


Where Should I Put My Money After an Economic Crisis?

*A Study of the 2000 and 2007
Post-Recession Period on Different Asset
Classes and Their Returns*

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Summary Questions


Which of these asset classes performs the best following a recession?

- S&P 500 - “The Market”
- Gold
- Emerging Markets
- Real Estate
- Bonds



Summary Questions


- Does the nature of recessions affect the performance of the assets in the future?
 - No two recessions are alike; for our study, we chose to examine the 2000 and 2007 recession. For 2000, this recession was caused by the burst of the Internet Bubble, while for 2007, this recession was caused by sub-prime mortgages.



Summary
Why?

OPPORTUNITY





Summary
Why?

RISK MANAGEMENT





Process Data Exploration

- Data Background
 - Information is for **monthly** data at the beginning of the month (ie, 8/1/2000; 9/1/2000, etc).
- Data Types Used
 - API
 - We used the Quandl API to pull data for the S&P 500
 - CSVs
 - We utilized Yahoo! Finance for a majority of the asset classes
 - We used St. Louis FRED Data for the real estate prices



Process

Data Exploration - API

- “The S&P 500 or Standard & Poor's 500 Index is a market-capitalization-weighted index of the 500 largest U.S. publicly traded companies. The index is widely regarded as the best gauge of large-cap U.S. equities. Other common U.S. stock market benchmarks include the Dow Jones Industrial Average or Dow 30 and the Russell 2000 Index, which represents the small-cap index”.
- Quandl dataset based off Robert Schiller's Historical S&P 500 Prices



Process

Data Exploration - REITs

- Boston Properties(NYSE: BXP) is a Real Estate Investment Trust(REIT) that specializes in Class-A office properties in the United States, primarily concentrated in 5 markets - Los Angeles, Boston, New York, Washington D.C. and San Francisco. They were chosen as a data-source in our project to indicate performance of commercial real estate during, and immediately following, periods of financial recession.
- Since 1997, BXP has been traded publicly on the New York Stock Exchange. As such, the data for the trust's performance during our selected time periods was parsed and collected via Yahoo! Finance. All data was collected based on monthly closing prices in order to match with the federal housing data collected for use in the same analysis and visualization.



Process

Data Exploration - REITs

- Welltower (NYSE: WELL, formerly HCN) is a REIT that focuses primarily on the healthcare industry. Their portfolio consists primarily of investments in Senior-Housing, Post-Acute Care Facilities and Outpatient Medical Facilities. They were chosen as a data-source for our project to represent the performance of medical real-estate investment during and immediately following periods of financial recession.
- Welltower is also publicly traded on the New York Stock Exchange. Their historic trading data was collected for analysis from Yahoo! Finance.



Process

Data Exploration - REITs

- Prologis (NYSE: PLD) is a REIT that is a global leader in logistic real estate. Their holdings are almost entirely comprised of warehouses and distribution centers. They were included as a data-source to indicate the performance of supply chain real estate holdings during, and immediately following, periods of market recession.
- Prologis was founded in 1983, and has been publicly traded on the NYSE since 1997. The historic trading data used for this project was sourced from Yahoo! Finance.



Process

Data Exploration - BlackRock Funds

- **Introduction**
 - BlackRock, founded in 1988, is the world's largest asset manager. As a company, they went public in 1998. They were enlisted by the U.S. government to help assist with economic recovery in the wake of the 2008 financial crisis. All the funds listed below are managed by BlackRock.
- **Bond Funds**
 - The two bond funds selected are the BlackRock Core Bond Portfolio (Nasdaq: BFM CX) and BlackRock U.S. Government Bond Portfolio (Nasdaq: PNIGX).
- **Equity Funds**
 - The equity fund selected is the BlackRock Emerging Markets Fund (Nasdaq: MADCX).



Process

Data Exploration - Fed Housing Data

- Our housing data was pulled from FRED Economic Data, curated by the St. Louis Fed. We used the Case-Shiller Index to represent national housing prices and trends.
- The S&P CoreLogic Case–Shiller U.S. National Home Price Index is a composite of single-family home price indices for the nine U.S. census divisions. It is calculated monthly, using a three-month moving average. This data guided our project in that it required us to use monthly returns for all other data types.



