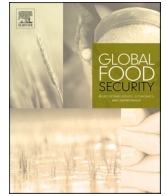




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Zoonotic diseases and the COVID-19 pandemic: Economic impacts on Somaliland's livestock exports to Saudi Arabia

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A B S T R A C T

The livestock sector plays an important socioeconomic role in the Somaliland economy, particularly through revenues from exports. The partial ban on livestock imports from Somalia imposed by Saudi Arabia due to animal health concerns has resulted in significant negative economic impacts for the government and the value chain actors involved. In previous years, the ban was lifted during the Hajj season to meet the increased demand for sheep and goats. However, given the current COVID-19 pandemic, the Saudi government decided to suspend Umrah visits in 2020 and only allowed a very restricted number of persons to attend the Hajj pilgrimage, thus obviating the need for livestock imports. This study quantified the economic losses associated the current partial livestock ban (started in November 2016) on Somali imports and the added impacts associated with COVID. We estimate that the cumulative losses for the Somaliland livestock sector and the government are US\$ 770 million over a five-year period. The additional losses imposed by the COVID pandemic, which restricted participation during the Hajj season, were estimated at US\$ 42 million. Livestock producers, who are mainly pastoralists, are the most affected stakeholder group, incurring around 54% of the total losses. Our study highlights the multifaceted, and often overlooked, socio-economic and socio-cultural impacts faced by the livestock sector and general economy in the wake of public health restrictions.

1. Introduction

Livestock is one of the main economic pillars of the Somali economy. In Somaliland (north-western part of Somalia), live animal exports are vital for its economy, contributing 85% of export earnings and 30% of the Gross Domestic Product (GDP) and directly and indirectly employs 70% of the population (Mugunieri et al., 2016). At the production level, the livestock value chain is mainly supplied by smallholder producers (pastoralists and agro-pastoralists) whose livelihoods are directly linked to livestock rearing and trade. Other actors involved and directly benefiting from the livestock export value chain include traders and agents of exporters, service providers (veterinarians, agro-vet shops, transporters, quarantine stations, port facilities, etc.), government (through tax receipts), and exporters.

Somaliland's livestock exports are mainly directed to the Saudi Arabian market (especially for sheep and goats) with other Middle East markets growing in importance (Yemen and Oman for cattle and UAE for sheep and goats). In 2016, Somaliland exported about 3 million heads of livestock to the Arabian Peninsula (AP) from Berbera Port, including 2.8 million sheep and goats to Saudi Arabia (SLCCIA, 2016). The Muslim Hajj season represents the peak season, and estimates of its importance on trade range between 52% (Mugunieri et al., 2016) and

70% (Majid, 2010) of total exports. The period between the months of Ramadan and Dhu Al Hijja (Islamic calendar) forms the main part of the peak season.

The current COVID-19 pandemic has considerably impacted this trade during the peak Ramadan period in 2020. The Saudi government decided to suspend the Umrah visits (those to the holy cities of Mecca and Medina outside of the Hajj period) from March 2020 (France24, 2020) and has drastically reduced and limited the number of persons to attend the Hajj pilgrimage. From a number of 2.5 million pilgrims who attended in 2019, the following year (2020) the number was a tiny fraction of around 10,000 persons (Aljazeera, 2020). In addition, the COVID-19 pandemic and the collapse in oil prices have negatively impacted the oil-dependent economies of the AP countries' economies (Arezki et al., 2020). These dynamics portend considerable losses for the Somaliland government and livestock value chain actors.

Livestock and livestock products are often consumed during religious and non-religious festivals across the world. While this paper focuses on the particular case of small ruminant slaughtering as part of the Hajj pilgrimage, the use, or consumption, of animals, meat, milk or eggs is common during numerous festivals like the Grand Magal of Touba in Senegal, Thanksgiving in the USA, Christmas in Europe and other countries, etc. These festivities represent an important market for

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producers and any disruption, like the current COVID-19 pandemic or an animal disease outbreak, could have heavy consequences on their incomes and profits, and highlight the often-overlooked quantification of the temporal impacts of animal diseases (Rich and Perry, 2011).

