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Abstract

Using a panel of National Hockey League players from 2000 through 2010, we analyze the determinants of career length in the league. In our analysis, we include both performance variables and nationality of origin to determine their importance in determining career length. We find that European-born players have shorter careers than do North American-born players holding performance constant and Russian-born players have even shorter careers than other Europeans. We further explore if the empirical evidence of a shorter career is consistent with exit discrimination on the part of team owners or with foreign-born players voluntarily returning home to end their careers in European leagues.

JEL Classifications: Z22, L83

Keywords: National Hockey League, exit discrimination, professional sports, foreign workers

1. Introduction

As employers increasingly pursue talent, labor markets increasingly become more international. For instance, in the United States in the health care profession 27% of surgeons are foreign born while in the education profession 40% of engineering professors are foreign born. Aslanbeigui and Montecinos (1998) estimated that in the 1990s approximately 30% of US economics professors were foreign born. The internationalization of labor markets has led to many questions such as are foreign workers more productive because of self-selection on the part of immigrants (Borjas and Bratsberg, 1996) or less productive due to language and cultural differences than native born workers (Dustmann and Soest, 2002)? Do foreign born workers experience negative discrimination (Aslund, 2014)?

All sports leagues in pursuit of the most talented players have international labor markets. For instance in 2014, twenty percent of the players in the National Basketball League were foreign born, while twenty five percent of Major League Baseball were foreign born and in the National Hockey League fifty one percent of the players were born in Canada, twenty four percent born in the United States and twenty five percent born in Europe.

Sports leagues provide a fertile ground to further the research on immigration due to the increasing degree of internationalization of sports leagues. For instance, Kahane, Longley and Simmons (2013) find that NHL teams who employ higher proportion of Europeans perform better given the Europeans are from the same country than teams with less Europeans or Europeans from many different countries.

In sports leagues discrimination may arise if fans, managers, or other players prefer native-born players over immigrants. For instance, many European soccer leagues limit the number of foreign-born players on a team. In the Kontinental Hockey League, Russian teams are not allowed more than 5 foreign players. Although no U.S. league explicitly limits the number of foreign born players, teams may still discriminate against foreign players due to fan, player, or management preferences.

Exit discrimination is defined as the involuntary termination of employment due to a particular innate characteristic of the worker. For example, exit discrimination exists when a worker is terminated because of their race or country of birth even when they are as productive as other workers. We test for exit discrimination against foreign-born players in the National Hockey League (NHL) using a panel of players from 2000-2010 and focusing on whether there are systematic differences in career length between North American and European-born players of similar playing ability. We posit that the influx of European players in the NHL could lead to exit discrimination if the NHL chooses to retain native-born players over foreign-born players.

Exit discrimination has a long history in sports economics. Johnson and Marple (1973) pioneered this branch of discrimination research when they found evidence from 1970-71 NBA data that marginal white players had longer careers than marginal black players. Hoang and Rascher (1999) more formally developed a model to explore the concept of racially-based retention barriers in the NBA. They, too, found evidence that, performance being equal; there was exit discrimination in the NBA. Groothuis and Hill (2004) failed to confirm Hoang and Rascher's results using more recent data, adding height as an added explanatory variable, and using a duration model that allows for both stock and flow samples. Jiobu (1988) found evidence that race decreased career length, *ceteris paribus*, for black players but not Hispanics in Major League Baseball from 1971-1985. Again, Groothuis and Hill (2008) failed to find exit discrimination in MLB using more recent data from 1990-2004 and a model that better accounted for performance decay. Lastly, Ducking, Groothuis, and Hill (2013) find no exit discrimination in the NFL.

