



WORLD CUP MATHS 1: EQUAL OPPORTUNITY?

Age Range: 8–14

(See 'Making it easier/ harder')

Time: 40 min

Overview: This is the first of three activities in this Maths themed part of the scheme. It looks at the countries taking part in the tournament and uses fractions to express the chances of different teams winning. Pupils then move on to look at FIFA rankings and use the language of probability to assess how likely different teams are to win the tournament. Finally, pupils discuss the reasons behind why some teams are more likely than others to win, linking this to football but also wider issues related to resources available to a country, before asking if this is fair.

Key Curricular Links

England

- 7-11: Decide which representations of data are most appropriate and why.
- 11-14: Describe, interpret and compare observed distributions of a single variable.

Wales

- 7-11: Draw conclusions from data and recognise that some conclusions can be uncertain.
- 11-14: Draw inferences from statistics and recognise that some conclusions of data can be misleading.

Scotland

- Numeracy and Mathematics: Decimal fractions - informed choices for real-life situations.

Resources:

- World Cup Maths PowerPoint Slides 2–10.

Learning Objectives:

- Understanding how to use fractions and probability statements.
- Assessing if each team has an equal chance of winning the World Cup.
- Deciding if this is fair or not based on what makes teams more or less likely to win.

Learning Outcomes

- Use fractions to decide how equal the chances of different teams winning the World Cup are.
- Use FIFA rankings to make probability statements about teams' chances.
- Think critically about why teams are successful using football and non-football reasons.

Key Questions

Who is most likely to win the World Cup?
Why? Is that fair?

Keywords

Chance Equal Opportunity Unequal Inequality

Introduction: (10 min)

Introduce the activity by explaining they will be considering if the World Cup really is a fair playing field (slides 2–4). Although the rules of football are the same for everyone, does every team have an equal chance of winning? They will be using probability to examine this, and then ask why it is the case.

Use the 3 true/false statements to introduce the idea of probability as statements or fractions in relation to the World Cup using slide 3. Check that pupils are happy with these ideas. They will probably know the answers, but explain they will check the answers to all 3 statements using their maths through the activity.

Main activity: (20 min)

1. Probability using fractions (slide 4–6)

Display the country flags of all World Cup countries. Which ones can pupils identify?

Ask pupils if they can work out, as fractions of an amount, how likely each country is to win.

Now using the same idea, ask pupils to answer probability questions on PowerPoint slide 6, and then discuss answers.

Do the fractions suggest every team has an equal chance of winning?

2. Probability using statements (slide 7–8)

Now pupils will look at the FIFA rankings of teams in the World Cup. This will suggest that the chances of success are not equal. Using FIFA rankings, pupils will use the language of probability to make 'probability statements' on how likely individual teams/groups, or teams from different continents are of winning the World Cup, backed up by FIFA ranking evidence.

Display slide 8 with the FIFA rankings (1 = highest). Use slides 8–9 to help them make probability statements with words such as *more likely* or *certain* using the FIFA rankings as evidence.

Feedback and discuss statements.

Ask the question again, does every team have an equal chance to win? Consider also not just individual teams, but also teams from different continents (e.g. Europe vs. Africa)

NOTE – there are more European teams in the competition as FIFA allocates them more places. However, European teams also have higher rankings than, for example, African teams. As an extension you could ask pupils to calculate the average rankings of teams per continent.

Thinking activity: (10min)

Pupils will have established used the FIFA rankings that certain countries, or teams from certain continents, have a better chance of winning than others. Now they will think about why.

Use slide 9 to help pupils think about the football (star players, good manager etc.) and non-football reasons (better training resources, better pay, more money invested in the domestic leagues). Use the question 'why' repeatedly to help interrogate their thinking.

Pupils should establish a variety of non-football reasons. Ask pupils if they think that is fair.

They will move onto considering this in more detail in the next activity.

Making it easier:

- You could just focus on 2 or 3 of the probability questions on slide 6.

Making it harder:

- You could ask pupils to express their probabilities as percentages and decimals, not just fractions.