In this study, based on a combination of secondary data and the use of a recently developed system dynamics model of the small ruminant value chains, we assessed the economic costs and social implications for the Somaliland economy in general and small ruminants subsector in particular due to partial livestock export bans (temporarily lifted during the Hajj season) and the current COVID-19 pandemic and its subsequent reduction in the number of Hajj pilgrims.

2. The demand for livestock during seasonal festivals

Festive seasons and religious ceremonies represent an important market for livestock producers and traders. For instance, in the city of Touba – Senegal, the Grand Magal religious gathering receives every year between 4 to 5 million pilgrims mainly from Senegal (Gautret et al., 2020). During these festive days, special dishes are prepared like méchoui (roasted sheep) and Touffé that is a special dish with chicken or beef with an onion garlic sauce with potatoes. During Magal de Touba, people normally eat meats such as chicken, camel, sheep, and beef (CREATE!, 2018). In 2020, despite the COVID-19 pandemic, the Grand Magal was celebrated and millions of devoted persons attended the celebrations, with little to no impact on the progression of COVID-19 in Senegal at that time.

Increased demand for sheep during Tabaski (Eid al-Adha) also demonstrates the effect of religious festivities on livestock trade and is an important phenomenon in the livestock trade between countries in the Sahel region (Mauritania, Burkina Faso, Niger and Mali) and those in the West African coast (Senegal, Ghana, Côte d'Ivoire, Benin and Nigeria). During these festivities, many Muslim families sacrifice a young male sheep to commemorate the willingness of Abraham to obey God's command to sacrifice his son, before God intervened and provided him with a ram to sacrifice instead. Studies including Apolloni et al. (2019) and Valerio et al. (2020), report that cross border trade in sheep increases significantly in the months leading up to Tabaski. In 2014, when Tabaski occurred at the beginning of October, animal mobility data in Mauritania showed an increase in September–October in small-ruminant trades, involving more than 900,000 heads (Apolloni et al., 2018, 2019) compared to less than 200,000 during the preceding month of August (Apolloni et al., 2018). Another analysis by Williams et al. (2006) found that during Tabaski in Burkina Faso, sheep attracted much higher prices consistent with high demand. In Asia, Budisatria et al. (2002) for example cite the increased demand for small ruminants in Indonesia during Muslim celebrations.

Other cases of the importance of livestock in festivals are described in the literature. Akliu et al. (2007) cite the effects of religious festivals periodically shifting local demand and prices of poultry in Ethiopia. Soares et al. (2012) found that the number of avian influenza infections in both animals and birds in Southern China rose during the Chinese New Year festivities due to increase trade in live poultry. The same pattern has been observed in Thailand (Wiratsudakul et al., 2014), with higher trade up to 15 days before the festivities (including the Chinese New Year). Roesel et al. (2019) found that pork consumption in Uganda is mainly driven by festivals especially during religious celebrations like Easter and Christmas where demand peaks are observed during the months of April and December.

In the United States, turkey consumption represents an important agro-food industry. Data from the National Turkey Federation report the importance of festive and religious seasons on turkey consumption in the country. Around 46 million turkeys are consumed each Thanksgiving, with another 22 million turkeys on Christmas and 19 million turkeys on Easter (University of Illinois Extension, 2020). A recent study by Hayes et al. (2020) indicated that U.S. turkey industry, despite being vertically integrated with a modest number of producers who own most of the

supply chain, has been disrupted during the COVID-19 outbreak primarily from the demand side, as consumption switched from food away from home to food at home. The closure of much of the U.S. food service sector—that is, restaurants, school lunch programs, and cafeterias—had a severe impact on U.S. turkey producers (Hayes et al., 2020). The authors conducted a survey on turkey companies in late April 2020, showing important monetary losses (around US\$20 million/month losses for the turkey industry), especially for the retail sector (food at home).

