The Gold Standard

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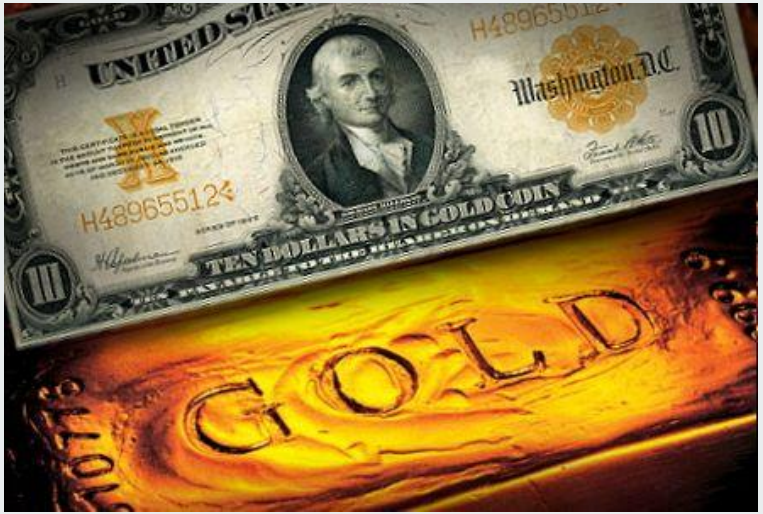


The G”olden” Days

- The Lydians created first form of standardized currency by melting gold into coins in 700 B.C.
- As time passed, more currencies were created by developed societies around the world, but they ran into a problem when global exchange become more prominent.
- **How could two countries engage in trade if they didn’t have a mutual benchmark for the value of goods nor knew the value of each other’s currency?**

The Solution: Gold!

Objective

- We wanted to know how many hours people who get paid minimum wage around the world should work to purchase 1 troy ounce of gold and use that data to determine the strength of each currency.

- We drew insights based on the buying power of different currencies that we determined through our calculations and data presentation

- Our project aims to illustrate and deduce the strength of each currency using gold as the standard to determine each of their value.

Data (exploration)

- **Csv file for the hourly minimum wage from:**

  https://stats.oecd.org/Index.aspx?DataSetCode=RMW#

- **CSV file for the Price of Gold using the Philadelphia Gold and Silver Index INDEXNASDAQ: XAU**

  https://www.investing.com/currencies/xau-usd-historical-data

- **Csv file for the countries latitudes and longitudes:**

  https://developers.google.com/public-data/docs/canonical/countries_csv

Data (cleanup process)

After checking the data sets:

- From there we had to import the paths.
- Defined our variable names for both data sets.

```
# Set path
gold_csv_path = Path("Resources/gold_price.csv")
wages_csv_path = Path("Resources/minimum_hourly_wage_worldwide.csv")
```

```
# Read Data into DataFrame
gold_price_df = pd.read_csv(gold_csv_path, index_col="Date", parse_dates=True, infer_datetime_format=True)
minimum_wage_df = pd.read_csv(wages_csv_path, index_col="Country")
```

Data (cleanup process)

After checking the data sets:

- We set the date as index
- We proceed to drop unnecessary columns by using the .dropna() function, followed by adjusting the columns with numbers to floats using the str.replace() and .astype functions.

[7]:

Country	Unnamed: 0	Australia	Belgium	Canada	Chile	Colombia	Czech Republic	Estonia	France	Germany	...	Portugal	Slovak Republic	Slovenia	Spain	Turkey	United Kingdom	United States	Costa Rica	Brazil	Russian Federation
NaN	Year	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
NaN	2001	10.9	10.9	7.2	1.9	2.1	3.1	1.8	10.1	..	...	4.7	1.4	5.0	5.8	3.0	7.1	7.4	2.9	1.1	0.3
NaN	2002	11.0	11.1	7.1	1.9	2.1	3.4	2.0	10.2	..	...	4.8	1.5	5.2	5.8	3.2	7.6	7.3	2.8	1.1	0.4
NaN	2003	11.1	11.0	7.0	1.9	2.1	3.7	2.3	10.4	..	...	4.7	1.8	5.4	5.7	3.4	7.8	7.2	2.9	1.2	0.4
NaN	2004	11.3	10.9	7.1	2.0	2.2	3.9	2.5	10.7	..	...	4.7	2.0	5.6	5.7	4.4	8.2	7.0	2.8	1.2	0.4

