BUSH AGRIBUSINESS PTY LTD

Profiting from Angus Genetics in Commercial Herds

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Executive Summary

- 24 scenarios were investigated in a herd modelling exercise to quantify the benefits of Angus genetics to commercial beef production.
- The scenarios were combinations of straight Angus and Angus cross, breeding & growing to feeder and slaughter weight, and weaner production, for the regions QLD Central West, QLD Southern Inland, and NSW Tablelands. Modelling assumptions were informed by analysis of empirical price and EBV data, the Australian Beef Report 2020, and other published literature.
- Incremental ten-year discounted cash flow analysis showed all scenarios to produce a net benefit over 'business as usual', which was assumed to be the regional average herd income statement from the Australian Beef Report.
- The impact of both price and productivity were quantified in the analysis. Productivity differences were attributed to both the inherent difference between scenarios, and the magnitude of trends in productivity drivers (weaning rate, sale weight, mortality rate) over time.
- The present value attributable to productivity outweighed the contribution of market premiums for all cases. Therefore, small differences in productivity that may be available through superior genotypes are likely to far outweigh any market premiums received.
- The net present values for weaner scenarios were substantially less than others.
- Results were sensitive to changes in additional expenses, meaning that commercial producers should consider potential for increased bull costs and turnover when transitioning between seedstock suppliers.
- Sensitivity analyses demonstrated that modest improvements in phenotypic trends (rate of change over time) produced a net benefit, even when there was no inherent productivity difference, and the price difference was half (relativity = 0.5) the 'business as usual'.
- This means that the pace of genetic progress over a medium to long-term period can be as important to financial results as the inherent differences in productivity.
- The implications of these findings are that commercial producers can benefit from sourcing genetics that are improving as rapidly as possible, and seedstock producers could consider differentiating themselves based on their rates of progress.

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1 Introduction

Beef production enterprises may benefit from changes to herd genetics, either through improved productivity or attracting market premiums. Furthermore, running a cross enables producers to utilise the production benefits of heterosis (hybrid vigour). The Angus breed has potential to provide market premiums to beef producers, whilst also adding production benefits related to fertility and growth. The Angus breed can also be easily incorporated into crossing programs for heterosis. Importantly, commercial producers who regularly add well-selected genotypes from seedstock producers to their herd reap benefits of that breed's genetic progress. Producers engaging with breeds whose genetic progress is greater than alternatives may be better off over a medium to longer-term period, with minimal additional investment.

Several recent research efforts have quantified the productivity and heterosis gains related to Angus and Angus crossbred genetics (Pitchford, JM et al. 2021). This exercise draws on those efforts to inform a herd modelling analysis based on empirical data from selected Australian beef regions (McLean, IA et al. 2020). This enabled quantification of the relative contribution of both productivity and market premiums to the overall benefit of Angus or Angus crossbred genetics. It also enabled quantification of the benefit from genetic progress (greater genetic trends) compared with alternatives.

2 Data and analysis methodology

An incremental discounted cashflow analysis was used to compare a range of scenarios with 'business as usual' for selected enterprise types and regions. Incremental discounted cashflow is the change in cash flow related to a new project or investment. In this case, the regional herd average from the Australian Beef Report was taken as the 'business as usual' scenario to be compared incrementally with a straight Angus or Angus cross scenario (McLean, IA et al. 2020). Herd breed composition was assumed to be stable across the analysis period in all scenarios. Differences in income received and productivity per animal unit (kg beef/Adult Equivalent (AE)) were considered as relative between scenarios, rather than modelled as absolute quantities. This meant that results can be considered as the relative benefit or cost of a particular scenario over a 'business as usual' approach. Table 1 shows each scenario that was assessed for its incremental cost or benefit over 'business as usual' for that region and enterprise.

Table 1: Scenarios assessed for cost or benefit compared with a 'business as usual' herd, with regions corresponding to ABARES broadacre zones and regions and Australian Beef Report regions.

Region (Australian Beef Report regions)	Enterprise type	Breed	Scenario no.
QLD Central West (314- Longreach, Charleville, Barcaldine, Blackall)	Breeding & growing (to feeder weight)	Angus	1
		Brahman X Angus	2
	Breeding & growing (to slaughter)	Angus	3
		Brahman X Angus	4

	Growing (trading)	Angus	5
		Brahman X Angus	6
	Weaner production	Angus	7
		Brahman X Angus	8
QLD Southern Inland (322- Emerald, Goondiwindi, St George)	Breeding & growing (to feeder weight)	Angus	9
		Brahman X Angus	10
	Breeding & growing (to slaughter)	Angus	11
		Brahman X Angus	12
	Growing (trading)	Angus	13
		Brahman X Angus	14
	Weaner production	Angus	15
		Brahman X Angus	16
NSW Tablelands (131- Canberra, Orange, Bathurst, Goulburn, Armidale, Cooma, Glen Innes)	Breeding & growing (to feeder weight)	Angus	17
		Angus X Hereford	18
	Breeding & growing (to slaughter)	Angus	19
		Angus X Hereford	20
	Growing (trading)	Angus	21
		Angus X Hereford	22
	Weaner production	Angus	23
		Angus X Hereford	24

A range of informed assumptions were entered into the discounted cash flow analysis for each of these scenarios. Table 2 shows each of these input assumptions for scenario 1 (Table 1). Incremental trend in productivity (kg beef/AE) was estimated using regression coefficients for the relationship between kg beef/AE and three productivity drivers: weaning rate, mortality rate, and sale weight (McLean, IA et al. 2020; Wellington & Walmsley 2020). Increasing mature cow weight was penalised by increasing the AE rating, and therefore increasing the denominator of kg beef/AE (Wellington & Walmsley 2020). Additionally, an inherent productivity difference was added for each scenario; this was primarily to capture the effects of heterosis with values based on Pitchford et al. 2021. Sensitivity analysis was also conducted on this variable. These assumptions fed into a ten-year (2022 to 2032) discounted cash flow table (Table 3), enabling calculation of net present value of each incremental scenario. All scenarios were discounted at a rate of 5%, which is effectively the interest rate used to discount future costs or benefits and determine the present value. The basis of each of these assumptions are detailed in the following sections.

