

Genetics of Wholesale Carcass Cuts Predicted from Digital images

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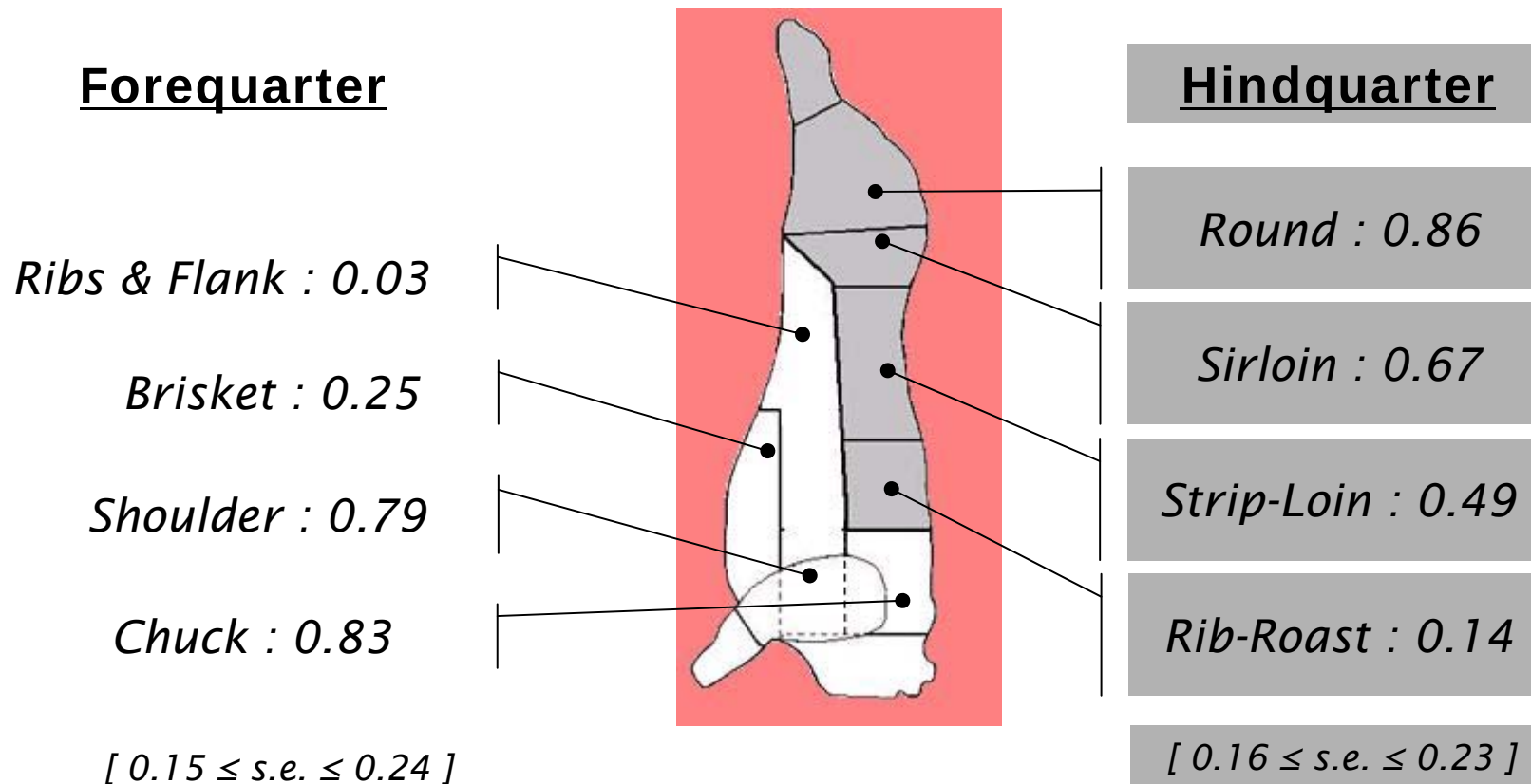
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Motivation

