Construction of the beef quality payment system

A desktop analysis of the effect of updated prices on the beef quality payment system, prepared by Teagasc, as requested in the Irish Beef Sector Agreement

27 December, 2019

Background

In the Irish Beef This Agreement reached on 15th September 2019, Teagasc was requested to conduct ***An immediate scientific review of the Quality Payment Grid by Teagasc; the first stage of the review, a desktop analysis of the pricing structure of the grid on the basis of meat yield/conformation, to be completed by end October.*** This report outlines the desktop analysis carried out by Teagasc.

The data and approaches used for the generation of the quality pricing system are founded on the paper "*The relationship of live animal muscular and skeletal scores, ultrasound measurements and carcass classification scores with carcass composition and value in steers*" S. B. Conroy, M. J. Drennan, D. A. Kenny and M. McGee. Animal (2009), 3:11, pp 1613–1624 based on research conducted by Michael Drennan, Teagasc, Grange (retired). The objective of the present study is to simply update the retail cut prices used in the Conroy et al (2009) paper to modern day prices and, using exactly the same animal-level carcass cut data and statistical approaches, update the differential in price per kg carcass per unit change in sub-class score for conformation and fat score.

Data

The data used were as described in the scientific paper which was based on 336 steers slaughtered over a 2-year period in eight different batches. The animals consisted of Holstein-Friesian, Aberdeen Angus x Holstein-Friesian as well as half-bred and 100% late-maturing continental breed crosses. All animals were slaughtered at the end of a winter housing period when approximately 2 years old. Carcass conformation and fat scores were obtained using the mechanical grading system on a 15-point scale. Hot carcass weight was recorded and cold carcass weight was taken as 0.98 of hot carcass weight. Weight of perinephric and retroperitoneal fat was also recorded at slaughter. Following a period of 48 h at 0-2°C, the right side of each carcass was quartered at the fifth rib into an eight-rib pistola and the remaining forequarter. After recording the weight, the pistola was dissected into 13 cuts (leg, heel, silverside, topside, knuckle, rump, tail of rump, cap of rump, fillet, strip loin, cube roll, cap of rib and eye of round) from which all visible fat and bone (where applicable) was removed. The weight of each meat cut and total fat from the pistola were recorded as was bone weight following removal of all adhering tissues. Lean trim was weighed separately and added to the meat cuts to give total pistola meat yield. A similar procedure was carried out with the fore-quarter, which was dissected into 11 cuts (front shin, neck, brisket, chuck, flat ribs (1 to 5), plate, leg of mutton cut, bladesteak, braising muscle, chuck tender and clod). Pistola and fore-quarter meat, fat and bone weights were combined to give the weight of each component in the half carcass. Carcass value was estimated as the sum of the commercial value of each meat cut with a small deduction for bone expressed as a proportion of half carcass weight. This was converted to carcass price per kg by dividing total carcass value by hot carcass weight.

The representation of the 336 steers on the QPS grid is in Figure 1. The percentage of the national kill on the ICBF database for steers slaughtered in the calendar year of 2018 is in Figure 2.

		EUROP Conformation														
		P-	P=	P+	O-	O=	O+	R-	R=	R+	U-	U=	U+	E-	E=	E+
Fat score	5+															
	5=						1	1	1							
	5-				1		3	1	9	5	2	1				
	4+							2	5	6	5	2	1	1		
	4=			2	3	1	3	1	8	8	5	5		2		
	4-			2		6	5	7	10	7	3		4			
	3+					2	7	9	6	14	7	5	3			
	3=				1	3	4	8	13	11	14	6	1			
	3-				1				2	10	7	10	2			
	2+					1		6	8	5	9	3	2			
	2=					1	3	4	8	4	3			1		
	2-						1				2					
	1+															
	1=															
	1-															

Figure 1. *Number of animals per cell on EUROP conformation by fat score in the research dataset.*