3. The importance and complexity of the Saudi market for somaliland livestock exports

The Saudi market is by far the most important market for Somaliland sheep and goats (shoats) and camel exports. Between 2013 and 2018, the Saudi market accounted between 79% and 91% of small ruminant exports (Table 1). For cattle, Yemen and Oman are the main importers. Mugunieri et al. (2016) indicate the existence of two value chains for livestock imported from Somaliland: the commercial livestock value chain (outside of the Hajj season) and the sacrificial animal value chain during the Hajj season. These two value chains differ in their spatial coverage, contractual arrangements and grading, and pricing system applied. Most of the sacrificial livestock imports from Somaliland were handled by two dominant Saudi companies (Mugunieri et al., 2016).

Livestock imported for the sacrificial animal value chain during the Hajj season¹ fall under the prerogatives of the Islamic Development Bank (IsDB), which has been assigned the responsibility of financing the importation of the largest share of livestock to be sacrificed by pilgrims by the Saudi government. The Adahi Program (www.adhi.org) established by the IsDB facilitates the process for pilgrims to acquire an animal (generally shoat) through payment and reception of a coupon and to be assured that the animal will be sacrificed. Meat produced in this process is generally donated to the poor in Saudi Arabia or to other Islamic communities in developing countries.

During the last three decades, exports from Somalia specifically and from the Horn of Africa (HoA) region more generally have been affected by livestock bans imposed by importing countries (Saudi Arabia was the main initiator of the bans) because of animal diseases (essentially Rift Valley Fever – RVF and Foot and Mouth Disease - FMD). To reduce livestock disease issues and bans, Saudi livestock importers decided to invest and construct quarantine stations in the city of Berbera (Somaliland) close to the main export seaport. Upon arrival to the quarantine station, animals go through clinical inspection, sample collection for testing, and vaccination (Knight-Jones et al., 2014). Each exporter has a pen in the quarantine to keep animals for a period of time in accordance with the requirements of the importing country related to sourcing, pre-export quarantine, and testing. Animals are provided with water and feed at a cost (Mugunieri et al., 2016). The quarantine stations are equipped with laboratories for serology and bacteriology for virus isolation, detection of common livestock diseases, and identification and characterization of bacterial species. The use of diagnostic tests, vaccination and length of quarantine vary according to the requirements of different importing nations. Animals are examined throughout the quarantine period and rejected if diseased. Animals found to be healthy are issued with a health certificate, allowing them to go for export to the specified country (Knight-Jones et al., 2014). At the export terminus (Port of Berbera), the animals go through final inspection conducted by the port veterinary officer, after which (if successful) an export health certificate is issued. The transport vessel is also inspected and certified that it is adequate for livestock transportation. The Somaliland Chamber of Commerce provides a certificate of origin required by the importing

¹ For more details about the Hajj season, the animal sacrifice ritual and the specific value chain and services provided we refer the reader to the study by Mugunieri et al. (2016).

Table 1
Exports destinations of livestock from Berbera port (Somaliland).

Year	Shoats			Cattle			Camels		
	All	S.A.	% S.A.	All	S.A.	% S.A.	All	S.A.	% S.A.
2013	2,852,875	2,339,358	82%	202,548	6076	3%	73,789	72,313	98%
2014	3,054,416	2,412,989	79%	245,950	19,676	8%	63,385	57,047	90%
2015	3,159,883	2,875,494	91%	150,880	4526	3%	54,039	52,958	98%
2016	2,806,612	2,413,686	86%	151,288	13,616	9%	55,723	49,593	89%
2017	1,327,185	1,088,292	82%	107,610	0	0%	38	0	0%
2018	1,285,307	1,066,805	83%	103,937	2079	2%	787	0	0%

Shoats: sheep and goats; All: all destinations; S.A.: Saudi Arabia; % S.A.: market share of Saudi Arabia.
Source: own compilation from [SLCCIA \(2013, 2014, 2015, 2016, 2017, 2018\)](#)

country ([Mugunieri et al., 2016](#)). Upon arrival to the final destination, the animals are visually inspected, with some animal blood samples taken for disease testing, the full documentation verified, and animals kept for few days in the importing port quarantine area.