5 rows × 33 columns

Analysis Process : Buying Power

```
# Calculating Work Hours
work_hours = pd.concat([avg_gold_price_df,minimum_wage_df], axis=1)
for Country in work_hours.columns:
    if Country != 'Price':
        work_hours[Country] = work_hours['Price'] / work_hours[Country]

work_hours.dropna(inplace=True)
work_hours.head()
```

	Price	Australia	Belgium	Canada	Chile	Colombia	Czech Republic
2001	271.370462	24.896373	24.896373	37.690342	142.826559	129.224029	87.538859
2002	310.700308	28.245483	27.991019	43.760607	163.526478	147.952527	91.382443
2003	364.215692	32.812225	33.110517	52.030813	191.692470	173.436044	98.436674
2004	409.897088	36.274079	37.605237	57.731984	204.948544	186.316858	105.101817
2005	445.391846	39.069460	41.239986	62.731246	222.695923	202.450839	108.632158

```
avg_gold_price_df.head()
```

	Price
Date	
2000	269.283871
2001	271.370462
2002	310.700308
2003	364.215692
2004	409.897088

```
minimum_wage_df.head()
```

	Australia	Belgium	Canada	Chile	Colombia	Czech Republic	Estonia	France	Germany	Greece	...
Year											
2001	10.9	10.9	7.2	1.9	2.1	3.1	1.8	10.1	11.58	5.7	...
2002	11.0	11.1	7.1	1.9	2.1	3.4	2.0	10.2	11.58	5.8	...
2003	11.1	11.0	7.0	1.9	2.1	3.7	2.3	10.4	11.58	5.9	...
2004	11.3	10.9	7.1	2.0	2.2	3.9	2.5	10.7	11.58	6.0	...
2005	11.4	10.8	7.1	2.0	2.2	4.1	2.6	11.2	11.58	6.1	...

Analysis Process: Monte Carlo - Gold Price in 5 Years

```python
# Importing Monte Carlo Simulation Python library
from MCForecastTools import MCSimulation

num_sims = 500

MC_GOLD = MCSimulation(
    portfolio_data = gold_df,
    num_simulation = num_sims,
    weights = [1],
    num_trading_days = 252 * 5
)

MC_GOLD.calc_cumulative_return()
line_plot = MC_GOLD.plot_simulation()
tbl = MC_GOLD.summarize_cumulative_return()

# Print summary statistics
print(tbl)
# Use the lower and upper `95%` confidence intervals to calculate the range
ci_lower = round(tbl[8]*1500,2)
ci_upper = round(tbl[9]*1500,2)

# Print results
print(f"There is a 95% chance that an initial investment of $1,500 in Gold"
      f" over the next 5 years will end within in the range of"
      f" ${ci_lower} and ${ci_upper}.")
```

