Article

Estimating the Value of Medal Success in the Olympic Games

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Abstract

We estimate Canadians' willingness to pay (WTP) for medals won by Team Canada in the 2010 Winter Olympic Games using data from contingent valuation method (CVM) surveys of nationally representative samples conducted before and after the Games. The results permit an assessment of Own the Podium, a government program designed to increase Canada's medal count. International prestige and national pride are important determinants of WTP. The results are sensitive to cost and scope, respondents' beliefs about the effectiveness of the program, as measured by expected medal count. WTP estimates suggest that Own the Podium generated benefits above its cost to a degree unique in the growing literature of sport CVM studies.

Keywords

Olympic Games, contingent valuation method, temporal reliability, willingness to pay

Introduction

Many national governments subsidize elite athletes to make them more competitive in international competition, especially the Olympic Games. For example, Germany spends hundreds of millions of dollars on schools developed to identify

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and train elite athletes. China subsidizes talent identification and coaching in elite sport, especially in sports that Western nations neglect. Australia began a similar strategy after failing to win a gold medal in the 1976 Summer Olympic Games. Japan in 2000 spent US$185 million on a National Training Center and in 2003 began spending about US$5 million per year in subsidies to athletes judged to be potential medal winners. (Johnson, 2008, p. A1). Swiss federal and cantonal governments directly and indirectly provide about US$35 million per year to Swiss Olympic, the Swiss National Olympic Committee, with explicit goals to place in the top 8 Winter and top 25 Summer medal counts (Swiss Olympic, 2010, pp. 6, 10).

The Canadian government, through Sport Canada, operates three programs designed to develop and support elite athletes: the Sport Support Program, the Hosting Event Program, and the Athlete Assistance Program. In 2007-2008, Sport Canada provided these programs a total of C$120 million in support. In addition, Canada spent an additional C$110 million over the period 2006-2010 on its Own the Podium program geared specifically toward enhancing Canadian performance in the 2010 Vancouver Winter Olympics. To that point, Canada was one of only two host nations not to win a gold medal at its own Olympics and had the dubious distinction of being the only host to be shut out twice at home, at both the 1976 Summer Games in Montreal and the 1988 Winter Games in Calgary. Created in 2005, Own the Podium was intended to help Canada achieve a best ever finish in the medal count in Vancouver. Whether due to Own the Podium or not, Canada did extremely well in the Vancouver Games, winning an all-time, all-nation, Winter Olympics record of 14 gold medals and finishing third behind the United States and Germany in the overall medal count with 26 medals.

Before the Vancouver Games, many Canadians approved of government spending to support elite athletes. In July 2006, a survey by NRG Research Group found that 73% of Canadians approved of the Own the Podium program's goal of Team Canada winning the medal count and placing in the top three countries in gold medals in 2010. In addition, 69% of Canadians reported that it was important for Canada to be the top medal finisher in 2010 (NRG Research Group, 2006). While Canadians and others clearly approve of the use of public funds to support their elite athletes, to this point there has been no attempt to compare this support to the actual level of spending on elite athletics by national governments. In other words, do the benefits exceed the costs in this case?

The economic benefits of Olympic success for a nation's athletes would come primarily from public goods such as national pride.[1] In this article, we undertake a contingent valuation method (CVM) study of the intangible benefits generated by the performance of Canadian athletes in the 2010 Vancouver Winter Olympic Games. This project represents an important extension of sports CVM research into a previously unexamined area. Based on data from two nationwide surveys, estimates suggest that the benefits of Canadian spending on elite athletes far exceed the costs. This finding stands in stark contrast to those in nearly every other published

CVM analysis of the benefits of sports-related public goods, which almost invariably find that costs exceed benefits.[2]

CVM and Willingness to Pay (WTP) for Sport Success

The CVM, first adapted to sports by Johnson and Whitehead (2000), is a survey technique widely used by economists to measure the value of public goods. The idea behind CVM research is straightforward. Respondents are presented with a hypothetical market in which they can pay for a specified increase in a public good or pay to avoid a specified loss of a public good. Their WTP is contingent upon the hypothetical scenarios and markets described to them in the survey (Mitchell & Carson, 1989). An example would be a scenario suggesting that a professional sports team might relocate unless the team is purchased by the host city; to buy the team, a yearly tax on local households would be required (see, e.g., Johnson, Mondello, & Whitehead, 2007).

Sports produce two broad types of benefits, which are sometimes classified as tangible benefits and intangible benefits, or alternatively use values and nonuse values. They derive from the consumption of private goods, in the case of tangible benefits and use values, or public goods, in the case of intangible benefits and nonuse values. People enjoy use values from their active consumption of the sporting experience. They buy tickets and licensed apparel. They subscribe to cable sports networks or watch on free broadcast TV, enabling teams and organizers to sell advertising. These are private goods, excludable and rivalrous. If I buy a ticket and a jersey, nobody else can sit in that seat or wear that shirt. These tangible benefits are private. They accrue to the people who buy the goods. No positive externalities are generated from the consumption of these private goods, and no economic justification for a public subsidy of them exists.

