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Role of Buffalo in International Trade

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Abstract

The study analyzed the foreign trade performance of buffalo products using several indicators. These are the foreign trade structure by product and by Geographic distribution, time trend, instability, the FOB price ratio of buffalo to cattle revealed comparative advantage of tradable buffalo products. Thailand has the highest buffalo exports of live animals and hides. India exports the highest share of buffalo meat. Buffalo dairy products exports are rare due to lack of expanded dairy processing industries of buffalo milk and lacking of awareness towards the buffalo milk quality, which limits the demand for buffalo dairy products and shortage in supply beyond the domestic consumption. While buffalo stock all over the world represents 12% of the world bovine stock, its share in buffalo exports of meat is around 27% of the world bovine exports measured in tons in 2007. Such share shrinkages to 13.2% when measured in dollars. This shrinkage is due to lower prices of buffalo products than cattle products. The ratio of annual average “FOB price” of buffalo meat to bovine price was about one-half and for hides was about 40%, and for live buffalo was 14%. Reasons of the apparent lower FOB price of buffalo Exported Products than cattle are the low carcass weight of buffalo exported mainly for processing, Low quality and limited demand for buffalo hides, and commonly, exporting live buffalo as weaned calves. Expansion in exports of buffalo products requires expansion in supply, through the potentiality of higher productivity, rather than stock size, to reach in balance with available feeds.

Key Words: Buffalo productivity trend, Instability of foreign trade, Revealed Comparative Advantage

Introduction

Buffalo expands over 44 countries in four cotenants, Asia, Africa, Latin America, and Europe. The total buffalo stock increased from about 135 million heads in 1991 to around 165 million heads in 2007, i.e., at annual growth rate of 3.3%, however, such stock was concentrated in four countries, India (61%), China (20%), Pakistan (13%) and Egypt (2.2%).¹ Buffalo development has a significant role in alleviation of poverty in the developing countries where it is raised². Buffalo enterprise has also a main role in employment of rural communities' population.³ Accordingly, Development of foreign trade of buffalo meat and milk production is vital for the development strategy in the world particularly in most developing Asian and African countries

International trade is a crucial precondition for growth. It is thus an important element of peoples' desire to live in peace, prosperity, and freedom. This applies to the developed as well as the world's poorest countries. The challenge is, however, that the poorest countries in the world have not sufficiently managed to take advantage of the trade liberalization that has taken place since the end of World War II⁴. Therefore, the strategy for trade and development should be “A way out of poverty”. The world is constantly changing, and continuously we must learn to find new solutions to new challenges. The new strategy for trade since 2002, focusing on agriculture sustainability has been increased in order to help the developing countries to achieve poverty reduction and realize the millennium development goals.

The economic principles provide apparent evidences that there are strong links between foreign trade and economic growth, either at country level or for the whole world market. A comparison between several econometric market models applied for the Western Europe, Central Europe, the United States, Canada, and Mexico in order to analyze confirmed the impact of foreign trade and industry on development. It was noticed that there were positive effects of foreign trade on economic growth either due to the role of imports from the supply side or to the effect of exports from the demand side.⁵ Other studies have shown the positive effects of exports, but very few have focused on

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the positive role of imports. The main benefit from increasing exports is usually to increase the capacity to import intermediate inputs and other goods and services, which are necessary to foster domestic production of goods and services⁶

Thereof, this study made an economic appraisal of the foreign trade performance of buffalo products using several indicators. These indicators are the products and Geographic structure of the trade, time trend and annual changes, instability of trade quantity and price, the FOB price ratio of buffalo to cattle of each tradable product, as well as the revealed comparative advantage coefficient of the buffalo tradable products. The study ended by a profile for approaching the foreign trade development of buffalo products

Materials and Methods

The study used data published in the internet site of the (FAOSTAT), for the period 1980 until 2007. The linear time trend model of both quantity and FOB price of each exported buffalo product was estimated for the period (1980-2007), using the form in (Equation 1). The average annual growth rate in both quantity and FOB price of exported buffalo products were derived as shown by (Equation 2). The significance of such annual change depends upon the result of t-test for the significance of estimated regression coefficient of the time trend model. The inference test applied for the deviation of the estimated regression coefficient from zero.