Process

Data Exploration - Other Considerations

- In addition to REITs and Bonds, we included Gold and the S&P 500 for baseline investment data. The S&P 500 was used, in this instance, to indicate market performance in general.
- Gold returns are included to demonstrate alternative portfolio options. In general, Gold tends to perform at an inverse to paper investments (stocks, bonds, etc.), so we wanted to analyze how it performed during and immediately following market recessions.



Process

Data Analysis - 2000 & 2007

Jupyter Lab Demo

- Import Libraries
- Clean Data
- Concat Data
- Run a Cumulative Portfolio
- Risk Metrics (Standard Deviation/Sharpe)
- Calculate Covariance/Beta



Process

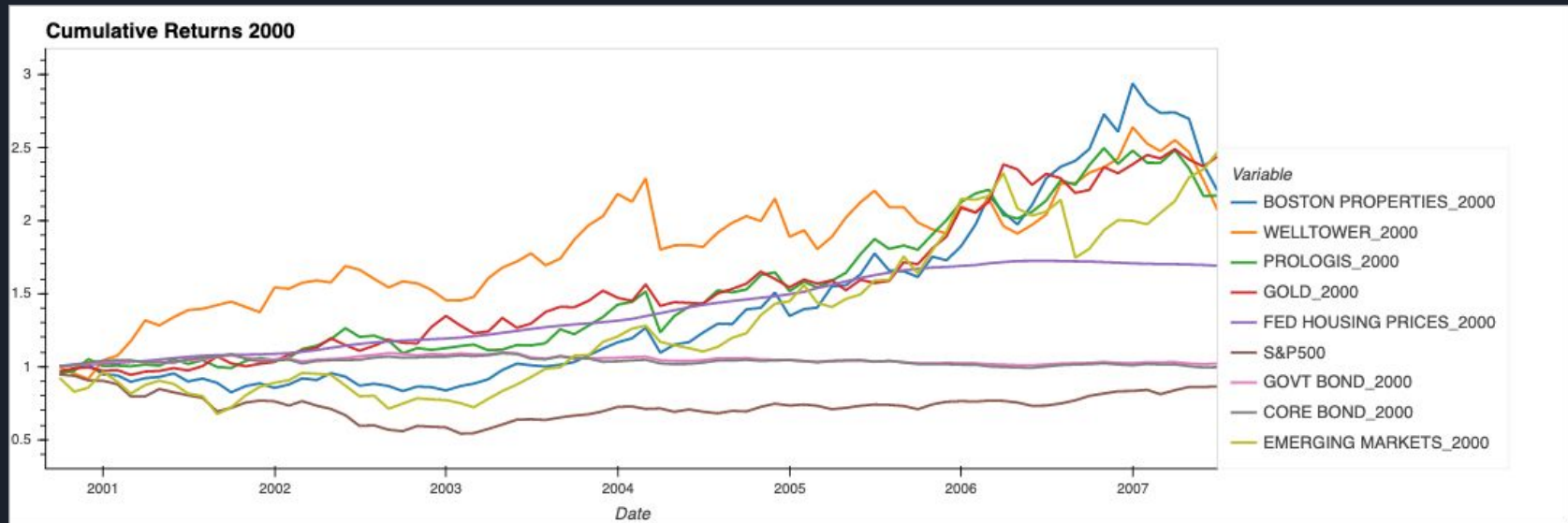
Data Analysis - Portfolio Simulation

Jupyter Lab Demo

- Choose two best performing asset classes from 2000/2007
- Create an equally weighted (50/50) portfolio.
- Run a monte carlo simulation over 6 years
- Examine Returns and probabilistic ending \$ amounts of investment.

