. In the region, aquaculture has grown steadily in recent years and now accounts for 40% of the region's total fishery output. In the list of high aquacultures producing countries in South Asia, Bangladesh came in second with an output of 2.2 million tons in 2016 while India as the top producer of aquaculture producing 5.7 million tons in 2016 (FAO, 2018). Approximately 27.3% of global fish production comes from South Asia (Hossain and Shrestha, 2019).

Pakistan is one of the most important countries in South Asia. The livestock sector of Pakistan is a significant subsector of agriculture sector. Livestock saw growth of 3.26 percent in 2021–22. The sector, contribute 14.04 percent to GDP and 61.89 percent to agricultural sector (GOP, 2022a). Besides, with 57 million tons of milk production, Pakistan ranks third in South Asia. Furthermore, the country's economy and food security are related to fish sector. Additionally, the

sector reduces strain on the mutton, beef, and poultry markets. The fishing industry is a vital source of income for people who live near the coast. Marine and inland fisheries (based in rivers, lakes, dams, etc.) are the common practices in the country. Despite making up a very modest portion of the GDP, the fishing sector considerably boosts export revenue for the nation. The fishing industry expanded by 0.35 percent, accounting for 1.39 percent of the value added to agriculture and 0.32 percent of GDP. Around 696 thousand metric tons of fish were produced in the country in 2022 (marine: 468 thousand metric tons; inland: 228 thousand metric tons). In 2022, the country's fishery sector exported 116.514 thousand metric tons of fish and seafood and earned US\$ 310 million. China, Thailand, Malaysia, the Middle East, Sri Lanka, and Japan are Pakistan's top fish export markets (GOP, 2022b). Nowadays, halal meat is successfully exported from Pakistan by 14 different businesses. The most prominent companies are the Organic Meat Company, Al-Shaheer Corporation, Fast Food Industries, Lahore Meat Company, PK Livestock Company, and Everfresh Meat. They are also known as Shafi Group. PK Livestock is regarded as Pakistan's top meat exporter and has an automated slaughter facility. Pakistan exports almost 80% of its halal meat to the Middle East, primarily Saudi Arabia and the United Arab Emirates (UAE) as well as Bahrain, Kuwait, Oman, and Qatar. In addition, Pakistan also exports its meat and meat products to Vietnam, Iran, and Thailand (Shoaib and Jamil, 2017).

Pakistan has the potential to generate US\$30 billion from exporting dairy products. Similarly, by raising dairy exports of the country can also save \$20 billion annually (Sattar, 2022). In addition, countries with a majority of Muslims have sizable halal food markets. The United Kingdom, France, Malaysia, Saudi Arabia, Egypt, Iran, Afghanistan, Turkey, the Gulf States, and certain African nations are among those that import halal meat. Customers from Muslim countries are increasingly drawn to halal processed meat and goods. The growth of halal meat and products, as well as their marketing, can greatly improve Pakistan's export of meat. The meat processing companies have great incentive in terms of halal meat that is needed to be explored at other regions besides their established markets such as Middle East and Gulf countries. The federal government in the past, struggled to explore new meat markets for Pakistani meat and meat products. Two years ago, Abdul Razak Dawood, Former Advisor to Prime Minster on Trade and Investment, announced that ten Pakistani meat processing companies get Egypt's approval for meat export. However, the government's role into the development of export-based meat processing industry is still limited. Finally, Sanitary and Phytosanitary (SPS) measures are essential for fish exports that have been ratified by the WTO. However, the country's fish exporters cannot fully benefit from any trade agreement

unless they allay the concerns of the importing nations about health and safety. The fisheries sector in Pakistan has a large export potential, but because to SPS worries, the European Union and some Middle Eastern nations have banned the import of fish and shellfish from Pakistan. Due to a lack of necessary infrastructure and other facilities, fish catch, and handling practices do not adhere to international standards.

The export of a commodity like milk, meat, and fishery is influenced by a number of demand side factors such as per capita income, population, exchange rate, distance between the exporter and importers, and trade agreements on local, regional, and world level (Kumar, 2010; Natale et al., 2015). The increase in per capita income is an indication of the growth of the economy and the success of international trade. A higher per capita income would most likely affect the exports of milk, meat, and fishery exports. The higher per capita income suggesting that the size of the economies should enhance the amount of trade between trading partners (Teweldemedhin and Mbai, 2013). The country with a high population encourages the demand for imports consequently, the country imports a wide range of goods from exporting countries. This suggests a positive impact of population on bilateral trade. On the other hand, total GDP and per capita GDP are the good measures of imports demand and exports supply, this suggests a negative impact of population on bilateral trade (Oguledo and MacPhee, 1994). Population is extremely important when it comes to an attractive export potential. A densely populated nation means a greater demand for protein commodities such as milk, meat, and fishery (Teweldemedhin and Mbai, 2013). The exchange rate shows the volatility in the value of a currency. When exchange rate increases then the domestic currency depreciates, domestic goods become cheaper in the importing country consequently, foreign demand for domestic goods increases and vice versa. (Bergstrand, 1985; Narayan and Nguyen, 2016). Rapid short-term depreciations of local currency will overshoot the potential export although over the long term the exchange rate effect becomes less severe compared with the other variables. Countries that lies geographically further from exporting country is expected to influence the profitability and as a result such a country becomes less attractive as export destination, particularly due to transport costs. This implies transportation cost is a major constrain for export capacity; as far from major trading partners will adversely affect trade volume (Teweldemedhin and Mbai, 2013).

With this background this study identifies the cross-bounder factors and trade agreements that affect exports of milk, meat and fishery from Pakistan, since it has never been treated before. The study used a gravity model and panel data from the nations where Pakistan exports milk, meat, and fishery products to achieve this goal. Our motivation for this research is to contribute to the literature of

Pakistan's agricultural trade in general, and its milk, meat, and fishery exports in particular. This study is significant for several reasons. First, Pakistan has a huge potential to export its milk, meat, and fishery products to various contraries. Second, this study would expand the literature on the commodity-specific gravity model of agricultural trade. Unlike traditional gravity models a commodity-specific gravity model focuses only on trade flows of one specific commodity. This allow the researchers to incorporate variables in the gravity model that are unique to trade flows of a specific commodity. For example, per capita income, population, exchange rate, distance, and trade agreements on local, regional, and world level play a significant role in exports of milk, meat, and fishery exports from Pakistan.Third, there is an enormous rise in the demand for milk, meat, and fishery products, thus; Pakistan can increase its export revenue from exporting these products to potential markets. Findings of this study will provide valuable input for policymakers which in turn will enable them to devise appropriate commercial policies for milk, meat, and fishery products. Finding of the study regarding the determinants of export markets will certainly help milk, meat, and fishery exporters in Pakistan.

