

# Predicting the medals for the 2018 Gold Coast Commonwealth Games



## Can Australia Take Back the Top Spot?

**Australia has historically been a Commonwealth Games powerhouse, but 2014 saw the motherland regain dominance with England amassing 37 more medals than Australia. Will this continue? Or will the Gold Coast be friendlier to the Green and Gold?**

The 2018 Commonwealth Games is being hosted by the City of Gold Coast, Australia. More than 6,600 athletes and officials are expected to attend the games from 70 Commonwealth nations and territories. It is expected that the event will attract 1.1 million visitors in the lead up to, during and after the Commonwealth Games, leading to spending of more than \$870 million in Queensland.

To understand how Australia as a team may fare at the games, NineSquared has applied its econometric and analytics expertise to assess our chances.

## Medal History

Historically, Australia has dominated the Commonwealth Games. In each of the six Commonwealth Games between 1990 and 2010 (inclusive), Australia led the overall medal count. Glasgow 2014, however, saw England not only awarded with more overall medals, but more of each medal. That is, England won more gold, more silver and more bronze medals than Australia.

While England did not host the 2014 Games, their proximity to Scotland may have played a part. At the Olympics, England and Scotland, along with Wales, compete as one under Great Britain, so labelling the Glasgow Commonwealth Games as a 'home' event for England may not be out of the question.

Will Australia be able to return to dominance? Will England be able to keep the Commonwealth Games crown? Or will another nation emerge and challenge for the top spot?

To answer this question, NineSquared has conducted a statistical analysis of previous events to predict the total medal count by country for the 2018 Games.

## Literature Review

A large amount of research has been conducted about medal count predictions for the Olympic Games, both summer and winter. These analyses cover a range of statistical tools, such as neural networks<sup>1</sup>, data envelopment analysis modelling<sup>2,3,4</sup>, and efficiency analysis<sup>5</sup>. But by far the most prevalent method is econometric analysis<sup>6,7,8,9</sup>.

These analyses link medal counts to a variety of country specific factors, such as gross domestic product and population. By analysing these factors over a long enough time series, trends and correlations begin to emerge, which have the potential to have predictive power.

While extensive study has been undertaken on the Olympics, the same cannot be said of the Commonwealth Games. To fill this hole in the market in the lead up of the 2018 Gold Coast Commonwealth Games, NineSquared have conducted an econometric analysis of the 6 Games that were held between (1994) Melbourne and Glasgow (2014).

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<sup>1</sup> Condon, Edward, Bruce Golden, and Edward Wasil. 1999. "Predicting the Success of Nations At the Summer Olympics Using Neural Networks," *Computers & Operations Research*, 26, 1243-1265.

<sup>2</sup> Lins, Marcos, Eliane Gomes, Joao de Mello, and Adelino De Mello. 2003. "Olympic Ranking Based on a Zero Sum Gains DEA Model," *European Journal of Operational Research*, 148, 312-322.

<sup>3</sup> Lozano, S., G. Villa, F. Guerrero, and P. Cortes. 2002. "Measuring the Performance of Nations at the Summer Olympics Using Data Envelopment Analysis," *The Journal of the Operational Research Society*, 53, 501-511.

<sup>4</sup> Wu, Jie, Liang, Liang, and Yao Chen. 2009. "DEA Game Cross-Efficiency Approach to Olympic Rankings," *Omega*, 37, 909-918.

<sup>5</sup> Rathke, Alexander and Ulrich Woitek. 2008. "Economics and the Summer Olympics: An Efficiency Analysis," *Journal of Sports Economics*, 9, 520-537.

<sup>6</sup> Lui, Hon-Kwong and Wing Suen. 2008. "Men, Money, and Medals: An Econometric Analysis of the Olympic Games," *Pacific Economic Review*, 13, 1-16.

<sup>7</sup> Bernard, Andrew and Meghan Busse. 2004. "Who Wins the Olympic Games: Economic Resources and Medal Totals," *The Review of Economics and Statistics*, 86, 413-417.

<sup>8</sup> Hoffman, Robert, Lee Chew Ging, and Bala Ramasamy. 2004. "Olympic Success and ASEAN Countries: Economic Analysis and Policy Implications," *Journal of Sports Economics*, 5, 262-276.

<sup>9</sup> Bredtmann, Julia, Crede, Carsten and Otten, Sebastian. 2016. "Olympic medals: Does the past predict the future?," *The Royal Statistical Society*, June, 22-25.

Historically, Australia has dominated the Commonwealth Games, both in respect to the total number of medals won as well as the number of gold medals won. However, the 2014 Glasgow Games saw England take the mantle winning 174 medals to Australia's 137

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## Econometric Analysis

Prior to conducting any analysis, a range of data was collected for each of the 70 nations in the 2018 Games. Data includes past Commonwealth Games performance, past Olympic performance, historic changes in Gross Domestic Product and population, socioeconomic factors and political systems.

