Genotype–Environment Interactions of Bulls used in Expanding Herds

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Genotype*Environment (G*E) Interaction

- Daughter performance varies according to her environment
  - Rescaling or reranking of sires

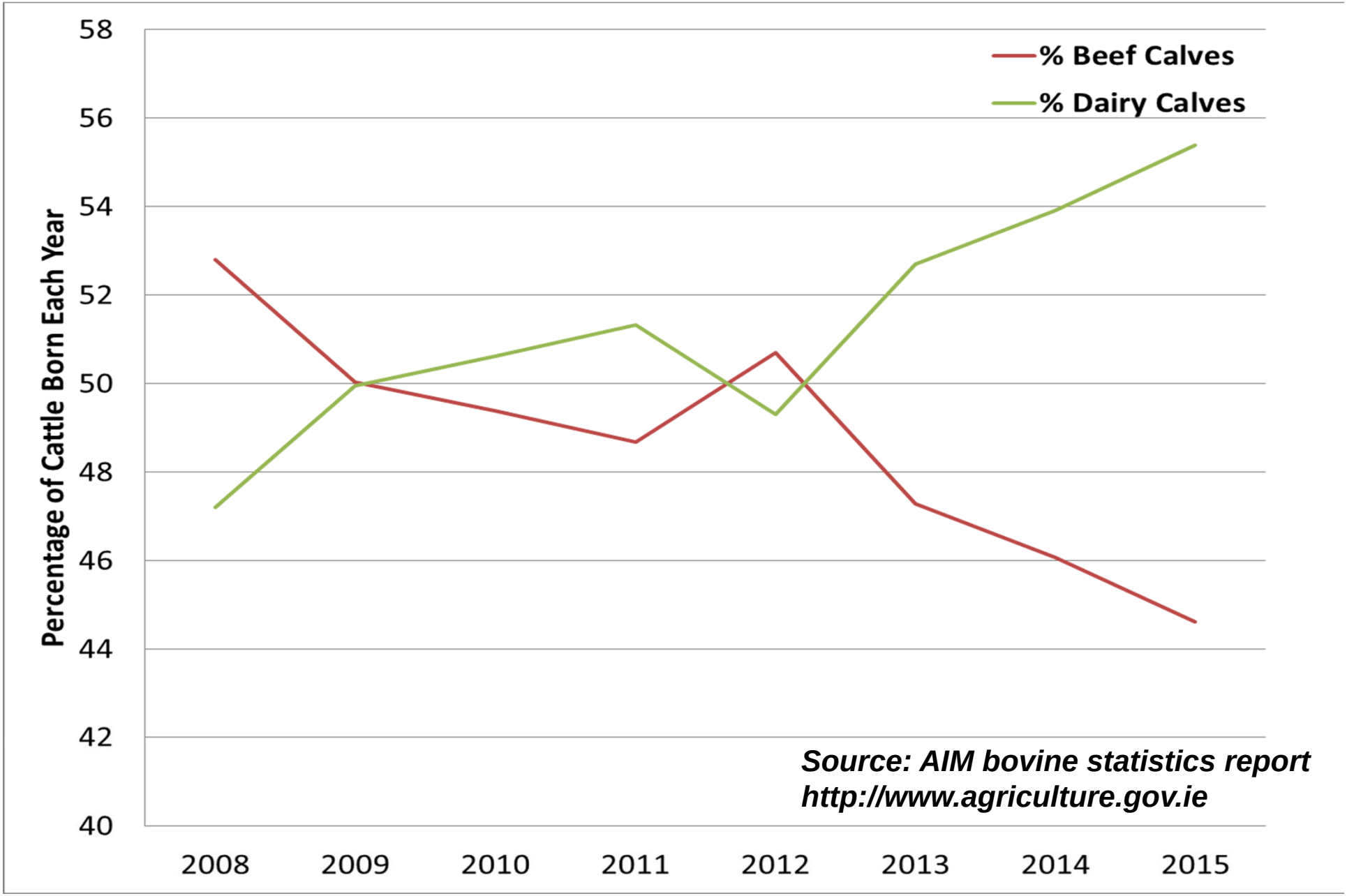
- High vs low concentrate input *(Cromie et al., 1997)*
- Large vs small herds *(Hayes et al., 2003)*
- High vs low temperature humidity *(Hayes et al., 2003)*
- Grazing vs confined production (*Kearney et al., 2004*)

