Reproductive production constraints within the New Zealand racing industry

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Abstract

The New Zealand Thoroughbred industry has seen rationalisation in response to changes in the domestic market and more recently the Global Financial Crisis (GFC). To quantify changes in production, end-of-season reproductive data for active Thoroughbred sires were extracted for the 1989/90 to 2011/12 breeding seasons. There were reductions in the numbers of mares bred and foals produced (10,176 mares & 5,882 foals vs. 5,826 mares & 3,927 foals, respectively in 1989/90 and 2011/12 seasons) resulting in a greater relative proportion of foals registrations (57% vs. 67%). During this period, the number of active sires decreased (265 vs. 94) and number of mares per sire increased (33 IQR 18-53 vs. 49 29-91). The 2007/08 season (GFC) was associated with an acute reduction in the number of shuttle stallions imported for breeding (from 23% in 2006/07 to 11% of active sires in 2007/08), and a temporary increase in number of mares bred (13%), in response to the 2007 Equine Influenza outbreak in Australia. The proportion of sires covering >100 mares per season increased from 6% (1989/90) to 25% (2011/12). Despite the reduction in active broodmares during the same period (43%), there has not been a proportional decrease in export numbers (24%) or domestic numbers of horses racing (6.5%).

Introduction

In contrast to the majority of the top 10 nations involved in Thoroughbred racing and breeding, the New Zealand industry is heavily reliant on the export market, rather than production of horses as domestic racing product (Fennessy 2010). Previous examination of the production process has identified that approximately 40% of the annual foal crop are exported (Bolwell et al. 2014), and that the industry could be considered to operate as two sectors or tiers – one sector focused largely on the export market and another group of smaller breeders (fewer mares per breeder) focusing on the domestic market (Rogers & Gee 2011). The export market was characterised by the use of shuttle sires (stallions breeding in the Northern and Southern Hemispheres in one calendar year) and expensive sires (>$10,000 service fee), while the domestic market was serviced by the low-cost (<$5,000 service fee) and to a lesser extent, medium-cost sires ($5,000 – $10,000 service fee).

While the majority of sires at stud (~70%) could be identified as servicing the domestic market, each of these sires typically sired fewer mares than those used for the export market and, thus, the distribution of mares mated to supply the domestic market accounted for 55% of the annual mating returns (Rogers & Gee 2011). The seasonal and lifetime reproductive efficiency of the Thoroughbred mare is limited by a number of industry practices including the restriction on the use of artificial insemination (AI) and the imposition of a short commercial breeding season. The effective breeding season in New Zealand is 1 September to 30 November, which does not mirror the physiologic breeding season, and this is driven by the perceived need to have foals born as early in the season as possible so they are larger when sold as yearlings and can, thus, maximise sales price (Waldron et al. 2011;Hanlon et al. 2012). The combination of short breeding season and the inability to use AI means a short intense mating period for the sire and most mares are covered (mated) only once per cycle. (Hanlon et al. 2012).

In contrast to sport horses, the Thoroughbred industry has a shorter generation interval, as sires are recruited to the breeding ranks shortly after their "classic year" as a three year old which is earlier than the timeframe to provide a competition proof on a sport horse (typically when 8-9 years old) (George et al. 2013). Also contributing to the lower generation interval is the short commercial life of a sire (4 years according to taxation law) and a high replacement rate. It is estimated that only 5% of sires prove themselves as a commercial success and previous analysis indicates that the median career is actually only three years at stud (Rogers et al. 2009). The generation interval on the mare side is also short compared to sport horses, with most mares recruited to stud as six year olds, and then achieving zero book value by the time they are 12 years old (Rogers et al. 2009; Aurich & Aurich 2006). A greater percentage of the mares sired by expensive sires and shuttle sires are recruited into the breeding herd and the median age of recruitment to breeding is 1-2 years earlier than mares sired by the median- and lower-service-fee sires. This industry structure effectively means that the two sectors of the Thoroughbred industry run in parallel with some overlap. In an animal production context (i.e., sheep or beef) the export sector could be considered as the equivalent to the stud stock industry and the domestic sector as analogous to the commercial farmer.