Results

Cumulative Returns - August 2000 to August 2007





Results

Cumulative Returns

August 2000 to August 2007

Best 2000 Asset Class; not
adjusted for Risk is
Emerging Markets

BOSTON PROPERTIES_2000	1.105669
WELLTOWER_2000	1.052755
PROLOGIS_2000	1.055149
GOLD_2000	1.172086
FED HOUSING PRICES_2000	0.642773
S&P500	-0.113002
GOVT BOND_2000	0.027991
CORE BOND_2000	0.000112
EMERGING MARKETS_2000	1.312208

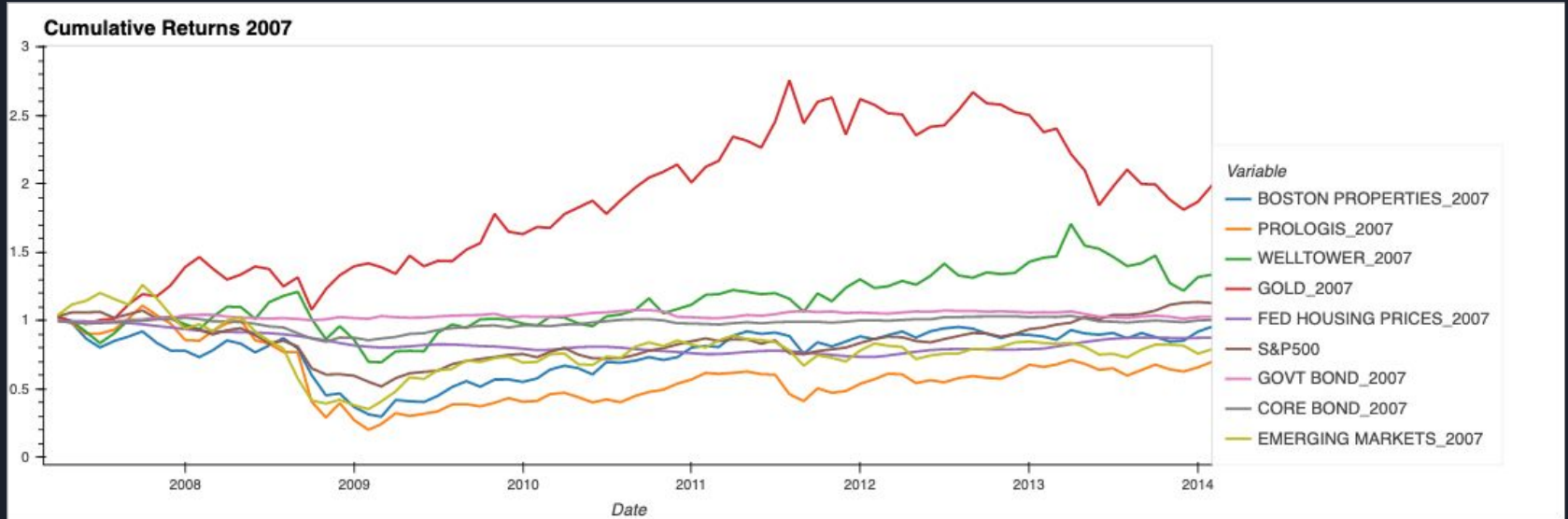
Best 2000 Risk Adjusted
Asset Class; are
FedHousingPrices

BOSTON PROPERTIES_2000	0.208852
WELLTOWER_2000	0.185231
PROLOGIS_2000	0.230504
GOLD_2000	0.289620
FED HOUSING PRICES_2000	1.298777
S&P500	-0.031409
GOVT BOND_2000	0.032741
CORE BOND_2000	0.000108
EMERGING MARKETS_2000	0.206254

Results

Cumulative Returns

March 2007 to March 2014





Results

Cumulative Returns

March 2007 to March 2014

Best 2007 Asset Class; not
adjusted for Risk is **Gold**

BOSTON PROPERTIES_2007	0.328742
PROLOGIS_2007	0.347798
WELLTOWER_2007	0.590778
GOLD_2007	1.020411
FED HOUSING PRICES_2007	-0.152208
S&P500	0.243520
GOVT BOND_2007	0.040614
CORE BOND_2007	0.015861
EMERGING MARKETS_2007	0.063638