Discrimination in the NHL Against Foreign born players

In hockey most of the discrimination literature has focused on discrimination against French Canadians. For instance, both Grenier and Lavoie (1988) and Jones and Walsh (1988) find significant pay discrimination against French-Canadian defensemen using 1977-78 data. In addition Lavoie (1989) finds evidence of positional stacking involving minority (French-Canadian) hockey players. Mongeon and Longley (2015) find referees in hockey exhibit discrimination with French Canadian referees showing a bias by calling more penalties against English Canadian players then against French Canadian Players, *ceteris paribus*. Lastly Christie and Lavoie (2015) find that there is entry discrimination against European players and particularly Russian players. They further suggest a bias against hiring players from the KHL. Overall we know of no studies that have examined exit discrimination of foreign born players in sports.

2. Theory

The textbook definition of discrimination in the labor market implies that certain individuals or groups of workers are treated differently than others unrelated to ability or performance. As discussed above, labor economists have explored a variety of formats for this differential treatment. Exit discrimination may represent the most recent path of research in the field. Hoang and Rascher (1999) define exit discrimination as “the involuntary dismissal of workers based on the preferences of employers, coworkers, or customers.” Research on this topic assumes that all turnover is involuntary; Kahn (1991, p. 406) argues that the high salaries paid in sports make voluntary quits unlikely. Thus, these studies are essentially survival models. If domestic players have longer careers than foreign players with similar performance statistics then exit discrimination is said to exist[1].

Jiobu (1988) and Hoang and Rascher (1999) apply exit discrimination to race and conclude that career length for black players in Major League Baseball and the NBA, respectively, were lower than their white counterparts, *ceteris paribus*. While Jiobu does not make any calculations on the impact of exit discrimination on career earnings, Hoang and Rascher (1999) conclude that this form of discrimination led to almost a two and a half times greater decrease in black career pay compared to the more commonly analyzed pay discrimination.

The motivation behind this form of discrimination could obviously come from personal prejudice on the part of owners/coaches or fans. Hoang and Rascher (1999) focused on customers as the possible source of the prejudice; the pay premium for white players was explained by the higher value of their performances compared to black players because of the prejudiced preferences of white, majority fans. Hoang and Rascher (1999, p.74) hypothesized:

"To satisfy the fans, there is a minimum number of white players on a team. The second assumption, that the pool of quality available talent is becoming increasingly black, causes annual replacement of players with rookies to occur mostly among black players. The white players have longer careers simply because there are fewer qualified white rookies to replace them,…"

In his study of exit discrimination in Major League Baseball, Jiobu (1988, p.532) does not specifically test for customer discrimination but he does state:

"Perhaps, motivated by the concern that white fans will not support a predominantly black team, management has silently placed an "invisible ceiling" on the black percentage. When coupled with the desire to have a winning team, this ceiling would generate strong pressures to (a) employ as many black players as possible in order to capitalize on their performance, but (b)

[1] In the present case some of the exit might be employee initiated particularly if outside opportunities exist such as playing in the Russian KHL.

in order to remain under the ceiling, to eliminate black players as soon as their performance declined, and (c) to retain white players of declining but similar ability."

Given the large influx of foreign born athletes in the NHL today, the two arguments advanced above could easily be applied to hockey. Our current research attempts to address this gap in the sports economics literature on discrimination against foreign born players by using a semi-parametric hazard model to test for differential survival patterns between North American born and foreign born professional hockey players in the NHL.

3. Non-parametric Analysis of Career Duration

We use a panel describing all players in the NHL from 2000 to 2010. To help understand career duration in the NHL, we calculate yearly hazard functions as:

(1) $$h_t = d_t / n_t ,$$

where d_t is the number of players who end their career in year *t* and n_t is the number of players at risk of ending their career in year *t*. The hazard rate can be interpreted as the percentage of players who exited the NHL given they have survived up to some level of tenure. In Table 1, we report the hazard rate for Non-Russian European-born NHL players, for Russian-born players, and for North American-players who were either born in Canada in the United States. We also report the longest career for each group.