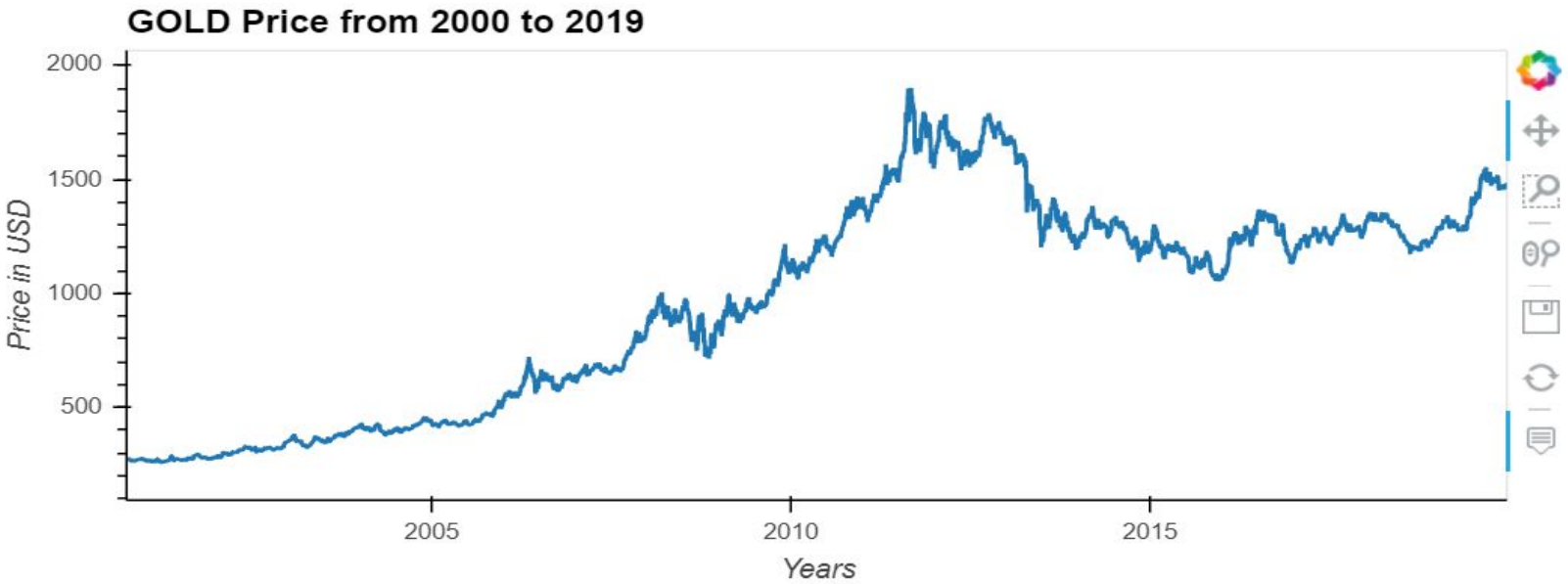
```
Running Monte Carlo simulation number 350.
Running Monte Carlo simulation number 360.
Running Monte Carlo simulation number 370.
Running Monte Carlo simulation number 380.
Running Monte Carlo simulation number 390.
Running Monte Carlo simulation number 400.
Running Monte Carlo simulation number 410.
Running Monte Carlo simulation number 420.
Running Monte Carlo simulation number 430.
Running Monte Carlo simulation number 440.
Running Monte Carlo simulation number 450.
Running Monte Carlo simulation number 460.
Running Monte Carlo simulation number 470.
Running Monte Carlo simulation number 480.
Running Monte Carlo simulation number 490.
count           500.000000
mean              0.694517
std               0.256914
min               0.225290
25%               0.502980
50%               0.642830
75%               0.845897
max               1.544938
95% CI Lower      0.335687
95% CI Upper      1.297705
Name: 1260, dtype: float64
```

