**On the Economics of the Jockey Club’s 140 Mare Limit Proposal (Feb. 28, 2020 Draft)**

**Robert L Losey, Ph.D. [[1]](#footnote-1)**

The Jockey Club, in its role as de facto regulator of Thoroughbred breeding, is considering limiting the number of mares that a stallion can breed each year.[[2]](#footnote-2) The Jockey Club is concerned that inbreeding could lead to a decrease in “genetic diversity,” and they note that in recent years the number of mares bred by the most popular stallions has trended higher. In 2009, 26 stallions bred 140 or more mares, accounting for 9.2% of mares bred. Breeding by top stallions was much more concentrated in 2019, when 44 stallions bred 140 or more mares, accounting for 25% of mares bred. This increase occurred over a period when total mares bred dropped by 36% from 45,317 to 29,217.

The Jockey Club has expressed concern that increasing numbers of mares bred by a limited number of stallions could be deleterious to the Thoroughbred breed. They have not cited a definitive scientific study in support of their case, and equine geneticists have not rallied to support their contentions. In contrast, a review of stallion records makes it clear that imposing a 140-mare limit on high-quality proven stallions virtually assures that we will see fewer seven-figure yearling sales and fewer superior runners in the future. Moreover, given the greater frequency with which high-quality proven stallions pass on superior genetic traits, a 140 limit on mares bred that is binding on high-quality proven stallions may very well be counterproductive.

Economists would point out that the Jockey Club’s stated rationale for intervening in the marketplace by imposing a limit on mares bred is a classic case of addressing what the Jockey Club considers to be an “externality.” Economists define an “externality” as an activity that injures parties other than the party engaging in the activity. The Jockey Club fears that breeders’ decisions today will cause future generations of foals to be compromised, imposing costs on owners, sales companies, trainers, racetracks and others because it will be more difficult to generate quality runners. If deleterious, then inbreeding can be viewed in a similar way to the pollution that a plant releases into the air or water. In the absence of cease and desist orders or fines on the polluter, the pollution imposes costs on others that should be borne by the polluter.

This writer, a bank regulator for four years in the 1980s and, subsequently, a Washington, DC, area based professor and consultant to the Justice Department and bank regulators, finds it unusual that the regulator of Thoroughbred breeding proposed a limit coincident with contracting with an expert to determine if there truly is a “genetic diversity” problem. In the absence of imminent danger, regulatory limits are typically proposed after identifying a specific problem or group of problems and collecting and publishing research and analyses germane to the situation, thus allowing both the regulator and affected parties ample time to interact and make well-informed decisions.

Though the genetics and economic aspects of the Jockey Club proposal are intertwined, as much as possible the purely genetics aspects of the Jockey Club proposal will be relegated to an addendum to this paper and the analysis will focus primarily on the economic implications of a limit on the number of mares a stallion can breed. Note that Jim Gagliano, president of the Jockey Club, was quoted in a September 6, 2019 Thoroughbred Daily News article saying, “*We cannot predict the economic effects of a limitation because of the complexity of the interactions among participants in the breeding and selling markets.”* Mr. Gagliano and the Jockey Club may not be able to predict the “economic effects of a limitation” but any number of agricultural/equine economists can. As explained in the following, the predictable economic outcomes of a significant limit on mares bred are in large part negative for breeders and racing, the phase-in proposals suggested by the Jockey Club are arbitrary, and the imposition of a 140-mare limit would raise significant fairness questions.

The analysis in this paper will address the following questions regarding the economics of the Jockey Club proposal: What will the costs be and who will bear the costs? What groups will benefit and what groups will be disadvantaged. Are there significant “fairness” considerations. Will a limit on mares bred affect the number and quality of foals produced? Will industry segments other than breeding be affected, most especially racetracks?

If there is an optimal limit on mares bred by a stallion, it is unlikely that it is the arbitrary number of 140. Nevertheless, given that 140 has been proposed, it will be used as the reference point for the analysis and discussion of the economic implications of a limit in what follows.

This paper is composed of five sections in the main body of the paper and an addendum section on genetics. The six sections are: 1) the economics of the logistics of adjusting to a 140-mare breeding limit the, 2) the “logic” of the 140 limit, 3) phase-in limits, 4) stallion values and the export problem, and 5) selective regulation.

**The Economics of Adjusting to the 140 Limit**

If stallions are limited to breeding 140 mares, the adjustment process necessary to comply with the new regulatory environment will likely involve at least a bit more time and analysis than usual because, as explained in the following, more stallions will fill their books and have to turn away mares. In order to demonstrate the logistics and economics of the adjustment process, this paper focuses on the likely adjustments that might have occurred if the 140 limit had been instituted prior to the 2019 breeding season, though similar adjustments would take place in any year that breeders are faced with a limit on mare numbers.[[3]](#footnote-3) Breeding patterns vary from year to year, and a primary factor causing significant swings in breeding patterns is the popularity of newly-retired stallions. The 2019 breeding season saw more than the usual interest in newly-retired stallions. In contrast, 2017 saw less interest than usual in newly-retired stallions. (See Figures 1 and 2 reported later in this paper). However, regardless of the swings in popularity of particular stallions, the general economic ramifications of a breeding limit will be largely the same, with two primary results:

1. Stallion season prices will rise across the board, though price increases and economic impact will tend to be greater for higher-priced stallions; and,
2. A breeding limit will create a significant reallocation of revenues to stallion owners, with revenues to the most popular stallions dropping, while revenues to most other stallions will increase. The most significant beneficiaries will be stallions that are reasonable alternatives to the most popular stallions.

