Group 5 Project Final Paper

Real-Estate agents and managers

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BAN 4550 – Analytics Programming

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Members: Ajinkya Kobal , Sangram Dedge, YNV Tanmayee

Introduction

1) **Team members name:**

A) Ajinkya Sanjay Kobal

B) Sangram Dedge

C) YNV Tanmayee

2) **Summary of your question and findings:**

The questions were regarding how the economic indicators significantly affect the Real Estate industry. The economic indicators we selected are Interest rate, Real income and House price index. After performing the regression analysis and other required statistics, it is found that the revenue and interest rate has a negative relationship while the house income and real income has a positive relationship with the revenue. It is also observed that the real estate industry is mostly affected by the interest rate as compared to the real income and house income.

Background

· **Overview of the industry**

3) **SIC code and its description:** 6531 **-** Real Estate Agents & Managers.

4) **Description of 3 representative companies with corresponding SEC EDGAR page:**

a) Marriott vacations worldwide Corp and
https://www.sec.gov/cgi-bin/browse-edgar?action=getcompany&CIK=0001524358&owner=include&count=40&hidefilings=0

b) Kennedy-Wilson, Inc and
https://www.sec.gov/cgi-bin/browse-edgar?action=getcompany&CIK=0000885720&owner=include&count=40&hidefilings=0

c) Silverleaf Resorts Inc and
https://www.sec.gov/cgi-bin/browse-edgar?action=getcompany&CIK=0001033032&owner=include&count=40&hidefilings=0

Research question with supporting evidence

5) **Description Interested economic indicators (their definitions and when the interested economic indicator is used) and its FRED page:**

A) **Interest Rate** - The real estate interest rate is an important economic metric that shows the cost of borrowing money for real estate investments or purchases. It is the annual percentage rate paid by lenders to borrowers for loans utilized in real estate transactions, such as mortgages for home purchases or commercial real estate. Changes in this interest rate can have a significant impact on the affordability and attractiveness of real estate investments, as higher rates can boost borrowing costs and potentially reduce demand, while lower rates can stimulate activity and investment.

https://fred.stlouisfed.org/series/DFF

B) **Real income** - A real income indicator is a measure of income that has been inflation-adjusted. This indicator, which is used to monitor individual and family spending, takes

the growing cost of goods and services into account over time. Real income indicators are crucial for the real estate sector since they have an impact on housing demand.

https://fred.stlouisfed.org/series/MEHOINUSA672N

C) **House price index -**House Price Index is an indicator which shows the changes in the price of residential houses in percentage from a particular date. It is estimated with the help of a weighted repeat sales index. It helps in measuring mortgages and provide results which are conventional as well as conforming.

https://fred.stlouisfed.org/series/CSUSHPINSA

6) **Research questions and corresponding evidence with the summary:**

Q1) Why changing interest rates might not be as bad for the Real Estate sector as it seems? And what were the different strategies applied by many Real Estate firms and Agents to keep their profit/Revenue stable?

Q2) Research Question: How does the fluctuation in real income levels influence the acquisition and disposition patterns of real estate companies, how should companies face fluctuations in real income indicators?

Hypothesis: The performance of the real estate industry is positively affected by the Housing Price Index.

We have taken revenue as the dependent variable and our expectations on revenue are the following:

1. The interest rate (independent variable) has a negative effect on the revenue (dependent variable) of the companies, so an increase in interest rate decreases the 5% revenue of the Real-Estate businesses.

2. The house price index (independent variable) has a positive impact on the revenue (dependent variable) of the companies, i.e. the house price increase has an impact on the revenue of organizations.

3. The Real income (independent variable) has a positive impact on the revenue (dependent variable) of the companies; as the Real Income income increases, the revenue of organizations in Real-Estate also increases.