Final Data Analysis: Panel Visualizations/Dashboard

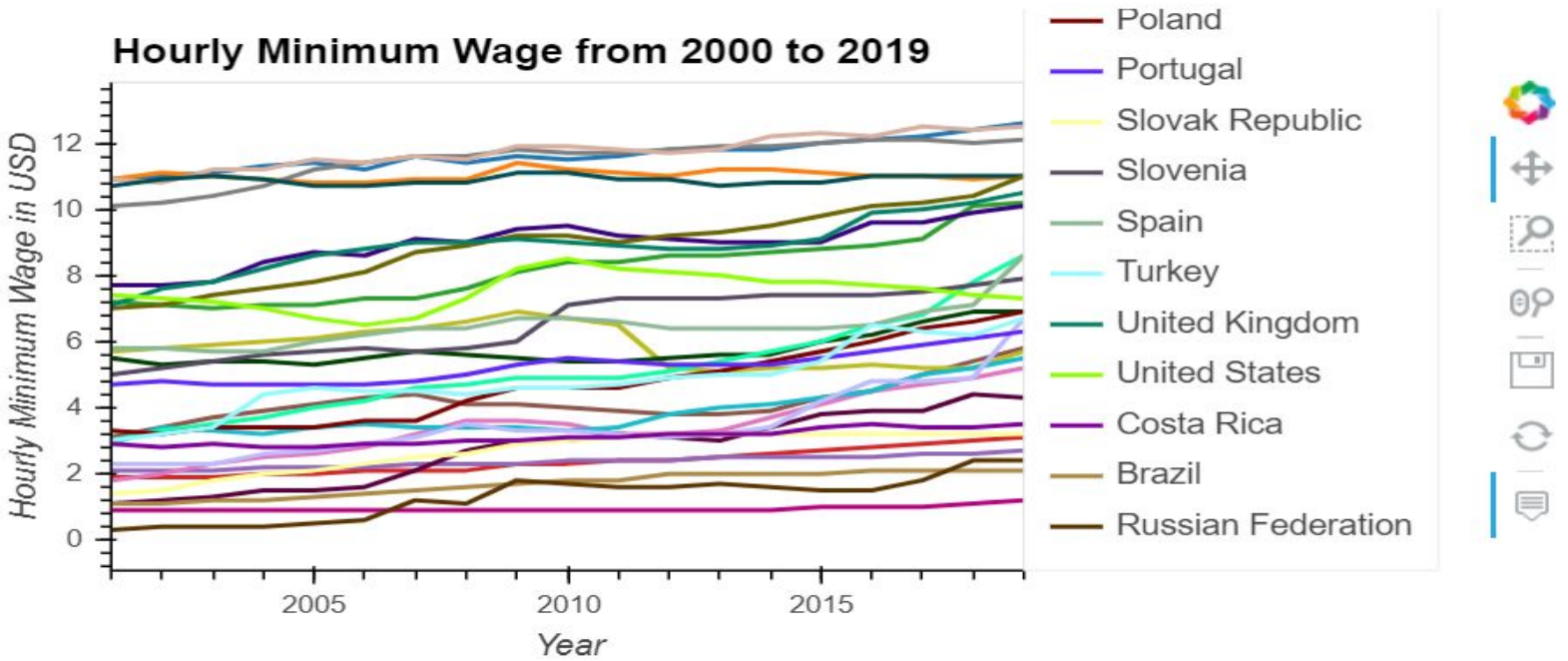
- First, we ran initial imports of modules and libraries, imported the CSVs to Pandas DataFrames and declared global variables.
- Next, we defined panel visualization functions as follows:
    - Line plot of daily gold price in USD from 2000 to 2019
    - Line plot of minimum hourly wage by country
    - Line plot of the number of hours people earning minimum wage in each country need to work to purchase 1 troy oz of gold from 2001 to 2019
    - World Map that shows the number of hours needed to purchase 1 troy oz of gold in 2019.
    - Parallel plot of top 5 countries with highest minimum wage
    - Bar plot of minimum hourly wage from 2001 to 2019 for each country
- We proceeded to create rows and columns for the panel tabs labeled: “Gold Price”, “Gold Buying Power”, “Minimum Wage” and “Highest Minimum Wage” and finally serve the panel dashboard.

Conclusion

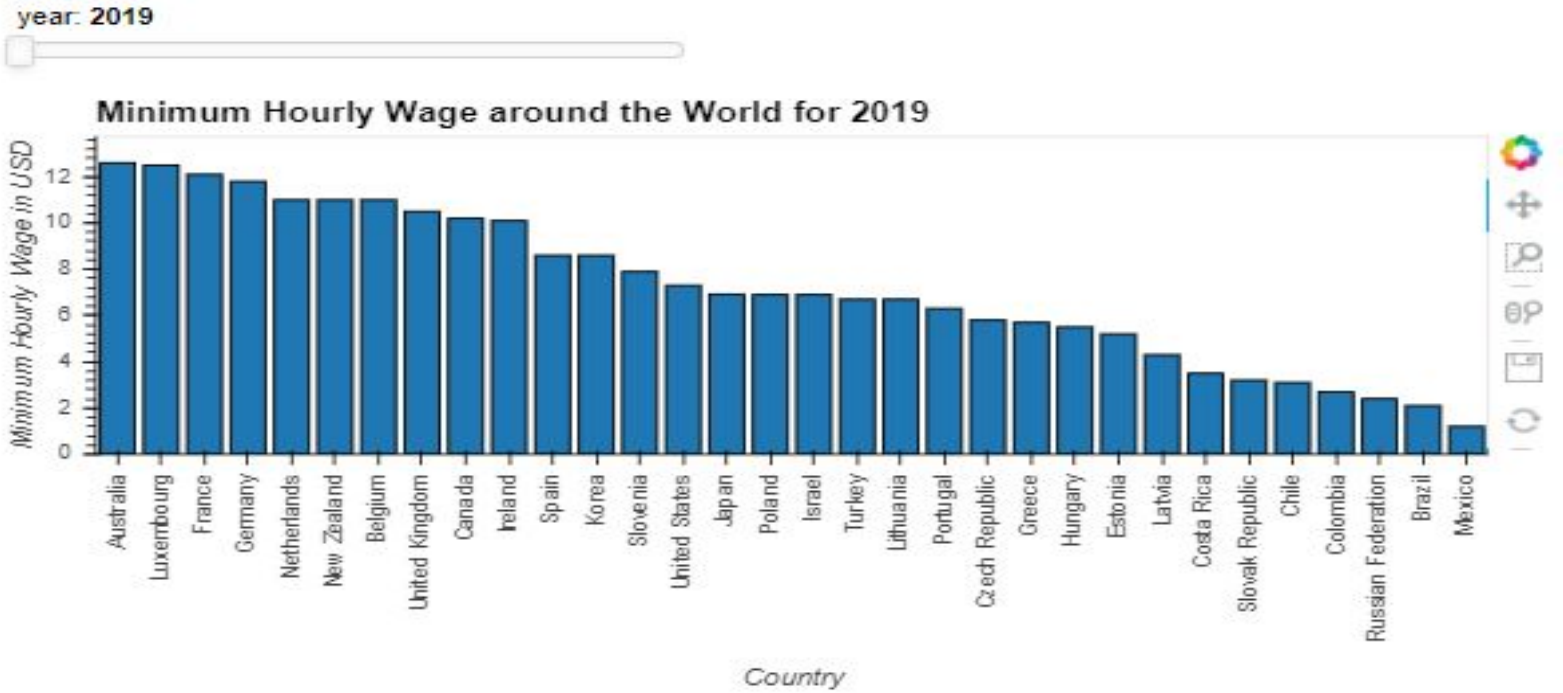
- “Paranoid investors pushed gold to $1,900 an ounce in 2011, but the bubble has burst.” -slate.com