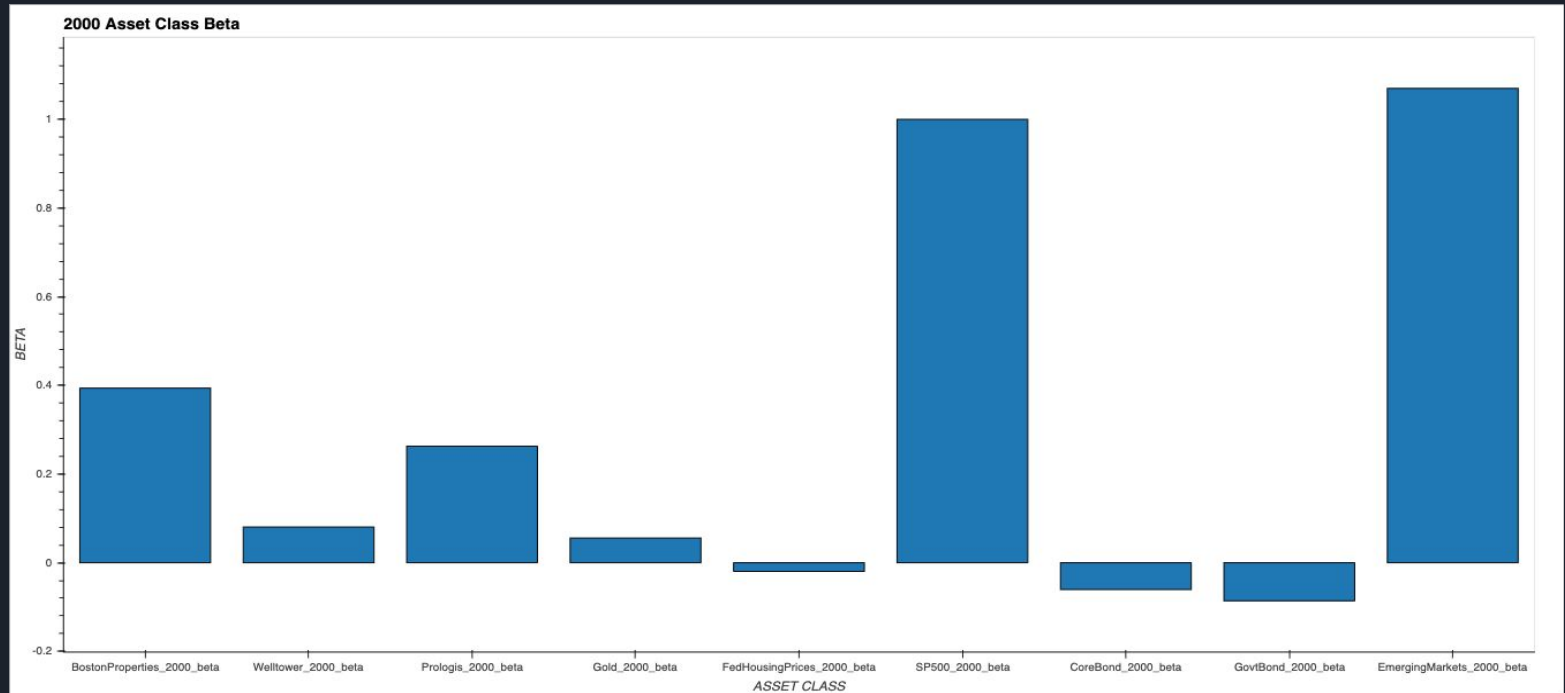
Best 2007 Risk Adjusted
Asset Class is **Gold**

BOSTON PROPERTIES_2007	0.037290
PROLOGIS_2007	0.029180
WELLTOWER_2007	0.085346
GOLD_2007	0.166960
FED HOUSING PRICES_2007	-0.151132
S&P500	0.056282
GOVT BOND_2007	0.042489
CORE BOND_2007	0.012302
EMERGING MARKETS_2007	0.007805