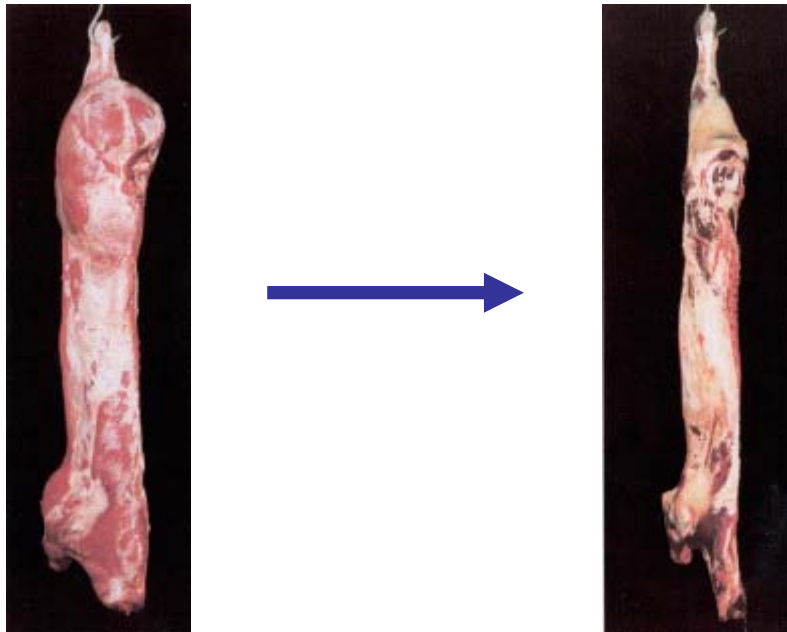
- Heritability of carcass cuts



Motivation

- **EUROP Classification to grade carcasses**

Conformation



S > E > U > R > O > P

Fat

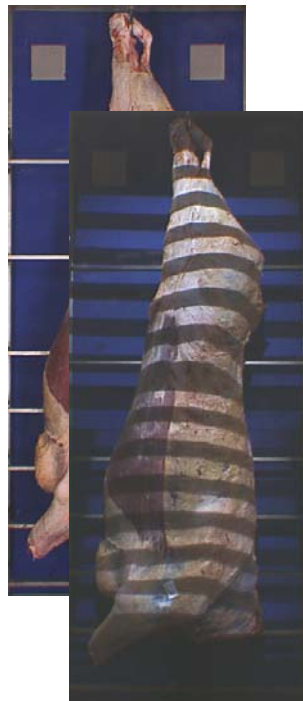


1 < 2 < 3 < 4 < 5

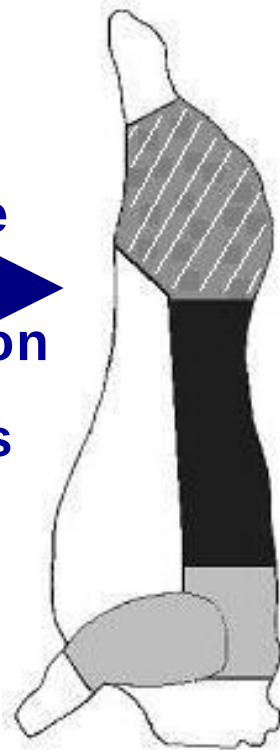
EEC Regulations n° 1208/81 ; 2930/81 ; 1026/91

Motivation

- Converting images into cut weights



Multiple
Regression
Analysis



- Lower value cuts
- Medium value cuts
- High value cuts
- Very high value cuts

Also available on steers:

- Total meat weight
- Total fat weight
- Total bone weight

Pabiou et al. Livestock Sci. (submitted).