The current partial trade ban imposed by Saudi Arabia from November 2016 on livestock imports from Somalia was initiated due to the presence of Rift Valley Fever (RVF) and Foot and Mouth Disease (FMD) detections in a few consignments, and which has notably affected Somali livestock exports. No outbreak of RVF had been reported in Somaliland at the time the ban was instituted. Unlike previous bans,² the current ban is a partial ban as it is temporarily lifted during the Hajj season to allow for the import of enough animals required for the religious rites performed during Hajj. In addition to trade limitations induced by these bans, other challenges faced by livestock keepers in Somaliland include climate change and the frequent droughts affecting Somalia and the HoA region that put additional stress on natural resources (land degradation, feed and fodder availability, water availability, etc.) and significantly affect livestock quality and availability.

Given the ongoing partial ban by Saudi Arabia on Somali livestock exports, the number of animals exported to the kingdom has notably decreased. The average number of shoats exported during the previous four years (2013–2016) fell by around 57% from 2.5 million heads/year to around 1 million heads/year for the period 2017–2018. The export of camels has completely ceased, while those of cattle declined by more than 90% (calculations from [Table 1](#)). These reductions in export numbers have huge economic losses on the Somaliland livestock sector in particular and the overall economy.

4. Methodology and data

To assess the prospective direct economic impacts of the COVID-19 pandemic and other zoonotic diseases (essentially RVF and FMD), we used system dynamics (SD) modelling ([Forrester, 1961](#); [Richardson and Pugh, 1981](#); [Sterman, 2000](#); [Rich et al., 2011](#)). SD models are based on the theory of complex systems, using a graphical means of coding non-linear differential equations to model the evolution, dynamics, and interactions of a range of natural and/or social systems and behavior. In the context of value chains, SD models move beyond narratives of value chain processes towards frameworks that can provide ex-ante impacts of different investment scenarios associated with technical, marketing, and institutional changes. The use of SD modeling to study the impacts of interactions in livestock value chains and systems offers several advantages. The methodology enables modeling of biological, social, economic and other relationships in one platform ([Rich et al., 2011](#)). Second, the method offers a way of evaluating both the immediate and delayed impacts of various shocks ([Sterman, 2000](#)). Third, the method enables inclusion of the non-linear feedback effects associated with

² [Musa et al. \(2020\)](#) present a detailed descriptions of the different previous livestock bans imposed by Saudi Arabia and in some cases followed by other Arabian Peninsula countries. The 2000–2009 RVF ban imposed by Saudi Arabia was the longest one in the last decades.

actors in the different sub-components that form the system. Finally, SD allows the analyst to control for the effects of other dynamic factors that may influence the performance of the agriculture and livestock sectors alongside the effects attributable to the shock being explored.

The SD model used in this analysis has five interacting modules: (i) a pasture production and consumption module, (ii) a livestock population dynamics module, (iii) a livestock breeding module, (iv) a livestock export marketing module, and (v) a domestic slaughter animals marketing module ([Fig. 1](#)). The pasture production module calibrates the availability of pasture for livestock, based on the quality of land (measured in terms of four levels of degradation identified by [Vargas et al. \(2009\)](#) in Somaliland) and rainfall. The livestock population dynamics and herd breeding modules specify herd dynamics for male and female animals. Only adult females are considered in the breeding module and are categorized into three stocks: non-pregnant animals with no young animals; pregnant animals; and suckling adult females. The export marketing module includes the two major marketing channels identified by [Mugunieri et al. \(2016\)](#). These value chains are temporally grounded, based on marketing within and outside the Hajj season. Due to the dominance of the Saudi market, the export marketing module focuses on the importation and marketing of the small ruminants from Somaliland to that market. Only male animals are exported. The domestic marketing module therefore deals with domestic grade male animals and culled females. The model tracks numerous important indicators of performance in livestock production including volumes of animals produced and marketed, earnings from these sales, rates of land degradation and price changes driven by supply and demand of animals.