Table 2: Input table for the QLD Central West 314: Straight Angus Feeder scenario with values and sources.

Inputs		**Source**
Business as Usual		
Trend in weaning rate (%)	0.10%	Comparable herd trends from BREEDPLAN (Graser et al. 2005)
Trend in mortality rate (%)	-0.01%	Comparable herd trends from BREEDPLAN (Graser et al. 2005)
Trend in sale weight (kg)	1.00	Comparable herd trends from BREEDPLAN (Graser et al. 2005)
Scenario		
Trend in weaning rate (%)	0.08%	EBV analysis, DTC trend, courtesy of Angus Australia
Trend in mortality rate (%)	-0.01%	Birth Weight and Calving Ease trends, courtesy of Angus Australia
Trend in sale weight (kg)	1.87	400d weight trend, Angus Australia
Key differences		
Inherent prod. diff (kg beef/AE)	2	
Price relativity	1.13	Price analysis of AuctionsPlus data
Herd Characteristics		
Income/kg	$2.00	Australian Beef Report
Increase in MCW (change in AE)	1.004	Analysis
AE carried	2,047	Australian Beef Report

Table 3: First three (2022-2024) and last two (2031-2032) years of the incremental discounted cash flow analysis for the QLD Central West 314: Straight Angus Feeder scenario, where 'delta' refers to 'change in' and represents the incremental element of the analysis.

	0	1	2	…	9	10
Year	2022	2023	2024		2031	2032
Delta kg produced	4,094	4,462	4,831		7,408	7,777
Price received/kg sold	$2.26	$2.26	$2.26		$2.26	$2.26
Delta income	$9,252	$10,085	$10,917		$16,743	$17,575
Delta enterprise expenses						
Delta expenses						
Net Cashflow	$9,252	$10,085	$10,917		$16,743	$17,575
Discounted cashflow	$9,252	$9,605	$9,902		$10,793	$10,790
NPV	**$113,468**					

2.1 Pricing analysis

Market premiums for Angus and Angus crosses were estimated using AuctionsPlus data. The data were divided into transactions that took place in either Queensland or New South Wales, then into straight Angus, Angus x Brahman, and Angus x Hereford, and into stock category (steers, heifers, and weaners). The data were aggregated into a monthly timeseries and compared against a baseline timeseries of saleyard data for steers and heifers, prepared by Bush AgriBusiness. The relativity of each breed's timeseries to the baseline informed the price relativity factored into the modelling. Figure 1 shows that straight Angus and Angus cross generally attract a premium relative to the market baseline and that the premium remains relatively constant across price fluctuations. Data scarcity meant that uncertainty was greater for crossbred scenarios, indicated by the error bars on the timeseries estimation in Figure 1.

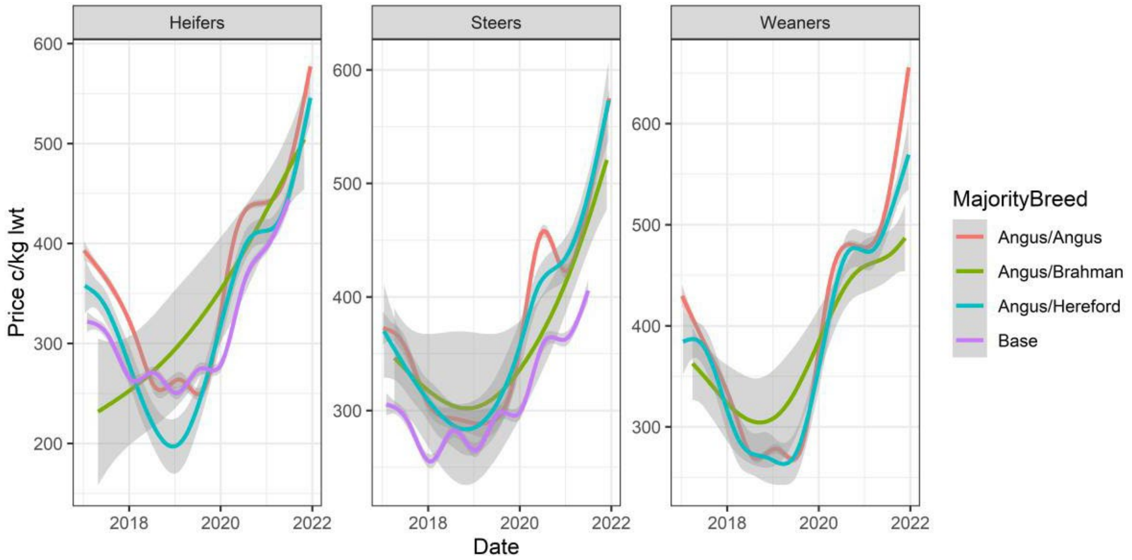

Figure 1: Locally fitted price timeseries for baseline, straight Angus, Angus x Brahman, and Angus x Hereford sales and baseline data from Bush AgriBusiness and from AuctionsPlus.

