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# Assignment 1

**Defined problem statement:** The effect of economic and demographic factors, such as GDP per capita and population size, on the number of Olympic medals countries achieve, and how differences in economic strength may influence overall Olympic success.

**Why We Chose This Project and Summary of Our Idea:**

We chose this project because we thought it would be interesting to see if money and population size explain how countries do in the Olympics. A lot of people just assume that richer countries always win more, but after looking at different papers, we saw that it's not just about being rich — richer countries usually have more resources to invest in sports, which helps them perform better. We wanted to take a closer look at this idea and see how much economic strength really matters when you also think about how the money is used. Plus, it's a topic that connects real-world events with numbers and data, which made it a good fit for us.

Our project is about checking how things like GDP and population affect the number of medals countries win. We're not trying to build a complicated model — we're more focused on comparing what different studies found and trying to put the big picture together. In the end, we want to understand better which factors really make a difference.

**Datasets:**

**1. 120 Years of Olympic History: Athletes and Results**

(Link: https://www.kaggle.com/datasets/heesoo37/120-years-of-olympic-history-athletes-and-results)

This dataset includes historical data for the Summer and Winter Olympics from 1896 to 2016. It has 271,116 rows and 15 columns, where each row represents an athlete's participation in an event. Columns include athlete ID, name, sex, age, height, weight, team, NOC code, year, season, host city, sport, event, and medal won (if any).

**2. GDP by Country (1961–2022)**

(Link: https://databank.worldbank.org/source/world-development-indicators#)

This dataset provides GDP data for every country from 1999 to 2022, measured in billions of US dollars. Each row is a country, and each column represents a year, allowing easy comparison of economic changes across countries over time.

**List to papers:**

Predicting Olympic Medal Counts: the Effects of Economic Development on Olympic Performance – Xun Bian,University of North Texas (2005)
Link:https://www.researchgate.net/publication/28328103_Predicting_Olympic_Medal_Counts_the_Effects_of_Economic_Development_on_Olympic_Performance

“The (Non) Determinants of Olympic Success” – Johan Rewilak, University of South Carolina (2021)
Link:https://www.researchgate.net/publication/349535025_The_non_determinants_of_Olympic_success

"Who Wins the Olympic Games: Economic Resources and Medal Totals" - Bernard & Busse (2004)
Link:https://www.researchgate.net/publication/24095908_Who_Wins_the_Olympic_Games_Economic_Resources_and_Medal_Totals

"Team Payroll Versus Performance in Professional Sports: Is Increased Spending Associated with Greater Success?" – Arcidiacono,Kimbrough , Duke University (2017)
Link: https://sites.duke.edu/djepapers/files/2017/06/grantshorin-dje.pdf

*"Olympic Success and ASEAN Countries: Economic Analysis and Policy Implications*"- Robert Hoffmann, Lee Chew Ging, Bala Ramasamy, Journal of Sports Economic (2004)
Link:https://www.researchgate.net/publication/247739538_Olympic_Success_and_ASEAN_Countries_Economic_Analysis_and_Policy_Implications

**The following are summaries of the papers:**

Summary of "Predicting Olympic Medal Counts: The Effects of Economic Development on Olympic Performance"

This paper investigates how socioeconomic variables affect nations' Olympic medal counts. The author, Xun Bian, analyzes data from four Olympics (1988-2000) using two models: a linear function* and a Cobb-Douglas production function**.

The research examines four key factors hypothesized to influence Olympic success: population size, economic resources (GDP per capita), political/economic structure (socialist background), and hosting advantage. The findings indicate that all four factors have a significant impact on medal counts in most of the Olympics examined.

Key findings confirm that larger populations and greater economic resources correlate positively with Olympic success, which measured in number of medals (not distinguishing between bronze, silver and gold medals).. Having a socialist political background and hosting the Olympics both provide significant advantages. The author found evidence of diminishing marginal returns for population and economic resources, though multicollinearity between these variables required model adjustments.

The paper acknowledges limitations in using cross-sectional data, which makes predicting future performance difficult since coefficients vary between Olympics. For future research, the author suggests including countries with zero medals using probit models, considering medal shares rather than counts, and incorporating cultural factors like political freedom indices.

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* $Medals = Constant + (Population \times coefficient) + (GDP\ per\ capita \times coefficient) + (Socialist\ dummy \times coefficient) + (Host\ dummy \times coefficient)$

** $ln(Medals) = Constant + \alpha_1\, ln(Population) + \alpha_2\, ln(GDP) + \alpha_3(Socialist\ dummy) + \alpha_4(Host\ dummy)$

As seen in page 40 of the article.