Results

Asset Beta

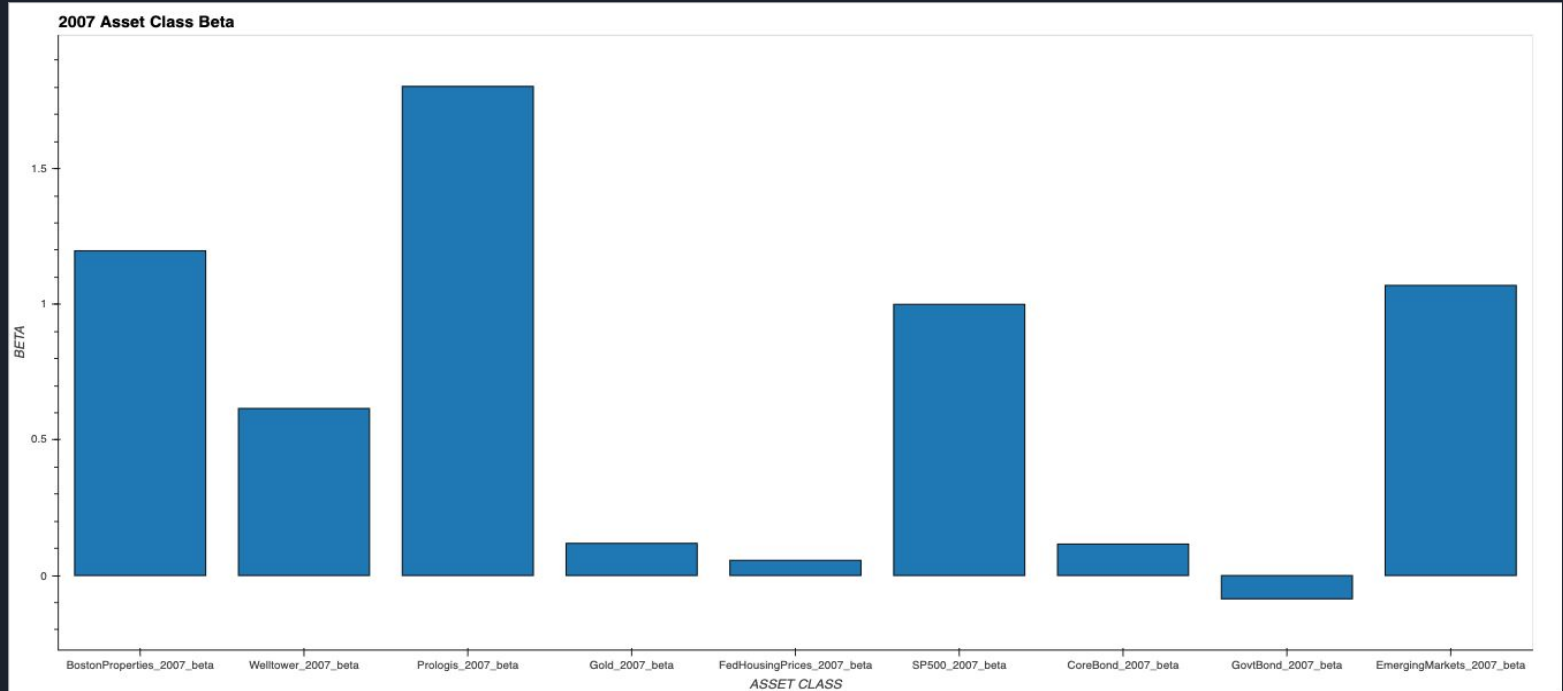
August 2000 to August 2007



Results

Asset Beta

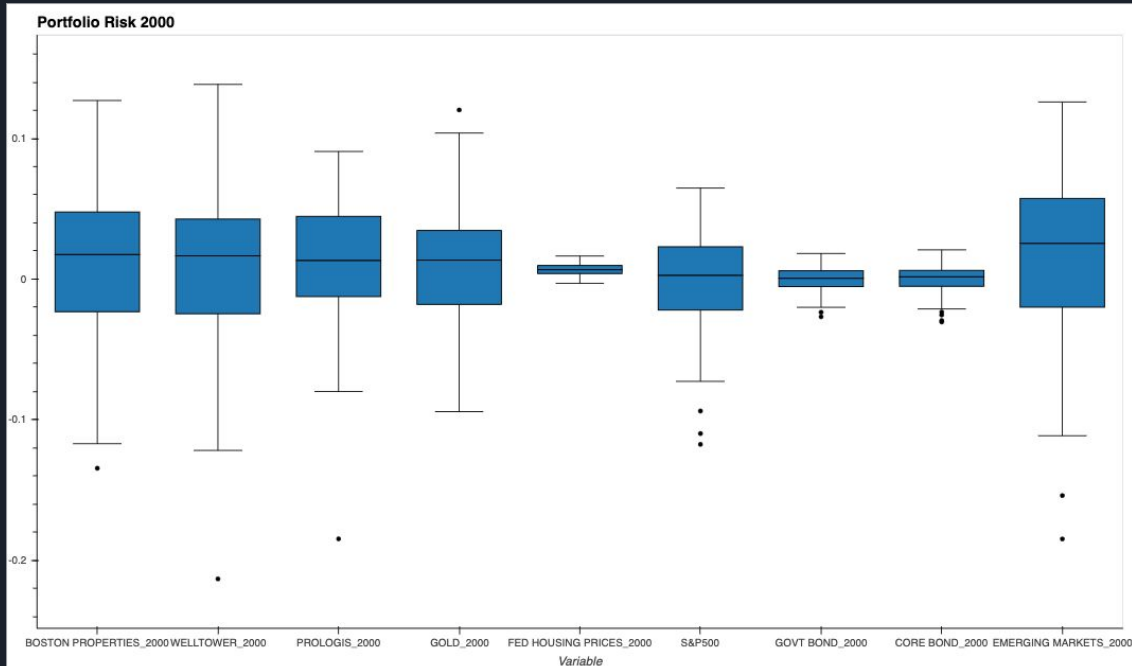
March 2007 to March 2014



Results

Portfolio Risk

August 2000 to August 2007