Intangible benefits, or nonuse values, accrue to people who consume public goods, which are nonexcludable and nonrivalrous. Many—maybe most—sports fans get their greatest benefits from activities, and teams and organizers do not control and cannot charge fees for. Civic and national pride from seeing a team win a championship, posting comments about teams and players on social media, conversations with friends, checking scores, and standings in local newspapers, on websites, or mobile phone apps—all of these and more occupy the attention of sports fans, many of whom never buy a ticket or jersey and never subscribe to a sports cable channel. Because teams and organizers derive no revenue from these nonuse values, they do not consider them in their decisions of where to locate their teams or how to stage their events. Consequently, in some cases, sports may be underproduced, in the sense that marginal benefits, including tangible and intangible, exceed marginal costs. In those cases, there may be a case for subsidies on efficiency grounds.

Sports CVM research covering a diverse set of scenarios has been conducted, analyzing WTP for public goods produced by the National Hockey League's

Pittsburgh Penguins (Johnson, Groothuis, & Whitehead, 2001), the National Football League's Jacksonville Jaguars (B. K. Johnson, Mondello, et al., 2007), a hypothetical National Basketball Association team in Jacksonville, FL (Johnson, Mondello, et al., 2007), a hypothetical Major League Baseball team in Portland, OR (Santo, 2007), the National Football League's Minnesota Vikings (Fenn & Crooker, 2009), a college basketball arena and a minor league baseball team in Lexington, KY (Johnson & Whitehead, 2000), and amateur sports and recreation programs in Alberta, Canada (Johnson, Whitehead, Mason, & Walker, 2007).

The CVM has recently been used to value the intangibles of hosting major world sporting events. Atkinson, Mourato, Szymanski, and Ozdemiroglu (2008) surveyed residents in London, Glasgow, and Manchester, UK, before the 2012 Summer Olympics in London and estimated that Britons were willing to pay in excess of $3 billion for the intangible benefits generated by hosting. Walton, Longo, and Dawson (2008) surveyed people from Bath and southwest England before the London Olympics and also found substantial WTP for the intangible benefits. Sussmuth, Heyne, and Maennig (2010) surveyed Germans' WTP to host the 2006 Fédération Internationale de Football Association (FIFA) World Cup football tournament. Their survey conducted before the Cup found a WTP of $467 million for the "feel-good" factor of hosting the World Cup. A follow-up survey conducted after the Cup found WTP had risen to $1.1 billion. Wicker, Hallmann, Breuer, and Feiler (2012) surveyed Germans year before the 2012 London Olympics and estimated the value of Germany being ranked first in medals. Average WTP was €6 per resident. Morgan and Whitehead (2018) surveyed U.S. residents before and after the 2014 World Cup and found that the present value of benefits to improve the Men's National Team's performance in the 2018 World Cup was $126 million.

To date, no CVM study has estimated the value of national pride and unity to the host country generated by watching fellow citizens win Olympic medals before and after the event. Certainly, much anecdotal evidence suggests that people value their nation's elite athletic success. For example, the 1972 Summit Series hockey games between Canada and the Soviet Union are regarded as a defining moment in Canadian history. In the Olympics, a similar response was engendered by the gold medal success of both the Canadian men's and women's ice hockey teams at the 2002 Games in Salt Lake City. Many people consider the 1980 Olympic hockey victory of the United States over the Soviet Union one of America's greatest sporting triumphs. Fans around the world follow the daily medal counts during the Olympics to see where their nations stand. People seem pleased when their nation does better than expected and displeased when it underperforms. TV ratings spike if a nation's athletes are contending for the gold medal. By eliciting information on expected gold, silver, and bronze medals, we are able to estimate the marginal value of each.

This obvious interest is invoked to justify the subsidies governments provide to aspiring Olympians who will represent their countries. The CVM analysis in this

study allows comparison of the costs of Canada's subsidies to the benefits, as measured by the estimated WTP for national pride and unity generated by Olympic gold. Hausman (2012) argues that CVM estimates provide little useful information for policy analysis. Carson and Groves (2007) and Carson (2012) argue that contingent valuation referendum questions are incentive compatible and will provide useful WTP responses to policy makers if they are consequential (see also Haab, Interis, Petrolia, & Whitehead, 2013). Consequential questions are those for which survey respondents think there is a nonzero probability that results of the study would influence policy. Vossler and Watson (2013) provide some empirical evidence that illustrates how hypothetical votes from consequential survey questions are similar to votes in an actual election. The phrasing of the referendum and supporting questions was designed to enhance the consequentiality of this survey. Nevertheless, we adjust our WTP estimates for certainty to mitigate any lingering hypothetical bias (Loomis, 2011). Also, we apply a conservative aggregation rule to adjust for survey nonresponse.

