Extending Days-on-Feed of Feedlot Steers – Economic Considerations

Lucas Horton (lhorton@vet.k-state.edu), Ted Schroeder (tcs@ksu.edu)[†], Marshall Streeter (marshall.streeter@merck.com)[‡], John Hutcheson (john.hutcheson@merck.com)[‡], and David Renter (drenter@vet.k-state.edu)**

**Kansas State University Department of Diagnostic Medicine and Pathobiology, Center for Outcomes Research and Epidemiology*

[†]Kansas State University Department of Agricultural Economics

[‡]Merck Animal Health

Introduction:

Feedlot cattle in the U.S. are spending more days-on-feed (DOF) than in previous decades, and subsequently have been progressively fed to heavier, more extreme endpoints. When doing so, live performance metrics such as daily weight gain and feed efficiency generally suffer; however, this can be misleading if marketing cattle dressed (on a carcass basis) as carcass weight gain as a proportion of live weight gain increases as DOF are extended (Galyean et al., 2023). Still, changes in carcass composition need to be strongly considered when extending DOF, particularly when marketing on a premium- and discount-based grid. In addition to added weight, cattle fed for longer DOF have increased proportions of high U.S. Department of Agriculture (USDA) Quality Grades (QG) receiving premiums; however, there are concurrent increases in the proportion of higher numerical USDA Yield Grades (YG) as well as an increased risk of heavyweight carcasses (commonly those over 1,050 lb) (Galyean et al., 2023), both of which receive substantial discounts.

Cattle feeding net return risk may arise from biological variability,[1] fluctuating market conditions, or inadequate information when making decisions. As the beef industry trends towards increasingly heavier fed cattle harvest weights, more information is needed on the economic risk associated with adding DOF. To evaluate this, contemporary populations of feedlot cattle and market prices should be used to evaluate net return variability and expectations if marketing beyond industry standards. By better understanding the economic risk of feeding cattle for extended DOF, producers can make more informed decisions when targeting optimal endpoints.

Objective:

To evaluate the economic risk of extending DOF beyond recent industry standards by characterizing net return distributions of feedlot steers marketed at later endpoints, and to assess which variables most influence net return variation.

[1] In this context, pens of cattle may have differing sets of baseline characteristics (e.g., weight, breed, health risks) and also experience differing magnitudes of health, growth, and carcass compositional changes when extending DOF.

Procedures:

To accomplish the primary objective, a simulation model was developed to evaluate net return distributions when feeding steers beyond industry standards. Controlled trial data (Martinez et al., 2023) and reported industry data from 2021 to mid-2024 were used in the model. The feedlot steer harvest endpoints evaluated were Endpoint 1 (EP1) – reflective of the baseline, recent industry average – and Endpoint 2 (EP2), Endpoint 3 (EP3), and Endpoint 4 (EP4), each of which represented feeding an additional 14 DOF beyond the prior endpoint. The simulation model used a partial budget framework, where the final outcome was the marginal difference in net return for EP2, EP3, and EP4, compared to EP1. In other words, we did not evaluate whether cattle were profitable at each endpoint, rather, we evaluated how much profitability changed if feeding to each of the later-fed endpoints instead of EP1. For live and dressed marketing, baseline harvest weights (± 1 standard deviation) for EP1 were 1,470 lb (± 25.2) and 950 lb (± 19.5), respectively.

Based on the trial data and reported industry data, a variety of animal health, performance, carcass characteristics, and economic variables were simulated to reflect variable steer populations and economic conditions. Simulated cattle variables included: dry matter intake, EP1 live and carcass weight, live and carcass weight gain (lb/day for later-fed endpoints), heavyweight carcasses (over 1,050 lb), QGs, YGs, morbidity, mortality, and removals (i.e., railers, those culled for health reasons). Simulated economic variables were the corn price and the fed cattle price.[2] An additional consideration accounted for was opportunity cost,[3] which was the cost of delaying when revenue is received. Variables that were not simulated but allowed to vary were the QG grid and the interest rate (for opportunity cost and ½ interest on feed), both of which had low, middle, and high levels. The remaining variables that were accounted for included: feed and yardage price, removal price, treatment cost, rendering fee (for mortalities), the YG grid, and the discount for heavyweight carcasses.