A useful way to analyze the adjustment process is to assume that a 140 limit had been put in place in September 2018 before any stallions had been booked for the 2019 breeding season. We know what stallion books looked like in the absence of the implementation of the 140 limit by analyzing the data provided by the Jockey Club on actual numbers of mares bred by each stallion in 2019. The question is, “in what ways would new breeding patterns have differed after the imposition of a 140-mare limit” Though we cannot determine the end results for individual mares with accuracy, major economic implications of the imposition of a mare limit are predictable with respect to season prices, quality of foals, and more. As analyzed later in this paper, a limit on mares bred would tend to at least marginally decrease the size and the quality of future foal crops, which would have negative effects on sales and racetrack handle and profits.

A major consequence of the introduction of a 140 limit in September of 2018 would have been an increase in advertised stud fees for most stallions. Consider first the stallions that would have been likely to have bred 140+ mares in the absence of the new 140 limit. Let’s label these stallions the “140+ stallions,” and let’s label the mares that would be bumped from the books of 140+ stallions by a 140 mare limit the “overage” mares. The stud fees of the 140+ stallions would have been most directly affected, as the number of mares available to them would be limited to 140. It would be logical for stallion managers to raise advertised stud fees for this group. An economist would explain the higher stallion season prices by noting that the regulatory limit on mares bred would allow farms to ration stallion seasons primarily to the 140 mare owners who offered the most favorable terms (prices, quality, fertility?) to be among the select 140. A second factor that would tend to push prices up would be the now increased rarity of foals for the 140+ stallions. (Duncan Taylor of Taylor Made Farm refers to this effect in a Dec. 21, 2019, BloodHorse article.) A third factor that should result in increased pricing pressure would be the recognition that the breeding shed will be less congested for the 140+ stallions as mares bred are limited to 140. This would tend to improve in-foal percentages and also the fraction of a stallion’s book that gets pregnant early in the breeding season.

In addition to the pricing effects on each 140+ stallion, we should expect that limiting the number of mares bred to popular stallions would cause increases in demand for stallions that were good alternatives to the 140+ stallions. The overage mares “bumped" by the 140 limit would need to find new mates, and demand for seasons from potential substitute stallions would thus increase. The “rarity factor” and the “congestion factor” that would tend to create upward pressure on prices of seasons for 140+ stallions would work marginally? against price increases for stallion seasons of “replacement” stallions picking up more mares from the displacement of the overage mares, as rarity would decrease and congestion would increase. Overall the increased demand for “replacement” stallion seasons would almost surely outweigh the now decreased rarity of their foals and the (possible) increased congestion at the breeding shed.[[4]](#footnote-4)

If the 140 limit had been put in place before the 2019 breeding season, it would most directly have affected 1397 “overage” mares that exceeded the 140 limit in the books of the 43 stallions that bred more than 140 mares. Certainly 1397, but also almost surely more mares, would have had to find new suitors. It’s not important to determine precisely which 1397 mares of the 7417 mares bred to the 140+ stallions would have moved to new stallions, but it’s reasonable to expect that the 1397 mares forced from the books of the 140+ stallions were some combination of mares unwilling to pay the new higher prices set by popular stallions in the post-140+ marketplace and/or those no longer on stallion managers’ acceptance lists.

Some of those 1397 mares would find new homes by displacing mares from the other 140+ stallions. For instance, some overage mares originally targeted for Into Mischief might end up with Uncle Mo, bumping mares in addition to his original overage mares. But, whatever amount of reshuffling that occurs amongst the 140+ stallions, ultimately 1397 overage mares would have to find a new suitor outside the 140+ stallions, and further reshuffling would often occur in stallion books for “replacement” stallions that landed overage mares It is instructive to take a look at both the characteristics of the 140+ stallions and to the potential “replacement” stallions bred to between 86 and 139 mares in 2019. This analysis classifies both groups of stallions by their number of years at stud. In 2019, the 61 stallions breeding 86 to 139 mares accounted for 25% of mares bred in North America. Coincidentally in 2019, the 43 stallions that bred more than 140 mares in 2019 also represented approximately 25% of total mares bred.

The 61 stallions that bred 86 to 139 mares had room to breed (slack) in their collective books totaling 1621 openings if each of these stallions could service 140 mares. More likely a number of these stallions might already be at or very near their own limits because of fertility, age, or syndicate restrictions. In the unlikely case that all 1621 openings were available for use, then the 1397 overage mares bumped from the 140+ stallions could conceivably fill 1397/1621 = 86% of the openings in the books of the stallions in the 86 to 139 mare group.

Without a doubt the increased demand for seasons to the stallions that bred 86 to 139 mares would result in increased advertised prices for this group. Though theoretically there is room for the 1397 overage mares to find a spot in the 86 to 139 group, it’s likely that a combination of pedigree, conformation, pricing, location, and stallion fertility/syndicate restriction considerations would result in some of the 1397 overage mares dropping further down to stallions that would have bred fewer than 86 mares in the absence of the imposition of the 140 limit. Additionally, the combination of overage mares dropping into the 86 to 139 group and higher advertised prices posted for seasons to the 86 to 139 stallion group would likely dislodge some mares originally targeted for the 86 to 139 stallions that would move down the ladder for financial reasons.

