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Status of Beef Cattle Production in Argentina Over the Last Decade and Its Prospects

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1. Introduction

Historically, beef cattle production has been one of the traditional activities and an important support to the economic growth of Argentina. This activity led the country to being inserted in the international market as a beef supplier, and placed it in the past as one of the world's largest beef exporters.

During 2001-2010, Argentina devoted an average of 84% of its beef production to the domestic market, on account of which it was exposed more to within-country changes than to international ones; an opposite situation to that of other South American countries where most beef is allocated to global markets.

The increase in soybean planting in Argentina led to its positioning as the crop with the largest planted area. It expanded from less than 40 thousand hectares at the beginning of the 70's [1] to 18.3 million hectares in the 2009/10 crop season [2]. Because of the steady increase in soybean production, cattle are being displaced from traditional production areas in Argentina's Pampa plains to other regions of the country.

In the course of the year 2006, misleading public policies intensified a process of strong intervention to ensure lower beef prices in the domestic market, which affected exports as well as domestic trade.

Although valuable information has been reported by several sources that emphasized different aspects of Argentina's beef cattle production [1, 3, 4, 5, 6, 7], this chapter is based mainly on local sources and it reviews and analyzes the information available on beef cattle: stock and its composition, relationship between cattle stock and human population, extraction rate, domestic consumption, production systems, territorial distribution, meat exports and health status over the period 2001-2010 and prospects. It also analyzes a particular non-traditional case of a province located in the west of the country.

2. Cattle stock and its composition

The number of beef cattle in Argentina experienced a sustained rise over the period 2001-2007. Since 2007, a sharp decline is recorded in cattle stock, which by the year 2010 had decreased by nearly 10 million head (Table 1).

Category	Year									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Cows	21.9	20.2	22.9	23.1	23.5	24.2	24.4	23.9	22.2	20.5
Calves	10.8	10.7	14.7	14.6	14.5	15.3	15.4	15.4	14.1	12.6
Heifers	7.0	7.2	8.0	8.2	7.9	8.0	8.3	7.9	7.7	6.9
Steers	7.8	8.9	10.5	11.1	11.3	10.9	10.8	10.7	10.6	9.1
Bulls	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.2	1.2
Without identification	0.1	0.3	--	--	--	--	--	--	--	--
Total stock	48.8	48.5	57.3	58.3	58.5	59.7	60.2	59.2	55.8	50.3

Source: Own preparation based on [8] Year 2001; [9] Year 2002; [10] Years 2003-2010

Table 1. Cattle stock evolution over the period 2001-2010 (million head) by category

The fluctuation of the cattle population in Argentina observed in Table 1 is not something new, because, to just mention an example, in 1977 there occurred the greatest liquidation of beef-cow herds in the country's cattle history, since cattle stock between that year and 1988 fell from 61.1 to 47.1 million head, which represented a 22.9% stock contraction [11].

From November 2005 on, misleading public policies intensified a process of strong intervention to ensure lower prices of beef in the domestic market, affecting exports as well as domestic trade. Some of the measures adopted by the National Government in terms of foreign trade were [11]:

- November 2005, a rise from 5 to 15% in export duties on beef cuts
- February 2006, creation of the Export Operations Register (ROE)
- March 2006, banning of beef exports for 180 days, except Hilton cuts
- May 2006, restriction of exports in the period June-November 2006 to 40% of the volume exported in the same period in 2005
- November 2006, restriction of monthly exports in the period December 2006-May 2007 to 50% of the average monthly volume exported in the period January-December 2005
- May 2008, restriction of exports to 540,000 tons per year

The public policies imposed were effective in the short term in keeping beef prices low in the domestic market, although in the medium term they favoured the process of beef cow liquidation. However, these policies had no influence on the high agricultural profitability, and did not reverse the existing difference between the last one and that from cattle production. As consequence of the government's intervention policy, the live weight price dropped, which reduced the profitability of cattle rearing, causing a strong sell-off of breeding cows, factors that explain the cattle stock decrease.

On the other hand, during the period 2007-2010, the national cattle herd drop was exacerbated by the worst drought in 70 years over 2008-2009 that affected about one third of the farm belt forcing some ranchers to sell off cattle [12].

3. Relationship between cattle stock and human population

The human population in the country was 36.3 million and 40.1 million in 2001 and 2010, respectively, which means an increase close to 11%. In turn, the cattle stock increased by only approximately 3% over the same period.

The beef cattle/inhabitant relationship was respectively 1.34, 1.53 and 1.25 for the years 2001, 2007 and 2010 [13, 14, 15]. The number of cattle head per inhabitant over the whole period analyzed here (2001-2010) was notoriously lower than the one the country had in 1952, which was 2.56 [3].