In Figure 1 we plot the hazard functions for each group of players. We find that for both Non-Russian European-born and Russian-born players the hazard rate is higher for the first eleven years of tenure than for North American-born players. Not surprisingly, we find that the North American born, the Russian born, and the non-Russian European born hazard rates increase over time. The increase suggests that the wear and tear from playing hockey as player's age increases the likelihood of exit. Interpreting the differences in hazard rates as discrimination, however, is potentially misleading because there is no control for productivity differences across players. In the next section we analyze career duration using semi-parametric techniques to control for differences in productivity.

4. Semi-parametric Analysis of Career Duration

Methodology

We estimate semi-parametric hazard functions following Berger and Black (1998) Groothuis and Hill (2004) and Berger, Black and Scott (2004). Because the data are reported at the season level we calculate the hazard rate as a discrete random variable. As with Berger, Black and Scott (2004), we model the durations of a single spell and assume a homogeneous environment so that the length of a particular spell is uncorrelated with the calendar time at which the spell begins. This assumption lets us treat all the players' tenure as the same regardless of when it occurred in the panel study. For instance, all fourth-year players are considered to have the same base line hazard regardless of calendar time, so a fourth-year player in 2000 has the same baseline hazard as a fourth-year player in 2009.

To understand how stock data influence a likelihood function we follow the notation of Berger, Black, and Scott (2004). Suppose the probability mass function (pmf) of durations is defined as $f(t,x,\beta)$, where t is the duration of the career, x is a vector of performance and personal characteristics, and β is a vector of parameters. Denote F(t,x,β) as the cumulative distribution function; the probability that a career lasts at least t° years is then 1 - F(t°,x,β). Defining the hazard function as h(t,x,β) ≡ f(t,x,β) / S(t,x,β) and applying the definition of conditional probabilities, the pmf can be expressed as

$$f(t_i,x_i,\beta)=\prod_{j=0}^{t_i-1}[1-h(j,x_i,\beta)]h(t_i,x_i,\beta). \quad (2)$$

If we have a sample of n observations, {t1, t2, . . ., tn}, the likelihood function of the sample is

(3) $$L(\beta)=\prod_{i=1}^{n} f\,(t_i,x_i,\beta)=\prod_{i=1}^{n}\left(\prod_{j=1}^{t_i-1}[1-h(j,x_i,\beta)]h(t_i,x_i,\beta)\right).$$

Often it is not possible to observe all careers until they end, hence careers are often right-censored. Let the set A be all observations where careers are completed during the sample period and the set B be all observations where careers are right censored. For the set B, all we know is that the actual length of the career is greater than t_i, the observed length of the career up through the last year. Because we know that the actual length of the career is longer than we observe then the contribution of these observations to the likelihood function is just the survivor function,

$$S(t,x,\beta)=\prod_{i=1}^{t-1}[1-h(i,x,\beta)].$$

To introduce stock sampling, let the set C be the careers that were in progress when data collection began. For these observations, we know that the career for player *i* has lasted for *r* years before the panel begins so the likelihood must be adjusted by the conditional probability of the career having length *r*. Of course, some stock-sampled observations may be right-hand censored. Let the set D be all observations that are both right and left censored. An example of a career that is both right and left censored would be a player who starts his career prior to 2000 and ends his career after 2010. Taking into account all four sets: A, B, C, and D the likelihood function becomes

$$L(\beta)=\prod_{i\in A}\left(\prod_{j=1}^{t_i-1}[1-h(j,x_i,\beta)]h(t_i,x_i,\beta)\right)\times\prod_{i\in B}\left(\prod_{j=1}^{t_i-1}[1-h(j,x_i,\beta)]\right)$$
(4)
$$\times\prod_{i\in C}\left(\prod_{j=r_i}^{t_i-1}[1-h(j,x_i,\beta)]\right)h(t_i,x_i,\beta)\times\prod_{i\in D}\left(\prod_{j=r_i}^{t_i-1}[1-h(j,x_i,\beta)]\right)$$

In equation (4), the contribution of censored, stock-sampled observations to the likelihood function is strictly from the last two terms; such observations simply provide information about the survivor function between (r,t).

