

The Economic Legacy of the 2010 Vancouver Olympics: A Regional Analysis of Employment,
Tourism, and Investment

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Economics

Abstract

This paper explores the effect of hosting the Olympic Games on various economic indicators relating to employment, tourism, and investment. Focusing on the 2010 Olympic Games in Vancouver, the study examines changes in economic indicators before and after the event. This study analyzes regional data from 2006 to 2017 compiled by Statistics Canada, using both Random-Effects and Fixed-Effects regression models. Additionally, a literature review discussing other authors' works on the topic provides insight on previous findings. The study finds that while some employment sectors saw lasting effects in the post-Games period, the broader effects on total employment and tourism were not lasting. This research contributes to the literature on the economic effect of hosting the Olympic Games by looking specifically into the regional effects of the 2010 Olympic Games.

Keywords: Olympic Games, Economic Impact, Employment

ON MY HONOR, I HAVE NEITHER NOR RECEIVED
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Kevin Somerville

Signature

Thank you to everyone who has helped me throughout my time at Colorado College. Mom and Dad, thank you for making it possible for me to be here. Professor Bayarmaa Dalkhjav, your guidance throughout my time working on this thesis has been incredibly helpful. Professor Esther Redmount, I am very appreciative of your assistance in my academic career at Colorado College, as it has guided me toward the completion of a degree in Economics. Lastly, to my friends, thank you for your unwavering support.

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1. Introduction

Hosting the Olympic Games is a prestigious opportunity for a country, and there are perceived economic and social benefits associated with doing so, but do these benefits justify the cost of hosting the Olympics? Theoretically, a host city would experience an increase in employment and tourism to stimulate the economy and hopefully spark growth, but what is left following the completion of the Olympic Games? A growing economy? Or abandoned stadiums and debt? These questions are essential to knowing the economic viability of being an Olympic host city.

By analyzing economic indicators by region such as GDP, Employment by sector (such as construction, accommodation, etc.), tourism, investment, and others, the economic benefits of hosting the Olympics can be quantified and compared to the cost of hosting the games. This comparison is important because it can help determine the economic legacy of hosting the games, as well as provide future host cities with information that can help them make a well-informed decision.

In this essay, I will examine the regional economic effects of hosting the Olympics, focusing on how the event impacts various sectors and communities. I will focus specifically on the 2010 Winter Olympics in Vancouver. I hypothesize that hosting the Olympic Games can bring temporary boosts to employment and tourism, which will temporarily cause economic growth. However, I predict that the economic benefits will not be lasting, and they will not persist through the period following the Olympic Games.

The hypothesis stated above is important to the study because it will provide insight on the cost and benefits of hosting the Olympics. This hypothesis will lead to a conclusion

determining whether or not hosting the Olympic Games is an economically viable growth initiative.

I will be collecting and analyzing data including the aforementioned economic indicators in British Columbia before, during, and after the Olympic Games. Furthermore, I will analyze data with economic indicators in Alberta and Quebec before, during, and after the Olympic Games. The inclusion of these control regions will allow me to compare the economic effects on host regions to regions that did not host the Olympics during the same time period. These control regions were selected by choosing regions that are geographically and economically similar to the host region so that the results can be compared for significant findings.

The data used will be from before, during, and after the Olympic games in both the host region and control regions. It will include economic indicators such as employment by sector (construction, accommodation and food services, transportation and warehousing, and retail and wholesale trade). The data will be accompanied by literature supporting claims and backing my findings. I expect to show that hosting the Olympic Games causes temporary economic expansion, but the benefits do not last, and the cost eventually outweighs the benefits.

2. Literature Review

“Cities invest millions of dollars in evaluating, preparing, and submitting a bid to the IOC” state James McBride, Noah Berman, and Melissa Manno (2024) in their article, *The Economics of Hosting the Olympic Games* (McBride et al, 2024). The authors discuss the financial obligation that cities need to fulfill just to enter the bidding process, and all things considered, this can cost the host city from \$50 to \$100 million, before any construction or infrastructure addition. Furthermore, the IOC puts in place strict requirements, such as "a minimum of forty thousand available hotel rooms" (McBride et al, 2024), which forces cities to invest heavily in infrastructure, often resulting in debts that affect the host city long after the Games conclude.