During 2010, Argentina's per capita cattle stock was higher than those in Brazil, Australia, United States of America (USA) and India, and lower than those in Uruguay and Paraguay, some of them competitors of Argentina in the world beef market (Table 2).

Country*	Cattle population (million head)**	Human population (million inhabitants)***	Cattle per capita
Uruguay	11.80	3.36	3.51
Paraguay	12.31	6.5	1.91
Argentina	48.95	40.41	1.21 [#]
Australia	26.73	22.30	1.20
Brazil	209.54	194.95	1.07
USA	93.88	309.35	0.30
India	210.20	1,224.62	0.17

[#]differs from the 1.25 value previously cited because of variation in the data source.

Source: Own preparation based on *[16]; **[17]; ***[18]

Table 2. Cattle population per capita in some of the main beef exporting countries in 2010

4. Cattle extraction rate

The number of animals slaughtered and the extraction rate in the country over the study period are shown in Table 3. The extraction rate (slaughter/beef cattle stock) was obtained from the stock cited in Table 1. In the year 2010 the extraction rate in the USA (37.6%) and Australia (31.1%) was higher than that in Argentina, whereas that Uruguay (18.6%), Brazil (14.0%), Paraguay (12.2%) and India (5.0%) had lower extraction rate [17, 19].

5. Beef domestic consumption

For many years, Argentina was the country with the highest per capita meat consumption worldwide. During the period considered, the year 2007 recorded the highest meat

consumption, 68.3 kg per capita, and 2010 the lowest, 56.3 kg per capita (Table 4). These figures contrast with the historical maximum recorded in 1956, with 100.8 kg per capita [21].

Year	Slaughter (million head*)	Extraction rate (%)
2001	11.6	23.8
2002	11.5	23.7
2003	12.5	21.8
2004	14.3	24.5
2005	14.4	24.6
2006	13.4	22.4
2007	15.0	24.9
2008	14.7	24.8
2009	16.1	28.9
2010	11.9	23.7

Source: Own preparation based on *[20]

Table 3. Argentina's cattle extraction rate over the period 2001-2010

Resurgence of the demand for beef since 2002 led to a rise in price that allowed a quick recovery of the cattle production profitability, influencing on the price of land in the Pampas cattle-rearing region, which quintupled in value between 2002 and 2008, with US\$ values of 377 and 1,950 per hectare, respectively [22].

For a long time, an undisputed paradigm of the beef market in Argentina was the inelasticity of the demand. Because beef is deeply rooted in the diet of the Argentines, a rise in price did not affect the amount of meat demanded, which continued to be strong. The decreasing per capita meat consumption has resulted in Argentina losing the first place in the ranking of countries that most consume meat. This structural change could be explained by an alteration of the factors determining the price-elasticity of beef demand, mainly thanks to availability of substitutes at competitive prices and to a new appraisal regarding the participation of the different products composing the typical diet of the consumers [21].

In relation to availability of substitutes, the great competitor for beef over the last years has been poultry meat. Consumption of poultry meat increased by 34% between 2001 and 2010, with consumption values being respectively 25.7 and 34.5 kg per capita [23, 24]. One kilogram of beef was equivalent to 2.1 and 2.5 kg of chicken in 2001 [25] and 2010 [24], respectively.

Despite meat consumption in Argentina decreased by some 11% in the cited period (Table 4), in 2010 the country continued to be, along with Uruguay with 55.5 kg per capita, the leading beef consumers in the world, compared for instance to the USA with 38.5, Brazil with 37.3, Australia with 35.3 and India with 1.8 kg per capita [26].

Year	Total apparent consumption (tons carcass weight equivalent*)	Human population**	Per capita consumption (kg)
2001	2,347,819	37,156,195	63.2
2002	2,181,066	37,515,632	58.1
2003	2,280,345	37,869,730	60.2
2004	2,395,806	38,226,051	62.7
2005	2,379,375	38,592,150	61.7
2006	2,475,541	38,970,611	63.5
2007	2,687,746	39,356,383	68.3
2008	2,705,482	39,745,613	68.1
2009	2,715,874	40,134,425	67.7
2010	2,305,917	40,518,951	56.9

Source: Own preparation based on *[27]; ** [14]

Table 4. Per capita beef meat apparent consumption in Argentina over the period 2001-2010

6. Cattle production systems

6.1. Classification

Feedlots are excluded in the methodology used in [27] to classify production systems but it takes into account:

- a. Cow-calf: ranchers with cows and without steers+yearling steers (17% of total national beef cattle stock)
- b. Ranchers with cows, steers and yearling steers. The variable selected to subdivide this stratum was the steer+yearling steer/total cows ratio
 - b1. Predominantly cow-calf: ratio lower than 0.2; cow-calf and finishing of part of own production (28 % of total national beef cattle stock)
 - b2. Complete cycle: ratio between 0.2 and 0.4; cow-calf and finishing of total or great part of own production (15 % of total national beef cattle stock)
 - b3. Finishing+cow-calf: ratio between 0.4 and 0.8; cow-calf and finishing of own and purchased production (17 % of total national beef cattle stock)
 - b4. Predominantly finishing: ratio higher than 0.8; cow-calf and finishing of own production and purchased production higher than b.3. (19 % of total national beef cattle stock)
 - b5. Finishing: ranchers with steer+yearling steer and without cows (4 % of total national beef cattle stock)

Although the classification in [27] does not include feedlots, it must be highlighted that for some time now they have been making an important contribution to cattle production, bringing a change to the traditional cattle system in Argentina, which had been eminently pastoral for years. The feedlot activity was not immune to government intervention, which resulted in fluctuations in use of the available infrastructure. At the beginning of the contribution of state subsidies in 2007, feedlots contributed 14% to total slaughter [1]. From that time on, the number of animals from feedlot destined for slaughter increased (Table 5).

During 2010, cattle feedlot occupancy amounted to 56%, a lower figure than the average for 2006-2010, which was 67% [28]. Although feedlots ceased to be subsidized in 2010, they continue to make a relevant contribution to the number of annually slaughtered animals in the country.

Year	National stock (head)*	Annual slaughter (head)**	Number of feedlot facilities	Slaughter of feedlot cattle	Slaughter from feedlots/annual slaughter (%)
2001	48,851,400	11,586,732		527,700***	4.6
2008	59,261,268	14,660,284	1,653&	3,436,125&	23.4
2009	55,803,147	16,053,031	2,213#	4,991,227#	31.1
2010	50,268,465	11,882,706	2,147#	3,714,557#	31.3

Source: Own preparation based on *[10]; **[20]; ***[8]; #[29]; &[30]

Table 5. Participation of feedlots in Argentina beef cattle slaughter

6.2. Description and 2001-2010 cost evolution of some production systems

6.2.1. Pastoral finishing

The technical scheme contemplates 80% of perennial pastures based on alfalfa, 20% of annual winter pastures and alfalfa hay, a stocking rate of 2 heads ha⁻¹, live weight at entry and exit of 180 and 440 kg, respectively, and a fattening cycle of 17.3 months. Costs in the period 2001-2010 were (mean and SD) US\$ 451.5 ± 130.4 ha⁻¹ equivalent to 521.3 ± 26.8 kg steer⁻¹. Despite in January 2011 the cost increased to 1,046 US\$ ha⁻¹, the cost in terms of kg steer⁻¹ showed no substantial variation as consequence of the fact that the price of steers rose as well [31].

6.2.2. Pastoral finishing with supplementation

This system is based on 70% of perennial pastures based on alfalfa, 30% of annual winter pastures and a supplementation (alfalfa hay, maize grain and protein nucleus) and a stocking rate of 3.5 heads ha⁻¹, live weight at entry and exit of 180 and 410 kg, respectively, and a fattening cycle of 13.1 months. The costs in the period 2001-2010 were (mean and SD) US\$ 1,050.0 ± 34.7 ha⁻¹ equivalent to 1,190.3 ± 39.9 kg steer⁻¹. Despite in January 2011 the cost increased to US\$ 2,493 ha⁻¹, the cost in terms of kg steer⁻¹ increased only to US\$ 1,234 as consequence of the fact steer prices were also raised [31].

Both systems are located in the Pampas region (West of Buenos Aires Province and South of Córdoba Province) [31].

6.2.3. Cow-calf production

This system is carried out in rangeland areas of the Pampas region (Southeast of Buenos Aires Province). Cows are fed some alfalfa hay as supplementary food. Calf crop is 80% and

stocking rate is 0.5 cow ha⁻¹. Costs in the period 2001-2010 were (mean and SD) US\$ 52.8 ± 13.4 ha⁻¹ equivalent to 58.1 ± 11.5 kg calf⁻¹ [31].

In the three production systems there was a significant linear increase in the price per hectare in the studied period: R² Adj.= 0.51, p=0.01 for pastoral finishing, R² Adj.= 0.57, p=0.007 for pastoral finishing with supplementation, and R² Adj.= 0.35, p=0.04 for cow-calf production.