“The (Non) Determinants of Olympic Success” – Johan Rewilak (2021)

Main Objective:

The paper reexamines the main factors behind national success at the Summer Olympics (1996–2016), focusing on the role of GDP per capita and whether it remains a key predictor after accounting for unobservable, country-specific traits.

Methodology:

Using a panel Tobit model with the Mundlak transformation to control for fixed effects, the author also applies Cragg and Heckman hurdle models to distinguish between achieving Olympic success and its magnitude.

Key Findings:

Once time-invariant country characteristics are controlled for, GDP per capita is no longer a significant predictor of Olympic success. Population size and being the host country are the only consistently significant factors. Hurdle model results show that population affects the likelihood of success, while hosting influences both the probability and extent of success. The hosting effect is equally strong for both genders, while population size plays a larger role in female performance.

Limitations and Future Work:

The study highlights challenges in identifying causality and recommends using more detailed, sport-specific data to better understand the mechanisms behind Olympic success. Improved data on funding and infrastructure could enhance future analyses.

Bernard & Busse (2004) – "Who Wins the Olympic Games: Economic Resources and Medal Totals"

**Objective:**
The paper investigates the economic and demographic factors that influence a country's success in winning Olympic medals.

**Methodology:**
The authors develop a production function model using population and GDP per capita as inputs, assuming that both athletic talent and the resources to train athletes affect medal outcomes. A Tobit regression is used to estimate medal shares from 1960 to 1996. The model includes variables for host status and former Soviet/planned economies to assess their impact beyond economic indicators.

**Key Findings:**
•Both population and GDP per capita significantly influence medal counts, with total GDP being the best single predictor.
•Host countries enjoy an average "bonus" of 1.8 percentage points in medal share.
•Soviet and Eastern Bloc countries consistently overperformed relative to their GDP, likely due to centralized investment in sports.
•Past medal performance also predicts current success, showing persistence in Olympic capability.
•Out-of-sample predictions for the 2000 Sydney Olympics were highly accurate ($R^2$ = 0.96).

**Limitations/Future Work:**
The model excludes factors like political systems, culture, or sport-specific investments due to data limitations. The authors suggest refining prediction accuracy by incorporating more detailed socioeconomic and policy variables.

# Team Payroll Versus Performance in Professional Sports: Is Increased Spending Associated with Greater Success?

This paper analyzes data from 1995–2015 across MLB, NBA, NHL, and NFL to assess whether higher team payrolls translate into better outcomes.

In the regular season, each one-standard-deviation increase in payroll boosts a team's winning percentage by roughly 2.3–5.4 points and yields stronger Simple Rating System (SRS) scores—an advanced metric that adjusts for margin of victory and strength of schedule. The effect is notably larger in MLB, NBA, and NHL than in the cap-strict NFL.

For postseason success, a one-SD payroll rise nearly doubles the odds of winning a championship in the NBA and NHL, with no significant impact in the NFL.

On the financial side, increased payroll spending generally reduces operating income, indicating that revenue gains seldom fully offset higher player costs. Thus, while money "buys" more on-field success in most leagues, it often comes at the expense of short-term profitability.

*Olympic Success and ASEAN Countries: Economic Analysis and Policy Implications*
**Authors**: Robert Hoffmann, Lee Chew Ging, Bala Ramasamy

**Main Objective**:
The goal of this paper is to understand what affects how well countries do in the Olympics, especially why ASEAN countries didn't do so well in the 2000 Sydney Games. The authors look at several things like how rich the country is (GNP), how big the population is, and also political and cultural factors. This is useful for my project since I'm also looking at the connection between the economy and Olympic medals.

**Methodology**:
They used data from the 2000 Olympics and did a regression analysis to check how different factors like GNP, population, and others affect medal counts.

**Key Findings**:

- Countries with higher GNP usually win more medals, which supports the idea that being richer helps in the Olympics.
- Bigger population also plays a big role.
- The low medal counts for ASEAN countries can be explained a lot by their lower GNP and smaller population compared to more successful countries.
- Even though higher GNP helps, the paper says that just getting richer won't suddenly make countries win a lot more medals unless they also support sports in other ways.

**Limitations and Future Work**:
The authors say that while GNP and population are important, they don't explain everything. They suggest that future studies could look more into how countries actually spend money on sports and how that affects their Olympic results over time.