Table 4 shows the price relativities used in the incremental discounted cashflow calculated as the price received for Angus or Angus X divided by the baseline saleyard price at a given point in time. These were close to previous analyses assessing the market premiums for Angus (Herrmann 2019). The standard errors show acceptable uncertainty in estimation, although a range of price relativities were tested in sensitivity analyses.

Table 4: Price relativities for each of the breeds and crosses analysed, with data from AuctionsPlus and Bush AgriBusiness benchmarking pricing.

Majority Breed	Region	Mean relativity	Standard deviation	*n* sales	Standard error
Angus/Angus	North	1.13	0.20	523	0.01
Angus/Angus	South	1.14	0.17	6,906	0.00
Angus/Brahman	North	1.10	0.11	23	0.02
Angus/Hereford	South	1.07	0.15	330	0.01

Pricing between stock categories was investigated to determine whether different relativities should be used between enterprise scenarios, particularly for the weaner production scenario. Figure 2 shows variable differences in price between stock categories over time, with a similar overall pattern. While there was a clear premium for weaners compared with steers and heifers over the past twelve months, Table 5 shows that this did not result in an overall premium on weaners, as the weaner price was on average lower (relativity < 1) than the heifer and steer price in some cases. It was therefore determined that there was not a sufficient long-term difference to warrant a separate relativity for a ten-year discounted cash flow.

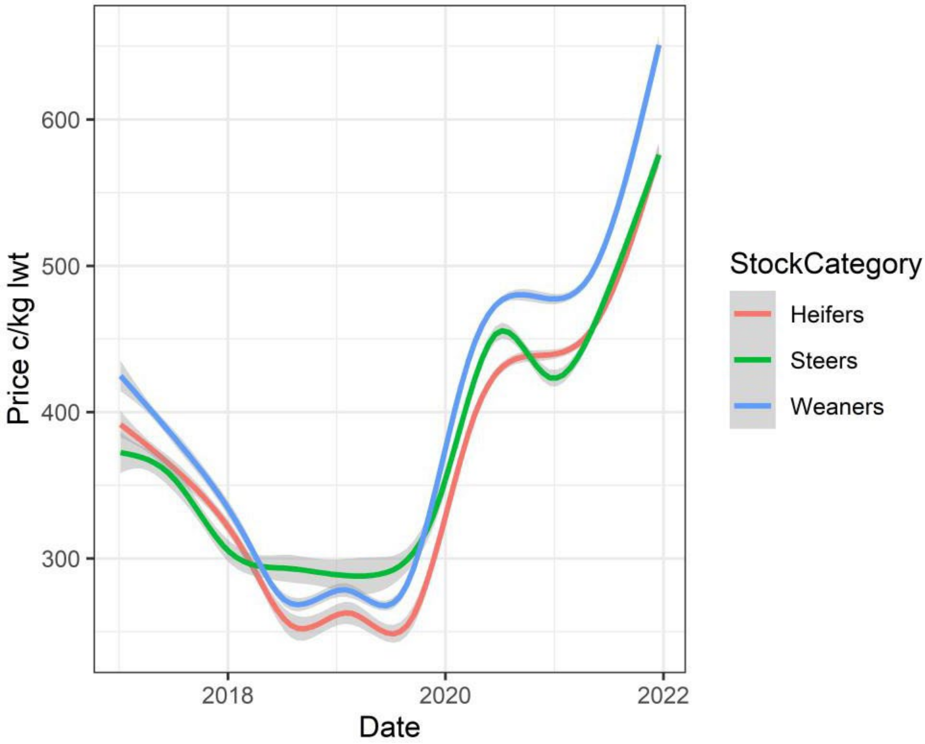

Figure 2: Angus prices over time for steers, heifers, and weaners, with data from AuctionsPlus.

Table 5: Mean relativity of weaner price to heifer and steer price from 2017 to 2021 for each of the breeds and crosses analysed, with data from AuctionsPlus.

Majority Breed	Relativity
Angus/Angus	0.95
Angus/Brahman	1.01
Angus/Hereford	0.96

2.2 Genetic trends

The pace of genetic improvement for the Angus breed were estimating by relating rates of change in phenotypic trends to their related productivity driver traits: weaning rate, mortality rate, and sale weight. ‘Business as usual’ trends were more difficult to estimate. However, figures chosen were informed by investigation of trends in several other breeds, the Australian Beef Report data, and a literature review of genetic trends in Australian cattle breeds (Lalman et al. 2019; McLean, IA et al. 2020; Pitchford, W et al. 2021; Pitchford, WS et al. 2021). Sensitivity analyses enabled the impact of uncertainty in both price and productivity assumptions to be tested.

Linear rates of change were used to quantify phenotypic trends and therefore the trends in productivity drivers. Table 5 shows EBV trends in relevant units for the Angus breed from 2001 to 2020, courtesy of Angus Australia, in addition to the % phenotypic change over the same period. EBV trends were used to inform herd productivity trend assumptions where the EBV unit related to a productivity unit, in this case kilograms for growth. Therefore, the 1.87kg trend in 400-day weight can be traced to the sale weight trend value in Table 2. The % phenotypic trend was used to inform trends in traits with other units, for example, the inverse of the percentage change in days to calving was used to inform the weaning rate trend (Table 2).

Table 6: Average annual changes for the Angus breed expressed in a) estimated breeding value (EBV) trends from 2001 to 2020 and b) as a percentage change in phenotypic trend for the same period.