6.2.4. Gross margin and meat production for some of the production systems

Based on the information in [27] was estimated the gross margin per kg of sold meat for all alternatives of cattle finishing and feedlot shown in Table 6. The mean values were US\$ 0.71 and 0.54 for pastoral finishing and feedlot, respectively.

	Systems								
	Cow-calf ¹	Cattle finishing ²		Complete cycle ³		Feedlot ⁴			
		Without suppl.	With suppl.	Area 1	Area 2	Hotel		Own	
						Cattle purchase		Cattle purchase	
						March	July	March	July
Gross margin ha ⁻¹	88.0	211.2	375.6	150.1	65.9				
Gross margin head ⁻¹						37.7	68.7	76.3	113.7
Meat production ha ⁻¹ year ⁻¹	72.2	278.0	571.0	165.0	55.8				

Source: Own preparation based on [27]

¹Cow-calf typical area (Cuenca del Salado, Buenos Aires Province)

²Western area of Buenos Aires Province

³Area 1: Central Southern Córdoba Province; Area 2: Semiarid La Pampa and San Luis Provinces

⁴Hotel: Rent structure and "know-how" offering cattle fattening services; Own: freelance entrepreneur; March and July: calf supply is higher in March than in July
suppl. = supplementation

Table 6. Gross margin (US\$) and meat production for some cattle production systems in June 2010

6.2.5. Calf/steer price ratio 2001-2010

Regarding cattle production systems, the purchase-to-sale ratio is a factor that should not be excluded for the analysis because of its effect on their viability. Historic prices (1985-2005) indicate that the calf price has been 10% higher than that of the steer [32]. The average price ratio of Aberdeen Angus calves and steers (Table 7) over the period 2001-2009 concurs with the cited historic value, even though in the years 2001, 2005 and 2006 there were values above that average, but always favoring the calf over the steer. The increased calf-steer ratio in 2010 begins to be a hint of the price ratio that followed later, until exceeding 40%. As of 2010, the highest rise in price for the calf compared to the steer can be explained by a lower supply of the former.

Year	Aberdeen Angus calf	Steer	Calf/steer ratio
2001	0.96	0.77	1.25
2002	0.50	0.47	1.06
2003	0.66	0.65	1.02
2004	0.73	0.71	1.03
2005	0.99	0.77	1.29
2006	0.92	0.79	1.16
2007	0.94	0.92	1.02
2008	1.08	1.08	1.00
2009	0.98	0.92	1.07
2010	2.18	1.71	1.27

Source: [33]

Table 7. Cattle prices (US\$ kg⁻¹) and calf/steer ratio over the period 2001-2010

7. Territorial distribution of cattle population

To analyze the territorial distribution of the beef cattle population, the provinces accounting for approximately 95% of the cattle stock were grouped into two zones. The Central-Eastern (CE) zone comprises the provinces historically producing beef cattle (Buenos Aires, Santa Fe, Córdoba, La Pampa and Entre Ríos) which keep the greatest number of cows. The other area, which was called North Eastern (NE) – North Western (NW) zone, to which cattle production displaced over the study period (Table 8) as result of agriculture intensification in the Central Eastern area.

During the period 2003-2010, the CE zone reduced its cattle inventories from 76.6 to 69.5 %, whilst the NE-NW zone increased its cattle herd from 18.4 to 25.3%. In the CE zone, the Provinces with higher stock losses were La Pampa, Córdoba and Buenos Aires with 38.4, 28.1 and 20.5%, respectively. Moreover, in the NE-NW zone, Misiones and Salta provinces increased their cattle stock by 69.8 and 86.8 %, respectively.

In spite of the fact that the NE-NW zone has increased its cattle herd, this increase does not compensate for the loss suffered by the CE zone and cannot be explained by territorial space because their land areas are comparable in size, 828.1 and 849.6 thousand km² respectively for the CE and NE-NW zones. The reason is that the conditions of production are not equal in different aspects that influence on production efficiency such as infrastructure, health, food, among others. Evidence to this is the calf-cow ratio during 2010, 65.8 and 51.8%, respectively, for CE and NE-NW zones (Table 9). This implies 14 less calves every 100 cows that have been displaced from the CE to the NE-NW zone if it is assumed that the calf-cow ratio is a variable that approximates the weaning index.

Fluctuation in the stock also involves the slaughter of female cattle, which varied among 42, 46, 42, 49 and a little more than 43% for the years 2001, 2004, 2006, 2009 and 2010, respectively considering that the limit value for maintaining the stock is about 43% [1]. Between 2009 and 2010 the number of cows and heifers continued to fall, which makes future restocking difficult. Table 10 illustrates the evolution of cows stock over the study

period and its territorial distribution by zone. Thus, the aforementioned is reinforced by the cow loss in the country that occurred between 2007 and 2010, which amounted to 3,883,266 cows, with the provinces losing the highest number of cows being Buenos Aires and La Pampa, both making up 63.4% of the total loss (2,460,086 cows).