Motivation

- **R² of Regressions**

Wholesale Cut Weight	Dataset	
	Heifer	Steer
Lower Value Cuts	0.65	0.92
Medium Value Cuts	0.70	0.86
High Value Cuts	0.85	0.93
Very High Value Cuts	0.72	0.84

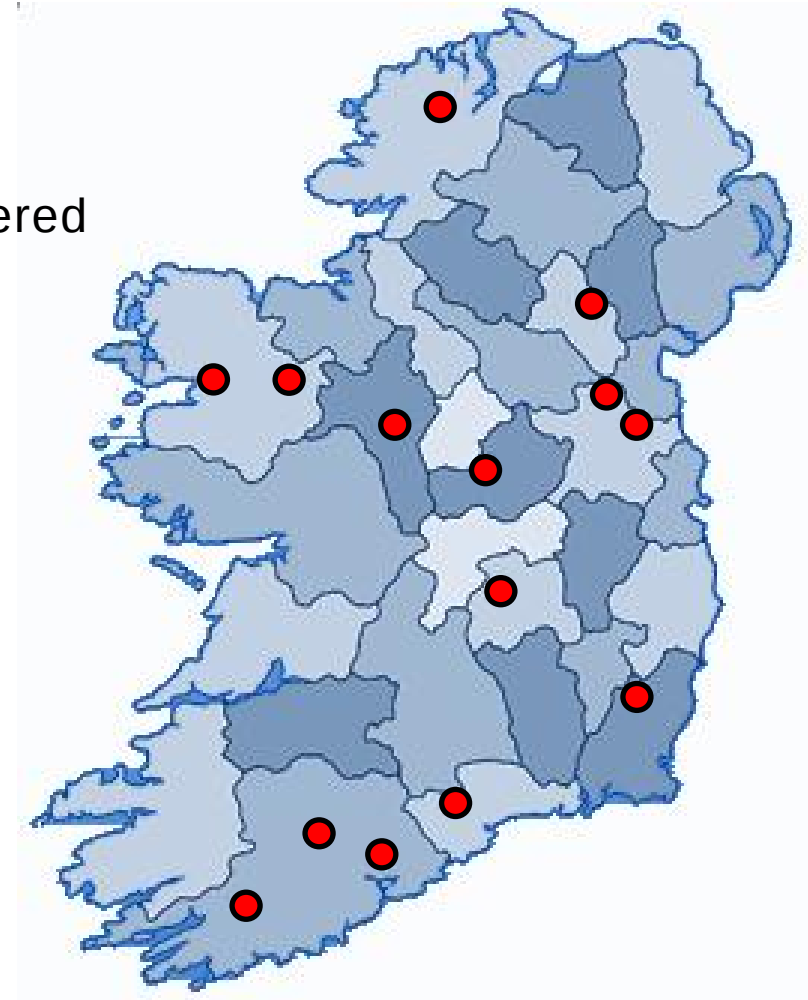
Pabiou et al. Livestock Sci. (submitted).

Objective

Calculate genetic parameters for predicted wholesale cut weights using a large crossbred population of steers and heifers in Ireland

Data Used

- Digital images collected
 - (x2) images of steers & heifers slaughtered between Nov. 2006 and May 2009
 - Across 14 slaughter houses in Ireland
 - Raw data = 515,494 x 2 images
- Main edits on carcasses
 - Absence of parentage
(n = 355,704)
 - Insufficient contemporary group size
(n = 63,379)
 - Error in recovering historical files
(n = 30,760)



Predicted Traits

Heifer data

N = 14,318

- Total meat (kg)
- Lower value cut (kg)
- Medium value cuts (kg)
- High value cuts (kg)
- Very high value cuts (kg)

Steer data

N = 38,404

- Total meat (kg)
- Total fat (kg)
- Total bone (kg)
- Lower value cut (kg)
- Medium value cuts (kg)
- High value cuts (kg)
- Very high value cuts (kg)