2.   Literature Review

Due to increasing demand for milk, meat, and fisheries around the globe, various researchers in different countries carried out studies on this important topic. For an instant, Kondaridze and Luckstead (2023) examined determinants of dairy-product trade by applying the Poisson Pseudo-Maximum Likelihood (PPML) method to the gravity model using panel data. Results of the study showed that domestic subsidies have a modest, but significant, impact on dairy-product trade across the models. Besides, memberships in trade agreements, market size factors, and government institutions also positively affect dairy-product trade. Furthermore, Teweldemedhin and Mbai (2013) identified the factors that affect meat exports globally. The study applied the Extended Gravity Model to a cross-sectional dataset of global trade for fresh beef and frozen beef, as well as sheep and goat meat. Results of the study showed that GDP per capita positively affecting fresh beef exports in Southern and West Africa. Besides, denser populated nations had higher demand for meat. For Asian markets, the study also found a significant impact of per capita income, making these markets attractive export destinations. Similarly, Yego and Siahi (2018) analyzed Kenyan livestock and livestock products (live animals, meat and meat preparations, dairy products, hides/skins/fur) export trade flows with major trading partners. Results from the gravity model indicated that exchange rate, GDP, and distance significantly affected livestock and livestock products exports from Kenya. One year later, Shahriar et al. (2019) identified the

determinants of China's pork exports under the panel gravity trade model. Results of the study revealed that GDP, exchange rate, common language, and country land area are the significant factors affecting the Chinese pork exports flows. Moreover, China's WTO membership, the 'Belt and Road' Initiative, and the common borders had a positive significant impact on its exports of pork. Kibona et al. (2022) investigated the factors that influence beef exports in Tanzania. Econometric results of the study revealed that terms of trade, Tanzania GDP per capita, global beef meat consumption, trade openness, and beef outputs positively and significantly affecting beef exports in Tanzania.

On the other hand, Ebahoro et al. (2021) summarized current trade in meat and estimated meat projections for the future. Results of the study identified existing patterns of trade in meat influenced by growing populations, increasing incomes, and changing diets in developing countries. Projections indicated that meat production and exports will increase among few countries. Some researchers extended the issue to fishery trade. For instance, Pham et al. (2016) analyzed the factors affect fishery exports from Vietnam to USA and Europe markets. Results of the study showed that GDP of exporting nations, population of these nations, exchange rate, and geographical distances significantly affect seafood export from Vietnam to USA and European markets. Two years later, Sitompul et al. (2018) analyzed the effects of trade facilitation on Indonesian fisheries export. Results of the study explained that shrimp and tuna exports from Indonesia increased due to trade facilitation, including port quality, access to electricity, measures of ethics and corruption, and the effectiveness of cross-border trade. In the next year, Bose et al. (2019) evaluated the domestic ban and border rejections of Oman fish exports to the EU. Results of the study showed that domestic export ban rather than the border denials by the EU countries, economic recession faced by the EU during 2009-10, and exchange rate instabilities have substantial effect on Oman's fish exports to the EU.

Few researchers prolonged the issue to Pakistan. For instance, Zaheer and Hussain (2015) analyzed development of dairy sector and trade reforms in Pakistan. The study's findings revealed that a lack of national government support for environmental conditions of milk production and processing has a negative impact on the dairy sector's performance. Furthermore, farm holders' potential was hampered by inflexible taxation regulations and insufficient export incentives. Five years' later, Hussain and Zaheer (2020) evaluated the role of rural women in development and export earnings of Pakistan dairy industry. Result of the study showed that women in rural areas appear to be more active in livestock-related activities and have discovered a way to engage in business activities by selling extra

milk produced in excess of their domestic need. On the other hand, Sohaib and Jamil (2017) investigated the Pakistani meat market, with a focus on halal meat. The study's findings indicated that Pakistan may become a center for halal meat and meat products by implementing a supply chain structure and rigorous safety and quality standards in meat production and processing. In the next year, Randhawa et al. (2018) examined growth performance of meat production and export in Pakistan. Results of the study showed that over time the halal meat production and export in the country increased. However, the establishment of halal meat handling areas in livestock specified regions in the country can further boost the production and exports of meat.

From the review of the above studies, we come to an end that the research carried out in the past focused on just one exporting commodity either milk or meat or fish. However, despite few studies on milk, meat, and fishery, none of the study analyzed the cross-border factors and trade agreements affecting the milk and meat exports. Thus, for filling this gap, in this study, we identify the cross-border factors and trade agreements that affect exports of milk, meat, and fishery from developing country Pakistan. Moreover, the few previous studies used gravity model while other studies ignore to use gravity model of international trade for their empirical analysis. Similarly, most of the previous studies used time-series data. Thus, this study fills these gaps by using gravity model for international trade for empirical analysis. The study also uses panel data for three different exporting commodities.

3. Data and Methodology

3.1. Data

In this study, we use the panel dataset of 14 countries that import milk from Pakistan, 11 countries that import meat from Pakistan, and 31 countries that import fish from Pakistan from 2003 to 2021[3]. We collect the required data from the UN Comtrade Database (2023), Wold Bank (2023), and from GOP (2023a, 2023b). The UN Comtrade Database (2023) provides information on the milk, meat, and fishery export trade value (USD) for Pakistan to trading partner countries. We compile information about the real per capita gross domestic product (GDP), population by age composition, and exchange rate from the Wold Bank (2023). Finally, the information on the trade agreements are taken from GOP (2023a, 2023b).

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[3] Since the data on the exports volume of the milk, meat, and fishery from Pakistan are available from 2003 to 2021; therefore, we construct our dataset from 2003 to 2021.

3.2. Gravity Model

Gravity model of international trade is one of the trade models that are frequently used in the research of the factors impacting trade between the export markets and import markets. The first to use this model to evaluate trade flows was Tinbergen (1962), who use the following equation:

$$X_{ijt} = \alpha_0 y_{it}^{\alpha_1} y_{jt}^{\alpha_2} d_{ij}^{\alpha_3} \tag{1}$$

Where X_{ijt} is export of country i to country j in year t, y_{it} is per capita GDP of country i in year t, y_{jt} is per capita GDP of country j in year t, and d_{ij} is the distance between country i and country j. Expansion of the model is given by:

$$X_{ijt} = \alpha_0 y_{it}^{\alpha_1} y_{jt}^{\alpha_2} d_{ij}^{\alpha_3} a_{ijj}^{\alpha_4} \mu_{ij} \tag{2}$$

Where a_{ijt} are other factors that can increase or decrease the flow of exports from country i to country j in year t and μ_{ij} are random elements. The model suggests that national economic scales of bigger economic and closer distances prefer to trade together more frequently than in other nations, and that trade flows rather than distance, per capita GDP turned favorable impact on the trade flow between the two countries. After receiving numerous applications, Tinbergen (1962) used this model to investigate the problems of increasing export turnover. James E. Anderson (1979) was the first economist who derived the gravity equation through the product differentiation model. An important contribution to establishing the crucial theoretical underpinnings of employing this model in economic research was made by Bergstrand (1985). According to Deadorff (1998), the core idea of Hechscher-Ohlin's theory of international trade was the theoretical underpinning of the gravity model of trade. According to Helpman (1999), the gravity model of trade is ideal for a study of intra-industry trade and would be a good tool for identifying the variables that influence the volume of international trade. Rustam (2020), Aydin et al. (2004), and others demonstrated how the exchange rate affects exports. Similar results were reached by Kristjánsdóttir 's study from 2005, which found that Iceland's exports were impacted by the per capita GDP, population, and geographic distance of neighboring nations.