Data

7) **Brief description of Compustat and FRED:**

· **Compustat:** It contains the information of all the companies in the world which are active as well as inactive and their statistical, market and financial information. Information like fundamentals, integrated databases and proprietary data are provided.[1]

· **FRED:** Federal Reserve Economic Data (FRED) has all the information regarding Consumer and producer price indexes, US financial data and international data etc. in their database, which is maintained by Federal Reserve Bank of St. Louis's Research division. The time series data is collected from various sources like the US Census and Bureau of Labor Statistics.[2]

[1] https://en.wikipedia.org/wiki/Compustat

[2] https://en.wikipedia.org/wiki/Federal_Reserve_Economic_Data

- **Data preparation**

8) **Describe how you import data:**

The data is imported through the WRDS and FRED by using the key and WRDS login.

```
In [6]: conn=wrds.Connection()
```

```
Enter your WRDS username [Ajinkya]:akobal
Enter your password:·····
WRDS recommends setting up a .pgpass file.
Create .pgpass file now [y/n]?: y
Created .pgpass file successfully.
You can create this file yourself at any time with the create_pgpass_file() function.
Loading library list...
Done
```

```
In [138…
real_estate = conn.raw_sql('''select cik, gvkey, datadate, conm, revt, ni from comp.funda
                        where sich=6531 and datadate>='01/01/1975' and datadate<='12/31/2023'
                        and  datafmt = 'STD' and consol = 'C'and indfmt = 'INDL'
                        ''', date_cols=['datadate'])
real_estate['year']=pd.DatetimeIndex(real_estate['datadate']).year
real_estate['month']=pd.DatetimeIndex(real_estate['datadate']).month
real_estate.head()
```

Out[138]:

	cik	gvkey	datadate	conm	revt	ni	year	month
0	0000216039	005357	1987-12-31	GRUBB & ELLIS CO	336.989	0.250	1987	12
1	0000216039	005357	1988-12-31	GRUBB & ELLIS CO	370.838	-1.946	1988	12
2	0000216039	005357	1989-12-31	GRUBB & ELLIS CO	357.566	0.521	1989	12
3	0000216039	005357	1990-12-31	GRUBB & ELLIS CO	319.022	-29.751	1990	12
4	0000216039	005357	1991-12-31	GRUBB & ELLIS CO	266.234	-49.297	1991	12

9) **Primary key of data:**

- **WRDS**: Gvkey and year
- **FRED:** Date

10) **Number of observations:**

IV) Ajinkya and Sangram and Tanmayee data merge

```
In [120…
allmerge=Adatamerge.merge(Sdata,how='inner', on='year')
allmerge.head()
```

Out[120]:

	cik	gvkey	datadate	conm	revt	ni	year	month	House_price	Interest_rate	Real_income
0	0000017221	002733	1997-07-31	CAPITAL INVESTMENT OF HAWAII	1.818	-0.847	1997	7	85.317833	3.199335	10046.794
1	0000820906	013915	1997-12-31	COLOR IMAGING INC	0.024	0.676	1997	12	85.317833	3.199335	10046.794
2	0001037976	065108	1997-12-31	JONES LANG LASALLE INC	221.535	25.840	1997	12	85.317833	3.199335	10046.794
3	None	015098	1997-04-30	BECKER MILK CO LTD -CL B	2.124	-3.968	1997	4	85.317833	3.199335	10046.794
4	0001408100	025632	1997-12-31	KENNEDY-WILSON HOLDINGS INC	25.568	4.030	1997	12	85.317833	3.199335	10046.794

```
In [121…
allmerge.shape
```

```
Out[121]: (572, 11)
```

- **WRDS:** 572 rows and 8 columns

- **FRED:** 586 rows and 4 columns

11) **Describe any steps related to change the data frame (adding variables, aggregating data, etc.):**

Data imported from FRED is updated on a monthly basis and the data imported through WRDS is updated annually, so in order to merge the data, it is grouped by their mean based on the year.

In [56]:
```
mykey='1453b54cebf781e8984cfe98db12fa16'
```

In [147…
```
econ_var='REAINTRATREARAT10Y'
fred = Fred(api_key=mykey)
econ=fred.get_series(econ_var,observation_start='1975-01-01')
econ=econ.to_frame().reset_index()
econ=econ.rename(columns={0:'Interest_rate','index':'date'})

econ['year']=pd.DatetimeIndex(econ['date']).year
econ['month']=pd.DatetimeIndex(econ['date']).month
econ[econ['year']>=1975].head()
```

Out[147]:

	date	Interest_rate	year	month
0	1982-01-01	7.623742	1982	1
1	1982-02-01	7.656648	1982	2
2	1982-03-01	7.128993	1982	3
3	1982-04-01	7.408347	1982	4
4	1982-05-01	7.320041	1982	5

In [148…
```
econ.shape
```

Out[148]:
```
(503, 4)
```

In [151…
```
trend_yi=econ.groupby('year')['Interest_rate'].mean()
trend_yi.head()
```