In response to changes in domestic demand there has been significant rationalisation within the New Zealand

Thoroughbred breeding industry. This has been reflected in increased industry efficiency with a greater proportion of foals being generated from fewer mares and sires (Rogers et al. 2009). Internationally the 2008 Global Financial Crisis (CFC) was associated with severe contraction in the number of horses breed and racing (Leadon et al. 2012). To date the effect of this on the horse population or number of horses breed has not been investigated. A confounding factor influencing horse production at this time was the 2007 Australian Equine Influenza (EI) outbreak. Australia has historically been numerically and financially the major export market for the New Zealand Thoroughbred, and changes in Australia, or changes in demand, influence New Zealand horse production. The objective of this paper is to describe the changes in New Zealand Thoroughbred production since the last review of breeding efficiency, and describe the impact the GFC and the Australian EI outbreak on New Zealand Thoroughbred horse production

Materials and methods

Breeding records for all active sires (stallions covering > 10 mares in a breeding season) from the 1989/90 to 2011/2012 breeding seasons were downloaded from the New Zealand Thoroughbred racing website (www.nzracing.co.nz) and imported into MS Excel (Microsoft Corporation, Redmond, WA, USA). The service fee of the sire, age when first standing at stud and number of years at stud were obtained from the sires details listed in the respective Register of Thoroughbred stallions of New Zealand (NZ Thoroughbred Breeders Association (Inc)) for each breeding season.

The full breeding records of the active sires permitted calculation of industry data on fertility, foaling percentage, length of breeding season and the age profile of the active broodmare herd.

To examine the association of service fee on stallion age, and age of the mares covered the sires were classified as low cost ($2,000-5,000), medium ($5,500-10,000) or expensive ($10,001-100,000). Due to the dramatic reduction in the number of shuttle sires utilised post GFC the category shuttle sires was not used for analysis.

Commercial career

To estimate the proportion of commercial sires and number of seasons when commercially active (covering ≥50 mares per season) all sires active in 2005/2006 breeding season were categorised as commercial (≥50 mares per season) or non-commercial (≤ 50 mares per season) in that season of interest. Full breeding records were then extracted and the number of seasons at stud during their career in which the sires could be classified as commercial (≥50 mares per season) were recorded.

Data on the period from season of initiation of breeding career until the season of the first non-service period were calculated from data based on the breeding records of all mares that were breed in the 2005/06 breeding season.

Statistical analysis

Data were examined graphically for distribution and errors in data transcription. After testing for normality, parametric data were examined using a general linear model and presented as mean and standard error. Non-parametric data were tested using a Kruskal Wallis test and presented as median and interquartile range (IQR). For all analysis the data were tested using STATA 12 (StataCorp, TX, USA) using a significance level of $P<0.05$

Results

Industry level data

There was a consistent reduction in the numbers of mares bred and foals produced. The number of mares bred in the 2011/12 season approximately halved from that bred in the 1989/99 season. However, there was a more moderate decrease in the number of foals registered during this period resulting in an increase in the relative proportion of foal registrations to number of mares bred (57% vs. 67%, Figure 1).

Somewhat mimicking the mare data there was an associated decrease in the number of active sires (265 vs. 94) and a resultant increase in the median number of mares covered per sire increased (33 IQR 18-53 vs. 49 IQR 29-91) during the same period (Figure 2).

The 2007/08 season (the GFC) was associated with an acute reduction in the number of shuttle stallions imported for breeding (from 23% in 2006/07 to 11% of active sires in 2007/08), and a temporary increase in number of mares bred (13%). This counter intuitive increase in mares bred was associated with the market response to fewer mares being bred in Australia (a 13% reduction from 26,800 bred the previous season) during this season due to the movement ban in place as part of the control measures for the 2007 Australian EI outbreak.

Sire level data

The proportion of sires covering >100 mares per season increased from 6% (1989/90) to 25% (2011/12). During this period the median career length of a sire remained at three (IQR 2-6) years, with a moderate increase to four (IQR 2-6) in the two seasons (2008/09 & 2009/10) following the GFC.

During the 2005/06 season 48% (49/101) sires could be classified as being commercially active (≥ 50 mares bred in that season). Of these sires, the median number of years in which they were commercially active was four (IQR 1-7).