According to research by Elshehawy et al. (2014), the amount of trade between countries relies on the size of the economies, the size of the markets, the volatility of foreign exchange rates, as well as geographical considerations. Following Elshehawy et al. (2014), we developed the following gravity models for milk, meat, and fishery exports:

$$\ln(Xmilk_{ijt}) = \alpha_i + \alpha_t + \alpha_1 \ln(y_{jt}) + \alpha_2 d_{ij} + \alpha_{3k} \sum \ln(pop_{jt}) + \alpha_4 er_{it} + \alpha_{5m} \sum ta_{ij} + \alpha_{6n} \sum r_j + \mu_{ij} \tag{3}$$

$$\ln(Xmeat_{ijt}) = \beta_i + \beta_t + \beta_1 \ln(y_{jt}) + \beta_2 d_{ij} + \beta_{3k} \sum \ln(pop_{jt}) + \beta_4 er_{it} + \beta_{5m} \sum ta_{ij} + \beta_{6n} \sum r_j + \varepsilon_{ij} \tag{4}$$

$$\ln(Xfishery_{ijt}) = \gamma_i + \gamma_t + \gamma_1 \ln(y_{jt}) + \gamma_2 d_{ij} + \gamma_{3k} \sum \ln(pop_{jt}) + \gamma_4 er_{it} + \gamma_{5m} \sum ta_{ij} + \gamma_{6n} \sum r_j + \epsilon_{ij} \tag{5}$$

Where $Xmilk_{ijt}$, $Xmeat_{ijt}$, $fishery_{ijt}$ are exports of milk and milk products, exports of meat, and exports of fishery from country i to country j in year t. y_{jt} is per capita GDP in country j, d_{ij} is the distance between country i and country j, pop_{jt} is population of type k in country j in year t, er_{it} is exchange rate in country j in year t, ta_{ij} is trade agreement of type m signed between country i and country j and r_j is region of type n where the country located. α_i, α_t, β_i, β_t, γ_i, and γ_t are country and time fixed effects, μ_{ij}, ε_{ij}, and ϵ_{ij} are random error terms, and $\alpha's$, $\beta's$, and $\gamma's$ are parameters to be estimated. $i = Pakistan$, in model (4) $j = 1, ..., 14$, in model (5) $j = 1, ..., 11$, in model (6) $j = 1, ..., 31$, and all three models $t = 1, ..., 19$. Equation (4), (5), and (6) are the generalized form of the two-way fixed effect panel data models. To evaluate the impact of cross-border factors on the milk, meat, and fishery exports from Pakistan, we estimate the above model using time and country fixed effect regression with STATA.

## 4. Results and Discussions

4.1. Trends in the exports of milk and milk products, meat and fishery from Pakistan

Pakistan has significantly grown its exports of milk and milk products, meat and fishery to the international market. Pakistan currently stands at 75th position among the top 100 nations and ranks third among South Asian nations in terms of milk and milk product exports. In terms of exporting meat, Pakistan ranks 14th out of the top 30th nations (Sohaib and Jamil, 2017), while in terms of exporting fisheries, Pakistan ranks 98th out of 110th nations. As illustrated in Figure 1, the country raised its exports earnings from milk and milk products, meat, and fisheries from US\$ 6.3 million to US\$ 10.8 million, US\$ 13.8 million to US\$ 339.9 million and US\$137.9 million to US\$ 398.2 million, respectively between 2003 and 2021. This demonstrates that during the previous nineteen years, the country's export earnings from milk and milk products have increased by 58 percent, while its export revenues from meat and fisheries have increased by 4 percent and 35 percent,

respectively. By raising the quality of its milk and milk products, meat and fisheries, the nation can make even more money from exports. Figure 2 makes it clear that between 2003 and 2021, exports of fisheries ranked first among the three commodities exported, followed by exports of meat and milk. This shows that over the past nineteen years, the average share of the fishery in exports has been approximately 82 percent. Comparably, the average share of meat exported is approximately 14 percent, whereas the average share of milk and milk products exported is only 4 percent.

In 2021, Afghanistan was the largest markets for Pakistani milk and milk products exports because 64 percent of the milk and milk products exports from Pakistan was made to this country. The remaining 36 percent milk and milk products exports from Pakistan was go to Singapore, United Arab Emirates (UAE), USA, Tajikistan and to other countries as shown in Figure 3. Pakistan and Afghanistan share a common border, which gives advantage to Pakistan to exports its milk and milk products to this nation. Similarly, Pak-Afghan common border provide access to Pakistan to exports its milk and milk products to Tajikistan. Similar to this, the large number of Pakistani migrants in the UAE, USA, and Singapore increase demand for Pakistani milk and milk products, which led to an increase in milk and milk product exports to these countries. Pakistan also exports a small quantity of its milk and milk products to other nations like Australia, Canada, Hong Kong, Kenya, Mozambique, South Korea, Saudi Arabia, South Africa, and United Kingdom.

Figure 1. Exports of milk, meat, and fishery from Pakistan
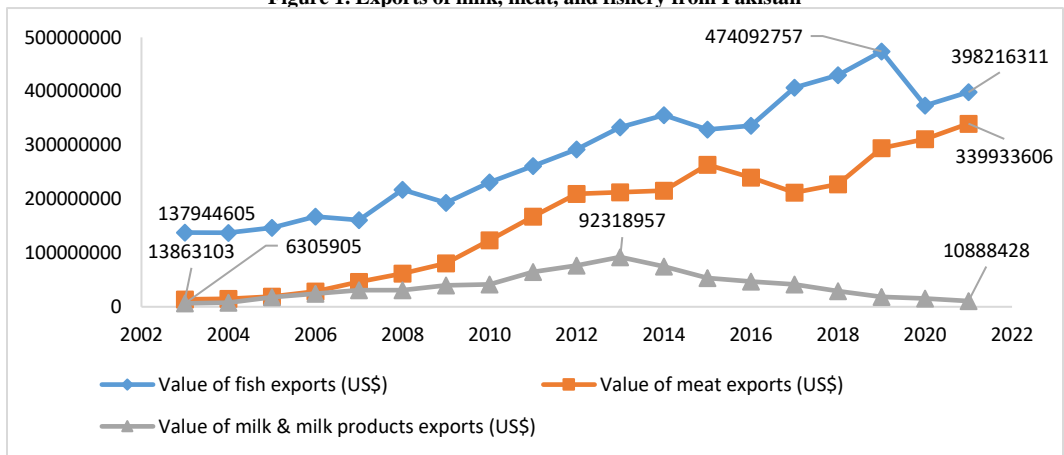
Source: Computed by authors based on panel from trading partners of Pakistan.

UAE, to whom Pakistan exported 45 percent of its meat exports in 2021, was the top market for Pakistani meat exports as indicated in Figure 4. The

remaining 55 percent of Pakistan's meat exports went to Kuwait, Saudi Arabia, Qatar, Bahrain, and other nations. This shows that Pakistan exports major share of its meat to Middle East. This may have to reasons, first, in the Middle East, majority of the population is Muslim, they demanded halal meat for their day-to-day consumption. Pakistan is a Muslim country that provide a trustable halal meat to Middle Eastern nations, resultantly; Pakistan exports its higher share of meat to Middle East. Second, a sizable population of Pakistani migrants in the Middle East demanded Pakistani halal meat, which led to an increase in the export of meat to Middle East. Pakistan also exports a reasonable amount of its meat to other Muslim and Non-Muslim countries like Afghanistan, Germany, Hong Kong, Oman, United Kingdom, and Viet Nam.