Equation 1: $\hat{Y} = a + bT$

Equation 2: Average Annual Growth Rate = $b/\hat{Y} \times 100$

The instability coefficient in either the quantity or the price of each exported buffalo product was derived as in (Equation 3) from the estimated coefficient of determination (R^2) of estimated time trend model (Equation 1)

Equation 3: Instability Coefficient = $\frac{\sum(Y - \hat{Y})^2}{\sum(Y - \hat{U}_y)^2} = [1 - R^2]$

Where:

\hat{Y}_{ij} = the estimated quantity of the FOB price of the exported commodity (i) in the year (j)

T_j = The explanatory variable of time trend, applied as the time series of successive years (1980-2007) measured as serial numbers, 0, 1,2, ..., 28.

With respect to competitiveness of buffalo exports in the world market, the study estimated the F.O.B. price ratio of buffalo to cattle of each concerned product (meat, live animals and hide). The lower such ratio the higher is the competitiveness of buffalo product with cattle compatible product Equation 4)⁷

(Equation 4): Buffalo is competitive with Cattle $\frac{P_{bij}}{P_{cij}} > 1$ → Buffalo is not competitive with cattle

Where:

P_{bij} = Buffalo F.O.B. price of Product i in the year j

P_{cij} = Cattle F.O.B. price of Product i in the year j

Another indicator was applied to measure the Revealed Comparative Advantage of Buffalo Exports (RVCA)⁸. Such indicator is estimated from (Equation 5)

Equation 5: $RVCA_{aim} = (X_{aim}/X_{nim}) / (X_{arM}/X_{nrM})$

Where:

$RVCA_{aim}$ = comparative Advantage in exports of commodity (a) from country (i) to selected market (m)

X_{aim} = export value of commodity (a) from country (i) to selected market m

X_{nim} = value of total agricultural exports of country (i) (except commodity a) to selected market (m)

X_{arM} = export value of commodity (a) to the world market (M) (minus the export value of commodity (a) of country i to selected market, m)

X_{nrM} = Value of total agricultural exports to the world market (M) – (the export value of commodity (a) to the world market – (agricultural exports of country (i), except commodity (a), to the selected market (m))

Results and Discussion

Transit Trade of Buffalo Products

It sees that there is a significant apparent transit trade in two of the three tradable buffalo products in the world market. These two commodities are the buffalo live animal and buffalo hide. Table 1, Shows that, always, the world imported physical quantities of both live animals and hides surpass the comparable world exports, which reflect transit trade of buffalo products. The third tradable buffalo commodity in the world market is the buffalo meat which shows almost a complete centralization of exports, as well be seen later in the following sections of this study. To avoid double counting and transit trade, the study presented and analyzed only the exports stream, rather than imports, of these three world commodities.

Structure of Buffalo Products Trade

The available data have shown no buffalo dairy products in the world foreign trade stream (either imports or exports). The three main buffalo outputs appeared in the world trade data are the meat, live animals and hide. Even though, hide trade has not shown an aggregate world values or quantities of buffalo, these aggregate world data were calculated from adding up the individual counties foreign trade data. The exports structure is expressed as the relative importance of each one of these three buffalo exportable products in total bovine exports of the comparable bovine product.

In general, buffalo product exports (meat, live animals and hide) increased from about 51 million dollars representing 0.5% of bovine exports of the same set of products in 1980 to 888 million dollars, i.e. 5.2% of bovine exports of the same set of products in 2007, (Table 2). The annual average value of buffalo exports (meat, live animals, and hide) was 194 million dollars, i.e. 1.6% of the average bovine exports of the same set of products over the period (1980-2007).

The main exportable buffalo product along the period (1980-2007) was red meat. The annual average exported value was around 181.7 million dollars, which represented less than 4% of the bovine meat exports during the same period. However, the relative importance of buffalo meat value in the total value of bovine meat has gradually increased from less 1% in 1980 to about 14% in 2007. Such increase was a result of doubling the export value of buffalo meat between 1980 and 2007, (Table 2).

The other two exportable buffalo products, i.e. live animals and hide are of not only minor importance in buffalo export structure, but also their export value has decreased over time, (Table 2). On the average, the share of buffalo export value was about 0.10% and 0.22% of the value of bovine live animal's export and bovine hide export over the period (1980-2007). The value of live animals export was about 8 million dollars, i.e. 0.3% of bovine live animal export in 1980 and decreased to about 3.4 million dollars, i.e. 0.1% of bovine live animal exports in 2007, (Table 2). In addition, buffalo hide export has decreased from about 1.6 million dollars in 1980, i.e. 0.1% of bovine hide export value in the same year to 34 thousand dollars, i.e. 0.04% of the hide export value in 2007.