Out[151]:
```
year
1982    6.934689
1983    5.888257
1984    6.637399
1985    5.660393
1986    4.048303
Name: Interest_rate, dtype: float64
```

12) **Relation between your datasets and the reason why you select:**

Relation between the datasets is **many to many** because there are multiple entries for different years for a company and the FRED data is updated on a monthly basis and WRDS data is updated annually

13) **How you merge data sets and why you select (e.g., Inner, outer, left, right, etc.):**

The data was merged using the inner joint, as it helps in getting the required data from 2 different tables into 1 table by filtering the unrelated data and merging them based on the matching rows and the data.

```
In [63]: Ajdata=real_estate.merge(Adata,how='inner', on='year')
         Ajdata.head()
```

Out[63]:

	cik	gvkey	datadate	conm	revt	ni	year	month	Interest_rate
0	0000017221	002733	1997-07-31	CAPITAL INVESTMENT OF HAWAII	1.818	-0.847	1997	7	3.199335
1	0000820906	013915	1997-12-31	COLOR IMAGING INC	0.024	0.676	1997	12	3.199335
2	0001037976	065108	1997-12-31	JONES LANG LASALLE INC	221.535	25.840	1997	12	3.199335
3	None	015098	1997-04-30	BECKER MILK CO LTD -CL B	2.124	-3.968	1997	4	3.199335
4	0001408100	025632	1997-12-31	KENNEDY-WILSON HOLDINGS INC	25.568	4.030	1997	12	3.199335

14) **Description of merged data:**

a) Number of observations – 572 columns and 11 rows

b) Number of unique companies – 99 unique companies

c) Periods (e.g., 2000-2020): 1975 - 2023

IV) Ajinkya and Sangram and Tanmayee data merge

```
In [120…  allmerge=Adatamerge.merge(Sdata,how='inner', on='year')
          allmerge.head()
```

Out[120]:

	cik	gvkey	datadate	conm	revt	ni	year	month	House_price	Interest_rate	Real_income
0	0000017221	002733	1997-07-31	CAPITAL INVESTMENT OF HAWAII	1.818	-0.847	1997	7	85.317833	3.199335	10046.794
1	0000820906	013915	1997-12-31	COLOR IMAGING INC	0.024	0.676	1997	12	85.317833	3.199335	10046.794
2	0001037976	065108	1997-12-31	JONES LANG LASALLE INC	221.535	25.840	1997	12	85.317833	3.199335	10046.794
3	None	015098	1997-04-30	BECKER MILK CO LTD -CL B	2.124	-3.968	1997	4	85.317833	3.199335	10046.794
4	0001408100	025632	1997-12-31	KENNEDY-WILSON HOLDINGS INC	25.568	4.030	1997	12	85.317833	3.199335	10046.794

```
In [121…  allmerge.shape
```

Out[121]: (572, 11)

b) TABLE: field names, descriptions of fields (i.e., definition), the number of missing values by a field, and type of fields (string, float, date, etc.):

o **CIK –** The Central Index Key (CIK) is the SEC's unique identifier for corporations and individuals who have filed disclosures with the SEC. CIKs are not available for Exchange Traded Funds.[3]

o **Gvkey –** This item is a unique identifier and primary key for each company in the database. A company can be defined as a public company, a private company, a tracking stock, a structured product, an ETF, a subsidiary, a PREFASB record, a PROFORMA record, an Exchangeable Share or a component of a Dual-Listed Company.[4]

o **Data date –** It is the date of the given data.

o **Conm –** It is the name of the companies in the given data

o **Revt –** It is the revenue of the companies in the given year and month

o **NI –** It is the national income for the given year and month

o **Year & month –** It shows the year and month details

o **House price –** It is the price that the seller is asking and which will be entered into the sales contract. In simple terms it is the price at which the property is agreed to sell. There are many

factors like market value, property's location and its conditions etc., which affect the sales price.[5]

- **Interest rate –** It is the cost that a borrower has to pay for the amount he has taken in the form of loan from an institution or a lender. Interest on mortgages is affected by many factors like personal earnings and ability to pay, state of general economy etc.[6]

- **Real income –** It is the real value of income after adjusting the changes in living costs and inflation. It shows the more accurate level of spending power of an individual. It is calculated using the formula - Real Income = [Wages/(1+InflationRate)].[7]