		EUROP Conformation														
		P-	P=	P+	O-	O=	O+	R-	R=	R+	U-	U=	U+	E-	E=	E+
Fat score	5+															
	5=															
	5-					0.1%	0.1%	0.1%	0.1%	0.0%						
	4+			0.1%	0.2%	0.3%	0.4%	0.3%	0.3%	0.2%	0.1%					
	4=		0.1%	0.2%	0.7%	1.3%	1.3%	1.0%	0.8%	0.6%	0.3%	0.1%				
	4-		0.2%	0.7%	1.6%	2.6%	2.4%	1.7%	1.4%	1.1%	0.6%	0.2%	0.1%			
	3+	0.1%	0.4%	1.5%	2.9%	3.9%	3.2%	2.3%	2.2%	1.7%	1.0%	0.4%	0.2%			
	3=	0.1%	0.8%	2.4%	3.9%	4.3%	3.0%	2.3%	2.7%	2.2%	1.5%	0.6%	0.3%			
	3-	0.2%	0.8%	2.2%	2.9%	2.5%	1.7%	1.5%	1.6%	1.4%	1.1%	0.5%	0.3%			
	2+	0.1%	0.6%	1.4%	1.5%	1.2%	0.9%	0.8%	0.8%	0.7%	0.6%	0.3%	0.2%			
	2=	0.1%	0.5%	0.9%	0.8%	0.6%	0.5%	0.5%	0.5%	0.4%	0.3%	0.2%	0.1%			
	2-	0.1%	0.3%	0.4%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%			
	1+	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%					
	1=	0.0%	0.1%	0.1%	0.0%	0.0%										
	1-	0.0%	0.0%	0.0%												

Figure 2. *Percentage of steers per cell on EUROP conformation by fat score in the ICBF database for the calendar year of 2018 where a cell had >100 carcass records.*

Construction of price differentials

The expected price differentials between adjacent conformation and fat subclass scores on a 1 to 15 scale were quantified using multiple linear regression of price per kg on both conformation and fat score as:

$Price\_per\_kg\_carcass = intercept + EUROP_{Conformation} + EUROP_{Fat} + e$

In the Conroy scientific paper, the equation developed was:

$Price\_per\_kg\_carcass = 296 + 5.6*EUROP_{Conformation} + (-5.1)*EUROP_{Fat} + e$

This implies that each sub-unit increase in the EUROP conformation score, holding EUROP fat score constant, is associated with a 5.6 c/kg greater price. Similarly, it implies that a one sub-unit increase in the EUROP fat score, holding EUROP conformation score constant, is associated with a reduction in price per kg of 5.1 c.

Update of price differentials

Price per kg for each of 26 different primal cuts was compiled by MII from its members for each year of 2017 and 2018 separately. For the purpose of the present study, the mean price per primal cut across both years was used. These cut price data were applied to the dataset of 336 carcasses to re-generate a total carcass value and subsequently price per kg.

The expected price differentials between adjacent conformation and fat sub-unit scores on a 1 to 15 scale were re-quantified using again a multiple linear regression of price per kg carcass on both conformation and fat score as:

$Price\_per\_kg\_carcass = intercept + EUROP_{Conformation} + EUROP_{Fat} + e$

The new equation based on the revised cut data was

$Price\_per\_kg\_carcass = 396 + 6.86*EUROP_{Conformation} + (-6.09)*EUROP_{Fat} + e$

This implies that each sub-unit increase in the EUROP conformation score, holding EUROP fat score constant, is associated with a 6.86 c/kg greater price. Similarly, it implies that a one sub-unit increase in the EUROP fat score, holding EUROP conformation score constant, is associated with a reduction in price per kg of 6.09 c. The association between carcass price and conformation score (for a fixed carcass fat) is depicted in Figure 3 based on the prices used in the 2009 study versus the 2017/2018 prices. Clearly the mean carcass price per kg is higher based on the revised primal cut prices (blue diamonds) but it is the slope of the two fitted continuous lines which are of interest as it is these which reflect the price differential between conformation scores. The slope of the black line through the revised data (blue diamonds) is 6.86 while that through the current prices (i.e., red triangles) is 5.6; hence the slope of both lines are relatively similar and thus the differential in price per kg carcass between conformation scores is relatively similar when comparing the currently used cut prices versus the revised cut prices. The higher overall base price is reflected in the intercept being €1.00 higher in the revised multiple regression model relative to the model currently used.