Thus we, as Berger, Black and Scott (2004), have expressed the likelihood function as a function of the hazard functions. All that remains is to specify the form of a hazard function and estimate by means of maximum likelihood estimation. As the hazard function is the conditional probability of exiting the NHL given that the NHL career lasted until the previous season, the hazard function must have a range from zero to one. In principle, any mapping with a range from zero to one will work. Cox (1972) recommends

(5)
$$\frac{h(t,x,\beta)}{1-h(t,x,\beta)}=\frac{h_t}{1-h_t}e^{x\beta}=\exp(\gamma_t+x\beta),$$

which is simply the logit model with intercepts that differ by time periods. The term h_t is a baseline hazard function, which is common to all observations. The $x\beta$ term, determined by the player's personal and productivity characteristics, shifts the baseline hazard function, but it affects the baseline hazard function in exactly the same way in each period. Berger and Black (1999) consider other hazard functions and find that their results are relatively robust across various specifications of the hazard function. As the logit model is available in many software packages, we follow Cox and use the logit model.

The intuition behind equation (5), when using the logit model for the hazard function, is relatively simple. For each year during the survey in which the player is in the NHL, the player either comes back for another season or ends his career. If the career ends, the dependent variable takes on a value of one; otherwise, the dependent variable is zero. The player remains in the panel until the player exits the NHL or the panel ends. If the panel ends, we say the worker's spell is right censored. Thus a player who begins his NHL career during the panel and plays for 6 years will enter the data set 6 times: the value of his dependent variable will be zero for the first 5 years (tenure one through five) and be equal to one for the sixth year.

To illustrate a stock observation, consider another player who enters the panel with 7 years of NHL job tenure prior to 2000 the first year of the panel, then plays for an additional 3 years for a 10 year career. For this player, we ignore his first 7 years of tenure because he is left censored. As the equation of the likelihood function with stock data indicates, the duration of a NHL career prior to the beginning of the panel makes no contribution to the value of the likelihood function. Therefore only years 8 through 10 will enter the data set with the dependent variable taking on the value zero for year 8 and 9 and in the 10^{th} year it takes on a value of one, this player appears in the data set a total of 3 times. Note for all players who are right censored, we do not know when their career ends so their dependent variables are always coded as zero.

Because the players in the panel have varying degrees of job tenure prior to the beginning of the panel, we identify the hazard function for both long and short careers. The disadvantage to this approach is that the vector γ_t of equation (10) can be very large. In our study it would require 25 dummy variables. We also run into problems with the Cox technique because we have too few players who have long careers. To simplify the computation of the likelihood function and to be able to keep the long careers, we approximate the γ_t vector with a 5^{th} order polynomial of player's tenure, which reduces the number of parameters to be estimated from 25 to 5. Thus, the hazard function becomes

(6) $$\frac{h(t,x,\beta)}{1-h(t,x,\beta)} = \Phi(t)\, e^{x\beta} = \exp(\phi(t) + x\beta),$$

where $\phi(t)$ is a 5^{th} order polynomial in the worker's tenure. We choose the Taylor series approximation technique over using tenure dummies due to the small number of observations for high tenures. This method provides a very flexible specification of the baseline hazard, but does impose more restrictions than Cox's model.[2]

Results

In Table 3, we report the results of estimating equation 6. Performance increases career length (or decreases the likelihood of exit) with the coefficients on games played, goals, assists, penalty minutes, and plus minus[3] all being negative and statistically significant. In addition we find that the coefficient on age is positive and significant suggesting that older players are more likely to exit than younger players. We also find that the coefficient on the year the player played is positive and statistically significant suggesting that current players are more likely to exit than past players. This result might be due to the influx of foreign players into the NHL and the increase in the talent pool. We find that neither height nor weight influences the likelihood of exiting a career in hockey.