A changing dairy industry

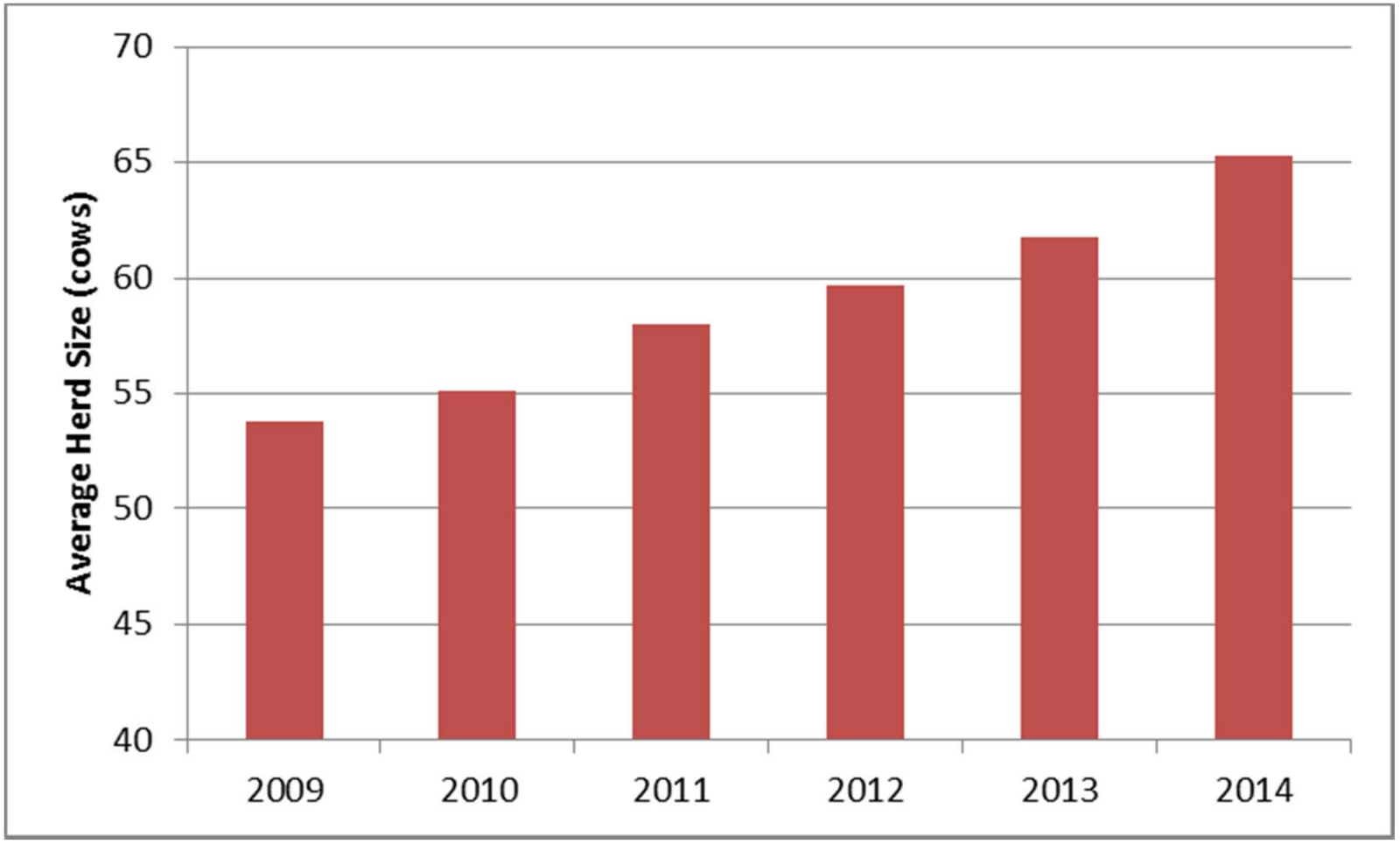
- Milk quota abolition has led to significant changes in European milk production
  - Previous limiting factor on milk production
  - Cows not yielding to full genetic potential
  - Farms not utilised to full potential

- Food Harvest2020
  - Strategy document published by Irish DAFM
  - Set target of increased milk output by 50% by 2020
    - Volumes increased by 10% by 2014

Calves born from dairy or beef dams (Ireland)



Average herd size in Ireland



Source: AIM bovine statistics report http://www.agriculture.gov.ie

Is there an impact of dairy expansion?

- Nationally, dairy herds are expanding

- Expanding vs Static herds
  - Lower milk yield, higher fat [illegible] n %
  - Better reproducti[illegible]
  - Lower a[illegible]
  - Higher [illegible]

These differences suggest different environments

Jago and Berry, 2011

Does bull performance differ in herds of different size, or herds differing in rate of expansion?