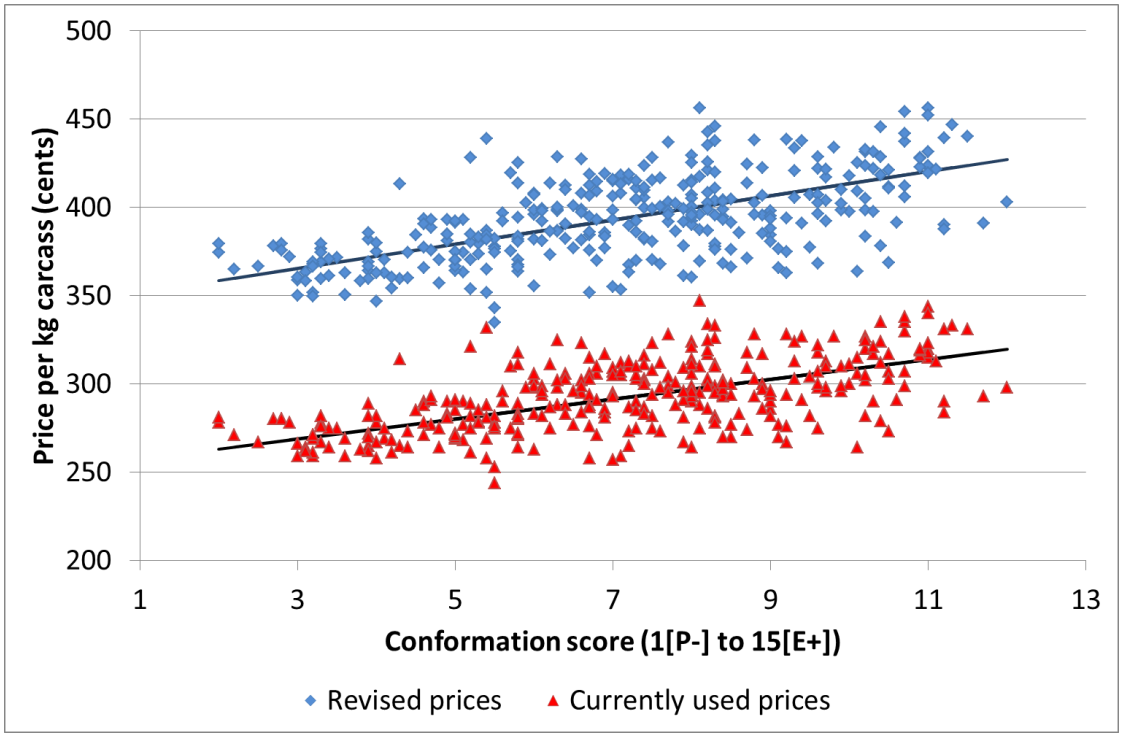

Figure 3. Scatter plot of price per kg carcass weight against conformation score for each of the 336 animals based on either the wholesale cut prices currently used in the QPS (red triangles) or the wholesale cut prices based on the 2017 and 2018 calendar years.

Conclusion

The primal cut prices were updated to the average prices for the 2017 and 2018 calendar year. Cut prices increased by almost 50% in value; this resulted in an increase in mean carcass value (and mean price per kg). The expected price per kg differential between each conformation score subclass based on the 2009 study versus updated prices increases from 5.6 c/kg to 6.86 c/kg; the expected price per kg differential between each fat score subclass based on the 2009 study versus updated prices changes from -5.1 c/kg to -6.09 c/kg.