Agroforestry and reforestation with the Gold Standard

Decision Analysis of a voluntary carbon offset label

Supplement

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1. Calibration process

1.2. Calibration questions

Lower confidence interval (CI): 95% probability that the searched value is above this value

Upper confidence interval: 95% probability that the value sought is below it

1.1.1. Germany

Part 1

#	Question	Lower CI	Upper CI
1	How long is a €10 note (in mm)?		
2	In how many countries is there at least 1 McDonald's?		
3	What is typically the percentage of copper in bronze?		
4	How long does the song "Bohemian Rhapsody" last (in minutes, seconds)?		
5	How long is the border between Germany and Switzerland?		
6	At what height is the world record in pole vaulting?		
7	How many inhabitants did Germany have in 1970?		
8	The Airbus A380 has seats for 525 people in a standard three-class design. How many people would there be room for if there was only economy class?		
9	In which year did the film "Forrest Gump" win the Oscar for Best Picture?		
10	How many cm per year does human hair grow on average?		
11	How high is the tallest office building in Germany?		
12	How many tonnes did the heaviest meteor ever found on Earth weigh?		
13	In which year did Walt Disney create Mickey Mouse?		
14	How many elements of the periodic table (chemical) were discovered in the 20th century?		
15	How many spectators could fit into the Colosseum in Rome?		
16	What is the melting point of gold (in °C)?		

#	Question		
17	In which year was Gerhard Schröder born?		
18	What is the percentage (by volume) of oxygen in the air?		
19	How many copies of the Harry Potter books (all parts) have been sold worldwide to date?		
20	How deep is the deepest point of the oceans?		

Part 2

#	Question	Lower CI	Upper CI
1	What is the life expectancy of a bottlenose dolphin (in years)?		
2	What is the percentage of households in Costa Rica with internet?		
3	In which year was the first episode of the series "Friends" broadcast in the USA?		
4	In which year was the double helix structure of DNA discovered?		
5	What is the average annual rainfall in the Sahara Desert?		
6	What is the average calorie intake in Germany per person/day?		
7	In which year did Jules Verne publish "20,000 Leagues Under the Sea"?		
8	How long is the Nile (in km)?		
9	How many letters does the Greek alphabet have?		
10	How many plays (only dramas, not sonnets) did Shakespeare write?		
11	On which degree of northern latitude is Freiburg located? (Hint: Equator: 0°, North Pole: 90°)		
12	What is the wingspan of a Boeing 747 (in m)?		
13	How many members does the European Parliament have?		
14	How many employees did ebay have in 2006 (in the first trimester of the year)?		
15	How many Olympic gold medals did Germany win from 1992-2016?		
16	How many litres of water per day does a US household use on average?		
17	How many millilitres is a (US) gallon?		

18	How many insect species have been scientifically described to date?		
19	How much does a bull giraffe weigh on average?		
20	How many words does the (German) Bible have?		

Answers

#	Part 1	Part 2
1	127 mm	15 years
2	120 countries	55%
3	88%	1994
4	5:54 minutes	1953
5	362 km	180 mm/year
6	6,16 m	3.500 kcal
7	60.650.584 inhabitants	1870
8	853 persons	6.650 km
9	1995	24 letters
10	13,5 cm	37 dramas
11	259 m (Commerzbank tower in Frankfurt a.M)	47,9953 Degrees north latitude
12	60 t	64 m
13	1928	751 members
14	29 elements	11.600 employees
15	50.000 people	122 gold medals
16	1.064 °C	1325 l
17	1944	3785,41 ml
18	20,95%	925.000 species
19	500 million copies	1600 kg
20	10.994 m	738.765 words

1.1.2. Costa Rica

Part 1

#	Question	Lower CI	Upper CI
1	Every how many minutes is a baby born in Costa Rica?		
2	In how many countries is there at least 1 McDonald's?		
3	What is typically the percentage of copper in bronze?		
4	How long does the song "Bohemian Rhapsody" last (in minutes, seconds)?		
5	How many women started studying at TEC in 2017 (all sites)?		
6	If you could jump 15 m straight up into the air, how many seconds would you be in the air before landing?		
7	How many inhabitants did Costa Rica have in 1892?		
8	The Airbus A380 has seats for 525 people in a standard three-class design. How many people would there be room for if there was only economy class?		
9	In which year did the film "Forrest Gump" win the Oscar for Best Picture?		
10	How many cm per year does human hair grow on average?		
11	How high is the tallest office building in Costa Rica?		
12	How many tonnes did the heaviest meteor ever found on Earth weigh?		
13	In which year did Walt Disney create Mickey Mouse?		
14	How many elements of the periodic table (chemical) were discovered in the 20th century?		
15	Where did "José Daniel" rank among the most popular names in 2016?		
16	What is the melting point of gold (in °C)?		
17	In which year was former president Laura Chinchilla born?		
18	By how many centimetres did the average height of women in Costa Rica increase from 1896 to 1996?		
19	How many copies of the Harry Potter books (all parts) have been sold worldwide to date?		