There was no significant difference between sire category for the age of the sire or the age of the mares bred to the sires in the different service-fee categories. There were significant differences in the management of the sires during the season with lower-value sires starting later in the season and, therefore having a shorter season as the final calendar day of breeding did not differ between sire categories.

Figure 1 Plot of the number of New Zealand Thoroughbred broodmares bred (◊) and live foals (□) for the breeding seasons 1989/90 to 2011/12. The shaded region (season 2007/2008) represents the start of the Global Financial Crisis and the Australian Equine Influenza outbreak.

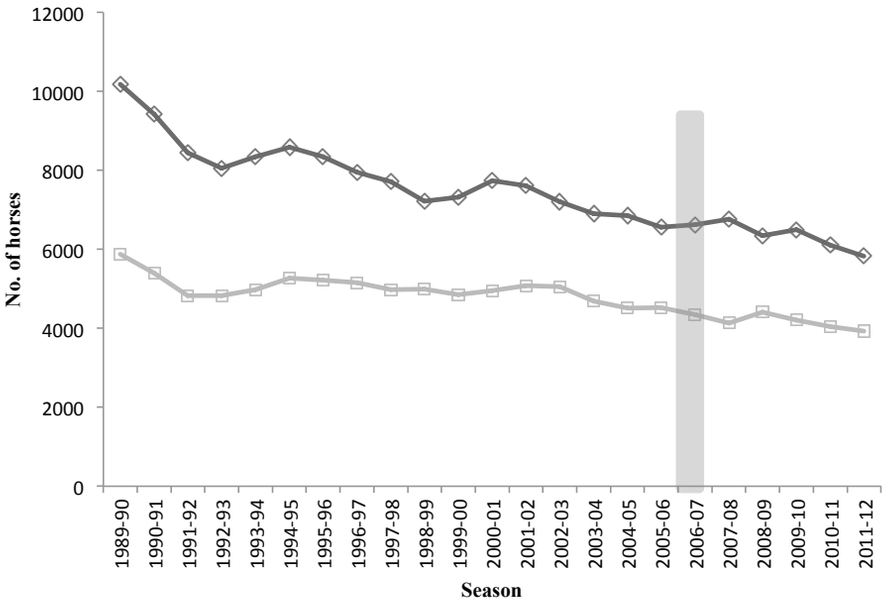

Figure 2 The number of active Thoroughbred sires (■) and median (IQR) number of mares covered per sire (◊) for the breeding seasons 2005/06 to 2011/12. The shaded region (season 2007/2008) represents the start of the Global Financial Crisis and the Australian Equine Influenza outbreak.

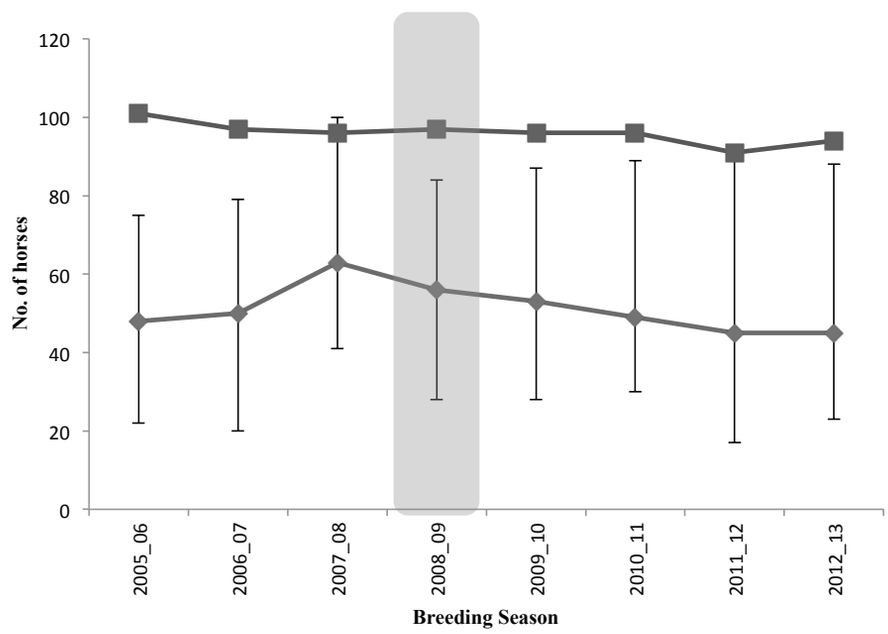

Table 1 Sire reproductive parameters by service fee category (low ($2,000-5,000), medium ($5,500-10,000) and expensive ($10,001-100,000)) for the 2011/12 breeding season

