TRAINING FOR SUCCESS

THE VALUE OF INVESTMENTS AT THE OLYMPIC TRAINING CENTER IN CHULA VISTA, CLAIFORNIA

A THESIS

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By

Krysti Kiesel

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Krysti Kiesel

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Abstract

This research was spurred by the Olympic Training Center's interest in gathering data to assess the current return on investment for track and field athletes. We predict that athletes who attend the Olympic Training Center should have improved performance in competitions that occur after they have attended the training program. In order to assess these results we have run an endogenous treatment effects model, where we select athletes who have attended the residence program at the Olympic Training Center as participants of the treatment. The Olympic Training Center spends millions of dollars each year to train these athletes, and this study will conclude whether those millions are really worth spending in terms of athletic success.

KEYWORDS: (Track and Field, Athletes, Olympic Training Center, Production Theory, Sport Economics, Endogenous Treatment Effects)

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CHAPTER 1

INTRODUCTION

Countries across the globe gather every four years to defend their honor and bring home glory through athletic competition. The Olympic Games inspire hope and pride for one's country, and the average viewers from home are awestruck by the physical accomplishments of the competing athletes. This wonderment leads to a consideration of the training involved in shaping these athletes to the Olympic level. The following study will aim to look at the effectiveness of a training program for such athletes. This paper will be looking specifically at the programs provided by Olympic Training Center in Chula Vista, California to determine whether the training programs tailored for Olympic athletes really improve athletic performance.

The Olympic Training Center (OTC) in Chua Vista, California is a training facility meant to help nationally recognized athletes hone their talent with the hopes to one-day becomes a competitor for Team USA in the Olympics. The organization is interested in learning how their training program affects athlete performance. This study has been designed to assign a quantitative measure to the return on performance from the Olympic training program. It is the expectation that the training program would increase athlete productivity, which would be observable through improvements in competition scores.

The literature reviewed for this study will span from production theory to the sport economics. This topic has necessary roots in sports economics due to the use of data from an athletic competition and the expanded analysis on cost effectiveness of an athletic program. The theory will evolve from literature in worker productivity changes due to training sessions. We will view athletes as professionals in the workplace who are continuously building their skills in the profession through physical and mental skills training. This study will shed light on how theory of production can translate into sport economics, which has yielded little past research due to sport economic research having a more dedicated focus in team sports and the organizations in which they are involved. The Olympic Training Center uses millions of dollars in funding every year to run the training programs, and yet there is no literature specifically analyzing whether the millions are paying off. This study aims to open this door for further inspection on the Chula Vista Olympic Training Center and other like facilities.

The methodology used for this analysis is focused on the effects to the athletes that were classified as residents at the Olympic Training Center. This model will do the best to focus on the athletes that received the full-package training program at the OTC in opposition with athletes who did not attend the OTC and those that only had short stays. In order to observe this effect, the model is run with endogenous treatment effects.

Complications arise due to human nature and the character of individual competition. The observed track and field events are all individualistic competitions, which means the results are dependent primarily on a singular person and their decisions. Athletics can be a highly mental game and thus every competition can vary depending on the athlete and said competitor’s state of mind. The outside forces playing a role in competition makes it difficult to claim complete accuracy in an analysis surrounded by pure data points that fail to account for many of the factors that affect individual athletes.

This study aims to draw concrete conclusions about the performance of athletes who have attended the Olympic Training and find a correlation of success. The results will also include a cost effectiveness analysis to determine whether the investment in the Olympic Training Center is worthwhile. Overall, this study has set out to expand the study of productivity to the success of Olympic athletes.

CHAPTER 2

LITERATURE REVIEW AND THEORY

When studying human behavior from an economic view, there are many factors to be considered. First, some surface understanding of the organization at the basis of this study is necessary to have the big picture. The direct involvement of athleticism in this study calls for research into sport economics and how the two subjects relate. Following the study of sport economics, the understanding of training as an important aspect of athletic success must be addressed. The key theory to pull this study together is rooted in productivity and human capital investment, thus this section is concluded with an in depth look into past studies on training programs in the professional workplace.

The Olympic Training Center

The National Olympic Committee is the organization given the task of selecting a champion team of athletes as representation of athleticism and country ideals to be sent to the Olympic Games. The National Olympic Committee stands as an individual entity to represent a country at the International Olympic Committee. The National Olympic Committee focuses on the primary responsibilities to select an Olympic team, promote Olympism, and implement the policies set forth by the International Olympic Committee.

The courses and grants that have helped to create the Olympic Training Center's across the United States have been partially aided through the Olympic Solidarity. The Olympic Solidarity originated in the 1960s and has since been a major source of funding for National Olympic Committees across the world to help carry out their mission. The main categories of programs solicited by the Olympic Solidarity include: courses for the athletes, coaches, administrators, sport physicians, and more, individual scholarships to put toward the improvement of coaches and athletes, subsidies for the National Olympic Committees, travel expenses, and contributions to events and establishment of museums or academies dedicated to the Olympics (Chappelet 2008). The United States is a country that has many federal funds to put into the creation of training centers and other resources for the preparation of national athletes in the pursuit of Olympic success. Due to the greater wealth of the USA the Olympic Solidarity has less influence in the financial support of the Olympic facilities in the United States.

Economics of Sports

Sportometrics is the development and testing of economic hypotheses using sports data as a laboratory for drawing conclusions to economic questions. Santos and Garcia (2011) express sport economics as the use of economics to analyze sports, so they view economics as a set of tools rather than a subject matter. In this approach the arena for sporting events are miniature laboratory in which researches can apply models and theories to explain and describe the observation that are made.

Researchers in this area examine the participation in athletics as an expression of rational human action subject to the relative constraints. A pair of researchers Goff and Tollicon (1990) apply the Paradigm of Rational Economic Man as an explanation to the actions of participants in sporting events, where we can observe athletes to respond to incentives and constraints within the sports arena. Individuals are expected to respond rationally to incentives and thus we would assume identical behavior across observations.

General human condition becomes an important variable in these models. Human decision will allow competitors to prepare more rigorously for the events they know to be more significant in advancing their careers, thus athletes are expected to perform at higher levels when there is more at stake. In the case of golfers and runners, where the athletes are playing for individualistic gains, the labor supply, measured by the propensity to enter a given event, is positively affected by the expected gain to participating. Interestingly, this gain was not highly motivated by monetary gain, and in fact, Kahn (2000) found the monetary incentives returned small statistical significance in player performance improvements. Although, the small significance did indicate that runners times were improved when setting records was rewarded with better prize money. With many of these individual sports the athletes respond strongly to incentives, but the strongest incentives are not easy to measure since it is often not due to monetary prizes or other external measures (Kahn 2000). Track and Field events are essentially a competition to prove who is best, and thus much of the incentive is individual pride and glory. A positive aspect to individualistic sports, such as track and field, is that the competition is fairly uniform no matter where it takes place, which means studies can more easily control for the technology and field of the event. These events take away the "home court advantage" phenomenon that is seen in many team sports.