While the value of Buffalo meat exports has doubled between 1980 and 2007, the physical quantity has reached in 2007 ten times its quantity in 1980, i.e. increased from about 40 thousand tons in 1980 to 491 thousand tons in 2007, (Table 3). The share of the quantity of buffalo meat export in bovine meat export has increased from 2% in 1980 to more than 26% in 2007. The less importance of buffalo meat export measured as value than its measurement as physical quantity is due o the less price of buffalo meat than cattle meat, as will be shown later in this study.

Geographic Centralization of Buffalo Exports

(Table 4) shows that up to the year 1999 all buffalo meat exports were from India. Since 200 little quantity of buffalo meat delivered to the world market from other Asian countries that raise buffalo. However, such quantities from other countries rather than India had not reached more than 2% of all buffalo meat exports. Accordingly, there is a geographic centralization of buffalo meat exports from India. With respect to live animals, the geographic

centralization pattern of buffalo exports had changed over the period (1980-2007). It centralized in Nepal market during (1980-1986), i.e. 79% of total exports, then shifted to Loa Republic during (1986-1995), i.e. 82%, then to Thailand for two years (1996-1997), and returned to Loa Republic and Myanmar for the successive five years (Table 5). Recently, Myanmar has exported the bulk of buffalo live animals over the period (2005-2007). Those countries are not of the major four countries raising buffaloes, which are India, Pakistan, China, and Egypt. It is an additional evidence that such trade was transit, as shown earlier in a previous section of this study. The geographic centralization of buffalo hide export had restricted within two countries (Table 6). They are Thailand and Viet-Nam over the period (1980-2007). Even if such geographic centralization were true, i.e. from the same countries produce rather than transit, it would be negligible as both commodities (live animals and hide) share in buffalo exports was very small.

Growth in Buffalo Products Exports

Estimates of the time trend of buffalo exports and associated FOB price are shown in (Table 7). The results indicated that there was a significant growth in buffalo meat export market. The quantity increased by 4.7% a year over the period (1980-2007). However, such development in buffalo meat exports was associated with a significant decrease in the price per ton by 5.3% a year, which made the share of the exported buffalo meat value in the value of the world bovine meat exports about one-half (Table 2, Table 3).

The exported market of Buffalo live numbers per year has grown, significantly, faster than buffalo meat exports. The average annual growth rate in the exported numbers of live buffaloes was about two folds that of buffalo meat, i.e. at about 10. % a year. In addition, the associated F.O.B. price per head of exported live buffalo was positive reached about 1% above the average annual level of FOB price.

The exported market of Buffalo hide had passed two distinct time trends. The first was during the decade (1980-1991), where the tonnage of exported buffalo hides expanded by 28% a year. However, over the two successive two decades (1990-2007), such tonnage decreased at an average annual rate of about 16%. The resultant was an annual decrease in the buffalo hide export value by 4.6% a year, over the period (1980-2007). It seems that the development in technology of the leather industry, particularly shoes manufacture, was behind such collapse in buffalo hide export market. The shoes industry has shifted to manufacturing the Slippers of the shoes from synthetic rubber materials rather than real buffalo hide. Even though, buffalo hide is very cheap but the synthetic materials are much cheaper and more durable and elastic, which makes walking, more comfortable. Therefore, the export F.O.B. price of buffalo hide per ton has shown a significant negative trend over the considered period.

Instability in Buffalo Products Exports

It is not only necessarily, to perform a positive significant growth rate of exports but the market stability is also a sufficient condition for exports development. The stability of the exports market should not be only in physical volumes but also should expand to price movements over time. The stable growth in exports is required to assure also stable domestic demand for inputs required for the concerned export industries, as the demand for inputs is a derived demand from the primary demand, which composes of both domestic and foreign demand for the outputs⁹. The demand for inputs includes not only raw materials but also labor employment. The generated income by exportable industries affects the GDP growth and then the economic growth. Accordingly, Stable growth of exports is effectively behind stable growth of domestic employment as well as the national economic growth and vice versa. Fluctuations in exports volume and/or prices affect negatively the domestic economic development of exporting countries.