Figure 2. Exports share of milk, meat, and fishery from Pakistan from 2003-2021
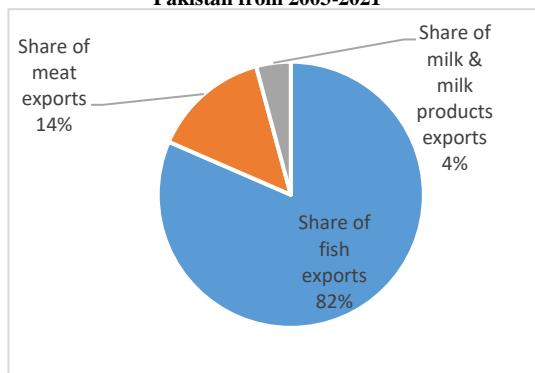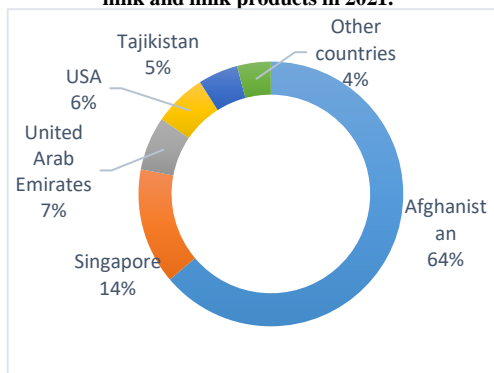

Figure 3. Top countries where Pakistan exports its milk and milk products in 2021.
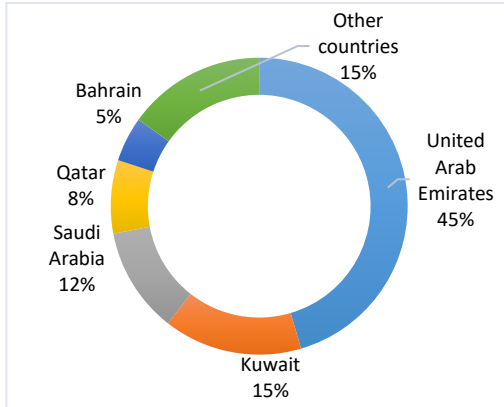

Source: Computed by authors based on panel from trading partners of Pakistan and 14 trading partners of Pakistan.

Since, China accounted for 41 percent of Pakistan's total fish exports in 2021, it was the main market for the aforementioned good as shown in Figure 5. The remaining 59 percent of Pakistan's fish exports went to Thailand, UAE, Malaysia, Viet Nam, Japan, Saudi Arabia, and other nations. Pakistan and China are a good neighbor and strategic economic partners. To feed its larger population and for tightening its strategic trade relations with Pakistan China export a huge sum of fishery from Pakistan. Similar to this, a sizable population of Pakistani migrants in the UAE and Saudi Arabia increased demand for Pakistani fish, which led to an increase in fish exports to the UAE and Saudi Arabia. In South East Asian countries like Thailand, Japan, Malaysia, and Viet Nam fishery is a common diet, thus; for fulfilling their daily dietary demand these countries exporting a significant amount of fish from Pakistan. Pakistan also exports a reasonable amount of its fish to other countries like Afghanistan, Bahrain, Bangladesh, Brunei Darussalam, Canada, Hong Kong, India, Indonesia, Jordan, Kuwait, Lebanon, Mauritius,
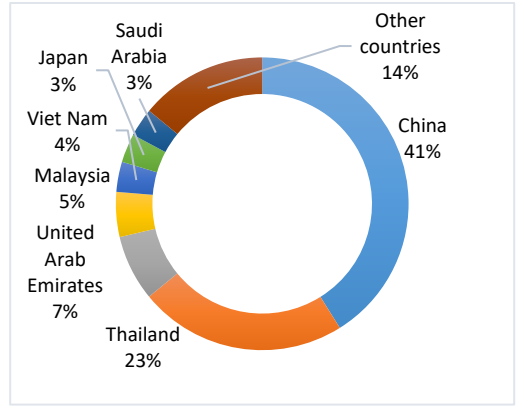
Netherlands, Oman, Philippines, Qatar, South Korea, Singapore, South Africa, Spain, Sri Lanka, Turkey, United Kingdom, and USA located in different regions.

Figure 4. Top countries where Pakistan exports its meat in 2021.

Other countries 15%
United Arab Emirates 45%
Bahrain 5%
Qatar 8%
Saudi Arabia 12%
Kuwait 15%

Source: Computed by authors based on panel from 11 trading partners of Pakistan.

Figure 5. Top countries where Pakistan exports its fish in 2021.

Saudi Arabia 3%
Japan 3%
Other countries 14%
China 41%
Viet Nam 4%
Malaysia 5%
United Arab Emirates 7%
Thailand 23%

Source: Computed by authors based on panel from 31 trading partners of Pakistan.

4.2.   Descriptive Statistics

Table 1 provides descriptive statistics on the study's dependent and explanatory variables. It is observed that on average Pakistan earned US$ 2,790,201 from milk and milk products exports, US$ 14,200,000 from meat exports, and US$ 8,693,557 from fishery exports annually. This shows that on average Pakistan earned highest export revenue from meat, followed by fishery and milk and milk products. We observe that the average per capita income of milk and milk products exporting countries is US$ 27,339, average per capita income of meat exporting countries is US$ 29082.5 and average per capita income of fish exporting countries US$ 21,336. This shows that Pakistan export its milk and milk products, meat, and fish mostly to high income countries. Comparing the average distance between Pakistan and its trading partners, it is observed that Pakistan not only export its milk and milk products, meat, and fish to neighboring countries but it also exports these products to distant countries. Comparing the population via age and gender, we observed that Pakistan export its milk and milk products, meat and fishery to those market having a significant number of male customers and having a significant number of customers of age 15-64 years. The average exchange rate relative to US$ in the partner countries implies that Pakistan export its meat and fish to those countries having depreciated currencies whereas export its milk and milk products to those countries having appreciated currencies. Regarding trade agreements, we observed that highest share (14%) of the milk and milk products exports from

Pakistan is going to the countries who are signatory with Pakistan in free trade agreements. Similarly, the country exports meat to countries who are signatory with