Because most of the 140+ stallions in 2019 (see Figure 3) were higher-priced stallions, the impact of the pricing adjustments would be strongest for higher-priced stallion seasons, but there is no doubt that there would be pricing pressure all the way down the price continuum. There are at least two reasons why we should expect this:

 1) Stallions priced at marginally lower prices than the preferred target price range for a mare are almost always considered as possible substitutes. Often, a lower-priced stallion with more compatible pedigree and/or conformation affinity for a mare will be chosen over a stallion who fits the preferred budget requirement of a breeder; and

2) Twelve percent of the 140+ overage mares had been targeted to modestly-priced stallions originally. Sharp Azteca, Klimt, Mor Spirit, and Cloud Computing, with stud fees from $7.5 to $10K were responsible for 169 “overage” mares. The displacement of these modestly-priced overage mares would have resulted in increased demand for other modestly priced stallions.

It’s reasonable to expect that the overage mares would have pursued a variety of alternatives rather than merely moving down to the next busiest group of stallions, or to stallions priced just below their original targets, and an analysis of data from Figures 1 and 2 below, which categorize mares by the year at stud of stallions to which they were bred, tends to reinforce that expectation.

 **Fig.** ***1 - 2019 Overage Mares Compared to Slack\* for 2019 86-139 mare sires***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  Overage | Mares bred  | % of 1397 |  | Slack\* | % of 1621 |
| Yr. 1 Sires | 595 | 43% |  | 100 | 6.2% |
| Yr. 2 Sires | 145 | 10% |  | 295 | 18.2% |
| Yr. 3 Sires | 23 | 2% |  | 182 | 11.2% |
| Yr. 4 Sires | 38 | 3% |  | 306 | 18.9% |
| Yr. 5 Sires | 166 | 12% |  | 150 | 9.3% |
| Yr. 5+ Sires | 430 | 31% |  | 588 | 36.3% |
|  Totals  | 1397 | 100% |  | 1621 | 100% |

*\*“Slack” is defined as the number of mare breeding openings theoretically*

 *available to stallions breeding**86 to 139 mares in 2019.*

 ***Fig. 2 – 2017 to 2019 Overage Mares***

|  |  |  |
| --- | --- | --- |
|  Overage | Mares bred  | % of 1397 |
| Yr. 1 Sires | 1210 | 33% |
| Yr. 2 Sires | 326 | 8.9% |
| Yr. 3 Sires | 167 | 4.6% |
| Yr. 4 Sires | 252 | 6.9% |
| Yr. 5 Sires | 550 | 15% |
| Yr. 5+ Sires | 443 | 31.7% |
|  Totals  | 3669 | 100% |

Columns 1, 2, and 3 from Figure 1 above report “overage” mares (those that would have been “bumped”) if a 140-mare limit had been imposed for 2019. Note that in 2019, the fraction of overage mares relative to total overage mares from the books of Year 1 sires was high (43%) compared to the average (33%) for the three years 2017-2019 reported in Figure 2. This reflects the variability in appeal of newly retired stallions from year to year: they were extremely popular in 2019 with 43% of overage mares. In 2017 newly retired stallions accounted for 15% of overage mares. The “slack,” or numbers of openings available as reported in columns 5 and 6 of Figure 1, are significantly less volatile from year to year than are the number of overage mares attributable to first-year stallions. Note also that in 2019 the overage numbers for stallions in their 3rd and 4th years at stud were very low. Though other explanations may also help explain the low overage figures for years 3 and 4 stallions in 2019, a partial explanation is that the popularity of first-year sires in 2019 pulled mares away from other unproven stallions.

Comparing the overage mares by stallion year to the slack from stallions that bred 86 to 139 mares in 2019 helps illustrate the likely complexity of the adjustment process. 595 (43%) of the overage mares were bred to first-year stallions in 2019. Almost half of these (288) were the result of the extreme popularity of three stallions, Justify, Mendelssohn, and Bolt d’Oro. But only 100 slots were available to first-year stallions breeding 86-139 mares in 2019. If their owners have strong preferences toward breeding to a 1st-year stallion, they would find the search for a substitute stallion involving substantial trade-offs. A consideration of the range of stud fees for the overage mares helps to illustrate the potential extent of tradeoffs that would have to be made. Figure 3 reports the advertised stud fees that the overage mares would have paid if not bumped by the 140 limit. Figure 4 reports the average advertised stud fee of stallions breeding 86-139 mares in 2019.