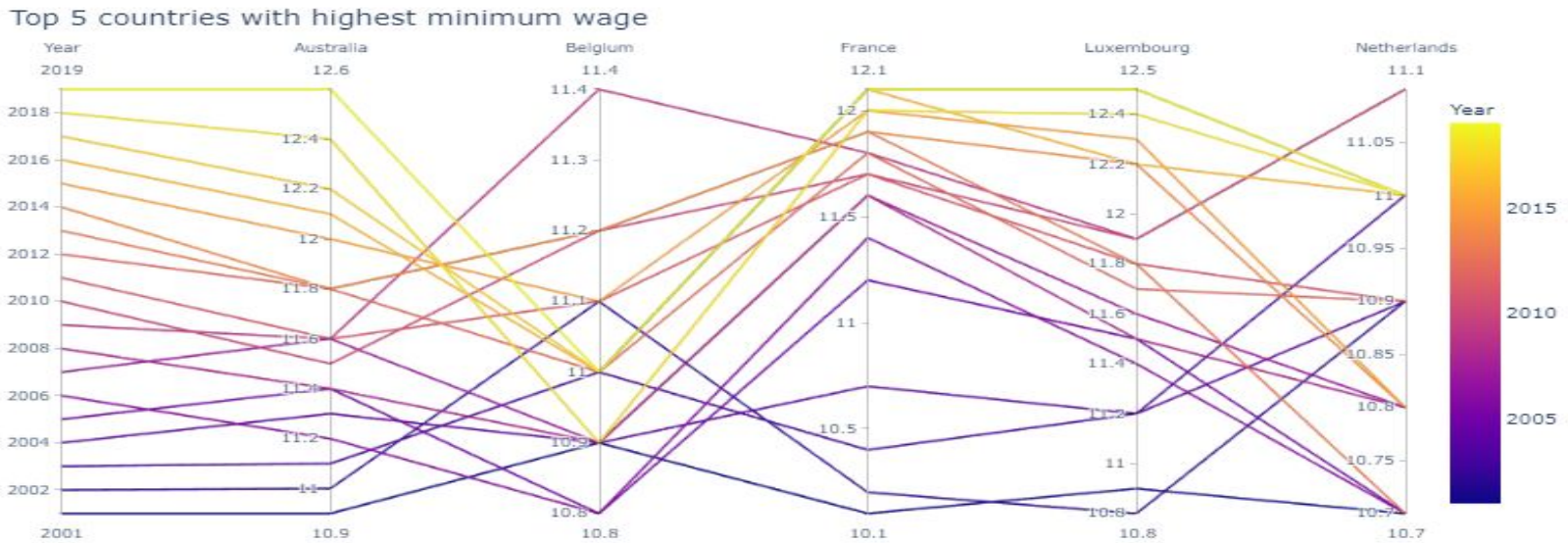
- Over the last 20 years, most of countries increased their minimum hourly-wage.