Even though, the buffalo meat exports showed a relatively limited instability in the exported quantity of meat, i.e. around 21%, it was associated by a very high instability in the F.O.B. price per ton, i.e. around 80% a year, (Table 7). The numbers of buffalo live animal exports has increased at high significant growth rate over the last three decades (Table 7). Such growth was associated with significant instability in the exported number of animals, where the instability coefficient was very high (72%). Even though there was a high stability in F.O.B. price of exported buffalo live animals, it was associated with a significant decrease in the price level at an annual rate about -5%.

On the other hand, the export of buffalo hide did not only deteriorate in quantity sold during the last two decades with a negative annual change rate but also associated with a high instability coefficient in the exported tonnage a year, i.e. around 62%. The F.O.B. price of buffalo hide has showed not only a significant change in its level, but also a Fluctuation as apparent instability of about 38% per year (Table 7).

Revealed Comparative Advantage of Buffalo Exports

Buffalo product exports compete with other livestock products in the international market. Competition is on the market revenue. Considering the price ratio derived from (Equation 4) as indicator for buffalo exports competitiveness with cattle, the estimated buffalo to cattle price ratio in Table 8), (Table 9) and (Table 10), showed that buffalo meat, buffalo live animals and buffalo hide are all, in general, of high competitiveness with cattle in the world market. The estimated price ratio is almost in all years are less than one. For buffalo meat such ratio ranged between (0.30 – 0.6). For live animals, the price ratio decreased gradually from 0.8 in 1980 to 0.14 in 2007. For Buffalo, hide the ratio decreased from 1.97 in 1980 to 0.37 in the year 2007. Over the period, (1980-1985) the price ratio of buffalo hide to cattle hide in the international market was greater than one. Accordingly, up to the year 1985 buffalo hide had no competitive advantage with respect to cattle hide. Over the successive years after 1985, this ratio had become less than one and decreased gradually up to 0.37 in the year 2007.

As livestock edible products are of elastic demand, and then of lower price, it supposes to enjoy more batches of sale. However, the simple price ratio in (Equation 4) may hides the impact of less price of buffalo product due to less demand for buffalo products stemming from the consumer taste that my gives less preference to buffalo product than cattle product or due to the less quality of the buffalo output delivered to the international market. In addition, the less buffalo to cattle price ratio could be due to changes in the development in technology that has denied buffalo row material of buffalo hide for other less cost more durable synthetic product or for better quality cattle hide

Therefore, the revealed comparative advantage (RCA) as competitiveness indicator was applied to the buffalo export of meat, where India is almost the only exporter of buffalo meat. Thereof, (Table 11) shows the estimated average value of RCA for India exports of buffalo meat to the world within each successive five years during the period (1980-2007). However, the total agricultural exports in (Equation 5) were replaced by the total bovine exports. The results showed that India has high revealed comparative advantage in buffalo meat exports. Therefore, It looks economically acceptable to have almost all buffalo meat exports are delivered to the world market from Indian market.

Foreign Trade and Buffalo Development

Although the share of buffalo products in the international trade of bovine has shown a minor share, the total world stock of buffalo reached about 181 million heads in 2008, such stock was about 12% of bovine stock¹⁰. The buffalo stock increased at annual growth rate of 8.8%, between 2007 and 2008, i.e. about two and half folds its annual growth rate over the period 1991-2007⁸. Not only that but buffalo stock holding in other countries rather than the four major ones has increased to be about 13% in 2008, while it was only 8% in 2007⁸.

Expansion in buffalo products exports requires expansion in supply, by raising productivity rather than stock size to make production in balance with available feeds¹¹.

, shows that there is a potentiality to raise milking buffalo share in buffalo population structure from an average of 32%, to the proportion recognized in Italy, i.e. 63% in 2008. There is a potentiality to raise the average of milk yield from 1529 kilograms per milking head to the average recognized in Pakistan, i.e. 1935 Kilograms per milking head in 2008. With respect to meat, production (Table 13) shows that the off-take rate of slaughtered buffalo in the world is low. It was only 14% in 2008. There is a potentiality to approach at least the off-take rate of the buffalo population for slaughter in Egypt, i.e. 31%.