Further ideas

You could use a **why-why-why chain** to deepen the discussion. See p.8 of *Getting started with Global Citizenship* here:

<http://www.oxfam.org.uk/education/global-citizenship/global-citizenship-guides>



WORLD CUP MATHS 2: COMPARING WEALTH

Age Range: 8–14

(See 'Making it easier/ harder')

Time: 1 hour

Overview: This is the second of three Maths activities. Pupils will compare the wealth (or income) of World Cup countries to analyse if the teams come from generally higher or lower income countries. They will explore this using fractions and percentages, and represent the data using bar or pie charts, before considering the inequality between World Cup country incomes using ratios. This reveals that the richer countries have 25x more income than the poorest. They will then consider why no low income countries are playing in the World Cup, leading them to ask questions about how a country's wealth affects its performance at football, and if this is fair.

Key Curricular Links

England

- following a line of enquiry, conjecturing relationships and generalisations, and (11-14) develop an argument.

Wales

- Search for patterns in results.
- Make and investigate conjectures.
- 11-14: Appreciate the difference between mathematical explanation and experimental evidence; recognise inconsistencies and bias.

Scotland

- Numeracy and Mathematics: Decimal fractions - informed choices for real-life situations.

Key Questions

- How wealthy are the World Cup countries?
- Can we find patterns about wealth around the world?

Keywords

Unequal Inequality Income Wealth

Resources:

Activity 1:

- World Cup Maths PowerPoint slides 11-28.
- World Cup Country Incomes map and tally sheet.
- 4 x colour pencils per pupils.

Activity 2/ Extension:

- World Cup Statistics sheet.

Learning Objectives:

- Use tallies, fractions, percentages and ratios to compare the incomes of the World Cup countries.
- Use bar or pie charts to display information about the wealth of World Cup countries.
- Use ratios to understand that the wealth of the world is unfairly distributed.

Learning Outcomes:

- Identify a relationship between a country's position in the world and the likely wealth that country has.
- Discuss what global inequality means and the likely implications of this for people living in poorer countries.
- Make generalisations about global income distribution



Starter activity (10min)

Explain that in the last activity, pupils saw that some countries have a higher chance of winning the World Cup than others, and began to look at why. They will now look at countries' incomes to begin to think more about the non-football reasons for this.

Explain that there are huge differences between countries' wealth. An organisation called The World Bank pays close attention to this. They lend money to different countries, and calculate countries' 'income', which they work out as an average per person to be able to compare countries with more or fewer people. To calculate it they add up the total amount of money being made in that country over the year. They then divide this by the number of people in the country. They do this calculation in dollars so they can compare all countries fairly.

This is called the GDP per capita, which you can just call the 'income per person' in the country. They then classify countries into different groups depending on their income.

1. Discuss the term income and the four classifications (slide 12). Ask the pupils which classification they think each of the countries shown are. Why? Discuss their answers. Were there any surprises?
2. Now show pupils the 32 country incomes (per person) from the countries in the World Cup. Can they guess which belong to which countries? Which do you think belong to which country? Can they spot the highest and lowest? Which is the UK? Which is Brazil?
3. Introduce the word **inequality** as the difference between the resources available to 2 different groups.

Activity 1: (40 min)

Part 1 – Where are most of the high income countries?

1. Show pupils the world map sheet with the country incomes (per person) of the World Cup countries. Discuss why Europe has been enlarged (because the countries are relatively small and it is difficult to see them all clearly).
2. Using the income boundary classifications shown on the map, pupils can also use coloured pencils to shade in the world map to show income group of each World Cup country, using a different colour for each income group.
3. What do they notice about the map? Where are most of the richer countries? Explain that countries towards the Northern hemisphere (North America, Europe) are often called 'developed' countries, and countries towards the Southern hemisphere are often called 'developing' countries.

Part 2 – Inequality in wealth in the World Cup

1. Now using the tally table, ask pupils to make a tally for each income group.
2. How many are in each group? Ask pupils to work this out as a fraction (out of 32) and then a percentage.
3. What do they notice? Are the World Cup countries generally wealthy or poorer? Did they notice that there are no low income countries playing at all?
4. You could ask pupils to make a bar or pie chart of this to **add to their World Cup Fairness Display**.
5. Lastly, can they work out how much more money the richest countries in the World Cup have compared to the poorest? They can use the 'global ratio's worksheet' to help do this as a ratio.
6. They should find an average of 66,000 to 1,300 is 66:1.3 or $(66/1.3 = 50.1)$ 50:1. Therefore the richest countries have **50x** as much money per person as the poorest. This is a measure of income inequality in the World Cup.
7. Do they think this is fair?

Part 3 – Why are there no low income countries?