Thousands of simulations were run to produce distributions of net return outcomes given the specified animal and economic conditions. These distributions were visualized to evaluate the frequency in which net return differences for EP2, EP3, and EP4 compared to EP1 were positive, and by how much. Following the accomplishment of this objective, additional analyses were performed to identify which variables were most influential on net return differences.[4] The variables were ranked based on their importance within EP2, EP3, and EP4 on a scale of 0 to 100. Using the findings of these procedures, producers may be able to evaluate the economic risk of extending DOF and feeding beyond industry standards, as well as consider which variables should be prioritized when making such decisions.

[2] Fed cattle prices were allowed to vary across endpoints to reflect price changes when marketing on different weeks, and these simulations were correlated so only realistic price changes could occur.
[3] There is a penalty for waiting to receive revenue due to the time-value of money when it is received earlier; this was estimated using an interest rate and revenue from steers marketed at EP1.
[4] Using conditional random forest models; importance scores do not have an absolute or linear (e.g. 50 is 5 times more than 10) interpretation, rather this is a ranking strategy as absolute differences are loosely captured and only approximate.

Key Findings:

On average, it was not economically advantageous to feed cattle beyond recent industry standards (EP1) when marketing either live or on a dressed basis with a premium- and discount-based grid. When live marketing, net return differences were positive for EP2, EP3, and EP4 – compared to EP1 – 45.4%, 43.7%, and 42.0% of the time, respectively. This indicates that on average, net returns were expected to be greater for the first endpoint than for extended DOF more than half of the time. When grid marketing, net return differences were positive for EP2, EP3, and EP4 – compared to EP1 – 44.1%, 38.4%, and 29.1% of the time, respectively. This does not imply that live marketing was more profitable than grid marketing – this comparison was not made. Rather, it implies that within marketing schemes, later-fed steers marketed on a grid more frequently had reduced net returns than EP1 compared to live marketing; however, baseline net returns may have been greater when grid marketing compared to live.

The distributions of net return differences when live marketing are in Figure 1, and distributions when grid marketing are in Figure 2. For both marketing strategies, net return variability increased – indicated by widening distributions – as steers were fed incrementally longer. Notably, when grid marketing, EP3 and EP4 distributions resulted in more profound leftward shifts, which is towards negative net returns, than when live marketing. This was driven primarily by receiving discounts for YG 4, 5, and heavyweight carcasses more frequently. In other words, increased weight and QG premiums did not often outweigh the discounts. Marketing on a dressed-cash basis with no grid or removing the heavyweight discount would result in more frequent positive net return differences for the later-fed endpoints (data not shown). However, these marketing strategies were not extensively evaluated as evidence of their use is infrequent in industry reported data.

The relative importance of the variables included in the simulation model is in Figures 3 and 4 for live and grid marketing scenarios, respectively. Three of the top four most important variables were economic when live marketing, and four of the top five were economic when grid marketing. Without question, the most impactful variable in the model for its influence on net returns was the difference in fed cattle price that was received for later-fed endpoints compared to the EP1 price. In essence, this means that weekly price changes, and the fact that altering DOF results in alternative marketing windows, should be of top prioritization when managing feedlot steer harvest dates. Other critical economic variables were the actual fed cattle price, corn price, and the QG grid (“grid number” in Figure 4) when grid marketing. The most important non-economic variable was the number of mortalities that occurred between harvest dates. The remaining variables in Figures 3 and 4 were of marginal to minimal importance in terms of their impact on net return differences compared to EP1.

Discussion:

While the highest possible net returns were achieved by increasing DOF and feeding to later endpoints, this came with increased risk of even greater losses. A similar research question for extending the DOF of feedlot heifers has been evaluated (Horton et al., 2024), where there was again minimal evidence to support feeding beyond a baseline endpoint. The overall, more apparent importance of economic factors as opposed to animal production variables implies that market signals should be prioritized when making endpoint management decisions. There may be seasonal trends for when it is advantageous or disadvantageous to extend DOF, and futures prices could be used as indicators. Regardless, appropriate risk management procedures should be implemented.

There are limitations to this research that need to be considered. First, there is likely a lag period between when the decision is made on a target harvest date (often 28+ days out), and when cattle are actually harvested. This allows more time for market fluctuations, and potentially further increases risk of price changes. Second, the simulation model used pen-level inference as opposed to feedlot-level, meaning that each simulation evaluated which endpoint was optimal for a pen of steers. However, this may not always be what is optimal for a feedlot which has a more complex dynamic, as available pen-space along with the price, availability, and quality of feeder cattle may also dictate feedlot-level marketing decisions. Lastly, we characterized industry-level economic risk of extending the DOF of feedlot steers beyond recent standards. This risk may differ for individual producers, particularly if baseline endpoints or grid pricing structures differ from industry averages. There may be cases where producers could benefit from more individualized iterations of the simulation model.