**Fig. 3:** Pre- 140 Limit Stud fees of Overage Mares **Fig. 4**: Stud Fees of Stallions

|  |
| --- |
| Stud fees No. of mares % of Overage Cum Breeding 86-139 mares  |
| 125-150K 365 26% 26%  |
|  35-80K 331 24% 50% |
|  25-30K 233 16.7% 66.7% No. of stallions =62 |
| 17.5-20K 235 16.8% 83.5% |
| 10-12.5K 178 12.7% 96% No. of slack seasons = 1621  |
|  6-7.5K 54 4% 100%  |
| **Avg. = 57.6K 1397 = Total mares**  **Avg. slack stud fee = 23.4K**  |

The weighted average stud fee of the overage mares in 2019 was $57,600. The weighted average of the stud fees of the slack seasons available from the 1621 available seasons from stallions that bred 86 to 139 mares (assuming all the slack seasons are actually available) is $23,400, quite a come-down for many of the overage mares. The dearth of obvious substitutes for the overage mares, especially overage mares from first-year stallions in 2019, illustrates the likelihood that overage mares would look for substitute stallions over a fairly wide range of potential substitutes, both with respect to breeding year of substitute stallions and stud fees. This reinforces the expectation that demand for a wide range of stallions with slack would be considered, including a significant number that had bred less than 86.

**Summary - Economics of the Adjustment Process**

In absolute terms, the number of overage mares looking for substitute stallions is relatively low – only 4.78% of total mares bred. But because the overage mares are predominantly being bumped from high-priced stallions (26% are bumped from stallions with stud fees of $125K or higher, another 24% from stallions with stud fees from 35 to 80K), the process of finding a replacement stallion would be challenging. Prices for stallions in all ranges will increase, with the strongest increases in prices for the 2019 breeding season occurring at the upper ends of stallion season prices for stallions that would have bred significantly more than 140 mares, most notably proven sires Into Mischief, Uncle Mo, American Pharoah, Candy Ride, and Union Rags, first-year sires Justify, Mendelssohn, Bolt d’Oro, and Sharp Azteca, and second-year stallions Practical Joke and Klimt. But the demand created by the displacement of the 1397 overage mares would create a cascade effect that pushes season prices higher at all price levels, though with diminishing intensity at lower price levels primarily because of the much greater number of available lower-priced stallions.[[5]](#footnote-5)

We can expect that higher average prices for foals from top stallions will prevail (though this effect will be diminished if/when high-priced stallions are exported to more passive regulatory environments), but also to a lesser extent for mid-level stallions that now have better mares. The higher average prices for top-level stallions are part illusion, as they would generally be left with the cream of the mare crop. For example, Uncle Mo would have raised his stud fee and probably kept most of the original best 140 mares that would have been bred to him. Even if the foals produced by those 140 mares would sell for the same prices as before the 140 limit is enforced, the Uncle Mo average will almost surely increase because (mostly) lesser mares went to other stallions. Prices for the most popular stallion seasons may further increase because of the (increased) rarity and (decreased) breeding shed congestion effects. The lower value of extremely popular stallion new prospects constrained by the 140 limit will at least marginally discourage them from retiring to stud in North America. The increase in stallion season prices for mid-level and below stallions will encourage new moderately-priced stallions to retire.

It’s likely that the overall money spent on stud fees will increase initially then fall back at least partially over time as more stallions retire. An increase in the frequency of very high-priced sales will be likely to occur due to the rarity effect for top stallions. But foals from mares that previously would have gone to a top 6 or 7 stallion that now are bred to a 10-20 rated stallion will probably generate lower prices than they would absent the 140 limit. It’s unlikely that the overall amount spent on sales horses will increase, as the mix of stallions will now have fewer foals from the most popular stallions and more foals from stallions further down the ladder. Breeders in the lower third of the market will probably be initially paying slightly higher prices for seasons to the formerly $5K to $10K stallions (who benefit marginally from the cascade effect).

Foals by lower-priced stallions will face cross-currents. The cascade effect will gain them additional mares, and those good mares will tend to generate higher prices. But the increased numbers of foals produced by lower-priced stallions will generate downward pressure on foal prices. A third effect tending to push the lower end lower will be that more mid and lower-level stallions will be encouraged to retire because of the cascade effect’s making more mares available to them, though this effect may be minimal initially until more new stallions retire. Whether foals by lower-priced stallions generate slightly higher, approximately the same, or slightly lower prices is unclear, though the higher season prices for lower-priced stallions because of the cascade effect are likely to cause profit potential for sellers at this level to be no better than it is now, and possibly worse. If worse then expect some marginal breeders to drop out and fewer foals will be produced, with inevitable pressure on racetrack entries.

**Why Any Limit and Why a 140-Mare Limit?**

Free-market adherents typically argue that the free market best allocates resources and that regulators should have compelling reasons to intervene in the free market. Many, perhaps most economists would agree, but would point out that an unfettered free market can lead to catastrophic conditions. Failures to limit the disposal of toxic chemicals in decades past and to regulate risky mortgage lending and risky mortgage derivative products in the run-up to the “great recession” are cases in point. Is the genetic diversity argument espoused by the Jockey Club (and previously by standardbred regulators) an example of a compelling need to regulate? The answer to this question is further complicated by arguments by a number of horsemen (e.g. Arthur Hancock – TDN Sept. 16, 2019) who seem to feel that limiting stallion books should be considered on economic grounds more so than on “genetic diversity.”