1. Use slides 16–19 to explore why teams from poorer countries may find it harder to compete. The example is looking at teams in Africa where (relatively) wealthier countries have more footballing success.
2. Use the example to explore why, linking income to success via direct support for football



(wealthier teams, better facilities) and indirect support (better schools and healthcare to help support young players).

3. Also use this to point out to pupils that countries in Africa vary a lot – and there are richer and poorer countries here too.

Thinking activity (10min)

1. What have pupils found? Support pupils to make statements using slides 20–22 to help. Pupils write down statements on mini-whiteboards / rough paper with a partner, discuss whether they agree or disagree and feedback. E.g.
 - Most of the High-Income Countries are in Europe.
 - A country is more likely to compete in the World Cup if it is in Europe.
 - The money a country has the more likely it is to take part in the World Cup.
 - Income inequality in the World Cup is very high.
2. Once pupils have decided on their statements, they can copy their statements onto their World Cup Display Flags (slide 26) to add to their **World Cup Fairness Display**.
3. Have a discussion over whether they think it is fair that different countries have more or less resources than others, both to compete at football but also in life more generally. What is the impact on people that the world is unequal in this way?

Making it easier:

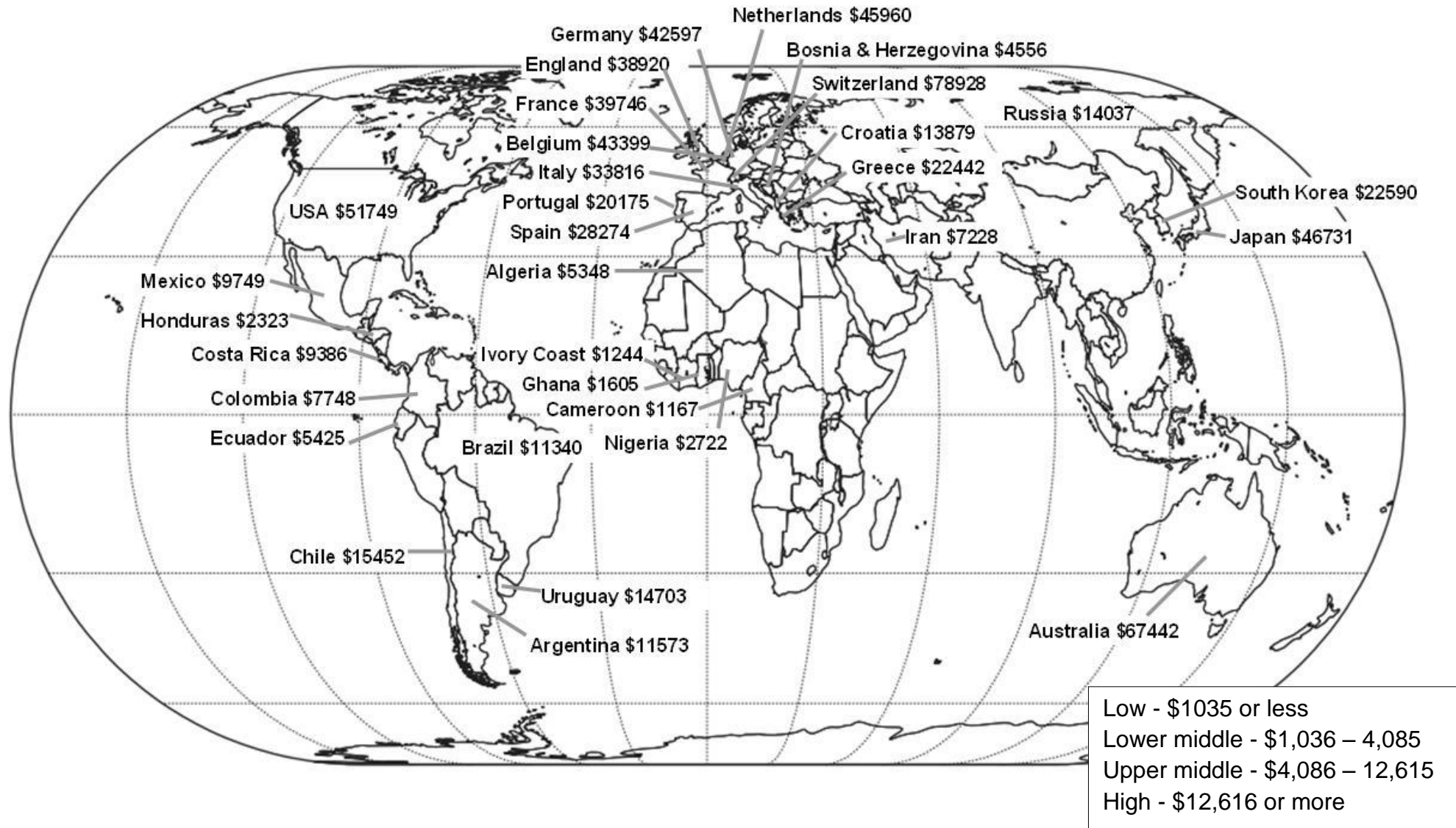
- Only ask pupils to compare tally totals rather than fractions/percentages/ratios.