In the 2014 Sochi Winter Games, debt and maintenance costs were estimated to "cost Russian taxpayers nearly \$1 billion per year for the foreseeable future" (McBride et al, 2024). However, some residents argued that this investment led to public infrastructure improvements like roads and water systems, but the long-term benefit of these investments remains questionable. The authors also found that jobs created by Olympic construction only temporarily reduce unemployment. The added jobs are also often taken by already employed workers, so the economic effect is limited. (McBride et al, 2024)

Despite the optimistic outlook by governments prior to the Games, McBride, Berman, and Manno (2024) point out that many post-Games studies find that these economic effects may not be as beneficial as previously thought. Researchers face difficulties in isolating the Olympics' impact from other variables due to external economic effects that may be overlooked, such as

current events. The authors attempt to make a more accurate evaluation of the Olympics' true economic effects, using multiple analyses and event studies to look into both direct and indirect impacts on GDP, tourism, and employment.

The economic effects of hosting the Olympics are also explored by Robert Baade and Victor Matheson (2016) in their article "Going for the Gold: The Economics of the Olympics." The authors highlight that, despite the hopes of host cities for economic growth, the reality often includes financial difficulty due to escalating costs in infrastructure, operations, and security. Historical data shows that every Olympic Games since 1968 has gone over budget. (Baade and Matheson, 2016)

The desire to host the Olympics is driven by potential benefits such as increased tourism and job creation. However, Baade and Matheson (2016) also argue that these benefits are frequently overstated. The economic boosts promised by event promoters are often undone by factors like temporary job gains. Baade and Matheson (2016) conclude that while there may be benefits that can't be measured, such as national pride, these usually do not become long-term economic gains. Their analysis suggests that hosting the Olympics often leaves cities with debts and unused infrastructure, causing doubt that hosting the games is economically beneficial. (Baade and Matheson, 2016)

In Wayne Drehs and Mariana Lajolo's (2017) ESPN article, "After the Flame," they discuss the Rio de Janeiro Olympic Games in 2016, and more importantly, the promises leading up to the games, as well as the reality following them. The 2016 Summer Olympics was

supposed to bring economic and athletic success to Rio and Brazil, but according to Drehs and Lajolo (2017), the games left behind “a city and country shrouded by corruption, debt and broken promises” (Drehs and Lajolo, 2017). The authors discuss the details of this dysfunction and provide an example of a city that experienced economic adversity as a result of hosting the Olympic Games.

The article includes a short video that highlights the debt and misuse surrounding the athletic facilities built for the games. Some of the facilities were completely abandoned, Drehs and Lajolo (2017) write that “15 of the original 27 venues have hosted some sort of event since the Games” (Drehs and Lajolo, 2017) which means that 12 of the venues have gone unused, and even the venues in use struggle to remain profitable. Brazil’s \$20 million golf course struggles to attract players due to the sport's lack of popularity. Furthermore, the stadiums’ high maintenance costs have contributed to the country’s debt following the Games. Olympic Park’s maintenance alone costs the city \$14 million per year, and the Rio 2016 Organizing Committee is still in \$40 million of debt (Drehs and Lajolo, 2017). The committee requested assistance with the debt from the IOC, but their request was denied. The benefits promised as a result of hosting the olympics were not only related to economics. Drehs and Lajolo (2017) note that the Games were supposed to “modernize Rio and make its streets safer” (Drehs and Lajolo, 2017), but that has not been the result. They report that not only was this goal not achieved, but violent crime rates actually rose after the Games. The Games were supposed to assist in making Rio a “safe city for all people” (Drehs and Lajolo, 2017), but that was just another unfulfilled promise. Lastly, there was an initiative meant to offset the environmental impact of the Games by planting millions of seeds, but this also ended up being a broken promise. (Drehs and Lajolo, 2017) Overall, the 2016

Summer Olympic Games in Rio are an example of the economic and social hardships that can accompany hosting the Olympic Games.

3. Theory and Methodology

The panel data used in this study includes monthly employment and tourism data from British Columbia, the host region of the Olympic Games, along with data from Alberta and Quebec, which serve as control groups in the study. The monthly employment data covers total employment, as well as construction, accommodation and food services, transportation and warehousing, and wholesale and retail trade employment. Monthly non-residential tourism and yearly Gross Domestic Product and Capital Expenditure data are also included for all of the regions. The data in this study are collected from records compiled by Statistics Canada, the country's national statistical agency. Statistics Canada provides reliable economic and demographic data across regions and sectors in Canada.