	Low Service Fee	Medium Service Fee	Expensive Service Fee	P value
Stallion Age	9 (6-11)	7 (7-10)	10 (7-14)	n/s
Mare Age	10 (7-14)	9 (7-13)	9 (7-12)	n/s
No. of Mares per Stallion	58 (32-106)	89 (73-105)	112 (87-138)	P<0.01
No. of Days from 1st to last covering	100 (90-107)	110 (99-114)	111 (106-119)	P<0.001
First day covering*	14 (9-27)	4 (1-16)	0 (0-4)	P<0.001
Last day covering*	111 (103-121)	114 (108-109)	113 (108-120)	n/s

*Number of days from September 1

Broodmare herd age distribution

During the observation period the majority of active broodmares were ≤12 year old (72 ±0.5 %). This stability of the broodmare herd age structure was reflected in the consistent mean age of the mares bred to the sires in the different sire categories. The median number of seasons until a mare was not served was differed between sire category, mares going to low service fee sires having a shorter interval between periods of non-service three (IQR 1-8) years vs mares breed to medium seven (IQR 2-8) years and expensive sires eight (IQR 5 -8) years P<0.01.

Discussion

In a pattern similar to that reported previously, there has been a continued trend for rationalisation within the New Zealand Thoroughbred industry (Rogers et al. 2009). This rationalisation reflects the global change in the pattern of Thoroughbred horse breeding and racing (Leadon et al. 2012).

The rationalisation of the New Zealand Thoroughbred industry has seen a reduction in the number of mares bred for the domestic market, while the export-focused sector has seen little change in numbers (Bolwell et al. 2014). The reduced number of active broodmares and sires was associated with an increase in efficiency and less supply-chain wastage. Despite the reduction in the mares bred and foals born, there has not been a proportional decrease in the number of horses exported, or number of horses entering race training (Bolwell et al. 2014). This consistency, or plateauing, in the number of horses exported and entering race training may be a reflection of the trend for breeding to be focused on race-winning mares and a more stringent breeding

programme, given the current financial constraints (Rogers & Gee 2011).

The trend for greater relative efficiency with the reduction in mares bred has been previously reported. It would appear that this efficiency has now stabilised at around 63%. This summary value represents the fertility rate and the economic and industry drivers for foal production (some mares deliberately not presented to be bred in that season). In New Zealand, there is significant emphasis placed on production of an early foal, which is reflected in the short effective breeding season and in some cases an emphasis on breeding on foal heat to minimise breeding drift (mares foaling later in the season with each successive foaling) (Hanlon et al. 2012). It is proposed that the lower relative cost of pasture management of mares in New Zealand means that non-presentation of a mare in a breeding season to ensure she can be mated early in the successive season is economically viable.

Despite the lower cost of "carrying a mare over a season", the interval from last non-service or initiation of breeding career, appears long for mares likely to be involved in the export sector of the market (median ~7 – 8 years of age) indicating that the willingness to breed on foal heat breeding policy may attenuate the impact breeding drift (the mare foaling later in the season with each successive year) and provide the opportunity to increase the relative economic lifetime reproductive capability of the mare. Mares at the domestic or lower production worth sector of the market appear more likely to be "not bred" at a higher frequency which may reflect an ownership model of a breeder breeding horses to race rather than supply of a product for sale. Heavy selection against older mares(>14 years), in part driven by changes in reproductive efficiency with increasing age, but predominately due to economic factors, may also influence this. The short breeding season and the inability to use artificial insemination means the most commercially popular sires will cover a mare only once per cycle and possibly only once within the breeding season (Hanlon et al. 2012)., Thus, there is strong selection pressure for fertile mares and optimal mare management.

