



The Coffee Value Chain

Commodity and FX Volatility in Emerging Markets

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Motivation and Summary

- How have FX and commodity price volatility affected coffee production, exports, and revenues, in the five largest Arabica-growing countries over time?
 - Prior to consulting available data, we hypothesized that higher FX and commodity price volatility were negatively correlated to production, exports, and revenues



Questions & Data

- In order to answer our questions we consulted the following data sources:
 - ICO (International Coffee Organization)
 - i. Spot price indicator
 - ii. Grower prices
 - UN ComTrade
 - i. Physical trade data
 - ICE Coffee Futures
 - International Monetary Fund
 - i. Foreign exchange rates
 - World Bank
 - i. Interest rates



**INTERNATIONAL
COFFEE
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Data Clean Up and Exploration

- Transposing columns and rows, locating columns
- Specify dtype .astype(), Removing nulls
- Date Formatting
 - split()
 - Looping through date index to fix format
- Conditionally slicing data
 - Defined functions to calculate derived statistics
- Concatenation of data
 - To visualize: Need for inclusion of location data with specific indicator information
 - Created master list(s) and wrote them to CSVs

Function for Calculating FX Realized Vol

```
# Defining function to calculate realized volatility by country
def real_vol(column):

    new_fx_data = pd.DataFrame()
    new_fx_data = fx_data[[f"{column}"]].astype(float)
    new_fx_data.index.name = "Date"
    new_fx_data.index = pd.to_datetime(new_fx_data.index)
    new_fx_data.index = new_fx_data.index.strftime('%m-%Y')

    new_fx_data["LogReturn"] = (np.log(new_fx_data[f"{column}"] / new_fx_data[f"{column}"].shift(1)))

    year_end = ["12-1990", "12-1991", "12-1992", "12-1993", "12-1994", "12-1995", "12-1996", "12-1997", "12-1998", "12-1999",
                "12-2000", "12-2001", "12-2002", "12-2003", "12-2004", "12-2005", "12-2006", "12-2007", "12-2008", "12-2009", "12-2010",
                "12-2011", "12-2012", "12-2013", "12-2014", "12-2015", "12-2016", "12-2017", "12-2018"]

    year_start = ["01-1990", "01-1991", "01-1992", "01-1993", "01-1994", "01-1995", "01-1996", "01-1997", "01-1998", "01-1999",
                 "01-2000", "01-2001", "01-2002", "01-2003", "01-2004", "01-2005", "01-2006", "01-2007", "01-2008", "01-2009", "01-2010",
                 "01-2011", "01-2012", "01-2013", "01-2014", "01-2015", "01-2016", "01-2017", "01-2018"]

    combined_years = zip(year_end, year_start)
    rvol_by_year = pd.DataFrame()
    rvol = []
    date_year = []

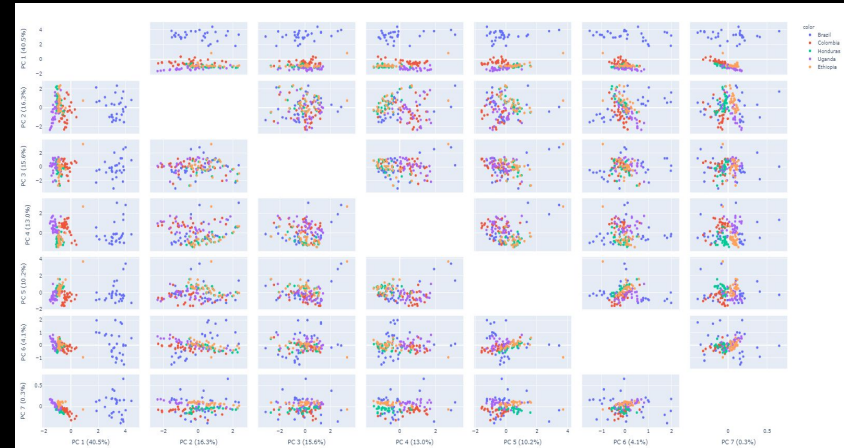
    for year in combined_years:
        year_data = new_fx_data.loc[str(year[1]):str(year[0])]
        monthly_std = np.std(year_data.LogReturn)
        std = float(round((monthly_std * 12 ** .5), 4) * 100)
        rvol.append(std)

    rvol_by_year["FX Realized Vol"] = rvol
    rvol_by_year.index = index_years

    return rvol_by_year
```