We also find that country of origin matters. Using North American born players as the baseline, both Russian-born and Non-Russian European-born hockey players have shorter careers, that is, a higher probability of exit, *ceteris paribus*. Our results are consistent with exit

[2] When higher order polynomials of the sixth and seventh power are included the results do not change, suggesting that a fifth order polynomial is flexible enough to capture the influence of the base line hazard.

[3] The "plus-minus" statistic is calculated as a points differential. When an even-strength or shorthanded goal is scored, every player on the ice for the scoring team is credited with a "plus." Every player on the ice for the team scored against gets a "minus." A player's overall plus-minus is calculated by subtracting the minuses from the pluses. A high plus-minus is taken to mean the player is a good offensive or defensive player.

discrimination if foreign-born hockey players have shorter careers because of either fan preference for North American-born players, or employee discrimination that might arise with possible language or cultural differences (see Kahane, 2013). However, the evidence is also consistent with European-born players exiting to return home to play in either the KHL or other European professional hockey league.

To get a feel for the magnitude of exit likelihood, we convert the coefficients into a percentage change by using 100(exp(β)-1) for each dummy variable. We find that a non-Russian European-born player have a 167% higher likelihood of exiting than a North American-born player, holding performance constant, while Russian-born players have a 423% higher likelihood of exiting their career than a North American-born player, holding performance constant. Our results suggest that although there has been a large influx of foreign players from Europe, exit discrimination or other reasons limits the proportion of players in the NHL from Europe to a smaller percentage than performance would suggest.

Nonlinear Decompositions

To further explore the effect of being foreign born on exit in the NHL we use the Blinder-Oaxaca nonlinear decomposition technique (Sinning, Hahn and Bauer 2008). Like the linear Blinder (1973) and Oaxaca (1973) method the nonlinear method decomposes the difference between groups into differences due individual characteristics and differences due to coefficients. In the linear case the decomposition is:

(7) $$\bar{Y}_A - \bar{Y}_B = (X_A - X_B)\beta^* + X_A(\beta_A - \beta^*) + X_B(\beta_B - \beta^*),$$

where $\bar{Y}_A - \bar{Y}_B$ is the total difference between groups, $(X_A - X_B)\beta^*$ is the difference due to characteristics, $X_A(\beta_A - \beta^*)$ is the advantage being in group A, $X_B(\beta_B - \beta^*)$ is the disadvantage in being in group B and β^* a weighted average of the coefficient vectors β_A- and β_B. In the simple

Blinder and Oaxaca (1973) decomposition method, the β^* is either set to β_A or to β_B. The other two methods to determine β^* are the Cotton (1988) and the Neumark (1988) method where Cotton uses a weighted average technique and Neumark (1988) uses a pooled model to derive β^* (Sinning, Hahn and Bauer 2008). The non-linear technique follows the same pattern decomposing the logit equations into the percentage determined by characteristics in our case performance and the percentage determined by differences in coefficients.

In our case, we estimate separate logit models for North American born players, for non-Russian European born players, and for Russian born players. We then perform two sets of decompositions, one for North American born players compared to non-Russian European born players and one for North American born players compared to Russian born players. We report the results in Tables 4A and 4B.

In Table 4A we report the results of the non-linear decompositions between North American born and non-Russian European born using the simple Blinder and Oaxaca technique, the Cotton technique and the Neumark technique. We find that the raw difference is .0263. We convert the coefficients into a percentage change of the raw difference by using 100(exp(β)-1) and find that non-Russian European players have a 38% higher likelihood of exit than North American born players on average. Using the decomposition we find that differences in productivity, however, lowers the likelihood of exit. The effect ranges from -163% to -106 percent depending upon what decomposition technique is performed. These results suggest that if only productivity determined career length Europeans should have a 40% to 62% lower probability of exit and longer careers than North Americans. But when focusing on differences in coefficients we find that this difference counts from 206% to 263% of the differential showing that on average non-Russian born Europeans are more likely to exit than North American born players. .