The panel nature of these data allows a test of the temporal reliability of WTP (Carson et al., 1997). In other words, is WTP stable over time? In the only other tests of temporal reliability in sport CVM analyses, Sussmuth et al. (2010) found that Germans' WTP to host the 2006 FIFA World Cup Championship more than doubled after the tournament, and Morgan and Whitehead (2018) found that WTP to improve the U.S. Men's National Team's World Cup performance in 2018 was stable. Temporal reliability is achieved if WTP estimates are stable over time. Instability is not necessarily an evidence of unreliability. If a significant intervening variable such as success in the 2010 Winter Games arises, then WTP estimates can be expected to change (Whitehead & Hoban, 1999).

Method

To assess Canadian households' WTP for Olympic medal success, we conducted two nationally representative surveys, one before the 2010 Vancouver Winter Olympic Games, in October and early November 2009, and the other after the Games, in April and May 2010. The random digit dial telephone surveys contacted samples stratified by region and gender, including a large subsample of respondents contacted in both surveys.

The response rate to the pre-Olympic survey, calculated as the percentage of eligible phone numbers contacted who completed the interview, was 20%. A total of 1,540 Canadians answered the pre-Olympic Games' survey. The response rate for those called the first time in the post-Olympic survey was slightly higher than in the earlier survey, about 22%. After the Olympics, 1,660 answered, including 758 who responded to the first survey. The sample was stratified by region and gender to represent the Canadian population. Residents of British Columbia were oversampled to gain additional information about the use value of the Olympic

Games. Because of item nonresponse to some important demographic questions asked later in the survey, the sample for the pre-Olympic survey dropped from 1,540 to 1,436, while the sample for the post-Olympic survey dropped from 1,660 to 1,564.

The survey began with a series of 17 questions to get respondents thinking about the 2010 Winter Olympic Games and ended with the usual questions about respondents' socioeconomic and demographic characteristics.

The heart of the survey revolved around the hypothetical scenarios and questions eliciting WTP for Olympic success.[3] Before the Games, the survey informed respondents that Canadians ranked third in total medals at the 2006 Winter Olympic Games and asked how satisfied they were with that performance. After the Games, it informed respondents about Canada's 2010 performance. It then informed them that the federal government spends about C$120 million per year or about C$10 per household to support athletes participating in both the Summer and Winter Olympic Games. Respondents were asked whether they supported such spending. Then they were told that the Own the Podium program accounts for C$3 of annual spending per Canadian household and were asked whether they thought Own the Podium could increase the number of Olympic medals won by Canadians. Those responding yes were led through a series of questions to determine how many more gold and total medals Canadians might be expected to win as a result of the Own the Podium program.

These questions set up the following hypothetical scenario asking about the continuation of the government's elite athlete training programs:

> Suppose that continuing to use federal money to fund the training of elite athletes for the Olympic Games were put to a vote. If more than half of all voters were in favor of the proposal, then it would pass. Remember, if the proposal passed, a typical household would continue to pay about $13 per year. If the proposal does not pass, the typical household would have about $13 more to spend on other things each year. Do you think that you would vote for or against the proposal?

If they said they would vote for the proposal, they were asked "On a scale of 1 to 10, where 1 is *not certain* at all and 10 is *very certain*, how certain are you that you would vote for the proposal if it were really put to a vote?" This scenario allows us to conduct a simple benefit–cost analysis of the Own the Podium program.

Next, the respondents were presented with a hypothetical scenario about expanded funding of Own the Podium for the 2014 Winter Olympic Games. They were told that the expanded program would be financed by a annual income tax surcharge for 3 years. They were asked if they thought this could increase the number of medals won by Canadians in the 2014 Winter Games.

If they said yes, they were asked a series of follow-up questions to determine how many more total and gold medals Canadians might win and whether they would be satisfied with these increases.

Then, the respondents were asked how they would vote in a referendum on the income tax surcharge in one of the randomly assigned amounts.

> Suppose continuing and expanding the Own the Podium program beyond 2010 were put to a vote. If more than half of all voters were in favor of the proposal, then it would pass. Remember, if the proposal passed, your household would have $[tax] less to spend on other things each year. Do you think that you would vote for or against the proposal?

If they said they would vote for the proposal, they were again asked the certainty question. Recoding for respondent certainty mitigates hypothetical bias, the tendency of survey respondents to overstate their WTP in hypothetical situations (Loomis, 2011). The survey responses allow estimation of WTP for Canadian medal success and to what extent it varies with personal and regional characteristics.