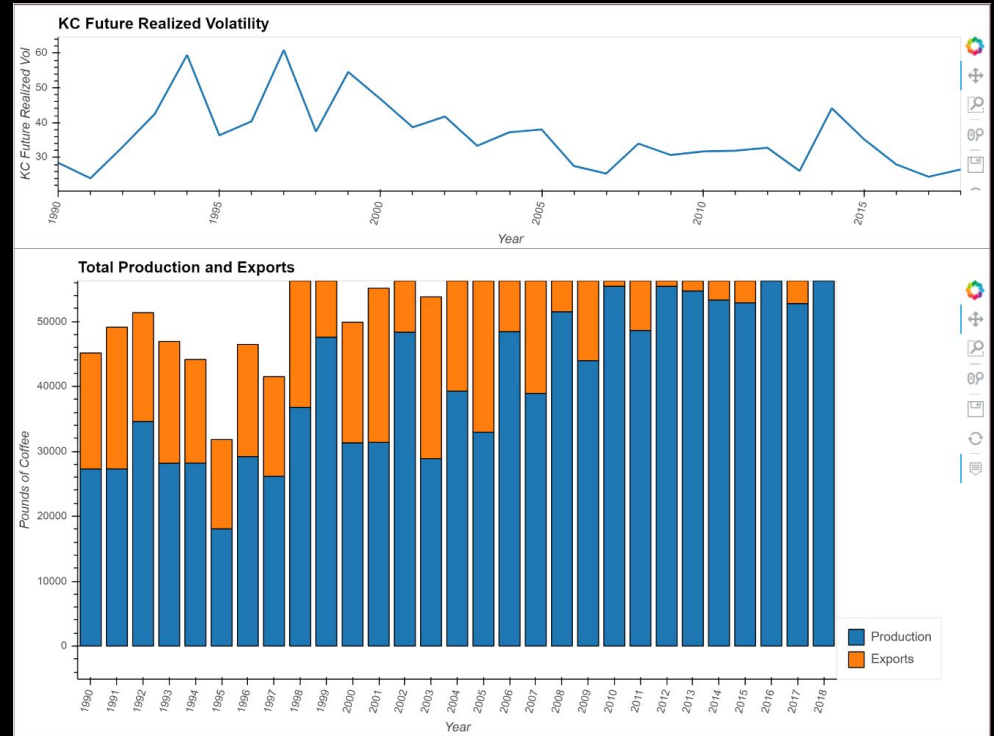
Data Analysis

- Map
 - Production and exports over time
- Currency vs. Exports
 - Currency depreciation positively correlated to increased exports
- FX Volatility vs. Exports
 - Cannot infer much from this relationship
- Coffee Futures Volatility and Production
 - Higher volatility leads to lower production levels
 - Colombia as an outlier
 - Correlation does not necessitate causation
 - Price elasticity of demand
 - Recession
- Spot vs. Future
 - Diff between futures' price and price paid to grower
 - High correlation between spot prices and future markets
- Heat Map
- PCA Analysis



Discussion

- Initial Hypothesis
 - FX rate weakness is positively correlated with exports
 - Where local currency is weaker against the dollar as a benchmark
 - KC (coffee futures) volatility is negatively correlated with production levels
- What the data showed or did not show
 - Data validated our initial hypotheses, with some exceptions and caveats
- Conclusions
 - Market price and FX volatility is generally intimately correlated to commodity production levels and exports
 - However, this relationship can be altered by consumer attitudes and choices
 - Different actors/markets/countries react and adapt differently to volatility



Postmortem

- Coding Issues
 - Cleanup was our main issue
 - Problem: data sets from various sources, with varying layouts
- Visualizations
 - Troubleshooting widgets
 - Multidimensional visuals
 - Difficulties seeing two panels at the same time
- Additional Questions
 - How can fintech solutions help mitigate coffee volatility?
 - Applications for other commodities?
 - Blockchain



An aerial photograph of Rio de Janeiro, Brazil, showing the city's iconic landscape. The foreground is dominated by the dense urban sprawl of the city, with numerous high-rise buildings and residential areas. The middle ground features the bay, filled with many small boats, and the prominent Sugarloaf Mountain (Pão de Açúcar) rising from the water. The background shows the surrounding mountains and the bay extending towards the horizon. The word "Questions?" is overlaid in the center of the image.

Questions?