Making it harder:

- Ask pupils to compare ratios of specific teams playing in different groups to find the largest income inequality ratio per scheduled game.
- Find the average players salary for players in world cup teams and calculate inequality ratios on this.

Further ideas

- Pupils can complete the extension activities on slides 27 and 28.



Background map source: http://www.geography.org.uk/downloads/GA_REMapsEckertIV.pdf

WORLD CUP COUNTRY INCOMES

First choose four colours, one for each income group. Shade in each country with the correct colour on the map. What do you notice about where most of the higher income countries are?

Next make a tally to show how many World Cup countries fit into each income group. What do you notice about the income levels of the World Cup countries?

Income Group	Colour	Tally	Total	Fraction	Percentage
Low Income Country: \$1,035 or lower					
Lower-Middle Income Country: \$1,036 – \$4,085					
Upper-Middle Income Country: \$4,086 – \$12,615					
High Income Country: \$12,616 or more					

WORLD CUP INEQUALITY RATIOS

Can you compare the average incomes per person of the 3 highest income countries in the World Cup to the average incomes per person of the 3 lowest income countries?

If so, how much more money per person do the richest countries have, on average, versus the poorest countries in the World Cup? Is that fair?

Top 3 average incomes per person per year (\$)

SWIT	78,928
Aus	67,442
USA	51,749

Average (\$)

Rounded to nearest hundred (\$)

Bottom 3 average incomes per person (\$)

Ghana	1,605
Ivory Coast	1,244
Cameron	1,167

Ratio of higher income to lower income country =

WORLD CUP INEQUALITY RATIOS – ANSWER SHEET

Can you compare the average incomes of the 3 highest income countries in the World Cup to the average incomes of the 3 lowest income countries?

If so, how much more money per person do the richest countries have versus the poorest countries in the World Cup? Is that fair?

Top 3 average incomes per person per year (\$)

SWIT	78,928
Aus	67,442
USA	51,749

Average (\$)

66,039.67

Rounded to nearest hundred (\$)

66,000

Bottom 3 average incomes per person (\$)

Ghana	1,605
Ivory Coast	1,244
Cameron	1,167

1,338.67

1,300

Ratio of higher income to lower income country =

66 : 1.3

As $66 / 1.3 = 51$

Therefore the same as **51:1**

or **51x higher income**

WORLD CUP MATHS 3: FAIRNESS SCORES

Age Range: 8–14

Timing: 1 hour + 30 min extension

Overview: This is the third of three activities in this Maths themed part of the scheme. This activity looks at how fair individual countries playing in the World Cup are using fairness scores for each country, which measure inequality within a nation. Pupils work with decimal numbers to order, find mean scores and then consider if the World Cup countries are generally fair or not. As an extension, plot bar or line graphs to explore relationships between FIFA rankings, wealth and fairness.

Learning Objectives:

- Use decimal numbers, mean of numbers and organising data, and plotting graphs.
- Compare and discuss fairness within countries.
- Work with real life data to draw conclusions.

Learning Outcomes:

- Make comparisons using data about inequality in World Cup countries.
- Use real life data to understand the world.
- Plot graphs and make comparisons using real data.

Key Questions:

- How equal are people within different countries?
- Which countries are more unequal?
- Which countries are more equal?

Resources:

- World Cup Maths PowerPoint
- Top Trumps cards
- Fairness Scores pupil sheets
- World Cup Statistics table
- World Map Worksheet (for challenge activity)

Key Curricular Links

England

- Compare numbers with the same number of decimal places up to two decimal places.
- Find the mean of a group of decimal numbers.
- Interpret data and present on a bar chart using complex scales.

Wales

- Search for patterns in results.
- Make and investigate conjectures.
- 11-14: Appreciate the difference between mathematical explanation and experimental evidence; recognise inconsistencies and bias.