To motivate this decision, consider the following model of household decision making. Suppose survey respondents possess a utility function $u = u(x, h(m), z)$, where u is increasing in x, $h(m)$, and z; x measures consumption of sporting events, $h(m)$ captures the existence of sports public goods, which is increasing in the Olympic medal count, m, and z is a composite commodity of market goods. Sport produces both public and private goods. The budget constraint is $y = z + px$, where y is income and p is the money cost of sports consumption, including ticket prices and costs of travel to sporting events. The price of the composite commodity is normalized to one, and the existence of sports public goods is an unpriced nonmarket good. Solving the utility maximization problem yields the indirect utility function $u = v(p, h(m), y)$, which is decreasing in p and increasing in $h(m)$ and y. If respondents minimize expenditures, $z + px$, subject to the utility constraint, the resulting expenditure function is $e = e(p, h(m), u)$. The expenditure function is increasing in p and u and decreasing in $h(m)$. With an increase in the medal count ($m' > m$), the expenditures necessary to reach the reference utility level decrease. The difference between expenditure functions is the WTP for Olympic medal success, WTP $= e(p, h(m), u) - e(p, h(m'), u)$. Substitution of the indirect utility function into the WTP function yields WTP $= y - e(p, h(m'), v(p, h(m), y))$. WTP is increasing in y if m is a normal good and increasing in $h(m)$.

The probability of a referendum "for" vote is estimated by a probit model WTP $= \beta'x$, where β is a unknown coefficient vector and x is a vector of independent variables:

$$
\begin{aligned}
Pr(for) &= Pr(WTP \geq tax) \\
&= Pr(\beta'x + \varepsilon \geq tax) \\
&= Pr\left(\frac{\beta'x - tax}{\sigma} \geq \frac{\varepsilon}{\sigma}\right) \\
&= \phi\left(\frac{\beta'x - tax}{\sigma}\right),
\end{aligned}
$$

and $\varepsilon_i \sim N(0, \sigma^2)$, for $i = 1, \ldots, n$ respondents.

The coefficients on the WTP model are estimated from the single-bound censored probit coefficients using the procedures described in Cameron and James (1987). Since the dollar amount varies across respondents, σ can be identified as the negative inverse of the probit coefficient on the tax amount and mean WTP is $\widehat{WTP} = \sigma(\beta'x)$. Marginal WTP is $m\text{WTP}_j = \sigma\beta_j$ for variable j. The standard errors are obtained from the asymptotic covariance matrix by the delta method (Cameron, 1991).

Results

Table 1 summarizes responses to several questions about pride in Canada's success at, and hosting of, the Olympic Games. Before the Games, 88% of respondents were proud to host the Games. Ninety-four percent were proud when a Canadian athlete wins a gold medal. Nearly as many expected to feel proud if Canada won the gold medal in men's or women's hockey. Eighty-seven percent were proud if Canadians won more gold medals than U.S. athletes and nearly 92% if Canadians won more gold than any other country's athletes. Three of these answers were not much different after the Games, with 5% more feeling proud that Vancouver hosted the Olympics and 4% less feeling proud that Canadian athletes won more gold than U.S. athletes and that Canadians won more gold overall.[4]

Not only are Canadians proud of their Olympic success, they also think Olympic success is important. Table 2 summarizes the responses, both before and after the Olympics, to four questions about the importance of winning Olympic medals. Before the Games, 59% and 60% of respondents agreed that it was important for Canadians to win the most gold and total medals. After the Games, it rose to 67% and 65%. Before the Games, 53% and 53% agreed it was important for Canadians to win more gold and more total medals than Americans. After the Games, it was 63% and 59%.

Clearly, respondents thought Olympic medals are important to Canada, especially after experiencing such great success in Vancouver. But it costs respondents nothing to say they think medals are important. Would they put their money where their mouths were?

To determine whether the benefits of Canadian medal success exceed the costs of existing subsidies, including Own the Podium, respondents were asked if they would vote in favor of a referendum to continue paying taxes of $13 per household per year, the current level of federal spending on elite athletes. Fifty-nine percent said they would vote in favor of the referendum. Adjusting for certainty to mitigate hypothetical bias, 54% said before the Games that they would vote in favor. After the Games, support increased significantly, with 81%,[5] adjusted for certainty, willing to vote in favor at the existing $13 per household per year funding level.

The large increase in the percentage of people willing to continue funding at the current level suggests that the ''feel-good'' effects detected by Sussmuth et al.

Table 1. Pride in the Vancouver Games and Team Canada Performance.

Question[a]	Percentage Yes		
	Pre-Olympics	Post-Olympics	Change
As a Canadian, are you proud that Vancouver will host the 2010 Winter Olympic Games?	88.01	93.16	5.07*
Do you feel proud when a Canadian athlete wins a gold medal?	94.22	95.14	0.92
Will you feel proud if the Canadian men's hockey team wins the gold medal?	91.78	92.33	0.55
Will you feel proud if the Canadian women's hockey team wins the gold medal?	93.31	82.74	−0.60
Will you feel proud if Canadian athletes win more gold medals than U.S. athletes?	86.77	82.74	−4.03*
Would you be proud if Canadians win more gold medals than any other country?	91.71	87.79	−3.93*
Sample size	1,436	1,564	

[a]This is the wording of the questions in the pre-Olympics survey. The questions were made past tense in the post-Olympics survey.
*Indicates a statistically significant difference in regression and chi-square tests at the $p = .01$ level. Similar results are found for the subsample that answered both surveys.

