Data Bootcamp Project -- Quinoa

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"IS THE global fad for quinoa a bane or boon to the peasants of the Andes?" - The Economist

Quinoa hasn't always been this popular. For centuries they were only eaten by a hand full of groups of people around the world. But today Quinoa has been publicly acknowledged as one of the world's healthiest foods. It has been featured on health magazines. It is available at many large chain grocery stores. It is the base of many people's diet as rice and other forms of carbs have lost their touch with many health conscious consumers. As quinoa becomes this "fad" described in The Economist, a few questions emerges.

What is the history of Quinoa production? Who are the people behind planting of quinoa? How has the demand of quinoa affected the people who grew them over the years?

This project will search and plot the avalible quinoa data on FAO to help illustrate and answer these questions.

Set Up

Downloading Packages

In [91]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

Data Report

Accessing the data

The data was available online from the FAO website. I downloaded all the available data related to Quinoa for the project. The data can be found here (http://www.fao.org/faostat/en/#search/quinoa).

For the production and price, I was able to find three files. One being the production file dating back to 1966, one archival file for price and one recent price file. In the work, below I will clean up all three files and combine them together.

I will also use the data from world trade to show the major quinoa production countries.

In [92]:
```
#this is the data file for quinoa production amount around the world
#this dataset include years from 1961 to 2017

fao = "/Users/lindayao/Desktop/DataBootcamp/final/FAOSTAT_data_5-7-2019.
csv"
fao_production = pd.read_csv(fao)
```

In [93]:
```
fao_production
```

Out[93]:

	Domain	Area	Element	Item	Year	Unit	Value
0	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1961	tonnes	9200
1	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1962	tonnes	10200
2	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1963	tonnes	13500
3	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1964	tonnes	11200
4	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1965	tonnes	6800
5	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1966	tonnes	8000
6	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1967	tonnes	7400
7	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1968	tonnes	9600
8	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1969	tonnes	9600
9	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1970	tonnes	9700
10	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1971	tonnes	10500
11	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1972	tonnes	10800
12	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1973	tonnes	12000
13	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1974	tonnes	13205
14	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1975	tonnes	15200
15	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1976	tonnes	14960
16	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1977	tonnes	9035
17	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1978	tonnes	7660
18	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1979	tonnes	6000
19	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1980	tonnes	8935
20	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1981	tonnes	13040
21	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1982	tonnes	15785
22	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1983	tonnes	11710
23	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1984	tonnes	16622
24	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1985	tonnes	21144
25	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1986	tonnes	20631
26	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1987	tonnes	23897
27	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1988	tonnes	22600
28	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1989	tonnes	18230
29	Crops	Bolivia (Plurinational State of)	Production	Quinoa	1990	tonnes	16077
...	...	...	...	...	...	...	...
141	Crops	Peru	Production	Quinoa	1988	tonnes	16284
142	Crops	Peru	Production	Quinoa	1989	tonnes	15753
143	Crops	Peru	Production	Quinoa	1990	tonnes	6260

	Domain	Area	Element	Item	Year	Unit	Value
144	Crops	Peru	Production	Quinoa	1991	tonnes	18266
145	Crops	Peru	Production	Quinoa	1992	tonnes	4961
146	Crops	Peru	Production	Quinoa	1993	tonnes	17157
147	Crops	Peru	Production	Quinoa	1994	tonnes	16629
148	Crops	Peru	Production	Quinoa	1995	tonnes	13773
149	Crops	Peru	Production	Quinoa	1996	tonnes	16070
150	Crops	Peru	Production	Quinoa	1997	tonnes	23688
151	Crops	Peru	Production	Quinoa	1998	tonnes	28171
152	Crops	Peru	Production	Quinoa	1999	tonnes	28413
153	Crops	Peru	Production	Quinoa	2000	tonnes	28191
154	Crops	Peru	Production	Quinoa	2001	tonnes	22267
155	Crops	Peru	Production	Quinoa	2002	tonnes	30373
156	Crops	Peru	Production	Quinoa	2003	tonnes	30085
157	Crops	Peru	Production	Quinoa	2004	tonnes	26997
158	Crops	Peru	Production	Quinoa	2005	tonnes	32590
159	Crops	Peru	Production	Quinoa	2006	tonnes	30429
160	Crops	Peru	Production	Quinoa	2007	tonnes	31824
161	Crops	Peru	Production	Quinoa	2008	tonnes	29867
162	Crops	Peru	Production	Quinoa	2009	tonnes	39397
163	Crops	Peru	Production	Quinoa	2010	tonnes	41079
164	Crops	Peru	Production	Quinoa	2011	tonnes	41182
165	Crops	Peru	Production	Quinoa	2012	tonnes	44213
166	Crops	Peru	Production	Quinoa	2013	tonnes	52129
167	Crops	Peru	Production	Quinoa	2014	tonnes	114725
168	Crops	Peru	Production	Quinoa	2015	tonnes	105666
169	Crops	Peru	Production	Quinoa	2016	tonnes	79269
170	Crops	Peru	Production	Quinoa	2017	tonnes	78657

171 rows × 7 columns

In [94]:
```
#this is the data file for quinoa's annual producer price around the wor
ld
#this dataset include years from 1991 to 2017
#some data is unavalible for Ecuador

price_data = '/Users/lindayao/Desktop/DataBootcamp/final/FAOSTAT_data_5-
7-2019_ProducerPrices.csv'
fao_price = pd.read_csv(price_data)
```

In [95]:
```
fao_price
```

Out[95]:

	Domain	Area	Element	Item	Year	Unit	Value
0	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	1991	USD	435.1
1	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	1992	USD	466.3
2	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	1993	USD	480.6
3	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	1994	USD	481.5
4	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	1995	USD	521.6
5	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	1996	USD	531.5
6	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	1997	USD	547.6
7	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	1998	USD	545.2
8	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	1999	USD	556.7
9	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2000	USD	526.6
10	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2001	USD	512.3
11	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2002	USD	439.6
12	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2003	USD	420.5
13	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2004	USD	443.6
14	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2005	USD	460.3
15	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2006	USD	448.2
16	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2007	USD	469.1
17	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2008	USD	756.2
18	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2009	USD	1320.0
19	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2010	USD	872.8
20	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2011	USD	937.8
21	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2012	USD	1005.6
22	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2013	USD	1087.4

	Domain	Area	Element	Item	Year	Unit	Value
23	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2014	USD	3060.7
24	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2015	USD	1430.8
25	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2016	USD	1028.8
26	Producer Prices - Annual	Bolivia (Plurinational State of)	Producer Price (USD/tonne)	Quinoa	2017	USD	770.6
27	Producer Prices - Annual	Ecuador	Producer Price (USD/tonne)	Quinoa	2003	USD	543.0
28	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	1991	USD	323.6
29	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	1992	USD	361.2
30	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	1993	USD	291.7
31	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	1994	USD	323.5
32	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	1995	USD	395.0
33	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	1996	USD	407.6
34	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	1997	USD	418.9
35	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	1998	USD	419.8
36	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	1999	USD	366.5
37	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2000	USD	335.2
38	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2001	USD	339.3
39	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2002	USD	318.5
40	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2003	USD	319.1
41	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2004	USD	325.2
42	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2005	USD	352.0
43	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2006	USD	360.4
44	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2007	USD	390.0
45	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2008	USD	547.1

	Domain	Area	Element	Item	Year	Unit	Value
46	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2009	USD	1115.7
47	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2010	USD	1196.4
48	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2011	USD	1336.2
49	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2012	USD	1471.0
50	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2013	USD	2328.0
51	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2014	USD	2773.8
52	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2015	USD	1540.6
53	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2016	USD	1178.7
54	Producer Prices - Annual	Peru	Producer Price (USD/tonne)	Quinoa	2017	USD	1128.7

Since some data for the pricing is missing, I found another dataset that includes the archive price data. I will import this data set as well to prepare it to be combined with the fao_price dataset from above.

In [96]:
```
#this is the data file for quinoa's annual producer price around the wor
ld
#this dataset include years from 1966 to 1990

price_archive_data = '/Users/lindayao/Desktop/DataBootcamp/final/FAOSTAT
_data_5-7-2019_ArchiveProducerPrices.csv'
fao_archive_price = pd.read_csv(price_archive_data)
```

In [97]:
```
fao_archive_price
```

Out[97]:

	Domain	Country	Element	Item	Year	Unit	Value
0	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1966	LCU	1196.00
1	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1967	LCU	1261.00
2	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1968	LCU	1304.00
3	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1969	LCU	1304.00
4	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1970	LCU	1348.00
5	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1971	LCU	1348.00
6	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1972	LCU	1413.00
7	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1973	LCU	1522.00
8	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1974	LCU	3022.00
9	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1975	LCU	3261.00
10	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1976	LCU	3649.00
11	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1977	LCU	3660.00
12	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1978	LCU	4310.00
13	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1979	LCU	4580.00
14	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1980	LCU	8171.00
15	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1981	LCU	10580.00
16	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1982	LCU	17800.00
17	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1983	LCU	110000.00
18	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1984	LCU	2.00
19	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1985	LCU	145.00
20	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1986	LCU	490.00
21	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1987	LCU	526.87
22	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1988	LCU	888.67

	Domain	Country	Element	Item	Year	Unit	Value
23	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1989	LCU	1399.00
24	Producer Prices - Archive	Bolivia (Plurinational State of)	Producer Price (LCU/tonne)	Quinoa	1990	LCU	1334.00
25	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1966	LCU	9690.00
26	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1967	LCU	10880.00
27	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1968	LCU	10660.00
28	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1969	LCU	13010.00
29	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1970	LCU	12960.00
...	...	...	...	...	...	...	...
45	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1986	LCU	106670.00
46	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1987	LCU	99410.00
47	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1988	LCU	190700.00
48	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1989	LCU	247100.00
49	Producer Prices - Archive	Ecuador	Producer Price (LCU/tonne)	Quinoa	1990	LCU	378800.00
50	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1966	LCU	2365.00
51	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1967	LCU	2450.00
52	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1968	LCU	4340.00
53	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1969	LCU	4150.00
54	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1970	LCU	3850.00
55	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1971	LCU	4050.00
56	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1972	LCU	4060.00
57	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1973	LCU	4830.00
58	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1974	LCU	6230.00
59	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1975	LCU	13800.00
60	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1976	LCU	15233.00

	Domain	Country	Element	Item	Year	Unit	Value
61	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1977	LCU	20970.00
62	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1978	LCU	28770.00
63	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1979	LCU	51407.00
64	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1980	LCU	112830.00
65	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1981	LCU	159590.00
66	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1982	LCU	200430.00
67	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1983	LCU	411440.00
68	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1984	LCU	773.00
69	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1985	LCU	3810.00
70	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1986	LCU	8830.00
71	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1987	LCU	12670.00
72	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1988	LCU	26250.00
73	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1989	LCU	619010.00
74	Producer Prices - Archive	Peru	Producer Price (LCU/tonne)	Quinoa	1990	LCU	28.00

75 rows × 7 columns

As a part of the study, we will be looking into the agricultural productivity of quinoa. Therfore, I have found a dataset that includes data on the area harvested.

In [98]:
```
#this is the data file for quinoa's area harvested around the world
#this dataset include years from 1961 to 2017

fao_harvest = "/Users/lindayao/Desktop/DataBootcamp/final/FAOSTAT_harvest.csv"
fao_harvest = pd.read_csv(fao_harvest)
```

In [99]:
```
fao_harvest
```

Out[99]:

	Domain	Area	Element	Item	Year	Unit	Value
0	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1961	ha	22000
1	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1962	ha	22300
2	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1963	ha	22600
3	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1964	ha	18800
4	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1965	ha	17000
5	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1966	ha	16000
6	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1967	ha	12330
7	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1968	ha	14120
8	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1969	ha	14150
9	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1970	ha	12200
10	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1971	ha	15000
11	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1972	ha	15000
12	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1973	ha	16000
13	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1974	ha	16890
14	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1975	ha	19240
15	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1976	ha	20800
16	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1977	ha	22400
17	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1978	ha	17830
18	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1979	ha	10455
19	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1980	ha	15640
20	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1981	ha	23040
21	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1982	ha	24930
22	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1983	ha	43086
23	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1984	ha	33382
24	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1985	ha	47939
25	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1986	ha	42850
26	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1987	ha	47330
27	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1988	ha	50000
28	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1989	ha	42640
29	Crops	Bolivia (Plurinational State of)	Area harvested	Quinoa	1990	ha	38615
...	...	...	...	...	...	...	...
141	Crops	Peru	Area harvested	Quinoa	1988	ha	18475
142	Crops	Peru	Area harvested	Quinoa	1989	ha	15241
143	Crops	Peru	Area harvested	Quinoa	1990	ha	8081

	Domain	Area	Element	Item	Year	Unit	Value
144	Crops	Peru	Area harvested	Quinoa	1991	ha	21007
145	Crops	Peru	Area harvested	Quinoa	1992	ha	7874
146	Crops	Peru	Area harvested	Quinoa	1993	ha	17812
147	Crops	Peru	Area harvested	Quinoa	1994	ha	20693
148	Crops	Peru	Area harvested	Quinoa	1995	ha	18729
149	Crops	Peru	Area harvested	Quinoa	1996	ha	18704
150	Crops	Peru	Area harvested	Quinoa	1997	ha	27033
151	Crops	Peru	Area harvested	Quinoa	1998	ha	30720
152	Crops	Peru	Area harvested	Quinoa	1999	ha	28979
153	Crops	Peru	Area harvested	Quinoa	2000	ha	28889
154	Crops	Peru	Area harvested	Quinoa	2001	ha	25601
155	Crops	Peru	Area harvested	Quinoa	2002	ha	27851
156	Crops	Peru	Area harvested	Quinoa	2003	ha	28326
157	Crops	Peru	Area harvested	Quinoa	2004	ha	27676
158	Crops	Peru	Area harvested	Quinoa	2005	ha	28632
159	Crops	Peru	Area harvested	Quinoa	2006	ha	29947
160	Crops	Peru	Area harvested	Quinoa	2007	ha	30381
161	Crops	Peru	Area harvested	Quinoa	2008	ha	31163
162	Crops	Peru	Area harvested	Quinoa	2009	ha	34026
163	Crops	Peru	Area harvested	Quinoa	2010	ha	35313
164	Crops	Peru	Area harvested	Quinoa	2011	ha	35475
165	Crops	Peru	Area harvested	Quinoa	2012	ha	38495
166	Crops	Peru	Area harvested	Quinoa	2013	ha	44868
167	Crops	Peru	Area harvested	Quinoa	2014	ha	68140
168	Crops	Peru	Area harvested	Quinoa	2015	ha	69303
169	Crops	Peru	Area harvested	Quinoa	2016	ha	64223
170	Crops	Peru	Area harvested	Quinoa	2017	ha	61721

171 rows × 7 columns

In [100]:
```
#this is the data file that includes the countires that export quinoa

world_data= "/Users/lindayao/Desktop/DataBootcamp/final/world_export_quinoa.csv"
world_data = pd.read_csv(world_data)
```

In [101]:
```
world_data
```

Out[101]:

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
0	H5	2018	2018	2018	6	1	1	Import	20	Andorra
1	H5	2018	2018	2018	6	1	1	Import	31	Azerbaijan
2	H5	2018	2018	2018	6	1	1	Import	32	Argentina
3	H5	2018	2018	2018	6	1	1	Import	51	Armenia
4	H5	2018	2018	2018	6	1	1	Import	60	Bermuda
5	H5	2018	2018	2018	6	1	2	Export	60	Bermuda
6	H5	2018	2018	2018	6	1	2	Export	68	Bolivia (Plurinational State of)
7	H5	2018	2018	2018	6	1	1	Import	84	Belize
8	H5	2018	2018	2018	6	1	1	Import	96	Brunei Darussalam
9	H5	2018	2018	2018	6	1	1	Import	112	Belarus
10	H5	2018	2018	2018	6	1	1	Import	124	Canada
11	H5	2018	2018	2018	6	1	2	Export	124	Canada
12	H5	2018	2018	2018	6	1	3	Re-Export	124	Canada
13	H5	2018	2018	2018	6	1	4	Re-Import	124	Canada
14	H5	2018	2018	2018	6	1	1	Import	152	Chile
15	H5	2018	2018	2018	6	1	2	Export	152	Chile
16	H5	2018	2018	2018	6	1	1	Import	170	Colombia
17	H5	2018	2018	2018	6	1	2	Export	170	Colombia
18	H5	2018	2018	2018	6	1	1	Import	191	Croatia
19	H5	2018	2018	2018	6	1	2	Export	191	Croatia
20	H5	2018	2018	2018	6	1	1	Import	203	Czechia
21	H5	2018	2018	2018	6	1	2	Export	203	Czechia
22	H5	2018	2018	2018	6	1	1	Import	208	Denmark
23	H5	2018	2018	2018	6	1	2	Export	208	Denmark
24	H5	2018	2018	2018	6	1	2	Export	218	Ecuador
25	H5	2018	2018	2018	6	1	1	Import	222	El Salvador
26	H5	2018	2018	2018	6	1	1	Import	233	Estonia
27	H5	2018	2018	2018	6	1	2	Export	233	Estonia
28	H5	2018	2018	2018	6	1	1	Import	242	Fiji
29	H5	2018	2018	2018	6	1	1	Import	246	Finland

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
...	...	...	...	...	...	...	...	...	...	...
64	H5	2018	2018	2018	6	1	2	Export	699	India
65	H5	2018	2018	2018	6	1	1	Import	703	Slovakia
66	H5	2018	2018	2018	6	1	2	Export	703	Slovakia
67	H5	2018	2018	2018	6	1	4	Re-Import	703	Slovakia
68	H5	2018	2018	2018	6	1	1	Import	705	Slovenia
69	H5	2018	2018	2018	6	1	2	Export	705	Slovenia
70	H5	2018	2018	2018	6	1	1	Import	716	Zimbabwe
71	H5	2018	2018	2018	6	1	1	Import	752	Sweden
72	H5	2018	2018	2018	6	1	2	Export	752	Sweden
73	H5	2018	2018	2018	6	1	1	Import	757	Switzerland
74	H5	2018	2018	2018	6	1	2	Export	757	Switzerland
75	H5	2018	2018	2018	6	1	1	Import	764	Thailand
76	H5	2018	2018	2018	6	1	2	Export	764	Thailand
77	H5	2018	2018	2018	6	1	1	Import	807	North Macedonia
78	H5	2018	2018	2018	6	1	2	Export	807	North Macedonia
79	H5	2018	2018	2018	6	1	1	Import	826	United Kingdom
80	H5	2018	2018	2018	6	1	2	Export	826	United Kingdom
81	H5	2018	2018	2018	6	1	1	Import	894	Zambia
82	H4	2018	2018	2018	6	1	1	Import	132	Cabo Verde
83	H4	2018	2018	2018	6	1	1	Import	268	Georgia
84	H4	2018	2018	2018	6	1	1	Import	484	Mexico
85	H4	2018	2018	2018	6	1	2	Export	484	Mexico
86	H4	2018	2018	2018	6	1	1	Import	498	Rep. of Moldova
87	H4	2018	2018	2018	6	1	1	Import	533	Aruba
88	H4	2018	2018	2018	6	1	1	Import	608	Philippines
89	H4	2018	2018	2018	6	1	1	Import	682	Saudi Arabia
90	H4	2018	2018	2018	6	1	1	Import	804	Ukraine
91	H4	2018	2018	2018	6	1	2	Export	804	Ukraine
92	H4	2018	2018	2018	6	1	1	Import	818	Egypt

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
93	H4	2018	2018	2018	6	1	1	Import	882	Samoa

94 rows × 35 columns

In [102]:
```
#this is the archival data file that includes the countires that export
 quinoa


world_data_1992= "/Users/lindayao/Desktop/DataBootcamp/final/world_expor
t_quinoa_1992.csv"
world_data_1992 = pd.read_csv(world_data_1992)
```

In [103]:
```
world_data_1992
```

Out[103]:

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
0	H0	1992	1992	1992	0	0	1	Import	12	Algeria
1	H0	1992	1992	1992	0	0	2	Export	12	Algeria
2	H0	1992	1992	1992	0	0	1	Import	36	Australia
3	H0	1992	1992	1992	0	0	2	Export	36	Australia
4	H0	1992	1992	1992	0	0	3	Re-Export	36	Australia
5	H0	1992	1992	1992	0	0	1	Import	50	Bangladesh
6	H0	1992	1992	1992	0	0	2	Export	50	Bangladesh
7	H0	1992	1992	1992	0	0	1	Import	68	Bolivia (Plurinational State of)
8	H0	1992	1992	1992	0	0	2	Export	68	Bolivia (Plurinational State of)
9	H0	1992	1992	1992	0	0	1	Import	76	Brazil
10	H0	1992	1992	1992	0	0	2	Export	76	Brazil
11	H0	1992	1992	1992	0	0	1	Import	84	Belize
12	H0	1992	1992	1992	0	0	2	Export	84	Belize
13	H0	1992	1992	1992	0	0	3	Re-Export	84	Belize
14	H0	1992	1992	1992	0	0	1	Import	96	Brunei Darussalam
15	H0	1992	1992	1992	0	0	2	Export	96	Brunei Darussalam
16	H0	1992	1992	1992	0	0	1	Import	104	Myanmar
17	H0	1992	1992	1992	0	0	2	Export	104	Myanmar
18	H0	1992	1992	1992	0	0	3	Re-Export	104	Myanmar
19	H0	1992	1992	1992	0	0	1	Import	124	Canada
20	H0	1992	1992	1992	0	0	2	Export	124	Canada
21	H0	1992	1992	1992	0	0	1	Import	144	Sri Lanka
22	H0	1992	1992	1992	0	0	2	Export	144	Sri Lanka
23	H0	1992	1992	1992	0	0	3	Re-Export	144	Sri Lanka
24	H0	1992	1992	1992	0	0	1	Import	152	Chile
25	H0	1992	1992	1992	0	0	2	Export	152	Chile
26	H0	1992	1992	1992	0	0	1	Import	156	China
27	H0	1992	1992	1992	0	0	2	Export	156	China

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
28	H0	1992	1992	1992	0	0	1	Import	170	Colombia
29	H0	1992	1992	1992	0	0	2	Export	170	Colombia
...	...	...	...	...	...	...	...	...	...	...
95	H0	1992	1992	1992	0	0	1	Import	699	India
96	H0	1992	1992	1992	0	0	2	Export	699	India
97	H0	1992	1992	1992	0	0	3	Re-Export	699	India
98	H0	1992	1992	1992	0	0	1	Import	702	Singapore
99	H0	1992	1992	1992	0	0	2	Export	702	Singapore
100	H0	1992	1992	1992	0	0	1	Import	711	So. African Customs Union
101	H0	1992	1992	1992	0	0	2	Export	711	So. African Customs Union
102	H0	1992	1992	1992	0	0	1	Import	724	Spain
103	H0	1992	1992	1992	0	0	2	Export	724	Spain
104	H0	1992	1992	1992	0	0	1	Import	752	Sweden
105	H0	1992	1992	1992	0	0	2	Export	752	Sweden
106	H0	1992	1992	1992	0	0	1	Import	757	Switzerland
107	H0	1992	1992	1992	0	0	2	Export	757	Switzerland
108	H0	1992	1992	1992	0	0	1	Import	764	Thailand
109	H0	1992	1992	1992	0	0	2	Export	764	Thailand
110	H0	1992	1992	1992	0	0	3	Re-Export	764	Thailand
111	H0	1992	1992	1992	0	0	1	Import	780	Trinidad and Tobago
112	H0	1992	1992	1992	0	0	2	Export	780	Trinidad and Tobago
113	H0	1992	1992	1992	0	0	3	Re-Export	780	Trinidad and Tobago
114	H0	1992	1992	1992	0	0	1	Import	784	United Arab Emirates
115	H0	1992	1992	1992	0	0	2	Export	784	United Arab Emirates
116	H0	1992	1992	1992	0	0	1	Import	788	Tunisia
117	H0	1992	1992	1992	0	0	2	Export	788	Tunisia
118	H0	1992	1992	1992	0	0	1	Import	792	Turkey
119	H0	1992	1992	1992	0	0	2	Export	792	Turkey

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
120	H0	1992	1992	1992	0	0	1	Import	842	USA
121	H0	1992	1992	1992	0	0	2	Export	842	USA
122	H0	1992	1992	1992	0	0	3	Re-Export	842	USA
123	H0	1992	1992	1992	0	0	1	Import	891	Serbia and Montenegro
124	H0	1992	1992	1992	0	0	2	Export	891	Serbia and Montenegro

125 rows × 35 columns

Cleaning

Fao_Production

In [104]:
```
#Delete the unnecessary columns

fao_production.drop(['Domain', 'Element',"Item","Unit"], axis=1, inplace
= True)
```

In [105]:
```
#Rename some columns so that they are easier to understand

fao_production.rename(columns={"Value":"Production"}, inplace=True)
fao_production.rename(columns={"Area":"Country"}, inplace=True)
```

In [106]:
```
fao_production
```

Out[106]:

	Country	Year	Production
0	Bolivia (Plurinational State of)	1961	9200
1	Bolivia (Plurinational State of)	1962	10200
2	Bolivia (Plurinational State of)	1963	13500
3	Bolivia (Plurinational State of)	1964	11200
4	Bolivia (Plurinational State of)	1965	6800
5	Bolivia (Plurinational State of)	1966	8000
6	Bolivia (Plurinational State of)	1967	7400
7	Bolivia (Plurinational State of)	1968	9600
8	Bolivia (Plurinational State of)	1969	9600
9	Bolivia (Plurinational State of)	1970	9700
10	Bolivia (Plurinational State of)	1971	10500
11	Bolivia (Plurinational State of)	1972	10800
12	Bolivia (Plurinational State of)	1973	12000
13	Bolivia (Plurinational State of)	1974	13205
14	Bolivia (Plurinational State of)	1975	15200
15	Bolivia (Plurinational State of)	1976	14960
16	Bolivia (Plurinational State of)	1977	9035
17	Bolivia (Plurinational State of)	1978	7660
18	Bolivia (Plurinational State of)	1979	6000
19	Bolivia (Plurinational State of)	1980	8935
20	Bolivia (Plurinational State of)	1981	13040
21	Bolivia (Plurinational State of)	1982	15785
22	Bolivia (Plurinational State of)	1983	11710
23	Bolivia (Plurinational State of)	1984	16622
24	Bolivia (Plurinational State of)	1985	21144
25	Bolivia (Plurinational State of)	1986	20631
26	Bolivia (Plurinational State of)	1987	23897
27	Bolivia (Plurinational State of)	1988	22600
28	Bolivia (Plurinational State of)	1989	18230
29	Bolivia (Plurinational State of)	1990	16077
...	...	...	...
141	Peru	1988	16284
142	Peru	1989	15753
143	Peru	1990	6260

	Country	Year	Production
144	Peru	1991	18266
145	Peru	1992	4961
146	Peru	1993	17157
147	Peru	1994	16629
148	Peru	1995	13773
149	Peru	1996	16070
150	Peru	1997	23688
151	Peru	1998	28171
152	Peru	1999	28413
153	Peru	2000	28191
154	Peru	2001	22267
155	Peru	2002	30373
156	Peru	2003	30085
157	Peru	2004	26997
158	Peru	2005	32590
159	Peru	2006	30429
160	Peru	2007	31824
161	Peru	2008	29867
162	Peru	2009	39397
163	Peru	2010	41079
164	Peru	2011	41182
165	Peru	2012	44213
166	Peru	2013	52129
167	Peru	2014	114725
168	Peru	2015	105666
169	Peru	2016	79269
170	Peru	2017	78657

171 rows × 3 columns

fao_price

In [107]:
```
#Delete the unnecessary columns

fao_price.drop(['Domain', 'Element',"Item","Unit"], axis=1, inplace = True)
```

In [108]:
```
#Rename some columns so that they are easier to understand

fao_price.rename(columns={"Value":"Producer_Price"}, inplace=True)
fao_price.rename(columns={"Area":"Country"}, inplace=True)
```

In [109]:
```
fao_price
```

Out[109]:

	Country	Year	Producer_Price
0	Bolivia (Plurinational State of)	1991	435.1
1	Bolivia (Plurinational State of)	1992	466.3
2	Bolivia (Plurinational State of)	1993	480.6
3	Bolivia (Plurinational State of)	1994	481.5
4	Bolivia (Plurinational State of)	1995	521.6
5	Bolivia (Plurinational State of)	1996	531.5
6	Bolivia (Plurinational State of)	1997	547.6
7	Bolivia (Plurinational State of)	1998	545.2
8	Bolivia (Plurinational State of)	1999	556.7
9	Bolivia (Plurinational State of)	2000	526.6
10	Bolivia (Plurinational State of)	2001	512.3
11	Bolivia (Plurinational State of)	2002	439.6
12	Bolivia (Plurinational State of)	2003	420.5
13	Bolivia (Plurinational State of)	2004	443.6
14	Bolivia (Plurinational State of)	2005	460.3
15	Bolivia (Plurinational State of)	2006	448.2
16	Bolivia (Plurinational State of)	2007	469.1
17	Bolivia (Plurinational State of)	2008	756.2
18	Bolivia (Plurinational State of)	2009	1320.0
19	Bolivia (Plurinational State of)	2010	872.8
20	Bolivia (Plurinational State of)	2011	937.8
21	Bolivia (Plurinational State of)	2012	1005.6
22	Bolivia (Plurinational State of)	2013	1087.4
23	Bolivia (Plurinational State of)	2014	3060.7
24	Bolivia (Plurinational State of)	2015	1430.8
25	Bolivia (Plurinational State of)	2016	1028.8
26	Bolivia (Plurinational State of)	2017	770.6
27	Ecuador	2003	543.0
28	Peru	1991	323.6
29	Peru	1992	361.2
30	Peru	1993	291.7
31	Peru	1994	323.5
32	Peru	1995	395.0
33	Peru	1996	407.6

	Country	Year	Producer_Price
34	Peru	1997	418.9
35	Peru	1998	419.8
36	Peru	1999	366.5
37	Peru	2000	335.2
38	Peru	2001	339.3
39	Peru	2002	318.5
40	Peru	2003	319.1
41	Peru	2004	325.2
42	Peru	2005	352.0
43	Peru	2006	360.4
44	Peru	2007	390.0
45	Peru	2008	547.1
46	Peru	2009	1115.7
47	Peru	2010	1196.4
48	Peru	2011	1336.2
49	Peru	2012	1471.0
50	Peru	2013	2328.0
51	Peru	2014	2773.8
52	Peru	2015	1540.6
53	Peru	2016	1178.7
54	Peru	2017	1128.7

fao_archive_price

In [110]:
```
#Delete the unnecessary columns

fao_archive_price.drop(['Domain', 'Element',"Item","Unit"], axis=1, inplace = True)
```

In [111]:
```
#Rename some columns so that they are easier to understand

fao_archive_price.rename(columns={"Value":"Producer_Price"}, inplace=True)
```