EBV	EBV change per year	% phenotypic change per year
200 d Wt (kg)	1.11	0.40%
400 d Wt (kg)	1.87	0.50%
600 d Wt (kg)	2.58	0.37%
DtC (days)	-0.12	-0.08%
MCW (kg)	1.95	0.36%

In addition to genetic merit and progress, crossing different breeds can produce more vigorous offspring through the phenomenon of heterosis or hybrid vigour. For the Angus breed, this is often achieved through crossing with another *Bos taurus* breed such as Hereford (Pitchford et al. 2021), or crossing with *Bos indicus* breed, depending on the breeding objectives and production environment. The benefit of heterosis is often realised through faster growing progeny (Pitchford et al. 2021). This has been factored into the inherent productivity assumption (Table 2) in this analysis. Sensitivity to inherent productivity difference in the results captures a range of responses to heterosis (Tables 8 & 9, Appendix 1).

3 Results

3.1 Scenario comparison

The net present values for each of the scenarios can be visualised within region. Figure 3 shows the net present values for QLD Central West, grouped by enterprise and breed, and their attribution to either market premiums or changes in productivity. The present value attributable to productivity outweighed the contribution of market premiums for all cases. The Angus x Brahman crosses gave the highest net present value for each enterprise, and breeding & growing to feeder weight was the highest among these. For the straight Angus scenarios, breeding & growing to slaughter weight gave the greatest net present value, and the contribution of market premiums was relative greater for these. The net present values for weaner scenarios were substantially less than other enterprise types.

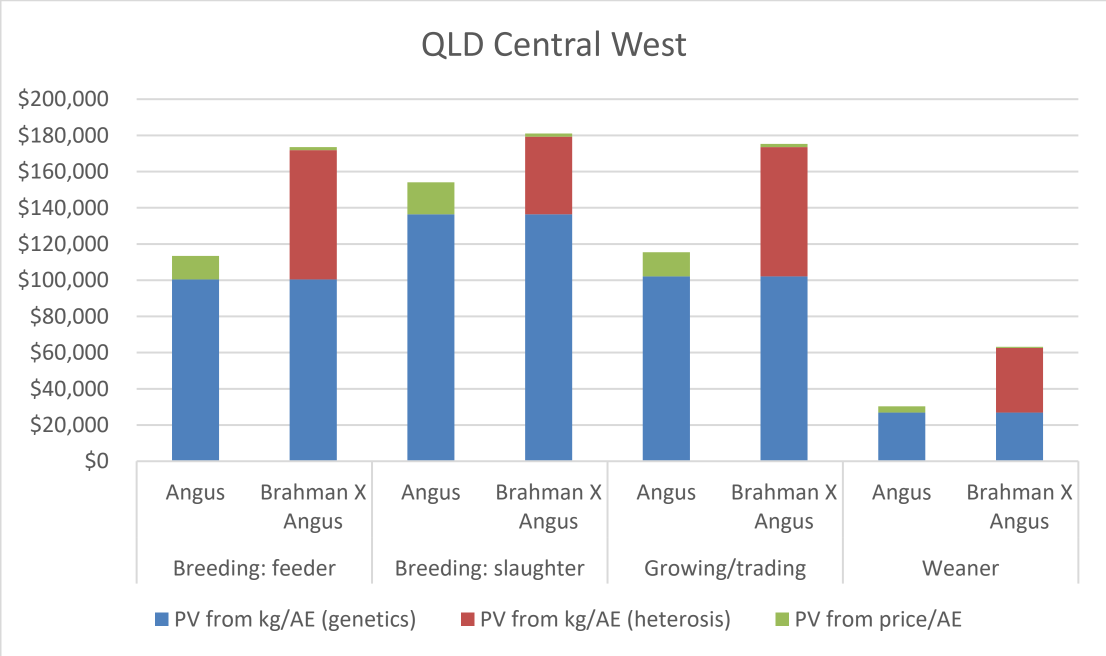

Figure 3: Net present value results from a ten-year discounted cash flow analysis and their attribution to either price or productivity from heterosis and genetics (kg) for each of the scenarios in QLD Central West.

Figure 4 shows similar patterns across enterprises for QLD Southern Inland, compared with QLD Central West. However, differences between Angus x Brahman and straight Angus were greater for QLD Southern Inland, especially for the breeding & growing to slaughter weight. This meant that results were similar across the breeding & growing to feeder weight, breeding & growing to slaughter weight, and growing/trading scenarios.