To assess the impacts of the Saudi animal export ban, simulations of total animal exports and earnings from both exports and local sales were compared for model runs under the status quo of the current partial

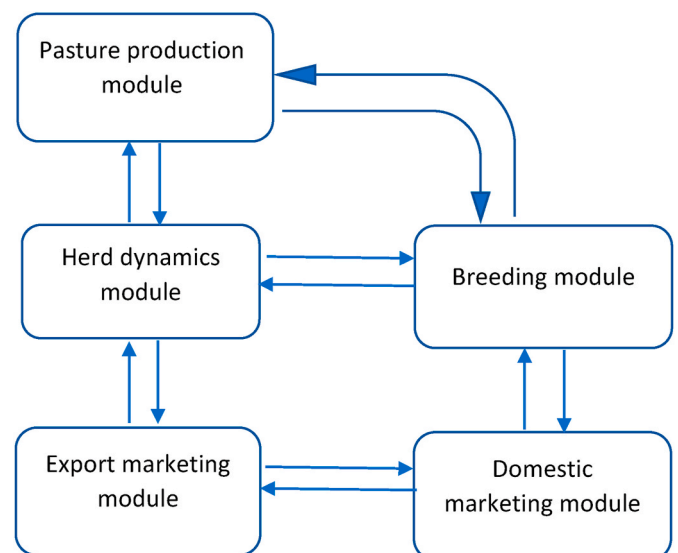


Fig. 1. Modules developed and used in the system dynamic model.

animal export trade ban. For the impacts of COVID-19, we assumed, considering the radical reduction of the number of pilgrims (a reduction of 99%) that the 2020 annual gathering of Muslims in Saudi Arabia for Hajj is essentially cancelled (in terms of livestock imports). We contrast both scenarios against a “no ban” scenario to compare how far these scenarios deviate from potential trade in the absence of trade bans. The model was run for 200 months (starting in August 2001) to allow it to stabilize before the partial ban by Saudi Arabia is instituted while the COVID-19 outbreak is included during the fourth year of the export ban.

Data were obtained from the Somaliland Chamber of Commerce, Industry and Agriculture (SLCCIA) which collects monthly data on livestock prices, grades and numbers in the main livestock market in Somaliland (Hargeisa, Burao, and Tog Wajaale) and data on livestock exports (by species and destination countries) from Berbera Port. We have also used time-series rainfall data from the World Bank climate change knowledge portal (climateknowledgeportal.worldbank.org) to construct a pasture production module which is a part of the SD model.

When developing the SD model and assessing the socio-economic costs of both the partial livestock ban and the cancelling of the Hajj season due to the COVID-19 pandemic, we have not only considered the losses incurred by the value chain actors due to the reduction in the number of animals exported, but also its direct and indirect repercussions on the local market and the overall economy, including the potential decrease in animal prices internally, land degradation due to low offtake and overgrazing, government export revenue losses, etc.

5. Results

5.1. Impacts of the current partial livestock ban due to animal health concerns

With the partial animal export trade ban by Saudi Arabia that started before the COVID-19 pandemic, the projected volumes of animal exports and total earnings from both export and domestic sales of animals are estimated at about 50%–60% of their projected potential about 3 million heads per year as noted by the no-ban scenario (Fig. 2). From past experience, the remaining 1.5 million head of shoats exported will follow different export routes to reach Saudi Arabia and other AP markets, such as the trade route from Somaliland to Yemen and then from Yemen to Saudi Arabia, Oman, and UAE. An alternative route is transiting through Djibouti and then exported to the Arabian Peninsula. However, these alternative trade routes are less lucrative than direct sales to Saudi Arabia since importers take profit from the livestock ban (higher supply than demand) and offer lower prices (Mtimet et al., 2020).

Income earnings are projected to fall to just 42% of their potential (Fig. 3). As indicated by Mtimet et al. (2020), these losses affect a range of actors, including those outside of the value chain. These include losses in revenue incurred by the Somaliland government and generally perceived through a specific per head tax applied to each specific animal species exported; the losses of revenue incurred by Berbera Port authorities; the losses in terms of foreign currency generated which translate into a devaluation of the local currency³; indirect losses to livestock producers, traders, and brokers due to the decrease in local market prices; losses for service providers (export quarantine stations, feed and fodder producers and traders, etc.); losses of jobs directly or indirectly associated with livestock exports and an increase of migration to urban areas; and increasing land and rangeland degradation due to low offtake rates, and losses related to deforestation processes due to an increase in other income-generating activities like wood cutting and charcoal making.