#	Question	Lower CI	Upper CI
20	How deep is the deepest point of the oceans?		

Part 2

#	Question	Lower CI	Upper CI
1	What is the life expectancy of a bottlenose dolphin (in years)?		
2	What is the percentage of households in Costa Rica with internet?		
3	How many words does the Royal Spanish Academy Dictionary contain?		
4	In which year was San José founded?		
5	What is the average annual rainfall in the Sahara Desert?		
6	What is the average calorie intake in Costa Rirca per person/day?		
7	How many earthquakes worldwide in the twentieth century measured more than 8.0 on the Richter scale?		
8	How much did the Apollo Command Module (the capsule where the astronauts sat) weigh (in kg)?		
9	How many letters does the Greek alphabet have?		
10	How many plays (only dramas, not sonnets) did Shakespeare write?		
11	In which year was Simon Bolivar born?		
12	What is the wingspan of a Boeing 747 (in m)?		
13	How many members does the European Parliament have?		
14	How many employees did ebay have in 2006 (in the first trimester of the year)?		
15	How many Olympic gold medals did Costa Rica win from 1936-2016?		
16	How many litres of water per day does a US household use on average?		
17	How many millilitres is a (US) gallon?		
18	How many insect species have been scientifically described to date?		
19	How much does a bull giraffe weigh on average?		

20	How many words does the Bible have?		

Answers

#	Part 1	Part 2
1	Every 8 minutes	15
2	120 countries	55%
3	88%	88.000 words
4	5:54 minuts	1848
5	635	180 mm/year
6	3,5 seconds	2.810 kcal
7	243.205	7
8	853 persons	5888 kg
9	1995	24
10	13,5 cm	37
11	150 (Sabana Capital)	1783
12	60 t	64
13	1928	751
14	29 elements	11,600 employees
15	8°	4
16	1.064 °C	1325 l
17	1959	3785,41 ml
18	13,7 cm	925.000 species
19	500 million copies	1600 kg
20	10 994	773.746 words

1.2. Equivalent Bet Test

Suppose I offered you a chance to win $1000 in one of two ways:

a) You win $1,000 if you your estimation turns out to be correct. If not, you win nothing.

b) You spin a dial divided into two unequal "pie slices," one comprising 90% of the dial and the other just 10%. If the dial lands on the large slice, you win $1,000. If it lands on the small slice, you win nothing (i.e., there is a 90% chance you win $1,000).

2. Interviews and surveys

2.1. Interview guideline

2.1.1. Framework

Length of interviews: Approx. 1h

Setting: If possible, the interviews are conducted in person. Where not otherwise possible, telephone interviews will be conducted.

Documentation: The interviews are recorded and documented in the form of keyword notes. The interviews will not be transcribed completely.

Evaluation: Collect named variables. Define for which variables definite values are available and for which estimates are needed. Identify experts who can provide these estimates and then interview them.

2.1.2. Personal details

- Name
- Position(s) in the project network
- Viewpoint/position from which the questions are answered

2.1.3. First round of interviews

- Where you already in the company when the Gold Standard certification of the reforestation sites took place?
- What was the original motivation for the decision to obtain the Gold Standard certification?
  - o Do you think that the credibility of BaumInvest is strengthened by the certification? How does an increased credibility manifest?
  - o Are the reasons for the Gold Standard certification rather economic? Or do sustainability issues play a role?
  - o Has anything changed in forest management strategies since BaumInvest became certified?

- What kind of challenges did you face during the time of the initial certification? Would you still consider them as challenges today, or is there anything else you might consider an important challenge now?
- Which opportunities do you see in the Gold Standard certification of the additional reforestation site/agroforestry project?
- What would indicate a "successful certification" for you?
- What other factors might have an influence of reaching the goal of a "successful certification"?
- Can you think of any other factors that might influence the certification process?
- Does it make a difference if shareholders sell or close down their shares?
- What else do you think influences these decisions? What variables should be taken into account?
- Are there alternatives to Gold Standard certification that should be considered?
- Who else is involved in the reforestation/agroforestry project, and might be an important interview partner regarding the Gold Standard certification?