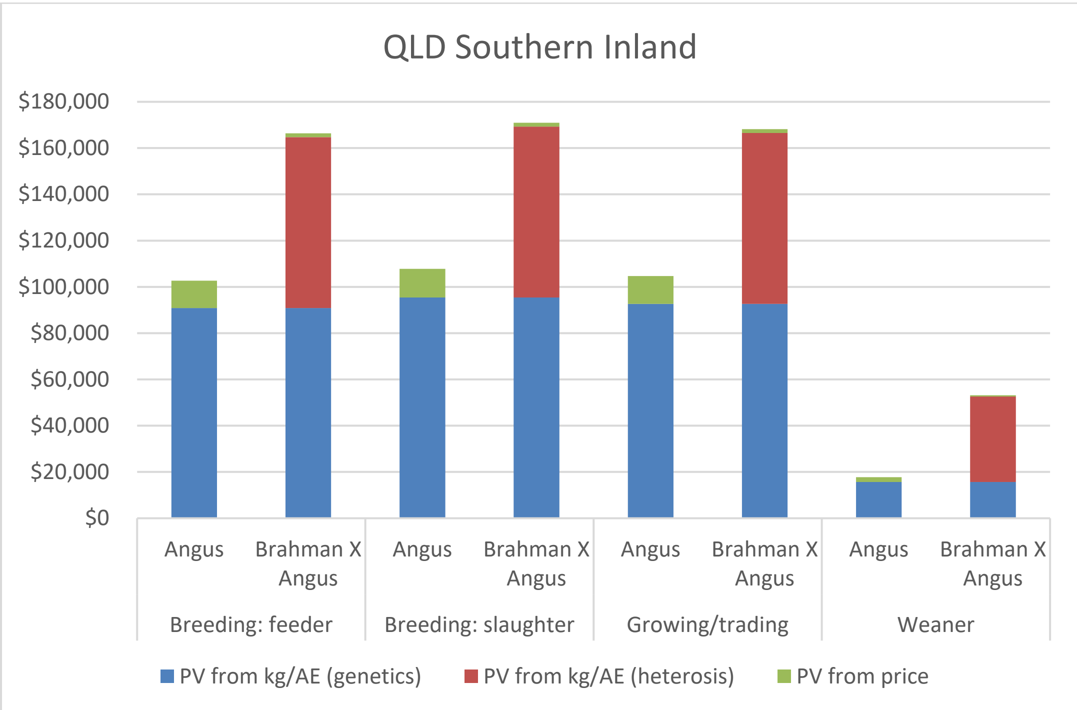

Figure 4: Net present value results from a ten-year discounted cash flow analysis and their attribution to either price or productivity from heterosis and genetics (kg) for each of the scenarios in QLD Southern Inland.

The NSW Tableland results (Figure 5) show a greater contribution of market premiums to the outcomes than the QLD scenarios. Again, comparisons between Angus X Hereford and straight Angus scenarios, and between enterprises, are like other regions.

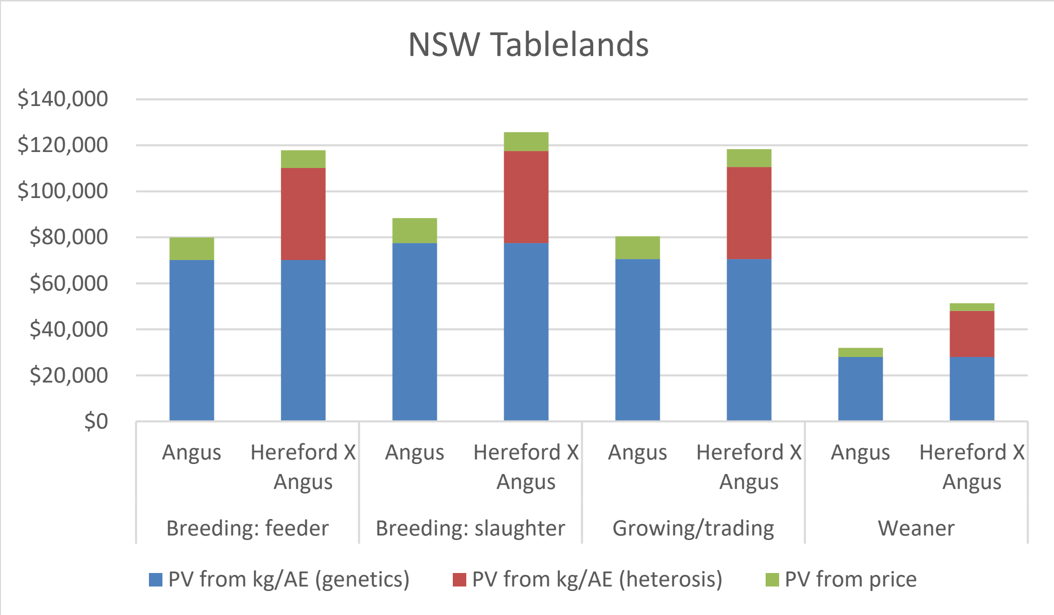

Figure 5: Net present value results from a ten-year discounted cash flow analysis and their attribution to either price or productivity (kg) for each of the scenarios in NSW Tablelands.

The net present value results can also be expressed per AE and compared with regional earnings before interest and tax (EBIT) per AE. Table 7 shows the EBIT/AE for the long-term average and top 25% from the Australian Beef Report 2020, and the net present value results per AE for each scenario. The present values per AE can be interpreted in the context of the average EBIT/AE for the region; that is, it is the change in EBIT/AE attributable to changes in production and price assumptions. In many scenarios, the net benefit per AE exceeded the difference between the average and top 25%, demonstrating that modest differences in productivity can have substantial impacts on financial results.

Table 7: EBIT/AE for the average and top 25% of producers in three regions, compared with net present value/AE for each of the production scenarios analysed from a ten-year discounted cash flow.

		QLD Central West	QLD Southern Inland	NSW Tablelands
Australian Beef Report	Average EBIT/AE	$28.51	$20.86	$0.10
	Top 25% EBIT/AE	$69.08	$85.49	$1.34
Breeding & Growing: Feeder	Straight Angus	$55.43	$57.46	$44.74
	Angus X	$84.78	$93.11	$65.95
Breeding & Growing: Slaughter	Straight Angus	$75.29	$60.33	$49.45
	Angus X	$88.44	$95.68	$70.37
Growing /trading	Straight Angus	$56.39	$58.59	$45.03
	Angus X	$85.63	$94.13	$66.22
Weaner	Straight Angus	$14.84	$9.93	$17.88
	Angus X	$30.88	$29.75	$28.76

3.2 Sensitivity analysis

Sensitivity analyses to key assumptions of price relativities and the inherent productivity difference were performed for each scenario. Table 6 shows the results for scenario 1 (Table 1), and the remaining sensitivity analyses are presented in Appendix 1. The colour scheme indicates that results are more sensitive to inherent productivity than price relativity (the ratio of Angus price to baseline price) over the ranges tested. Importantly, all price relativities produced a net benefit at inherent productivity differences of 0 or greater, while even the greatest price relativities were unable to offset any negative inherent productivity differences. Therefore, all results with an inherent productivity difference less than 0 produced a negative net present value. Sensitivity analyses for other scenarios showed similar patterns (Appendix 1) with values varying according to patterns evident in Figures 3-5. Lower price relativities produce better (less negative) results when the inherent productivity difference is less than 0 as the loss in kilograms produced has a lower value.