In [112]:
```
fao_archive_price
```

Out[112]:

	Country	Year	Producer_Price
0	Bolivia (Plurinational State of)	1966	1196.00
1	Bolivia (Plurinational State of)	1967	1261.00
2	Bolivia (Plurinational State of)	1968	1304.00
3	Bolivia (Plurinational State of)	1969	1304.00
4	Bolivia (Plurinational State of)	1970	1348.00
5	Bolivia (Plurinational State of)	1971	1348.00
6	Bolivia (Plurinational State of)	1972	1413.00
7	Bolivia (Plurinational State of)	1973	1522.00
8	Bolivia (Plurinational State of)	1974	3022.00
9	Bolivia (Plurinational State of)	1975	3261.00
10	Bolivia (Plurinational State of)	1976	3649.00
11	Bolivia (Plurinational State of)	1977	3660.00
12	Bolivia (Plurinational State of)	1978	4310.00
13	Bolivia (Plurinational State of)	1979	4580.00
14	Bolivia (Plurinational State of)	1980	8171.00
15	Bolivia (Plurinational State of)	1981	10580.00
16	Bolivia (Plurinational State of)	1982	17800.00
17	Bolivia (Plurinational State of)	1983	110000.00
18	Bolivia (Plurinational State of)	1984	2.00
19	Bolivia (Plurinational State of)	1985	145.00
20	Bolivia (Plurinational State of)	1986	490.00
21	Bolivia (Plurinational State of)	1987	526.87
22	Bolivia (Plurinational State of)	1988	888.67
23	Bolivia (Plurinational State of)	1989	1399.00
24	Bolivia (Plurinational State of)	1990	1334.00
25	Ecuador	1966	9690.00
26	Ecuador	1967	10880.00
27	Ecuador	1968	10660.00
28	Ecuador	1969	13010.00
29	Ecuador	1970	12960.00
...	...	...	...
45	Ecuador	1986	106670.00
46	Ecuador	1987	99410.00
47	Ecuador	1988	190700.00

	Country	Year	Producer_Price
48	Ecuador	1989	247100.00
49	Ecuador	1990	378800.00
50	Peru	1966	2365.00
51	Peru	1967	2450.00
52	Peru	1968	4340.00
53	Peru	1969	4150.00
54	Peru	1970	3850.00
55	Peru	1971	4050.00
56	Peru	1972	4060.00
57	Peru	1973	4830.00
58	Peru	1974	6230.00
59	Peru	1975	13800.00
60	Peru	1976	15233.00
61	Peru	1977	20970.00
62	Peru	1978	28770.00
63	Peru	1979	51407.00
64	Peru	1980	112830.00
65	Peru	1981	159590.00
66	Peru	1982	200430.00
67	Peru	1983	411440.00
68	Peru	1984	773.00
69	Peru	1985	3810.00
70	Peru	1986	8830.00
71	Peru	1987	12670.00
72	Peru	1988	26250.00
73	Peru	1989	619010.00
74	Peru	1990	28.00

75 rows × 3 columns

fao_harvest

In [113]:
```
#Delete the unnecessary columns

fao_harvest.drop(['Domain', 'Element',"Item","Unit"], axis=1, inplace = True)
```

In [114]:
```
#Rename some columns so that they are easier to understand

fao_harvest.rename(columns={"Value":"Area_Harvested(HA)"}, inplace=True)
fao_harvest.rename(columns={"Area":"Country"}, inplace=True)
```

In [115]:
```
fao_harvest
```

Out[115]:

	Country	Year	Area_Harvested(HA)
0	Bolivia (Plurinational State of)	1961	22000
1	Bolivia (Plurinational State of)	1962	22300
2	Bolivia (Plurinational State of)	1963	22600
3	Bolivia (Plurinational State of)	1964	18800
4	Bolivia (Plurinational State of)	1965	17000
5	Bolivia (Plurinational State of)	1966	16000
6	Bolivia (Plurinational State of)	1967	12330
7	Bolivia (Plurinational State of)	1968	14120
8	Bolivia (Plurinational State of)	1969	14150
9	Bolivia (Plurinational State of)	1970	12200
10	Bolivia (Plurinational State of)	1971	15000
11	Bolivia (Plurinational State of)	1972	15000
12	Bolivia (Plurinational State of)	1973	16000
13	Bolivia (Plurinational State of)	1974	16890
14	Bolivia (Plurinational State of)	1975	19240
15	Bolivia (Plurinational State of)	1976	20800
16	Bolivia (Plurinational State of)	1977	22400
17	Bolivia (Plurinational State of)	1978	17830
18	Bolivia (Plurinational State of)	1979	10455
19	Bolivia (Plurinational State of)	1980	15640
20	Bolivia (Plurinational State of)	1981	23040
21	Bolivia (Plurinational State of)	1982	24930
22	Bolivia (Plurinational State of)	1983	43086
23	Bolivia (Plurinational State of)	1984	33382
24	Bolivia (Plurinational State of)	1985	47939
25	Bolivia (Plurinational State of)	1986	42850
26	Bolivia (Plurinational State of)	1987	47330
27	Bolivia (Plurinational State of)	1988	50000
28	Bolivia (Plurinational State of)	1989	42640
29	Bolivia (Plurinational State of)	1990	38615
...	...	...	...
141	Peru	1988	18475
142	Peru	1989	15241
143	Peru	1990	8081

	Country	Year	Area_Harvested(HA)
144	Peru	1991	21007
145	Peru	1992	7874
146	Peru	1993	17812
147	Peru	1994	20693
148	Peru	1995	18729
149	Peru	1996	18704
150	Peru	1997	27033
151	Peru	1998	30720
152	Peru	1999	28979
153	Peru	2000	28889
154	Peru	2001	25601
155	Peru	2002	27851
156	Peru	2003	28326
157	Peru	2004	27676
158	Peru	2005	28632
159	Peru	2006	29947
160	Peru	2007	30381
161	Peru	2008	31163
162	Peru	2009	34026
163	Peru	2010	35313
164	Peru	2011	35475
165	Peru	2012	38495
166	Peru	2013	44868
167	Peru	2014	68140
168	Peru	2015	69303
169	Peru	2016	64223
170	Peru	2017	61721

171 rows × 3 columns

In [116]:
```
world_data= "/Users/lindayao/Desktop/DataBootcamp/final/world_export_quinoa.csv"
world_data = pd.read_csv(world_data)
world_data
```

Out[116]:

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
0	H5	2018	2018	2018	6	1	1	Import	20	Andorra
1	H5	2018	2018	2018	6	1	1	Import	31	Azerbaijan
2	H5	2018	2018	2018	6	1	1	Import	32	Argentina
3	H5	2018	2018	2018	6	1	1	Import	51	Armenia
4	H5	2018	2018	2018	6	1	1	Import	60	Bermuda
5	H5	2018	2018	2018	6	1	2	Export	60	Bermuda
6	H5	2018	2018	2018	6	1	2	Export	68	Bolivia (Plurinational State of)
7	H5	2018	2018	2018	6	1	1	Import	84	Belize
8	H5	2018	2018	2018	6	1	1	Import	96	Brunei Darussalam
9	H5	2018	2018	2018	6	1	1	Import	112	Belarus
10	H5	2018	2018	2018	6	1	1	Import	124	Canada
11	H5	2018	2018	2018	6	1	2	Export	124	Canada
12	H5	2018	2018	2018	6	1	3	Re-Export	124	Canada
13	H5	2018	2018	2018	6	1	4	Re-Import	124	Canada
14	H5	2018	2018	2018	6	1	1	Import	152	Chile
15	H5	2018	2018	2018	6	1	2	Export	152	Chile
16	H5	2018	2018	2018	6	1	1	Import	170	Colombia
17	H5	2018	2018	2018	6	1	2	Export	170	Colombia
18	H5	2018	2018	2018	6	1	1	Import	191	Croatia
19	H5	2018	2018	2018	6	1	2	Export	191	Croatia
20	H5	2018	2018	2018	6	1	1	Import	203	Czechia
21	H5	2018	2018	2018	6	1	2	Export	203	Czechia
22	H5	2018	2018	2018	6	1	1	Import	208	Denmark
23	H5	2018	2018	2018	6	1	2	Export	208	Denmark
24	H5	2018	2018	2018	6	1	2	Export	218	Ecuador
25	H5	2018	2018	2018	6	1	1	Import	222	El Salvador
26	H5	2018	2018	2018	6	1	1	Import	233	Estonia
27	H5	2018	2018	2018	6	1	2	Export	233	Estonia
28	H5	2018	2018	2018	6	1	1	Import	242	Fiji
29	H5	2018	2018	2018	6	1	1	Import	246	Finland

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
...	...	...	...	...	...	...	...	...	...	...
64	H5	2018	2018	2018	6	1	2	Export	699	India
65	H5	2018	2018	2018	6	1	1	Import	703	Slovakia
66	H5	2018	2018	2018	6	1	2	Export	703	Slovakia
67	H5	2018	2018	2018	6	1	4	Re-Import	703	Slovakia
68	H5	2018	2018	2018	6	1	1	Import	705	Slovenia
69	H5	2018	2018	2018	6	1	2	Export	705	Slovenia
70	H5	2018	2018	2018	6	1	1	Import	716	Zimbabwe
71	H5	2018	2018	2018	6	1	1	Import	752	Sweden
72	H5	2018	2018	2018	6	1	2	Export	752	Sweden
73	H5	2018	2018	2018	6	1	1	Import	757	Switzerland
74	H5	2018	2018	2018	6	1	2	Export	757	Switzerland
75	H5	2018	2018	2018	6	1	1	Import	764	Thailand
76	H5	2018	2018	2018	6	1	2	Export	764	Thailand
77	H5	2018	2018	2018	6	1	1	Import	807	North Macedonia
78	H5	2018	2018	2018	6	1	2	Export	807	North Macedonia
79	H5	2018	2018	2018	6	1	1	Import	826	United Kingdom
80	H5	2018	2018	2018	6	1	2	Export	826	United Kingdom
81	H5	2018	2018	2018	6	1	1	Import	894	Zambia
82	H4	2018	2018	2018	6	1	1	Import	132	Cabo Verde
83	H4	2018	2018	2018	6	1	1	Import	268	Georgia
84	H4	2018	2018	2018	6	1	1	Import	484	Mexico
85	H4	2018	2018	2018	6	1	2	Export	484	Mexico
86	H4	2018	2018	2018	6	1	1	Import	498	Rep. of Moldova
87	H4	2018	2018	2018	6	1	1	Import	533	Aruba
88	H4	2018	2018	2018	6	1	1	Import	608	Philippines
89	H4	2018	2018	2018	6	1	1	Import	682	Saudi Arabia
90	H4	2018	2018	2018	6	1	1	Import	804	Ukraine
91	H4	2018	2018	2018	6	1	2	Export	804	Ukraine
92	H4	2018	2018	2018	6	1	1	Import	818	Egypt

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
93	H4	2018	2018	2018	6	1	1	Import	882	Samoa

94 rows × 35 columns

In [117]:
```
world_data
```

Out[117]:

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
0	H5	2018	2018	2018	6	1	1	Import	20	Andorra
1	H5	2018	2018	2018	6	1	1	Import	31	Azerbaijan
2	H5	2018	2018	2018	6	1	1	Import	32	Argentina
3	H5	2018	2018	2018	6	1	1	Import	51	Armenia
4	H5	2018	2018	2018	6	1	1	Import	60	Bermuda
5	H5	2018	2018	2018	6	1	2	Export	60	Bermuda
6	H5	2018	2018	2018	6	1	2	Export	68	Bolivia (Plurinational State of)
7	H5	2018	2018	2018	6	1	1	Import	84	Belize
8	H5	2018	2018	2018	6	1	1	Import	96	Brunei Darussalam
9	H5	2018	2018	2018	6	1	1	Import	112	Belarus
10	H5	2018	2018	2018	6	1	1	Import	124	Canada
11	H5	2018	2018	2018	6	1	2	Export	124	Canada
12	H5	2018	2018	2018	6	1	3	Re-Export	124	Canada
13	H5	2018	2018	2018	6	1	4	Re-Import	124	Canada
14	H5	2018	2018	2018	6	1	1	Import	152	Chile
15	H5	2018	2018	2018	6	1	2	Export	152	Chile
16	H5	2018	2018	2018	6	1	1	Import	170	Colombia
17	H5	2018	2018	2018	6	1	2	Export	170	Colombia
18	H5	2018	2018	2018	6	1	1	Import	191	Croatia
19	H5	2018	2018	2018	6	1	2	Export	191	Croatia
20	H5	2018	2018	2018	6	1	1	Import	203	Czechia
21	H5	2018	2018	2018	6	1	2	Export	203	Czechia
22	H5	2018	2018	2018	6	1	1	Import	208	Denmark
23	H5	2018	2018	2018	6	1	2	Export	208	Denmark
24	H5	2018	2018	2018	6	1	2	Export	218	Ecuador
25	H5	2018	2018	2018	6	1	1	Import	222	El Salvador
26	H5	2018	2018	2018	6	1	1	Import	233	Estonia
27	H5	2018	2018	2018	6	1	2	Export	233	Estonia
28	H5	2018	2018	2018	6	1	1	Import	242	Fiji
29	H5	2018	2018	2018	6	1	1	Import	246	Finland

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
...	...	...	...	...	...	...	...	...	...	...
64	H5	2018	2018	2018	6	1	2	Export	699	India
65	H5	2018	2018	2018	6	1	1	Import	703	Slovakia
66	H5	2018	2018	2018	6	1	2	Export	703	Slovakia
67	H5	2018	2018	2018	6	1	4	Re-Import	703	Slovakia
68	H5	2018	2018	2018	6	1	1	Import	705	Slovenia
69	H5	2018	2018	2018	6	1	2	Export	705	Slovenia
70	H5	2018	2018	2018	6	1	1	Import	716	Zimbabwe
71	H5	2018	2018	2018	6	1	1	Import	752	Sweden
72	H5	2018	2018	2018	6	1	2	Export	752	Sweden
73	H5	2018	2018	2018	6	1	1	Import	757	Switzerland
74	H5	2018	2018	2018	6	1	2	Export	757	Switzerland
75	H5	2018	2018	2018	6	1	1	Import	764	Thailand
76	H5	2018	2018	2018	6	1	2	Export	764	Thailand
77	H5	2018	2018	2018	6	1	1	Import	807	North Macedonia
78	H5	2018	2018	2018	6	1	2	Export	807	North Macedonia
79	H5	2018	2018	2018	6	1	1	Import	826	United Kingdom
80	H5	2018	2018	2018	6	1	2	Export	826	United Kingdom
81	H5	2018	2018	2018	6	1	1	Import	894	Zambia
82	H4	2018	2018	2018	6	1	1	Import	132	Cabo Verde
83	H4	2018	2018	2018	6	1	1	Import	268	Georgia
84	H4	2018	2018	2018	6	1	1	Import	484	Mexico
85	H4	2018	2018	2018	6	1	2	Export	484	Mexico
86	H4	2018	2018	2018	6	1	1	Import	498	Rep. of Moldova
87	H4	2018	2018	2018	6	1	1	Import	533	Aruba
88	H4	2018	2018	2018	6	1	1	Import	608	Philippines
89	H4	2018	2018	2018	6	1	1	Import	682	Saudi Arabia
90	H4	2018	2018	2018	6	1	1	Import	804	Ukraine
91	H4	2018	2018	2018	6	1	2	Export	804	Ukraine
92	H4	2018	2018	2018	6	1	1	Import	818	Egypt

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
93	H4	2018	2018	2018	6	1	1	Import	882	Samoa