The Jockey Club’s proposed 140 mare limit is the same as the limit that became effective in 2009 for newly retired trotting stallions, though already active pacing stallions were phased in by allowing them to breed 160 mares in 2009, 150 mares in 2010, then 140 in 2011 and thereafter (Source – members.ustrotting.com/breeding.cfm). Both in terms of numbers of mares displaced from 140+ books and mares displaced as a percentage of total mares bred, the Jockey Club proposal would be significantly more restrictive than was the standardbred limitation. The explanation why a 140-limit is significantly more restrictive for Throroughbreds is two-fold:

1) The Jockey Club estimates that approximately 20,800 Thoroughbred foals born in North America in 2019 will be registered. (Source Jockey Club Fact Book). This is more than 2.6 times as many foals as the 7,600 or so standardbred foals projected for 2019. The larger population of Thoroughbreds not surprisingly has resulted in more significant commercial stallions and more stallions breeding larger books; and,

2) The Jockey Club proposal comes some 10-11 years after the imposition of the Standardbred mare limit. During that time veterinary technology improvements and market conditions have combined to generate a greater number of stallions breeding very large books, as exemplified by the 43 Thoroughbred stallions breeding more than 140 mares in 2019.

If for purposes of discussion we accept that the standardbred 140 limit is appropriate, it seems logical to question whether the same 140-mare limit is appropriate for two populations that are so different in size. A 140 limit is much more binding on Thoroughbred stallions than the 140-mare limit implemented in the much smaller Standardbred population

**Phase-In Limits**

Phase-in limits for new regulations, as opposed to immediate and full adherence to a new set of standards, are preferred when immediate adherence would create undue hardships on one set of affected parties and/or would cause undue windfalls to another set of affected parties. When there are catastrophic conditions that must be addressed, the importance of balancing hardships and windfalls may need to take a back seat to addressing clear and present danger, and though this author does not consider that the present state of Thoroughbred genetic diversity is in anything approaching catastrophic conditions, that is a question about which I and others should be willing to consider advice from learned individuals.

As discussed in the economics and logistics section of this paper, the economics of a 140 breeding limit will rather dramatically create new winners and losers for particular stallions and for particular stud farms. Though there will be others, the most obvious economic losers among proven stallions based on 2019 breeding numbers if the proposed phase-in limits are enforced would be Into Mischief, Uncle Mo, American Pharoah, Munnings, Kantharos, Candy Ride, Hard Spun, and Union Rags. The phase-in limits initially proposed by the Jockey Club would have these stallions limited to 140 mares in 2021. Limiting these stallions would have two major direct effects for their connections.

1) Though these stallions would be expected to increase stud fees substantially, the likely result would be that revenues generated by each of these stallions would drop. The most significant impacts would be on Into Mischief and Uncle Mo, which each bred 241 mares in 2019. In effect the limits change would penalize these two stallions for being both exceptionally fertile and for producing such high-quality runners that the market has generated great demand for their foals.

2) The inevitable result of the implementation of the 140 limit, given the genetic quality of this group of proven stallions, would be the loss of production of 200 or so of some of the best potential runners produced in North America. These stallions have proven their genetic prowess. Moreover, to this author’s knowledge, there are no reports of significant genetic defects being passed on by these stallions that would imperil future generations of Thoroughbreds. It seems that two factors argue for allowing a permanent exemption from a breeding limit for proven stallions. Curtailing the numbers of mares bred to quality proven stallions changes the limits from those under which the owners negotiated a purchase price for these stallions and is unfair to the owners, and would result in a windfall financial transfer to (typically) lesser quality stallions. Limiting numbers of mares to high-quality proven stallions will also lower the average quality of runners produced during their breeding careers, and to the extent that it is important that the industry offer the best possible products, seems unfair to the racing industry that supports the breeding industry.

More sound from a fairness perspective would be to grandfather (or slowly phase in limits on) all stallions now at stud, and to apply whatever limit (if any) is imposed on all stallions that were purchased or syndicated at a specified date after the limit is put in place. If buyers know that the limits of the game are set in stone, they will make reasonable choices (with price being a major item of concern) and will not be ambushed later by surprise regulatory changes. True, after mare limits are posted, new top-level stallions will be worth less at stud in North America, and the top stallions generate a major portion of the total value of stallions. But, at least in the early years after a mare limit is introduced, moderate and upper-midlevel stallions will be worth more because they will have access to mares cascading down as “overage” mares have to find new homes and generate a ripple effect down the stallion price and/or quality ladder. Thus, on average, it may be reasonable to expect that the total values of U. S. stallions

 prices will more be only marginally lower. Over time fewer top stallions will be retired to stand in the U.S. and the overall quality of foals is likely to fall.

Limits on mares will be decried by free-market supporters, but applying a mare limit to new stallions will at least partially appease Ryan McLean (TDN Sept. 26, 2019) and others who feel that limits might make sense given that new stallions are used by breeders more frequently than the ultimate racing success of their runners warrant. If a limit on mares bred creates demand for more stallion prospects to be retired early, the net effect will not be positive given that the very best newly-retired stallions may end up overseas. And even if a limit on mares bred increases demand for seasons to proven stallions, given that proven stallions could be limited to 140 mares and the very best may have been exported, it’s doubtful that a limit on mares bred does anything but lower the quality of the breed.

**Stallion Values and Stallion Exports**

James Keogh (TDN Sept. 26, 2009) is correct that the imposition of a limit on the number of Thoroughbred mares bred to any one stallion will cause the value of a stallion to fall if that stallion would have been expected to breed more than the imposed limit. Because a limit on mares bred creates an artificial scarcity in seasons for 140+ mare stallions, the prices of the 140 seasons available will increase, but because the demand curves for seasons to stallions are almost assuredly gently downward sloping (“elastic” in this market that economists classify as monopolistically competitive), the decreases in volume of mares bred will diminish revenues more than the increases in season prices will increase revenues. Because the stallions that would otherwise have bred 140+ mares will generate less revenue, their values in the North American market will fall. Stallions such as Into Mischief and Uncle Mo will be more likely than before to be the objects of buyout (and shuttle) offers from foreign buyers from locations where there are no limits on mares bred.