Table 8: Sensitivity analysis of net present value to inherent productivity difference and price relativity for scenario 1: QLD Central West, straight Angus, breeding & growing to feeder weight.

		Inherent prod. Diff (kg beef/AE)				
		-4	**-2**	**0**	**2**	**4**
Price relativity	**0.5**	-$56,913	-$21,207	$14,500	$50,207	$85,914
	0.75	-$85,370	-$31,810	$21,750	$75,310	$128,871
	1	-$113,827	-$42,413	$29,000	$100,414	$171,827
	1.25	-$142,284	-$53,017	$36,250	$125,517	$214,784
	1.5	-$170,740	-$63,620	$43,500	$150,621	$257,741

Sensitivity additional expenses per AE, which represent a potential increase in bull cost or bull turnover, was tested alongside differences in inherent productivity. Net present value was more sensitive to changes in additional expenses per AE between -$10 and $10 per AE than inherent productivity in Scenario 1, Breeding & Growing in QLD Central West. This region carries an average of 2,047 AE, so to put this in context, an additional expense of $5,000 per year, either due to a more expensive bull purchase or an additional bull purchase, would result in an additional expense of $2.44/AE, and likewise additional bull-related expenses in a herd of this size would result in additional expenses of $4.88/AE.

Table 9: Sensitivity analysis of net present value to inherent productivity difference and change in enterprise expenses for scenario 1: QLD Central West, straight Angus, breeding & growing to feeder weight.

		Inherent prod. Diff (kg beef/AE)				
		-4	**-2**	**0**	**2**	**4**
Increase in expenses $/AE	**-$10.00**	$49,910	$130,607	$211,304	$292,002	$372,699
	-$5.00	-$39,357	$41,340	$122,037	$202,735	$283,432
	$0.00	-$128,624	-$47,927	$32,770	$113,468	$194,165
	$5.00	-$217,891	-$137,194	-$56,497	$24,201	$104,898
	$10.00	-$307,158	-$226,461	-$145,764	-$65,066	$15,631

4 Insights and discussion

4.1 Importance of productivity relative to price

Figures 3-5 demonstrate that small differences in productivity that may be available through superior genotypes are likely to far outweigh any market premiums received. In the case of the Angus breed, producers may expect to receive greater income from both productivity and market premiums, depending on the relative merits of alternative genotypes.

These findings are consistent with previous analyses of beef production which have found productivity to be a greater source of variation in profits between businesses than price (McLean, IA et al. 2020). Management factors such as grazing land management and animal husbandry have generally been identified as causing more variation in animal unit productivity than genetics, although a key difference is that superior genetics may be accessible with little to no additional investment.

Given the importance of productivity relative to price, it follows that the productivity benefits of heterosis outweighs any market premium for straight Angus progeny. The finding is consistent with Pitchford et al (2021) who found that pure Angus weaner steers would need to attract a premium of at least 4.1% to offset the benefit of heavier carcass from a Hereford x Angus weaner steer.

The Angus breed is versatile in its ability to be crossed with both *Bos indicus* and *Bos taurus* breeds. However, perverse effects of crossing should be considered. For example, Pitchford et al. (2021) found greater calving difficulties for Angus heifers calving Hereford x Angus progeny than for purebred Angus. This may offset growth benefits of heterosis by increasing the cow and calf mortality rate. Pitchford et al. (2021) suggested using cows rather than heifers to overcome this in addition to being wary of birth weight.

Similarly, the productivity benefits of Angus x Brahman crosses may be partially outweighed by reduced survivability and adaptability of Angus cattle in northern Australian environments. However, Wellington (2019) found that this was only likely to be relevant in a few tropical, coastal environments. Furthermore, crossing with adapted *Bos indicus* breeds is likely to overcome any adaptability concerns.

4.2 Importance of genetic trends

Productivity benefits are not only realised from using genotypes inherently superior to alternatives, but also from continually sourcing genotypes that are improving more rapidly than alternatives. In this modelling exercise, these sources of gain have been accounted for by including both a trend effect and inherent productivity effect. The sensitivity analyses (Table 6 and Appendix 1) demonstrate that even when there is no inherent productivity difference and price is half the 'business as usual' (relativity = 0.5), modest differences in phenotypic trends cause a net benefit over a ten-year period. This finding demonstrates the critical importance of the pace of genetic trends.

Commercial producers can capture the benefits of genetic trends by simply sourcing genotypes that follow or outpace a breed's progress. Commercial producers may consider calculating or requesting trends in critical EBVs from their preferred seedstock suppliers and benchmarking these against breed average. Progressive seedstock producers could also use this finding to support their promotion of their herd's trends relative to breed average. Additionally, rates of progress may be built into long-term seedstock supply contracts for larger commercial producers (Holmes 2018).

4.3 Enterprise type

Differences in results were not substantial for the various breeding & growing scenarios. However, each of these produced substantially greater benefits than the weaner production scenario. This result reflects the greater opportunity to capture growth benefits from superior genetics when animals are sold heavier and the multiplication of the price premium. However, it may also be partially due to limitations of the analysis which mean that weaner production systems are not well-reflected in productivity modelling. For example, the profitability of weaner production is likely to be more sensitive to weaning rate compared with breeding & growing and given that the empirical data is likely to be mostly breeding & growing based, the coefficients may not reflect this. The implication is that benefits to weaner production systems may be expected to differ from those stated, depending on the influence of Angus genetics on fertility.