Economic characteristics of these regions in Canada are measured with the following variables: Total_Employ, Construct_Employ, Accommodation_Employ, Transport_Employ, Trade_employ, NonRes_Tourism, GDPyr, CapExYr, BeforeGamesDummy, AfterGamesDummy, and GamesMonthDummy. Also included are the log-transformed variables for each sector of employment, as well as GDP and Capital Expenditure. Below are tables detailing the variables' definition, mean, and standard deviation for each region:

Table 1

<i>Variable Definitions and Descriptive Statistics, British Columbia</i>		<i>(Employment x1,000)</i>	
<i>Variable</i>	<i>Definition</i>	<i>M</i>	<i>SD</i>
Total_Employ	Total Employment	2307.11	115.41
ln_tot_employ	Log of Total Employment	7.742	.049
Construct_Employ	Construction Employment	135.06	10.96
ln_const_employ	Log of Construction Employment	4.903	.079
Accommodation_Employ	Accommodation + Food Services Employment	120.95	8.43

ln_accom_emp	Log of Accommodation + Food Services Employment	4.793	.07
Transport_Employ	Transportation and Warehousing Employment	92.32	9.88
ln_trans_employ	Log of Transportation and Warehousing Employment	4.52	.106
Trade_employ	Retail and Wholesale Trade Employment	252.45	12.71
ln_trade_emp	Log of Retail and Wholesale Trade Employment	5.53	.05
NonRes_Tourism	Non-Residential Tourism	388,894	44,014
ln_NR_tour	Log of Non-Residential Tourism	12.86	.11
GDPyr	Yearly Gross Domestic Product (x1,000,000)	209,543	25,339
ln_GDPy	Log of Gross Domestic Product	12.24	.12
CapExYr	Yearly Capital Expenditure (x1,000,000)	5,610.61	620.53
ln_CEY	Log of Yearly Capital Expenditure	8.627	.109
BeforeGamesDummy	Pre-Games Dummy Variable (1 = months before Games, in British Columbia)	.331	-
AfterGamesDummy	Post-Games Dummy Variable (1 = months after Games, in British Columbia)	.669	-
GamesMonthDummy	During Games Dummy Variable (1 = months during Games, in British Columbia)	.0211	-

Table 2

Variable Definitions and Descriptive Statistics, Alberta

(Employment x1,000)

Variable	Definition	M	SD
Total_Employ	Total Employment	2123.87	107.43
ln_tot_employ	Log of Total Employment	7.66	.051
Construct_Employ	Construction Employment	151.149	20.97
ln_const_employ	Log of Construction Employment	5.008	.143
Accommodation_Employ	Accommodation + Food Services Employment	89.85	12.32
ln_accom_employ	Log of Accommodation + Food Services Employment	4.489	.14
Transport_Employ	Transportation and Warehousing Employment	83.12	11.87
ln_trans_employ	Log of Transportation and Warehousing Employment	4.41	.138
Trade_employ	Retail and Wholesale Trade Employment	217.55	14.012

ln_trade_emp	Log of Retail and Wholesale Trade Employment	5.38	.066
NonRes_Tourism	Non-Residential Tourism	76,682	6,073
ln_NR_tour	Log of Non-Residential Tourism	11.24	.078
GDPyr	Yearly Gross Domestic Product (x1,000,000)	291,319	37,474
ln_GDPy	Log of Gross Domestic Product	12.574	.129
CapExYr	Yearly Capital Expenditure (x1,000,000)	7,574.49	827.46
ln_CEY	Log of Yearly Capital Expenditure	8.926	.117

*Dummy Variables omitted from table for control regions

Table 3

Variable Definitions and Descriptive Statistics, Quebec (Employment x1,000)

Variable	Definition	M	SD
Total_Employ	Total Employment	3970.54	120.26
ln_tot_emp	Log of Total Employment	8.28	.030
Construct_Employ	Construction Employment	148.8	19.24
ln_const_emp	Log of Construction Employment	4.99	.132
Accommodation_Employ	Accommodation + Food Services Employment	183.4	19.66
ln_accom_emp	Log of Accommodation + Food Services Employment	5.206	.11
Transport_Employ	Transportation and Warehousing Employment	127.47	11.57
ln_trans_employ	Log of Transportation and Warehousing Employment	4.84	.09
Trade_employ	Retail and Wholesale Trade Employment	458.15	16.65
ln_trade_emp	Log of Retail and Wholesale Trade Employment	6.13	.036
NonRes_Tourism	Non-Residential Tourism	212,219	21,180
ln_NR_tour	Log of Non-Residential Tourism	12.26	.095
GDPyr	Yearly Gross Domestic Product (x1,000,000)	325,679	34,310
ln_GDPy	Log of Gross Domestic Product	12.688	.105
CapExYr	Yearly Capital Expenditure (x1,000,000)	8210.1	1253.93
ln_CEY	Log of Yearly Capital Expenditure	9.001	.157