In any economic study, the most common interest lies in finding how an individual can maximize utility or how a firm can maximize production, and the same general question exists in the economics of sports. The economic question in the arena of track and field searches to find how runners can minimize their running time subject to their constraints. To answer this question we must take into account many factors such as; number of competitors, value of winning, technology, etc. (Goff and Tollicon 1990). A seemingly simple question becomes quite difficult to answer since the factor inputs that are easily changed, such as buying a new pair of shoes, do not have the greatest impact on runner performance. Instead it is the training and physical preparation of the athlete that become indicative to success.

Athlete Training Programs

It is important to emphasize the different training needs of various athletic events. Although athletes may be categorized under the umbrella of track and field, the different events require different skills and thus different training needs. Field competitors may have an event that is focused on jumping, which often requires a stronger training regime on lower body strength. On the other side of field competitions, athletes compete in throwing events, which requires a larger focus on upper body strength. Even the running events have necessity for differentiating training. The short-distance track events require training for explosive bursts, whereas the long-distance track events require training for endurance and steady speeds (Raslanas 2011).

Track and Field events are most commonly individualistic endeavors and thus athletes must have a strong sense of intrinsic motivation. Success depends on the individual, there is no team to pick up slack and there is no team to motivate the need to win. There is a deeper need for mental training and preparation to evoke the competitor within. The training does not stop at physical fitness and preparedness but it continues with mental strength and motivating the desire to achieve greatness (Sharp 2013).

Productivity Theory

The economic theory of production is based on observing inputs to form outputs. This theory is vast and expands across many sub theories. The theory of changes to productivity when the labor force is given training or extra education will be the primary focus of this section. The most general hypothesis is that training will increase productivity, but the type of training must play a role in determining what kind of improvements can be expected.

Productivity is a large contributor to any study related to economic growth. The theory of productivity is related to that of production, but it does more to highlight the efficiency of production and not heavily focused on the direct inputs in a production function. Most measurements for productivity are based on models of producer behavior (Jorgenson, 1995). To measure the rate of growth of total factor productivity it is the difference between the rate of growth of real product and the rate of growth of real factor input. Rates of growth of real product and real factor product are defined as weighted averages of the rates of growth of individual products and factors, weights are relative shares of each product in the value of total output and of each factor in the value of total input. Changes in total factor productivity or shifts in given production function may be accompanied by movements along a production function. The standard interpretation of factor productivity is based upon economic theory of production (Jorgenson, 1967). This study is most specifically interested in how human capital investment can be expected to change, and hopefully improve, production.

Human Capital Investment

In several studies on workplace productivity, it was found that continuous worker training increases productivity while also providing other benefits. Training has been proven to be an important part of labor productivity, and continuous training has become even more necessary as technology in the work place is constantly evolving. Training can be seen as a complement to education. Most people would agree that the accumulation of knowledge is a life-long process, which is why training provides the essential education to keep any work place running smoothly.

The National Athletic Trainers' Association conducted a study in 2006 where they used athletic trainers to conduct a training program for occupational athletes. Occupational athletes are classified as people who work in manufacturing plants, industrial facilities, service industries, and offices. The National Athletic Trainers' Association gathered the information for their study through survey responses from employees at companies that underwent the training program. One hundred percent of the survey respondents reported a positive return on investment to the use of athletic trainers. Eighty-three percent of companies indicated the return on investment to be three dollars per employee for every one dollar they invested.

The increase in productivity was seen not just in return on investment but also in decreases in injuries. The majority of companies (ninety four percent) reported the severity of injuries to drop by at least twenty-five percent. Half of the companies conveyed the incidence of injuries to be cut in half. As the number and severity of injuries decreased, the amount of money spent on workers comp was also lessened. For many of the involved companies the cost of health care decreased by fifty percent due to the inclusion of physical therapy trainers on-site.

Bishop (1994) concludes that employer-provided training raises the subjective productivity measure by almost sixteen percent, which is the same percentage Bartel (1989) found as the increase in productivity from the returns to training investments. Both conducted their data collection through survey responses, but subscribed to different methods. Bishop uses a subjective measure where workers answered a survey question about how productive you felt during the work day. Bartel links data from a survey of human resources management practices in establishment level to firm levels to create a computed statistic on productivity and financial performance. Bartel published another study in 1992 that uses a longitudinal data study on manufacturing firms, where he found lagged training investments, rather than current training, generates positive effects on productivity.

Black and Lynch (1996) gathered data from the National Center on the Educational Quality of the Workforce National Employers' Survey, which presents findings pertaining to the impact of human capital investments on business productivity. It was found that higher productivity was related to a greater proportion of time spent in formal off-the-job training. Off-the-job training is more useful since on-the-job training has output loss and higher opportunity costs. The type of training programs provided for workers are much more significant than just whether workers have been trained or not. Black and Lynch also found that in nonmanufacturing establishments there is higher productivity in conjunction with higher standards of education reported in the hiring process. Black and Lynch (1998) follow this finding with another study that focuses on the importance of using training as a complement and not a substitute for investments in physical capital and education. They found an interesting relationship between the training received and the amount of prior education, where workers who were more educated had a much higher likelihood of receiving a greater amount of training. This can be seen as a result that more educated workers understand the value of continuous training and will continue to strive to become more efficient and productive members of the workforce.

O'Mahony (2012) provides a more in-depth look at the employees receiving training and the companies providing training. One of the primary findings is that the return to training is vastly different for males and females across professions. In some industries it is found that there is a larger increase in male productivity due to training, but in other industries it is found that female productivity benefits greater from training. This discrepancy can be explained by the inherent differences in strengths and weaknesses that often characterize men and women and may dictate their chosen job field. This also brings up the need to emphasize differentiation in work place training. The same training will not work for everyone, and continuing to use the same methods will not work as the workplace evolves.

The largest constraint for studies in this subject area has been the data limitations. Most studies about worker productivity changes from the use of training, including the studies mentioned thus far, are limited to survey responses. The use of surveys can introduce many biases to a study and therefore are not the most ideal form of gathering data, but unfortunately it is the most efficient way to collect the necessary data for a study conducted on worker productivity.

Capital accumulation involves depreciation rates, which includes the slow decrease in worker productivity overtime. In the United States, The average rate for the depreciation in workers' productivity is four percent (O'Mahony 2012). The use of work place training helps to decrease these depreciation rates for workers by providing continuous education. Supplemental training programs will allow a firm to more quickly and more efficiently maximize productivity. Due to the nonlinear relationship between training and productivity, training programs can only make large impacts up to a point where the productivity increase plateaus. This nonlinear relationship suggests the importance of choosing the most suitable training program and not getting caught up in over training workers where the costs become larger than the returns on human capital investments.