Table 1. Descriptive statistics

Variables	Definition	Mean and Standard deviation	Mean and Standard deviation	Mean and Standard deviation
Dependent:				
Value of milk and milk products exports	Value of milk and milk products exports from Pakistan to 14 trading partner countries (US$)	2790201 (11200000)		
Value of meat exports	Value of meat exports from Pakistan to 11 trading partner countries (US$)		14200000 (22800000)	
Value of fish exports	Value of fish exports from Pakistan to 31 trading partner countries (US$)			8693557 (19900000)
Explanatory:				
Income:				
Per capita income	Per capita income (constant US$) in 22 trading partner countries	27339 (21539)	29082.5 (17897)	21336 (18667)
Distance:				
Distance	Distance between Pakistan to trading partner countries (Km)	5478 (3459.2)	2766.2 (1555.4)	4388.5 (2602.1)
Population:				
Population 0-14	Population aged 0-14 years in trading partner countries	11700000 (14900000)	6486912 (7106747)	32600000 (78300000)
Population 15-64	Population aged 15-64 years in trading partner countries	32400000 (50300000)	19400000 (21700000)	91800000 (21800000)
Population 65+	Population aged 65 years and above in trading partner countries	5504345 (11100000)	3350096 (5411080)	11700000 (2600000)
Population-male	Male population in trading partner countries	24800000 (37100000)	15000000 (15900000)	69300000 (163000000)
Population-female	Female population in trading partner countries	24800000 (38300000)	14300000 (16600000)	66800000 (155000000)
Exchange rate:				
Exchange rate	Exchange rate in trading partner countries (relative to US$)	95.4 (285.2)	1790.1 (5717.1)	1097.2 (3976.4)
Trade agreements:				
Free trade agreement	1 if free trade agreement is signed between Pakistan and importing country and 0, otherwise	0.14 (0.35)	0.09 (0.29)	0.13 (0.34)
Preferential trade agreement	1 if preferential trade agreement is signed between Pakistan and importing country and 0, otherwise			0.06 (0.25)
SAFTA	1 if SAFTA is signed between Pakistan and importing country and 0, otherwise	0.07 (0.26)	0.09 (0.29)	0.13 (0.34)
Transit Trade Agreement	1 if transit trade agreement is signed between Pakistan and importing country and 0, otherwise	0.07 (0.26)	0.09 (0.29)	0.03 (0.18)
TIFA	1 if TIFA is signed between Pakistan and importing country and 0, otherwise	0.07 (0.26)		0.03 (0.18)
Trade in goods agreement	1 if trade in goods agreement is signed between Pakistan and importing country and 0, otherwise			0.03 (0.18)
Region:				

South Asia	If the importing country is in South Asia, the value is 1, else it is 0	0.07 (0.26)	0.09 (0.29)	0.13 (0.34)
Central Asia	If the importing country is in Central Asia, the value is 1, else it is 0	0.07 (0.26)		
East Asia	If the importing country is in East Asia, the value is 1, else it is 0	0.14 (0.35)	0.09 (0.29)	0.13 (0.34)
Southeast Asia	If the importing country is in Southeast Asia, the value is 1, else it is 0	0.07 (0.26)	0.1 (0.29)	0.23 (0.42)
Western Asia	If the importing country is in Western Asia, the value is 1, else it is 0		0.09 (0.29)	
Middle East	If the importing country is in Middle East, the value is 1, else it is 0	0.14 (0.35)	0.64 (0.48)	0.19 (0.39)
North America	If the importing country is in North America, the value is 1, else it is 0	0.14 (0.35)		0.06 (0.24)
East Africa	If the importing country is in East Africa, the value is 1, else it is 0	0.07 (0.26)		
Southern Africa	If the importing country is in Southern Africa, the value is 1, else it is 0	0.14 (0.35)		0.06 (0.24)
Eastern Europe	If the importing country is in Eastern Europe, the value is 1, else it is 0			
Western Europe	If the importing country is in Western Europe, the value is 1, else it is 0		0.09 (0.29)	
Northwestern Europe	If the importing country is in Northwestern Europe, the value is 1, else it is 0	0.07 (0.26)	0.09 (0.29)	0.06 (0.24)
Southwestern Europe	If the importing country is in Southwestern Europe, the value is 1, else it is 0			0.03 (0.18)
Australia	If the importing country is in Australia, the value is 1, else it is 0	0.07 (0.26)		
Observations		266	209	589

Source: Determined by the authors using a panel of Pakistan's trading partners. Parentheses around standard errors.

Pakistan in free trade agreements, SAFTA, and Transit Trade Agreement. In similar fashion, most of the country fish exports are diverted to those countries who are signatory to SAFTA and free trade agreements. Comparing the geographical areas, it can be seen that Pakistan's largest markets for milk and milk products exports are in East Asia, Middle East, North America, and Southern Africa. Likewise, Pakistan's largest market for meat exports is located in Middle East. Finally, Pakistan's largest markets for fishery are in South Asia, East Asia, Southeast Asia, and Middle East.

4.3. Results

Table 2. Results of gravity model for milk and milk products exports

Model:	(1)	(2)	(3)
Dependent variable:	Value of milk and milk products exports (ln)	Value of meat exports (ln)	Value of fish exports (ln)
Income:			
Per capita income (ln)	2.917**	1.883*	1.402***
	(1.244)	(1.061)	(0.448)
Distance:			
Distance	-0.0284***	-0.00497	0.00906***
	(0.00535)	(0.00318)	(0.00214)
Population:			
Population 0-14 (ln)	1.467	-2.511	-2.348*
	(3.013)	(3.563)	(1.368)
Population 15-64 (ln)	-13.49*	10.07	3.587
	(7.079)	(6.625)	(3.180)
Population 65+ (ln)	10.03***		-0.327
	(2.179)		(0.851)
Population-male (ln)	14.35**	-11.05*	0.196
	(6.949)	(6.069)	(2.765)
Population-female (ln)	-3.726	6.326	0.852
	(7.125)	(4.418)	(2.998)
Exchange rate:			
Exchange rate	-0.000927	-0.000343**	-0.000355***
	(0.00498)	(0.000134)	(0.00008)
Trade agreements:			
Transit Trade Agreement (Reference)			
No trade agreement (Reference)			
Free trade agreement	-44.37***	-13.54***	-7.111***
	(10.20)	(3.199)	(1.833)
Preferential trade agreement			29.44***
			(6.097)
SAFTA	-217.3***	-13.81	16.83***
	(46.14)	(13.80)	(3.787)
Transit trade agreement			14.91***
			(4.013)
Trade in goods agreement			-9.693***
			(2.170)
TIFA	32.93***		-18.43***
	(6.963)		(4.150)
Region:			
South Asia and Australia (Reference)			
South and East Asia (Reference)			
South Asia and Southwestern Europe (Reference)			
Central Asia	-197.3***		
	(41.71)		
East Asia	-109.4***		-18.64***
	(22.11)		(4.018)
Southeast Asia	-105.0***	1.573	0.257
	(20.35)	(1.419)	(1.208)
Western Asia			6.107**
			(2.603)
Middle East	-176.3***	-9.996	17.07***
	(34.93)	(6.122)	(5.461)
North America	30.90***		-67.87***
	(5.790)		(14.59)
East Africa	-64.54***		
	(17.44)		

Southern Africa	-16.70***		-47.05***
	(5.762)		(10.00)
Western Europe		-14.43***	
		(4.044)	
Northwestern Europe	-98.69***	2.493	-28.96***
	(18.29)	(11.63)	(5.613)
	Time	Time	Time
	Country	Country	Country
Constant	119.1***	-28.66	-65.15***
	(40.63)	(20.95)	(17.11)
Observations	266	209	589
R-squared	0.75	0.84	0.79
F-statistics	17.5***	25.6***	35.3***
Root MSE	1.7	1.3	1.1

Source: calculated by the authors using a panel of 14 Pakistani trading partners.
Parentheses around standard errors. *** p<0.01, ** p<0.05, * p<0.1.

Table 2 displays results of gravity models for milk and milk products, meat, and fishery exports. The gravity models for the three exported commodities are estimated via time and country fixed effect. Heterogeneity of the countries and time in the three models are taken into account by introducing time and country fixed effects[4]. The last panel of Table 2 presents diagnostic tests for the three models. R-squared of the models ranged from 0.75 to 0.84. On the basis of statistically significant values of F test, we reject the null hypotheses that explanatory variable did no bring any change in milk and milk products, meat, and fishery exports. Finally, root-mean squared error (Root MSE) of the models ranged from 1.1 to 1.7. This shows that we estimated the models with least errors.