*Dummy Variables omitted from table for control regions

The tables above provide insight into the dataset with variable definitions, as well as the mean and standard deviation of the variables by region. Each table provides an economic snapshot of its respective region from 2006 to 2017. The tables include both raw values and log-transformed variables. Log-transformed variables are used in these regressions to facilitate the interpretation in percent change rather than absolute change. The coefficient in regression results will capture the percent change in the dependent variable during a specific time period, such as before or after the games took place. As previously mentioned, these time periods are indicated by dummy variables in the dataset. March 2006 to January 2010 is the pre-Games period, and March 2010 to December 2017 is the post-Games period.

In order to analyze the changes in employment across sectors, non-residential tourism, and capital expenditure surrounding the hosting of the Olympic Games, it is necessary to use linear regressions fit to panel data. Specifically, using random effects and fixed effects models, employment across sectors and non-residential tourism are regressed against yearly GDP and Capital Expenditure to examine how these economic factors affect employment and tourism before and after the Olympic Games. Additionally, regressions are conducted to examine how Capital Expenditure interacts with Olympic hosting.

While conducting these analyses, both Random-Effects and Fixed-Effects models were consulted, and a combination of these will be used in the final estimation. The models analyzing employment will use a Random-Effects approach, while the models analyzing tourism and capital expenditure will use a Fixed-Effects approach. This is because the employment models using a Fixed-Effects approach resulted in frequent statistical insignificance, while the Random-Effects model resulted in statistically significant results. However, the models analyzing

tourism and capital expenditure will use a Fixed-Effects approach because the results were statistically significant.

In these panel data regressions, log variables were generated for employment across sectors, non-residential tourism, and yearly capital expenditure so that the results could be interpreted with figures showing the percent change in the dependent variable during the time period of interest. The model below is representative of the regressions run, along with variables that were used in the model.

$$y_{it} = \alpha + x_{it1}\beta_1 + x_{it2}\beta_2 + x_{it3}\beta_3 + \epsilon_{it} \quad (1)$$

i = region

t = time

y = Total Employment, Construction Employment, Accommodation and Food Services Employment, Transportation and Warehousing Employment, Retail and Wholesale Trade Employment, Non-Residential Tourism, Yearly Capital Expenditure

x_1 = Pre-Games Dummy Variable, Post-Games Dummy Variable, During Games Dummy Variable

x_2 = Yearly Gross Domestic Product

x_3 = Yearly Capital Expenditure

ϵ = error term

Multiple regressions were run with the above model with different combinations of the variables listed. The dependent variables listed next to y all consist of monthly data with the exception of capital expenditure. The x_1 variables are all dummy variables that indicate the time

period of interest in the host region. For example, *BeforeGamesDummy* shows a value of 1 for all observations in British Columbia before February 2010, the month in which the Vancouver Olympics was held, and all other observations show a value of 0. The same is true for the variables *AfterGamesDummy* and *OlympicMonthDummy* for post-games estimations and estimations during the games, respectively. Lastly, the variables x_2 and x_3 are filled in with log of yearly GDP and log of yearly Capital Expenditure. The base model used in these regressions is below:

$$Total\ Employment_{it} = \alpha + BeforeGamesDummy_{it}\beta_1 + ln_GDPy_{it}\beta_2 + ln_CEY_{it}\beta_3 + \epsilon_{it} \quad (2)$$

In the base model above, employment by sector, as well as non-residential tourism, can be substituted for total employment to see how each variable interacts with Olympic hosting. Furthermore, the model can also be altered by substituting in dummy variables that indicate different time periods, such as after or during the games. Lastly, a model with capital expenditure as the dependent variable and removed from the independent variables was analyzed to explore the interaction between capital expenditure and hosting the Olympics.

