An Analysis Of The Economic Efficiency Of Thoroughbred Breeder/Owner Incentive Policies

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Abstract

Thoroughbred incentive programs are subsidy policies designed to promote regional race horse breeding and ownership. At issue, is an ongoing debate concerning the effectiveness of alternative policies. Empirical results indicate the programs have a positive economic affect, but gains in efficiency can be obtained by reallocating funds to open purses.

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Introduction

Subsidy policies for agricultural commodities have long been used as a means to manage supply and augment demand. Thoroughbred breeder/owner incentive programs are state administered subsidy policies designed to promote regional race horse breeding and ownership. Currently, twenty-seven states operate incentive programs that transfer one-hundred million dollars annually to the horse racing industry, (American Horse Council, 1995).

Breeder/owner incentive programs are funded through a tax levied on parimutuel wagering pools. This share of tax revenue is transferred to owners and breeders under a variety of alternative subsidy programs. Washington operated an incentive program as early as 1945, and many states initiated incentive programs in the 1960's and 1970's. Each state has different policies regarding the administration and levels of funding across the alternative incentive programs.

Limited analysis exists evaluating the economic efficiency of the alternative breeder/owner incentive program policies. This has become of increasing concern due to the high levels of expenditures, the limited growth in pari-mutual wagering pools across the nation, and states that have recently introduced alternative gaming into pari-mutual racing markets seek to subsidize pari-mutual racing and the regional thoroughbred industry in the most efficient manner possible. Additionally, incentive programs are a green space preservation policy. In contrast to confined animal feeding operations, horse farm and training facilities are environmentally sustainable due to the large acreage of grassland required for proper horse management. Green space preservation is an issue not only in densely populated states such as New York and New Jersey, but also in the

primary thoroughbred production state of Kentucky. The objective of this study is to examine the economic effectiveness of breeder incentive program alternatives on the supply of registered foals and the demand for the foals as they are sold as yearlings.

Background and Literature Review

Incentive programs encourage thoroughbred breeding to expand the state's agriculture and to assure an adequate supply of horses for regional parimutuel racing. Each states' incentive program differs in the distribution of transfer payments to the breeder/owner of state-bred horses[1] winning races across five alternative programs: Breeder awards transfer money to the breeder of record of a state bred horse; Stallion awards transfer money to stallion owners; Owner awards transfer money to the owner of a state bred horse winning a race open to all horses meeting the race conditions regardless of state of breeding; Restricted race owner awards transfer money to the owner of a state bred horse winning a race restricted only to state bred horses; And other awards is a miscellaneous category for state bred stake races, stallion stakes, and other races highlighting state bred horses.

Restricted race owner awards accounts for fifty-three percent of the distribution of incentive award payments. Breeder and stallion awards account for twenty-two and five percent of the distribution of incentive program payments respectively. Open race owner awards accounts for eighteen percent of the payment distribution, and other awards two percent.

Of particular interest is the difference in incentive program expenditure per registered foal across states. New York and New Jersey rank first and second in incentive program transfer

[1] Generally, to be classified as a state bred, the foal must be conceived in the state, and the mare must give birth in the state.

payments, which average over $11,000 per foal. In comparison, Maryland ranks twelfth in expenditures at over $2,000 per foal. And, Kentucky which ranks first in foal crop, ranks twenty-fifth in incentive payment transfers at $525 per foal.

While there exists a number of studies examining agricultural commodity supply policies, (Shumway, Smith and Richardson, 1995, and Sun, Kaiser and Forker, 1995) and demand policies, (Alston, Carter and Smith, 1993, and Halliburton and Hennebery,1995), for example, there is limited analysis concerning the effectiveness of thoroughbred breeder/owner subsidies.

