THE DEMAND FOR PROTEIN FEED IN SOUTH AFRICA FOR 2000, 2010 AND 2020 : PART II

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Protein feed consumption is projected for future years, derived from the projected consumption of animal products. Results show significant increases in the demand for protein feed largely due to expected use as poultry feed. South African protein feed imports amount to about R1 billion and results indicate that the concern of the Protein Advisory Trust about the cost of future imports is justified.

SAMEVATTING: DIE VRAAG NA PROTEïENVOER IN SUID-AFRIKA VIR 2000, 2010 EN 2020

Proteïenveevoer verbruik word geprojekteer vir toekomstige jare, deur dit af te lei van die geprokjekteerde verbruik van lewendehaweprodukte. Resultate toon betekenisvolle toename in die verbruik van proteïenvoer hoofsaaklik tewyte aan verwagte hoendervoer verbruik. Suid-Afrika se proteïenveevoer invoere beloop ongeveer R1 miljard en die resultate toon dat die Proteïennavorsingstrust wel rede tot kommer het oor die koste van toekomstige invoere.

1. INTRODUCTION

In order to be able to meet more effectively the demand for protein feed in South Africa it is relevant to estimate the future demand for protein feed. The consumption of protein feed in South Africa has significantly increased in recent years and imports at present are about R1 billion.

In this study the consumption of protein feed is estimated for 2000, 2010 and 2020. The procedure was to estimate consumption of livestock products first and then to derive feed consumption from consumption of the final product (livestock products).

Final consumption of livestock products depends upon demand and supply factors. The demand factors were studied in an earlier paper by Nieuwoudt (1997) and projected demand indexes are shown in Table 1 for 2000, 2010 and 2020 using 1995/96 = 100. Some supply factors will be included in this paper in order to estimate consumption of livestock products.

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Table 1: Projections of demand for 2000, 2010 and 2020 using low and high income growth projections of Spies (1996) (1995/96 = 100)

	2000/2001		2010/2011		2020/2021	
	Low	High	Low	High	Low	High
Beef	112.04	124.72	134.80	189.60	160.20	289.92
Poultry	110.98	122.46	131.92	178.08	155.32	258.55
Pork	108.96	111.57	125.11	134.29	142.81	160.77
Mutton/Goat's meat	110.03	121.96	128.82	179.59	149.68	268.33
Eggs	113.24	123.27	138.39	181.74	166.44	269.14
Milk	110.42	117.23	129.73	158.00	151.05	215.80
Milk Powder	111.88	116.89	134.53	157.36	159.89	216.07
Cheese	105.91	115.85	115.62	155.92	125.80	216.33

Source: Nieuwoudt, 1998 – Agrekon this issue.

The livestock supply side was included using available data on supply functions and supply elasticities. The projected increases in final product consumption are then applied to their protein consumption in the base period (1995/96) to arrive at projected protein consumption for 2000, 2010 and 2020. The following additional factors are considered; (a) the possible scaling down of tariffs and (b) increased production of dairy, beef and sheep is only assumed possible through more intensive feeding.

2. SUPPLY EFFECTS AND TRENDS

In the case of the more factory type of products such as poultry, the supply is more elastic while for beef and mutton/goat'ss meat the supply is more inelastic. Less is known about supply shifts than demand shifts as the former depend upon technological changes in production and changes in feed costs which are less predictable than demand shifts such as for instance population growth. The supply function is a cost function and the area under a supply function is costs (in opportunity cost sense).

Supply functions of animal products are determined by costs of feeding, housing, labour etc. A major cost factor in feeding is the feed conversion ratio, which differs for different livestock products. To produce 1 kg meat of poultry, pork, beef and mutton requires respectively 1.8, 3.6, 6 and 6 kg of feed (Lishman, 1996). More meat can only be produced in South Africa through more intensive feeding which implies that the feed conversion ratio will be an important factor

in affecting future relative prices. In the long run and in the absence of imports, it can be expected that chicken prices will decline relative to red meat prices and that poultry per capita consumption will increase relative to per capita consumption of red meat. Increased imports of meat, however, will affect this trend.