Table 2 presents the projected revenue losses suffered by different

³ In January 2015, 1 USD \approx 7300 SLSH (Somaliland Shilling). Four years later, in January 2019, 1 USD \approx 10,000 SLSH.

value chain actors due to the partial animal export ban by Saudi Arabia and to the COVID-19 pandemic. It shows the breakdown by value chain actor of the drop in income presented in Fig. 3. The revenue losses are estimated by multiplying the estimated losses with the corresponding proportions of the average export price received by exporters that accrue to the different value chain actors based on findings of a study by Negassa et al. (2008). The losses of revenue due to an export ban range from US\$ 42 million to US\$ 208 million per annum.

Previous studies also found large losses incurred by the Somali livestock sector due to earlier livestock bans. In Somaliland, Cagnolati et al. (2006) found that due to livestock export bans imposed by Arab countries in 1997 and 2001 due to an RVF outbreak in the horn of Africa countries, about 8.2 million small ruminants, 110,000 camels and 57,000 cattle were prevented from being exported, translating into an economic loss of US\$ 109 million for the first ban (February 1998–May 1999) and US\$326 million for the second ban (September 2000–December 2002). Soumaré et al. (2006) found that between February 1998 and December 2003, the Somaliland government suffered losses of income estimated at US\$ 40 million from potential taxes on export livestock and US\$ 5 million from vessel docking fees. Livestock exporters lost a net cumulative profit of US\$ 330 million, whereas estimated annual losses for producers were over US\$8 million. The study of Holleman (2002) that analyzed the first two years of the socio-economic impacts of the 2000–2009 livestock ban in Somaliland indicated that in addition to the financial losses of value chain actors, there are also other losses including the dramatic depreciation of the Somaliland shilling (the dollar exchange rate of the Somaliland shilling dropped from SLSH 3487 at the time when the ban was imposed in September 2000 to SLSH 6200 in December 2002), an increase in the rate of import duties, an increase in the migration to urban centers with negative consequences on urban poverty and unemployment, and environmental degradation due to increasing grazing pressure.

5.2. Impacts of the COVID-19 pandemic

The occurrence of COVID-19 is projected to further depress the volume of animal exports, because of the reduced number of pilgrims attending the Hajj gathering in Saudi Arabia, to about 46% of the potential (Fig. 2). This represents an additional decrease of 23% of the number of exported shoats (around 334 thousand heads less) compared to the situation with ban. The situation could have been worst, considering the cancellation of the Hajj season and the decline of the total number of shoats exported to Saudi Arabia (less than half compared to the previous years). The Somaliland exporters were able to increase their livestock exports to Oman, Yemen and Bahrein which relatively offset the drop in exports to Saudi Arabia.

When we combine the effects of the current livestock partial ban with the reduction in the number of pilgrims attending the Hajj season, the losses in income for the Somaliland livestock sector are estimated at around US\$207.48 million, or a 62% reduction compared to the potential earnings that would arise without any export bans (Fig. 3). The COVID-19 losses alone (without considering the ban) are around US\$ 42 million which represents 13% of the potential incomes without the ban (no-ban) in 2020, and it represents 25% of the losses due to the livestock ban losses for the same year.

The most affected value chain actors are livestock producers mainly pastoralists and smallholders (Table 2) and whose losses represent around 54% of the total losses. Producers are the backbone of the livestock sector in Somalia and in the Horn of Africa region. They represent the vulnerable node in the value chain especially during climatic shocks like droughts and floods, disease outbreaks, and livestock bans. Traders and their service providers incur losses representing 9% of the total losses but are less vulnerable compared to producers because they are generally involved in other economic activities. The Somaliland government loses tax revenues that represent about 8% of the total losses, excluding the indirect losses incurred due to the decrease in foreign