Zone and Province	Year								
	2002	2003	2004	2005	2006	2007	2008	2009	2010
Central Eastern (CE)									
Buenos Aires	16.61	21.07	21.79	21.56	21.58	21.50	20.39	18.87	16.74
Córdoba	6.10	7.02	6.83	6.59	6.60	6.42	5.93	5.69	5.05
Santa Fe	6.15	6.96	7.14	7.25	7.45	7.70	7.59	7.07	6.44
Entre Ríos	3.81	4.61	4.67	4.64	4.87	4.78	4.78	4.63	4.14
La Pampa	3.69	4.19	4.00	4.04	4.06	4.02	3.85	3.18	2.58
Subtotal	36.36	43.86	44.42	44.09	44.55	44.42	42.53	39.44	34.95
CE/total (%)	74.9	76.6	76.3	75.4	74.6	73.8	71.8	70.7	69.5
North Eastern (NE) and North Western (NW)									
Corrientes	3.61	4.42	4.58	4.68	5.07	5.20	5.61	5.35	5.07
Chaco	1.98	2.20	2.45	2.37	2.49	2.56	2.76	2.66	2.42
Formosa	1.34	1.40	1.46	1.67	1.70	1.68	1.80	1.79	1.75
Santiago del Estero	1.04	1.16	1.23	1.22	1.25	1.37	1.51	1.53	1.40
Salta	0.49	0.56	0.62	0.69	0.76	0.88	0.97	1.02	1.05
Misiones	0.35	0.22	0.27	0.31	0.31	0.34	0.37	0.38	0.38
La Rioja	0.25	0.22	0.20	0.19	0.19	0.18	0.20	0.21	0.21
Catamarca	0.23	0.19	0.20	0.22	0.21	0.24	0.24	0.24	0.22
Tucumán	0.10	0.12	0.10	0.12	0.14	0.15	0.14	0.15	0.15
Jujuy	0.09	0.07	0.07	0.07	0.07	0.06	0.04	0.06	0.05
Subtotal	9.49	10.56	11.17	11.54	12.19	12.65	13.65	13.39	12.70
(NE) and (NW)/total (%)	19.6	18.4	19.2	19.8	20.4	21.0	23.0	24.0	25.3
Total country	48.54	57.25	58.24	58.44	59.72	60.17	59.26	55.80	50.27

Source: Own preparation based on [8, 10]

Table 8. Cattle displacement by zones over the period 2002-2010 (million head)

8. Cattle meat exports

In analyzing Argentina's beef exports over the decade, it is observed that both ends of the decade, years 2001 and 2010, the lowest export values in tons carcass weight equivalent were recorded (Table 11). Thus, exports were of 150,025 and 308,663 tons respectively for 2001 and 2010. The export average of the decade was of 468,439 tons with two peak export values being recorded in 2005 and 2009. Exports in 2005 and 2001 were the highest and lowest export values recorded since 1934 [34] with 771,942 tons for 2005. The drop in exports in 2001 occurred in a context of foreign markets closed by an outbreak of Foot and Mouth Disease (FMD). The increase in foreign sales, mostly between 2002 and 2005, was due to favorable conditions as result of increased international prices and lower worldwide supply because of animal health problems in some of the major beef exporting countries.

Zone and Province	Cows		Calves		Calf/cow (%)	
	2003	2010	2003	2010	2003	2010
Central Eastern (CE)						
Buenos Aires	8,459,775	7,004,706	6,362,850	5,199,002	75.2	74.2
Córdoba	2,576,079	1,958,439	1,574,957	1,151,538	61.1	58.8
Santa Fe	2,566,576	2,407,153	1,507,229	1,384,517	58.7	57.5
Entre Ríos	1,813,823	1,641,825	1,124,019	935,557	62.0	57.0
La Pampa	1,478,333	896,702	970,841	478,737	65.7	53.4
Subtotal	16,894,586	13,908,825	11,539,896	9,149,351	68.3	65.8
CE/total (%)	73.9	67.9	78.4	72.6		
North Eastern (NE) and North Western (NW)						
Corrientes	2,076,142	2,256,967	955,591	1,054,629	46.0	46.7
Chaco	926,542	1,019,506	508,366	555,558	54.9	54.5
Formosa	610,463	737,928	336,740	385,175	55.2	52.2
Santiago del Estero	471,551	544,312	277,480	318,355	58.8	58.5
Salta	224,425	390,423	117,139	236,767	52.2	60.6
Misiones	103,762	153,492	36,462	76,307	35.1	49.7
La Rioja	103,323	110,155	59,501	59,929	57.6	54.4
Catamarca	80,986	93,199	39,962	56,965	49.3	61.1
Tucumán	48,890	58,085	25,967	34,916	53.1	60.1
Jujuy	28,640	20,391	16,024	11,360	55.9	55.7
Subtotal	4,674,724	5,384,458	2,373,232	2,789,961	50.8	51.8
NE and NW/total (%)	20.4	26.3	16.1	22.2		
Total country	22,864,159	20,469,240	14,719,545	12,595,096	64.4	61.5

