The Effect of Short Run Workload on Goalie Performance: An Application of Labour Economics and Econometrics

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1 Introduction

1.1 Abstract

1.2 Context

In labour economics, one of the most fundamental comparative statics examined is how changes in labour input affect productivity. As input increases, holding other factors constant, output is expected to increase as well, however not proportionally. Economic theory suggests this notion of diminishing marginal returns, such that the marginal return on output, of additional units of labour, declines as workload intensity increases. However, when workload affects worker effectiveness, through fatigue or other inefficiencies, the overall relationship becomes theoretically ambiguous. Depending on how these influences balance, the marginal effect may be positive, zero, or negative. This ambiguity motivates an empirical examination of the short-run effect of workload on productivity.

1.3 Guiding Research Questions

Does short-run workload affect goalie performance within a season? When a goalie plays more in the short run, does their performance change?

1.4 Comparative Statics

2 Literature Review

3 Data

3.1 NHL Goalie Panel Data

Datasets

```
library(readxl)
library(dplyr)
summary <- read_excel("Summary.xlsx", sheet= 1)
summary <- summary %>% select(Player, `Game Date`, GS, GAA, Team, SA, `Sv%`)
days_rest <- read_excel("Days Rest.xlsx", sheet= 1)
days_rest <- days_rest %>% select(Player, `Game Date`, `0 Days Rest`, `1 Days Rest`, `2 Days Rest`, `3 D
                                  `4+ Days Rest`)

goalie <- summary %>% left_join(days_rest, c("Player", "Game Date"))
goalie <- goalie %>% rename(b_to_b= `0 Days Rest`, one_day_rest= `1 Days Rest`, two_days_rest= `2 Days R
```

```r
library(plm)
```

```
##
## Attaching package: 'plm'

## The following objects are masked from 'package:dplyr':
##
##     between, lag, lead
```

```r
library(stargazer)
```

```
##
## Please cite as:

##  Hlavac, Marek (2022). stargazer: Well-Formatted Regression and Summary Statistics Tables.

##  R package version 5.2.3. https://CRAN.R-project.org/package=stargazer
```

```r
pdat <- pdata.frame(goalie, index=c("player", "game_date"))
pdat <- pdat %>%
  mutate(
    starts= as.numeric(starts),
    save_percentage= as.numeric(save_percentage),
    one_day_rest= as.numeric(one_day_rest),
    two_days_rest= as.numeric(two_days_rest),
    three_days_rest= as.numeric(three_days_rest),
    b_to_b= as.numeric(b_to_b),
    shots_against= as.numeric(shots_against),
    GAA= as.numeric(GAA))
pdat <- pdat %>%
  mutate(rest_days = 1*one_day_rest + 2*two_days_rest + 3*three_days_rest)
```

3.2 Variables

Controls - Shots against

Fixed Effects - Goalie FE (height, weight, age, draft position, goalie coach, experience)

Workload Variables - back to back - starts in last 7 days - days of rest

Standard Errors - cluster by goalie

4 Methodology

4.1 Econometric Models

save percentage $= \beta_1$workload $+ \beta_2$shots against $+ \alpha_i$individual FE

5 Results

5.1 Main Regression Model

5.2 Robustness

5.3 Discussion

6 Conclusion

6.1 Key Findings

6.2 Implications

7 References

New Model (Revised Method)

```
fit <- plm(save_percentage~starts+shots_against, data=pdat, model="within")
stargazer(fit, header=FALSE, float=FALSE)
```

	Dependent variable:
	save_percentage
starts	-0.072^{***}
	(0.007)
shots_against	0.004^{***}
	(0.0002)
Observations	2,762
R^2	0.142
Adjusted R^2	0.109
F Statistic	220.620^{***} (df = 2; 2657)
Note:	*p<0.1; **p<0.05; ***p<0.01

```
printEqu(fit, stars=TRUE)
```

$$\widehat{save_percentage} = \underset{(0.007134)^{***}}{-0.072272}\ starts\ +\ \underset{(0.000193)^{***}}{0.004036}\ shots_against$$

$$n = 2762, \quad R^2 = 0.142420.10885, SSR = 12.91805$$

$$^{*}\text{pv} < 0.1;\ ^{**}\text{pv} < 0.05;\ ^{***}\text{pv} < 0.01$$

```
fit6 <- plm(GAA~starts+shots_against, data=pdat, model="within")
stargazer(fit6, header=FALSE, float=FALSE)
```

	Dependent variable:
	GAA
starts	1.416***
	(0.233)
shots_against	−0.050***
	(0.006)
Observations	2,762
R^2	0.027
Adjusted R^2	−0.012
F Statistic	36.300*** (df = 2; 2657)
Note:	*p<0.1; **p<0.05; ***p<0.01

```
fit2 <- plm(save_percentage~b_to_b+shots_against, data=pdat, model="within")
stargazer(fit2, header=FALSE, float=FALSE)
```

	Dependent variable:
	save_percentage
b_to_b	0.005
	(0.010)
shots_against	0.003***
	(0.0002)
Observations	2,762
R^2	0.109
Adjusted R^2	0.075
F Statistic	163.150*** (df = 2; 2657)
Note:	*p<0.1; **p<0.05; ***p<0.01

```
fit3 <- plm(GAA~b_to_b+shots_against, data=pdat, model="within")
stargazer(fit3, header=FALSE, float=FALSE)
```

	Dependent variable:
	GAA
b_to_b	−0.053
	(0.313)
shots_against	−0.035***
	(0.006)
Observations	2,762
R^2	0.013
Adjusted R^2	−0.026
F Statistic	17.610*** (df = 2; 2657)
Note:	*p<0.1; **p<0.05; ***p<0.01

```r
fit4 <- plm(save_percentage~rest_days+shots_against, data=pdat, model="within")
stargazer(fit4, header=FALSE, float=FALSE)
```

	Dependent variable:
	save_percentage
rest_days	-0.0002
	(0.001)
shots_against	0.003^{***}
	(0.0002)
Observations	2,762
R^2	0.109
Adjusted R^2	0.074
F Statistic	163.026^{***} (df = 2; 2657)
Note:	*p<0.1; **p<0.05; ***p<0.01

```r
fit5 <- plm(GAA~rest_days+shots_against, data=pdat, model="within")
stargazer(fit5, header=FALSE, float=FALSE)
```

	Dependent variable:
	GAA
rest_days	0.010
	(0.043)
shots_against	-0.035^{***}
	(0.006)
Observations	2,762
R^2	0.013
Adjusted R^2	-0.026
F Statistic	17.620^{***} (df = 2; 2657)
Note:	*p<0.1; **p<0.05; ***p<0.01