Table 2. Attitudes About the Importance of Medal Success.

Question[a]	Percentage Agree or Strongly Agree		
	Pre-Olympics	Post-Olympics	Change
It is important that Canadian athletes win the most gold medals.	59.40	66.69	7.29*
It is important that Canadian athletes win the most total medals, including gold, silver, and bronze.	59.61	64.51	4.90*
It is important that Canadian wins more gold medals than the United States.	52.92	62.92	9.99*
It is important that Canada wins more total medals than the United States.	53.20	59.53	6.32*
Sample size	1,436	1,564	

[a]The wording of the questions in Table 1 has been edited to fit the available space. The post-Olympics survey questions began with "In 2014."
*Indicates a statistically significant difference in regression and chi-square tests at the $p = .01$ level. Similar results are found for the subsample that answered both surveys.

(2010) after the 2006 FIFA World Cup in Germany appear to operate in Canada as well. It also suggests an increase in the WTP for Olympic success. To quantify the WTP beyond pre-Olympic funding levels, respondents were also asked whether they

would support increased funding of Own the Podium for the 2014 Winter Olympics at tax levels of $5, $10, $20, $30, $35, $50, or $65 per year over 3 years through an income tax surcharge. In the post-Olympic survey, the tax surcharge amounts were adjusted upward to $15, $25, $35, $50, $65, $75, $100, and $150 because early responses indicated an apparently much higher WTP than before the Olympics. Tax amounts were revised in real time based on early responses. Some tax amounts in the prestudy experimental design were not included after these real-time revisions (i.e., $5, $10, and $30 in the pre-Olympic survey).

Table 3 summarizes the responses, both before and after the Games, and before and after adjusting for certainty. The percentage of those voting for the expansion of Own the Podium drops as the bid amount increases, consistent with economic theory. Even after adjusting for certainty, more than half the respondents in the pre-Olympics survey said they would vote for higher taxes to extend Own the Podium for the 2014 Winter Olympics. Adjusted for certainty, the percentage of respondents who said they would vote in favor rose from 52% before the Games to 57% after. The percentage in favor rose despite the fact that hypothetical tax increases rose after the Olympics, with bid amounts ranging from $15 to $150 post-Olympics as opposed to the pre-Olympics range of $5–$65. While most bid amounts from the first survey were not used again in the second, three were: $35, $50, and $65. The percentage voting yes at each of these bid levels rose after the Games. For instance, 40% were certain they would vote in favor at $65 before the Games, while 55% would have voted in favor after the Games.

The probit model was estimated with data from two samples, one using all responses to the pre-Olympic survey and the other using all responses to the post-Olympic survey. Table 4 lists variable names, definitions, and expected signs of all variables used in the estimation of WTP to support Own the Podium for the 2014 Winter Olympics. Table 5 shows the summary statistics for those variables for respondents to the pre-Olympic survey and the same for respondents to the post-Olympic survey.

For those respondents who agreed that the Own the Podium program could increase the number of medals won in 2010, we elicited respondent estimates of gold and total medals. For those respondents who did not think that the Own the Podium program could increase the medal count, we assumed that expectations of medals are the same as those achieved in the 2006 Olympics, six gold and 24 total medals. Before the Olympics respondents believed that the gold and total medal count would be 11 and 29 in the 2010 Olympics. After the Olympics, in which Canada won 14 gold and 26 total medals, respondents believed that the gold and total medal count would be 15 and 27 in the 2014 Olympics. Household income is $70,000 in the pre-Olympic sample and $72,000 in the post-Olympic sample.

A variable to measure the effect of national pride on WTP is also included in the probit regression model. Respondents were asked if they agree that Canada's standing in the world was affected by its medal count in the winter Olympics. In all, 67% and 83% thought that Canada's standing in the world was affected by the medal

Table 3. Response to the Referendum Valuation Question.

Pre-Olympic Games Survey				Post-Olympic Games Survey			
Tax	*n*	%For	%Sure	Bid	*n*	%For	%Sure
$5	311	72	59				
$10	11	73	64				
				$15	182	77	73
$20	317	65	57				
				$25	266	72	65
$30	10	70	60				
$35	302	63	54	$35	259	66	61
$50	294	54	44	$50	263	56	51
$65	189	48	40	$65	22	55	55
				$75	252	58	54
				$100	243	53	46
				$150	77	52	45
Total	1,436	62	52	Total	1,564	62	57

Table 4. Variable Definitions.