[1] https://www.alacra.com/alacra/outside/lei/info/cik.html

[1] https://www.alacra.com/alacra/outside/lei/info/gvkey.html

[1] https://www.investopedia.com/terms/h/house-price-index-hpi.asp

[1] https://www.investopedia.com/mortgage/mortgage-rates/housing-market/#:~:text=The%20interest%20rate%20is%20the,economy%20and%20your%20personal%20circumstances

[1] https://www.investopedia.com/terms/r/realincome.asp

```
In [103…  # Check missing values

          merge_ind.isnull().sum()

Out[103]: cik              0
          gvkey            0
          datadate         0
          conm             0
          revt             4
          ni               4
          year             0
          month            0
          House_price      0
          Interest_rate    0
          Real_income      0
          dtype: int64

In [106…  merge_ind.shape

Out[106]: (23, 11)

In [107…  merge_ind.dropna(how='any').shape

Out[107]: (19, 11)

In [108…  merge_ind.dropna(how='all').shape

Out[108]: (23, 11)

In [111…  merge_ind.dropna(subset=['revt'], how='any').shape

Out[111]: (19, 11)

In [111…  merge_ind.dropna(subset=['revt'], how='any').shape

Out[111]: (19, 11)

In [112…  merge_ind.dropna(subset=['revt'], how='any').isnull().sum()

Out[112]: cik              0
          gvkey            0
          datadate         0
          conm             0
          revt             0
          ni               0
          year             0
          month            0
          House_price      0
          Interest_rate    0
          Real_income      0
          dtype: int64
```

Figure 2

o There are 4 missing values in the revt and ni column and their type is float. Missing values were handled by dropping them. (Figure 2)

Data analysis

· **Descriptive statistics:**

15) **max, mean, etc. for your interested variables:**

From the figure 3 we can see that the **max value** of revenue, National Income and Interest rate are 30,828.246, 1,407.37 and 4.45 respectively. **Min value** of revenue, National Income and Interest rate are -356.79, -1912 and -0.12 respectively. **Mean values** of revenue, National Income and Interest rate are 1277.41, 12.82 and 1.80 respectively.

```
In [124]: mean= allmerge.loc[:,['revt','Real_income','House_price','Interest_rate','ni']].mean()
          print("mean:\n",mean)

          mean:
           revt             1277.414473
          Real_income      13361.274170
          House_price        148.177210
          Interest_rate        1.799518
          ni                  12.823004
          dtype: float64
```

```
In [31]: Ajdata.describe()
```

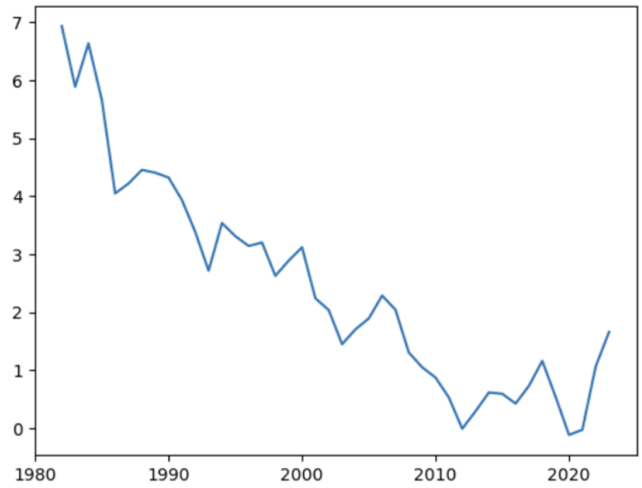
Out[31]:

	datadate	revt	ni	year	month	Interest_rate	norm	log_revt
count	572	565.000000	565.000000	572.000000	572.000000	572.000000	565.000000	564.000000
mean	2007-03-17 15:08:48.671328768	1277.414473	12.823004	2006.291958	11.013986	1.799518	639.207236	4.434322
min	1986-12-31 00:00:00	-356.790000	-1912.000000	1986.000000	1.000000	-0.119478	-177.895000	-0.693147
25%	1998-01-23 06:00:00	36.151000	-4.765000	1997.750000	12.000000	0.589024	18.575500	2.970877
50%	2007-12-31 00:00:00	255.030000	1.192000	2007.000000	12.000000	1.445796	128.015000	4.865459
75%	2016-12-31 00:00:00	904.499000	24.557000	2016.000000	12.000000	3.116589	452.749500	6.116614
max	2022-12-31 00:00:00	30828.246000	1407.370000	2022.000000	12.000000	4.452901	15414.623000	9.643072
std	NaN	2857.895545	219.147399	10.466546	2.584437	1.385928	1428.947773	2.526005