Policy adjustments reform programs

The gains of trade liberalization do not come about automatically. Development aid, trade related technical assistance, and market access must work closely together. The goal is to ensure that poor communities gain maximum benefits from free trade. Therefore, growth is not created by single efforts. It requires a long-term perspective as well as cohesive policies at both the local, regional, and international level.

To provide the environment for buffalo production increase via raising productivity requires readjustment of current policies and development programs, which include reform of the milk marketing system in the villages by overcoming the obstacle facing all efforts towards raising the buffalo productivity. The main obstacle to overcome such obstacle is the lack of an institutional framework in the rural area to expand the marketable rural supply and quality of milk for a fair price¹². The progressive farms in each region should be as a nucleus farm that provides the common

farms with improved genetic makeup, either as buffalo heifers or as bull semen, The A. I. units should be located on those farms to serve the village (region) herds¹³.

The governments should place great emphasis on the close interplay between development and trade policies. This is the key priority of this strategy. It is achieved through assistance at the country level to identify possibilities to exploit increased market access. Furthermore, environmental considerations must be recognized as a precondition for long-term growth.

Although the cornerstone of growth is the development of the private sector, the business environment must be improved in order to create incentives for entrepreneurship for small and medium sized enterprises. Consequently, this strategy should be accompanied by an action plan to support business. Such strategy shares the objective of alleviating poverty through economic growth, which in turn stems from trade and business development interdependency, as one will not be successful unless accompanied by the other.

Table 1 Excess in Buffalo Imports of live Animals and Hides above the Annual Exports

Year	Live animal (head)	Hide (ton)
1980	9782	3000
1981	18456	1837
1982	17534	3355
1983	12857	2732
1984	95695	1723
1985	38930	8281
1986	34159	17416
1987	14863	16591
1988	124	27994
1989	7412	29392
1990	2096	32688
1991	338	26899
1992	792	48567
1993	1122	61046
1994	632	64661
1995	91	40436
1996	158	40530
1997	293	54540
1998	509	40334
1999	110	29904
2000	66	20938
2001	149	10502
2002	762	49
2003	344	52
2004	12618	52
2005	15628	40
2006	13651	41
2007	13280	40

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation: Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 2 World Exports Structure of Buffalo Products (1980-2007)