4. Estimation and Results

This section presents the key findings from the Random-Effects and Fixed-Effects regression models. These regression results offer insight into the impact of the 2010 Winter Olympics on various sectors of employment, as well as tourism and capital expenditure. For conciseness, only the most relevant portions of the results are presented, focusing mostly on the effects of the pre-Games and post-Games dummy variables. The analyses conducted cover total employment, sectoral employment—including construction, accommodation and food services, transportation and warehousing, and retail and wholesale trade—non-residential tourism, and yearly capital expenditure. Each table lists the dependent variable at the top, followed by the regression results for the pre-Games period in the first section and the results for the post-Games period in the second section. Also included are the number of observations, and the overall and within R-squared values. Finally, each table is accompanied by a brief interpretation of the results.

Table 4

Panel Regression Results, Random-Effects Model * indicates statistical significance

Dependent Variable: Log of Total Employment

Independent Variables	Coefficient	P-Value
Pre-Games Dummy Variable	.1617196*	0.000
Log of Yearly GDP	.9269801*	0.000
Log of Yearly CapEx	-.0604848	0.499
Number of observations: 426 Overall R-squared: 0.3617 Within R-squared: 0.7051		
Post-Games Dummy Variable	.0370781	0.279
Log of Yearly GDP	.7143245*	0.000
Log of Yearly CapEx	.0860627	0.378

Number of observations: 426 Overall R-squared: 0.3449 Within R-squared: 0.8502

In Table 4, the Random Effects regression results reveal a highly statistically significant positive impact of the pre-Games period on total employment, with a coefficient of about .162 and P-value of 0.000. This indicates that in the period leading up to the Olympic Games, total employment increased by approximately 16.2%. In the post-Games period, the coefficient of .037 and P-value of 0.279 indicates a statistically insignificant finding, and it implies that the positive employment effect observed in the pre-Games period did not persist into the post-Games period. Additionally, the high coefficients and low P-values of Log of Yearly GDP indicate a strong positive relationship between GDP and employment throughout both periods. Conversely, no significant relationship between capital expenditure and employment is found. The results of this regression are particularly important as they provide evidence of the employment impact of hosting the Olympic Games, especially because total employment includes all other sectors tested. However, conducting analyses on employment by sector can offer a more detailed assessment of which industries are most impacted by hosting the Olympics.

Table 5*Panel Regression Results, Random Effects Model* * indicates statistical significance**Dependent Variable:** Log of Construction Employment

Independent Variables	Coefficient	P-Value
Pre-Games Dummy Variable	.0352674	0.083
Log of Yearly GDP	.318937*	0.000
Log of Yearly CapEx	.1088253*	0.006
Number of observations: 426 Overall R-squared: 0.4164 Within R-squared: 0.5663		
Post-Games Dummy Variable	.088368*	0.000
Log of Yearly GDP	.2655417*	0.000
Log of Yearly CapEx	.2481863*	0.000

Number of observations: 426 Overall R-squared: 0.4609 Within R-squared: 0.4692

In Table 5, the Random Effects regression results show a positive impact of the

pre-Games period on construction employment, with a coefficient of about .035, but the finding is of weak statistical significance with P-value of 0.083. This indicates that in the period leading up to the Olympic Games, a confident conclusion cannot be drawn regarding the change in construction employment, but it is likely that there was a slight increase in the period leading up to the Games. In the post-Games period, the coefficient of .088 and P-value of 0.000 indicates a statistically significant finding that construction employment did increase in the period following the Olympic Games. Once again the coefficients and low P-values of Log of Yearly GDP indicate a positive relationship between GDP and construction employment throughout both periods. In addition, the coefficients on capital expenditure are also positive and statistically significant, showing a positive relationship between it and construction employment in both the pre-Games and post-Games periods. The regression results in Table 5 do not align with that of

Table 4, making it evident that the Olympics may have different impacts on the construction sector than it does on total employment. Although unexpected, this result is not entirely surprising considering construction employment makes up only a small fraction of total employment.