Past supply and demand shifts can be analysed by studying past trends in consumption and prices. According to Table 2, total per capita consumption of all meat increased from 38.3 kg per capita in 1960/61 - 64/65 to 44.7 kg per capita in 1980/81 - 84/85. It then declined again to 42.1 kg per capita in 1990/91 - 94/95 in spite of increased imports in the latter period. The consumption per capita in 1994/95 of 38.7 kg per capita was almost identical to the 38.4 kg per capita realised during 1960/61 - 64/65. The totals per capita consumption of all meats have remained relatively constant during the 35 years.

Table 2. Consumption per capita (kg/year) of meat, RSA, 1960/61 - 1994/95

	Beef	Chicken	Mutton/goat's	Pork	Total
5 Year Periods					
1960/61 - 64/65	25.72	2.36	7.56	2.71	38.35
1965/66 - 69/70	22.97	3.77	8.14	3.00	37.88
1970/71 - 74/75	23.14	7.91	7.12	3.42	41.59
1975/76 - 79/80	22.89	11.06	6.16	3.12	43.23
1980/81 - 84/85	20.91	13.99	6.56	3.26	44.72
1985/86 - 89/90	17.82	15.98	5.26	3.10	42.16
1990/91 - 94/95	17.00	17.25	4.62	3.22	42.09
Last three years					
1992/93	17.86	16.77	4.80	3.20	42.63
1993/94	16.10	16.45	4.00	3.10	39.65
1994/95	14.07	17.37	3.80	3.50	38.74
Compound % rate of total production*	0.9475	9.2696	0.7678	2.9796	

Source: Directorate of Agricultural Statistics, 1997.

* Annual % rate (compounded) of increase of total consumption over 30 years (1960/61 - 64/65 to 1990/91 - 94/95).

Not only the total consumption of chicken increased but also per capita consumption increased significantly replacing beef and mutton/goat's meat. Pork per capita consumption remained remarkably constant. The feed conversion for pork is more favourable than for beef and lower relative pork

prices (refer Table 4 presented later) have prevented pork consumption from falling as in the case of beef.

Mutton/goat's per capita consumption has fallen significantly. Total mutton/goat's consumption has remained approximately constant during the past 30 years in spite of significant imports in recent years (Collett, 1996). Beef per capita consumption declined (Table 2), while total production and consumption increased from 1955/56 to 1979/80 but then started to decline again.

Per capita consumption of dairy products and eggs is presented in Table 3 for the period 1960/61 to 1994/95. If growth in production (consumption) in the last row is compared with population growth of about 2% then it is evident that per capita consumption of eggs and cheese increased while that of total milk declined.

Table 3: Total consumption of dairy products and eggs, 1960/61 - 1994/95

	Total milk	Fresh Milk	Cheese	Industrial and other milk	Eggs
	Million litres (Milk)				1000 ton
1960/61 - 64/65			170		69
1965/66 - 69/70			208		82
1970/71 - 74/75			221		104
1975/76 - 79/80			328		131
1980/81 - 84/85			390		150
1985/86 - 89/90	1707	886	411	820	181
1990/91 - 94/95	1843	975	430	868	220
Compound % increase in total production	1.778 **	2.295 **	3.134 *	1.105 **	3.937 *

Source: Directorate Agricultural Statistics, 1997. Milk consumption data were obtained from the Milk Board (Coetzee, K., 1996).

* The trend is the compound interest increase in total consumption over a 30 year period 1960/61 - 64/65 to 1990/91 - 94/95.

** Compound rate increase in total consumption for period 1983/84 to 1995/96. Data for earlier period are not reported due to discrepancy in data between sources.

Changes in relative consumption (Tables 2 and 3), can be attributed to relative price changes (Table 4). Real prices are presented in Table 4 for the period 1990-94 using 1961-65 as the base (= 100). For instance the index for poultry meat of

38.4 means that the real poultry meat price in 1990-94 was 61.6% below the 1961-65 price. On the other hand, the price of beef was 24.7% higher in 1990-94 than in 1961-65. The replacement of beef by poultry meat can be partially explained by changes in relative prices and it is necessary that in consumption projections, future changes in relative prices be considered. Per capita consumption of eggs increased (Table 3) while real prices declined by 50.8%.

Table 4 Real prices in 1990-94 using 1961-65 = 100*

Product	Price index
Poultry meat	38.4
Beef	124.7
Mutton	101.1
Pork	69.3
Fresh milk	73.2
Eggs	49.2
Maize (yellow)	86.8

* Prices are deflated by CPI.