The displacement of mares from 140+ books will increase demand for stallions that are close substitutes to the 140+ mare stallions. The values of the seasons in these “replacement” stallions will rise as demand increases. They will further benefit in many cases from larger books, further increasing their revenues and values. These close substitute stallions will tend to be more valuable in the North American market than abroad. A cascade effect will ripple downward through the stallion market, most strongly buoying the upper middle market, but to a lesser degree the middle market and those (especially commercial) stallions below the middle market. It is not obvious what will happen to the total value of stallions in North America as a result of the 140+ limit. The decline in the value of the 140+ stallions could be offset by the rise in the value of less popular stallions that attract overage mares. Until more stallions are retired (probably over a multi-year period) the restrictions on mares bred may even cause the total value of North American stallions to increase slightly. Two related effects will mitigate price increases:

1) Higher prices and lower available sire power because of the 140+ limit will almost surely result in a lower average quality of foals produced, which may discourage breeders from breeding marginal mares and lower the volume of foals produced. 2) Although initially the market will face a scarcity of stallions due to the 140+ limit (and potential losses of stallions due to exports as well), over time we will see an increased rate of retirements of mid and lower level stallions attracted by higher stallion season prices, though stallions that would have been able to breed well over 140 mares when newly retired will not be as valuable in the North American market after the implementation of a 140 mare limit.

Not only will established 140+ stallions be more likely to be exported after the introduction of a limit on mares bred, but also potential extremely popular newly-retired stallions that can breed more mares overseas than in North America will be more likely to be sold overseas.

**Selective Regulation**

The arbitrariness of the proposal by the Jockey Club to impose a 140-mare limit on stallions without providing documented scientific evidence of a “genetic diversity” problem is highlighted by their decision not to pursue one (or more) obviously beneficial regulatory changes.

Consider that Dr. Hill, the respected geneticist whom the Jockey Club has reportedly chosen to provide an analysis of the “genetic diversity” question, is renowned for being the lead author in an effort to isolate and describe the workings of the myostatin (speed/staying) gene that is widely recognized as affecting the racing potential of all Thoroughbreds. Unfortunately for the average breeder, the vast majority of Kentucky stud farms have decided that they will not divulge the results of speed gene tests. Two farm representatives were willing to explain the rationale for the reluctance to provide information after this writer pledged that their names would not be used. Farms know that a minority of stallions will test double copy for “staying” at the myostatin locus and they worry that many breeders will prefer either the heterozygous condition for the myostatin gene or double copy for speed, and thus will pay less for seasons to stallions that are double copy for staying. Never mind that A. P. Indy was likely to have been double copy for staying and that the logic of stud farms’ view on this issue is questionable, the point is that stud farms are withholding information that could allow breeders to make better decisions that might save the industry millions of dollars. Jockey Club members who care to know surely understand this, but have apparently chosen to give this practice a wink and a nod.

For the average breeder most farms advise something on the order of “you can get a good idea of this stallion’s speed gene status by looking at his conformation and race record.” (I wonder whether the breeder with millions of dollars to spend gets that same story.) This speed gene situation is analogous to a car dealership telling a potential buyer of a car that “you can look under the hood and get a good idea of the horsepower of this car, but you will only find out more definitive information if you buy it and drive it for a while.” Many of us worry about government regulatory overreach, but wouldn’t you prefer that regulators require that auto manufacturers (and stallion managers) divulge important specifications of the products they are trying to sell us?

My business school colleagues who specialize in corporate governance would ask me “what do you expect from a regulator with no independent outside directors on its board, and whose members are “elected” by a self-perpetuating group of individuals who in many cases have inherent conflicts of interest because of their substantial ties to stud farms?”

The Jockey Club has achieved any number of outstanding accomplishments where their interests and the Thoroughbred’s interest coincide, but this writer wonders whether a regulator that was responsive to the best interests of the Thoroughbred wouldn’t have put the “genetic diversity” question on the back burner while more research was done, and instead propose that all stallions breeding more than X number of mares publicize the results of the stallions’ speed gene tests.[[6]](#footnote-6)

Whether or not a mare limit is implemented, Dan Vella’s[[7]](#footnote-7) (see this footnote) suggestion that Thoroughbred breeding should consider artificial insemination (AI) invites an explanation why the considerable savings and safety associated with AI[[8]](#footnote-8) do not justify a regulatory OK? And if a mare limit is implemented, why not raise the mare limit to the extent that seasons are bought/sold internationally by allowing international AI so that U.S. breeders could access foreign stallions and U.S. stallions could sell abroad? This would help achieve the Jockey Club’s goal of “genetic diversity.”