The Bottom Line: The optimal economic endpoint for feedlot steers is likely a moving target and may differ from what some may consider the optimal "biological" endpoint based on cattle characteristics. Market signals should be prioritized when making harvest management decisions.

References:

Galyean, M. L., W. T. Nichols, M. N. Streeter, and J. P. Hutcheson. 2023. Effects of extended days on feed on rate of change in performance and carcass characteristics of feedlot steers and heifers and Holstein steers. Appl. Anim. Sci. 39:69–78. doi:10.15232/aas.2022-02366.

Horton, L. M., B. E. Depenbusch, T. C. Schroeder, D. L. Pendell, M. N. Streeter, J. P. Hutcheson, and D. G. Renter. 2024. Impacts of economic factors influencing net returns of beef feedlot heifers administered two implant programs and fed for differing days-on-feed from pooled randomized controlled trials. Transl. Anim. Sci. 8. doi:10.1093/tas/txae021.

Martinez, S. L., A. B. Word, B. P. Holland, K. J. Karr, J. P. Hutcheson, L. J. Walter, J. T. Richeson, T. E. Lawrence, and K. L. Samuelson. 2023. Effects of growth-implant regimen on performance, carcass outcomes, activity, and rumination of finishing steers fed to different days on feed. Appl. Anim. Sci. 39:456–471. doi:10.15232/aas.2023-02424.

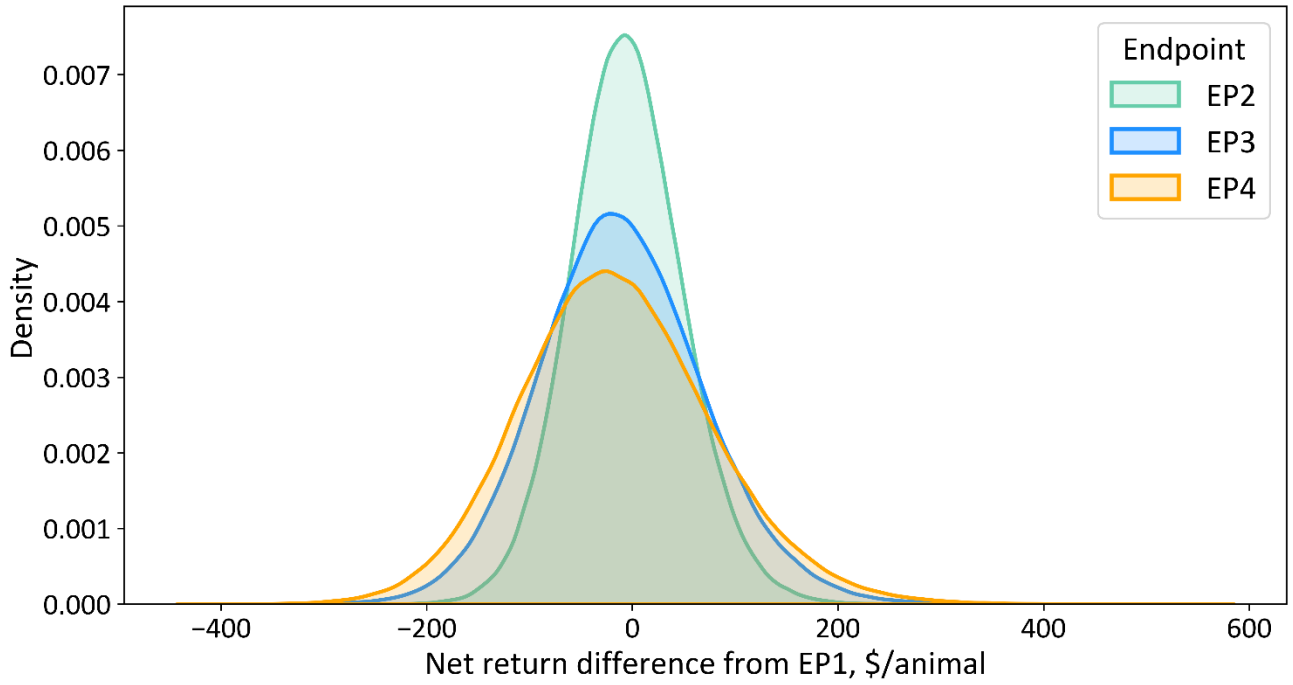

Figure 1. Distributions of net return differences for later-fed endpoints compared to EP1 when live marketing.