Scotland

- Numeracy and Mathematics: Decimal fractions - informed choices for real-life situations.

Before the activity (15 min)

Top Trumps

Either as a whole class, or in groups of 4, play World Cup Top Trumps.

You will find this in the **introductory activities** to this World Cup resource so you will find the cards and instructions there.

Use this as an opportunity to remind them about country fairness scores.

Activity 1: (30 min)

- **Fairness scores (slides 31–34)**

To remind pupils about fairness scores and how they are calculated, use slides 31–34

Remind them that this is to look at income inequality within a country.

Ensure you explain that no country is either 1 or 0, but somewhere near the middle.

However, there are still quite large variations, showing some countries are much more unequal than others.

Ask pupils to plot the 4 examples. This requires them to use decimal numbers.

- **Fairness Winners (slides 35–36)**

Use the World Cup Statistics excel sheet and distribute the fairness scores for each country to pupils.

Split pupils into 8 groups, and allocate 1 World Cup group (A–H) to each one.

Pupils use the worksheet to order the equality score for their group, and then find the mean (average) for their group.

Then pupils can compare and contrast the averages for each group, and find the fairest and unfairiest groups and countries.

- **Drawing conclusions**

First in their groups using the worksheet, and then as a class, discuss what comments you are able to make from ordering the data. E.g.

The most equal country is _____

The most unequal countries are _____

The most equal world cup group is _____

Pupils can use these statements for their **World Cup Fairness Display**.

Extension (30 min) – Optional

Comparing data using graphs by using the World Cup Statistics Table and slides 37–39

Pupils choose two sets of data to compare in a scatter chart to explore relationships.

This could be:

1. Country Incomes and FIFA Rankings: Do wealthier countries have higher FIFA rankings?
2. Country Incomes and Equality Scores: Do more wealthy countries more equal?
3. Equality scores and FIFA rankings: Do more equal countries have higher FIFA scores?

See copy of scatter charts below for examples.

Encourage pupils to draw conclusions from any patterns they find.

Thinking activity (15 min)

Discuss THINK IT OVER questions on slide 41.

What were pupils surprised about?

Is it right that some people have much more money than others?

What might a less equal country look like?

What might a more equal country look like?

Pupils record their thoughts. These could be added to their **World Cup Fairness Display**.

WORLD CUP MATHS 3: FAIRNESS SCORES

Allocated Group: _____

Look at the equality scores for the four teams in the group you have been allocated.

1. Order the scores from lowest to highest:

Most Equal

Most Unequal

2. Find the mean score for your group:

$$\underline{\quad\quad} + \underline{\quad\quad} + \underline{\quad\quad} + \underline{\quad\quad} \div 4 =$$

WORLD CUP MATHS 3: FAIRNESS SCORES

Allocated Group: _____

Look at the equality scores for the four teams in the group you have been allocated.

1. Order the scores from lowest to highest:

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2. Find the mean score for your group:

$$\underline{\quad\quad} + \underline{\quad\quad} + \underline{\quad\quad} + \underline{\quad\quad} \div 4 =$$

FAIRNESS SCORES

Collect the score for the most equal country in each group:

Group	Most Fair Country from Each Group	Average for group
A		
B		
C		
D		
E		
F		
G		
H		

Order these scores:

Collect the score for the most unequal country in each group:

Group	Most Unfair Country from Each Group	Average for group
A		
B		
C		
D		
E		
F		
G		
H		

Order these scores:

What statements can you make from the data you have organised?

FAIRNESS WORLD CUP GRAPHS

Challenge: Explore relationships between statistics.

Use the World Cup Statistics Table to plot line graphs linking relationships between different data on the World Cup countries.

1. Do wealthier countries have higher Fifa rankings (1 = highest ranking)?
2. Are more wealthy countries more equal (by their fairness scores)?
3. Do more equal countries have higher Fifa scores?