Figure 3

- **The trend of interested variables:**

```
plt.plot(trend_yi)
plt.show()
```

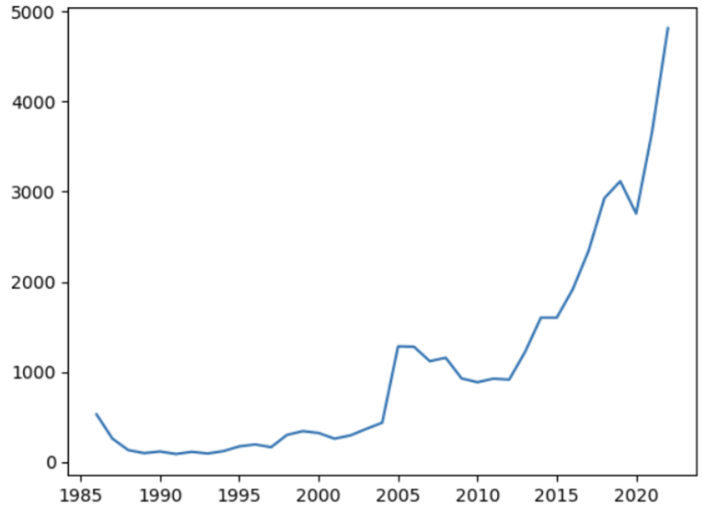


We can see that there is a decrease in Interest Rate along the years from 1980 to 2020 in fast rate.

16) **The trend of revenues over the years (group by mean):**

The following diagram shows the trend of revenues over the years and we can see that there are ups and downs in the revenue. Initially revenue has fallen then it is stable and then it keeps on increasing. First increase in the revenue is seen in the year 2005 after which the revenue started to increase significantly from the year 2014.

```
n [143…  plt.plot(trend_ry)
         plt.show()
```



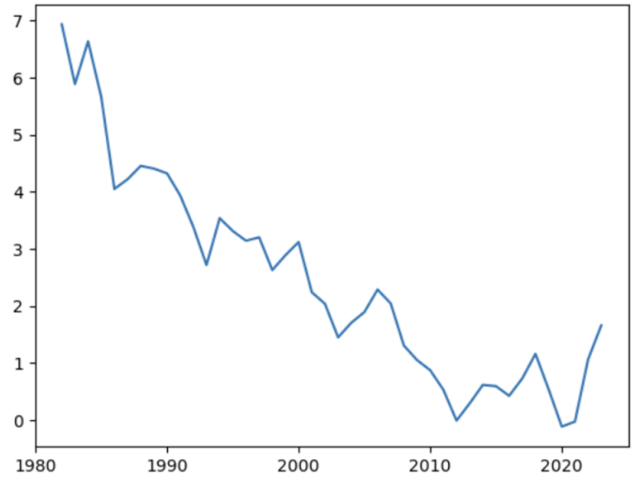
We can see that there is a Increase in Revenue along the years from 1980 to 2020 in fast rate.

Figure 4

17) **The trend of your interested economic variable over the years:**

Here the interesting economic variable is interest rate and it shows the negative trend. There are fluctuations in the interest rate but the most significant decrease can be seen in the years from 1983 to 1987 and from 2008 to 2012. We can see the decrease in the interest rates from 1980 to 2021 but increased later in 2022. (Figure5)

```
plt.plot(trend_yi)
plt.show()
```



We can see that there is a decrease in Interest Rate along the years from 1980 to 2020 in fast rate.

Figure - 5

- ## Correlation

Correlation between all Economic Indicators and Revnue

In [104]:
```
# Correlation
econ_all = allmerge[['revt','Real_income','House_price','Interest_rate']]
econ_Call =econ_all.corr()
econ_Call
```

Out[104]:

	revt	Real_income	House_price	Interest_rate
revt	1.000000	0.414739	0.442127	-0.310096
Real_income	0.414739	1.000000	0.946404	-0.901816
House_price	0.442127	0.946404	1.000000	-0.769529
Interest_rate	-0.310096	-0.901816	-0.769529	1.000000

In [105]:
```
econ_Call.shape
```

Out[105]: (4, 4)

18) **Any analysis showing a correlation between revenues and your economic variables:**

Here the economic variables are Real Income, House Price and Interest Rate. From the figure-6 we can see that real income, house price has positive correlation while the interest rate has negative correlation. Correlation between revenue and interest rate is -0.31, between revenue and house price is 0.44 and between revenue and real income is 0.414. Correlation between real income and house price is 0.95 and between real income and interest rate is -0.90. Correlation between house price and interest rate is -0.77.