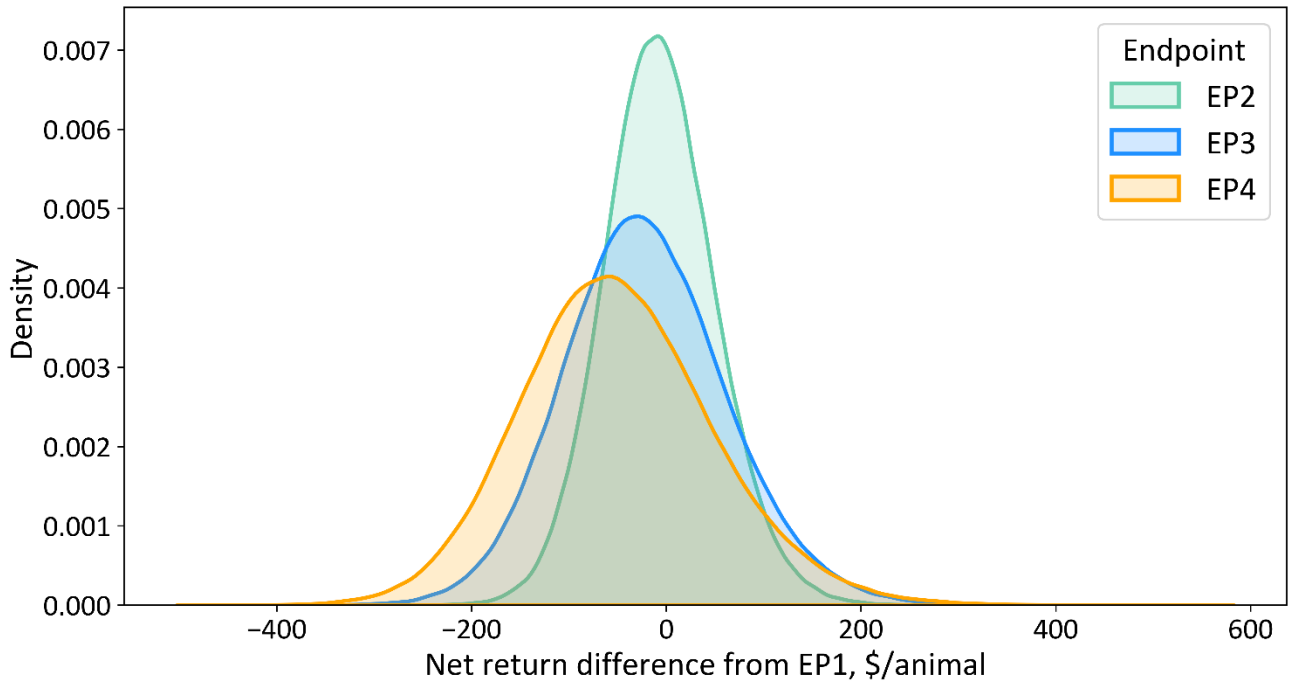

Figure 2. Distributions of net return differences for later-fed endpoints compared to EP1 when grid marketing.