Table 6

Panel Regression Results, Random Effects Model * indicates statistical significance

Dependent Variable: Log of Accommodation and Food Services Employment

Independent Variables	Coefficient	P-Value
Pre-Games Dummy Variable	.22465*	0.000
Log of Yearly GDP	.9167611*	0.000
Log of Yearly CapEx	-.2074237	0.064

Number of observations: 426 Overall R-squared: 0.1929 Within R-squared: 0.3523

Post-Games Dummy Variable	.2239539*	0.000
Log of Yearly GDP	.6062754*	0.000
Log of Yearly CapEx	.2268526	0.057

Number of observations: 426 Overall R-squared: 0.2174 Within R-squared: 0.4804

In Table 6, the Random Effects regression results display a coefficient of about .2246 and P-value of 0.000 next to the Pre-Games Dummy Variable. This coefficient, in conjunction with a P-value of 0.000, indicates a highly statistically significant positive impact of the pre-Games period on accommodation and food services employment. The interpretation of this finding is that in the period leading up to the Olympic Games, accommodation and food services employment increased by approximately 22.46%. In the post-Games period, the coefficient of .2239 and P-value of 0.000 also indicates a statistically significant finding, and it suggests that the accommodation and food services employment continued to increase following the Olympic

Games, at a marginally lower approximate rate of 22.39%. The coefficients and P-values surrounding the Log of Yearly GDP continue to indicate a positive relationship with employment, and in this case with accommodation and food services employment.

Table 7

Panel Regression Results, Random Effects Model * indicates statistical significance

Dependent Variable: Log of Transportation and Warehousing Employment

Independent Variables	Coefficient	P-Value
Pre-Games Dummy Variable	.1234953*	0.001
Log of Yearly GDP	.822319*	0.000
Log of Yearly CapEx	-.2173462*	0.002
Number of observations: 426 Overall R-squared: 0.3528 Within R-squared: 0.4431		
Post-Games Dummy Variable	.1439181*	0.000
Log of Yearly GDP	.6498186*	0.000
Log of Yearly CapEx	.0492193	0.499
Number of observations: 426 Overall R-squared: 0.3809 Within R-squared: 0.4911		

In Table 7, the Random Effects regression results reveal a highly statistically significant positive impact of both the pre-Games and post-Games period on transportation and warehousing employment. In the pre-Games period, a coefficient of roughly .123, with a P-value of 0.001, indicates an approximate increase of 12.3% in transportation and warehousing employment. In the post-Games period, a coefficient of about .144, with a P-value of 0.000, indicates an approximate increase of 14.4% in the sector. The results of this estimation suggest that transportation and warehousing employment increased in the periods both before and after the Olympic Games, with a slight increase in growth rate in the period after the Games. This result is

another example of how sectoral employment can differ from total employment. It is important to note that these employment sectors are likely affected by factors outside of the hosting of the Olympic Games. As in previous results, the Log of Yearly GDP continues to show a strong relationship with employment. In this model specifically, the coefficient on Log of Yearly Capital Expenditure shows a negative relationship to transportation and warehousing employment in the pre-Games period that is statistically significant. However, the relationship between Log of Yearly Capital Expenditure and this sector of employment becomes insignificant in the post-Games period.

Table 8
Panel Regression Results, Random Effects Model * indicates statistical significance
Dependent Variable: Log of Retail and Wholesale Trade Employment

Independent Variables	Coefficient	P-Value
Pre-Games Dummy Variable	.198652*	0.000
Log of Yearly GDP	1.018057*	0.000
Log of Yearly CapEx	-.1204153	0.273
Number of observations: 426 Overall R-squared: 0.2862 Within R-squared: 0.3144		
Post-Games Dummy Variable	.040395	0.337
Log of Yearly GDP	.7572873*	0.000
Log of Yearly CapEx	.0527089	0.660
Number of observations: 426 Overall R-squared: 0.2670 Within R-squared: 0.4005		

In Table 8, the Random Effects regression results reflect that of the results in Table 4, a highly statistically significant positive impact of the pre-Games period on retail and wholesale trade employment, and a statistically insignificant finding in the post-Games period. The coefficient of approximately .199 and P-value of 0.000, suggest that in the period leading up to

the Olympic Games, retail and wholesale trade employment increased by approximately 19.9%. In the post-Games period, the coefficient of .04 and P-value of 0.337 indicates a statistically insignificant finding that suggests that retail and wholesale trade employment did not show a sustained positive effect after the Olympics. Similarly to previous results, the model suggests that Log of Yearly GDP and retail and wholesale trade employment have a strong positive relationship, and the relationship between Log of Yearly Capital Expenditure and this sector of employment is statistically insignificant.