Results from model (1), model (2), and model (3) in Table 2 show that the estimated per capita income coefficient is positive and statistically significant at 5%, 10%, and 1% level, respectively. This demonstrates that Pakistan's exports of milk and milk products grow by 3% for every 1% growth in per capita income in the nations that import milk from Pakistan. This result is consistent with findings of Kaur and Brian (2020), Maleki et al. (2012), and Budiraharjo et al. (2021). Similarly, a rise in per capita income of 1% in the meat importing countries increases the meat exports from Pakistan by 2 percent. This outcome is in line with findings by Dadi (2017), Sohaib and Jamil (2017), and Randhawa et al. (2018). Likewise, fishery exports from Pakistan grow by 1.4 percentage points for every one percent point increase in per capita income in nations that purchase fish from Pakistan. Pham et al. (2016) also found that GDP of importing nations significantly affect fishery and seafood export. These results confirm the theoretical background

[4] The gravity models for the three exported commodities are also estimated via pooled OLS, time fixed effect, and country fixed effect separately. The results of pooled OLS, time fixed effect, and country fixed effect models are given in appendix Table A1, Table A2, and Table A3, respectively.

of gravity model that the demand for Pakistani milk and milk products, meat, and fishery increases in the foreign market as the per capita income in the foreign market increases. This also reveals that richer nations frequently export milk and milk products, meat, and fishery from Pakistan.

At the 1% level, distance has a negative and significant coefficient in model (1) whereas it has a positive and significant coefficient in model (3). This demonstrates that a one-kilometer increase in distance between Pakistan and nations that buy milk and milk products causes a 0.03 percent point decline in Pakistan's exports of milk and milk products. According to the gravity model, countries that are physically close to each other will save more money on transportation and other expenses than distant countries, and there is an inverse relationship between exports and distance. Thus, according to the gravity model, there is an inverse relationship between the distance between Pakistan and its trade partners that export milk and milk products from Pakistan. Conversely, an increase in distance of one kilometer between Pakistan and fishery importing countries increases the fishery exports from Pakistan by 0.009 percent points. This result is in contradiction with a conventional anticipation, distance has a negative coefficient. This result is consistent with the findings of Pham et al. (2016) and Kawala et al (2018), they found that geographical distances significantly affect fishery and seafood export.

Results from model (1) show that population age between 15 to 64 is significant at 10 percent level with a negative sign. This demonstrates that a 1%-point increase in population having age between 15 to 64 in the importing countries decreases the milk and milk products exports from Pakistan by 13.5 percent points. Population age between 65 and older has a positive coefficient at 1% level. This demonstrates that a 1%-point increase in population having age 65 and above in the importing countries increases the milk and milk products exports from Pakistan by 10 percent points. The coefficient of male population is significant at the level of 5 percent, and its sign is positive. This shows that a one percent point increase in male population in the importing countries increases the milk and milk products exports from Pakistan by 14 percent points. The partner countries with a high population having age and gender diversifies either encourage or discourage the demand for milk and milk products exports from Pakistan. Since, milk and milk products are essential dietary items for elders as compared to adolescents, adults, and middle-aged persons. Thus, any increase in the population having age between 15 to 64 in the importing countries decreases the milk and milk products exports from Pakistan whereas an increase in population having age 65 and above in the importing countries increases the milk and milk products exports from Pakistan. Similarly, it

is evident from the literature that as compared to females, males consume more milk and milk product. Thus, any increase in male population in the importing countries increases the milk and milk products exports from Pakistan.

In model (2) the coefficient of male population is significant at the level of 10%, with a negative sign. This shows that a one percent point increase in male population in the importing countries decreases the meat exports from Pakistan by 11 percent points. It is evident from the literature that males consume less meat as compared to females. Thus, any increase in male population in the importing countries decreases the meat exports from Pakistan. The partner nations with large populations who are diverse in terms of age and gender either support or oppose the desire for Pakistani meat exports. As opposed to children, adults, and those in their middle years, meat is a necessary component of the diet for elders. Results from model (3) show that population age between 0–14 years is significant at 10 percent level with a negative sign. This demonstrates that a 1%-point rise in population having age 0–14 years in the importing countries decreases the fishery exports from Pakistan by 2.3 percent points. Since, fish is essential dietary items for elders, adolescents, adults, and middle-aged persons and not for children. Thus, any increase in the population having age 0–14 years in the importing countries decreases the fishery exports from Pakistan. Pham et al. (2016) also found similar result when analyzed the factors that affecting fishery exports from Vietnam to USA and European markets.

In model (2) and model (3) the coefficient of exchange rate is significant at 5% and 1% level with negative sign. This shows that a one percent point increase in exchange rate in the importing countries decreases the meat exports from Pakistan by 0.0003 percent points. This outcome is in line with findings by Maitah et al. (2016). Furthermore, a one percent point increase in exchange rate in the importing countries decreases the fishery exports from Pakistan by 0.0004 percent points. This outcome is consistent with the findings of Pham et al. (2016) and Bose et al. (2019). The fluctuation in a currency's value is demonstrated by the exchange rate. When exchange rates increase in the countries where Pakistan exports its meat and fishery then the domestic currencies in these countries devalue, local goods in countries that import meat and fishery become less expensive, as a result, foreign demand for Pakistani meat and fishery declines.

In model (1) the coefficients of the free trade agreement and SAFTA (South Asian Free Trade Area) are negative and significant at 1 percent level whereas the coefficients of the TIFA (Trade and Investment Framework Agreement) is positive and significant at the 1% level. This demonstrates the countries who signed free

trade agreement and SAFTA with Pakistan received 44 and 217 times lower exports of milk and milk products from Pakistan as compared to countries who signed transit trade agreement with Pakistan. On the other hand, countries who signed TIFA with Pakistan received 33 times higher exports of milk and milk products from Pakistan as compared to countries who signed transit trade agreement with Pakistan. TIFA is signed between the governments of Pakistan and USA. This agreement promoted trade, strengthen economic interrelationship, remove trade barriers, resolve trade problems, and eliminate non-tariff trade barriers between the two countries (GOP, 2023a, 2023b). Consequently, along with other products, this agreement increases exports of milk and milk products from Pakistan to USA. This does not necessarily mean that free trade agreements and SAFTA are not good agreements for Pakistan. Although these agreements did not increase milk and milk products exports from Pakistan, but it may increase other products exports from Pakistan to partner countries.

In model (2) the coefficient of the free trade agreement is negative and significant at 1 percent level. This shows that the countries who signed free trade agreement with Pakistan received 14 times lower exports of meat from Pakistan as compared to countries who signed transit trade agreement with Pakistan. In model (3) the coefficients of the free trade agreement, trade in goods agreement, and TIFA are negative and significant at 1 percent level while the coefficients of the preferential trade agreement, SAFTA, and transit trade agreement are positive and significant at 1% level. This shows that the countries who signed free trade agreement, trade in goods agreement, and TIFA with Pakistan received 7, 10, and 18 times lower exports of fishery from Pakistan as compared to countries who did not signed any trade agreement with Pakistan. On the other hand, countries who signed preferential trade agreement, SAFTA, and transit trade agreement with Pakistan received 29, 17, and 15 times higher exports of fishery from Pakistan as compared to countries who did not sign any trade agreement with Pakistan. Various preferential trade agreement is signed between the Pakistan and other countries such that Pakistan-Uzbekistan Preferential Trade Agreement (PTA), Pak-Iran Preferential Trade Agreement, Pak-Mauritius Preferential Trade Agreement, and Pak-Indonesia Preferential Trade Agreement. These agreements strengthen the economic relationship, increase the volume of trade in goods, promoted a more predictable and secure environment for the sustainable growth of trade, expand mutual trade, and removed barriers to trade between the contracting parties. SAFTA is signed between the South Asian countries which mainly focused on tariff reduction. Similarly transit trade agreement is signed between the government of Pakistan and Afghanistan in order to facilitate the free movement of traded goods

between the two countries (GOP, 2023a, 2023b). Consequently, along with other products, this agreement increases exports of fishery from Pakistan to trade partner countries.