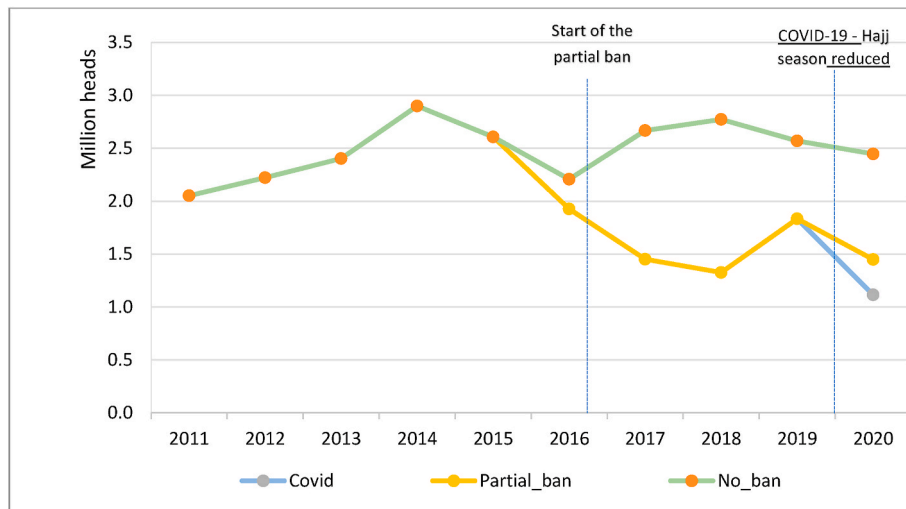


Fig. 2. Estimates of total number (heads) of small ruminants' exports from Somaliland with and without export ban and the COVID-19 pandemic.

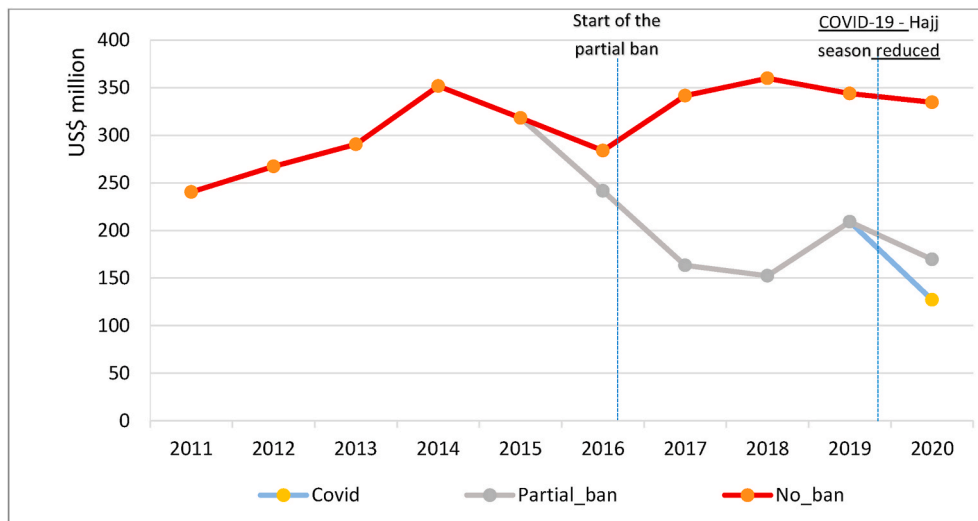


Fig. 3. Estimated level of income (US\$ per year) in the small ruminants' sector in Somaliland with and without export ban and the COVID-19 pandemic.

Table 2

Projected revenue losses (million US\$/year) among various actors in the Somaliland small ruminant value chain with and without partial export ban and with the COVID-19 pandemic.

	Year	Total Losses ^a	Producers	Traders & their service providers	Exporters	Government	Shipment companies	Other service providers to exporters
Partial ban by Saudi Arabia	2016	42.31 (15%)	22.85	3.81	4.65	3.38	5.09	2.54
	2017	178.22 (52%)	96.25	16.04	19.60	14.25	21.39	10.69
	2018	207.55 (58%)	112.08	18.68	22.83	16.60	24.91	12.45
	2019	134.77 (39%)	72.78	12.13	14.82	10.78	16.17	8.08
Partial ban + COVID-19	2020	207.48 (62.0%)	112.05	18.67	22.82	16.59	24.91	12.44

^a Number in brackets are percentages of potential revenues losses compared to a normal situation without ban and without reduction in number of pilgrims attending Hajj.

currency earnings and the devaluation of the local currency. The total economic losses for the first five years of the partial ban, including the reduction of the number of pilgrims attending Hajj last year, sum up to US\$ 770 million for only the Somaliland region.