The large export focus of the breeding industry, to generate a foal to sell, biases the industry profile (sire preference and mare age and reproductive performance record) towards a model to optimise financial returns. At an industry, or farm level, optimisation of financial returns are achieved by reducing wastage (i.e. reduced reproductive efficiency with older mares) and optimising financial returns selling yearlings via early born foals, from younger mares (Waldron et al. 2011). This heavy emphasis of economic drivers on selection decisions is the norm in most animal production systems but is not often observed within many equine production systems (Rogers & Wickham 1993;George et al. 2013).

The counter-intuitive spike in the number of mares bred during the season of the GFC was associated with the market response to the EI outbreak in Australia. With the movement controls in place and pregnancy loss in some infected mares there was an expectation there would be a decrease in supply of yearlings presented for sale in Australasia from that breeding season. It was subsequently reported that the effect of the EI outbreak on breeding was a 13% decrease (down from 26,800 mares bred in Australia the previous season). In the longer term (six years after the EI outbreak) it was predicted that the fewer foals bred in Australia may result in a shortage of mares retained for breeding (Callinan 2008).

The GFC had an immediate effect on the number of shuttle sires imported for the 2007/08 breeding season. This reduction was, in part, due to the perceived drop in returns expected by breeders for the resultant foals given the poor financial outlook. Farms standing shuttle sires pay a large lease fee to the owner of the stallion for the southern hemisphere breeding rights, which often provides a relatively tight margin for profitability. Given the financial outlook, the risk of not obtaining a return on investment may have reduced the farms willingness to expose themselves to the financial risk of standing a shuttle sire.

Stallion owners may also have identified that there would be a shift by breeders to a more-conservative approach to breeding and the use of more-established and proven sires, rather than the use of younger shuttle sires. Maximisation of yearling sales returns is heavily dependent on the sale category and use of a proven consistent sire is a mechanism to increase the likelihood of the yearling being selected for sale in the premier sales category (Waldron et al. 2011).

In association with the GFC there was a two year period with an increase in the median commercial career of a stallion at stud. This shift may in part be explained by the importation of fewer shuttle sires (these traditionally only shuttle for one to three years). There also was a period of limited investment in new sires resulting in a moderate shift in the stallion roster to older established sires. After the GFC the proportion of shuttle sires on the stallion roster never reached the levels seen earlier. This, in part, was a response to the post GFC economic climate and willingness for exposure to financial risk by farms. There also was also considerably discussion prior to the GFC of the relative financial and genetic returns obtained using shuttle sires and a recognition of the strength of the Australian racing industry and international ranking of Australasian racehorses. Farms were, thus, more willing to invest via syndication in potential stallions from the ranks of colts racing on the Australasian circuit, and thus retain ownership and opportunity for long-term return on investment, than in shuttle sires.

Within New Zealand, the contraction of the racing and breeding industry in relation to the GFC was attenuated by the robustness of the Australian and South East Asian economy during this time and the reduction in supply of horses within Australia as a result of the EI outbreak. The increase in the relative proportion of the foal crop exported reflects the reduced domestic demand and the increasing opportunities for the sale of early racing

product (trial winning two-year colts and geldings) into Asia. An increasing proportion of trainers have focused on production of two-year old racehorses for the Asian market. As these markets only purchase colts or geldings there is reduced domestic demand by trainers for the fillies offered for sale. Breeders that previously made a comfortable living selling to the domestic market are now faced with 50% of the annual foal crop being difficult to market or selling at below production cost. This additional financial burden has been reflected by the reduced production of foals for the domestic market as the gender bias by purchases is greatest at the lower level yearling-sales categories (Waldron et al. 2011).

In conclusion, the trend for industry level reproductive efficiency appears to have plateaued and reflects the data pre GFC. A change in sire use away from shuttle sires and reduced focus on supply to the domestic market has been associated with a total reduction in annual foal crop. Industry structure and the age profile of the sires at stud and the active broodmare herd population reflects the strong export driven-economic drivers for Thoroughbred breeding in New Zealand.

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