In model (1) the coefficients of Central Asia, East Asia, Southeast Asia, Middle East, East Africa, Southern Africa, and Northwestern Europe are significant at 1 percent level with negative signs while North America's a has a significant coefficient at 1% level. This shows that the countries located in Central Asia, East Asia, Southeast Asia, Middle East, East Africa, Southern Africa, and Northwestern Europe receive 197, 109, 105, 176, 65, 17, and 99 times lower exports of milk and milk products from Pakistan as compared to countries located in South Asia and Australia. On the other hand, countries located in North America receive 31 times higher exports of milk and milk products from Pakistan as compared to countries located in South Asia and Australia. The possible reason for these results may be the milk and milk products markets in Central Asia, East Asia, Southeast Asia, Middle East, East Africa, Southern Africa, and Northwestern Europe are not so much profitable for the milk and milk product exporters of Pakistan while milk and milk products markets in North America, South Asia and Australia may be more profitable venues for Pakistani milk exporters.

In model (2) the coefficient of Western Europe is significant at 1 percent level with negative sign. This shows that the countries located in Western Europe receive 14 times lower exports of meat from Pakistan as compared to countries located in South and East Asia. The possible reason for these results may be the meat markets in Western Europe are not so much profitable for the meat exporters of Pakistan while meat markets in South and East Asia may be more profitable venues for Pakistani meat exporters. In model (3) the coefficients of East Asia, North America, Northwestern Europe, and Southern Africa are significant at 1 percent level with negative signs while the Western Asia and Middle East coefficients are significant at 5 and 1 percent level having a positive sign. This shows that the countries located in East Asia, North America, Northwestern Europe, and Southern Africa receive 19, 68, 29, and 47 times lower exports of fishery from Pakistan as compared to countries located in South Asia and Southwestern Europe. On the other hand, countries located in Western Asia and Middle East received 6 and 17 times higher exports of fishery from Pakistan as compared to countries located in South Asia and Southwestern Europe. The possible reason for these results may be the fishery markets in East Asia, North America, Northwestern Europe, and Southern Africa are not so much profitable for the fishery exporters of Pakistan while fishery markets in Western Asia, Middle

East, South Asia, and Southwestern Europe may be more profitable venues for Pakistani fishery exporters.

5. Conclusion and Recommendations

Results from gravity model that increase in income in importing countries increases milk and milk products, meat, and fishery exports from Pakistan suggest that Pakistan must divert their exports from lower and middle-income countries to high-income countries. However, it is evident from this study that Pakistan mostly exports its milk and milk products to lower and middle-income countries like Afghanistan, Tajikistan, Hong Kong, Kenya, Mozambique, South Korea, and South Africa. Although, the country also exports its milk and milk products to high-income countries like United Kingdom, Singapore, UAE, USA, Canada, and Saudi Arabia but the amounts of these exports are still minimal. Thus, it is recommended that Pakistani exporters must increase their milk and milk products exports to high-income countries. Moreover, Pakistan meat exports is limited to few high-income countries like UAE, Kuwait, Saudi Arabia, Qatar, Bahrain, Oman, Germany, and United Kingdom. Development of advisory council/platform by federal or provincial governments can play an important role to run the meat export value chain efficiently and to explore new markets. The establishment of e-commerce portal at federal or provincial level is another option which can boost the meat exports from Pakistan. Besides, there are huge halal food markets among the Muslim population countries all over the world. Exports of meat from Pakistan may be significantly increased in quality and quantity by creating and selling Halal meat and products. Although Pakistan's fisheries sector has a strong export potential in high-income nations, the European Union and Middle Eastern countries have banned fish imports from Pakistan due to Sanitary and Phytosanitary (SPS) concerns. The implementation of cutting-edge food safety management techniques like Hazard Analysis and Critical Control Point (HACCP) by fish processors can also increase exports of fishery from Pakistan.

Results from the population variables are also relevant for exporters and playmakers in Pakistan. The results that an increase in the population of age group of 65 and above increases milk and milk products exports is an impetus for Pakistani milk and milk products exporters to increase their exports to countries having relatively older population. Similarly, increasing meat exports to countries having high female population and increasing fishery exports to countries having less children population can increase the exports earning of the country. The countries having depreciated currencies imports less meat and fishery from Pakistan. These results are also an impetus for Pakistani exporters to divert heir

exports to countries having sable currencies. The results that trade agreements like TIFA increase milk and milk products exports from Pakistan, transit trade agreements increase meat exports, and preferential trade agreements increase fishery exports are also important. This laid responsibility on the country's Commerce Ministry to take necessary actions for signing TIFA like agreements with milk and milk products importing countries, transit trade agreements with meat importing countries, and preferential trade agreements with countries that importing fish from Pakistan. The result from regional dummies indicates that potential markets are exists for Pakistani milk and milk products, meat, and fishery in North America, South and East Asia, Western Asia, and Middle East. This again laid responsibility on Ministry of Commerce to take necessary actions for facilitating trade with countries located in the above-mentioned regions.

However, the results of the study are satisfactory but further analysis may be merited. We are focused on three agriculture commodities such that milk and milk products, meat and fisheries that are exporting from Pakistan to other countries. There is a need for further research to replicate the same analysis for other important agriculture commodities like poultry, cotton, sugar, vegetables, fruits etc. that are being exported from Pakistan to other countries. A large number of other nations are also listed among the leading exporters of milk, meat, and fishery. Future scholars can repeat this study on the exports of milk, meat, and fishery from these nations.