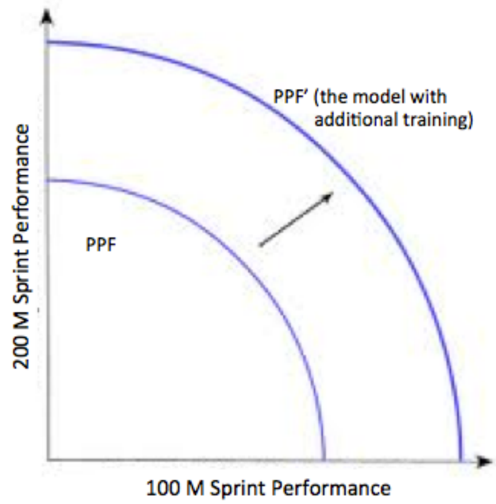
Workplace training is one of the many intangible investments made by a firm and there is a necessity for this investment in order to gain productivity when introducing new technology. Knowledge capital is important in driving the economy, and training serves to build this knowledge. Growth in the US economy is currently based largely on the expansion and application of technology and gaining knowledge about the technology (Corrado & Hulten, 2009).

CHAPTER 3

APPLIED PRODUCTION THEORY

The microeconomic theory of production will help to explain how training athletes has an expected positive effect on productivity. Theory of production often begins with a production possibilities frontier (PPF), which is a model that shows all of the possibilities for production with the available resources. The PPF will always model two outputs, so for now consider an athlete who runs in two separate events can only perform with a certain combination of outcomes in the two events (Olney 2009). It is possible to shift the production function to a new combination of outputs by introducing new resources, such as knowledge and capital. When an athlete receives training they are gaining knowledge and building new muscles, which increases the machinery inside of the human body. With increases in knowledge and capital the athlete's PPF shifts outward, allowing the athlete to achieve more desirable combinations of performance in each events. Figure 3.1 shows a graphical representation on the effects of training on the production possibilities frontier for an individual athlete.

Figure 3.1
The Production Possibilities Frontier with Training



The PPF shows how individuals, company's, or the economy as a whole can only select certain output combinations due to resource constraints at a given point in time. Thus, the accumulation of new resources becomes a key factor to increase production in any situation. It is important to recognize which resources can be utilized and improved to allow for the largest increases in production. For an athlete partaking in individualized competition, such as track and field, it is most important that the individual searches for solutions that will improve their own production above that of the competition. In track and field the technology is often changing, primarily with construction of better shoes and outerwear, but these advancements stand to benefit all of the competitors equally, whereas a training program singles out the individual for personalized improvement.

The interest lies more naturally in the individuals' performance in a single event, which cannot be observed in the PPF. In order to focus on an athlete's performance in a single event, we will use a simple production function to describe the interaction of the individual's resources and the output in performance. A production function does well to describe how a multitude of inputs can affect a specific output. In this case the output, usually denoted as *y,* is the athlete's performance in an event. The model considers several factor inputs that will play key roles in an athlete's performance. The inputs include: gender, age, year of the event, level of competition, and most importantly the training component. We can assume that most athletes will undergo training of some sort, but the production function will help to determine the effect of a particular program over others. The production function is a simple tool that describes the amount of output that can be produced for each vector of inputs (Jehle and Reny 2000). Equation 3.1 below represents the simplest version of the production function; where *y* is the output, x_i represents a different input (the subscript *i* demonstrates the different *x'*s), β_i are the coefficients that assign the interaction between each input to the output, and C represents the constant (which is just a representation for the level of output when all of the inputs are zero).

$$y = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + C \tag{3.1}$$

Each β_i plays a key role in the production function by determining the magnitude and direction of the relationship between the inputs and output. There are many computer programs such as STATA that can compute estimations of the β_is from a given set of data. The regressions for a production function are most often run with the Ordinary Least Squares method, which will estimate a linear regression model by minimizing the sum of squared errors. Consider a scatter graph where the *x's* are graphed against the output, *y,* and the general trend is not inherently obvious. Although this process can be done by hand, a computer program more easily will find the squared distances from each data point to a line. The linear regression is determined by finding the line where all of the squared distances are as small as possible.

Figure 3.2
OLS Regression Results

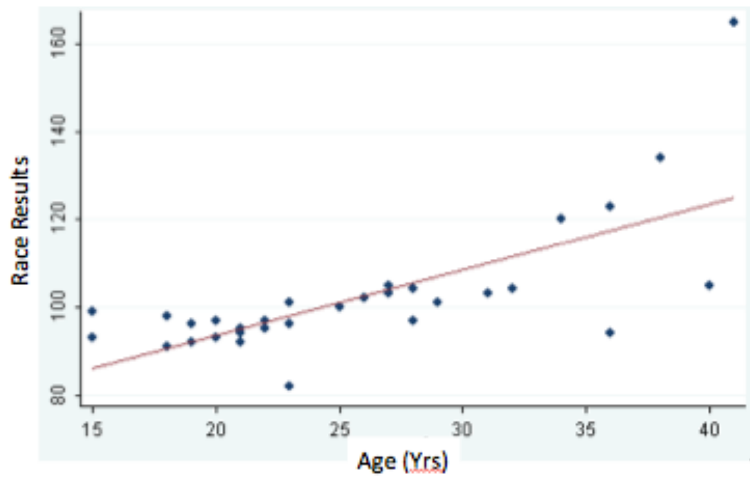


Figure 3.2 illustrates age as the input variable against the output, race performance, in a track event. The graph illustrates the individual points as the graph of the raw data and the line is the best-fit model determined by an Ordinary Least Squares Regression. Most datasets will include many more observations, but this shows a relative representation of how the best-fit line is situated in a place that has the least distance possible between the data points and the linear regression.

Occasionally, the OLS will not be able to find a satisfying fit for a linear regression and thus other methods are employed. A useful method when OLS fails is a two-stage least squares regression, which is most useful in models where the errors in the dependent variables are correlated with the independent variable. An OLS model assumes uncorrelated errors, which often explains a poor fit in a linear regression with OLS. Many production functions require two-stage regressions because the inputs often have some other interaction with the output. The two-stages will run an initial estimation that can create proxy measures to replace the correlated input, and then the final regression is run with that proxy and therefore returns a more reliable model to fit the data.

The production function has become a useful tool in determining the relationship amongst a particular output and the given inputs. There are many different forms of production functions along with many ways to model these production functions. Each function is different and depending on the goal there are different methods of analysis required to extract the most relevant information to a given study.

CHAPTER 4

DATA AND METHODOLOGY

Data

The data used for this study has been collected by the Olympic Training Center in Chula Vista, California. The data spans across Olympic Track and Field events for men and women's competitions. The race results used to estimate this regression are all gathered from national competitions. Competitors are not offered prizes or promotions by winning these competitions, and thus the motivation is entirely intrinsic and meant for a larger gain. Thus the motivation is a key unobservable variable in this dataset.

Dependent Variable

The dependent variable in this model is RelativeResultB, which is used as a measure of performance for the athletes. Given the final competition results for each event an athlete competed in, this final result is converted into a relative measure compared to the Bronze medal result in each year national competition or Olympics (if the event occurred on an Olympic year). This conversion allows for more general categories to run the models, rather than running each model by the individual event. The dependent variable expressed as a percentage comparison to the Bronze medal results gives a more uniform understanding of the times. The largest and most important difference to notice during analysis is the different measures in field events versus track events. Competitors in the field events are performing below Olympic bronze level if the number is below one hundred percent because due to the scoring larger numbers are better. Whereas, the track events are performing below the Olympic bronze level when they are above one hundred percent, because the scoring in this area dictates that a lower number is a better results.