The inclusion of the weaner scenario was inspired by recent moves to capitalise on high prices, especially for Angus weaners in southern Australia. These production systems, such as those studied in Pitchford et al (2021), do not generally perform well in extensive environments to the relatively expensive production of beef per unit of energy intake for cows and calves compared with growing heifers and steers (McLean, I et al. 2018; McLean, IA et al. 2020). This phenomenon is also partly reflected in the results.

4.4 Bull cost and turnover

Changing the sources of genetics may incur additional costs to commercial producers. These may be in some combination of more expensive bulls or higher bull turnover either due to management strategy or higher bull breakdown. Table 9 shows that overall results are quite sensitive to additional cost of changing genetics, some of which can be attributed to bull cost.

Commercial producers should consider how a planned change in sourced genetics will affect both the absolute cost and turnover of bulls. They may also benchmark their bull's longevity and build this into seedstock supply contracts.

5 Conclusion

Angus genetics are likely to provide financial benefits to commercial beef herds through improved productivity, with market premiums adding modestly to this benefit. Producers may further capitalise on productivity by capturing the benefits of heterosis in an Angus cross. Although this attracts a lesser market premium, that is more than completely offset by productivity benefits under the assumptions tested. The pace of genetic progress over a medium to long-term period can be as important to financial results as the inherent difference in productivity. This means that commercial producers can benefit from at least keeping pace with breed average genetic merit.

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7 Appendix 1

Sensitivity analyses of net present value to price relativity and inherent productivity difference for all scenarios.

Scenario 1		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$56,913	-$21,207	$14,500	$50,207	$85,914
	0.8	-$85,370	-$31,810	$21,750	$75,310	$128,871
	1	-$113,827	-$42,413	$29,000	$100,414	$171,827
	1.3	-$142,284	-$53,017	$36,250	$125,517	$214,784
	1.5	-$170,740	-$63,620	$43,500	$150,621	$257,741

Scenario 2		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$54,380	-$18,673	$17,034	$52,741	$88,447
	0.8	-$81,570	-$28,010	$25,551	$79,111	$132,671
	1	-$108,760	-$37,346	$34,067	$105,481	$176,895
	1.3	-$135,950	-$46,683	$42,584	$131,851	$221,118
	1.5	-$163,139	-$56,019	$51,101	$158,222	$265,342

Scenario 3		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$53,205	-$17,498	$18,209	$53,916	$89,622
	0.8	-$79,807	-$26,247	$27,313	$80,874	$134,434
	1	-$106,409	-$34,996	$36,418	$107,831	$179,245
	1.3	-$133,012	-$43,745	$45,522	$134,789	$224,056
	1.5	-$159,614	-$52,494	$54,627	$161,747	$268,867

Scenario 4		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$53,205	-$17,498	$18,209	$53,916	$89,622
	0.8	-$79,807	-$26,247	$27,313	$80,874	$134,434
	1	-$106,409	-$34,996	$36,418	$107,831	$179,245
	1.3	-$133,012	-$43,745	$45,522	$134,789	$224,056
	1.5	-$159,614	-$52,494	$54,627	$161,747	$268,867

Scenario 5		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$56,049	-$20,342	$15,365	$51,072	$86,779
	0.75	-$84,073	-$30,513	$23,048	$76,608	$130,168
	1	-$112,097	-$40,684	$30,730	$102,144	$173,557
	1.25	-$140,121	-$50,854	$38,413	$127,680	$216,946
	1.5	-$168,146	-$61,025	$46,095	$153,215	$260,336

Scenario 6		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$56,049	-$20,342	$15,365	$51,072	$86,779
	0.75	-$84,073	-$30,513	$23,048	$76,608	$130,168
	1	-$112,097	-$40,684	$30,730	$102,144	$173,557
	1.25	-$140,121	-$50,854	$38,413	$127,680	$216,946
	1.5	-$168,146	-$61,025	$46,095	$153,215	$260,336

Scenario 7		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$57,973	-$22,266	$13,440	$49,147	$84,854
	0.75	-$86,960	-$33,399	$20,161	$73,721	$127,281
	1	-$115,946	-$44,533	$26,881	$98,294	$169,708
	1.25	-$144,933	-$55,666	$33,601	$122,868	$212,135
	1.5	-$173,919	-$66,799	$40,321	$147,442	$254,562

Scenario 8		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$57,973	-$22,266	$13,440	$49,147	$84,854
	0.75	-$86,960	-$33,399	$20,161	$73,721	$127,281
	1	-$115,946	-$44,533	$26,881	$98,294	$169,708
	1.25	-$144,933	-$55,666	$33,601	$122,868	$212,135
	1.5	-$173,919	-$66,799	$40,321	$147,442	$254,562

Scenario 9		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$65,379	-$28,440	$8,498	$45,436	$82,374
	0.8	-$98,068	-$42,661	$12,747	$68,154	$123,561
	1	-$130,757	-$56,881	$16,995	$90,872	$164,748
	1.3	-$163,447	-$71,101	$21,244	$113,590	$205,935
	1.5	-$196,136	-$85,321	$25,493	$136,308	$247,122

Scenario 10		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$65,379	-$28,440	$8,498	$45,436	$82,374
	0.8	-$98,068	-$42,661	$12,747	$68,154	$123,561
	1	-$130,757	-$56,881	$16,995	$90,872	$164,748
	1.3	-$163,447	-$71,101	$21,244	$113,590	$205,935
	1.5	-$196,136	-$85,321	$25,493	$136,308	$247,122