Degennaro, 1989 examined the role of sire stakes[2] on the volume of wagering (handle) for harness racing at Scioto Downs near Columbus Ohio. A direct relationship between parimutuel handle and sire stakes was not found, indicating that the state-bred sire stakes program had no economic impact on wagering. However, the primary purpose of breeder/owner awards is to promote regional race horse breeding and ownership. The effectiveness of incentive programs on promoting breeding can be measured through the supply of registered foals in the state. The effectiveness of promoting race horse ownership can be measured through the demand for yearlings.

The Model

The hypothesis to be tested is that breeder/owner incentive programs have a positive affect on the supply and demand of thoroughbred bloodstock. The empirical specification is based on a structural thoroughbred yearling supply and demand model of inter-temporal equilibrium with price expectations, Neibergs and Thalheimer, 1997, augmented to include breeder/owner subsidy

[2] Sire stakes are a restricted race for state bred colts.

programs. The proposed model is a set of state-level thoroughbred market models and can be specified as follows:

Supply of Registered Foals

$$RFOAL_{it} = \alpha_0 + \alpha_1 RFOAL_{it-1} + \alpha_2 P_{it-2} + \alpha_3 BA_{it-2} + \alpha_4 SA_{it-2} + \alpha_5 MTB_{t-2} + \alpha_6 FCI_{t-2} + \alpha_7 SFEE_{t-2} + \mu_{it} \quad (1)$$

Foal to Yearling Transfer

$$YRL_{it} = RFOAL_{it-1} \quad (2)$$

Inverse Demand For Yearlings

$$P_{it} = \beta_0 + \beta_1 YRL_{it} + \beta_2 PRSE_{it} + \beta_3 RPRSE_{it} + \beta_4 OA_{it} + \beta_5 YTB_t + \beta_6 GFP_t + \beta_7 EXR_t + \beta_8 PCI_{it} + \nu_{it} \quad (3)$$

where i = 1...n represents an index of state level variables.

A working description of the model is provided herein. For a complete model description, see Neibergs and Thalheimer, 1997. Equation (1) represents a supply model of registered thoroughbred foals, $RFOAL_{it}$. The model is based on the hypothesis that breeders act in accordance with the information available to them when breeding decisions are made in a way represented by the interaction of thoroughbred yearling supply and demand. Breeding decisions are dependent on the expected price of yearlings. The decision to breed a mare is made early in year t, which is followed by an 11-month gestation period, to produce and register a foal in year t+1. The foal matures for a year and is sold as a yearling in year t+2. Therefor supply decisions are based in part on breeders' price expectations two years in the future.

Supply response is modeled where $RFOAL_{it}$ responds to state average price for

thoroughbred yearlings lagged two years, P_{it-2}, to represent price expectations and reproductive constraints associated with breeding decisions as previously discussed. Due to the high asset fixity associated with thoroughbred breeding investments and the long biological lag associated with breeding decisions, the supply of thoroughbred yearlings changes gradually over time. The stickiness in supply response is in part attributable to the large fixed capital investment associated with horse production that is not easily liquidated, the small difference in marginal cost between a bred mare versus a non-productive barren mare, and the biological constraints of reproduction. Also, many breeders may not be price responsive due to their willingness to subsidize their thoroughbred investment through periods of non-profitability. A partial adjustment process is represented by a one period lag of the endogenous variable, $RFOAL_{it}$.

Breeder awards, BA_{it-2}, and stallion awards, SA_{it-2}, are transfer payments to thoroughbred producers. They impact the expected returns of breeding decisions and are included on the supply side of the model. Tax benefits are a primary consideration in thoroughbred investment decisions. Tax benefits are a better indication than tax costs of federal tax policy impacts on the yearling market, because tax benefits apply equally to profitable and non-profitable investment decisions. The effects of changes in federal tax policy can be captured through an index that measures the present value of tax benefits from a capital investment in a thoroughbred broodmare, MTB_{t-2}. A farm cost index, FCI_{t-2}, represents input costs of production, and $SFEE_{t-2}$, represents the national average stud fee paid to breed a mare. A stochastic error term is represented by μ_{it}.