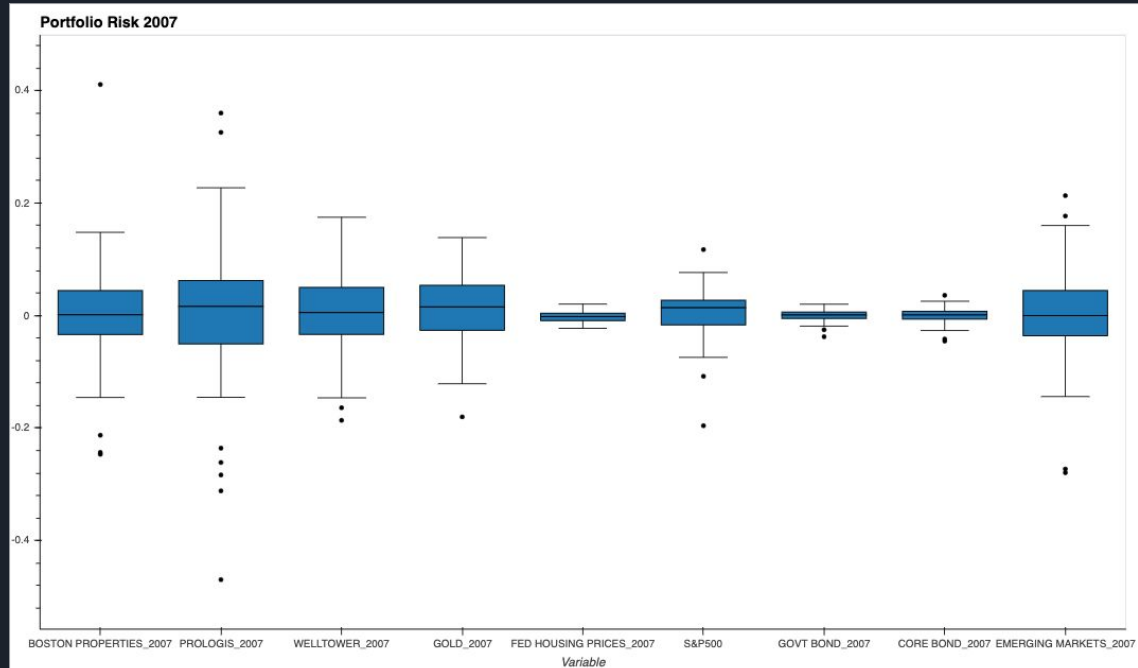


BOSTON PROPERTIES_2000	5.294020
WELLTOWER_2000	5.683482
PROLOGIS_2000	4.577576
GOLD_2000	4.046985
FED HOUSING PRICES_2000	0.494906
S&P500	3.597801
GOVT BOND_2000	0.854919
CORE BOND_2000	1.036627
EMERGING MARKETS_2000	6.362104