In Table 4B we report the results of the non-linear decompositions between North American born and Russian born using the simple Blinder and Oaxaca technique, the Cotton technique and the Neumark technique. We find that the raw difference is .0769. We convert the coefficients into a percentage change of the raw difference by using 100(exp(β)-1) and find that non-Russian European players have a 40% higher likelihood of exit than North American born players on average. Using the decomposition we find that differences in productivity, however, lowers the likelihood of exit. The effect ranges from -143% to -31% percent depending upon what decomposition technique is performed. These results suggest that if only productivity determined career length Russian should have a 12% to 57% lower probability of exit and longer careers than North Americans. But when focusing on differences in coefficients we find that this difference counts from 131% to 243% of the differential showing that on average Russian born players are more likely to exit than North American born players. .

Our decomposition results further suggest that although there has been a large influx of foreign players from Europe, exit discrimination or some other reasons shortens careers and thus the proportion of players in the NHL from Europe is a smaller percentage than performance would suggest. In addition, the decompositions show that European players should have longer careers than North American-born players if only performance determined career length. Either exit discrimination or other factors must determine why Europeans players have a higher likelihood of exit. One potential explanation is if Europeans return home to end their careers in professional leagues.

Post NHL Lockout influence on Exit Probability.

The 2004-2005 NHL season was cancelled because of a lockout against the players. The lost season provided an opportunity for many players, especially European-born players, to seek employment in other hockey leagues around the world. After the end of the lockout, brought about by a collective bargaining agreement which dramatically altered the market price for hockey talents by introducing an individual and team salary cap, reducing the average salaries to year-2000 levels, and introducing greater minimum wages (see Depken and Lureman, 2014, for further analysis of how the market for hockey talents changed after the lockout).

These changes in the market for NHL talents might have provided European-born players a greater incentive to leave the NHL early to play in European leagues that might be more competitive in salaries. This appears to have been the case with the KHL which started paying higher salaries starting in 2008 and thereby recruiting heavily from NHL players.

To test for changes in exit patterns after the collective bargaining agreement, we interact the dummy variables describing country of birth with a dummy variable that takes a value of one after the lockout ended and zero otherwise. The results including these interactions are reported in Table 6. To better interpret the magnitude of the likelihood of exit in both the pre- and post-lockout period, we convert the coefficients into a percentage by using $100(\exp(\beta)-1)$ for each country-of-origin dummy variable and post-lockout interaction. We find that a non-Russian European-born player had a 126% higher likelihood of exiting in a given year than a North American born players prior to the lockout, holding performance constant. After the lockout this likelihood increased additional 21 percentage points higher after the lockout although the post-lockout effect is statistically insignificant. Russian-born players have a 237% higher likelihood of exiting their career than North American-born players prior to the lockout and this likelihood increases by an additional 147 percentage points after the lockout for a total 384% higher likelihood of exit than North American-born players.

Conclusion

We find that European-born hockey players have shorter careers than their performance statistics would suggest. In particular, Russian-born hockey players have the highest likelihood of exit and this likelihood increased dramatically after the end of the 2004-2005 lockout in the NHL which also corresponded to increased salaries in the Russian Kontinental Hockey League. Our statistical evidence is consistent with exit discrimination but it is not possible to identify whether such discrimination is customer-based, player based, or owner-based. On the other hand, our evidence is also consistent with players leaving early to play in other leagues in Europe and there is anecdotal evidence that many players choose to retire from the NHL early so to wind down their careers in leagues with shorter seasons, fewer injuries, although with lower salaries.