Foal To Yearling Transfer

Thoroughbred foals are registered with the Jockey Club as weanlings shortly after they are

born and become yearlings on the first January 1 after they are foaled. Equation (2) is an identity that transfers $RFOAL_{it}$ to the supply of marketable yearlings, YRL_{it}. Once a foal is registered, only death prevents it from becoming a yearling. Since death loss rates are unavailable and presumed negligible and invariant over time, an identity is used to transfer foals to yearlings.

The Demand Model

Demand for thoroughbred yearlings can best be represented as a capital investment function. Equation (3) represents an inverse demand function where the state average price of yearlings, P_{it}, is a function of the predetermined supply of yearlings, $YRL_{it,}$ and a set of current exogenous variables. The price of a capital asset, a thoroughbred yearling being no exception, is related to its earning potential. For thoroughbred yearlings, those earnings are the purses for which it competes, plus incentive program transfer payments targeting thoroughbred yearling/race-horse owners. The state average purse per race, $PRSE_{it}$, restricted race purses, $RPRSE_{it}$, and owner awards, OA_{it}, represents yearling earning potential.

The yearling tax benefit, YTB_t, represents the present value of the tax benefits from a capital investment in a thoroughbred yearling, and is calculated in the same manner as MTB_{t-2}. Foreign investment influences the thoroughbred yearling market. The gross amount of foreign purchases of thoroughbred yearlings, GFP_t, and the exchange rate of United Kingdom for U.S. dollars, EXR_t, capture the export influences of demand on the thoroughbred market. State per capita income, PCI_{it}, represents regional economic conditions. The stochastic error term is ν_{it}.

Because there is no direct feedback from the demand equation to the supply equation, the specified model is recursive. In a recursive system, each endogenous variables can be determined sequentially. Given values for P_{it-2}, one can solve directly for $RFOAL_{it}$ in the supply equation.

Then, knowing $RFOAL_{it}$, the value of P_{it} can be solved recursively in the demand equation.

Results and Discussion

Data availability constrained the scope of states included in the model. A number of states failed to maintain an archive of incentive program transfer payments. Other states did not conduct yearling auction sales, so data on P_{it} is unavailable in those states. Three states are included in the model based on the comparability of their thoroughbred industries. Annual data from 1966 to 1995 for Washington, Maryland and Ohio were analyzed. These states represent a geographical dispersion of thoroughbred production, and rank seventh, ninth and twelfth in foal crop size.

The specified state level thoroughbred yearling market was estimated using Kmenta's method of pooling cross-section time-series data, which assumes autocorrelation and heteroskedasticity (Kmenta, 1986). Due to problems of multicollinearity in the supply model between BA_{it-2} and SA_{it-2}, the relatively small distribution of incentive transfer payments through SA_{it-2}, and these awards largely target the same thoroughbred producer, they were combined into one variable, $BASA_{it-2}$, by adding them together. A dummy variable for Maryland was included in the model. An extraordinary price drop occurred in 1974 to the present which reflects the export of Maryland's higher quality horses to more lucrative markets in Kentucky and New York through the Fasig-Tipton auction house, Finney, 1990. Estimated results are presented in Table 1. Overall model results support the suggested model specification, based on the consistency of estimated parameters with what is expected from economic theory, and statistical measures of significance and goodness of fit.

The supply model's Buse R^2 of 0.97, and the Durbin-H statistic of 0.09 supports the

conclusions of an absence of serial correlation and proper model specification. All variables in the supply model are statistically significant. The estimated parameter of $RFOAL_{t-1}$ of 0.84 results in a coefficient of adjustment of 0.16[3] which substantiates the slow adjustment process of thoroughbred supply response to changes in economic conditions. Although $SFEE_{t-2}$ is a production cost and its anticipated sign is negative, the estimated sign is positive. This may be due to, as the thoroughbred industry expands, stud fees increase. Producers are willing to pay increased stud fees as they expect the marginal value product of YRL_{it} to increase.