Per capita consumption of cheese increased while fresh milk prices fell by 30.7 %. The decline in per capita consumption of fresh milk and milk powder is attributed to the fact that per capita consumption is high for Whites who also have a low population growth rate.

3. CONSUMPTION OF LIVESTOCK PRODUCTS

Future consumption depends upon demand and supply shifts and thus relative prices. The effect of relative prices was simulated using estimates of demand elasticities. Partial price elasticities are shown in Table 5 for selected commodities.

Table 5: Partial price elasticities of demand

Commodity	Price elasticity	Source
Beef	-0,96	Hancock et.al. 1984
Beef	-0.43	Badurally Adam *et.al*, 1997
Mutton	-1.93	Hancock *et.al.* 1984
Mutton	-0.81	Badurally Adam *et.al* 1997
Pork	-1.86	Hancock *et.al.* 1984
Pork	-0.39	Badurally Adam *et.al*, 1997
Cheese	-0.31	Du Toit, 1982

Poultry	-0.36	Badurally Adam, 1997
Poultry	-1.66	Hancock et.al. 1984
Eggs	-0.30	Egg Board Report,1990
Fresh milk (retail)	-0.78	McKenzie et.al.,1985
Fresh milk (farm)	-0.51	
Industrial milk (retail)	-0.93	
Industrial milk (farm)	-0.47	

For projection purposes the relevant elasticity of demand is the total elasticity which is lower than the partial elasticity estimated in single equation regressions. The total elasticity is lower as it allows for substitution in demands (cross elasticities). For products with close substitutes such as types of meats the partial and total elasticities will differ.

3.1 Eggs

The low-income elasticity of egg consumption for Whites (Nieuwoudt, 1997) indicates that per capita consumption is approaching its saturation point for this group. It can be expected that income elasticities for all population groups will fall as their incomes increase.

Technological advances in the egg industry will be reflected in low real prices. The real price for eggs during 1990-94 was 49.2 (Table 4) with 1961-65 = 100, which implies that the real price in 1990-94 was 51 % below the 1961-65 level. The decline in real prices was a major contributing factor to increased egg consumption during this period. If egg prices continue to fall in real terms, then consumption will be more than what is projected by demand estimates in Table 1. According to Gous (1996), some technological advances experienced during the past 30 years were due to improved import breeding stock and are expected not to be repeated again. In the following calculation it was assumed that real egg prices will continue to decline in real terms by 25% during the next 25% years which is lower than the 51% decline during the past 30 years.

Using a price elasticity of demand for eggs of -0.3 (Table 5) and an estimated real decline in egg prices of 25 %, the lower real price will stimulate consumption by 25 (0.3) % = 7.5 %. The projected demand figures shown in Table 1 for eggs were adjusted to allow for expected lower real prices and presented in Table 6. Projected consumption at the lower growth is 179 and at the higher growth is 255 for 2020.

It appears that the trend in past consumption levels will only be maintained at high economic growth levels. The trend projection based on data for the past 30

years is 263. High economic growth will lead to a decline in income elasticities and an estimate of 255 is seen as an upper bound estimate.

Alternative estimates of final consumption for 2020 were also made. If White per capita consumption is seen as an upper bound for other groups then the maximum consumption for all groups can be determined as follows:

(a) Black per capita consumption reaches White per capita consumption in 2020. Estimated consumption (with 1995 = 100) in 2020 is 255. [Rural Black per capita consumption is assumed unchanged].

(b) Same as (a) but rural Black per capita consumption reaches White per capita consumption. Estimate for year 2020 is 348 with 1995 taken as 100.

(c) Current consumption trend continues. Consumption in 2020 is estimated as 263 with 1995 equal to 100.

Table 6: Projection of consumption for 2000, 2010 and 2020 using high and low income growth projections (1995/96 = 100)

	2000/2001		2010/2011		2020/2021	
	Low	High	Low	High	Low	High
Beef	102	103	107	111	112	124
Poultry	118	131	154	209	193	321
Pork	115	118	142	152	171	192
Mutton/goat's meat	101	102	103	106	106	112
Eggs	116	121	146	175	179	255
Fresh milk	110	117	130	158	151	216
Milk powder	112	117	135	157	160	216
Cheese	107	117	119	161	132	226
Total Milk	110	117	129	158	149	218

3.2 Cheese

The real price of fresh milk has fallen by 27 % over the period 1961-65 to 1990-94 (Table 4). The real price of yellow maize the predominant feed component fell by 13 % during the same period. It is assumed that real milk prices will continue to decline but at a lower rate as the impact of liberalising the milk marketing scheme on real milk prices has had an effect on consumer milk prices in recent

years. Future increases in fresh milk production are possible through more intensive feeding.