Source: Own preparation based on [10]

Table 9. Calf-cow ratio by zones and Provinces in 2003 and 2010

The export value, as percentage of cattle meat annual production, during 2010 was lower than those of Australia, Canada, India and Brazil that allocated 65.5, 41.1, 32.3 and 17.1%, respectively, but higher than those of USA, Mexico and European Union (EU), with 8.7, 5.9 and 4.2%, respectively [35].

Cattle meat exports by product category and their value over the period 2001-2010 and Argentina beef exports, and their value and destination countries during 2010 are presented in Table 12 and Table 13, respectively. Except for 2001, the greatest export volumes correspond to chilled and frozen meat (Table 12). The decline in sales during 2010 is indicative of the loss of presence of Argentina cattle meat in the international beef market. In 2010, the primary destination of non-Hilton chilled cuts and frozen meat was Russia, whereas the major purchaser of Hilton cuts was Germany (Table 13).

The Hilton Quota is an export quota of high-quality high-value boneless beef cuts that the EU grants to beef producing and exporting countries. Argentina is the country having the highest percentage of this quota, with 28,000 tons year⁻¹ in 2010. Other supplying countries are Brazil, Uruguay, Paraguay, USA, Canada, Australia and New Zealand. Beef cuts included in the quota are rump and loin, strip loin, rump, tender loin, silver side, top side and knuckle. The 25,639 tons of Hilton cuts exported in 2010 did not fulfill the quota allotted for that year.

Zone and Province	Year								
	2002	2003	2004	2005	2006	2007	2008	2009	2010
Central Eastern (CE)									
Buenos Aires	7.08	8.46	8.75	8.79	8.94	8.91	8.47	7.75	7.00
Córdoba	2.22	2.58	2.49	2.44	2.46	2.40	2.27	2.15	1.96
Santa Fe	2.33	2.57	2.59	2.65	2.75	2.84	2.82	2.54	2.41
Entre Ríos	1.62	1.81	1.81	1.84	1.92	1.90	1.85	1.76	1.64
La Pampa	1.33	1.48	1.40	1.45	1.47	1.45	1.41	1.14	0.90
Subtotal	14.58	16.89	17.04	17.16	17.54	17.50	16.81	15.34	13.91
CE/total (%)	72.2	73.9	73.8	73.1	72.6	71.9	70.4	69.0	67.9
North Eastern (NE) and North Western (NW)									
Corrientes	1.80	2.08	2.11	2.15	2.28	2.35	2.46	2.36	2.26
Chaco	0.87	0.93	0.99	0.97	1.03	1.07	1.14	1.11	1.02
Formosa	0.59	0.61	0.63	0.71	0.72	0.73	0.76	0.75	0.74
Santiago del Estero	0.42	0.47	0.50	0.50	0.51	0.54	0.59	0.59	0.54
Salta	0.20	0.22	0.24	0.26	0.29	0.33	0.35	0.36	0.39
Misiones	0.13	0.10	0.11	0.14	0.14	0.14	0.15	0.15	0.15
La Rioja	0.12	0.10	0.10	0.10	0.08	0.09	0.08	0.09	0.11
Catamarca	0.09	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.09
Tucumán	0.04	0.05	0.04	0.05	0.06	0.06	0.06	0.06	0.06
Jujuy	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.02
Subtotal	4.29	4.67	4.83	5.00	5.23	5.45	5.70	5.60	5.38
NE-NW/total (%)	21.3	20.4	20.9	21.3	21.6	22.4	23.9	25.2	26.1
Total country	20.18	22.86	23.08	23.47	24.16	24.35	23.88	22.23	20.47

Source: Own preparation based on [8, 10]

Table 10. Beef cow stock by zones over the period 2002-2010 (million head)