Independent Variables

The independent variables are all of the observable variables that are thought to have a significant impact on athlete performance. There are two variables for expressing the age of the athletes in order to account for the nonlinear affects of age on performance, especially for athletes where they can only improve up to a point in their career.

The Res variable describes the program the athletes were enrolled in at the Olympic Training Center in Chula Vista. The residents are the athletes who live on the campus and receive not only athletic training but also access to many other professionals and training programs, such as mental training and health programs. Although many other athletes are known to visit the training center, they are not essential to this study since they do not receive all of the benefits associated with the training programs designed by the training center. The number of days each athlete took up residency at the Olympic Training Center is important to this study because different lengths of time receiving treatment at the training center is expected to effect performance in different ways. This time variable is presented in UserDays.

The FallEvent variable is significant in the determination of performance, because this variable gets as close to an observable measurement of athlete motivation as we can get in this study. Fall versus Spring events bring out different types of competitors and athletes are seen performing at different levels depending on the season. Athletes tend to show their peak performances close to and at the national competitions, which are held in the fall. Thus, this hopes to capture some explanation of athletic performance depending on motivation.

The FDaysOld and FFinalResult variables are meant to control for the level of athlete. The data provided by the Olympic Training Center includes data for athletes expanding across four different calibers of competition. These calibers are separated into Olympic, National, Developmental, and Junior Developmental. The FFinalResult and FDaysOld, hope to represent the caliber of the athlete during their first recorded competition. It is expected that athletes who begin competition younger would have higher recorded performances overtime.

The EventClass variable is used in this study to separate the track and field events into six categories. The first major distinction was made between male and female competitors, because the scores are not comparable between men's and women's events. In the 2012 Olympic Games the Men's 100M track bronze medal winner ran in 9.79 seconds, and the Women's 100M track bronze medal winner ran in 10.81 seconds. Although the times only differ by one second, that is huge in such a short running event. Consider the gold medal winner compared to the bronze medal winner; the Women's gold medal winner ran 100M in 10.75 seconds which is only six one hundredths of a second faster than the bronze medal winner, so it is clear that even hundredths of a second can make a huge difference in these events. Once the Gender differences were separated, we also divided the events based on whether competitors were scored on time results or points/distance results. In the case of track events athletes aim to run in the shortest time possible, whereas field events encourage athletes to aim for the greatest score possible. These measures must be separated in the data because in one case the lower the number, the better the result, and in the other case the higher the number the better the result. Next the data was split further to distinguish between short track events, where the results are more effected by times down to the hundredth of the second, and long track events where the results times are much more widely spread.

Table 4.1
Description of Included Variables

Variable Name	Variable Type	Definition
RelativeResultB	Dependent	The competitor results as relative percentage of the result of the bronze medal winner at the national or Olympic competition in that year, where 100 is the Bronze medal result.
Res	Independent	Dummy variable to describe whether the athlete was part of the residency program at the OTC or not.
UserDays	Independent	The number of days the given athlete has spent as a resident of the training center.
FallEvent	Independent	Dummy variable to indicate whether the track event was held during the fall or spring season.
EventYear	Independent	The year in which the event took place.
DaysOld	Independent	The age (in days) of the competitor at the time of the event.
DaysOld2	Independent	The age (in days) squared in order to account for the nonlinearity in competitors age.
FFinalResult	Independent	The first final race result recorded for a given competitor.
FDaysOld	Independent	The age of the athlete at the first event they were recorded to have competed.

This table provides a condensed overview of the variables used in this model.

Table 4.2
Statistical Overview of Model Variables

Variable	Men's Field Events	Women's Field Events	Men's Long Distance Track Events	Women's Long Distance Track Events	Men's Short Distance Track Events	Women's Short Distance Track Events
RelativeResultB	84.62	80.78	107.67	111	105.82	107.7
Res	0.01	0.01	0.004	0.002	0.002	0.01
UserDays	13.17	10.69	4.5	2.28	2.41	7.67
FallEvent	0.24	0.22	0.27	0.23	0.4	0.36
EventYear	2008.2	2008.15	2007.94	2008.07	2007.41	2007.85
DaysOld	8568.86	8332.88	8746	8635.52	8672.4	8396.02
DaysOld2	752.06	708.79	780.95	767.26	768.92	720.47
FFinalResult	324.53	228.07	901.57	1001.34	42.12	46.63
FDaysOld	7957.52	7766.56	8234.23	8131.34	8017.6	7768.7

Table 4.2 shows the variation in data by event. This table provides a general overview on how the variables differ between the models, and thus can create different effects in the models. A more detailed summary of the variable statistics can be found in Appendix A.

Methodology

We begin with a simple OLS regression, which estimates a linear regression model. This initial regression is used to determine whether the model is significant and shows that the independent variables included in the model are good determinants of athlete performance. This OLS model helped to determine which variables were important in the model and which variables could be dropped. Throughout this process we found that the significant independent variables in the model are those included in the description above. The OLS model found to have the best fit is as seen below (equation 3.1), where β_0 is the constant and the rest of the βs are coefficients to the variables that describe the independent variable relationship to the dependent variable.

$$RelativeResultB = \beta_0 + \beta_1 Res + \beta_2 UserDays + \beta_3 EventYear + \beta_4 FallEvent + \beta_5 DaysOld + \beta_6 DaysOld2 + \beta_7 FDaysOld + \beta_8 FFinalREsult \quad (4.1)$$

Once the OLS regression was in place and the variables included in the model were shown to have impact on competition results, it was taken into consideration whether this model could best describe the data. This data has a selection bias based on the athletes who attend the residency program at the Olympic Training Center, and those who do not, thus it is important to find a model that can account for this selection. This led to a trial with the Treatment Effects model, which was a better fit for the data but still not the best, which is how we arrived at the Endogenous Treatment Effects Model.

Endogenous Treatment Effects

We are primarily focused on the effects of the training program at the Olympic Training Center for the resident athletes. In order to account for this an endogenous treatment effects model was used for this study. An Endogenous Treatment Effects model is a linear regression with endogenous treatment effects. A treatment effects model accounts for the effects of receiving one type of treatment over another. Treatment effects are used with observational data, which is non-experimental data, such as the data in this study. The endogenous treatment effects model applies the treatment effects to a system while accounting for the endogeneity in the model. The use of endogenous treatment effects also takes away the assumption of conditional independence from the treatment.

An endogenous treatment effects model is used with linear outcomes and relies upon a normal distribution to model treatment assignments. One of the pitfalls to this model is that it can only apply to a binary treatment variable, so the subject will either receive the treatment or not. This model cannot account for a treatment where subjects are given one of three or more treatments. In the case of an athlete we know that all of the competing athletes must be attending a training program of some sort even if it is not at the Olympic Training Center, and some athletes are not residents of the OTC but do attend a portion of the training program that is offered there.