Year	Meat (000 \$)			Live Animals(000 \$)			Hide (000\$)			Total Exports (000 \$)		
	Buffalo	Bovine		Buffalo	Bovine			Bovine		Buffalo	Bovine	
1980	43905	4,767,830	0.90%	4190	3,127,064	0.13%	1379	1,438,596	0.10%	49474	9,333,490	0.50%
1981	54177	4438874	1.20%	4219	3,106,450	0.14%	785	1,661,562	0.05%	59181	9,206,886	0.60%
1982	37180	4162913	0.90%	4637	2,713,065	0.17%	618	1,765,784	0.03%	42435	8,641,762	0.50%
1983	36244	3487496	1.00%	6586	2,488,752	0.26%	836	2,422,317	0.03%	43666	8,398,565	0.50%
1984	34199	3400246	1.00%	2402	2,409,971	0.10%	1121	2,284,553	0.05%	37722	8,094,770	0.50%
1985	35641	4507198	0.80%	1412	3,047,273	0.05%	951	2,708,521	0.04%	38004	10,262,992	0.40%
1986	37350	4996867	0.70%	8126	3,401,129	0.24%	25858	3,062,704	0.84%	71334	11,460,700	0.60%
1987	39310	5262469	0.70%	14754	3,928,516	0.38%	27687	3,522,370	0.79%	81751	12,713,355	0.60%
1988	40928	6104193	0.70%	14787	3,872,133	0.38%	22031	3,265,320	0.67%	77746	13,241,646	0.60%
1989	49171	6720885	0.70%	11150	4,263,282	0.26%	32038	3,591,843	0.89%	92359	14,576,010	0.60%
1990	66433	6635626	1.00%	3598	4,368,862	0.08%	31504	2,863,393	1.10%	101535	13,867,881	0.70%
1991	76643	6912258	1.10%	8535	4,995,263	0.17%	4463	2,978,693	0.15%	89641	14,886,214	0.60%
1992	73649	5724785	1.30%	8626	4,770,995	0.18%	4895	2,849,477	0.17%	87170	13,345,257	0.70%
1993	86828	5953004	1.50%	1530	5,249,481	0.03%	5712	3,251,978	0.18%	94070	14,454,463	0.70%
1994	143175	5985968	2.40%	2126	5,596,855	0.04%	5641	3,562,950	0.16%	150942	15,145,773	1.00%
1995	140399	4783021	2.90%	1127	4,610,900	0.02%	3498	3,486,717	0.10%	145024	12,880,638	1.10%
1996	171652	4693351	3.70%	1091	4,453,300	0.02%	2585	3,687,648	0.07%	175328	12,834,299	1.40%
1997	160949	4615523	3.50%	2468	4,492,128	0.05%	2239	2,897,036	0.08%	165656	12,004,687	1.40%
1998	152541	3948778	3.90%	9785	4,273,651	0.23%	2884	2,635,261	0.11%	165210	10,857,690	1.50%
1999	276773	3695822	7.50%	7482	4,296,465	0.17%	4031	3,331,252	0.12%	288286	11,323,539	2.50%
2000	244084	2753925	8.90%	8572	3,781,072	0.23%	4749	3,630,342	0.13%	257405	10,165,339	2.50%
2001	264222	3278565	8.10%	9114	4,264,594	0.21%	202	3,571,423	0.01%	273538	11,114,582	2.50%
2002	306116	3963559	7.70%	4551	4,140,831	0.11%	36	3,592,045	0.00%	310703	11,696,435	2.70%
2003	320886	3999009	8.00%	5500	4,370,054	0.13%	36	3,694,603	0.00%	326422	12,063,666	2.70%
2004	561539	4800759	11.70%	5063	5,043,934	0.10%	34	3,590,280	0.00%	566636	13,434,973	4.20%
2005	708268	5600187	12.60%	2515	6,052,640	0.04%	35	3,808,063	0.00%	710818	15,460,890	4.60%
2006	884200	6460368	13.70%	3386	6,533,746	0.05%	34	4,201,568	0.00%	887620	17,195,682	5.20%
2007	181680	4882794	3.70%	5930	4,171,031	0.14%	6699	3,036,659	0.22%	194309	12,090,484	1.60%
Annual Average	186719.4	4876295	3.83%	5830.786	4207980	0.14%	6877.893	3085463	0.22%	199428	12169738	1.64%

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation: Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009.

Table 3 Relative Importance of Buffalo Meat and Live Buffalo Exports in Bovine Exports

Year	Meat (tons)			Live Animals (tons)		
	Buffalo	Bovine	% of Buffalo	Buffalo	Bovine	%
1980	40067	2038217	2.00%	23737	7030910	0.30%
1981	38836	2028145	1.90%	11330	7267919	0.20%
1982	49779	1841502	2.70%	10688	7686528	0.10%
1983	33641	1894217	1.80%	11048	7094858	0.20%
1984	32610	1794627	1.80%	16665	6708834	0.20%
1985	37248	1841012	2.00%	6429	6401792	0.10%
1986	34810	2240686	1.60%	5062	7107714	0.10%
1987	37471	1871726	2.00%	25219	7377704	0.30%
1988	40123	1794862	2.20%	45956	7361299	0.60%
1989	48454	2213167	2.20%	45147	7306111	0.60%
1990	52211	2140518	2.40%	33381	8005187	0.40%
1991	69049	2374008	2.90%	12335	8349227	0.10%
1992	76365	2463857	3.10%	29662	9182124	0.30%
1993	82170	2120658	3.90%	32565	8919633	0.40%
1994	93590	2118368	4.40%	7658	9718557	0.10%
1995	131839	2011561	6.60%	9418	10346269	0.10%
1996	124575	1858844	6.70%	4931	8853528	0.10%
1997	150857	1911836	7.90%	5046	9358047	0.10%
1998	148411	1733383	8.60%	21905	9028360	0.20%
1999	155443	1582086	9.80%	61307	9361011	0.70%
2000	262567	1643006	16.00%	55615	9438863	0.60%
2001	233282	1362486	17.10%	78498	8793362	0.90%
2002	292765	1549903	18.90%	76368	9124314	0.80%
2003	319210	1563230	20.40%	40825	7951543	0.50%
2004	275861	1415733	19.50%	49500	8087046	0.60%
2005	428686	1639571	26.10%	51548	8291599	0.60%
2006	483100	1754588	27.50%	25069	9490044	0.30%
2007	490802	1856458	26.40%	33061	9084923	0.40%
Annual Average	152279.4	1880652	8.10%	29641.89	8311690	0.36%