94 rows × 35 columns

In [118]:
```
world_data_1992= "/Users/lindayao/Desktop/DataBootcamp/final/world_export_quinoa_1992.csv"
world_data_1992 = pd.read_csv(world_data_1992)
```

In [119]:
```
world_data_1992
```

Out[119]:

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
0	H0	1992	1992	1992	0	0	1	Import	12	Algeria
1	H0	1992	1992	1992	0	0	2	Export	12	Algeria
2	H0	1992	1992	1992	0	0	1	Import	36	Australia
3	H0	1992	1992	1992	0	0	2	Export	36	Australia
4	H0	1992	1992	1992	0	0	3	Re-Export	36	Australia
5	H0	1992	1992	1992	0	0	1	Import	50	Bangladesh
6	H0	1992	1992	1992	0	0	2	Export	50	Bangladesh
7	H0	1992	1992	1992	0	0	1	Import	68	Bolivia (Plurinational State of)
8	H0	1992	1992	1992	0	0	2	Export	68	Bolivia (Plurinational State of)
9	H0	1992	1992	1992	0	0	1	Import	76	Brazil
10	H0	1992	1992	1992	0	0	2	Export	76	Brazil
11	H0	1992	1992	1992	0	0	1	Import	84	Belize
12	H0	1992	1992	1992	0	0	2	Export	84	Belize
13	H0	1992	1992	1992	0	0	3	Re-Export	84	Belize
14	H0	1992	1992	1992	0	0	1	Import	96	Brunei Darussalam
15	H0	1992	1992	1992	0	0	2	Export	96	Brunei Darussalam
16	H0	1992	1992	1992	0	0	1	Import	104	Myanmar
17	H0	1992	1992	1992	0	0	2	Export	104	Myanmar
18	H0	1992	1992	1992	0	0	3	Re-Export	104	Myanmar
19	H0	1992	1992	1992	0	0	1	Import	124	Canada
20	H0	1992	1992	1992	0	0	2	Export	124	Canada
21	H0	1992	1992	1992	0	0	1	Import	144	Sri Lanka
22	H0	1992	1992	1992	0	0	2	Export	144	Sri Lanka
23	H0	1992	1992	1992	0	0	3	Re-Export	144	Sri Lanka
24	H0	1992	1992	1992	0	0	1	Import	152	Chile
25	H0	1992	1992	1992	0	0	2	Export	152	Chile
26	H0	1992	1992	1992	0	0	1	Import	156	China
27	H0	1992	1992	1992	0	0	2	Export	156	China

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
28	H0	1992	1992	1992	0	0	1	Import	170	Colombia
29	H0	1992	1992	1992	0	0	2	Export	170	Colombia
...	...	...	...	...	...	...	...	...	...	...
95	H0	1992	1992	1992	0	0	1	Import	699	India
96	H0	1992	1992	1992	0	0	2	Export	699	India
97	H0	1992	1992	1992	0	0	3	Re-Export	699	India
98	H0	1992	1992	1992	0	0	1	Import	702	Singapore
99	H0	1992	1992	1992	0	0	2	Export	702	Singapore
100	H0	1992	1992	1992	0	0	1	Import	711	So. African Customs Union
101	H0	1992	1992	1992	0	0	2	Export	711	So. African Customs Union
102	H0	1992	1992	1992	0	0	1	Import	724	Spain
103	H0	1992	1992	1992	0	0	2	Export	724	Spain
104	H0	1992	1992	1992	0	0	1	Import	752	Sweden
105	H0	1992	1992	1992	0	0	2	Export	752	Sweden
106	H0	1992	1992	1992	0	0	1	Import	757	Switzerland
107	H0	1992	1992	1992	0	0	2	Export	757	Switzerland
108	H0	1992	1992	1992	0	0	1	Import	764	Thailand
109	H0	1992	1992	1992	0	0	2	Export	764	Thailand
110	H0	1992	1992	1992	0	0	3	Re-Export	764	Thailand
111	H0	1992	1992	1992	0	0	1	Import	780	Trinidad and Tobago
112	H0	1992	1992	1992	0	0	2	Export	780	Trinidad and Tobago
113	H0	1992	1992	1992	0	0	3	Re-Export	780	Trinidad and Tobago
114	H0	1992	1992	1992	0	0	1	Import	784	United Arab Emirates
115	H0	1992	1992	1992	0	0	2	Export	784	United Arab Emirates
116	H0	1992	1992	1992	0	0	1	Import	788	Tunisia
117	H0	1992	1992	1992	0	0	2	Export	788	Tunisia
118	H0	1992	1992	1992	0	0	1	Import	792	Turkey
119	H0	1992	1992	1992	0	0	2	Export	792	Turkey

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
120	H0	1992	1992	1992	0	0	1	Import	842	USA
121	H0	1992	1992	1992	0	0	2	Export	842	USA
122	H0	1992	1992	1992	0	0	3	Re-Export	842	USA
123	H0	1992	1992	1992	0	0	1	Import	891	Serbia and Montenegro
124	H0	1992	1992	1992	0	0	2	Export	891	Serbia and Montenegro

125 rows × 35 columns

Formatting

Combine archival prices with newer prices by merging the two datasets together...

In [120]:
```
#use concat to combine the two datasets

prices_combine = pd.concat([fao_archive_price,fao_price])
prices_combine
```

Out[120]:

	Country	Year	Producer_Price
0	Bolivia (Plurinational State of)	1966	1196.00
1	Bolivia (Plurinational State of)	1967	1261.00
2	Bolivia (Plurinational State of)	1968	1304.00
3	Bolivia (Plurinational State of)	1969	1304.00
4	Bolivia (Plurinational State of)	1970	1348.00
5	Bolivia (Plurinational State of)	1971	1348.00
6	Bolivia (Plurinational State of)	1972	1413.00
7	Bolivia (Plurinational State of)	1973	1522.00
8	Bolivia (Plurinational State of)	1974	3022.00
9	Bolivia (Plurinational State of)	1975	3261.00
10	Bolivia (Plurinational State of)	1976	3649.00
11	Bolivia (Plurinational State of)	1977	3660.00
12	Bolivia (Plurinational State of)	1978	4310.00
13	Bolivia (Plurinational State of)	1979	4580.00
14	Bolivia (Plurinational State of)	1980	8171.00
15	Bolivia (Plurinational State of)	1981	10580.00
16	Bolivia (Plurinational State of)	1982	17800.00
17	Bolivia (Plurinational State of)	1983	110000.00
18	Bolivia (Plurinational State of)	1984	2.00
19	Bolivia (Plurinational State of)	1985	145.00
20	Bolivia (Plurinational State of)	1986	490.00
21	Bolivia (Plurinational State of)	1987	526.87
22	Bolivia (Plurinational State of)	1988	888.67
23	Bolivia (Plurinational State of)	1989	1399.00
24	Bolivia (Plurinational State of)	1990	1334.00
25	Ecuador	1966	9690.00
26	Ecuador	1967	10880.00
27	Ecuador	1968	10660.00
28	Ecuador	1969	13010.00
29	Ecuador	1970	12960.00
...	...	...	...
25	Bolivia (Plurinational State of)	2016	1028.80
26	Bolivia (Plurinational State of)	2017	770.60
27	Ecuador	2003	543.00

	Country	Year	Producer_Price
28	Peru	1991	323.60
29	Peru	1992	361.20
30	Peru	1993	291.70
31	Peru	1994	323.50
32	Peru	1995	395.00
33	Peru	1996	407.60
34	Peru	1997	418.90
35	Peru	1998	419.80
36	Peru	1999	366.50
37	Peru	2000	335.20
38	Peru	2001	339.30
39	Peru	2002	318.50
40	Peru	2003	319.10
41	Peru	2004	325.20
42	Peru	2005	352.00
43	Peru	2006	360.40
44	Peru	2007	390.00
45	Peru	2008	547.10
46	Peru	2009	1115.70
47	Peru	2010	1196.40
48	Peru	2011	1336.20
49	Peru	2012	1471.00
50	Peru	2013	2328.00
51	Peru	2014	2773.80
52	Peru	2015	1540.60
53	Peru	2016	1178.70
54	Peru	2017	1128.70

130 rows × 3 columns

Combine production and producer price.

In [121]:
```
fao_combined = pd.merge(prices_combine,fao_production, on=['Year','Country'], how='inner')
```

In [122]:
```
fao_combined
```

Out[122]:

	Country	Year	Producer_Price	Production
0	Bolivia (Plurinational State of)	1966	1196.00	8000
1	Bolivia (Plurinational State of)	1967	1261.00	7400
2	Bolivia (Plurinational State of)	1968	1304.00	9600
3	Bolivia (Plurinational State of)	1969	1304.00	9600
4	Bolivia (Plurinational State of)	1970	1348.00	9700
5	Bolivia (Plurinational State of)	1971	1348.00	10500
6	Bolivia (Plurinational State of)	1972	1413.00	10800
7	Bolivia (Plurinational State of)	1973	1522.00	12000
8	Bolivia (Plurinational State of)	1974	3022.00	13205
9	Bolivia (Plurinational State of)	1975	3261.00	15200
10	Bolivia (Plurinational State of)	1976	3649.00	14960
11	Bolivia (Plurinational State of)	1977	3660.00	9035
12	Bolivia (Plurinational State of)	1978	4310.00	7660
13	Bolivia (Plurinational State of)	1979	4580.00	6000
14	Bolivia (Plurinational State of)	1980	8171.00	8935
15	Bolivia (Plurinational State of)	1981	10580.00	13040
16	Bolivia (Plurinational State of)	1982	17800.00	15785
17	Bolivia (Plurinational State of)	1983	110000.00	11710
18	Bolivia (Plurinational State of)	1984	2.00	16622
19	Bolivia (Plurinational State of)	1985	145.00	21144
20	Bolivia (Plurinational State of)	1986	490.00	20631
21	Bolivia (Plurinational State of)	1987	526.87	23897
22	Bolivia (Plurinational State of)	1988	888.67	22600
23	Bolivia (Plurinational State of)	1989	1399.00	18230
24	Bolivia (Plurinational State of)	1990	1334.00	16077
25	Ecuador	1966	9690.00	872
26	Ecuador	1967	10880.00	800
27	Ecuador	1968	10660.00	768
28	Ecuador	1969	13010.00	740
29	Ecuador	1970	12960.00	740
...	...	...	...	...
100	Bolivia (Plurinational State of)	2016	1028.80	65548
101	Bolivia (Plurinational State of)	2017	770.60	66792
102	Ecuador	2003	543.00	519

	Country	Year	Producer_Price	Production
103	Peru	1991	323.60	18266
104	Peru	1992	361.20	4961
105	Peru	1993	291.70	17157
106	Peru	1994	323.50	16629
107	Peru	1995	395.00	13773
108	Peru	1996	407.60	16070
109	Peru	1997	418.90	23688
110	Peru	1998	419.80	28171
111	Peru	1999	366.50	28413
112	Peru	2000	335.20	28191
113	Peru	2001	339.30	22267
114	Peru	2002	318.50	30373
115	Peru	2003	319.10	30085
116	Peru	2004	325.20	26997
117	Peru	2005	352.00	32590
118	Peru	2006	360.40	30429
119	Peru	2007	390.00	31824
120	Peru	2008	547.10	29867
121	Peru	2009	1115.70	39397
122	Peru	2010	1196.40	41079
123	Peru	2011	1336.20	41182
124	Peru	2012	1471.00	44213
125	Peru	2013	2328.00	52129
126	Peru	2014	2773.80	114725
127	Peru	2015	1540.60	105666
128	Peru	2016	1178.70	79269
129	Peru	2017	1128.70	78657

130 rows × 4 columns

Combine the fao_productivity with fao_combined

In [123]:
```
fao_productivity = pd.merge(fao_combined,fao_harvest, on=['Year','Countr
y'], how='inner')
fao_productivity
```

Out[123]:

	Country	Year	Producer_Price	Production	Area_Harvested(HA)
0	Bolivia (Plurinational State of)	1966	1196.00	8000	16000
1	Bolivia (Plurinational State of)	1967	1261.00	7400	12330
2	Bolivia (Plurinational State of)	1968	1304.00	9600	14120
3	Bolivia (Plurinational State of)	1969	1304.00	9600	14150
4	Bolivia (Plurinational State of)	1970	1348.00	9700	12200
5	Bolivia (Plurinational State of)	1971	1348.00	10500	15000
6	Bolivia (Plurinational State of)	1972	1413.00	10800	15000
7	Bolivia (Plurinational State of)	1973	1522.00	12000	16000
8	Bolivia (Plurinational State of)	1974	3022.00	13205	16890
9	Bolivia (Plurinational State of)	1975	3261.00	15200	19240
10	Bolivia (Plurinational State of)	1976	3649.00	14960	20800
11	Bolivia (Plurinational State of)	1977	3660.00	9035	22400
12	Bolivia (Plurinational State of)	1978	4310.00	7660	17830
13	Bolivia (Plurinational State of)	1979	4580.00	6000	10455
14	Bolivia (Plurinational State of)	1980	8171.00	8935	15640
15	Bolivia (Plurinational State of)	1981	10580.00	13040	23040
16	Bolivia (Plurinational State of)	1982	17800.00	15785	24930
17	Bolivia (Plurinational State of)	1983	110000.00	11710	43086
18	Bolivia (Plurinational State of)	1984	2.00	16622	33382
19	Bolivia (Plurinational State of)	1985	145.00	21144	47939
20	Bolivia (Plurinational State of)	1986	490.00	20631	42850
21	Bolivia (Plurinational State of)	1987	526.87	23897	47330
22	Bolivia (Plurinational State of)	1988	888.67	22600	50000
23	Bolivia (Plurinational State of)	1989	1399.00	18230	42640
24	Bolivia (Plurinational State of)	1990	1334.00	16077	38615
25	Ecuador	1966	9690.00	872	1200
26	Ecuador	1967	10880.00	800	1100
27	Ecuador	1968	10660.00	768	1000
28	Ecuador	1969	13010.00	740	1000
29	Ecuador	1970	12960.00	740	1000
...	...	...	...	...	...
100	Bolivia (Plurinational State of)	2016	1028.80	65548	118913
101	Bolivia (Plurinational State of)	2017	770.60	66792	110639
102	Ecuador	2003	543.00	519	1000

	Country	Year	Producer_Price	Production	Area_Harvested(HA)
103	Peru	1991	323.60	18266	21007
104	Peru	1992	361.20	4961	7874
105	Peru	1993	291.70	17157	17812
106	Peru	1994	323.50	16629	20693
107	Peru	1995	395.00	13773	18729
108	Peru	1996	407.60	16070	18704
109	Peru	1997	418.90	23688	27033
110	Peru	1998	419.80	28171	30720
111	Peru	1999	366.50	28413	28979
112	Peru	2000	335.20	28191	28889
113	Peru	2001	339.30	22267	25601
114	Peru	2002	318.50	30373	27851
115	Peru	2003	319.10	30085	28326
116	Peru	2004	325.20	26997	27676
117	Peru	2005	352.00	32590	28632
118	Peru	2006	360.40	30429	29947
119	Peru	2007	390.00	31824	30381
120	Peru	2008	547.10	29867	31163
121	Peru	2009	1115.70	39397	34026
122	Peru	2010	1196.40	41079	35313
123	Peru	2011	1336.20	41182	35475
124	Peru	2012	1471.00	44213	38495
125	Peru	2013	2328.00	52129	44868
126	Peru	2014	2773.80	114725	68140
127	Peru	2015	1540.60	105666	69303
128	Peru	2016	1178.70	79269	64223
129	Peru	2017	1128.70	78657	61721

130 rows × 5 columns

Who are the big quinoa exporters?