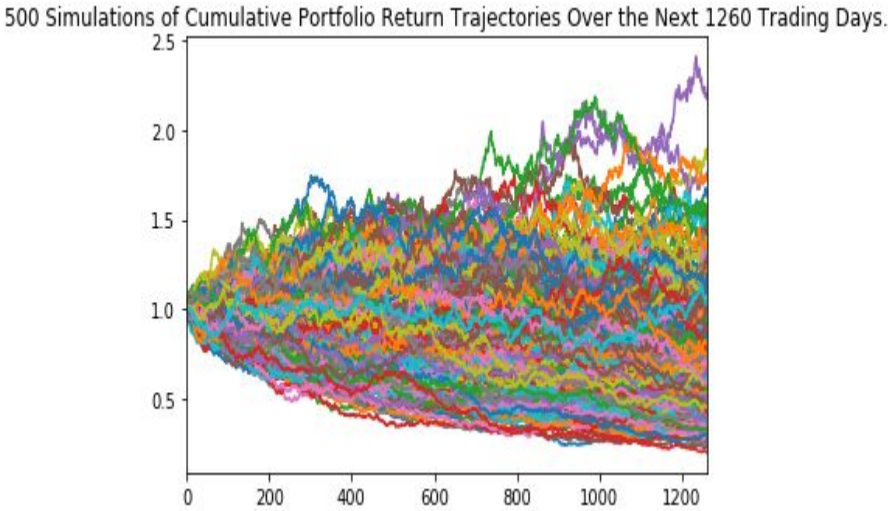
- Over the last 20 years, Mexico's minimum hourly-wage hasn't changed. (0.9 USD in 2001 and 1.2 USD in 2019)

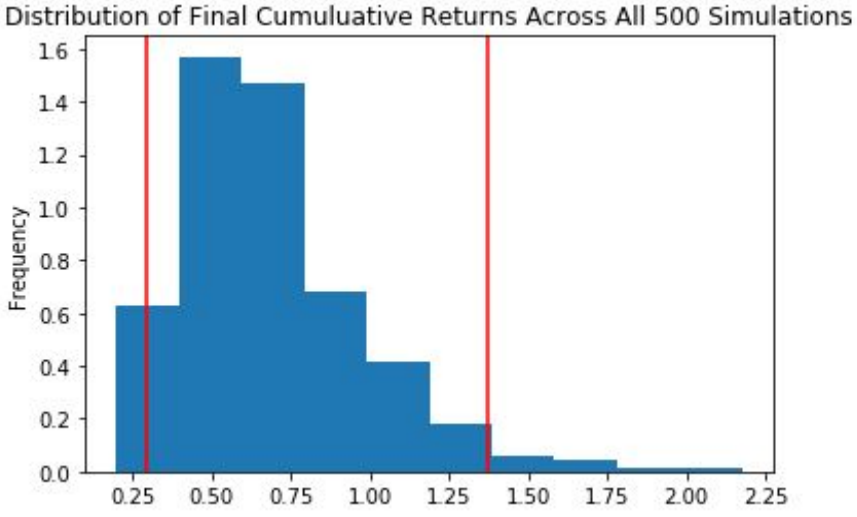


- Although the standard of living in the US is high, it is not among the top 5 countries with the highest minimum hourly-wage in the world.