Results

Portfolio Risk

March 2007 to March 2014



BOSTON PROPERTIES_2007	8.815914
PROLOGIS_2007	11.919268
WELLTOWER_2007	6.922118
GOLD_2007	6.111716
FED HOUSING PRICES_2007	1.007122
S&P500	4.326827
GOVT BOND_2007	0.955872
CORE BOND_2007	1.289352
EMERGING MARKETS_2007	8.153535



Monte Carlo Simulation - Portfolio

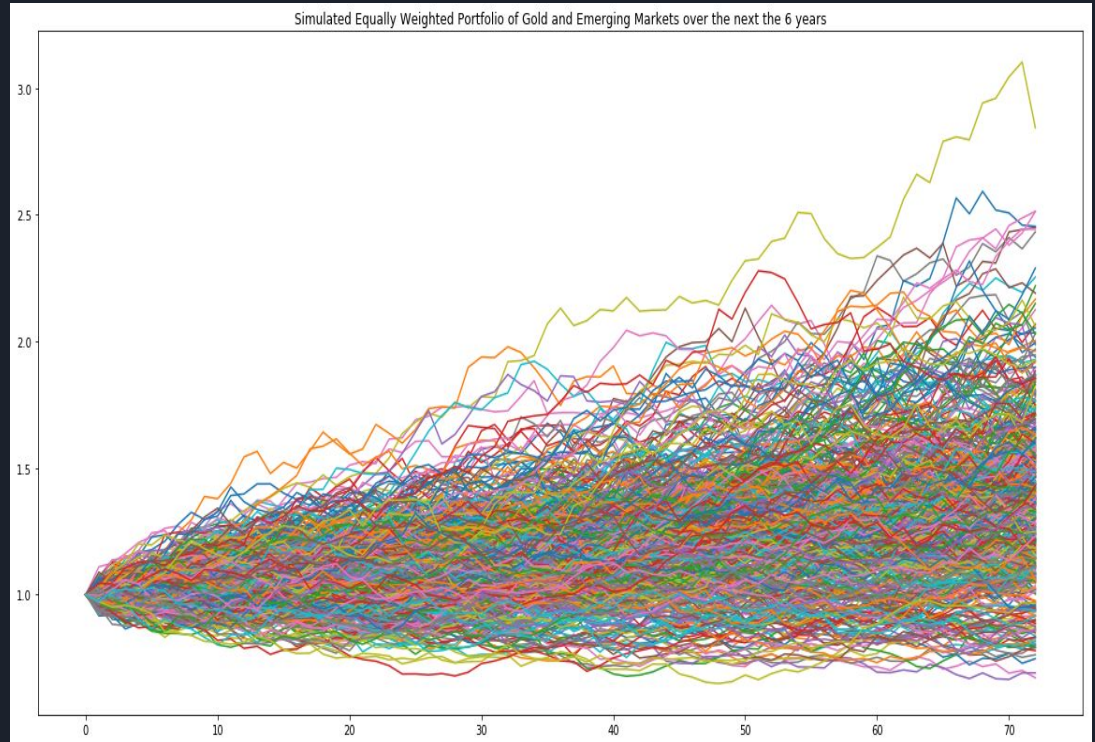
- After our analysis of 2000 and 2007; we determined the best asset classes on a returns basis were **Emerging Markets** and **Gold**,
- We chose to create an equally weighted portfolio (50/50) split between Emerging Markets and Gold to create simulated return values for the current 2020 recession.
- We ran a Monte Carlo with 500 Simulations using data from 2007-2014 to hypothesize potential investment returns for the current 2020 recession period.