In order to better understand the market of quinoa, it is important to see which countries currently are the big players in the quinoa production market. This understanding will better help us determine which countries to later study when it comes to the history of quinoa production and how the demand affects those exporters' prices, production and productivity.

In [124]:
```
#Group the countries based on their production to see how much they expo
rt

groupby_country = fao_combined.groupby("Country").agg(sum)
```

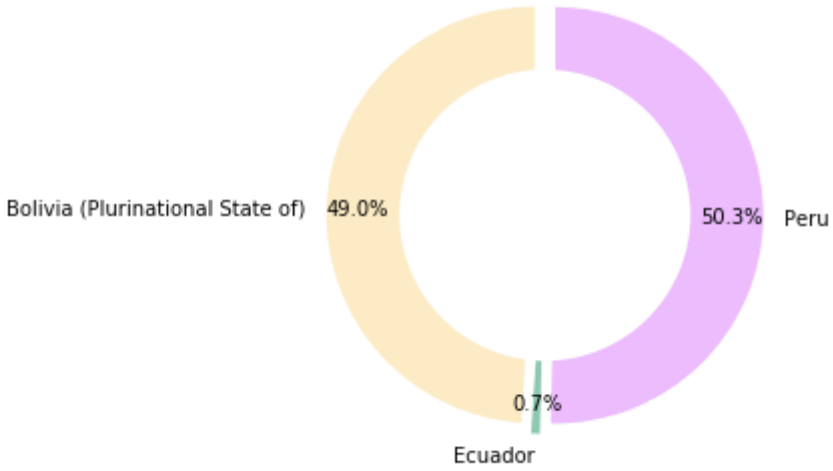
In [125]:
```
groupby_country
```

Out[125]:

Country	Year	Producer_Price	Production
Bolivia (Plurinational State of)	103558	205071.54	1246904
Ecuador	51453	1671533.00	17312
Peru	103558	1742829.70	1281977

Illustrate the findings

In [126]:
```
# Pie chart
labels = groupby_country.index
sizes = groupby_country["Production"]
#colors
colors = ['#FCEBC5','#8DC9B0','#ECBCFD']
#explsion
explode = (0.05,0.05,0.05)

plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', starta
ngle=90, pctdistance=0.85, explode = explode)
#draw circle
centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
# Equal aspect ratio ensures that pie is drawn as a circle
plt.tight_layout()
plt.show()
```



Who were the major players before? Who are the major players now?

Boliva and Peru weren't always the dominant exporters of quinoa. Before the increase in demand, which countries exported the most quinoa?

In [127]:
```
list_type = ['Export']
world_data_export  = world_data[world_data['Trade Flow'].isin(list_type
)]
world_data_1992_export  = world_data_1992[world_data_1992['Trade Flow'].
isin(list_type)]
```

In [128]:
```
#Rename columns
world_data_export.rename(columns={"Trade Value (US$)":"Trade_Value_USD"
}, inplace=True)
world_data_1992_export.rename(columns={"Trade Value (US$)":"Trade_Value_
USD"}, inplace=True)
```

In [129]:
```
#organize the dataset based on the trade value
ordered_export = world_data_export.sort_values('Trade_Value_USD')
ordered_1992_export = world_data_1992_export.sort_values('Trade_Value_US
D')
```

Find the top 5 export countires today and before the 2000s

In [130]:
```
#isolate the top 5 by using .tail()

top_5_exported_today = ordered_export.tail(5)
top_5_exported_today
```

Out[130]:

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
39	H5	2018	2018	2018	6	1	2	Export	372	Ireland
80	H5	2018	2018	2018	6	1	2	Export	826	United Kingdom
11	H5	2018	2018	2018	6	1	2	Export	124	Canada
24	H5	2018	2018	2018	6	1	2	Export	218	Ecuador
6	H5	2018	2018	2018	6	1	2	Export	68	Bolivia (Plurinational State of)

5 rows × 35 columns

In [131]:
```
#Isolate the top 5 by using .tail()

top_5_exported_1992 = ordered_1992_export.tail(5)
top_5_exported_1992
```

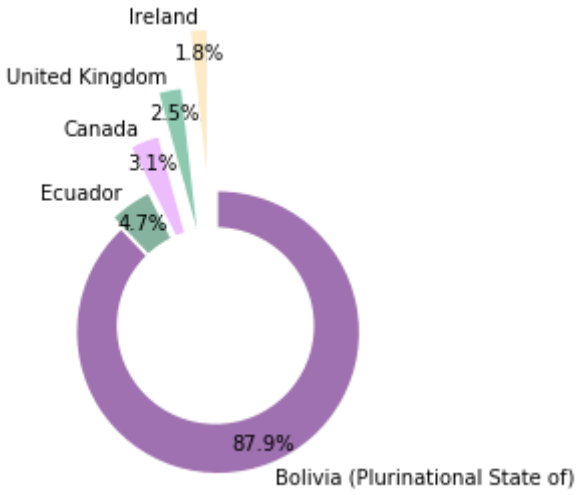
Out[131]:

	Classification	Year	Period	Period Desc.	Aggregate Level	Is Leaf Code	Trade Flow Code	Trade Flow	Reporter Code	Reporter
20	H0	1992	1992	1992	0	0	2	Export	124	Canada
77	H0	1992	1992	1992	0	0	2	Export	528	Netherlands
59	H0	1992	1992	1992	0	0	2	Export	392	Japan
42	H0	1992	1992	1992	0	0	2	Export	276	Germany
121	H0	1992	1992	1992	0	0	2	Export	842	USA

5 rows × 35 columns

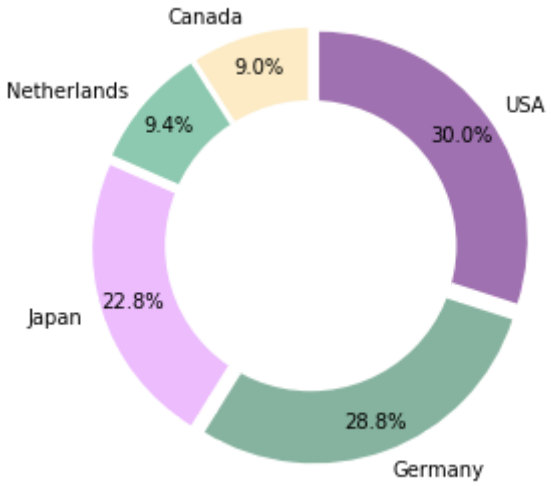
The top 5 exporting countries of quinoa today: (excluding Peru)

In [132]:
```
# Pie chart
labels = top_5_exported_today["Reporter"]
sizes = top_5_exported_today["Trade_Value_USD"]
#colors
colors = ['#FCEBC5','#8DC9B0','#ECBCFD',"#86B39F","#9F71B0"]
#explsion
explode = (1.1,0.70,0.40,0.05,0.05)

plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', starta
ngle=90, pctdistance=0.85, explode = explode)
#draw circle
centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
# Equal aspect ratio ensures that pie is drawn as a circle
plt.tight_layout()
plt.show()
```



The top 5 exporting countries of quinoa before 2000:

In [133]:
```
# Pie chart
labels = top_5_exported_1992["Reporter"]
sizes = top_5_exported_1992["Trade_Value_USD"]
#colors
colors = ['#FCEBC5','#8DC9B0','#ECBCFD',"#86B39F","#9F71B0"]
#explsion
explode = (0.05,0.05,0.05,0.05,0.05)

plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', starta
ngle=90, pctdistance=0.85, explode = explode)
#draw circle
centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
# Equal aspect ratio ensures that pie is drawn as a circle
plt.tight_layout()
plt.show()
```



As shown above, Bolivia and Peru weren't the major export of quinoa 20 years ago. Instead the countries that were exporting quinoa were will spread between some of the wealthy countries today like US, Japan and Germany. This graph can show how overtime some third world countries took on the production of quinoa as wealthier countries moved on to other exports and become major importers of quinoa.

When did Bolivia, Peru and Ecuador become the dominant exporter of quinoa?

"Quinoa is rising up the popularity charts as a food staple in U.S. and Europe. A growing spate of positive coverage cites quinoa (pronounced KEEN-wa) as a high-protein grain-like relative of spinach and beets which is a newly discovered gluten-free superfood" (foodfirst.org, 2014).

This graph shows that Peru and Bolivia really picked up as the major producer of quinoa after 2010 as U.S and Europe became more health concious and increasing demand for gluten-free superfoods.

Let's take a look at the historic production level and pricing of these major exporters.

First, I will group the dataset based on country and year.

In [134]:
```
#use groupby to organize the data
new = fao_combined.groupby(["Country", "Year"]).agg(sum)
new
```

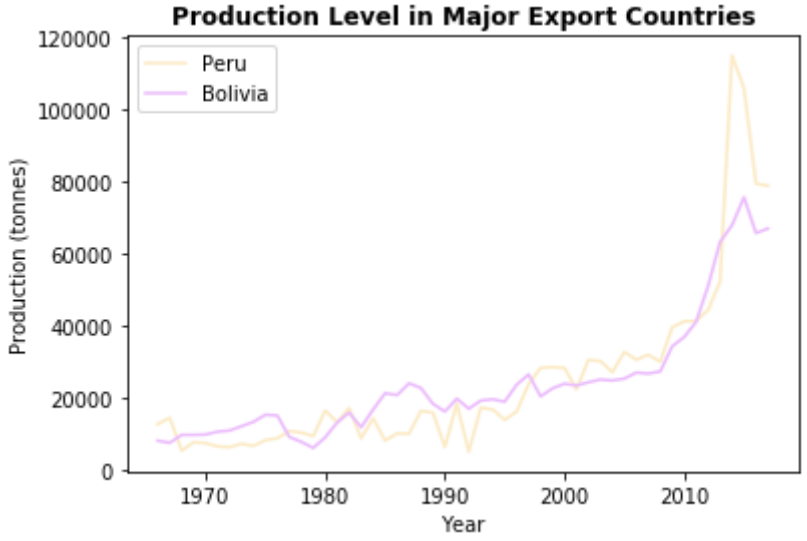
Out[134]:

Country	Year	Producer_Price	Production
Bolivia (Plurinational State of)	**1966**	1196.00	8000
	1967	1261.00	7400
	1968	1304.00	9600
	1969	1304.00	9600
	1970	1348.00	9700
	1971	1348.00	10500
	1972	1413.00	10800
	1973	1522.00	12000
	1974	3022.00	13205
	1975	3261.00	15200
	1976	3649.00	14960
	1977	3660.00	9035
	1978	4310.00	7660
	1979	4580.00	6000
	1980	8171.00	8935
	1981	10580.00	13040
	1982	17800.00	15785
	1983	110000.00	11710
	1984	2.00	16622
	1985	145.00	21144
	1986	490.00	20631
	1987	526.87	23897
	1988	888.67	22600
	1989	1399.00	18230
	1990	1334.00	16077
	1991	435.10	19651
	1992	466.30	16858
	1993	480.60	19129
	1994	481.50	19465
	1995	521.60	18814
...	**...**	...	...
Peru	**1988**	26250.00	16284
	1989	619010.00	15753

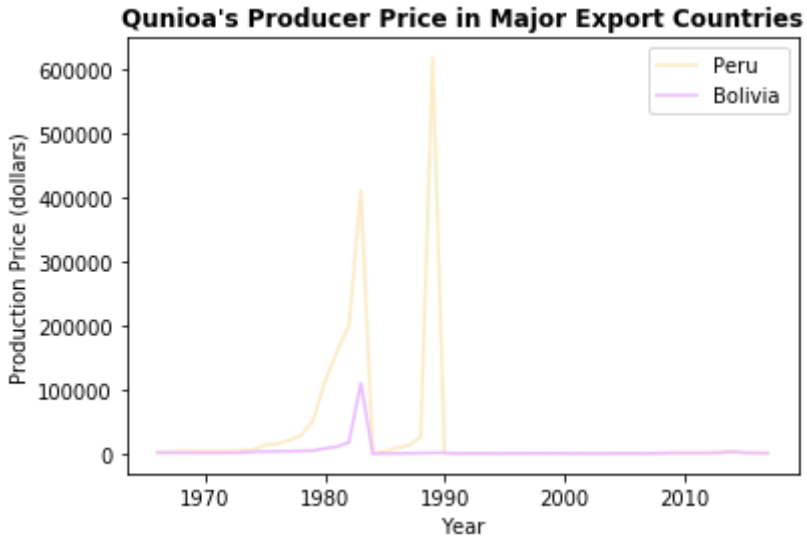
Country	Year	Producer_Price	Production
	1990	28.00	6260
	1991	323.60	18266
	1992	361.20	4961
	1993	291.70	17157
	1994	323.50	16629
	1995	395.00	13773
	1996	407.60	16070
	1997	418.90	23688
	1998	419.80	28171
	1999	366.50	28413
	2000	335.20	28191
	2001	339.30	22267
	2002	318.50	30373
	2003	319.10	30085
	2004	325.20	26997
	2005	352.00	32590
	2006	360.40	30429
	2007	390.00	31824
	2008	547.10	29867
	2009	1115.70	39397
	2010	1196.40	41079
	2011	1336.20	41182
	2012	1471.00	44213
	2013	2328.00	52129
	2014	2773.80	114725
	2015	1540.60	105666
	2016	1178.70	79269
	2017	1128.70	78657

130 rows × 2 columns

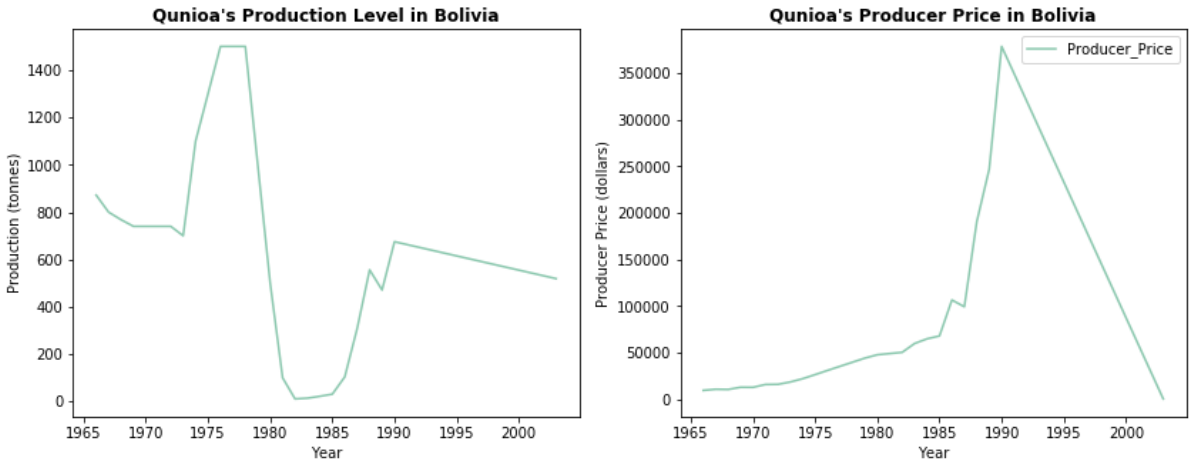
In [135]:
```
#plot the dataset
fig, ax = plt.subplots()

#give a title
ax.set_title("Production Level in Major Export Countries", fontsize = 12
, fontweight = "bold")

#mark the axis
ax.set_ylabel("Production (tonnes)")
ax.set_xlabel("Year")

#plot the data
ax.plot(new.loc['Peru'].index, new.loc["Peru"].Production, label = "Per
u", color = "#FCEBC5")
ax.plot(new.loc['Bolivia (Plurinational State of)'].index, new.loc["Boli
via (Plurinational State of)"].Production, label = "Bolivia", color = '#
ECBCFD')

plt.legend()

plt.show()
```