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 4 Geographic centralization of Buffalo meat Exports

Year	Buffalo Meat Exports (Ton)		
	World	India	% in World Exports
1980	40067	40067	100
1981	38836	38836	100
1982	49779	49779	100
1983	33641	33641	100
1984	32610	32610	100
1985	37248	37248	100
1986	34810	34810	100
1987	37471	37471	100
1988	40123	40123	100
1989	48454	48454	100
1990	52211	52211	100
1991	69049	69049	100
1992	76365	76365	100
1993	82170	82170	100
1994	93590	93590	100
1995	131839	131839	100
1996	124575	124575	100
1997	150857	150857	100
1998	148411	148411	100
1999	155443	155443	100
2000	262567	262491	99.97
2001	233282	233052	99.9
2002	292765	292163	99.79
2003	319210	319087	99.96
2004	275861	275861	100
2005	428686	428686	100
2006	483100	473198	97.95
2007	490802	480429	97.89

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation: Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 5 Geographic centralization of exported buffalo live animals over the period (1980-2007)

year	country	Geographic centralization (% of total Buffalo Exports)
1980-1986	Nepal	78.87
1987-1995	Loa People's Democratic Republic	82.33
1996-1997	Thailand	83.81
1998-2004	Lao people's Democratic Republic	41.02
	Myanmar	50.96
2005-2007	Myanmar	86.07

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation: Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 6 Geographic centralization of exported buffalo hides in (1980-2007)

year	country	Geographic centralization
1980-1986	Thailand	76.01
1986-1991	Viet Nam	22.27
1992-2007	Viet Nam	84.72

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation: Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 7 Growth Rate and Instability of World exports buffalo products and FOB prices (1980-2007)

Commodity	element	Estimated Time Trend model	growth rate/yr %	R ²	Instability coefficient %
Buffalo meat	export quantity (tones)	$\hat{Y} = -70278 + 15349 T$ (-2.78)** (10.00)**	10.08	79.4	20.6
	FOB price (\$/kg)	$\hat{Y} = 0.921 + 0.011 T$ (13.56)** (2.58)**	1.02	20.4	79.6
Buffalo live animal	export quantity (head)	$\hat{Y} = 9301.2 + 1402.81 T$ (1.28) (3.21)**	4.73	28.4	71.7
	FOB price (\$/head)	$\hat{Y} = 428.4 - 12.85 T$ (35.14)** (-17.50)**	-5.31	91.9	8.1
Buffalo hide	export quantity (ton)	$\hat{Y} = 21413 - 813.32 T$ (3.85)** (-3.01)**	-15.8	37.6	62.4
	FOB price (\$/ton)	$\hat{Y} = 1.816 - 0.05 T$ (14.32)** (-6.55)**	-4.58	62.3	37.7

Values between parentheses is the calculated (t) value for the statistical inference of the estimated equation's parameters

Source: Estimated from the raw data of (Table 2, Table 3) and (Equation 1 and Equation 2)

Table 8 World F.O.B. Price ratio of Meat (Buffalo to Cattle) during (1980- 2007)

Year	Buffalo Meat (\$/kg)	Cattle Meat (\$/kg)	F.O.B. Price (Buffalo/ Cattle)
1980	1.01	2.51	0.40
1981	1.13	2.37	0.48
1982	1.09	2.45	0.44
1983	1.11	2.22	0.50
1984	1.11	1.96	0.57
1985	0.92	1.87	0.49
1986	1.02	2.03	0.51
1987	1.00	2.70	0.37
1988	0.98	2.98	0.33
1989	0.84	2.80	0.30
1990	0.94	3.19	0.29
1991	0.96	2.85	0.34
1992	1.00	2.86	0.35
1993	0.90	2.77	0.32
1994	0.93	2.90	0.32
1995	1.09	3.11	0.35
1996	1.13	2.68	0.42
1997	1.14	2.57	0.44
1998	1.08	2.81	0.39
1999	0.98	2.66	0.37
2000	1.05	2.48	0.43
2001	1.05	2.22	0.47
2002	0.90	2.40	0.38
2003	0.96	2.94	0.33
2004	1.16	3.23	0.36
2005	1.31	3.50	0.37
2006	1.47	3.85	0.38
2007	1.80	4.08	0.44