Model

- For both steer & heifer model

Fixed class effects	Age of dam, Contemporary Group, Factory x slaughter date
Fixed regressions	Heterosis, Recombination loss, Age at slaughter, Carcass weight
Genetic groups	11 breed groups (min. group size = 675 founders)
Random effects	Animal or Sire, error
Software	ASreml

Mean Performances

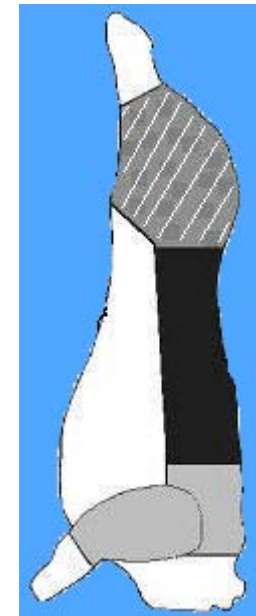
	Heifers	
	Mean	CV
Carcass weight (kg)	290	15%
<i>Overall Predicted weights (kg)</i>		
Total meat	175	11%
Total fat	<i>n/a</i>	<i>n/a</i>
Total bone	<i>n/a</i>	<i>n/a</i>
<i>Wholesale predicted weights (kg)</i>		
Lower Value Cuts	91	16%
Medium Value Cuts	20	18%
High Value Cuts	46	18%
Very High Value Cuts	21	17%

Mean Performances

	Heifers		Steers	
	Mean	CV	Mean	CV
Carcass weight (kg)	290	15%	344	14%
<i>Overall Predicted weights (kg)</i>				
Total meat	175	11%	231	15%
Total fat	n/a	n/a	44	34%
Total bone	n/a	n/a	76	12%
<i>Wholesale predicted weights (kg)</i>				
Lower Value Cuts	91	16%	88	21%
Medium Value Cuts	20	18%	49	16%
High Value Cuts	46	18%	60	15%
Very High Value Cuts	21	17%	25	15%