Year	Production	Consumption (%)	Exports (%)
2001	2,500,418	94.0	6.0
2002	2,532,207	86.1	13.9
2003	2,672,328	85.3	14.7
2004	3,026,836	79.2	20.8
2005	3,150,784	75.5	24.5
2006	3,040,598	81.4	18.6
2007	3,226,757	83.3	16.7
2008	3,134,482	86.3	13.7
2009	3,377,252	80.4	19.6
2010	2,615,791	88.2	11.8
Mean 2001-2010	2,927,745.3	84.0	16.0

Source: [27]

Table 11. Production in tons of carcass weight equivalent, apparent consumption and exports of beef cattle meat over the period 2001-2010

Year	Chilled and frozen meat (tons)	Processed meat (tons)	Total meat exports (tons)	FOB value (thousand US\$)
2001	38,414	39,028	77,442	215,733
2002	158,321	46,497	204,818	452,735
2003	184,118	46,919	231,037	577,206
2004	322,713	59,885	382,598	972,522
2005	432,653	50,494	483,147	1,294,966
2006	316,504	37,471	353,975	1,199,889
2007	296,592	38,927	335,519	1,281,042
2008	229,991	34,920	264,911	1,486,335
2009	383,501	35,836	419,337	1,652,731
2010	166,265	25,494	191,759	1,187,454

Source: Own preparation based on [27]

Table 12. Cattle meat exports by product category and their value over the period 2001-2010

Country	Exports (tons)	(Value (thousand US\$))	Value (US\$ per ton)
Non-Hilton chilled cuts and frozen meat			
Russia	35,678	119,785	3,357
Israel	26,558	132,343	4,983
Chile	18,007	89,222	4,955
Venezuela	11,762	54,796	4,659
Germany	10,325	110,558	10,708
Others	38,296	236,024	6,163
Total	140,626	742,728	5,282
Hilton chilled cuts			
Germany	14,776	194,145	13,139
Netherlands	5,625	71,180	12,654
Italy	4,255	55,300	12,996
Spain	495	6,280	12,687
Others	488	6,293	12,895
Total	25,639	333,198	12,996
Processed meat			
Total	25,494	111,528	4,375
Total Argentina	191,759	1,187,454	6,192

Source: Own preparation based on [27]

Table 13. Destination countries of Argentina's cattle meat exports and their value in the year 2010

9. Cattle health state

Foot and Mouth Disease, the last outbreak of which occurred in February 2006, is the disease of greatest economic importance because it hampers exports to FMD-free circuits. The Agri-

food Health and Quality National Service (SENASA) has implemented health control programs against different pathologies and has taken actions towards preventing the entry of exotic diseases. Most important among them to the international market for animals and their byproducts are Bovine Spongiform Encephalopathy (BSE) and Scrapie. According to World Organization for Animal Health (OIE), Argentina is a member recognized as having a negligible BSE risk and as being an FMD-free zone where vaccination is not practiced to the south of Parallel 42° and an FMD-free zone with vaccination in the rest of the country [36]. Also SENASA has implemented health control programs against other diseases which are not restrictive on beef exports but do limit herd productivity, such as Brucellosis and Tuberculosis.

10. A non-traditional cattle production case

Mendoza lies in the West Central of the country with 148,827 km². An important portion of Mendoza falls within the Central Eastern part of the Monte Phytogeographic Province, the most arid rangeland of the country. Of the total surface of Mendoza, around 9 million hectares could be devoted to cow-calf production systems and about 450,000 ha are under irrigation, of which 75,000 ha are uncultivated at present. Cow-calf operations under rangeland conditions are the dominant production system [37]. The steer+yearling steer/cows ratio ranged from 0.08 to 0.16 in 2002 and 2010, respectively.

Mendoza has beef cattle but not in enough numbers to be considered a high cattle-producing province. Proof of this is the beef cattle stock/human population ratio, 0.25 and 0.31 for 2002 and 2010 respectively, values far below the 1.21 ratio for the country during 2010. The 2002-2010 evolution of bovine stock and human population was 404,710 to 533,488 heads [38] and 1,595,448 to 1,738,929 people, respectively [39].

The displacement of beef cattle production as consequence of the advance of agriculture is a process of no return. This situation led to the Argentinean Institute for Arid Land Research (IADIZA) to analyze the possibility of developing a non-traditional cattle activity in Mendoza, a province where competition with agricultural activities is high. At present, 10% of the animals consumed in Mendoza are finished locally, and hence the aim arises to enhance the production of steers for increasing the local supply. This framework promoted several investigations for analyzing the profitability of different production systems on cultivated pastures such as [40] beef cattle post-weaning, feedlot [41] and early weaning of calves combined with post-weaning production [37].