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation: Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 9 World F.O.B. Price ratio of Live Animal (Buffalo to Cattle) during (1980- 2007)

Year	Buffalo (\$/head)	Cattle (\$/head)	FOB price Ratio (Buffalo/ Cattle)
1980	366.43	446.37	0.82
1981	369.81	430.35	0.86
1982	394.74	404.16	0.98
1983	419.71	382.34	1.10
1984	395.20	370.91	1.07
1985	373.62	376.46	0.99
1986	278.94	428.83	0.65
1987	322.22	461.48	0.70
1988	321.05	535.01	0.60
1989	327.53	531.24	0.62
1990	334.02	533.40	0.63
1991	291.69	523.61	0.56
1992	287.74	544.85	0.53
1993	264.89	535.88	0.49
1994	199.79	540.42	0.37
1995	225.74	541.24	0.42
1996	228.55	520.96	0.44
1997	216.21	476.02	0.45
1998	112.67	498.49	0.23
1999	159.61	458.49	0.35
2000	134.53	457.09	0.29
2001	109.20	432.88	0.25
2002	119.34	470.33	0.25
2003	111.48	522.87	0.21
2004	111.11	543.02	0.20
2005	98.22	611.51	0.16
2006	100.32	639.21	0.16
2007	102.42	721.44	0.14

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation: Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 10 World F.O.B. Price ratio of Hide (Buffalo to Cattle) during (1980- 2007)

year	Buffalo (\$/ton)	Cattle (\$/ton)	FOB price Ratio (Buffalo/ Cattle)
1980	2.49	1.27	1.97
1981	1.61	1.14	1.42
1982	1.82	1.18	1.53
1983	1.78	1.25	1.43
1984	1.97	1.57	1.25
1985	1.95	1.48	1.31
1986	1.38	1.63	0.85
1987	0.89	1.84	0.49
1988	1.07	2.13	0.50
1989	0.99	1.98	0.50
1990	1.09	2.09	0.52
1991	1.13	1.76	0.64
1992	0.99	1.75	0.56
1993	0.93	1.66	0.56
1994	0.87	1.80	0.49
1995	1.32	1.96	0.67
1996	0.73	1.80	0.40
1997	0.68	1.78	0.38
1998	0.57	1.55	0.37
1999	0.38	1.44	0.26
2000	0.45	1.66	0.27
2001	0.49	1.87	0.26
2002	1.01	1.91	0.53
2003	0.69	2.01	0.34
2004	0.69	1.98	0.35
2005	0.85	1.96	0.43
2006	0.85	2.03	0.42
2007	0.85	2.28	0.37

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation: Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 11 Revealed Comparative Advantage (RVC) of buffalo meat export from India

Period	Average (RVC)
1980 -1985	9.29
1985 – 1989	9.40
1989 – 1993	9.10
1993 – 1997	8.63
1997 – 2001	9.07
2001 – 2007	9.56

Source: Estimated using (Equation 5), and exports data from Food and Agricultural Organization of the United Nation Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 12 Geographic Distribution of Buffalo Milk production in 2008

Country	2008				
	Stock (Head)	% of total stock	Milk Buffalo	% of Milk Buffalo	Yield (Kg/Milk Buffalo)
China	23271909	12.88%	5452000	23%	532
Egypt	5023162	2.78%	1650000	33%	1600
India	98595000	54.56%	38100000	39%	1598
Italy	294000	0.16%	186000	63%	1183
Pakistan	29883000	16.54%	10845000	36%	1935
Total % Averages	180702923	100.00%	58399702	32%	1529

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

Table 13 Geographic Distribution of Buffalo Meat production in 2008

Country	2008				
	Stock (Head)	% of total stock	Slaughtered Animals	% of Slaughtered	Carcass Weight
China	23271909	12.88%	3061750	13%	100
Egypt	5023162	2.78%	1550000	31%	174
India	98595000	54.56%	10846000	11%	138
Italy	294000	0.16%	10516	4%	228
Pakistan	29883000	16.54%	5940000	20%	119
Total, % and Averages	180702923	100.00%	24468941	14%	137

Source: Collected and Calculated from: Food and Agricultural Organization of the United Nation Statistical Data Base (FAOSTAT), Internet Site (www.fao.org), 15th of November 2009

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