The Buse R^2 in the demand model is 0.84. All model variables are statistically significant except for variables measuring export influences of the market, GFP_t and EXR_t. The states included in the study are regional markets, and typically do not have the quality of horses to attract international buyers. The key model variables of $PRSE_t$, $RPRSE_t$ and OA_t are statistically significant at a one percent level of significance or greater. The Durbin-Watson statistic of 1.91 indicates a proper model specification and the absence of serial correlation. All breeder/owner incentive program variables are positive and statistically significant indicating they have a positive economic impact. Their elasticities are calculated to evaluate their effectiveness.

Supply and Demand Parameter Elasticities

The short-run supply elasticities and price flexibilities presented in Table 3 are all inelastic, with the exception of $PRSE_t$ which has a price flexiblity of 1.116. The price flexibility of owner award programs OA_t and $RPRSE_t$ are similar at 0.104 and 0.120. Supply response to price is inelastic, 0.089, and breeder awards, $BASA_t$ is also inelastic, 0.078. These results are consistent

[3] (1-0.84)

with the elasticities estimated by Neibergs and Thalheimer, 1997. The price flexibility of $PRSE_t$ in this study of 1.116 is lower than the purse flexibility estimated in Neibergs and Thalheimer, 1997, of 2.606. Two reasons may account for the lower response. In Neibergs and Thalhemer, 1997 the purse variable was an aggregate of purses, restricted purses and owner awards, and it was a national study, so the price variable had more variation.

Long-Run Comparative Statics

The derivation of the final form of the model by substituting the supply model, equation (1), into equation (3) takes into account the interaction of supply and demand simultaneously. If a disequilibrating change occurs in the form of a variation in an exogenous variable, the initial equilibrium will be upset. Endogenous variables (RFOAL and P) adjust relative to the new value of the exogenous variable, plus the recursive adjustments between RFOAL and P until long-run equilibrium is reached. Long-run supply elasticities and price flexibilities of key model variables are presented in Table 3. The long-run elasticities can be used to rank the relative effectiveness of the alternative breeder incentive programs.

The policy in question is how to effectively allocate parimutuel pool revenues to promote regional thoroughbred breeding. Each state has the authority to allocate funds to the open race purse account, $PRSE_{it}$, or across its breeder award programs, $RPRSE_{it}$, OA_{it}, or $BASA_{it}$. The long-run elasticities indicate that PRSE has the greatest affect on RFOAL with a long run elasticity of 0.562, followed by BASA with a long-run elasticity of 0.440. Although BASA is a direct transfer payment to producers, thus stimulating foal supply, it works against itself by decreasing price, because there is an increase in supply without a commensurate increase in demand. BASA has a long-run price flexibility of -0.097. The breeding sector's marginal revenue

would increase by allocating revenue to PRSE over BASA, because PRSE increases both supply and price. The long-run price flexibility of PRSE is 0.971, and its supply elasticity is 0.562.

Figure one illustrates the total revenue[4] effect to breeders in response to policy scenarios that increases $PRSE_t$ or $BASA_t$ by ten percent. The analysis is relative to a single state in the study. Starting from a point of long-run equilibrium, year 0, breeder revenue is $10.5 million. The policy options are initiated in year 1. The policy option to increase $PRSE_t$, results in an immediate increase in P_t, so breeder revenue increases to $11.5 million. Breeder revenue stays at this level for the two year time lag required for breeders to adjust supply relative to an exogenous shock. From years 3 to 15, breeder revenue increases to $11.9 million as the market adjusts to equilibrium. In contrast, the policy option of increasing $BASA_t$, increases breeder revenue to $10.6 million in years one and two, reflecting only the increase in $BASA_t$ transfer payments. Starting in year three, breeder revenue increases as supply responds to the increase in $BASA_t$, and increases to $10.9 million by year 15. The difference in total revenue between the two policy options over the fifteen year simulation period is $14.9 million.