Results

Monte Carlo Simulation - Portfolio

Returns for Equally Weighted
Portfolio of \$20,000

- 10% Interval - \$19,479
- 50% Interval - \$27,546
- 90% Interval - \$36,464





Problems

Learning to use Git

- Branching
 - How to separate the recession years and collaborate on the research?
- Merging
 - How to merge into the master while other collaborators are behind on commits?
- Committing
 - How to avoid conflicts with commits



Problems

- Uniformity in the Data sets caused us to use the monthly data
- for all data sets.
- We had originally planned to use the last 3 recessions but with data for our REIT we could only get for the last two
- Premium APIs would have allowed an easier integration of the necessary data into the notebook



Problems

Discrepancy in Well Tower Data

- Well Tower showed a return of 1,357% from the time period of 2007-2014, which is incorrect.
- After opening up the WellTower CSV, noticed that the two dates 2/2012, and 3/2013, had a closing value of .11 cents and .14 cents.
- Solution
 - Verify with Google Finance
 - Input the correct prices for analysis

Problems

Discrepancy in Well Tower Data

```
[170]: #Print the Average Monthly Returns (by a percentage basis)
print(monthly_returns_2007.mean()*100)
```

```
BOSTON PROPERTIES_2007    0.328742
WELLTOWER 2007            1357.424960
PROLOGIS_2007              0.347798
GOLD_2007                  1.020411
FED HOUSING PRICES_2007   -0.152208
S&P500                     0.243520
GOVT BOND_2007             0.040614
CORE BOND_2007             0.015861
EMERGING MARKETS_2007     0.063638
dtype: float64
```

	A	B	C	D	E	F	G
1	Date	Open	High	Low	Close	Adj Close	Volume
2	3/1/2013	63.7	67.92	0.11	0.11	0.076928	33514300
3	12/1/2012	59	61.33	0.14	0.14	0.096716	35896700
4	3/1/2009	29.77	35.02	25.86	30.59	16.97148	88116700
5	2/1/2009	37.1	38.95	28.45	30.77	16.75709	64288200
6	4/1/2009	30.03	35.88	29.62	34.07	18.90219	83672600
7	6/1/2009	34.62	36.41	33.04	34.1	19.30321	45206500
8	5/1/2009	34.02	35.14	31.57	34.25	19.00207	63038800
9	7/1/2007	40.65	42.37	35.87	36.71	18.2275	19770300
10	1/1/2009	42.32	42.32	34.81	37.81	20.59102	66471700
11	11/1/2008	44.83	45	30.14	38	20.34848	57296500
12	8/1/2007	35.16	40.53	35.08	39.9	19.81142	22988500
13	7/1/2009	34.12	40.75	32.64	40.06	22.67703	39456300
14	6/1/2007	43.8	44.1	38.64	40.36	20.03982	12642200
15	2/1/2008	42.88	43.73	39.52	41.16	21.43946	16517300
16	9/1/2009	40.7	44.37	39.55	41.62	23.93105	54410300
17	6/1/2010	42.81	44.84	40.7	42.12	25.39554	43193800
18	12/1/2008	37.43	42.4	32.49	42.2	22.98177	61581600
19	2/1/2010	43.27	43.55	39.82	42.36	24.74126	33715200
20	8/1/2009	40.36	44.4	39.58	42.71	24.17713	39633700
21	1/1/2008	44.68	45.42	39.26	42.82	21.97265	24432700




Additional Questions

- More recessions periods and more diverse portfolios
 - Testing more start/end dates of each recession.
Assets/markets top/bottom at different times and also the Official start/end dates are revised later so a more robust test of different dates would be needed.
- Monte Carlo simulation for all the asset classes moving forward
- Additional asset classes
- Utilize daily data as opposed to monthly for more accurate models
 - Some asset classes only go back 10 years

Q&A





Process Appendix - Sources

- [Boston Properties bxp](#)
- [Boston Properties, Inc. \(BXP\) Stock Historical Prices & Data](#)
- [Welltower Inc. \(WELL\) Stock Historical Prices & Data](#)
- [Welltower – NYSE: WELL](#)
- [Prologis, Inc. \(PLD\) Stock Historical Prices & Data](#)
- [Prologis: Logistics Real Estate & Supply Chain Logistics](#)
- [BlackRock Emerging Markets Fun \(MADCX\) Stock Historical Prices & Data](#)
- [BlackRock Core Bond Portfolio - \(BFMCX\) Stock Historical Prices & Data](#)
- [<https://finance.yahoo.com/quote/PNIGX/history?p=PNIGX>](#)
- [BlackRock: Financial Planning & Investment Management](#)