A decline in the real price of milk of 15 % is estimated. Using a price elasticity of demand for cheese of -0.31 (Table 5), a 15 % decline in the price will boost consumption by (15) (31) % = 4.65 %. Projected consumption figures, derived from the projected demand (Table 1), are presented in Table 6. Data are adjusted for the effect of lower real prices. The projected range is (132, 226) (Table 6). If the trend of the past 30 years is continued then the projection is (1.03134) 25 * 100 = 216 which is near the upper range of the previous projection.

The income elasticity of demand for cheese for the Black population is in excess of 2.0 which means that with high-income growth demand will increase significantly. The future demand will thus be sensitive to economic conditions.

3.3 Milk Powder

The price elasticity of industrial milk at retail level is estimated by McKenzie *et al*. (1985) at -.93. Industrial and fresh milk are almost perfect substitutes and the total elasticity of all milk consumption will be low, as total milk consumption has no close substitutes. A projected decline in the real price of milk will thus affect total consumption less than what is predicted by partial elasticities estimated. An assumption of no substitutes is consistent with an assumption of an inelastic demand. As the focus in the study is on the projection in demand of all milk consumption, price elasticities were assumed as low and thus not considered. Since the abolishment of price discrimination in milk marketing, no distinction is made in the production of fresh and industrial milk and milk can be seen as a single commodity. The lower and upper bound estimates for consumption in 2020 are [160, 216] as estimated in Table 1.

The deregulation in the fresh milk market in recent years is expected to have influenced the consumption of milk powder in a negative way. Surplus milk in the past had been converted into milk powder and model estimates cannot be compared with trends in use.

3.4 Fresh milk

The price elasticity of demand of fresh milk at retail level has been estimated by McKenzie *et al.* (1985) at -0.78. As in the case of milk powder the price elasticity for all milk was assumed as low and thus not considered. The per capita consumption of fresh milk amongst Blacks is low which is partially explained by lactose intolerance (Stewart, 1996). This alleged phenomenon might inhibit the

growth in fresh milk consumption. It is thus foreseen that the consumption of sour milk, etc. may increase in future years.

Fresh milk consumption is relatively high for Whites with the lowest population growth, which inhibits expansion in demand. Other factors may stimulate demand such as (a) use of long life milk overcoming the storage problem of poor people and (b) overcoming lactose intolerance.

The model estimates lower and upper bound consumption for 2020 as [151, 216] as estimated in Table 1. Based on consumption during 1983/84 to 1995/96 the trend estimate is 176 which falls within the model prediction.

3.5 Total milk consumption

Projections of total milk consumption were calculated by weighting consumption of fresh milk, milk powder and cheese by their relative consumption in 1995. The following weights were applied; fresh milk (61.3 %), cheese (21.2 %) and milk powder (17.5 %). The lower and upper bound estimates of consumption in 2020 are [149, 218]. During the period 1983/84 to 1995/96 total consumption has increased at a compound rate of 1.778 % per year giving a trend estimate of 155 in year 2020. This is towards the lower range of the model estimate.

3.6 Poultry

The real price of poultry meat declined 62 % between 1960-65 to 1990-94. It is not expected that this price decline will continue (Gous, 1996). The price of yellow maize, an important feed, declined 13 % during the same period. Some decline in the real price of yellow maize is possible through technological advances in the grain industry.

Due to possible substitution in the meat market the total elasticity, required for projection purposes, will be lower than the partial elasticity estimated in single equation regressions. The total price elasticity of demand for poultry meat was taken as -1.2, a figure lower than the estimate of the partial elasticity of -1.66 (Table 5). A projected decline in the price of poultry meat of 20 % will stimulate consumption by (20)(1.20) % = 24.0 %. The lower and upper bound consumption levels are estimated at [193, 321], using data from Table 1.