Conclusions

At issue, is an ongoing debate concerning the effectiveness of alternative breeder/owner incentive programs. This study focuses on the incentive program's objective of promoting the regional breeding sector. Empirical results indicate that breeder/owner awards have a positive economic impact, but gains in efficiency can be obtained by reallocating funds to open purses. This policy may have further benefits outside of that identified by this model. Increased purses improves the quality of horses running in a race, and may increase the field size of the race, both of which have been shown to increase parimutuel handle. Additional research is needed along these lines. The results from this study indicate that market based policies of open race purses, and the

[4] Total revenue to breeders is $YRL_t * P_t + BASA_t$. $BASA_t = 0$ when analyzing the policy to increase purses.

resulting competition between horses, is the most efficient policy for thoroughbred breeding.

Table 1. Breeder/Owner Awards Affects On Yearling Market Empirical Results

Supply ($RFOAL_t$)		Demand (P_t)	
Variable	Estimated Result	Variable	Estimated Result
Intercept	-287.37***	Intercept	3234.1
	-4.67		1.54
$RFOAL_{t-1}$	0.845***	YRL_t	-1.151*
	24.52		-1.81
P_{t-2}	$0.172E^{-1}$***	$PRSE_t$	1.001***
	4.25		8.95
$BASA_{t-2}$	$0.132E^{-3}$**	$RPRSE_t$	$0.464E^{-3}$***
	2.33		4.62
MTB_{t-2}	0.010**	OA_t	$0.103E^{-2}$***
	3.61		2.05
FCI_{t-2}	-0.243**	YTB_t	1.369***
	-2.40		6.02
$SFEE_{t-2}$	0.114***	GFP_t	$0.375E^{-5}$
	5.04		0.93
MADUM	-65.73*	EXR_t	-6.473
	1.70		-1.32
		PCI_t	-70.4***
			-7.81
		MADUM	-4712.1***
			-4.54
n	90	n	90
Buse R^2	0.97	Buse R^2	0.84
Durbin-Watson	1.96	Durbin-Watson	1.91
Durbin-H	0.09		

Notes: The top number is the estimated parameter and the bottom number is the T-statistic; single asterisk (*), double asterisk (**), and triple asterisk (***) denote rejection of H_0 at 0.10, 0.05 and 0.01 significance levels respectively.

Figure 1. Breeder Revenue From A 10% Increase in Purses Versus Breeder Awards.

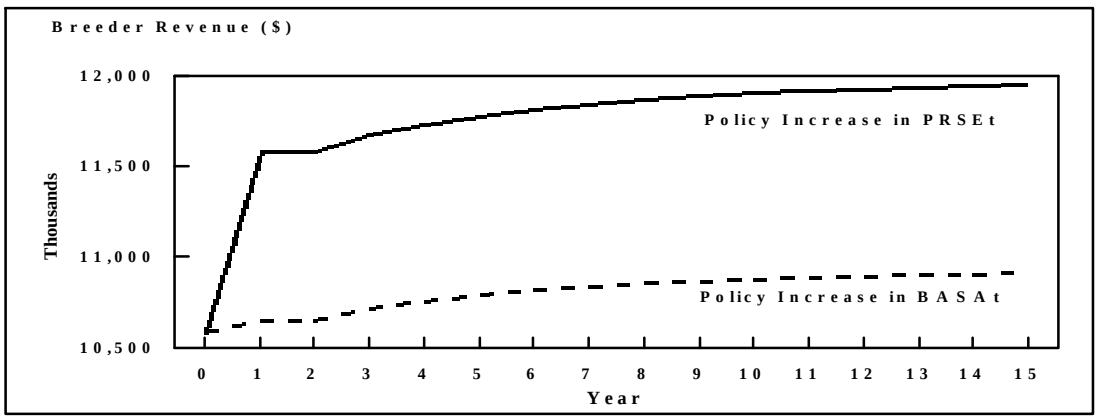

Table 2. Short-Run Supply Elasticities and Demand Flexibilities at the Mean.