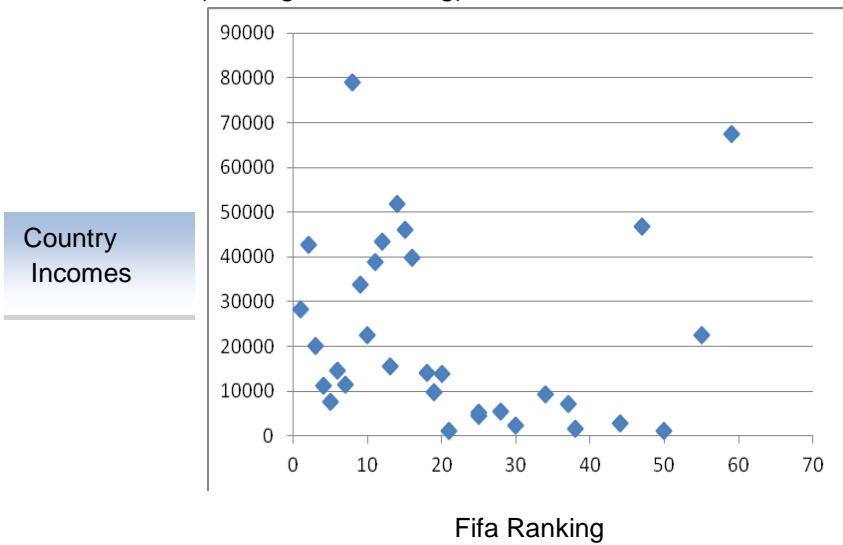
WORLD CUP STATISTICS TABLE

Country	Group	FIFA Ranking	Fairness Score	\$ Income Per Person Per Year
Croatia	A	20	0.31	13879
Brazil	A	4	0.46	11340
Mexico	A	19	0.44	9749
Cameroon	A	50	0.36	1167
Australia	B	59	0.33	67442
Netherlands	B	15	0.26	45960
Spain	B	1	0.33	28274
Chile	B	13	0.47	15452
Japan	C	47	0.29	46731
Greece	C	10	0.33	22442
Colombia	C	5	0.47	7748
Cote d Ivoire (Ivory Coast)	C	21	0.40	1244
England (UK data)	D	11	0.36	38920
Italy	D	9	0.33	33816
Uruguay	D	6	0.42	14703
Costa Rica	D	34	0.46	9386
Switzerland	E	8	0.30	78928
France	E	16	0.31	39746
Ecuador	E	28	0.43	5425
Honduras	E	30	0.51	2323
Argentina	F	7	0.39	11573
Iran	F	37	0.47	7228
Bosnia & Herzegovina	F	25	0.35	4556
Nigeria	F	44	0.41	2722
USA	G	14	0.37	51749
Germany	G	2	0.29	42597
Portugal	G	3	0.33	20175
Ghana	G	38	0.41	1605
Belgium	H	12	0.25	43399
Korea (South Korea)	H	55	0.32	22590
Russia	H	18	0.43	14037
Algeria	H	25	0.33	5348

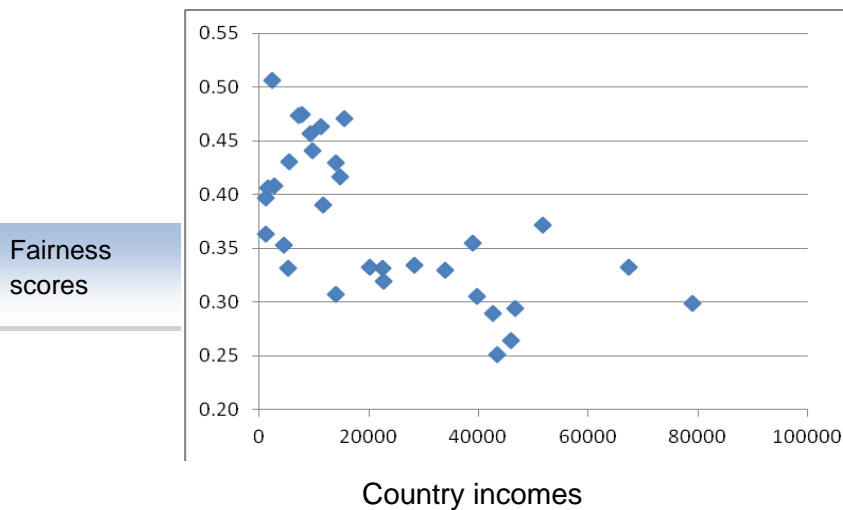
Sources:
Income: GDP per capita: <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD/countries>
Fairness Score: GINI index: <http://hdl.handle.net/1902.1/11992>

Fairness Graphs – examples

1. Country Incomes and Fifa Rankings: Do wealthier countries have higher Fifa rankings (1 = highest ranking)?



2. Country Incomes and Fairness Scores: Are more wealthy countries more equal?



3. Fairness scores and Fifa rankings: Do more equal countries have higher Fifa scores?