It was important that we use the endogenous treatment effects because the model can make an explicit connection between the unobservable variables that affect the treatment and the potential outcomes. In the case of human subjects, especially in athletics where the internal mental motivation plays a large role in performance, but this aspect of the model is unobservable and is likely to have a great affect on both the outcomes as well as how the treatment is interpreted (StataCorp LP, 2013).

Equation 3.2 below shows the regression model and equation 3.3 below is the treatment equation, which accounts for the residents of the Olympic Training Center receiving a different treatment than the other individuals in this model.

$$RelativeResultB = \beta_0 + \beta_1 UserDays + \beta_2 FallEvent + \beta_3 EventYear + \beta_4 DaysOld + \beta_5 DaysOld2 + \beta_6 FDaysOld + \beta_7 FFinalResult + \beta_8 Res \tag{4.2}$$

$$Res = \beta_0 + \beta_1 DaysOld + \beta_2 DaysOld2 + \beta_3 FDaysOld + \beta_4 FFinalResul \tag{4.3}$$

Expected Outcomes for the Model

The Men's and Women's long distance and short distance track events models have similar expectations for the interaction of variables. These similar expectations are primarily due to the fact that the track events aim to result in lower times, the degree of the difference in the times is the main difference in these models. The men's and women's field events are expected to have similar interactions with the variables, and the signs are expected to be opposite of those expected for track events. The reason for this is because getting a higher score in field events is more desirable and thus affects the interpretation of the data differently.

For the track events it is important to remember that a lower relative result is desired because it means the athlete is performing at a level above the Olympic bronze medal winner. The variables that are expected to have a negative correlation with the results variable in the track model are Res, UserDays, and FallEvent. It is expected that athletes who took up residency at the training center would have lower race times, thus if Res is equal to one then there should be a trend of lower scores. For a moment it was discussed that UserDays could have a nonlinear effect, where the number of days spent at the training center only make a difference up to a certain point. By looking at the summary statistics on the variable it is observable that no one uses the training center for such an extended period of time that it would not be expected to make an improvement, thus it is predicted that the more days an athlete uses the Olympic Training Center, the more they will benefit and thus the lower their running times will be. Runners are expected to perform at higher levels during the fall season and thus if the event takes place in the fall (FallEvent=1) then the race results are anticipated to be lower. The age of competitors (measure by DaysOld) is not expected to be linear and thus we have created a squared age variable (DaysOld2), which will help describe this relationship. The regular age variable, DaysOld, is expected to have a negative relationship with the results for the track events, because with more experience and age the athletes should show improvements. The squared age variable is expected to have a positive correlation with the track results because as athletes reach a certain age they are no longer improving and most likely will begin to worsen with the natural aging process of the human body. FFinalResult is expected to have a negative interaction with results, because as athletes compete in more events they should show improvement over time. FDaysOld could go either way. If athletes are first entered into the dataset at a really young or really old age, then they are expected to have worse scores, but the age group in the middle "ideal" age are expected to perform better and thus this variable will depend more on the age distribution for how it is expected to correlate with results.

The field events are largely expected to have the opposite relationship with variables. For the field events if the final result is greater than 100 than the athlete is performing above the Olympic bronze medal level, and this difference from the track event data is the sole reason the signage is anticipated to be opposite. Otherwise the explanations remain the same to the point that the sign is determined by whether the given variable is expected to improve or worsen the athletes' performance.

CHAPTER 5

RESULTS AND DISCUSSION

This section will elaborate on the findings from the regression model described in the previous chapter. The first portion displays a table containing the results of the linear regressions with the endogenous treatment effects, and a more detailed representation is available in Appendix C. The treatment model is presented in Appendix B, which shows the first level of determining how Res is interacting with the results model. The regression created with the analysis software STATA '13 shows the best fit of the relationship between the independent variables and the race results of the observed athletes. It is clear in table 5.1 that the model is a better fit for some of the observations than it is for others. In fact, the model was bad enough for the Women's Short Distance Track Events that a slightly adjusted model, two-stage model, was used for the regression.

Table 5.1
Linear Regression with Endogenous Treatment Effects

Variable	Men's Field Events	Women's Field Events	Men's Long Distance Track Events	Women's Long Distance Track Events	Men's Short Distance Track Events	Women's Short Distance Track Events
# Observations	6989	7135	4451	4411	8029	8422
UserDays	***0.01	***0.016	***-0.016	***-0.02	-0.004	***-0.01
FallEvent	***2.67	***3.92	***-1.5	***-2.75	***-1.66	***-2.7
EventYear	***-0.29	0.03	***0.09	***-0.06	0.027	***-0.11
DaysOld	***0.01	***0.01	***-0.003	***-0.003	***-0.003	***-0.004
DaysOld2	***-0.01	***-0.02	***0.013	***0.007	***0.01	***0.01
FFinalResult	***0.0002	***0.0003	***0.002	***0.002	***0.01	***0.004
FDaysOld	***-0.003	***-0.002	***0.001	***0.001	***0.001	***0.001
Res	***-13.65	***-14.58	**3.28	***6.02	***9.56	***17.75
Constant	***656.64	-5.55	**-69.25	***250.92	*60.99	***337
LR Test of Independent Equations						
Chi2(1)	89.87	59.01	1.1	6.05	108.49	1984.93
Prob>Chi2	0	0	0.29	0.01	0	0

The Chi2(1) statistic for Women's Short Distance Track Events is from a Wald test not the LR Test.
* >90% significance level, ** > 95% significance level, *** > 99% significance level

The Women's Short Distance Track Events model could not run the endogenous treatment effects model with maximum likelihood estimation, so the model was slightly adjusted with a two-stage regression. This model still shows the endogenous treatment effects, but runs in two-stages in order to avoid the error preventing the model from running with maximum likelihood estimation. Beyond this difference in how the regression is run, the analysis can be conducted the same way on all of the models.

The first important figure to note in this table is the LR Test of Independent Equations, which shows that the model is a good choice to most accurately represent the relationships within the model. For five of the six models the high chi-squared values and low p-values give certainty that this model is the best to represent the relationships within the variables. The Men's Long Distance Track Events regression shows that the model used is not as perfectly suited for these observations, but it is still adequate for the describing the relationships in the data. This just tells us that the treatment may not be as much of an important factor in the Men's Long Distance Track model. Several other models were explored in the course of this study, but they all proved to be worse fits for each model including the Men's Long Distance Track Events.

Table 5.1 includes the betas on each variable that describe the relationship of the results with each dependent variable for the separate models. It is clear from the chart that aside from a few, the variables are all highly significant to the model. The few variables that were not significant could not be excluded from the model because the model overall becomes a worse descriptor of the other relationships between variables. In order to take a closer look at these regression results refer to Appendix C. The expectations for the direction of the relationships within the model have been met for all of the variables, except for one, which happens to be the variable we are most interested in observing.