11. Prospects

Based on the analysis of the information developed here and on the opinion of leading specialists [1, 4, 5, 42] in the topic addressed, the need is highlighted for the growth of Argentina's beef cattle production to fulfill the needs of both domestic consumption and exports. Evolution of the stock through retention of females is slow, somewhat faster by keeping cow culling rates low, although a better result is obtained by improving weaning. For this reason it is indispensable to improve this index as soon as possible.

Different hypothetical projections can be made in relation to cattle stock and beef production. One scenario that would allow achieving a production of 3.31 million tons of beef by 2020, with higher export surpluses and possibilities of expanding domestic consumption, should consider national weaning indices of 65%, a 25% of regional production rate, a 25% of cattle extraction rate, a 77% of retention of females, and a carcass weight of 225 kg. This would provide an export surplus of 800,000 tons, similar to that exported by Argentina in 2005.

Increased beef demand from developing countries has significantly impacted on the rise of international prices. Upon the basis of a scenario of low supply, a domestic demand that has validated current price levels and an international demand that has approve prices that were unimaginable a few years back (US\$ 2,680 and 6,192 per ton carcass weight equivalent in 2005 and 2010 respectively) it is possible to project sustained cattle prices for the next 3 to 4 years and, therefore, cattle production systems would continue to be profitable.

The input/output ratio is going through a propitious time, with values well above those of previous years. Thus, for instance, in December 2001, purchasing a tractor of 100 HP required 50,393 kg of steer and 44,724 kg of calf, whereas in July 2010 these numbers had dropped to 23,937 and 19,552 respectively. On the other hand, the amounts needed to buy a pickup truck on the mentioned dates were 25,352 and 14,545 kg of steer and 22,500 and 11,881 kg of calf [43]. Therefore, with a scenario of good cattle prices ahead for the coming years, it is advantageous to now make investments and adopt technology so that, from the production standpoint, cattle farms are provided with a more solid platform for their growth.

A high-impact factor for economic results in production models is the relationship between steer sale price and calf purchase price. With a buying/selling ratio exceeding 25-30%, as has occurred in 2010 (29.5%), it is convenient to add more kilograms to the animals at finishing stages, which would diminish the impact of the above ratio. However, the limitation to this higher weight per head is given by a lower sale price for heavier animals, which is directly related to the purchasing power of exporters.

Because pastoral finishing is more profitable than feedlot, in terms of gross margin per kg of meat sold, is expected that the number of pasture-finished cattle destined for slaughter increase in the future.

International prices are excellent and there is an unfulfilled demand. Notwithstanding, export meat processing plants have a limited purchasing power due to the export-restricting policies. These policies have been wrong because the countries with high purchasing power consume the highest-value cuts. If it were possible to export these cuts at high prices, the lower value cuts could be destined for domestic consumption.

Argentina has gradually lost its place in the world markets. However, the country still has possibilities of recovery its position because the world will run short of meat due to deceleration of the production processes in Europe and a growing demand from countries like China and India. Russia needs increasing amounts of imported beef. The only reservoirs for production of red meat are in Latin America. This turned Brazil, despite not having high quality meat, into the major exporter worldwide, whilst Uruguay earned a place by exporting 63% of its production. The strategy is focused on the EU potential demand, on the

important volumes imported into Russia and on the possibility of entering NAFTA, but it must be considered that the strategy for the next decade is toward Japan and Korea.

At the XVIII Meat World Congress held in Buenos Aires in September 2010, it was stated that food production will increase strongly over the next years and that the Argentina beef-producing sector has the necessary technology to improve efficiency and increase cattle stock. Nonetheless, some of the challenges facing the Argentina meat chain are the expansion of agriculture at the expense of grazing land devoted to cattle farming and the need to set up a sustainable system including all facets: economic, social, health and animal welfare. The future of the meat market of Mercosur has the challenge to coordinate the combat of FMD disease and remove the barriers for enhancing production [27], highlighting the possibility and strength it represents for Argentina to be close to being an FMD-free country without vaccination.

At global scale, raising awareness, compromise, joint action, cooperation, a long term vision, predictability and equity are some of the concepts that will determine the magnitude of the change and its success. Argentina will have to take the challenge, to not miss opportunities, to be part of the change and become established as a major player in supplying high quality meat to the world [27].

While all links in the chain should be adjusted to increase meat production, it is evident that production, and rearing within it, is the limitation to be solved. Increased calf production will have to come from improved production efficiency of the already existing herd. It is likely that the cattle area continues to decrease, but this should not be viewed as an obstacle to the sector's growth.

In brief, the displacement of cattle population to marginal lands and reduction of stock numbers are some of the changes in beef cattle production occurred over the last decade. Specific policies are needed to increase the cattle production in view of this new frame of situation.

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