During the period 1960/61 - 64/65 to 1990/91 - 94/95 poultry meat consumption increased by 9.27 % per year. During the more recent period 1979/80 - 1994/95 consumption increases 5.4 % per year, while during the even

more recent period, 1984/85 to 1994/95 the growth in total consumption has declined further. A trend consumption estimate based on the most recent ten years is 241 which falls within the upper and lower ranges of the model estimate.

3.7 Pork

The real price of pork declined 31 % between 1961-65 to 1990-94. The total price elasticity equal to -1.30 (Table 5) was used in calculations. An expected price decline in real pork prices of 15 % between 1995 and 2020 will stimulate consumption by 19.5 %. Upper and lower bound consumption estimates for 2020 are [171, 192]. The trend estimate for the year 2020, based on the recent ten years, is 189, which is towards the higher bound model estimate.

3.8 Beef

The real price of beef cattle increased by 24.7 % during the 29 years 1961-65 to 1990-94 as the demand for beef shifted along a supply that is not perfectly elastic. Increases in future production of beef will be possible through intensive feeding, and it can be expected that future beef prices will increase. In the absence of imports it can be expected that future real prices will at least increase at the rate experienced during past years in order to make intensive feeding of beef profitable. Beef prices are however significantly affected by poultry prices. A slower increase in the latter or decline will have a depressing effect on future beef prices as markets adjust.

The demand model (Table 1) projects an upper and lower bound estimate for beef demand of [160, 290], which is a significant increase. In the absence of significant beef imports, local production will only increase if beef prices increase substantially due to the relatively unfavourable feed conversion ration of 6 kg of feed for 1 kg of meat. An increase in demand for beef as estimated (Table 1) will increase the time beef is kept in feedlots. The estimated future consumption will thus depend on future real prices, which in turn will depend on supply and demand elasticities. Expected future consumption is derived as follows, using an elasticity of supply of 0.5 (Lubbe, 1992). The positioning of demand and supply functions as well as shifts are depicted in Figure1 where

Supply function: $P = -100 + 2q$

Demand function: $P = 183.3 - .2874q$ [upper bound]
$P = 183.3 - .5208q$ [lower bound]
$P = 148$ and $q = 124$ [upper bound]

P = 125 and q = 112 [lower bound]

Elasticity of supply = 0.5 (Lubbe (1992) estimated elasticity of supply for beef at 0.539).

Elasticity of demand = -1.2

Lower and upper bound estimates of quantities are [112, 124].

The equilibrium quantities are calculated by equating quantity supplied equal to quantity demand. Fig 1 shows projected equilibrium consumption in 2020 of 24 % above the current level for the upper bound estimate. The consumption increase is lower than the demand increase (190 %) due to expected increase in real prices.