- ## Regression analysis

```
Amodel3 = smf.ols(formula='log_revt ~ Real_income+y_2013+y_2014+y_2015+y_2016+y_2017+y_2018+y_2019+y_2020+y_2021', data=Sadata)
Aresults3 = Amodel3.fit()
print(Aresults3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:               log_revt   R-squared:                       0.259
Model:                            OLS   Adj. R-squared:                  0.245
Method:                 Least Squares   F-statistic:                     19.28
Date:                Mon, 04 Dec 2023   Prob (F-statistic):           1.40e-30
Time:                        00:06:51   Log-Likelihood:                -1238.0
No. Observations:                 564   AIC:                             2498.
Df Residuals:                     553   BIC:                             2546.
Df Model:                          10
Covariance Type:            nonrobust
================================================================================
                   coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------
Intercept       -0.5383      0.464     -1.160      0.246      -1.450       0.373
y_2013[T.True]  -0.1497      0.555     -0.270      0.787      -1.239       0.940
y_2014[T.True]  -0.1404      0.611     -0.230      0.818      -1.340       1.060
y_2015[T.True]  -0.0746      0.581     -0.128      0.898      -1.216       1.067
y_2016[T.True]  -0.2136      0.568     -0.376      0.707      -1.330       0.903
y_2017[T.True]   0.3619      0.606      0.597      0.551      -0.829       1.553
y_2018[T.True]   0.2640      0.581      0.454      0.650      -0.877       1.405
y_2019[T.True]   0.2913      0.563      0.518      0.605      -0.814       1.397
y_2020[T.True]  -0.4735      0.532     -0.890      0.374      -1.519       0.572
y_2021[T.True]  -0.5659      0.529     -1.069      0.286      -1.606       0.474
Real_income      0.0004   3.82e-05      9.800      0.000       0.000       0.000
==============================================================================
Omnibus:                       39.847   Durbin-Watson:                   1.948
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               47.227
Skew:                          -0.707   Prob(JB):                     5.56e-11
Kurtosis:                       2.891   Cond. No.                     1.36e+05
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 1.36e+05. This might indicate that there are
strong multicollinearity or other numerical problems.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) Coef - 0.0004 which is positive

- **Figure 7 is the regression analysis of Revenue and Real Income and below is its summary.**

Prob(F-stat) – It is <0.1

R2 – 0.259

Coefficient of real income - 0.0004

P-value - 0

```
Bmodel2 = smf.ols(formula='log_revt ~ Interest_rate+y_2013+y_2014+y_2015+y_2016+y_2017+y_2018+y_2019+y_2020+y_2021', data=Ajdata)
Bresults2 = Bmodel2.fit()
print(Bresults2.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:               log_revt   R-squared:                       0.223
Model:                            OLS   Adj. R-squared:                  0.209
Method:                 Least Squares   F-statistic:                     15.89
Date:                Mon, 04 Dec 2023   Prob (F-statistic):           3.07e-25
Time:                        00:06:56   Log-Likelihood:                -1251.2
No. Observations:                 564   AIC:                             2524.
Df Residuals:                     553   BIC:                             2572.
Df Model:                          10
Covariance Type:            nonrobust
================================================================================
                   coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------
Intercept        5.6370      0.243     23.175      0.000       5.159       6.115
y_2013[T.True]  -0.6146      0.588     -1.046      0.296      -1.769       0.540
y_2014[T.True]  -0.1647      0.631     -0.261      0.794      -1.405       1.076
y_2015[T.True]   0.1390      0.595      0.234      0.815      -1.030       1.308
y_2016[T.True]  -0.0274      0.584     -0.047      0.963      -1.174       1.120
y_2017[T.True]   0.9612      0.609      1.577      0.115      -0.236       2.158
y_2018[T.True]   1.3756      0.567      2.426      0.016       0.262       2.490
y_2019[T.True]   1.1494      0.553      2.078      0.038       0.063       2.236
y_2020[T.True]   0.2824      0.524      0.539      0.590      -0.746       1.311
y_2021[T.True]   0.5878      0.497      1.182      0.238      -0.389       1.565
Interest_rate   -0.7436      0.091     -8.155      0.000      -0.923      -0.565
==============================================================================
Omnibus:                       33.116   Durbin-Watson:                   1.847
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               37.877
Skew:                          -0.629   Prob(JB):                     5.96e-09
Kurtosis:                       2.830   Cond. No.                         21.5
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) Coef - 1.7250 which is positive