It is important to note that Somaliland is heavily dependent on imports of food, fuel and manufactured products that are mainly financed using earnings from exports of livestock and livestock products (Somaliland Ministry of Planning and Development, 2011; Muhumed, 2016).

Thus, reduced earnings from animal exports will have direct implications on people's welfare including food security, due to the lack of financial resources to finance imports. Moreover, the purchasing power in households who also heavily depend on sale of animals as their main source of income (Soumaré et al., 2006; Leonard, 2007; Too et al., 2015) may fall, reducing their ability to access food and other necessities. Cagnolati et al. (2006) indicated that losses that occurred during the first 28 months of the Arab livestock export ban started in 2000 have

undermined pastoralists' purchasing power and weakened their coping mechanisms. It has also affected people employed along the marketing and export chain and those providing support services to the industry.

6. Conclusions

The livestock sector plays an important socio-economic role in the Horn of Africa region. Livestock exports from HoA countries to the Arabian Peninsula (AP) are among the main economic drivers of the sector. Somalia and Sudan are among the main livestock exporters to the AP, while Ethiopia and Kenya are increasing their meat exports to the region. The previous livestock bans imposed by Saudi Arabia and followed by the rest of the Gulf Cooperation Countries (GCC) on account of animal health concerns (i.e., Rift Valley Fever outbreaks) have heavily affected live animals exports and resulted in huge economic losses for export countries, especially Somalia where the livestock sector is among the most important ones.

COVID-19 presents a particularly unique case where public health concerns associated with zoonotic disease spread have wide ranging economic and cultural effects on supplying and recipient markets that go beyond standard impacts associated with export bans. In particular, the COVID-19 pandemic has disrupted important cultural events (Hajj) where livestock and the movements of both people and animals associated with such activities play a critical part.

In this study, we have provided a case study focused on Somaliland (northwestern region of Somalia) and assessed the additional costs imposed on Somaliland resulting from the drastic reduction in the demand for small ruminants from fewer pilgrims attending Hajj due to the COVID-19 pandemic. We estimate that the effect of COVID-19 pandemic alone is around US\$ 42 million, representing 13% of the Somaliland annual budget estimated at US\$ 330 million (somaliland.com, 2020). We consider these losses as lower-bound estimates since we have not accounted for potential losses that would persist for a period of time (over a year) due to the financial losses incurred by the Arabian Peninsula importing countries due to the COVID-19 pandemic and the collapse in oil prices which are affecting the local demand in these countries. If we consider the totality of impacts associated with both COVID-19 and previous trade bans that have been in place over the past five years, the total four-year cost is estimated at US\$ 770 million. If the rest of Somalia and other HoA livestock exporting countries were also included in the analysis, the overall cost would likely be in billions of US \$. Mtimet et al. (2020) estimated that the cost of the current partial livestock ban by Saudi Arabia for the entire HoA region for the first four years will be around US\$ 2.8 billion before the COVID-19 pandemic.

The most affected and fragile actors in the livestock value chain are the millions of smallholder producers (mainly pastoralists: men and women) and traders in the HoA whose livelihood is directly related to the export business. An important proportion of these producers will be pulled out of the business and this will generate urban migration and unemployment. While these impacts are not unique to COVID-19, it is important to emphasize that COVID-19 also has a host of intangible impacts on livestock demand and socio-cultural activities. The recovery of this demand and activities may not be immediate, and thus mitigation strategies, such as moving towards the diversification of markets, will be needed to manage this process.

The COVID-19 pandemic has put into the spot the issue related to zoonotic diseases that affect human health and in this particular case also restricts not only animal movements (livestock movement bans) but also humans movements as it is currently happening all over the world. As mentioned by Bett et al. (2020), pandemics may be increasing in frequency and Africa might become an important source of so-called "zoonotic pathogens". This means that better animal health systems should be put in place with animal traceability and stricter sanitary controls at the borders and quarantine stations, to avoid the widespread of diseases, economic and eventually human losses.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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