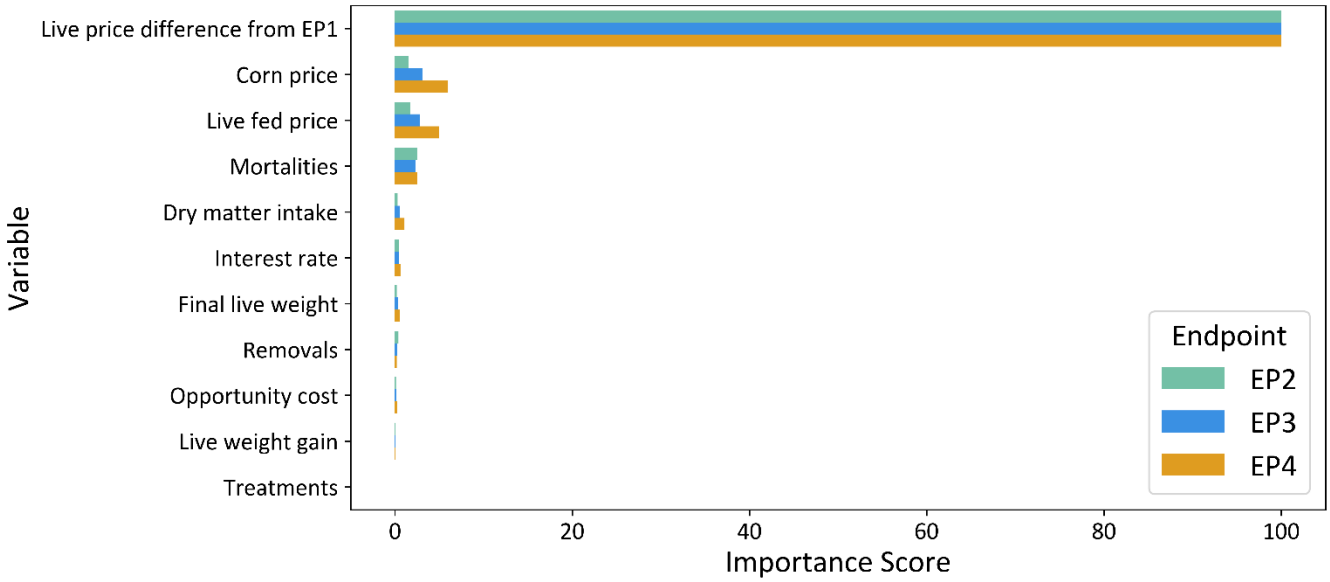

Figure 3. Conditional variable importance scores for the relative influence of each variable on net return differences from EP1 for later-fed endpoints when marketing steers on a live basis.

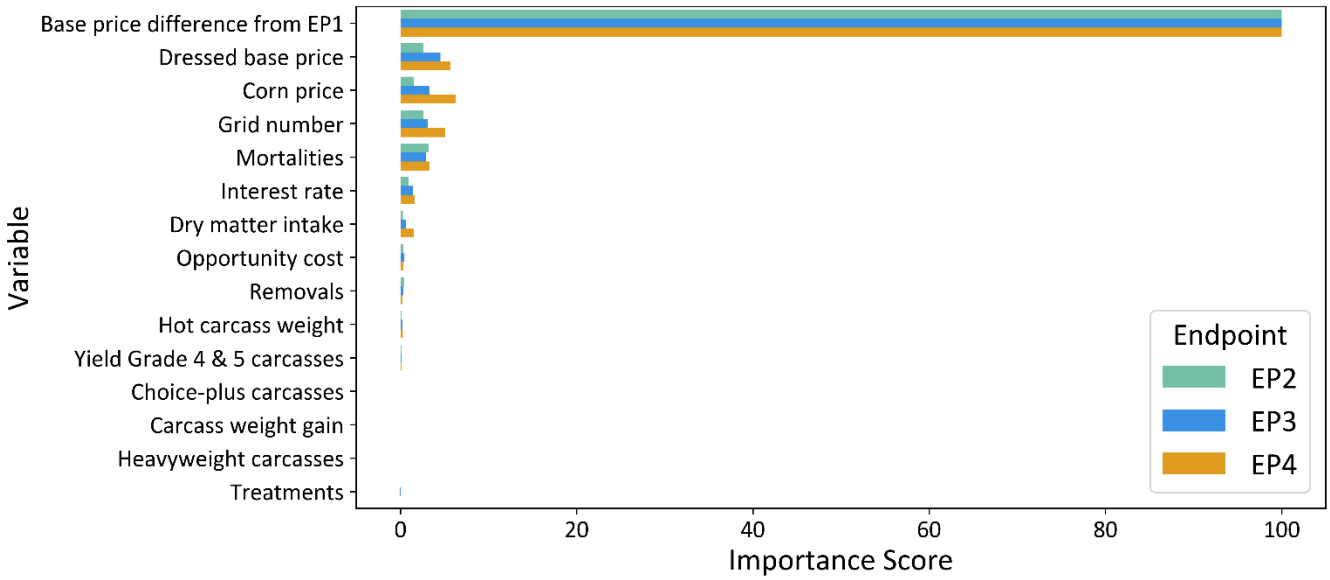

Figure 4. Conditional variable importance scores for the relative influence of each variable on net return differences from EP1 for later-fed endpoints when marketing steers on a grid basis.

View more information about the authors of this publication and other K-State agricultural economics faculty.
For more information about this publication and others, visit AgManager.info.
K-State Agricultural Economics | 342 Waters Hall, Manhattan, KS 66506-4011 | (785) 532-1504 | Fax: (785) 532-6925