As a starting point, two simple models were estimated using ordinary least squares. The form of these models are as follows:

$$1. M_{i,j} = \gamma_0 + \gamma_1 Population_{i,j} + \varepsilon$$

$$2. M_{i,j} = \gamma_0 + \gamma_1 GDP_{i,j} + \varepsilon$$

Where:

- $M_i$  = Medals won in year  $i$  by country  $j$
- $\gamma_x$  = Model coefficient
- $Population_{i,j}$  = Population in year  $i$  by country  $j$
- $GDP_{i,j}$  = Gross Domestic Product in year  $i$  for country  $j$
- $\varepsilon$  = Error term.

While these models demonstrated that population and GDP are significantly correlated to the number of medals a country wins, the explanatory power of these models is poor. To address this, other factors were included in the model to improve the predictive power. This resulted in three alternative models being devised which not only had significant correlation between the variables, but explanatory power in with respect to total medals. The functional form of these models includes:

$$3. M_{i,j} = \gamma_0 + \gamma_1 \ln(GDP_{i,j}) + \gamma_2 Comm_{i-4,j} + \gamma_3 Host_{i,j} + \varepsilon$$

$$4. M_{i,j} = \gamma_0 + \gamma_1 \ln(GDP_{i,j}) + \gamma_2 Olympics_{i-2,j} + \gamma_3 Host_{i,j} + \varepsilon$$

$$5. M_{i,j} = \gamma_0 + \gamma_1 \ln(GDP_{i,j}) + \gamma_2 Comm_{i-4,j} + \gamma_3 Olympics_{i-2,j} + \gamma_4 Host_{i,j} + \varepsilon$$

Where:

- $M_{i,j}$  = Medals won in year  $i$  by country  $j$
- $\gamma_x$  = Model coefficient
- $GDP_{i,j}$  = Gross Domestic Product in year  $i$  for country  $j$
- $Olympics_{i-2,j}$  = Olympic medals won by country  $j$  in the 2 years prior to year  $i$
- $Commonwealth_{i-4,j}$  = Commonwealth Games medals won by country  $j$  in the 4 years prior to year  $i$
- $Host_{i,j}$  = Dummy variable indicating if country  $j$  is the host of the Games in year  $i$
- $\varepsilon$  = Error term.

While some of these factors may not have a direct impact on an athlete's performance, they act as representations of factors which do have an impact. This means the interpretation of the inputs and their interaction with the output is important. For example, GDP does not directly impact an athlete's ability, but it is a representation of the availability of leisure time, professional support and exposure to sport<sup>10</sup>.

The three models presented account for between 89% and 94% of the variation in medal totals over the analysis period. Additionally, each of the input variables are significantly correlated to medal totals. Including both historic Olympic and Commonwealth Games performance.

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<sup>10</sup> Bredtmann, Julia, Crede, Carsten and Otten, Sebastian. 2016. "Olympic medals: Does the past predict the future?," The Royal Statistical Society, June, 22-25.

## Medal Predictions

*While Australia is the favourite for gold medals with the bookies, the analysis shows that England are a solid chance of an upset.*

The NineSquared prediction of the top 10 countries at the Gold Coast 2018 Commonwealth Games is displayed below.

A range of outcomes is provided based on the different econometric models discussed in the previous section. Only under one model specification does Australia total more medals than England. This year, it is predicted that 771 medals will be won, approximately 50 less than the 2014 Games. The analysis has been rebased to reflect the changes in medal totals over time. The inclusion of past Olympic medals

favors England, due to Great Britain's strong performance at the Rio Olympics. However, when Olympic performance is excluded, the shift of host nation away from Great Britain to Australia sees the Green and Gold take a small medal lead (141 to 144).

While this does not look great for Australia, it provides a bit of hope that Australia can re-take the crown as leading Commonwealth Nation.

Table 1: Predicted Gold Coast 2018 Commonwealth Games

Rank	Country	Predicted Medals	Range (Low to High)
1.	England	163	141 - 177
2.	Australia	143	134 - 144
3.	Canada	81	69 - 95
4.	New Zealand	54	38 - 76
5.	Scotland	52	44 - 59
6.	India	42	23 - 54
7.	South Africa	39	34 - 48
8.	Kenya	36	22 - 55
9.	Wales	36	31 - 42
10.	Jamaica	30	18 - 44

While the modelling may be disappointing news to Australian supporters, we still predict Australia is forecast to win a larger share of medals than occurred in Glasgow. Of course, no model is perfect, and Australia may still top the medal tally. We are confident of one thing though - the Commonwealth Games are going to be great. Good luck to all the athletes.

Go Australia!

# About NineSquared

NineSquared is a specialist economic consulting and commercial advisory firm focused on helping governments and companies make great decisions to achieve your goals and objectives. (We also love a bit of sport).

Our principals and staff are experienced, senior level practitioners who have worked in and advised government and private sector clients about a range of commercial and economic issues, primarily relating to transportation. Broadly, our expertise lies in the fields of transport and regulatory economics, policy development and analysis and advising on commercial arrangements between government and the private sector as well as arrangements between companies operating within regulated environments.

Our combined public and private sector experience means that we are well placed to provide our clients with deep understanding of both the public and private sectors and the interface between them.

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