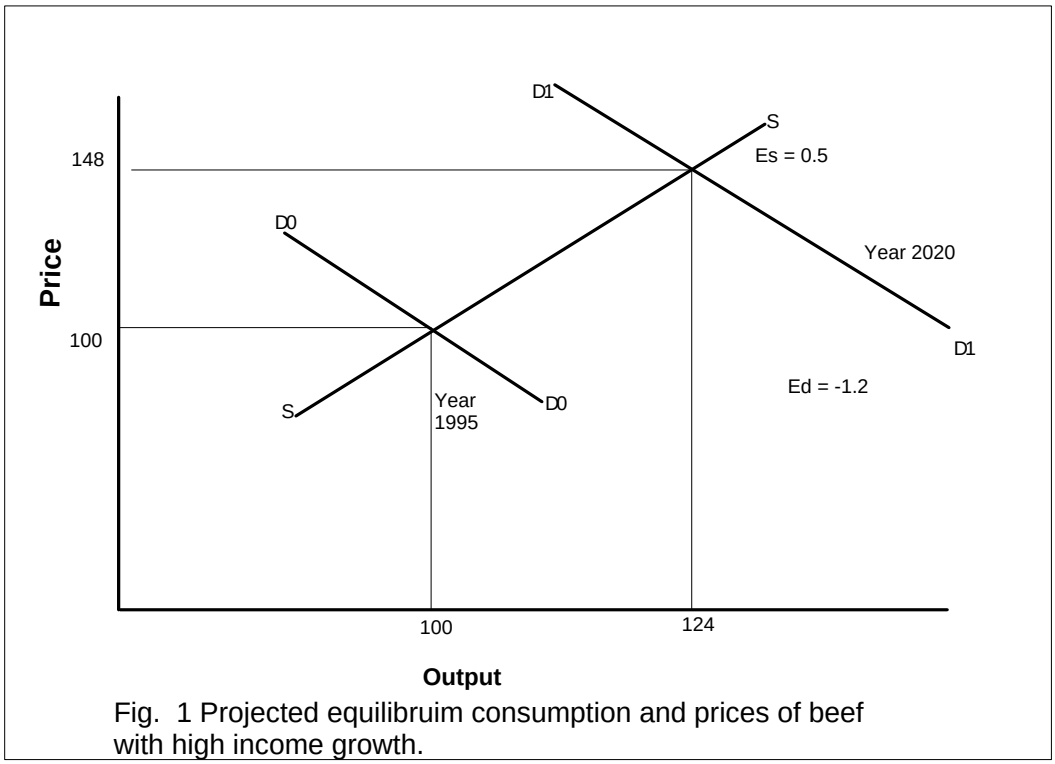

Fig. 1 Projected equilibruim consumption and prices of beef with high income growth.

Figure 1: Projected equilibrium consumption and prices of beef with high-income growth

During the past 29 years, beef prices increased 25 % in real terms. This is consistent with the lower bound demand growth scenario depicted above as the

latter scenario estimates prices to increase by 25 % during the next 25 year period (1995 to 2020).

3.9 Mutton

The real price of mutton increased by 1 % between 1961-65 to 1990-94. Due to the unfavourable feed conversion ratio (6 kg of feed is required for 1 kg meat), intensive feeding of mutton/goat's will only be viable if the price of mutton/goat's meat is very high relative to feed prices. The partial price elasticity of demand for sheep meat is high (Table 5) implying that mutton will be replaced by other meats at higher prices. According to slaughtering in South Africa, total local production is seasonal and cyclical while declining somewhat. Imports increased since 1984/85, but total consumption remained constant during the period 1970/71 - 1994/95. In spite of massive imports during 1993/94 and 1994/95, total consumption during the latter period was well below the long-term trend.

Evidence indicates that total production will remain more or less constant, while total consumption will only increase with increased imports. The latter is possible, as cheap imports with lower tariffs are possible from New Zealand/Australia.

The equilibrium future consumption is estimated as follows;

Supply function $P = -300 + 4q$

Demand function $P = 183.3 - .3109q$ [upper bound]
$P = 183.3 - .5556q$ [lower bound]
$P = 148.4\ q = 112$ [upper bound]
$P = 124\ q = 106$ [lower bound]

Elasticity of demand = -1.2
Elasticity of supply = 0.25

Equilibrium future consumption for 2020 is estimated for lower and upper bound estimates as [106, 112].

4. PROJECTION OF FINAL CONSUMPTION OF LOCALLY PRODUCED COMMODITIES

The estimated local consumption presented in Table 6 may be partly met by additional imports. SA import tariffs were as follows during 1995/96,

Beef	40 %
Mutton	40 %
Chicken	27 %

The impact of lower tariffs on imports depends on the local elasticities of demand and supply while the impact on local production depends on the local supply function. If an elasticity of supply of 0.9 is taken for poultry meat (Tomek & Robinson, 1972) a 1 % reduction in price will lead to a displacement of local supply by 0.9 %. The displacement on local production is estimated in Table 7 using supply elasticities as reported by Tomek and Robinson for all products except mutton. An elasticity of supply of 0.25 was assumed for mutton. Table 7 estimates if all tariffs are phased out that local production (1995/96) will be displaced as follows; beef (11 %), mutton (6 %), chicken (13 %) and pork (3 %).

Table 7: Displacement % in local supply due to reduction in tariffs*

Product	%
Beef	11
Mutton	6
Chicken	13
Pork	3

* The following elasticities of supply were used; Beef (0.5), Poultry (0.9), Pork (0.6) (Tomek and Robinson, 1972 p64), Beef 0.539 (Lubbe, 1992).

South Africa fresh milk prices are about the second lowest in the world. Only the fresh milk price in New Zealand is lower than the South Africa price. Increased imports are only likely as far as cheese and milk powder are concerned. South African exports and imports are more due to seasonal fluctuations in production than due to long term trends.