Scenario 11		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$63,112	-$26,173	$10,765	$47,703	$84,641
	0.8	-$94,667	-$39,260	$16,147	$71,555	$126,962
	1	-$126,223	-$52,347	$21,530	$95,406	$169,283
	1.3	-$157,779	-$65,433	$26,912	$119,258	$211,603
	1.5	-$189,335	-$78,520	$32,295	$143,109	$253,924

Scenario 12		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$63,112	-$26,173	$10,765	$47,703	$84,641
	0.8	-$94,667	-$39,260	$16,147	$71,555	$126,962
	1	-$126,223	-$52,347	$21,530	$95,406	$169,283
	1.3	-$157,779	-$65,433	$26,912	$119,258	$211,603
	1.5	-$189,335	-$78,520	$32,295	$143,109	$253,924

Scenario 13		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$64,484	-$27,546	$9,392	$46,331	$83,269
	0.75	-$96,726	-$41,319	$14,089	$69,496	$124,903
	1	-$128,968	-$55,092	$18,785	$92,661	$166,538
	1.25	-$161,210	-$68,864	$23,481	$115,827	$208,172
	1.5	-$193,452	-$82,637	$28,177	$138,992	$249,807

Scenario 14		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$64,484	-$27,546	$9,392	$46,331	$83,269
	0.75	-$96,726	-$41,319	$14,089	$69,496	$124,903
	1	-$128,968	-$55,092	$18,785	$92,661	$166,538
	1.25	-$161,210	-$68,864	$23,481	$115,827	$208,172
	1.5	-$193,452	-$82,637	$28,177	$138,992	$249,807

Scenario 15		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$66,026	-$29,088	$7,850	$44,788	$81,726
	0.75	-$99,040	-$43,632	$11,775	$67,182	$122,590
	1	-$132,053	-$58,176	$15,700	$89,576	$163,453
	1.25	-$165,066	-$72,721	$19,625	$111,970	$204,316
	1.5	-$198,079	-$87,265	$23,550	$134,365	$245,179

Scenario 16		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$66,026	-$29,088	$7,850	$44,788	$81,726
	0.75	-$99,040	-$43,632	$11,775	$67,182	$122,590
	1	-$132,053	-$58,176	$15,700	$89,576	$163,453
	1.25	-$165,066	-$72,721	$19,625	$111,970	$204,316
	1.5	-$198,079	-$87,265	$23,550	$134,365	$245,179

Scenario 17		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$24,944	-$4,940	$15,065	$35,069	$55,073
	0.8	-$37,416	-$7,409	$22,597	$52,603	$82,609
	1	-$49,888	-$9,879	$30,129	$70,137	$110,146
	1.3	-$62,360	-$12,349	$37,661	$87,672	$137,682
	1.5	-$74,831	-$14,819	$45,194	$105,206	$165,219

Scenario 18		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$24,944	-$4,940	$15,065	$35,069	$55,073
	0.8	-$37,416	-$7,409	$22,597	$52,603	$82,609
	1	-$49,888	-$9,879	$30,129	$70,137	$110,146
	1.3	-$62,360	-$12,349	$37,661	$87,672	$137,682
	1.5	-$74,831	-$14,819	$45,194	$105,206	$165,219

Scenario 19		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$21,253	-$1,249	$18,755	$38,759	$58,763
	0.8	-$31,880	-$1,874	$28,133	$58,139	$88,145
	1	-$42,507	-$2,498	$37,510	$77,519	$117,527
	1.3	-$53,133	-$3,123	$46,888	$96,898	$146,909
	1.5	-$63,760	-$3,747	$56,265	$116,278	$176,290

Scenario 20		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$21,253	-$1,249	$18,755	$38,759	$58,763
	0.8	-$31,880	-$1,874	$28,133	$58,139	$88,145
	1	-$42,507	-$2,498	$37,510	$77,519	$117,527
	1.3	-$53,133	-$3,123	$46,888	$96,898	$146,909
	1.5	-$63,760	-$3,747	$56,265	$116,278	$176,290

Scenario 21		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$24,719	-$4,715	$15,289	$35,294	$55,298
	0.75	-$37,078	-$7,072	$22,934	$52,940	$82,947
	1	-$49,438	-$9,430	$30,579	$70,587	$110,595
	1.25	-$61,797	-$11,787	$38,224	$88,234	$138,244
	1.5	-$74,157	-$14,144	$45,868	$105,881	$165,893

Scenario 22		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$24,719	-$4,715	$15,289	$35,294	$55,298
	0.75	-$37,078	-$7,072	$22,934	$52,940	$82,947
	1	-$49,438	-$9,430	$30,579	$70,587	$110,595
	1.25	-$61,797	-$11,787	$38,224	$88,234	$138,244
	1.5	-$74,157	-$14,144	$45,868	$105,881	$165,893

Scenario 23		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$25,998	-$5,994	$14,010	$34,014	$54,018
	0.75	-$38,997	-$8,991	$21,015	$51,021	$81,028
	1	-$51,996	-$11,988	$28,020	$68,029	$108,037
	1.25	-$64,996	-$14,985	$35,025	$85,036	$135,046
	1.5	-$77,995	-$17,982	$42,030	$102,043	$162,055

Scenario 24		Inherent prod. Diff (kg beef/AE)				
		-4	-2	0	2	4
Price relativity	0.5	-$25,998	-$5,994	$14,010	$34,014	$54,018
	0.75	-$38,997	-$8,991	$21,015	$51,021	$81,028
	1	-$51,996	-$11,988	$28,020	$68,029	$108,037
	1.25	-$64,996	-$14,985	$35,025	$85,036	$135,046
	1.5	-$77,995	-$17,982	$42,030	$102,043	$162,055