Table 9
Panel Regression Results, Fixed-Effects Model * indicates statistical significance
Dependent Variable: Log of Non-Residential Tourism

Independent Variables	Coefficient	P-Value
Pre-Games Dummy Variable	.0806693*	0.000
Log of Yearly GDP	.5464314*	0.000
Log of Yearly CapEx	-.2149409*	0.000
Number of observations: 426 Overall R-squared: 0.1086 Within R-squared: 0.3053		
Post-Games Dummy Variable	-.0806693*	0.000
Log of Yearly GDP	.5464314*	0.000
Log of Yearly CapEx	-.2149409*	0.000
Number of observations: 426 Overall R-squared: 0.2649 Within R-squared: 0.3053		

In Table 9, the Fixed-Effects regression results show a statistically significant positive impact of the pre-Games period on Non-Residential Tourism, with a coefficient of about .081 and P-value of 0.000. This indicates that in the pre-Games period, non-residential tourism increased by approximately 8.1%. In the post-Games period, the coefficient of -.081 and P-value

of 0.000 indicates a statistically significant finding that non-residential tourism decreased approximately 8.1%. It is worth noting that the coefficients in this result are equal in magnitude but opposite in direction, and both are highly statistically significant. This result could indicate that the positive effect on non-residential tourism in the pre-Games period ended up being reversed in the post-Games period. This result also shows a statistically significant positive relationship between Log of Yearly GDP and non-residential tourism, and a negative relationship between Log of Yearly Capital Expenditure and non-residential tourism.

Table 10
Panel Regression Results, Fixed-Effects Model * indicates statistical significance
Dependent Variable: Log of Yearly Capital Expenditure

Independent Variables	Coefficient	P-Value
Pre-Games Dummy Variable	.1570779*	0.000
Log of Yearly GDP	.5573813*	0.000
Number of observations: 426 Overall R-squared: 0.6346 Within R-squared: 0.2246		
Post-Games Dummy Variable	-.1570779*	0.000
Log of Yearly GDP	.5573813*	0.000
Number of observations: 426 Overall R-squared: 0.6986 Within R-squared: 0.2246		

In Table 10, a similar result to Table 9 is presented. The Fixed-Effects regression results show a statistically significant positive impact of the pre-Games period on Yearly Capital Expenditure, with a coefficient of about .157 and P-value of 0.000. This indicates that in the pre-Games period, yearly capital expenditure increased by approximately 15.7%. In the post-Games period, the coefficient of -.157 and P-value of 0.000 indicates a statistically significant finding that yearly capital expenditure decreased approximately 15.7%. Once again,

this result shows coefficients equal in magnitude, but opposite in direction. This result is expected given the increased capital expenditure required for hosting the Olympic Games, and it is likely that this capital expenditure was reduced following the completion of the Games. Finally, the Log of Yearly GDP shows a positive, and statistically significant relationship to yearly capital expenditure.

In summary, these regression results show that the 2010 Winter Olympics had a significant, although varied, impact on employment, tourism, and investment. It is evident that employment sectors reacted differently through the pre-Games and post-Games periods. Total employment and retail and wholesale trade employment increased in the pre-Games period, but there is no indication that these positive effects continued through the post-Games period. Conversely, in construction, accommodation and food services, and transportation and warehousing employment, positive effects were seen in the post-Games period. However, the total employment regression result holds slightly more weight as it encapsulates the entire labor market's response to the 2010 Winter Olympics. Lastly, these regression results show that tourism and capital expenditure both increased in the period leading up to the Olympics and decreased following the games. These results as a whole demonstrate the temporary increases hosting the Olympic Games can bring to specific economic indicators, but the benefits do not always persist following the completion of the event.

5. Conclusion

The analysis conducted reveals the economic impacts of the Olympic Games on employment, tourism, and investment. The pre-Games period showed an approximate 16.2% increase in total employment, an approximate 8.1% increase in non-residential tourism, and a 15.7% increase in capital expenditure. These figures are promising when presented alone, as they indicate economic growth. However, none of these effects persisted throughout the period following the Olympic Games. There was no statistical significance in the total employment growth rate during the post-Games period, and the positive effects relating to tourism and capital expenditure in the pre-Games period were reversed in the post-Games period. While there is more data to be collected and more analyses to be conducted to determine whether or not hosting the Olympics is economical, these findings, along with the reviewed literature, strongly suggest that government officials consider the long-term economic effect of hosting the Olympics before deciding it is something their city or country must pursue.

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