2.1.4. Specific questions for reforestation project
- How does a reforestation project in form of a stock corporation work? What is special about this concept compared to a "normal" reforestation project?
- Why do people become a member of the corporation?
- Why did you decide not to pass the VER on directly to the shareholders anymore?
- Which impact did this decision have?
- How does the process of selling more stock shares work?

2.1.5. Specific questions for agroforestry project
Marketing strategies
- How does the cooperative PuroVerde eG work?
- Is there some kind of business plan, how (fast) the corporative should grow?
- How much saying do the members have?
- At first, the VER generated by the reforestation project were not sold but given directly to the shareholders. Why did this change?
- Do you consider it feasible to pass the VER potentially generated by the agroforestry project directly on to the members?
- Can you think of any other ways of using the VER?
- Which benefits and risks might other usages of the VER have?

<u>Development of agroforestry project</u>

- PuroVerde is only now starting its work with a small ginger production. Can you describe the future plans for this project?
- What factors might have an impact on the success or failure of the project?

2.1.5 After completion of first graphic drafts of model

- Please have a look at this graph. Do you consider it complete?
- Can you think of any other factors that might be missing here, that you would consider important for the decision?
- I have a question regarding the variable XXX. Who could I talk to about this specific variable?

2.2 BaumInvest AG shareholders survey

2.2.1. Framework

The following survey was conducted online among all BaumInvest AG shareholders. The survey was not designed specifically for our study, but the results were used to support the decision analysis process of our research project.

The questions in the first three parts were designed as Likert scale questions. The scale ranked from "It is not important to be at all (1) to "It is very important for me (10). The last part was about whether the shareholders wanted to keep or increase their shares.

2.2.2. Questions

<u>How important are the effects achieved by BaumInvest to you?</u>

- Forestry concept: With the innovative forestry concept (which imitates the natural growth of a forest), BaumInvest AG has forest), BaumInvest AG has developed a sustainable reforestation project for future generations.
- Biodiversity: The forestry concept of BaumInvest AG takes positive influence on the preservation of biodiversity.
- Fossil resources: The near-natural mixed forests of BaumInvest AG produce regenerative raw materials in the long run. This helps to avoid the use of fossil raw materials.
- Social aspects: Bauminvest AG creates jobs and prevents more and more land from being bought up by land speculators.
- CO_2 storage: CO_2 storage through reforestation makes a significant contribution to reducing CO_2 in the atmosphere.

- Climate change: Bauminvest AG contributes through the CO_2 storage of the afforestation to slow down the worldwide climate change.
- Change in the economic system: Bauminvest AG contributes to a regional change in the economic system, reducing the outflow of capital from the region to food corporations.
- Return on investment: Bauminvest AG is a sustainable, citizen-financed investment project. The generation of a continuous return on investment is an important prerequisite for the shareholders and thus a contribution to the success of BaumInvest.

How important are possible new business areas for BaumInvest AG?
- Rolling forestry system: Reforestation of new areas and implementation of the sustainable, self-sustaining, rolling forestry system with continuous timber harvesting
- Planning: Timber harvesting and sales planning for existing forestry sites
- Timber marketing/processing: The further processing and distribution of the wood into intermediate or final products.
- Research: Implementation of research and development projects with the help of subsidies
- Consulting: Production of tree seedlings and development and realization of consulting services for sustainability oriented, external forestry companies

How do you evaluate the communication of BaumInvest AG and its integration into the futuroverde project network?
- Information density: I receive sufficient information about the business development of BaumInvest AG.
- Trust: The information and the appearance of BaumInvest AG are trustworthy.
- Digitalization: In the future, communication should be more digital and increasingly avoid the use of paper.
- Younger target group: In the future, younger interested parties should also be addressed in order to ensure the long-term existence of BaumInvest AG.
- Modernity: BaumInvest AG should establish a modern appearance in order to inspire younger people for a sustainable business concept.
- Project network: BaumInvest AG is part of the project network FuturoVerde, in order to achieve synergies with the other companies involved.

Shares
- On a long-term basis, I plan to…
    - ○ Keep my shares
    - ○ Sell my shares

- o Bequeath my shares
- I plan to purchase additional shares and would like to reserve shares without obligation to the value of…

3. Code and datasets

The datasets generated and/or analysed during the current study are available under the following link: https://doi.org/10.5281/zenodo.5606497