TAX	Dollar amount by which respondent's annual household tax bill would rise if referendum passes.
FORSURE	Equal to 1 if respondent is certain she would vote in favor of referendum for higher taxes, 0 otherwise.
GOLD	The number of gold medals respondent thinks Canada can win in 2014 if Own the Podium is continued.
OTHMEDAL	The number of gold medals respondent thinks Canada can win in 2014 if Own the Podium is continued.
INCOME	Household income in thousands of dollars.
MALE	Equal to 1 if respondent is male, 0 otherwise.
AGE	Respondent's age in years
PRESTIGE	Equal to 1 if respondent believes that Canada's Olympic medal count is somewhat or very important to Canada's standing in the world, 0 otherwise.
PROUDHOST	Equal to 1 if respondent is proud that Vancouver will host the 2010 Winter Olympic Games.
PROUDGOLD	Equal to 1 if respondent is proud if Canadians win more gold medals than any other country, 0 otherwise.
BOTH	Equal to 1 if respondent participated in both pre- and post-Olympic surveys, 0 otherwise.

count before and after the Olympics. We also included all the variables that appear in Tables 1 and 2 in these preliminary referendum voting models. Only two of the variables in Table 1 (" ... are you proud that Vancouver will host ... " referred to as PROUDHOST; and "Do you feel proud when a Canadian athlete wins a gold

Table 5. Summary Statistics.

Variable	Pre-Olympic Survey				Post-Olympic Survey			
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
GOLD	11.44	6.30	7	50	15.44	2.81	14	35
OTHMEDAL	18.05	6.00	0	78	12.29	2.85	0	35
INCOME[a]	69.52	42.31	20	150	71.92	41.80	20	150
AGE	49.96	15.42	19	89	51.23	14.67	19	92
PRESTIGE	0.67	0.47	0	1	0.83	0.38	0	1
PROUDHOST	0.88	0.32	0	1	0.93	0.25	0	1
PROUDGOLD	0.92	0.28	0	1	0.88	0.33	0	1
BOTH	0.48	0.50	0	1	0.44	0.50	0	1
Sample size		1,436				1,564		
Nonmissing sample size[a]		999				1,241		

[a]The sample size with nonmissing income is 999 for the pre-Olympic survey and 1241 for the post-Olympic survey.

medal?'' referred to as PROUDGOLD) and none of the variables in Table 2 are statistically significant. We include PROUDHOST and PROUDGOLD in all regression models. Also included in the model are provincial dummy variables to control for unobservable heterogeneity in factors affecting WTP across provinces.

Note that the estimated parameters on the indicator variables for the response to the questions about success by men's and women's hockey teams were not statistically different from zero in the preliminary probit models. This indicates that the WTP estimates are not driven by Canadians' interest in the two national hockey teams. We omitted these indicator variables from the regression models. Reported results are not sensitive to inclusion of these variables.

To facilitate estimation of WTP, we first estimate a probit model with only the tax amount as the independent variable. The results and estimates of average household WTP appear in Table 6. As the tax amount increases, the probability of voting in favor falls, consistent with the summary statistics reported in Table 3. The average WTP rose dramatically after the Olympics, from $38 per household to about $90. Perhaps the increased WTP was due to the record gold model tally in 2010, which was 133% greater than Canada's 2006 total and 27% larger than respondents had predicted before the Games.

These estimates are larger than the estimated WTP for Germany finishing atop the London 2012 Summer Games medal table reported by Wicker et al. (2012). However, that estimate was for the Summer Games and not for the host country. Because of these differences, it may not be comparable to the Winter Games estimates for the host country reported here. No other WTP estimates for Winter Olympic Games success exist.

Even before the Olympics, Canadians' WTP for Olympic medals far exceeded federal government spending to promote Canadian elite athletic success. Based on

Table 6. Probit Model Results and WTP Estimates: Dependent Variable = FORSURE.

Variable	Pre-Olympics		Post-Olympics	
	Parameter	Standard Error	Parameter	Standard Error
Intercept	0.327***	0.063	0.485***	0.061
TAX	−0.0086***	0.0017	−0.0055***	0.0009
Model χ^2	26.84***		36.04***	
Psuedo-R^2	0.014		0.017	
n	1,436		1,564	
Annual willingness to pay (WTP)	$38.19***	4.06	$89.70***	7.94
Aggregate annual WTP (millions)[a]	Upper bound	$477	Upper bound	$1,121
	Lower bound	$95	Lower bound	$247
Present value WTP (millions)[b]	Upper bound	$1,300	Upper bound	$3,053
	Lower bound	$260	Lower bound	$672

[a]For the upper bound figures, annual pre-Olympics household WTP and annual post-Olympics household WTP were multiplied by 12.5 million households, the number of Canadian households. The lower bound figures equal the upper bound figures times 20%before the Games and 22% after the Games, the response rates for the two surveys. This is equivalent to assuming that the WTP for people who did not want to answer the survey was $0. All dollar figures are expressed in Canadian dollars. [b]Discount rate is 5%.
***Indicates statistical significance at the 1% level.

about 12.5 million households,[6] aggregate ex ante WTP has an upper bound of $477 million, using data from the pre-Olympic survey. Because the hypothetical scenario called for a 3-year surcharge, the discounted total WTP based on the preliminary results from the pretest is roughly $1.3 billion.[7]

Due to our relatively low response rate, it is possible that our sample suffers from selection bias. In other words, those most interested in the Olympics were most likely to respond to the survey. Assuming survey nonrespondents have a WTP of zero, a more conservative estimate of aggregate WTP would be 20% of the estimates above, a present discounted value of about $260 million. This can be interpreted as a lower bound on total WTP. Even the lower bound estimates would be large enough to justify continuing the Own the Podium program at present levels of government funding.