Figure 8

- **Figure 8 is the regression analysis of Revenue and Interest rate and below is its summary.**

Prob(F-stat) – It is <0.1

R2 – 0.223

Coefficient of interest rate – (-0.7436)

P-value - 0

19) **Brief description of the definition of regression analysis:**

By using regression analysis, we can analyze and estimate the relationship between 2 or more dependent or independent variables. It helps us to identify the important factors and also to determine the factors that can be ignored. **[8]**

20) **Summary of your findings from regression analysis (F-stat, R2, and your interested variable's coefficient and its p-value):**

```
Cmodel3 = smf.ols(formula='log_revt ~ House_price+y_2013+y_2014+y_2015+y_2016+y_2017+y_2018+y_2019+y_2020+y_2021', data=datamerge)
Cresults3 = Cmodel3.fit()
print(Cresults3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:                log_revt   R-squared:                       0.253
Model:                            OLS   Adj. R-squared:                  0.240
Method:                 Least Squares   F-statistic:                     18.72
Date:                Mon, 04 Dec 2023   Prob (F-statistic):           1.06e-29
Time:                        00:07:01   Log-Likelihood:                -1238.2
No. Observations:                 563   AIC:                             2498.
Df Residuals:                     552   BIC:                             2546.
Df Model:                          10
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      1.5726      0.266      5.922      0.000       1.051       2.094
y_2013[T.True] 0.4170      0.549      0.760      0.447      -0.661       1.495
y_2014[T.True] 0.4406      0.604      0.730      0.466      -0.746       1.627
y_2015[T.True] 0.6247      0.569      1.098      0.273      -0.493       1.742
y_2016[T.True] 0.4241      0.556      0.763      0.446      -0.668       1.516
y_2017[T.True] 0.9946      0.593      1.677      0.094      -0.170       2.159
y_2018[T.True] 0.8870      0.565      1.570      0.117      -0.223       1.997
y_2019[T.True] 0.9953      0.542      1.838      0.067      -0.068       2.059
y_2020[T.True] 0.3838      0.498      0.770      0.442      -0.595       1.363
y_2021[T.True] -0.0681     0.508     -0.134      0.893      -1.065       0.929
House_price    0.0182      0.002      9.535      0.000       0.014       0.022
==============================================================================
Omnibus:                       37.538   Durbin-Watson:                   1.919
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               43.203
Skew:                          -0.666   Prob(JB):                     4.16e-10
Kurtosis:                       2.742   Cond. No.                     1.29e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 1.29e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) coef - Value is positive.

Figure 7

- Figure 7 is the regression analysis of Revenue and Real Income and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.259

Coefficient of House Price - 0.0182

P-value - 0

```
Bmodel2 = smf.ols(formula='log_revt ~ Interest_rate+y_2013+y_2014+y_2015+y_2016+y_2017+y_2018+y_2019+y_2020+y_2021', data=Ajdata)
Bresults2 = Bmodel2.fit()
print(Bresults2.summary())
```

OLS Regression Results

Dep. Variable:	log_revt	R-squared:	0.223
Model:	OLS	Adj. R-squared:	0.209
Method:	Least Squares	F-statistic:	15.89
Date:	Mon, 04 Dec 2023	Prob (F-statistic):	3.07e-25
Time:	00:06:56	Log-Likelihood:	-1251.2
No. Observations:	564	AIC:	2524.
Df Residuals:	553	BIC:	2572.
Df Model:	10		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	5.6370	0.243	23.175	0.000	5.159	6.115
y_2013[T.True]	-0.6146	0.588	-1.046	0.296	-1.769	0.540
y_2014[T.True]	-0.1647	0.631	-0.261	0.794	-1.405	1.076
y_2015[T.True]	0.1390	0.595	0.234	0.815	-1.030	1.308
y_2016[T.True]	-0.0274	0.584	-0.047	0.963	-1.174	1.120
y_2017[T.True]	0.9612	0.609	1.577	0.115	-0.236	2.158
y_2018[T.True]	1.3756	0.567	2.426	0.016	0.262	2.490
y_2019[T.True]	1.1494	0.553	2.078	0.038	0.063	2.236
y_2020[T.True]	0.2824	0.524	0.539	0.590	-0.746	1.311
y_2021[T.True]	0.5878	0.497	1.182	0.238	-0.389	1.565
Interest_rate	-0.7436	0.091	-8.155	0.000	-0.923	-0.565

Omnibus:	33.116	Durbin-Watson:	1.847
Prob(Omnibus):	0.000	Jarque-Bera (JB):	37.877
Skew:	-0.629	Prob(JB):	5.96e-09
Kurtosis:	2.830	Cond. No.	21.5

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) Coef - 1.7250 which is positive

Figure 8

- Figure 8 is the regression analysis of Revenue and Interest rate and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.223

Coefficient of interest rate – (-0.7436)

P-value - 0