The Res variable was expected to have the opposite influence than seen on the results variable. This unexpected result can be attributed to the fact that the selection in this model was based upon whether or not the athlete has been a resident at the Olympic Training Center, which is held in the Res variable. The selection describes how the athletes in the residency program are systematically higher achieving than those who were not selected to attend the Olympic Training Center. The UserDays variable is interacting with Res in the model since the number of days an athlete spends in the training program is now controlling for the improvement of the athletes once they have been chosen for the program. The model shows that the relationship between event results and the selection of residents is very strong and significant for athletes in each event. Due to the interaction between UserDays and Res, the two variables must express opposite directions for the relationship, which is what causes the contradictory sign on the Res variable.

Figure 5.1
Res and RelativeResultB for Track Events

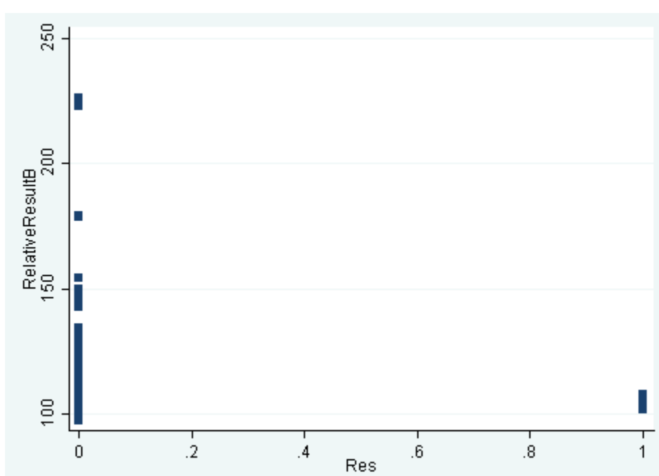


Figure 5.1 shows the general relationship between the Res variable and RelativeResultB, and it is clear that athletes in the Res program (Res=1) are generally better athletes and more closely scattered to the bronze medal level, whereas the athletes who are not in the Olympic Training Center residence program (Res=0) have many more scores that are farther from the bronze medal level. The graph shows the relationship for the track events, which means that the better results are closer to the 100 level. The clustering results were very similar for field events, but the residents were found at levels of 100 and higher, which shows improved results for those events since they are scored differently.

Figure 5.2
UserDays individual effect on RelativeResultB

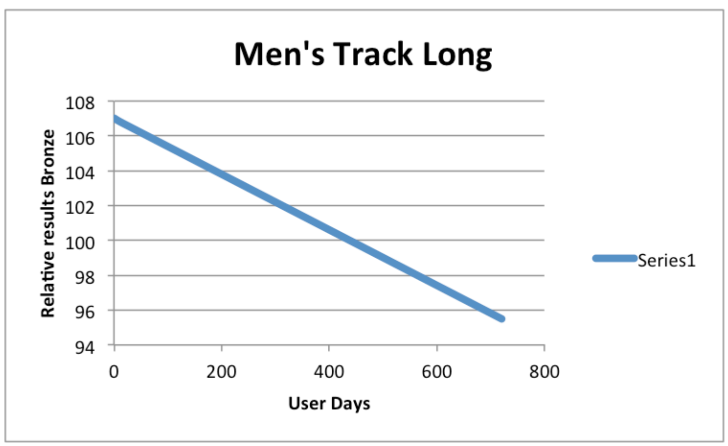


Figure 5.2 gives us a closer look at the relationship between UserDays and RelativeResultB. This examination points out the strong indication that more days spent in the residency program leads to better performance. The beta on UserDays shows the positive relationship between more days in the training program to higher performance, and the Res variable represents the strength of the relationship between the training program and performance. Figure 5.2 is just one example of the positive relationship in the model where a greater number of UserDays pays off in performance at or above the

bronze medal level. The relationship looks the same for each event model, but the slope is not as steep for the field events as it is for each of the track events, so it would seem that the field events require more time to perform at the bronze medal level.

By looking at all of the evidence and interactions, it is clear that the residency program enrolls and breeds a higher quality of track and field athletes. Now that the elite status of these athletes can be seen in these models, it is necessary to analyze the cost effectiveness to better determine if the athlete improvement is truly worth the costs. The Olympic Training Center is a large facility that costs money to maintain. The total expenses used in this analysis accounts for expenditure on GS&A, depreciation, repairs and maintenance, outside services, supplies, vehicles, insurance, utilities, taxes, and food/supplies for residents and staff. Unfortunately we were only able to collect this data for the years 2011-October 2013. In 2011 the expenditures were at the lowest, while the attendance of athletes at the Olympic Training Center in Chula Vista, California was at a high, which led to a cost of $117,385 per resident athlete. In 2012, the cost per resident athlete rose a significant amount to $193,216. In the final year of the data, 2013, the costs doubled from 2011 to $245, 734 for each resident athlete. These costs are all-inclusive since athletes do not pay any fees to attend the training center, but are chosen and offered the training program free of charge. It is important to note that other athletes do utilize the facilities at the Olympic Training Center, but the majority of costs goes towards maintaining the necessary resources for the residence program, and thus the cost is analyzed in respects to the athletes in the resident program at the training center.

Finding the expense per athlete helps to understand the magnitude of the costs poured into the Olympic Training Center, but in order to gain more insight on the benefits that result from those costs the analysis must be expanded. Table 5.2 is key for analyzing how much success athletes can expect. 2012 is the chosen sample year for observation in this analysis, and table 5.2 shows the initial level, prior to the OTC, for the median athlete, the athlete in the seventy-fifth percentile and the top group of athletes at the ninetieth percentile. These initial values show a starting point from which improvement can be analyzed.

Table 5.2
PreOTC Results for 2012

	Men's Field	Women's Field	Men's Long Distance	Women's Long Distance	Men's Short Distance	Women's Short Distance
50th %	89.73	90.1362	104.4	105.51	103.65	103.67
75th %	93.2	92.6	102.2	104.4	103	102.5
90th %	98.7	97.7	99.9	102.3	102.5	100.2

The UserDays variable best describes the athlete changes in performance after residency at the Chula Vista Olympic Training Center. The average number of UserDays for residents in the year 2012 multiplied by the beta on UserDays will give the average expected improvement in athlete performance for 2012. The results have been broken into three levels in order to better understand the level of athlete that benefits the most from the training program. By taking the event times from table 5.2 we can add the average effect of the training programs for athletes and determine how likely athletes are to compete at the bronze medal level after attending the training center. In table 5.3 the first section shows the average effects of the residency program on result times and the next two sections show the effects at both extremes of a ninety-five percent confidence interval for the effects.