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Appendix

Table A1: Results of gravity model for milk and milk products exports

Model:	(1)	(2)	(3)
Dependent variable: Value of milk and milk products exports (ln)	Pooled OLS	Time fixed effect	Country fixed effect
Income:			
Per capita income (ln)	1.854**	4.022***	0.772
	(0.807)	(1.241)	(0.932)
Distance:			
Distance	-0.00533***	-0.0105***	-0.0150***
	(0.00116)	(0.00237)	(0.00440)
Population:			
Population 0-14 (ln)	-4.905*	-1.472	-3.888
	(2.832)	(2.989)	(2.844)
Population 15-64 (ln)	-10.87	-8.667	-14.20**
	(7.083)	(7.153)	(7.175)
Population 65+ (ln)	2.965*	7.950***	3.160*
	(1.771)	(2.165)	(1.758)
Population-male (ln)	13.00*	16.15**	11.43*
	(6.812)	(7.126)	(6.790)
Population-female (ln)	2.268	-9.008	7.703
	(6.687)	(7.177)	(7.050)
Exchange rate:			
Exchange rate	-0.00358	-0.00305	-0.00287
	(0.00504)	(0.00509)	(0.00500)
Trade agreements:			
Transit Trade Agreement (Reference)			
Free trade agreement (Dummy)	-10.36	-16.03**	-26.42***
	(6.636)	(6.981)	(9.662)
SAFTA (Dummy)	-24.16***	-53.71***	-115.5***
	(7.221)	(14.53)	(40.85)
TIFA (Dummy)	6.054**	9.100***	19.45***
	(2.757)	(2.823)	(6.505)
Region:			
South Asia and Australia (Reference)			
Central Asia (Dummy)	-23.03***	-48.61***	-106.2***
	(6.986)	(12.45)	(37.27)
East Asia (Dummy)	-17.12***	-36.25***	-56.34***
	(6.591)	(10.42)	(18.47)
Southeast Asia (Dummy)	-18.89***	-34.87***	-57.29***
	(4.715)	(7.945)	(17.55)
Middle East (Dummy)	-27.82***	-56.51***	-93.35***
	(7.046)	(13.99)	(29.70)
North America (Dummy)	5.901***	11.55***	16.24***
	(1.665)	(2.627)	(4.842)
East Africa (Dummy)	-1.676	-6.124	-35.16**
	(7.218)	(7.844)	(16.39)
Southern Africa (Dummy)	1.374	3.701**	-11.27*
	(1.759)	(1.844)	(5.836)

Northwestern Europe (Dummy)	-19.78***	-38.33***	-51.99***
	(3.785)	(8.716)	(14.67)
	No	Yes	No
	No	No	Yes
Constant	0.489	-5.796	74.92*
	(19.71)	(23.57)	(38.17)
Observations	266	266	266
R-squared	0.691	0.730	0.698
F-statistics	29***	16.7****	28.3***
Root MSE	1.8	1.7	1.8

Source: calculated by the authors using a panel of 14 Pakistani trading partners.
Parentheses around standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A2. Results of gravity model for meat exports

Model:	(4)	(5)	(6)
Dependent variable: Value of meat exports (ln)	Pooled OLS	Time fixed effect	Country fixed effect
Income:			
Per capita income (ln)	0.269	0.642	2.122**
	(0.444)	(0.449)	(0.874)
Distance:			
Distance	-0.00130*	-0.00142**	-0.00152
	(0.000710)	(0.000702)	(0.00279)
Population:			
Population 0-14 (ln)	-6.581***	-1.337	-6.126**
	(1.975)	(2.472)	(2.461)
Population 15-64 (ln)	8.279	12.78**	9.724*
	(5.587)	(5.861)	(5.534)
Population-male (ln)	-8.095*	-12.27**	-9.654*
	(4.812)	(5.070)	(5.034)
Population-female (ln)	7.509***	1.815	8.310***
	(2.838)	(3.299)	(2.985)
Exchange rate:			
Exchange rate	-0.000471***	-0.000395***	-0.000280**
	(0.000114)	(0.000117)	(0.000129)
Trade agreements:			
Transit Trade Agreement (Reference)			
Free trade agreement (Dummy)	-15.02***	-11.65***	-13.35***
	(2.754)	(2.970)	(2.830)
SAFTA (Dummy)	-5.008	-5.558	2.636
	(3.544)	(3.533)	(12.02)
Region:			
South and East Asia (Reference)			
Southeast Asia (Dummy)	0.914	0.987	1.400
	(1.342)	(1.383)	(1.342)
Middle East (Dummy)	-4.500	-5.166*	-3.003
	(2.838)	(2.835)	(5.377)

Western European (Dummy)	-15.79***	-12.11***	-16.49***
	(2.815)	(3.078)	(2.895)
Northwestern Europe (Dummy)	-9.665***	-6.505**	-11.51
	(2.694)	(2.792)	(10.12)
	No	Yes	No
	No	No	Yes
Constant	-0.368	-1.009	-38.20***
	(5.335)	(5.295)	(14.28)
Observations	209	209	209
R-squared	0.811	0.833	0.826
F-statistics	64.4***	28.5***	53.2***
Root MSE	1.3	1.3	1.3

Source: calculated by the authors using a panel of 14 Pakistani trading partners.
Parentheses around standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A3. Results of gravity model for fish exports

Model:	(7)	(8)	(9)
Dependent variable: Value of fish exports (ln)	Pooled OLS	Time fixed effect	Country fixed effect
Income:			
Per capita income (ln)	-0.0955	-0.133	1.185***
	(0.209)	(0.211)	(0.406)
Distance:			
Distance	0.000273**	0.000296***	0.00839***
	(0.000113)	(0.000114)	(0.00200)
Population:			
Population 0-14 (ln)	-3.657***	-3.781***	-1.308
	(0.905)	(0.918)	(1.225)
Population 15-64 (ln)	9.213***	9.520***	3.898
	(2.126)	(2.147)	(3.078)
Population 65+ (ln)	0.0628	0.0427	-0.486
	(0.391)	(0.418)	(0.675)
Population-male (ln)	-6.887***	-7.082***	-0.449
	(1.751)	(1.765)	(2.681)
Population-female (ln)	1.982	2.014	-0.0743
	(1.746)	(1.791)	(2.813)
Exchange rate:			
Exchange rate	0.00002	0.00002	-0.000350***
	(0.00002)	(0.00002)	(0.00007)
Trade agreements:			
No trade agreement (Reference)			
Free trade agreement (Dummy)	2.115***	2.126***	-7.210***
	(0.236)	(0.238)	(1.829)
Preferential trade agreement (Dummy)	0.437	0.437	26.77***
	(0.298)	(0.300)	(5.138)
SAFTA (Dummy)	1.724***	1.808***	15.38***
	(0.600)	(0.623)	(3.533)
Transit trade agreement (Dummy)	5.519***	5.630***	12.26***
	(0.656)	(0.686)	(3.188)

Trade in goods agreement (Dummy)	-4.581***	-4.601***	-8.504***
	(0.457)	(0.465)	(1.647)
TIFA (Dummy)	0.791	0.787	-16.53***
	(0.512)	(0.515)	(3.461)
Region:			
South Asia and Southwestern Europe (Reference)			
East Asia (Dummy)	0.833**	0.860**	-17.12***
	(0.412)	(0.415)	(3.666)
Southeast Asia (Dummy)	2.560***	2.606***	0.140
	(0.427)	(0.454)	(1.194)
Western Asia (Dummy)	4.469***	4.592***	4.390**
	(0.620)	(0.662)	(1.988)
Middle East (Dummy)	6.577***	6.719***	14.81***
	(0.753)	(0.789)	(4.419)
North America (Dummy)	-2.353***	-2.409***	-63.09***
	(0.600)	(0.604)	(13.52)
Northwestern Europe (Dummy)	-0.522	-0.450	-26.82***
	(0.456)	(0.461)	(5.000)
Southern Africa (Dummy)	0.122	0.109	-44.62***
	(0.535)	(0.554)	(9.484)
	No	Yes	No
	No	No	Yes
Constant	-6.120**	-5.865**	-54.09***
	(2.623)	(2.650)	(12.64)
Observations	589	589	589
R-squared	0.645	0.653	0.780
F-statistics	49***	26.5***	51.5***
Root MSE	1.4	1.4	1.1

Source: calculated by the authors using a panel of 14 Pakistani trading partners.
Parentheses around standard errors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.