Supply ($RFOAL_t$)		Demand (P_t)	
Variable	Estimated Result	Variable	Estimated Result
$RFOAL_{t-1}$	0.836	YRL_t	-0.220
P_{t-2}	0.089	$PRSE_t$	1.116
$BASA_{t-2}$	0.078	$RPRSE_t$	0.120
MTB_{t-2}	0.212	OA_t	0.104
FCI_{t-2}	-0.134	YTB_t	0.725
$SFEE_{t-2}$	0.186	GFP_t	0.021*
		EXR_t	-0.213*
		PCI_t	-0.939

Notes:* indicates the estimated parameter is not statistically significant.

Table 3. Long-Run Comparative Statics of Key Model Variables.

Long-run Supply (RFOAL)			Long-run Demand (P)		
Comparative Static	Supply Response[1]	Long-Run Elasticity[2]	Comparative Static	Price Response[1]	Long-run Flexibility[2]
$\frac{\partial RFOAL}{\partial PRSE}$	0.098	0.562	$\frac{\partial P}{\partial PRSE}$	0.887	0.971
$\frac{\partial RFOAL}{\partial RPRSE}$	$4.530E^{-5}$	0.060	$\frac{\partial P}{\partial RPRSE}$	$4.0895E^{-4}$	0.104
$\frac{\partial RFOAL}{\partial OA}$	$1.018E^{-4}$	0.052	$\frac{\partial P}{\partial OA}$	$9.178E^{-4}$	0.090
$\frac{\partial RFOAL}{\partial BASA}$	$7.514E^{-4}$	0.440	$\frac{\partial P}{\partial BASA}$	$-8.647E^{-3}$	-0.097

[1] The result is the evaluation of the comparative static using the estimated coefficients from the supply and demand equations.
[2] Elasticity and flexibility estimates are calculated at the mean.

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Table 1. Alternative Breeder Incentive Program Options.

Program Option	Distribution of Average Total Incentives
Breeder Awards	22 percent
Owner Awards	18 percent
Stallion Owner Awards	5 percent
Restricted Purses	53 percent
Other Awards/Funding	2 percent

Table 2. Breeder Incentive Expenditures Per Foal.

Rank	State	Num. Foals	Foal Crop Rank	Total Per Foal Incentives
1	New York	1,579	9	11,364
2	New Jersey	581	14	11,100
3	Illinois	1,468	10	9,660
4	Ohio	1,010	11	6,206
5	Louisiana	1,711	6	5,188
6	West Virginia	442	19	4,188
7	California	3,946	2	4,031
8	Pennsylvania	872	12	3,667
9	Nebraska	546	15	3,626
10	Michigan	509	16	3,093
11	New Mexico	636	13	2,158
12	Maryland	1,581	8	2,061
13	Arkansas	457	18	1,686
14	Washington	1,610	7	1,501
15	Arizona	413	20	1,473
16	Oregon	289	22	1,462
17	Oklahoma	1,723	5	1,449
18	Florida	3,784	3	1,381
19	Minnesota	505	17	1,254
20	Massachusetts	125	26	1,088
21	Iowa	192	25	1,049
22	Kansas	243	24	658
23	Wyoming	46	28	635
24	South Dakota	81	27	632
25	Kentucky	7,274	1	525
26	Idaho	347	21	414
27	Colorado	252	23	282
28	Texas	2,294	4	220

Policy Scenarios

Blood Horse, July 19 page 3824 . The approach is firmly grounded in the Irish racing experience, where purses are currently estimated to cover barley one-fifty of training costs and selling horses and stallion services has long been the only way for professional horsemen to produce regular profits. Coolmore also has taken full advantage of Irish fiscal policies that levy no tax at all on stallion values or stallion income. Adopted in 1969 as and economic incentive to horse breeding in Ireland, the policies have encouraged numerous other major European breeders to maintaining Irish breeding farms and patronize Irish stallions.

Future work ? Field size and handle? Socially optimal solution for the region?