Table 5.3
Average Effect on Performance of Residents at the OTC

	Men's Field	Women's Field	Men's Long Distance	Women's Long	Men's Short Distance	Women's Short
UserDays*Beta+PreOTC Results						
50th %	92.119898	93.5894624	100.946738	101.193422	102.786684	101.511711
75th %	95.358289	96.0532624	98.7467376	100.083422	102.136684	100.341711
90th %	101.089898	101.153262	96.4467376	97.983422	101.636684	98.041711
(UserDays*Beta+95% CI)+PreOTC Results						
50th %	92.4805235	94.3509099	101.877396	102.462501	104.098066	102.061645
75th %	95.9505235	96.8147099	99.6773957	101.352501	103.448066	100.891645
90th %	101.450524	101.91471	97.3773957	99.2525012	102.948066	98.5916453
(UserDays*Beta-95% CI)+PreOTC Results						
50th %	91.2960545	92.8280149	100.01608	99.9243428	101.475303	100.961777
75th %	94.7660545	95.2918149	97.8160795	98.8143428	100.825303	99.7917767
90th %	100.266054	100.391815	95.5160795	96.7143428	100.325303	97.4917767

By looking at the median level of athlete enrolled in the resident program and the average effect of the training program, none of the athletes are performing at or above the bronze medal standard in 2012. If we observe the ninetieth percentile of athletes, then most are performing above the bronze medal standard after attending the OTC. This shows that the training center does improve athlete performance, but the improvement is mostly significant for those that are already performing close to the bronze medal standard. At the high end of the spectrum, where athletes are in the higher percentiles and they are receiving the maximum effectiveness of the training program, the program is really paying off with more athletes bringing home medals. On average, athletes are expected to improve by 2.7 percent closer to the bronze medal time, or exceeding the bronze medal time. So if we consider the cost per athlete in 2012, $193,216, then each dollar spent on an athlete improves their performance by 0.00001 of a percentage closer to the bronze medal time. Due to the selection of athletes who are already performing at levels closer to the bronze medal time, this small percentage does make a difference, and since that percentage is averaged out amongst the events it is even larger for some events, but also a much smaller effect for other events.

Are millions of dollars a worthwhile investment for a couple of percentage point improvements toward medalling in a competition? This question is difficult to answer. From a purely economic view it would seem that the funding could be better invested elsewhere, and athletes could find less costly training with similar outcomes. This case is special since it applies to the Olympic Training Center, which boasts a tradition of athletic success and glory for the United States. Just looking at the numbers, the money invested in not receiving a worthwhile return on performance, but as a facility for athletic camaraderie the return to this expenditure is a lot more than just athletic performance.

CHAPTER 6

CONCLUSION

The Olympic tradition has given importance for each country to find and train the top-notch athletes to compete in the world arena. The United States has taken great pride in providing noteworthy competitors that encourage other countries to train with intentions of competing on the same level as the USA athletes. The Chula Vista Olympic Training Center plays a key role in shaping the track and field athletes to become top competitors in the world. As the competitive spirit lives within these athletes, they are also trained to become better than one another and be revered as the best in the nation at their particular event.

The Olympic Training Center in Chula Vista, California puts a large amount of resources into training track and field athletes. The training program not only conditions their physical ability to become champions, but trains athletes to have the mindset of a champion. The events held nationally do not provide monetary or other incentives for athletes to win competitions, but the intrinsic motivation and tedious training programs drive these athletes to perform their best and claim respect within the competitive community. The training program provided to residents of the Chula Vista Olympic Training Center pushes the athletes to excel. This study has proven that the investment of these resources has not gone to waste and the training center does breed a higher level of athleticism, but we are left to question whether the small increase in success is enough to continue investing resources into the training center. If the investment is not worth it, what might be a better allocation of this funding in order to continue inspiring the Olympic spirit within track and field athletes?

APPENDIX A

SUMMARY STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
Men's Field Events					
RelativeResultB	8491	84.62319	8.396107	37.49275	106.1913
Res	8491	0.0107172	0.1029739	0	1
UserDays	8491	13.16712	59.45072	0	456
FallEvent	8491	0.2402544	0.4272631	0	1
EventYear	8491	2008.203	3.475334	2001	2013
DaysOld	6989	8568.859	1334.425	6160	20109
DaysOld2	6989	752.0578	259.9111	379.456	4043.719
FFinalResult	8491	324.5334	1442.99	1.95	8275
FDaysOld	6989	7957.516	1033.304	6160	20109
Men's Long Distance Track Events					
RelativeResultB	5907	107.6734	4.236217	98.18752	179.3547
Res	5907	0.0044016	0.0662037	0	1
UserDays	5907	4.500931	26.42733	0	364
FallEvent	5907	0.2744202	0.4462594	0	1
EventYear	5907	2007.937	3.633207	2001	2013
DaysOld	4451	8746.997	1259.164	5066	18638
DaysOld2	4451	780.951	244.9512	256.6436	3473.75
FFinalResult	5907	901.566	820.2301	214.1	6579.5
FDaysOld	4451	8234.231	1076.791	5066	18638
Men's Short Distance Track Events					
RelativeResultB	9027	105.8233	5.105247	97.65861	226.497
Res	9027	0.0016617	0.0407321	0	1
UserDays	9027	2.414534	19.91251	0	364
FallEvent	9027	0.4003545	0.4899973	0	1
EventYear	9027	2007.41	3.688872	2001	2013
DaysOld	8029	8672.402	1296.917	6146	18566
DaysOld2	8029	768.9234	251.1949	377.7332	3446.964
FFinalResult	9027	42.10679	34.8418	9.9	131.4
FDaysOld	8029	8017.605	1059.706	6146	17838

Women's Field Events					
RelativeResultB	8505	80.78282	9.496727	45.82885	140.252
Res	8505	0.0091711	0.0953312	0	1
UserDays	8505	10.69442	53.73339	0	456
FallEvent	8505	0.2224574	0.4159212	0	1
EventYear	8505	2008.153	3.462188	2001	2013
DaysOld	7135	8332.877	1200.913	5416	15657
DaysOld2	7135	708.7884	224.1659	293.3306	2451.416
FFinalResult	8505	228.0715	1023.232	1.6	6177
FDaysOld	7135	7766.563	907.3179	5416	15657
Women's Long Distance Track Events					
RelativeResultB	5995	111.9884	5.578057	83.02457	141.6334
Res	5995	0.0023353	0.0482723	0	1
UserDays	5995	2.284737	17.57138	0	364
FallEvent	5995	0.2328607	0.4226895	0	1
EventYear	5995	2008.07	3.57846	2001	2013
DaysOld	4411	8635.521	1467.89	5065	18635
DaysOld2	4411	767.2644	294.0535	256.5423	3472.632
FFinalResult	5995	1001.344	865.8815	226.7	7622
FDaysOld	4411	8131.34	1232.406	5065	18569
Women's Short Distance Track Events					
RelativeResultB	8275	107.6951	5.495801	93.32724	298.4064
Res	8275	0.0084592	0.0915897	0	1
UserDays	8275	7.670937	42.93736	0	456
FallEvent	8275	0.3573414	0.4792455	0	1
EventYear	8275	2007.848	3.821781	1900	2013
DaysOld	7255	8396.026	1246.584	5418	16013
DaysOld2	7255	720.4701	232.8586	293.5472	2564.162
FFinalResult	8275	46.63507	40.47968	10.21	145.1
FDaysOld	7253	7768.706	993.1569	5418	16013