The ex post average WTP leads to much larger aggregate WTP figures. After the Olympics, the average WTP per household leads to an ex post present value of aggregate WTP of $3 billion. This estimated WTP is slightly larger than the esti-mated WTP found by Atkinson et al. (2008) in the UK associated with hosting the 2012 Olympic Games in London, £2 billion, which was about C$3.1billion at the prevailing exchange rate during the post-Olympic survey period.[8] However, the Atkinson et al. (2008) WTP estimate is for hosting, while this estimate is for enhan-cing success in the games. Again assuming survey nonrespondents have a WTP of zero, this implies that the lower bound estimates for aggregate present value WTP after the Olympics increased to about $672 million.

The results in Table 6 clearly show a lack of stability in the CVM estimates of WTP, as could be expected. The estimated WTP for the Own the Podium program from both before and after the Olympics suggests that winning so many Olympic medals is a good experience. Canadians knew, because they had experienced disappointing medal counts in earlier Olympic Games, that they valued superior performances. But since they had never experienced such a showing, they could not accurately estimate just how much they really would be willing to pay until they could see how they felt after experiencing a record-setting gold medal count. Sussmuth et al. (2010) found a similar lack of stability in their CVM estimates of the value of hosting the 2006 World Cup in Germany. Another explanation for the increase in WTP is that before the Olympics there was likely some uncertainty about the Own the Podium program. With success in 2010, some of the uncertainty was likely resolved and WTP increased. Given that an increased WTP is a rational response to the positive experience of 2010, the instability in WTP estimates is consistent with temporal reliability.

The regression results in Table 6 allow an estimate of the average household WTP for a repeat of the 2010 medal performance in 2014, but they cannot be used to estimate the marginal value of another gold medal, nor can they identify motives for public goods or respondent characteristics correlated with WTP. For that, the other covariates listed in Table 4 were added to the probit models. Identical models were estimated using data from the pre-Olympic sample and the post-Olympic sample. The results appear in Table 7. There are many similarities between the two sets of results. Both before and after the Olympics, as the level of the tax increased, respondents were less likely to vote in favor of the proposal. The more gold and other medals respondents thought Own the Podium would generate, the more likely they were to vote for the proposal. Likewise, the higher their income, the more likely they were to support the referendum. People who agreed that Canada's world standing is affected positively by their Olympic medal count were more likely to vote in favor, as were people who were proud that Canada won the gold medal count. Canadians who were proud that Vancouver hosted the Olympics were more likely to vote in favor before the Olympics but not after.[9]

The pre- and post-Olympic probit regression results estimates in Table 7 allow estimation of the marginal values of gold and other medals won by the Canadian Olympic Team. Before the Olympics, respondents' marginal value of an additional gold medal was $10, while the marginal value of an additional silver or bronze medal was $4. After the Games, the marginal values rose to $28 and $19 for a silver or bronze medal. Not only did marginal values rise substantially, but the relative values of gold and other medals changed. Before the Games, respondents valued an additional gold medal more than twice as much as another silver or bronze. The gold and other medals regression coefficients are significantly different at the 5 percentage level. After the Games, gold medals were valued at about 33% more than silver and bronze and the regression coefficients are not statistically different. This could be due to the fact that Canada had the highest gold medal count but not

Table 7. Probit Model Results: Dependent Variable = FORSURE.

Variable	Pre-Olympics		Post-Olympics	
	Parameter	Standard Error	Parameter	Standard Error
Intercept	−2.87***	0.255	−5.02***	0.357
TAX	−0.0092***	0.0018	−0.0056***	0.001
GOLD	0.0905***	0.0078	0.158***	0.015
OTHMEDAL	0.0355***	0.0073	0.108***	0.014
INCOME[a]	0.0061***	0.0011	0.0059***	0.001
MISSINC	0.0773	0.109	0.175	0.110
PRESTIGE	0.244***	0.083	0.376***	0.102
PROUDHOST	0.568***	0.133	0.171	0.168
PROUDGOLD	0.333**	0.152	0.706***	0.128
BOTH	0.141*	0.074	−0.011	0.072
QUEBEC	0.223**	0.112	0.204**	0.113
ONTARIO	0.239***	0.106	0.227**	0.107
MANITOBA	0.485***	0.236	0.447**	0.210
SASKATCHEWAN	0.291	0.281	0.741***	0.255
ALBERTA	0.459***	0.146	0.400***	0.142
BRITISH COLUMBIA	0.300*	0.127	0.338**	0.122
Model χ^2	409.21***		420.97***	
Psuedo-R^2	0.206		0.197	
N	1,436		1,564	
WTP gold medals	$9.81***	2.11	$28.39***	5.68
WTP other medals	$3.85***	1.10	$19.43***	4.25

[a]If respondent did not answer, income was set equal to 0. MISSINC is equal to 1 if income is missing, 0 otherwise.
***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

the highest overall medal count at the Vancouver Games. After the Games, silver and bronze medals became relatively more valuable because Canadians felt that if they had won more silver and bronze medals, they would have had the highest overall medal count as well.