Table 1: Hazard Rates

Tenure	North American Born	Non-Russian European Born	Rusian Born
1	.012 n=244	.103 n=116	.041 n=24
2	.014 n=363	.088 n=137	.035 n=28
3	.036 n=416	.083 n=157	.100 n=20
4	.027 n=415	.082 n=146	.074 n=27
5	.049 n=390	.090 n=132	.185 n=27
6	.040 n=349	.031 n=128	.142 n=21
7	.050 n=299	.159 n=113	.285 n=28
8	.085 n=318	.150 n=113	.125 n=24
9	.060 n=267	.119 n=101	.129 n=29
10	.089 n=245	.084 n=83	.176 n=34
11	.092 n=228	.131 n=84	.320 n=25
12	.140 n=200	.111 n=63	.063 n=16
13	.169 n=190	.094 n=53	.000 n=11
14	.164 n=146	.104 n=48	.417 n=12
15	.218 n=128	.294 n=34	.300 n=10
16	.191 n=110	.178 n=28	.000 n=5
17	.345 n=84	.500 n=20	.333 n=6
18	.307 n=65	.083 n=12	.000 n=3
19	.304 n=46	.333 n=9	1.00 n=3
20	.265 n=34	.667 n=3	
Longest Career	26 years	21 years	19 years