APPENDIX B

TREATMENT RESULTS

Res	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Men's Field Events						
DaysOld	0.002	0.0003	6	0	0.0013	0.003
DaysOld2	-0.007	0.0016	-4.68	0	-0.0108	-0.004
FFinalResult	0.00E+00	0.00003	0.11	0.909	0	0.0001
FDaysOld	-0.0003	0.00004	-7.82	0	-0.0004	-0.00025
_cons	-11.329	1.702	-6.65	0	-14.666	-7.99
Men's Long Distance Track Events						
DaysOld	0.002	0.0008	3.02	0.003	0.0008	0.004
DaysOld2	-0.011	0.0037	-2.99	0.003	-0.018	-0.004
FFinalResult	0.0003	0	7.11	0	0.00025	0.0004
FDaysOld	0.0002	0	1.78	0.075	0	0.0004
_cons	-18.26	4.42	-4.13	0	-26.93	-9.59
Men's Short Distance Track Events						
DaysOld	0.001	0.001	1.04	0.299	-0.001	0.0029
DaysOld2	-0.004	0.0048	-0.76	0.445	-0.013	0.0057
FFinalResult	0.002	0.0017	1.39	0.165	-0.001	0.0055
FDaysOld	-0.0002	0.0001	-3.26	0.001	-0.0003	-0.0001
_cons	-6.221	5.296	-1.17	0.24	-16.6	4.158
Women's Field Events						
DaysOld	0.0017	0.0004	4.39	0	0.0009	0.0025
DaysOld2	-0.005	0.0019	-2.84	0.005	-0.009	-0.0017
FFinalResult	-0.0002	0.0003	-0.51	0.61	-0.0008	0.0004
FDaysOld	-0.0005	0.0001	-8.97	0	-0.0006	-0.0003
_cons	-9.68	2.07	-4.67	0	-13.75	-5.624
Women's Long Distance Track Events						
DaysOld	0.009	0.0028	3.44	0.001	0.004	0.0154
DaysOld2	-0.039	0.0118	-3.34	0.001	-0.063	-0.0164
FFinalResult	0.0003	0.0001	4.35	0	0.00016	0.0004
FDaysOld	-0.0001	0	-0.85	0.394	-0.0004	0.0002
_cons	-61.27	17.24	-3.55	0	-95.07	-27.476
Women's Short Distance Track Events						
DaysOld	0.00217	0.0005	4.51	0	0.0012	0.003
DaysOld2	-0.008	0.0024	-3.6	0	-0.013	-0.004
FFinalResult	-0.0012	0.0007	-1.79	0.074	-0.0026	0.0001
FDaysOld	-0.0001	0	-2.12	0.034	-0.0002	0.00E+00
_cons	-14.12	2.55	-5.54	0	-19.12	-9.126

APPENDIX C

REGRESSION RESULTS

RelativeResultB	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Men's Field Events						
UserDays	0.01	0.0014	6.96	0	0.007	0.0125
FallEvent	2.67	0.2077	12.83	0	2.259	3.0729
EventYear	-0.29	0.0272	-10.71	0	-0.345	-0.238
DaysOld	0.01	0.0006	9.42	0	0.004	0.0063
DaysOld2	-0.01	0.0028	-3.42	0	-0.015	-0.004
FFinalResult	0.0002	0	3.49	0	0.0001	0.0003
FDaysOld	-0.003	0.0001	-19.51	0	-0.003	-0.003
Res	-13.65	0.7273	-18.76	0	-15.07	-12.22
Constant	656.64	55.215	11.89	0	548.41	764.86
Men's Long Distance Track Events						
UserDays	-0.0159	0.0022	-7.33	0	-0.0202	-0.012
FallEvent	-1.499	0.12	-12.49	0	-1.735	-1.264
EventYear	0.0936	0.0149	6.28	0	0.0644	0.1228
DaysOld	-0.0034	0.0003	-10.04	0	-0.004	-0.0027
DaysOld2	0.0129	0.0017	7.52	0	0.0095	0.0163
FFinalResult	0.0016	0.0001	24.84	0	0.0015	0.0017
FDaysOld	0.0008	0.0001	8.91	0	0.0006	0.001
Res	3.2846	1.3635	2.41	0	0.6121	5.957
Constant	-69.253	30.113	-2.3	0.02	-128.28	-10.23
Men's Short Distance Track Events						
RelativeResultB	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
UserDays	-0.004	0.0031	-1.36	0.2	-0.0101	0.0018
FallEvent	-1.658	0.1166	-14.22	0	-1.886	-1.429
EventYear	0.027	0.0166	1.64	0.1	-0.005	0.0596
DaysOld	-0.003	0.0003	-8.9	0	-0.0037	-0.0024
DaysOld2	0.01	0.0018	5.56	0	0.0064	0.0134
FFinalResult	0.011	0.0016	7.46	0	0.0086	0.0147
FDaysOld	0.001	0.0001	11.71	0	0.0009	0.0013
Res	9.555	1.04	9.19	0	7.517	11.594
Constant	60.98	33.703	1.81	0.07	-5.067	127.05

Women's Field Events						
RelativeResultB	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
UserDays	0.016	0.0018	9.18	0	0.0128	0.0198
FallEvent	3.915	0.229	17.13	0	3.467	4.363
EventYear	0.028	0.0298	0.95	0.3	-0.0302	0.0864
DaysOld	0.007	0.0008	9.59	0	0.0057	0.0087
DaysOld2	-0.0185	0.004	-4.61	0	-0.0264	-0.0106
FFinalResult	0.0003	0.0001	3.37	0	0.0001	0.00047
FDaysOld	-0.0022	0.0002	-12.42	0	-0.0025	-0.002
Res	-14.579	0.9704	-15.02	0	-16.48	-12.677
Constant	-5.551	60.35	-0.09	0.9	-123.83	112.73
Women's Long Distance Track Events						
RelativeResultB	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
UserDays	-0.0157	0.003	-4.69	0	-0.022	-0.0092
FallEvent	-2.752	0.166	-16.55	0	-3.078	-2.426
EventYear	-0.063	0.019	-3.25	0	-0.101	-0.025
DaysOld	-0.0028	0.0004	-7.62	0	-0.0035	-0.002
DaysOld2	0.0071	0.0018	3.92	0	0.0035	0.0106
FFinalResult	0.0019	0.0001	23.43	0	0.0017	0.002
FDaysOld	0.0005	0.0001	4.37	0	0.0003	0.0007
Res	6.024	1.667	3.61	0	2.7565	9.292
Constant	250.92	39.088	6.42	0	174.3	327.52
Women's Short Distance Track Events						
RelativeResultB	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
LongTerm	0.806	1.087	0.74	0.5	-1.326	2.937
UserDays	-0.005	0.0013	-4.01	0	-0.0078	-0.0027
FallEvent	-2.701	0.119	-22.6	0	-2.936	-2.467
EventYear	-0.105	0.0159	-6.65	0	-0.136	-0.0744
DaysOld	-0.0038	0.0004	-9.29	0	-0.0046	-0.0029
DaysOld2	0.0125	0.002	5.67	0	0.008	0.0168
FFinalResult	0.0039	0.0006	6.08	0	0.0026	0.005
FDaysOld	0.0007	0.0001	7.18	0	0.0005	0.0009
Res	17.745	2.4599	7.21	0	12.923	22.566
Constant	337	32.09	10.5	0	274.1	399.9

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