Canada ranked second in gold medals and third in total medals in the 2014 Sochi Winter Olympics. Increasing medals by two gold medals and seven silver or bronze medals would have made Canada first in both counts. According to our results (and extrapolating beyond the margin), this would have been worth $716 million in aggregate discounted present value, assuming that only survey respondents value medals.

Conclusions

We performed a CVM analysis of a sports mega-event in a novel context. Previous CVM studies of sporting events estimated the WTP for the presence of a team

or the hosting of a mega-event like the Olympic Games or the FIFA World Cup in a country. We focused on WTP for success, in terms of the host national team winning gold, silver, and bronze medals in the Olympic Games. Canada experienced little success when hosting previous Olympic Games in 1976 and 1988. In response to this lack of success, funding for elite athletes was increased in the run up to the 2010 Games in Vancouver to foster improved performance by Canadian athletes in those Games. In this sense, we analyzed the effects of a successful government-sponsored subsidization program, where the program has the ability to affect national pride and identity. Own the Podium appears to have generated substantial intangible benefits. A lower bound on the present value of aggregate WTP for the Own the Podium program was $260 million before the 2010 Vancouver Olympics and increased to about $672 million after the Olympics. Achieving enough gold and other medals to make Canada first in both counts at the Sochi Winter Olympics would have been worth $716 in aggregate discounted present value after the 2010 Vancouver Olympics.

Our results confirm that CVM estimates of the intangible benefits generated by a sports mega event show a lack of stability with a significant intervening variable. Sussmuth et al. (2010) found that the WTP estimates from hosting the FIFA World Cup increased substantially after the Cup. We find that the WTP estimates from medal success increased substantially after the Games after improved medal success and increased national pride and changing attitudes about medal success. Our results suggest that CVM estimates of WTP should be assessed carefully, since the estimates generated may change with significant changes in intervening variables.

Our results suggest that Canadians believed, even before the 2010 Vancouver Olympics, that the intangible benefits generated by the Own the Podium program far exceeded the costs of operating the program. Their experience with the 2010 Winter Olympics caused them to reassess and conclude that the benefits were even higher than they previously expected. In the small but growing CVM sports literature, no other examples of the WTP for sports public goods unambiguously exceeding the cost of the subsidies granted have been found, much less an example of benefits of a multiple of two to six times costs. Seeing the national team succeed at unprecedented levels seems to generate significantly greater net intangible benefits than does winning the rights and then hosting a sports mega event.

Do the results mean that the policies aimed at improving the performance of elite athletes pursued by the Canadian government are economically efficient? Not necessarily. While respondents were told to consider alternative uses of their own tax dollars, they were not asked whether they value alternative uses of their aggregate tax dollars by more than they value Olympic medals. There is also a broader question that we did not address. While Own the Podium certainly aided Canadian athletes, there is no evidence that Own the Podium increased the Canadian medal count. Concluding that Own the Podium led to a higher medal count risks the fallacy of post hoc ergo propter hoc ("after this, therefore because of this"). Even if Own the Podium led to more medals in the 2010 Games, that program is Canada's response to

an international arms race. As such, it is a product of a prisoner's dilemma-type game where countries compete for a fixed number of gold medals by spending more and more on elite athletes. The results here should not necessarily be used to justify additional spending to enhance the performance of elite athletes in other countries. All parties would be better off ending the race, since returns to this type of spending will diminish quickly if other countries adopt a similar policy.

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Notes

1. Other benefits include reduced health-care costs associated with Canadians becoming inspired by the athletic performances of elite athletes and becoming more active themselves.
2. A notable exception is Fenn and Crooker (2009) who found that the benefits of keeping the Minnesota Vikings in the state roughly equaled the cost of a new stadium.
3. These sections of the survey are available in online appendix.
4. These percentages are not statistically different for those respondents who answered both surveys.
5. Eighty-eight percent were in favor before adjusting for certainty.
6. According to Statistics Canada, based on the 2006 census.
7. We use a discount rate of 5%.
8. At the average exchange rate in April 2011, between sterling and Canadian dollars, as reported by the Bank of Canada.
9. The parameter estimates on some variables were statistically insignificant both before and after the Olympics. Respondents' self-reported state of health, life satisfaction, employment status, marital status, age, and education level had no statistically significant relationship to their willingness to vote for the proposal. Nor was planned or actual attendance at the Olympics a factor, implying that enjoyment of Canadian medal success is in no way diminished or enhanced by viewing it in person.

Supplemental Material

Supplementary material for this article is available online.

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