The EU dump dairy produce on world markets at prices well below their own cost of production. In the longer run, dumped EU dairy produce may be of a lesser threat to the South African industry as (a) EU efforts to decrease the animal load on farms due to environmental concerns may lead to an overall reduction in livestock production and (b) decoupling of price support and acreage set-aside may lead to lower feed grain production and higher feed prices.

The South African dairy industry has moved away from price discrimination, explaining why fresh milk prices have declined in recent years. The abolishment

of the one channel marketing scheme for maize will also translate into relative lower maize feed prices in normal years. No major increase in imports of dairy produce in future years are foreseen as increased milk production is possible with no major increase in real costs. The reason for the latter is the importance of intensive feeding in the milk industry.

South Africa has been a net exporter of eggs in past years. Since 1980/81 exports were relatively minor being less than 2 % of total production (Directorate of Agricultural Statistics, 1997), and no increase in imports is foreseen.

In Table 8, the consumption projections of locally produced commodities are presented.

Table 8: Projection of consumption of local demand of scenarios presented in Table 6

	2000/2001		2010/2011		2020/2021	
	Low	High	Low	High	Low	High
Beef*	100	101	100	105	100	110
Poultry*	113	125	139	188	168	279
Pork*	114	117	139	149	166	186
Mutton/goat's meat*	100	101	100	103	100	105
Eggs	116	121	146	175	179	255
Fresh milk	110	117	130	158	151	216
Milk powder	112	117	135	157	160	216
Cheese	107	117	119	161	132	226
Total Milk	110	117	129	158	149	218

* Projections presented are adjusted for percentage displacement as shown in Table 7.

5. PROJECTION OF PROTEIN CONSUMPTION

Protein consumption projections are presented in Tables 9 and 10. The actual consumption for 1995/96 (first column of tables 9 and 10) was multiplied times the projected index (Table 8) for poultry, pork and eggs.

Table 9: Projected consumption of oil cake (tons) using scenarios presented in Table 8

	1995/1996	2000/2001		2010/2011		2020/2021	
	Actual	Low	High	Low	High	Low	High
1. Broilers	230778	260779	288473	320781	433863	387707	643871
2. Layers	121798	14128	147376	17782	213147	218018	310585

3. Dairy*	127830	136296	145492	154946	188475	176149	244155
4. Pigs	64439	73460	75394	89570	96014	106969	119857
5. Dogs#	11942	13143	13143	15451	15451	18035	18035
6. Beef and Sheep	39358	39358	43079	39358	51611	39358	61831
7. Horses#	7447	8196	8196	9635	9635	11247	11247
8. Other#	49651	54646	54646	64242	64242	74984	74984
TOTAL	653243	727164	775799	871808	1072438	1032467	1484565

* No increase in fishmeal is projected in Table 10 for dairy.
\# Growth was taken equal to population growth.
Source: Data for 1995/96 is Griessel (1997)

For products, partly produced extensively, feed consumption was derived from the additional intensive production of the product as follows:

Milk production

0.450 kg of feed is required per litre of milk while 12.5 % of the dairy feed ration is oil cake meal. Increase in total milk production for the higher bound estimate is 118 % (Table 8) above the 1995/96 base level of 1 753 million litres which is equal to 2 068 million litres. This calculation is explained in Table 11. Feed requirement is thus (2068 million)(0.450)/1000 tons = 930600 tons which includes 116325 tons oil cake. Total oil cake consumption for dairy (year 2020/21) is presented in Table 9 (last column) as (116325 + 127830) = 244155 tons. In this calculation no increase in fishmeal consumption is foreseen due to high cost and possible unavailability of fishmeal. No increase in fishmeal consumption is thus shown for dairy in Table 10.

Table 10: Projected consumption of fishmeal (tons) using scenarios presented in Table 8

	1995/1996	2000/2001		2010/2011		2020/2021	
	Actual	Low	High	Low	High	Low	High
1. Broilers	183758	207646	229698	255424	345465	308713	512685
2. Layers	20755	24076	25114	30302	36321	37151	52926
3. Dairy*	1519	1519	1519	1519	1519	1519	1519
4. Pork	31642	36072	37021	43982	47147	52526	58854
5. Dogs#	7087	7800	7800	9170	9170	10703	10703
6. Beef and Mutton	0	0	0	0	0	0	0
7. Horses#	2785	3065	3065	3603	3603	4206	4206
8. Other#	5565	6125	6125	7200	7200	8404	8404
TOTAL	253111	286303	310342	351200	450425	423222	649297

* No increase in fish meal projected as all the increase in protein feed assumed to occur through oil cake consumption.
\# Growth was taken as equal to population growth.