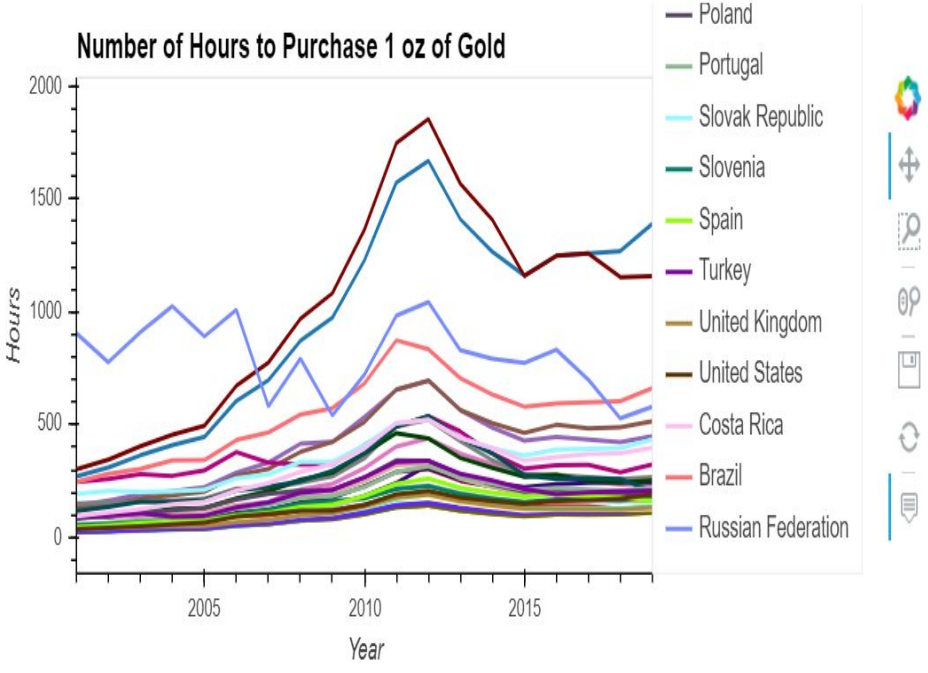


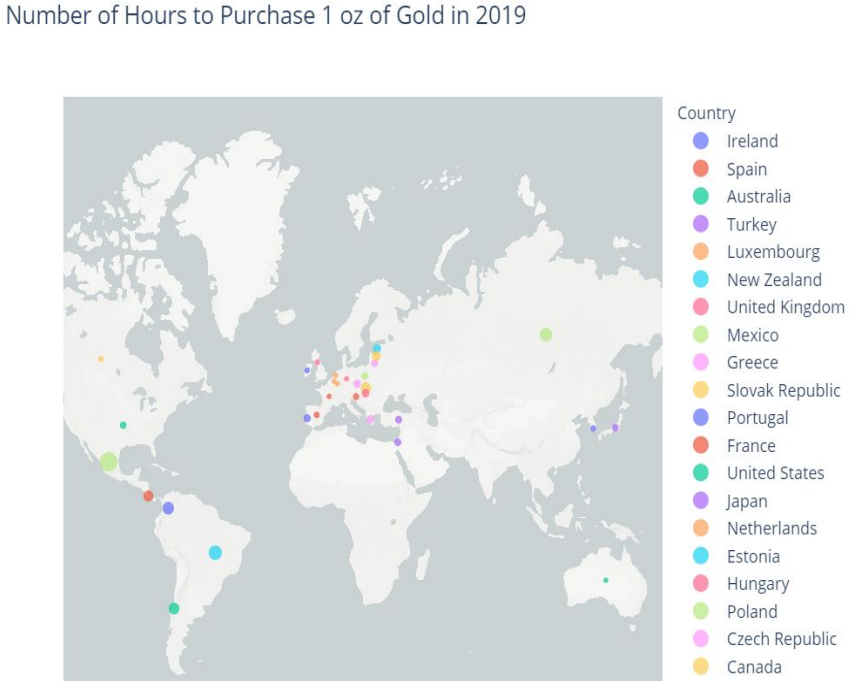
- Our result showed that there was a 95% chance that an initial investment of $1,500(price of 1 troy oz) in Gold over the next 5 years will end within in the range of $442.4 and $2055.26 - volatility is pretty high





- Mexico requires largest work hours (1160 hours =about 2.5 months of work) to purchase 1 oz of Gold in the world. (as of 2019)
- Australia requires 110 hours (less than 3 weeks) of work to purchase 1 oz of Gold.
- US requires 190 hours (less than 5 weeks) of work to purchase 1 oz of Gold.





Implications & discussion

- Purchasing Power Parity (PPP) allows us to compare economies more effectively than nominal purchasing power. It enables us to assume that all people are using the same currency and that prices all over the world are the same, helping us measure the affluence of each country in a comparable way.
- Our project used the gold price and U.S. dollar as currency to analyze the work hours to purchase the same amount of gold around the world, and this provides a clearer picture of the global economy. (the inverse of work hours = Purchasing Power)
- Weak currency is related to more work hours to buy 1 oz of gold. (e.g. current (Nov. 14, 2020) 1 Mexico Peso = 0.049 USD ~ 20 times more work hours of US)
- South America tends to require large work hours, and Europe requires smaller work hours to purchase 1 oz of Gold.
- Investors can use PPP figures to find potentially overvalued or undervalued currencies, or to predict whether the U.S. dollar – and so the price of gold – will appreciate or depreciate.
- Gold behaves like a currency, in a sense, so it is sensitive to changes in exchange rates between national fiat currencies and the divergence in monetary policies of the major central banks.