**Addendum on The Genetic Diversity Argument**

**By Robert L Losey, Ph.D.[[9]](#footnote-9)**

**Introduction**

If you are reading this, this writer’s best explanation for that is that the Jockey Club has let us down. I say that because I’m only a “semi-expert” on the equine genetics topics I opine about in this addendum. I suspect that I have a stronger grounding in equine genetics than 95% of the Jockey Club members who have collectively decided that we have a “genetic diversity” problem in Thoroughbreds (see footnote 6). But wouldn’t you rather be reading a summary of findings and opinions by leading equine geneticists on whether Thoroughbreds have a “genetic diversity” problem than reading what semi-expert me has to say? If the Jockey Club wanted to do the right thing, wouldn’t it have encouraged a staff member from the BloodHorse (in which it has a controlling interest) to attend and report on the Equine Genetics Session of the January 9, 2020, Annual University of Kentucky Equine Showcase in Lexington that discussed the “genetic diversity” topic. (The moderator of that session, a highly respected equine geneticist, opined that he did not see a significant problem with Thoroughbred genetic diversity at this time.)

Better still, wouldn’t it be useful if the Jockey Club would sponsor a symposium on the topic where leading geneticists discuss the pros and cons of the Jockey Club’s genetic diversity argument and the proposed 140 mare limit? Reportedly the Jockey Club has contracted to have Dr. Emmeline Hill, an eminent genetics professor who is an expert in the equine genome, study the “genetic diversity” question. This writer has great respect for Dr. Hill, having extolled her work on myostatin (speed) gene research in a BloodHorse Daily column, but my experience as a regulator informs me that the industry would benefit from hearing from a significant cross-section of experts.

The Thoroughbred breeding industry deserves a regulator that is unbiased, that supports the free flow of information, that thoroughly justifies proposed changes in “regulations,” and that provides adequate opportunities for industry participants to examine and debate the rationale for, and implications of, regulatory changes.

**Genetic Diversity and A Short History of Thoroughbred Inbreeding**

The Jockey Club seems to view inbreeding as “bad” and genetic diversity as “good.” If things were only that simple.

All Thoroughbreds are said to have descended in tail-male line from the three original foundation stallions of the breed, the Darley Arabian, the Godolphin Arabian, and the Byerly Turk. Because there were only three founding sires, there was significant inbreeding in those early days, and a substantial element of inbreeding was fixed in the Thoroughbred population forever. There would have had to have been duplicate great-grand sires in almost every early pedigree since there were four sires three generations back and only three founding stallions. In some cases, there would have been two duplications of great-grand parents. In extreme cases a 2nd-generation daughter of a stallion might have been bred back to her sire, and the 3rd-generation daughter might be returned to the same stallion, meaning that the same stallion would be sire, grandsire, and great-grandsire of a foal. The extreme case was perhaps not as rare as we might imagine, given the costs of travel (which typically meant walking your mare to the stud farm) and stud fees when procuring an outside stallion. The point is that there was significant inbreeding early on, and that, at least on the margin, inbreeding was more pronounced than it is now. The primary potential problem with inbreeding is that it might result in two problematic recessive genes becoming double copy (homozygous), thus resulting in the expression of a deleterious characteristic. Such a situation could have been especially harmful to the breed if the three founding stallions possessed recessive genes that led to significant problems when homozygous.

If there was a son (or sons) of one of the original stallions that had greatly superior conformation and racing abilities, it was probable that that son gained a greater share of the breeding opportunities and tended to increase inbreeding in the population. Had that popular stallion had problematic recessive genes, then at least a portion of the population would have suffered in quality, and a lack of genetic diversity would have been troublesome. Apparently though, inbreeding in the early history of the Thoroughbred led more to reinforcement of good genes than to problematic recessive genes.

If we look for problematic recessive genes in the equine population today, a case in point is hyperkalemic periodic paralysis problem (HYPP) in quarter horses. The quarter horse stallion Impressive passed on a gene that gave rise to HYPP, which is characterized by intermittent (and occasionally fatal) paralysis in his descendants when the deleterious recessive gene is homozygous (HH). The quarter horse breeding registry now will not register a quarter horse foal that is homozygous (HH). (Source: <https://www.tsln.com/news/hypp-and-the-impressive-line-of-american-quarter-horses-the-facts/>.) Should the Thoroughbred industry worry about analogous situations? The answer is mostly no but potentially very rarely yes.

There are many recessive genes in Thoroughbreds that express differently when homozygous. For example, a black Thoroughbred is always homozygous for the recessive gene causing the black color. However, being homozygous for the black color will not affect the durability or speediness of a Thoroughbred runner. Fortunately, there is no known reservoir of recessive genes in the Thoroughbred gene pool that when homozygous, gives rise to anything approaching the devastating effects of hyperkalemic periodic paralysis. Fortuitously, the three founding stallions from whence the Thoroughbred breed has descended fixed many good traits in the breed without creating genetic land mines from recessive genes that paired up (were homozygous) in subsequent generations.

 If there were potential genetic land mines associated with homozygous recessive genes in Thoroughbreds then inbreeding could be viewed as problematic. But does the fact that the incidence of problems caused by homozygous recessive genes in Throroughbreds are *de minimus* mean that we can completely relax with respect to inbreeding? The answer is that in extremely rare cases inbreeding may result in problems if a stallion has a gene mutation that creates the potential for a recessive gene “land mine.” In the extremely unlikely case that another stallion has the same mutation, crosses including these two stallions, one in the upper half, the other in the lower half of the pedigree, will cause the expression of the deleterious recessive trait in a minor fraction of breedings. More likely is that the deleterious recessive trait will only show up when the one stallion that experienced a deleterious recessive mutation has descendants that inbreed to express a problematic homozygous recessive trait. This was apparently the case with the quarter horse stallion Impressive. Because he had been a superior physical specimen, he was heavily used as a stallion, and his descendants ended up on both the top and bottom of some pedigrees only a few years after he started breeding, leading to the expression of the HH recessive condition relatively soon after he went to stud.