In [136]:
```
#plot the dataset
fig, ax = plt.subplots()

#give a title
ax.set_title("Qunioa's Producer Price in Major Export Countries", fontsi
ze = 12, fontweight = "bold")

#mark the axis
ax.set_ylabel("Production Price (dollars)")
ax.set_xlabel("Year")

#plot the data
ax.plot(new.loc['Peru'].index, new.loc["Peru"].Producer_Price, label =
"Peru", color = "#FCEBC5")
ax.plot(new.loc['Bolivia (Plurinational State of)'].index, new.loc["Boli
via (Plurinational State of)"].Producer_Price, label = "Bolivia", color
= '#ECBCFD')

plt.legend()
plt.show()
```



In [137]:
```
#plot the datasets and put them side by side
fig, ax = plt.subplots(1,2, sharex = True, figsize = (14,5))

#add title and axis to first graph
ax[0].set_title("Qunioa's Production Level in Bolivia", fontsize = 12, f
ontweight = "bold")
ax[0].set_ylabel("Production (tonnes)")
ax[0].set_xlabel("Year")

#add title and axis to the other graph
ax[1].set_title("Qunioa's Producer Price in Bolivia", fontsize = 12, fon
tweight = "bold")
ax[1].set_ylabel("Producer Price (dollars)")
ax[1].set_xlabel("Year")

#plot both graphs
ax[0].plot(new.loc['Ecuador'].index, new.loc["Ecuador"].Production,color
= "#8DC9B0")
ax[1].plot(new.loc['Ecuador'].index, new.loc["Ecuador"].Producer_Price,c
olor = "#8DC9B0")
plt.legend()


plt.show()
```

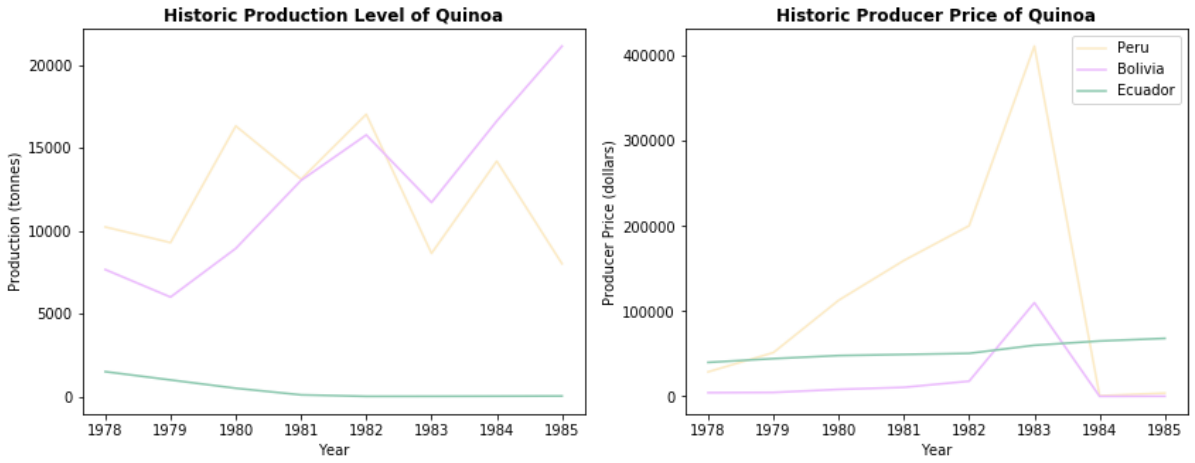


What helped spur the production of qunioa for Peru and Bolivia?

1980

In [138]:
```
#isolate the years around 1980
years = ["1978","1979","1980","1981","1982","1983","1984","1985"]
years1980 = fao_combined.loc[fao_combined['Year'].isin(years)]

#group the new dataset to graph
years_1980 = years1980.groupby(["Country", "Year"]).agg(sum)
```

In [139]:
```
#plot the datasets and put them side by side
fig, ax = plt.subplots(1,2, sharex = True, figsize = (14,5))

#add title and axis to first graph
ax[0].set_title("Historic Production Level of Quinoa", fontsize = 12, fo
ntweight = "bold")
ax[0].set_ylabel("Production (tonnes)")
ax[0].set_xlabel("Year")

#add title and axis to the other graph
ax[1].set_title("Historic Producer Price of Quinoa", fontsize = 12, font
weight = "bold")
ax[1].set_ylabel("Producer Price (dollars)")
ax[1].set_xlabel("Year")

#plot both graphs
ax[0].plot(years_1980.loc['Peru'].index, years_1980.loc["Peru"].Producti
on, label = "Peru", color = "#FCEBC5")
ax[0].plot(years_1980.loc['Bolivia (Plurinational State of)'].index, yea
rs_1980.loc["Bolivia (Plurinational State of)"].Production, label = "Bol
ivia", color = '#ECBCFD')
ax[0].plot(years_1980.loc['Ecuador'].index, years_1980.loc["Ecuador"].Pr
oduction, label = "Ecuador", color = '#8DC9B0')
ax[1].plot(years_1980.loc['Peru'].index, years_1980.loc["Peru"].Producer
_Price, label = "Peru", color = "#FCEBC5")
ax[1].plot(years_1980.loc['Bolivia (Plurinational State of)'].index, yea
rs_1980.loc["Bolivia (Plurinational State of)"].Producer_Price, label =
"Bolivia", color = '#ECBCFD')
ax[1].plot(years_1980.loc['Ecuador'].index, years_1980.loc["Ecuador"].Pr
oducer_Price, label = "Ecuador", color = '#8DC9B0')

plt.legend()

plt.show()
```



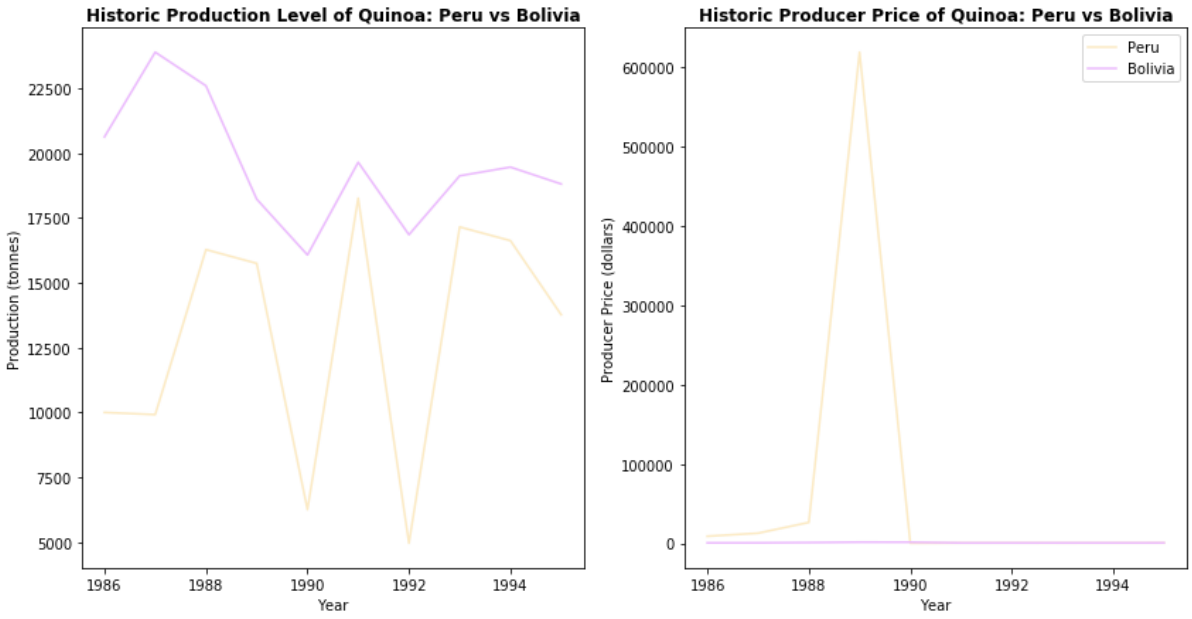
1990

In [140]:
```
#isolate the years around 1990
years = ["1986","1987","1988","1989","1990","1991","1991","1992","1993",
"1994","1995"]
years1990 = fao_combined.loc[fao_combined['Year'].isin(years)]


#group the new dataset to graph
years_1990 = years1990.groupby(["Country", "Year"]).agg(sum)
years_1990
```

Out[140]:

		Producer_Price	Production
Country	**Year**		
Bolivia (Plurinational State of)	**1986**	490.00	20631
	1987	526.87	23897
	1988	888.67	22600
	1989	1399.00	18230
	1990	1334.00	16077
	1991	435.10	19651
	1992	466.30	16858
	1993	480.60	19129
	1994	481.50	19465
	1995	521.60	18814
Ecuador	**1986**	106670.00	104
	1987	99410.00	309
	1988	190700.00	556
	1989	247100.00	471
	1990	378800.00	675
Peru	**1986**	8830.00	10004
	1987	12670.00	9921
	1988	26250.00	16284
	1989	619010.00	15753
	1990	28.00	6260
	1991	323.60	18266
	1992	361.20	4961
	1993	291.70	17157
	1994	323.50	16629
	1995	395.00	13773

In [141]:
```
#plot the datasets and put them side by side
fig, ax = plt.subplots(1,2, sharex = True, figsize = (14,7))

#add title and axis to first graph
ax[0].set_title("Historic Production Level of Quinoa: Peru vs Bolivia",
fontsize = 12, fontweight = "bold")
ax[0].set_ylabel("Production (tonnes)")
ax[0].set_xlabel("Year")

#add title and axis to the other graph
ax[1].set_title("Historic Producer Price of Quinoa: Peru vs Bolivia", fo
ntsize = 12, fontweight = "bold")
ax[1].set_ylabel("Producer Price (dollars)")
ax[1].set_xlabel("Year")

#plot both graphs
ax[0].plot(years_1990.loc['Peru'].index, years_1990.loc["Peru"].Producti
on, label = "Peru", color = "#FCEBC5")
ax[0].plot(years_1990.loc['Bolivia (Plurinational State of)'].index, yea
rs_1990.loc["Bolivia (Plurinational State of)"].Production, label = "Bol
ivia", color = '#ECBCFD')
ax[1].plot(years_1990.loc['Peru'].index, years_1990.loc["Peru"].Producer
_Price, label = "Peru", color = "#FCEBC5")
ax[1].plot(years_1990.loc['Bolivia (Plurinational State of)'].index, yea
rs_1990.loc["Bolivia (Plurinational State of)"].Producer_Price, label =
"Bolivia", color = '#ECBCFD')


plt.legend()

plt.show()
```



After 2007: Production Level and Pricing

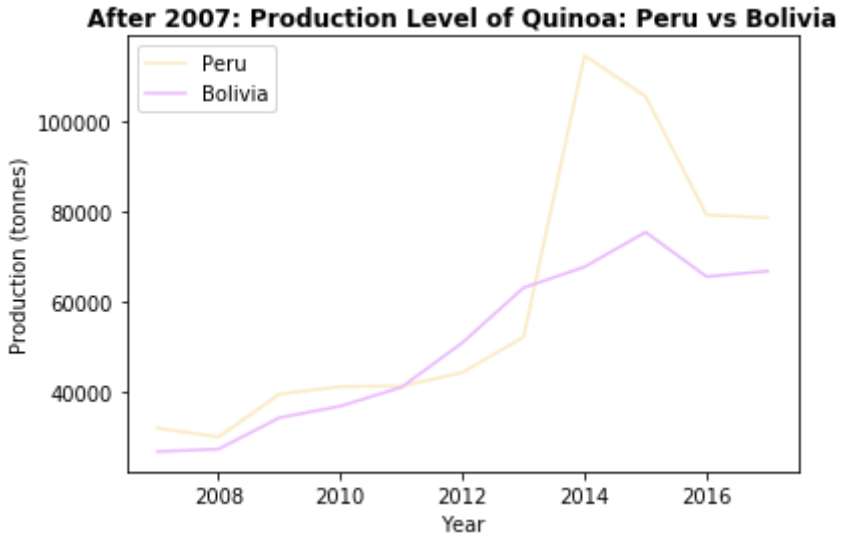
In [142]:
```
#isolate the more recent years
years = ["2007","2008","2009","2010","2011","2012","2013","2014","2015",
"2016","2017"]
recent_years = fao_combined.loc[fao_combined['Year'].isin(years)]


new_recent_years = recent_years.groupby(["Country", "Year"]).agg(sum)
new_recent_years
```

Out[142]:

		Producer_Price	Production
Country	**Year**		
Bolivia (Plurinational State of)	**2007**	469.1	26601
	2008	756.2	27169
	2009	1320.0	34156
	2010	872.8	36724
	2011	937.8	40943
	2012	1005.6	50874
	2013	1087.4	63075
	2014	3060.7	67711
	2015	1430.8	75449
	2016	1028.8	65548
	2017	770.6	66792
Peru	**2007**	390.0	31824
	2008	547.1	29867
	2009	1115.7	39397
	2010	1196.4	41079
	2011	1336.2	41182
	2012	1471.0	44213
	2013	2328.0	52129
	2014	2773.8	114725
	2015	1540.6	105666
	2016	1178.7	79269
	2017	1128.7	78657

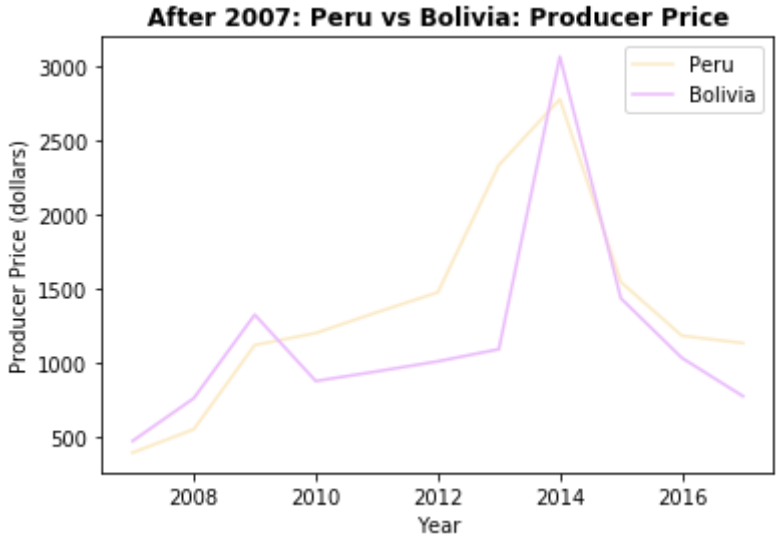
The graph below shows how production in Peru and Bolvia increased dramatically after 2012.

In [143]:
```
#plot the dataset
fig, ax = plt.subplots()

#give a title
ax.set_title("After 2007: Production Level of Quinoa: Peru vs Bolivia",
fontsize = 12, fontweight = "bold")

#mark the axis
ax.set_ylabel("Production (tonnes)")
ax.set_xlabel("Year")

#plot
ax.plot(new_recent_years.loc['Peru'].index, new_recent_years.loc["Peru"]
.Production, label = "Peru", color = "#FCEBC5")
ax.plot(new_recent_years.loc['Bolivia (Plurinational State of)'].index,
new_recent_years.loc["Bolivia (Plurinational State of)"].Production, lab
el = "Bolivia", color = '#ECBCFD')

plt.legend()

plt.show()
```



The graph below shows how as the demand increased in 2012 there was a shortage in supply. As supported by the supply and demand, the price of quinoa increased dramatically following 2012 and reached a peak in 2014.