Figure 1: Hazard Rates for Career Ending vs. Tenure

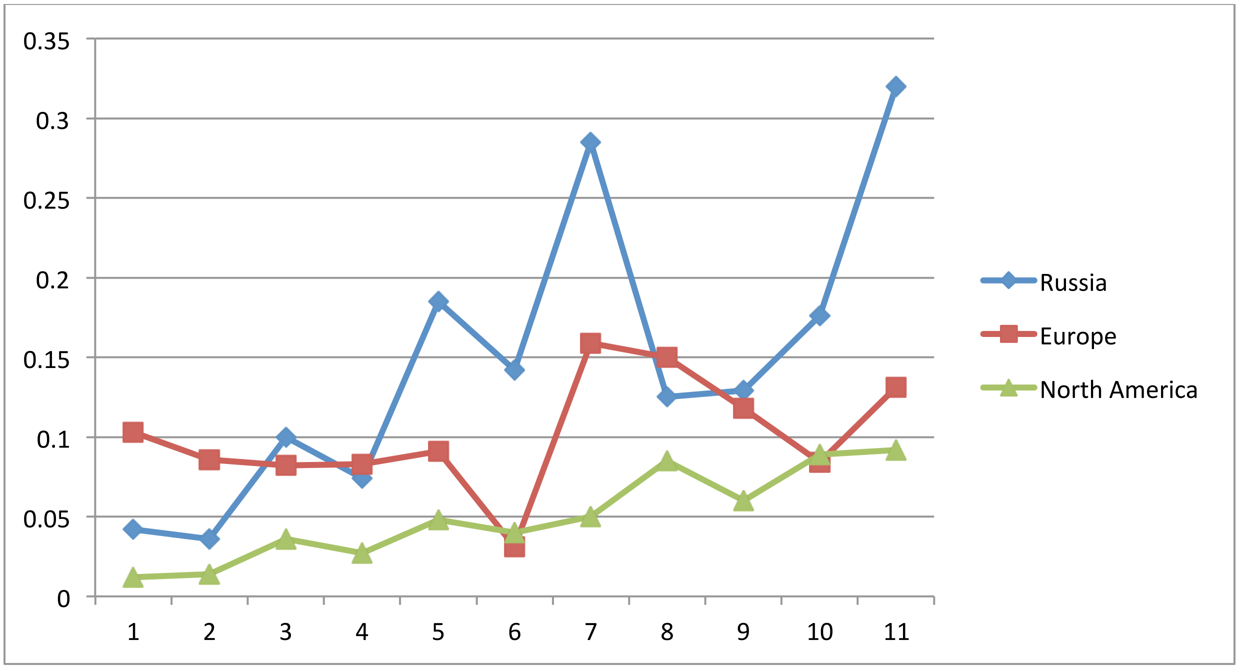

Table 2: Descriptive Statistics of the Sample

Variable	Mean (standard deviation)	Minimum Maximum
Games played	64.39 (18.03)	1 85
Assists	17.46 (13.36)	0 96
Goals	10.20 (9.53)	0 65
Penalty Minutes	49.99 (37.76)	0 354
Plus Minus	-.088 (10.93)	-46 52
Weight (Pounds)	202.23 (16.91)	125 265
Height (Inches)	73.01 (2.16)	64 81
Age (Years)	27.67 (4.59)	18 46
Year	2005 (3.29)	2000 2010
European born (1=Yes)	.26 (.44)	0 1
Russian born (1=Yes)	.05 (.21)	0 1
Post Lockout (1=Yes)	.69 (.46)	0 1
Post Lockout (1=Yes) * European Born	.18 (.38)	0 1
Post Lockout (1=Yes) * Russian Born	.02 (.18)	0 1

N=6,480

Table 3: Determinants of Exit Logit Model

Variable	Coefficient (standard error)
One	-67.689** (29.55)
Games played	-.016*** (.003)
Assists	-.097*** (.011)
Goals	-.034*** (.012)
Penalty Minutes	-.010*** (.002)
Plus Minus	-.035*** (.006)
Weight	-.007 (.005)
Height	-.009 (.034)
Age	.186*** (.026)
Year	.032** (.014)
European born	.983*** (.121)
Russian born	1.655*** (.197)
Pseudo R^2	.319

N=6,478 *10 percent level **5 percent level ***1 percent level

Table 4A: Nonlinear Decompositions of Exit Logits: European Born

Omega =1	Coefficient	Standard Error[1]	Percentage
Characteristics	-.0429***	.0079	-163%
Coefficients	.0693***	.0120	263%
Omega =0			
Characteristics	-.0294***	.0037	-112%
Coefficients	.0558***	.0078	212%
Cotton Technique			
Productivity	-.0402***	.0061	-153%
Advantage	.0200***	.0031	76%
Disadvantage	.0466***	.0078	177%
Neumark Technique			
Productivity	-.0279***	.0039	-106%
Advantage	.0403***	.0056	153%
Disadvantage	.0139***	.0019	53%
Raw Difference	.0263	.0088	100%

Number of Observations in European Born Group 1572
Number of Observations in North American Born Group 4558
[1]Standard Errors calculate by 50 Bootstrap Replications using STATA

Table 4B: Nonlinear Decompositions of Exit Logits: Russian Born

Omega =1	Coefficient	Standard Error[1]	Percentage
Characteristics	-.1099***	.0340	-143%
Coefficients	.1869***	.0354	243%
Omega =0			
Characteristics	-.0248***	.0085	-32%
Coefficients	.1017***	.0184	132%
Cotton Technique			
Productivity	-.1018***	.0318	-132%
Advantage	.0124***	.0025	16%
Disadvantage	.1662***	.0329	116%
Neumark Technique			
Productivity	-.0242***	.0080	-31%
Advantage	.0939***	.0161	122%
Disadvantage	.0072***	.0072	9%
Raw Difference	.0769	.0189	100%

Number of Observations in European Born Group 348
Number of Observations in North American Born Group 4558
[1]Standard Errors calculated by 50 Bootstrap Replications

Table 5: Determinants of Exit with Lockout Effects

Variable	Coefficient (standard error)
One	-70.159** (29.55)
Games played	-.017*** (.003)
Assists	-.097*** (.011)
Goals	-.034*** (.013)
Penalty Minutes	-.009*** (.002)
Plus Minus	-.035*** (.006)
Weight	-.007 (.005)
Height	-.010 (.036)
Age	.190*** (.026)
Year	.033 (.033)
European born	.857*** (.197)
Russian born	1.214*** (.279)
Post Lockout \	-.131 (.214)
Post Lockout * European Born	.191 (.237)
Post Lockout * Russian Born	.904** (.384)
Pseudo R^2	.3187

N=6,478 *10 percent level **5 percent level ***1 percent level

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