Should the Thoroughbred industry be concerned about the possibility of something on the order of the Impressive phenomenon occurring in a Thoroughbred stallion? Yes, but! Unfortunately, until the Thoroughbred genome is completely understood and mutations can be identified and evaluated at minimal cost before a stallion breeds, there are no reasonable solutions that would be cost effective to head off those one-in-a-million situations where a mutation will create future genetic problems.

While it is extremely rare for a stallion to introduce a devastating trait into the gene pool via a mutation, we see frequent cases of a highly respected stallion prospect producing slow runners. In time the marketplace takes care of that because breeders want to breed better runners and stop using even champions that produce slow progeny. When the marketplace heavily uses a new stallion, that stallion will fail to become commercial 85-90% of the time. Eventually that situation will tend to be self-correcting, as the stallion will not be used after he proves his mediocrity. Moreover, that is not an “inbreeding” problem, it is a slow progeny problem.

**Returning to the Jockey Club’s 140 Mare “Solution”**

All of us have seen breeding choices by others that we consider suboptimal--that is part and parcel of a business that allows breeders to make their own choices. Breeding for brilliance, which many, perhaps most breeders try to do, has its own set of accompanying “problems” because fast horses put more pressure on limbs. A 140-mare limit will do little or nothing toward solving either the suboptimal decision-making of breeders or the “fast horses are more often sidelined” problem.

As of now there is no well-documented scientifically-based evidence that inbreeding has led to problematic genetic traits in the Thoroughbred population. However, compelling evidence that the proven sires that breed more than 140 mares generate runners that increase the numbers of high-quality runners is readily observable from a variety of sources. Until we have definitive proof that inbreeding lowers performance and risks the health and future welfare of the Thoroughbred population, why should we introduce a requirement that adversely affects both the economics of the business and the quality of runners?

1. Though the following individuals may or may not agree with the analysis and conclusions in this paper, I am indebted to them for their helpful comments and/or contributions. Thanks to George Adams, Dr. Ernest Bailey, Terri Burch, Dr. Ann Gillette, Dr. Thomas Lambert, Dr. James Marsden, and Dr. Jill Stowe. Thanks also to Sarah Mitchell and Dorothy Losey for Excel and editing work respectively. Any errors that remain are mine alone. [↑](#footnote-ref-1)
2. See https://www.thoroughbreddailynews.com/jockey-club-considers-limit-to-limit-stallions-books/ [↑](#footnote-ref-2)
3. Though I would like to think I would have conceptualized the adjustment process arising from the implementa-tion of the 140 limit as discussed in this paper, I must report that Dr. James Marsden, UConn Professor Emeritus (whose first foal on his Anderson County farm became a stakes winner) made the mare displacement/replacement adjustment process easier for me by succinctly outlining the basics of that adjustment process. [↑](#footnote-ref-3)
4. For a detailed discussion of the economics of stallion seasons see this author’s article…http://rllosey.com/wp-content/uploads/2014/09/Pricing\_Stallion\_Seasons\_DiscrimMonopolyAI-pdf.doc. on RLLosey.com [↑](#footnote-ref-4)
5. A significant factor explaining the more moderate price increases in lower-priced seasons is that there are many more lower-priced stallions than higher-priced stallions. As a result, the pricing pressure on lower-priced seasons is dissipated as it is spread over more replacement stallion. [↑](#footnote-ref-5)
6. For further discussion of the “speed gene”, see the following materials by this writer. From the *BloodHorse Daily:* See p. 14 at <https://cdn.bloodhorse.com/daily-app/pdfs/BloodHorseDaily-20170528.pdf>, see p. 18 from

<https://cdn.bloodhorse.com/daily-app/pdfs/BloodHorseDaily-20170702.pdf> . From the January 25, 2020 *BloodHorse*, see the bottom of p. 40. [↑](#footnote-ref-6)
7. See https://www.thoroughbreddailynews.com/letters-to-the-editor-more-reactions-to-jc-cap/ [↑](#footnote-ref-7)
8. See https://thehorse.com/14368/artificial-insemination-for-horses/ [↑](#footnote-ref-8)
9. Let me warn readers of my limitations in the area of genetics. I was a chemistry major/biology & economics undergrad minor earning an A in genetics, my favorite biology course at Centre College. My academic training in genetics expanded only a bit during my one semester at Vanderbilt Med School. My graduate economics training at the University of Virginia, and later in the University of Kentucky Ph.D. program in economics did nothing to expand my knowledge of genetics, though the “on-the-job” training into which I submerged myself at Keeneland Race Track several weeks each year for several years did provide a basis for a life-long interest in equine genetics. I have read and researched a variety of topics about equine genetics during my 40+ years involved in breeding, racing, and writing about the Thoroughbred industry, including having written on equine genetics as a columnist for *Blood-Horse Daily*. [↑](#footnote-ref-9)