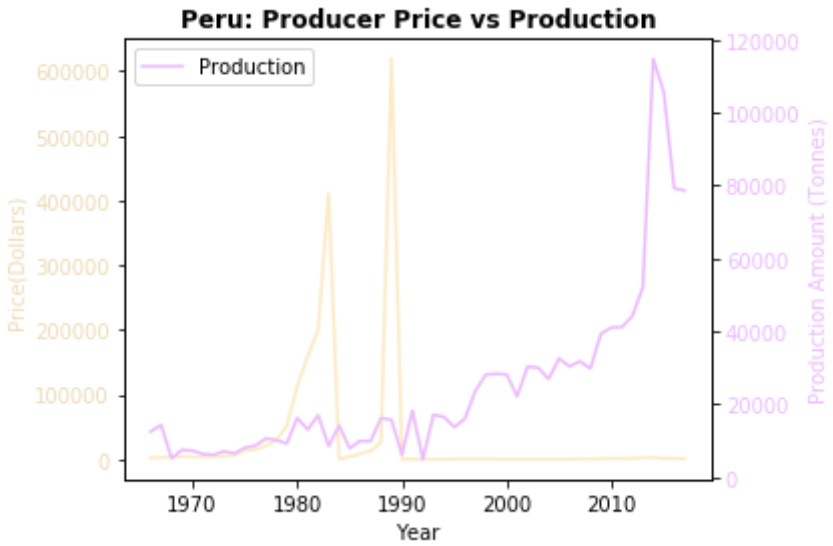
In [144]:
```
#plot the dataset
fig, ax = plt.subplots()

#give a title
ax.set_title("After 2007: Peru vs Bolivia: Producer Price", fontsize = 1
2, fontweight = "bold")

#mark the axis
ax.set_ylabel("Producer Price (dollars)")
ax.set_xlabel("Year")

#plot
ax.plot(new_recent_years.loc['Peru'].index, new_recent_years.loc["Peru"]
.Producer_Price, label = "Peru", color = "#FCEBC5")
ax.plot(new_recent_years.loc['Bolivia (Plurinational State of)'].index,
new_recent_years.loc["Bolivia (Plurinational State of)"].Producer_Price,
label = "Bolivia", color = '#ECBCFD')

plt.legend()

plt.show()
```



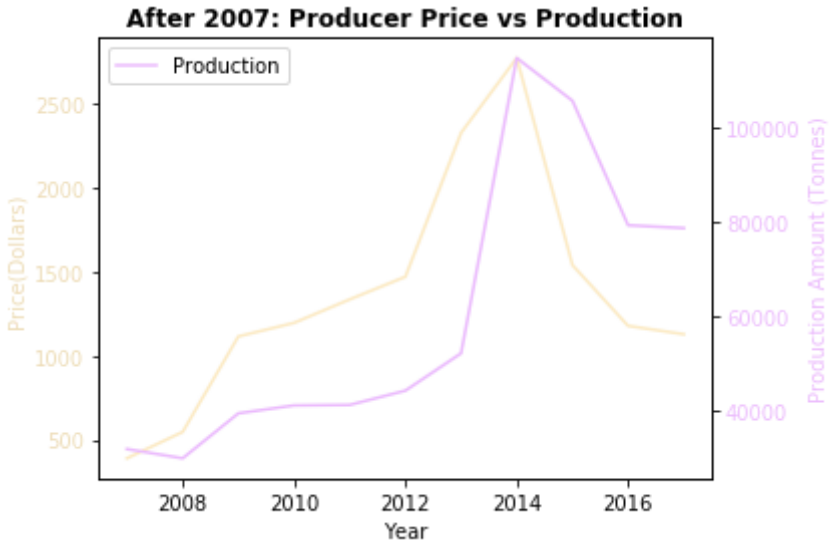
Case Study : Producer price vs production amount

Peru

In [145]:
```
fig, ax1 = plt.subplots()

#set the title
ax1.set_title("Peru: Producer Price vs Production", fontsize = 12, fontw
eight = "bold")


color = '#eddcb6'


#set the axis for left side of the graph
ax1.set_xlabel('Year')
ax1.set_ylabel('Price(Dollars)', color=color)

#plot first line
ax1.plot(new.loc['Peru'].index, new.loc["Peru"].Producer_Price, color =
"#FCEBC5")
ax1.tick_params(axis='y', labelcolor=color)



#plot the second line
ax2 = ax1.twinx()  # instantiate a second axes that shares the same x-ax
is

color = '#ECBCFD' #set color for second line

ax2.set_ylabel('Production Amount (Tonnes)', color=color)  # we already
 handled the x-label with ax1
ax2.plot(new.loc['Peru'].index, new.loc["Peru"].Production, color = '#EC
BCFD')
ax2.tick_params(axis='y', labelcolor=color)

fig.tight_layout()  # otherwise the right y-label is slightly clipped


plt.legend()

plt.show()
```

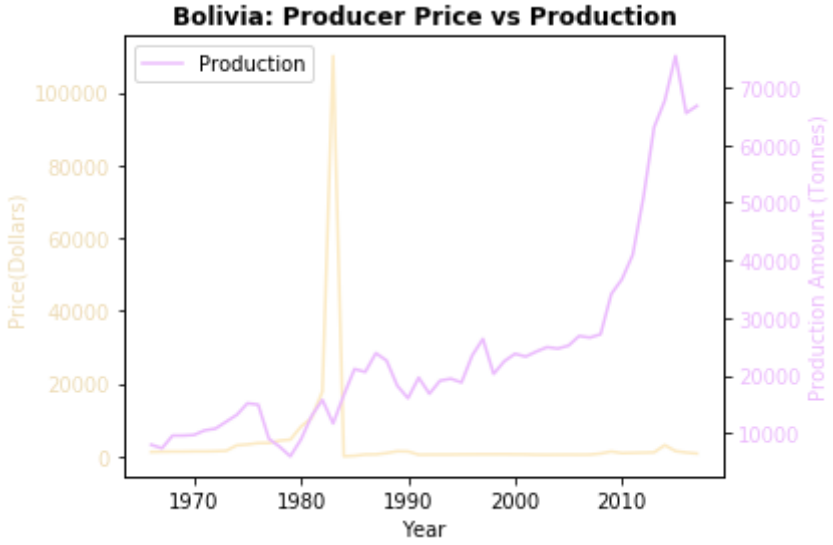


In [146]:
```
fig, ax1 = plt.subplots()

#set the title
ax1.set_title('After 2007: Producer Price vs Production', fontsize=12,fo
ntweight = "bold")


#set the axis for left side of the graph
color = '#eddcb6'
ax1.set_xlabel('Year')
ax1.set_ylabel('Price(Dollars)', color=color)

#plot first line
ax1.plot(new_recent_years.loc['Peru'].index, new_recent_years.loc["Peru"
].Producer_Price, color = "#FCEBC5")
ax1.tick_params(axis='y', labelcolor=color)

ax2 = ax1.twinx()  # instantiate a second axes that shares the same x-ax
is


#plot the second line
color = '#ECBCFD'
ax2.set_ylabel('Production Amount (Tonnes)', color=color)  # we already
 handled the x-label with ax1
ax2.plot(new_recent_years.loc['Peru'].index, new_recent_years.loc["Peru"
].Production, color = '#ECBCFD', )
ax2.tick_params(axis='y', labelcolor=color)

fig.tight_layout()  # otherwise the right y-label is slightly clipped


plt.legend()

plt.show()
```

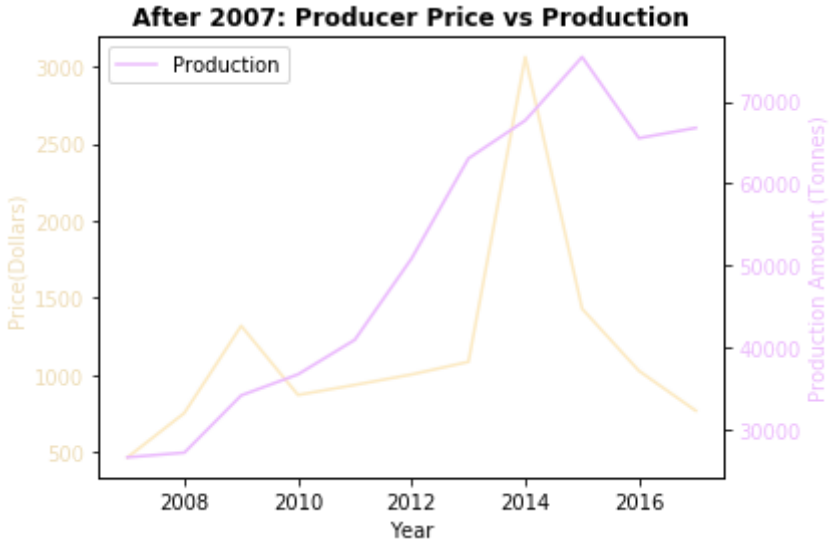


Bolivia

In [147]:
```
fig, ax1 = plt.subplots()
# ax.plot(new.loc['Bolivia (Plurinational State of)'].index, new.loc["Bo
livia (Plurinational State of)"].Producer_Price, label = "Price", color
 = "#FCEBC5")
#ax.plot(new.loc['Bolivia (Plurinational State of)'].index, new.loc["Bol
ivia (Plurinational State of)"].Production, label = "Production", color
 = '#ECBCFD')

#set the title
ax1.set_title("Bolivia: Producer Price vs Production", fontsize = 12, fo
ntweight = "bold")


#set the axis for left side of the graph
color = '#eddcb6'

#label the left axis
ax1.set_xlabel('Year')
ax1.set_ylabel('Price(Dollars)', color=color)

#plot first line
ax1.plot(new.loc['Bolivia (Plurinational State of)'].index, new.loc["Bol
ivia (Plurinational State of)"].Producer_Price, color = "#FCEBC5")
ax1.tick_params(axis='y', labelcolor=color)

ax2 = ax1.twinx()  # instantiate a second axes that shares the same x-ax
is

color = '#ECBCFD'
ax2.set_ylabel('Production Amount (Tonnes)', color=color)  # we already
 handled the x-label with ax1

#plot second line
ax2.plot(new.loc['Bolivia (Plurinational State of)'].index, new.loc["Bol
ivia (Plurinational State of)"].Production, color = '#ECBCFD')
ax2.tick_params(axis='y', labelcolor=color)

fig.tight_layout()  # otherwise the right y-label is slightly clipped


plt.legend()

plt.show()
```


Bolivia: Producer Price vs Production
Production
Price(Dollars)
Production Amount (Tonnes)
Year
0
20000
40000
60000
80000
100000
10000
20000
30000
40000
50000
60000
70000
1970
1980
1990
2000
2010

In [148]:
```
fig, ax1 = plt.subplots()

#set the title
ax1.set_title('After 2007: Producer Price vs Production', fontsize=12,fo
ntweight = "bold")


color = '#eddcb6'

#set the axis for left side of the graph
ax1.set_xlabel('Year')
ax1.set_ylabel('Price(Dollars)', color=color)

#plot first line
ax1.plot(new_recent_years.loc['Bolivia (Plurinational State of)'].index,
new_recent_years.loc["Bolivia (Plurinational State of)"].Producer_Price,
label = "Price", color = "#FCEBC5")
ax1.tick_params(axis='y', labelcolor=color)

ax2 = ax1.twinx()  # instantiate a second axes that shares the same x-ax
is

#plot the second line
color = '#ECBCFD'
ax2.set_ylabel('Production Amount (Tonnes)', color=color)  # we already
 handled the x-label with ax1
ax2.plot(new_recent_years.loc['Bolivia (Plurinational State of)'].index,
new_recent_years.loc["Bolivia (Plurinational State of)"].Production, lab
el = "Production", color = '#ECBCFD' )
ax2.tick_params(axis='y', labelcolor=color)

fig.tight_layout()  # otherwise the right y-label is slightly clipped


plt.legend()

plt.show()
```



How did the spike in demand influence the farmers' productivity?

Amount of land and quantity of export

In [149]:
```
fao_harvest
```

Out[149]:

	Country	Year	Area_Harvested(HA)
0	Bolivia (Plurinational State of)	1961	22000
1	Bolivia (Plurinational State of)	1962	22300
2	Bolivia (Plurinational State of)	1963	22600
3	Bolivia (Plurinational State of)	1964	18800
4	Bolivia (Plurinational State of)	1965	17000
5	Bolivia (Plurinational State of)	1966	16000
6	Bolivia (Plurinational State of)	1967	12330
7	Bolivia (Plurinational State of)	1968	14120
8	Bolivia (Plurinational State of)	1969	14150
9	Bolivia (Plurinational State of)	1970	12200
10	Bolivia (Plurinational State of)	1971	15000
11	Bolivia (Plurinational State of)	1972	15000
12	Bolivia (Plurinational State of)	1973	16000
13	Bolivia (Plurinational State of)	1974	16890
14	Bolivia (Plurinational State of)	1975	19240
15	Bolivia (Plurinational State of)	1976	20800
16	Bolivia (Plurinational State of)	1977	22400
17	Bolivia (Plurinational State of)	1978	17830
18	Bolivia (Plurinational State of)	1979	10455
19	Bolivia (Plurinational State of)	1980	15640
20	Bolivia (Plurinational State of)	1981	23040
21	Bolivia (Plurinational State of)	1982	24930
22	Bolivia (Plurinational State of)	1983	43086
23	Bolivia (Plurinational State of)	1984	33382
24	Bolivia (Plurinational State of)	1985	47939
25	Bolivia (Plurinational State of)	1986	42850
26	Bolivia (Plurinational State of)	1987	47330
27	Bolivia (Plurinational State of)	1988	50000
28	Bolivia (Plurinational State of)	1989	42640
29	Bolivia (Plurinational State of)	1990	38615
...	...	...	...
141	Peru	1988	18475
142	Peru	1989	15241
143	Peru	1990	8081

	Country	Year	Area_Harvested(HA)
144	Peru	1991	21007
145	Peru	1992	7874
146	Peru	1993	17812
147	Peru	1994	20693
148	Peru	1995	18729
149	Peru	1996	18704
150	Peru	1997	27033
151	Peru	1998	30720
152	Peru	1999	28979
153	Peru	2000	28889
154	Peru	2001	25601
155	Peru	2002	27851
156	Peru	2003	28326
157	Peru	2004	27676
158	Peru	2005	28632
159	Peru	2006	29947
160	Peru	2007	30381
161	Peru	2008	31163
162	Peru	2009	34026
163	Peru	2010	35313
164	Peru	2011	35475
165	Peru	2012	38495
166	Peru	2013	44868
167	Peru	2014	68140
168	Peru	2015	69303
169	Peru	2016	64223
170	Peru	2017	61721

171 rows × 3 columns

In [150]:
```
#combine fao_combined and fao_harvest to get the production and area ded
icated to quinoa
fao_productivity = pd.merge(fao_combined,fao_harvest, on=['Year','Countr
y'], how='inner')
fao_productivity
```

Out[150]:

	Country	Year	Producer_Price	Production	Area_Harvested(HA)
0	Bolivia (Plurinational State of)	1966	1196.00	8000	16000
1	Bolivia (Plurinational State of)	1967	1261.00	7400	12330
2	Bolivia (Plurinational State of)	1968	1304.00	9600	14120
3	Bolivia (Plurinational State of)	1969	1304.00	9600	14150
4	Bolivia (Plurinational State of)	1970	1348.00	9700	12200
5	Bolivia (Plurinational State of)	1971	1348.00	10500	15000
6	Bolivia (Plurinational State of)	1972	1413.00	10800	15000
7	Bolivia (Plurinational State of)	1973	1522.00	12000	16000
8	Bolivia (Plurinational State of)	1974	3022.00	13205	16890
9	Bolivia (Plurinational State of)	1975	3261.00	15200	19240
10	Bolivia (Plurinational State of)	1976	3649.00	14960	20800
11	Bolivia (Plurinational State of)	1977	3660.00	9035	22400
12	Bolivia (Plurinational State of)	1978	4310.00	7660	17830
13	Bolivia (Plurinational State of)	1979	4580.00	6000	10455
14	Bolivia (Plurinational State of)	1980	8171.00	8935	15640
15	Bolivia (Plurinational State of)	1981	10580.00	13040	23040
16	Bolivia (Plurinational State of)	1982	17800.00	15785	24930
17	Bolivia (Plurinational State of)	1983	110000.00	11710	43086
18	Bolivia (Plurinational State of)	1984	2.00	16622	33382
19	Bolivia (Plurinational State of)	1985	145.00	21144	47939
20	Bolivia (Plurinational State of)	1986	490.00	20631	42850
21	Bolivia (Plurinational State of)	1987	526.87	23897	47330
22	Bolivia (Plurinational State of)	1988	888.67	22600	50000
23	Bolivia (Plurinational State of)	1989	1399.00	18230	42640
24	Bolivia (Plurinational State of)	1990	1334.00	16077	38615
25	Ecuador	1966	9690.00	872	1200
26	Ecuador	1967	10880.00	800	1100
27	Ecuador	1968	10660.00	768	1000
28	Ecuador	1969	13010.00	740	1000
29	Ecuador	1970	12960.00	740	1000
...	...	...	...	...	...
100	Bolivia (Plurinational State of)	2016	1028.80	65548	118913
101	Bolivia (Plurinational State of)	2017	770.60	66792	110639
102	Ecuador	2003	543.00	519	1000

	Country	Year	Producer_Price	Production	Area_Harvested(HA)
103	Peru	1991	323.60	18266	21007
104	Peru	1992	361.20	4961	7874
105	Peru	1993	291.70	17157	17812
106	Peru	1994	323.50	16629	20693
107	Peru	1995	395.00	13773	18729
108	Peru	1996	407.60	16070	18704
109	Peru	1997	418.90	23688	27033
110	Peru	1998	419.80	28171	30720
111	Peru	1999	366.50	28413	28979
112	Peru	2000	335.20	28191	28889
113	Peru	2001	339.30	22267	25601
114	Peru	2002	318.50	30373	27851
115	Peru	2003	319.10	30085	28326
116	Peru	2004	325.20	26997	27676
117	Peru	2005	352.00	32590	28632
118	Peru	2006	360.40	30429	29947
119	Peru	2007	390.00	31824	30381
120	Peru	2008	547.10	29867	31163
121	Peru	2009	1115.70	39397	34026
122	Peru	2010	1196.40	41079	35313
123	Peru	2011	1336.20	41182	35475
124	Peru	2012	1471.00	44213	38495
125	Peru	2013	2328.00	52129	44868
126	Peru	2014	2773.80	114725	68140
127	Peru	2015	1540.60	105666	69303
128	Peru	2016	1178.70	79269	64223
129	Peru	2017	1128.70	78657	61721

130 rows × 5 columns

Calculate the productivity by dividing area harvested to production amount

In [151]:
```
fao_productivity["Agr_Productivity"] = fao_productivity["Area_Harvested
(HA)"]/fao_productivity["Production"]
```

In [152]:
```
fao_productivity
```

Out[152]:

	Country	Year	Producer_Price	Production	Area_Harvested(HA)	Agr_Productivity
0	Bolivia (Plurinational State of)	1966	1196.00	8000	16000	2.000000
1	Bolivia (Plurinational State of)	1967	1261.00	7400	12330	1.666216
2	Bolivia (Plurinational State of)	1968	1304.00	9600	14120	1.470833
3	Bolivia (Plurinational State of)	1969	1304.00	9600	14150	1.473958
4	Bolivia (Plurinational State of)	1970	1348.00	9700	12200	1.257732
5	Bolivia (Plurinational State of)	1971	1348.00	10500	15000	1.428571
6	Bolivia (Plurinational State of)	1972	1413.00	10800	15000	1.388889
7	Bolivia (Plurinational State of)	1973	1522.00	12000	16000	1.333333
8	Bolivia (Plurinational State of)	1974	3022.00	13205	16890	1.279061
9	Bolivia (Plurinational State of)	1975	3261.00	15200	19240	1.265789
10	Bolivia (Plurinational State of)	1976	3649.00	14960	20800	1.390374
11	Bolivia (Plurinational State of)	1977	3660.00	9035	22400	2.479247
12	Bolivia (Plurinational State of)	1978	4310.00	7660	17830	2.327676
13	Bolivia (Plurinational State of)	1979	4580.00	6000	10455	1.742500
14	Bolivia (Plurinational State of)	1980	8171.00	8935	15640	1.750420
15	Bolivia (Plurinational State of)	1981	10580.00	13040	23040	1.766871
16	Bolivia (Plurinational State of)	1982	17800.00	15785	24930	1.579347

	Country	Year	Producer_Price	Production	Area_Harvested(HA)	Agr_Productivity
17	Bolivia (Plurinational State of)	1983	110000.00	11710	43086	3.679419
18	Bolivia (Plurinational State of)	1984	2.00	16622	33382	2.008302
19	Bolivia (Plurinational State of)	1985	145.00	21144	47939	2.267263
20	Bolivia (Plurinational State of)	1986	490.00	20631	42850	2.076972
21	Bolivia (Plurinational State of)	1987	526.87	23897	47330	1.980583
22	Bolivia (Plurinational State of)	1988	888.67	22600	50000	2.212389
23	Bolivia (Plurinational State of)	1989	1399.00	18230	42640	2.339002
24	Bolivia (Plurinational State of)	1990	1334.00	16077	38615	2.401878
25	Ecuador	1966	9690.00	872	1200	1.376147
26	Ecuador	1967	10880.00	800	1100	1.375000
27	Ecuador	1968	10660.00	768	1000	1.302083
28	Ecuador	1969	13010.00	740	1000	1.351351
29	Ecuador	1970	12960.00	740	1000	1.351351
...	...	...	...	...	...	...
100	Bolivia (Plurinational State of)	2016	1028.80	65548	118913	1.814136
101	Bolivia (Plurinational State of)	2017	770.60	66792	110639	1.656471
102	Ecuador	2003	543.00	519	1000	1.926782
103	Peru	1991	323.60	18266	21007	1.150060
104	Peru	1992	361.20	4961	7874	1.587180
105	Peru	1993	291.70	17157	17812	1.038177
106	Peru	1994	323.50	16629	20693	1.244392
107	Peru	1995	395.00	13773	18729	1.359834
108	Peru	1996	407.60	16070	18704	1.163908
109	Peru	1997	418.90	23688	27033	1.141211
110	Peru	1998	419.80	28171	30720	1.090483

	Country	Year	Producer_Price	Production	Area_Harvested(HA)	Agr_Productivity
111	Peru	1999	366.50	28413	28979	1.019920
112	Peru	2000	335.20	28191	28889	1.024760
113	Peru	2001	339.30	22267	25601	1.149728
114	Peru	2002	318.50	30373	27851	0.916966
115	Peru	2003	319.10	30085	28326	0.941532
116	Peru	2004	325.20	26997	27676	1.025151
117	Peru	2005	352.00	32590	28632	0.878552
118	Peru	2006	360.40	30429	29947	0.984160
119	Peru	2007	390.00	31824	30381	0.954657
120	Peru	2008	547.10	29867	31163	1.043392
121	Peru	2009	1115.70	39397	34026	0.863670
122	Peru	2010	1196.40	41079	35313	0.859636
123	Peru	2011	1336.20	41182	35475	0.861420
124	Peru	2012	1471.00	44213	38495	0.870672
125	Peru	2013	2328.00	52129	44868	0.860711
126	Peru	2014	2773.80	114725	68140	0.593942
127	Peru	2015	1540.60	105666	69303	0.655868
128	Peru	2016	1178.70	79269	64223	0.810191
129	Peru	2017	1128.70	78657	61721	0.784685

130 rows × 6 columns

Group the data

In [153]:
```
clean_productivity = fao_productivity.groupby(["Country", "Year"]).agg(s
um)
clean_productivity
```

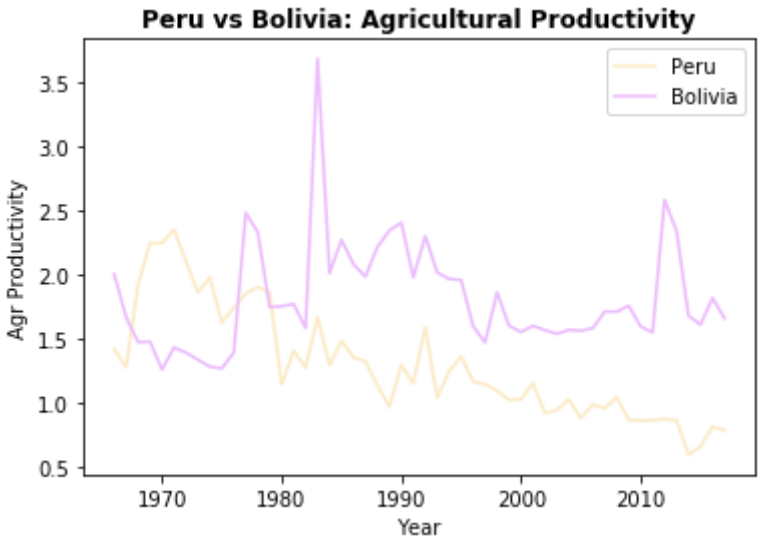
Out[153]:

Country	Year	Producer_Price	Production	Area_Harvested(HA)	Agr_Productivity
Bolivia (Plurinational State of)	1966	1196.00	8000	16000	2.000000
	1967	1261.00	7400	12330	1.666216
	1968	1304.00	9600	14120	1.470833
	1969	1304.00	9600	14150	1.473958
	1970	1348.00	9700	12200	1.257732
	1971	1348.00	10500	15000	1.428571
	1972	1413.00	10800	15000	1.388889
	1973	1522.00	12000	16000	1.333333
	1974	3022.00	13205	16890	1.279061
	1975	3261.00	15200	19240	1.265789
	1976	3649.00	14960	20800	1.390374
	1977	3660.00	9035	22400	2.479247
	1978	4310.00	7660	17830	2.327676
	1979	4580.00	6000	10455	1.742500
	1980	8171.00	8935	15640	1.750420
	1981	10580.00	13040	23040	1.766871
	1982	17800.00	15785	24930	1.579347
	1983	110000.00	11710	43086	3.679419
	1984	2.00	16622	33382	2.008302
	1985	145.00	21144	47939	2.267263
	1986	490.00	20631	42850	2.076972
	1987	526.87	23897	47330	1.980583
	1988	888.67	22600	50000	2.212389
	1989	1399.00	18230	42640	2.339002
	1990	1334.00	16077	38615	2.401878
	1991	435.10	19651	38791	1.973996
	1992	466.30	16858	38700	2.295646
	1993	480.60	19129	38518	2.013592
	1994	481.50	19465	38196	1.962291
	1995	521.60	18814	36790	1.955459
...	...	...	...	...	...
Peru	1988	26250.00	16284	18475	1.134549
	1989	619010.00	15753	15241	0.967498

Country	Year	Producer_Price	Production	Area_Harvested(HA)	Agr_Productivity
	1990	28.00	6260	8081	1.290895
	1991	323.60	18266	21007	1.150060
	1992	361.20	4961	7874	1.587180
	1993	291.70	17157	17812	1.038177
	1994	323.50	16629	20693	1.244392
	1995	395.00	13773	18729	1.359834
	1996	407.60	16070	18704	1.163908
	1997	418.90	23688	27033	1.141211
	1998	419.80	28171	30720	1.090483
	1999	366.50	28413	28979	1.019920
	2000	335.20	28191	28889	1.024760
	2001	339.30	22267	25601	1.149728
	2002	318.50	30373	27851	0.916966
	2003	319.10	30085	28326	0.941532
	2004	325.20	26997	27676	1.025151
	2005	352.00	32590	28632	0.878552
	2006	360.40	30429	29947	0.984160
	2007	390.00	31824	30381	0.954657
	2008	547.10	29867	31163	1.043392
	2009	1115.70	39397	34026	0.863670
	2010	1196.40	41079	35313	0.859636
	2011	1336.20	41182	35475	0.861420
	2012	1471.00	44213	38495	0.870672
	2013	2328.00	52129	44868	0.860711
	2014	2773.80	114725	68140	0.593942
	2015	1540.60	105666	69303	0.655868
	2016	1178.70	79269	64223	0.810191
	2017	1128.70	78657	61721	0.784685

130 rows × 4 columns

In [154]:
```
#plot the dataset
fig, ax = plt.subplots()


#give a title
ax.set_title("Peru vs Bolivia: Agricultural Productivity", fontsize = 12
, fontweight = "bold")

#mark the axis
ax.set_ylabel("Agr Productivity")
ax.set_xlabel("Year")

#plot the data
ax.plot(clean_productivity.loc['Peru'].index, clean_productivity.loc["Pe
ru"].Agr_Productivity, label = "Peru", color = "#FCEBC5")
ax.plot(clean_productivity.loc['Bolivia (Plurinational State of)'].index
, clean_productivity.loc["Bolivia (Plurinational State of)"].Agr_Product
ivity, label = "Bolivia", color = '#ECBCFD')

plt.legend()

plt.show()
```



The averge productivity:

Peru

In [155]:
```
Peru_Mean = clean_productivity.loc['Peru'].mean()
Peru_Mean
```

Out[155]:
```
Producer_Price        33515.955769
Production            24653.403846
Area_Harvested(HA)    24841.846154
Agr_Productivity          1.298661
dtype: float64
```

Bolivia

In [156]:
```
Bolivia_Mean = clean_productivity.loc['Bolivia (Plurinational State of)'
].mean()
Bolivia_Mean
```

Out[156]:
```
Producer_Price         3943.683462
Production            23978.923077
Area_Harvested(HA)    43453.230769
Agr_Productivity          1.811808
dtype: float64
```

The graph below shows how the productivity in Peru overtime has decreased with more land used.

In [157]:
```
#add lines for the avg

fig, ax = plt.subplots(1,2,sharex = True, figsize = (14,5))

#add title and axis to first graph
ax[0].set_title("Agriculture Productivity in Peru", fontsize = 12, fontw
eight = "bold")
ax[0].set_ylabel("Agriculture Productivity")
ax[0].set_xlabel("Year")

#add title and axis to the other graph
ax[1].set_title("Agriculture Productivity in Bolivia", fontsize = 12, fo
ntweight = "bold")
ax[1].set_ylabel("Agriculture Productivity")
ax[1].set_xlabel("Year")

#add the lines that show the mean of productivity
ax[0].axhline(y= 1.298661,label= 'Mean')
ax[1].axhline(y=1.811808,label= 'Mean')

#plot both graphs
ax[0].plot(clean_productivity.loc['Peru'].index, clean_productivity.loc[
"Peru"].Agr_Productivity,label= 'Mean',color = "#FCEBC5")
ax[1].plot(clean_productivity.loc['Bolivia (Plurinational State of)'].in
dex, clean_productivity.loc["Bolivia (Plurinational State of)"].Agr_Prod
uctivity, color = '#ECBCFD')



plt.legend()

plt.show()
```