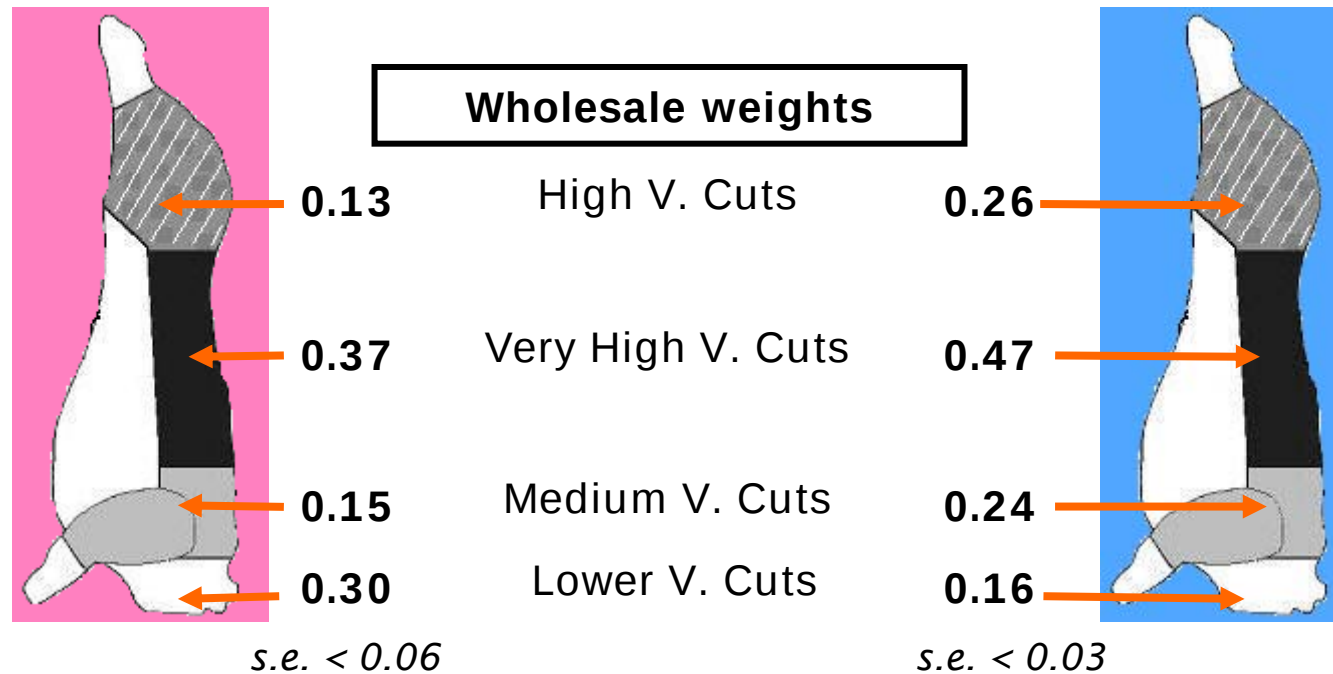
Heritability

<i>Heifers</i>	Overall weights	<i>Steers</i>
0.58 (0.06)	Carcass (<i>True perf.</i>)	0.48 (0.03)
0.72 (0.06)	Total meat	0.38 (0.03)
<i>n/a</i>	Total fat	0.14 (0.03)
<i>n/a</i>	Total bone	0.49 (0.03)



Heritability

<i>Heifers</i>	Overall weights	<i>Steers</i>
0.58 (0.06)	Carcass (<i>True perf.</i>)	0.48 (0.03)
0.72 (0.06)	Total meat	0.38 (0.03)
<i>n/a</i>	Total fat	0.14 (0.03)
<i>n/a</i>	Total bone	0.49 (0.03)



Genetic Correlations

1- In the steer and in the heifer datasets

Steers Heifers	Carc. Weight	Total meat	Total fat	Total bone	Low. V. cuts	Med. V. cuts	High V. cuts	Very H. V. cuts
Carcass weight		0.39			0.4	0.32	0.43	0.45
Total meat	0.28				0.71	0.78	0.93	0.80
Total fat	n/a			0.13	-0.50			-0.54
Total bone	n/a	n/a			-0.22			-0.62
Lower Value cuts	0.26	0.87	n/a					
Medium Value cuts	0.10	0.75	n/a	n/a				
High Value cuts	0.26	0.89	n/a	n/a				
Very High Value cuts	0.38	0.62	n/a	n/a				