Materials & Methods 1) Herd Characterisation

- National data base of milk recorded cows 2010 – 2014, inclusive
  - Spring calving herds retained
  - Only herds present for all 5 years retained
- Linear robust regression to quantify rate of expansion
  - Static (−/+b; $p>0.05$)
  - ~~Contracting (b; $p<0.05$)~~
  - Expanding (+b; $p<0.05$)
    - Slowly (+3.1 cows / year)
    - Rapidly (+8.7 cows / year)
- Predicted herd size in 2012
  - Small (46.5 cows), Medium (72.6 cows), Large (125.3 cows)

Materials & Methods 2) Data & Analysis

- Sire PTA from December 2011 national genetic evaluation obtained (http://www.icbf.com)
  - PTA deregressed
  - Retained if reliability >50%

- Holstein–Friesian cows calving for first time in 2012 or after
- Predicted 305–day yields (Biological extremes removed)

- Linear mixed models ASReml
  - Test for sire PTA * herd classification (expansion or size)
  - Test for sire PTA * parity
  - Herd class, parity, sire PTA, [HYS calving]

Data Summary

	Avg Cows	No Recs
Small	47	38,756
Medium	73	67,485
Large	125	115,431
Static	0	125,652
Slow	3	36,517
Rapid	9	59,503

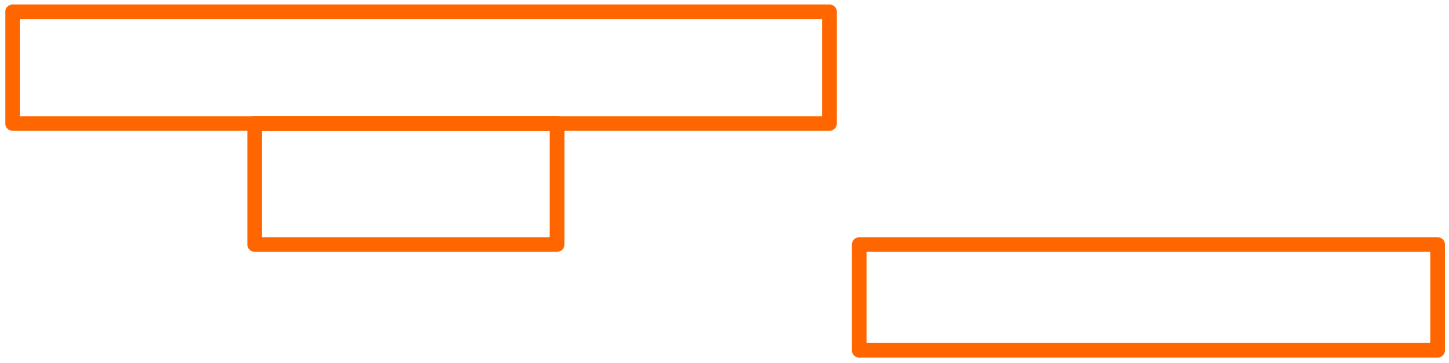
RESULTS

Did daughters perform as expected?

	Milk (kg)	Fat (kg)	Prot (kg)	Fat (%)	Prot (%)
Average	0.59	0.61	0.48	0.79	0.73

Daughter Performance

	Milk (kg)	Fat (kg)	Prot (kg)	Fat (%)	Prot (%)
Small (47)	5,777[A]	232.6[A]	202.1[A]	4.06[A]	3.51[A]
Med (73)	5,834[B]	236.9[B]	204.5[B]	4.10[B]	3.52[B]
Large (125)	5,705[C]	234.8[C]	201.3[A]	4.16[C]	3.54[C]



Sire use across herd categories

	Milk (kg)	Fat (kg)	Prot (kg)	Fat (%)	Prot (%)
Small (47)	177[A]	12.8[A]	10.5[A]	0.11[A]	0.09[A]
Med (73)	201[B]	13.5[B]	11.2[B]	0.11[A]	0.09[A]
Large (125)	207[C]	14.1[C]	11.6[C]	0.12[C]	0.10[C]

Sire performance across herd categories

	Milk (kg)	Fat (kg)	Prot (kg)	Fat (%)	Prot (%)
Small (47)	0.67[A]	0.66[A]	0.52[A]	0.84[A]	0.76[A]
Med (73)	0.62[A]	0.62[A]	0.51[A]	0.82[A]	0.74[A]
Large (125)	0.58[B]	0.55[B]	0.46[B]	0.75[B]	0.72[B]

Conclusion

- Irish dairy herds are undergoing expansion
- Cows performed closest to their genetic potential in
  - Small & medium sized herds
  - Herds which were slowly expanding (<3 cows / year)
- Genetic correlations among classes of expansion / herd size will indicate if differences are due to rescaling or reranking

Thank you for your attention

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An Roinn
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Bia agus Mara

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