The increased utilisation of feed in beef feedlots was calculated as follows:

Of the 1995/96 beef consumption of 671200 tons, 70 % is feed in feedlots (Lishman, 1996). Cattle are kept on average for 3 months in a feedlot while the average slaughtering age of the total herd is approximately 2 years. That is an estimated 117460 tons of meat are currently (1995/96) produced in feedlots. It is further estimated that beef consumption will increase by 10% for the higher bound estimate (Table 16) or 67120 tons. Thus feedlot beef production is expected to increase from 117460 tons to 184580 tons in 2020 or by 57.1%. It is thus expected that beef rations will increase by the same percentage.

Table 11: Projected increases in protein consumption for dairy in year 2020/2021

1.	Base milk consumption (1995/96)	1753 million litres
2.	Projected increase in milk consumption	
	(a) upper bound	2068 million litres
	(b) lower bound	859 million litres
3.	Feed requirement for 2	
	(a) upper bound	930 600 metric ton
	(b) lower bound	386 550 metric ton
4.	Oil cake requirement for 3	
	(a) upper bound	116 325 metric ton
	(b) lower bound	48319 metric ton

6. CONCLUDING COMMENTS

Estimates of protein consumption in feed rations for the next 25 years are presented. The estimates will be as good as the data incorporated in the forecasting models.

In the first step of the analysis a forecasting model was developed to predict the demand for individual animal products for the next 25 years. An important factor in this model is population growth for different population groups. Growth rates are fairly stable over time and this factor can be estimated with a small margin of error. Less is known about future income growth and high and low growth scenarios are presented. A very high growth scenario may lead to a

fall in income elasticities. This was seen more likely in egg consumption where White per capita consumption appears to be close to the saturation point. The data incorporated in the demand projection model are based on extensive surveys reported by the Bureau of Market Research, UNISA.

Future consumption also depends upon relative future prices, which in turn depend upon supply conditions. Less information is available on future supply conditions than demand conditions. The supply side of the model was included using data on supply elasticities and trends in relative prices. The impacts of imports on local production displacement depend also on local supply elasticities.

Fishmeal consumption is expected to increase less than oil cake due to expected unavailability of the former in future years. In Table 10 it was assumed that fishmeal will be available. If this is not the case then increases in fishmeal consumption as estimated in Table 10 can be converted to equivalent tons of oil cake using a conversion factor of tons oil cake = 1.4 * tons fish meal as oil cake has 45 % protein and fish meal 63 %.

Tables 9 and 10 show that most of the increased consumption of protein feeds are in the poultry sector (broilers and layers). The other sectors are dwarfed by feed consumption in this sector. The second most important growth sector is dairy and thirdly pork. Increased intensive feeding in beef is expected only to occur under high-income growth conditions.

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APPENDIX

ASSUMPTIONS

The following assumptions were made:

1. Elasticities of supply used are, Beef (0.5), Poultry (0.9), Pork (0.6) [Tomek and Robinson, 1972 p.64; Lubbe, Beef 0.539 (Lubbe, 1992).

2. Spies's income growth scenario was adopted in Table 1,

3. Real price declines from 1995 to 2020: Eggs (25 %), cheese (15 %), poultry (20 %) and pork (15 %). Past trends were considered in price projections.

4. Total price elasticities of demand: Eggs (-0.3), cheese (-0.31), all milk (0.0), poultry (-1.2), pork (-1.30), beef (-1.2) and mutton (-1.2). Total elasticities are based upon past studies.

5. Cross elasticities considered only in an indirect way through relative changes in prices and using the concept of total rather than partial price-elasticities.

6. No further increase in imports of dairy products and eggs assumed. A further increase in EU dumping assumed unlikely due to current negotiations with the EU. There is concern about high possible chicken imports particularly from the USA (discarded cuts, culled hens etc). It was thus assumed that tariff structures and local supply elasticities capture possible displacement of local production.

7. Import tariffs on meat imports are phased out immediately.