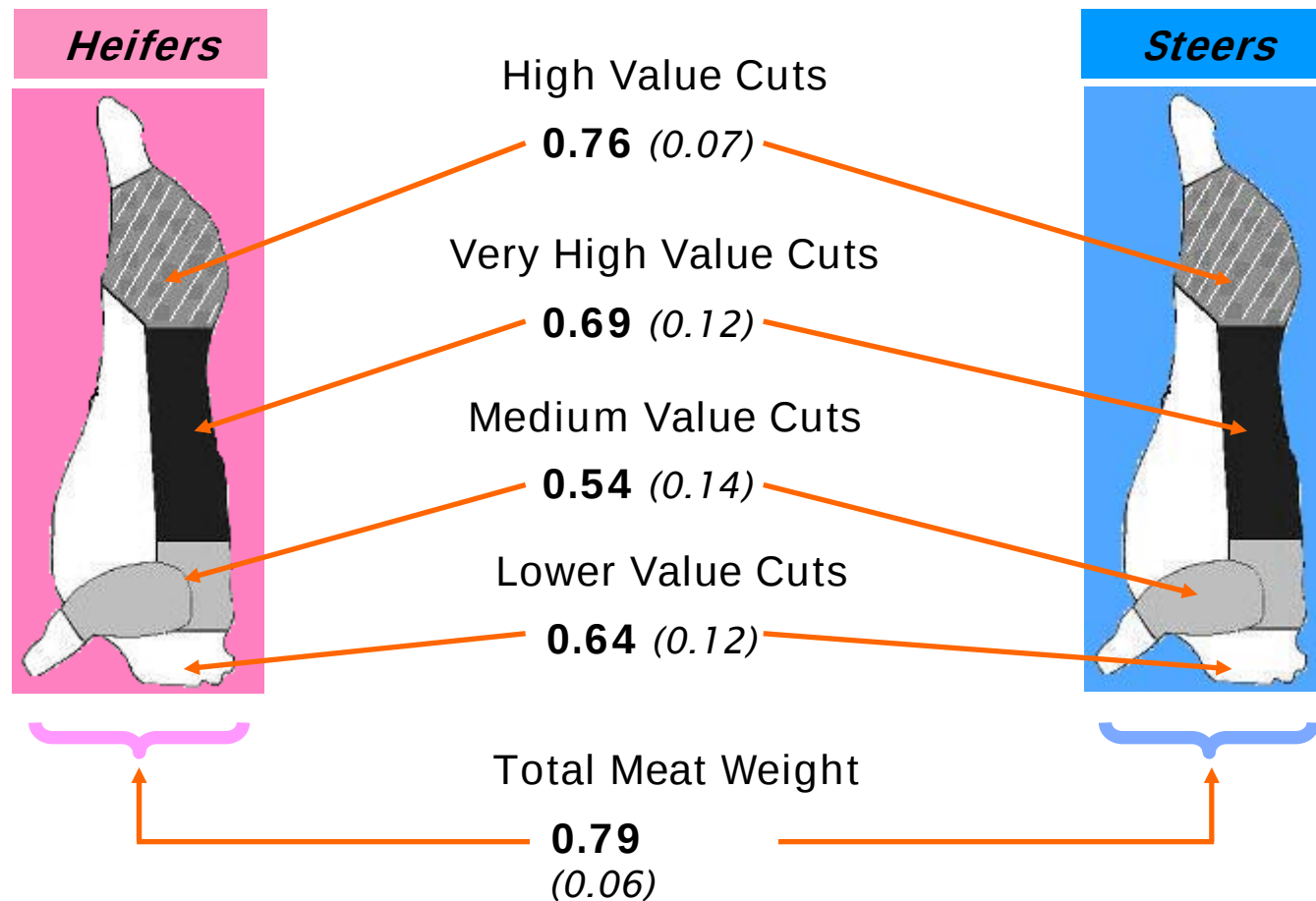
Genetic Correlations

1- In the steer and in the heifer datasets

	Steers		Heifers					
	Carc. Weight	Total meat	Total fat	Total bone	Low. V. cuts	Med. V. cuts	High V. cuts	Very H. V. cuts
Carcass weight		0.39	0.28	0.13	0.4	0.32	0.43	0.45
Total meat	0.28		0.87	0.75	0.71	0.78	0.93	0.80
Total fat	n/a			0.13	-0.50	0.6	0.8	-0.54
Total bone	n/a	n/a			-0.22	0.3	0.5	-0.62
Lower V. cuts	0.26	0.87	n/a			0.45	0.66	0.57
Medium V. cuts	0.10	0.75	n/a	n/a	0.47		0.79	0.86
High V. cuts	0.26	0.89	n/a	n/a	0.80	0.82		0.89
Very H. V. cuts	0.38	0.62	n/a	n/a	0.69	0.82	0.82	

Genetic Correlations

2 - Between steer and heifer datasets



Conclusion

- Large genetic variation exploitable for different cut weights predicted from digital images
 - Routinely collected
- Implementation of the new traits into the carcass evaluation for both beef & dairy cattle in Ireland
- Implication for the Irish industry
 - Will provide farmers tools to select directly for meat yields
 - Could provide opportunity for enhanced payment systems to benefit farmers and factories