```
Cmodel3 = smf.ols(formula='log_revt ~ House_price+y_2013+y_2014+y_2015+y_2016+y_2017+y_2018+y_2019+y_2020+y_2021', data=datamerge)
Cresults3 = Cmodel3.fit()
print(Cresults3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:               log_revt   R-squared:                       0.253
Model:                            OLS   Adj. R-squared:                  0.240
Method:                 Least Squares   F-statistic:                     18.72
Date:                Mon, 04 Dec 2023   Prob (F-statistic):           1.06e-29
Time:                        00:07:01   Log-Likelihood:                -1238.2
No. Observations:                 563   AIC:                             2498.
Df Residuals:                     552   BIC:                             2546.
Df Model:                          10
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      1.5726      0.266      5.922      0.000       1.051       2.094
y_2013[T.True]     0.4170      0.549      0.760      0.447      -0.661       1.495
y_2014[T.True]     0.4406      0.604      0.730      0.466      -0.746       1.627
y_2015[T.True]     0.6247      0.569      1.098      0.273      -0.493       1.742
y_2016[T.True]     0.4241      0.556      0.763      0.446      -0.668       1.516
y_2017[T.True]     0.9946      0.593      1.677      0.094      -0.170       2.159
y_2018[T.True]     0.8870      0.565      1.570      0.117      -0.223       1.997
y_2019[T.True]     0.9953      0.542      1.838      0.067      -0.068       2.059
y_2020[T.True]     0.3838      0.498      0.770      0.442      -0.595       1.363
y_2021[T.True]    -0.0681      0.508     -0.134      0.893      -1.065       0.929
House_price        0.0182      0.002      9.535      0.000       0.014       0.022
==============================================================================
Omnibus:                       37.538   Durbin-Watson:                   1.919
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               43.203
Skew:                          -0.666   Prob(JB):                     4.16e-10
Kurtosis:                       2.742   Cond. No.                     1.29e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 1.29e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) coef - Value is positive.

Figure 9

- Figure 9 is the regression analysis of Revenue and House Price and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.253

Coefficient of interest rate – 0.0182

P-value - 0

```
model2 = smf.ols(formula='log_Interest_rate ~ House_price+y_2013+y_2014+y_2015+y_2016+y_2017+y_2018+y_2019+y_2020+y_2021', data=Adatamerge)
results2 = model2.fit()
print(results2.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:      log_Interest_rate   R-squared:                       0.713
Model:                            OLS   Adj. R-squared:                  0.708
Method:                 Least Squares   F-statistic:                     138.9
Date:                Mon, 04 Dec 2023   Prob (F-statistic):          1.53e-144
Time:                        00:07:05   Log-Likelihood:                -109.87
No. Observations:                 571   AIC:                             241.7
Df Residuals:                     560   BIC:                             289.6
Df Model:                          10
Covariance Type:            nonrobust
==============================================================================
                     coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept          1.0068      0.035     28.399      0.000       0.937       1.076
y_2013[T.True]    -0.7517      0.074    -10.203      0.000      -0.896      -0.607
y_2014[T.True]    -0.4815      0.081     -5.937      0.000      -0.641      -0.322
y_2015[T.True]    -0.4622      0.076     -6.050      0.000      -0.612      -0.312
y_2016[T.True]    -0.5348      0.075     -7.166      0.000      -0.681      -0.388
y_2017[T.True]    -0.2931      0.080     -3.681      0.000      -0.449      -0.137
y_2018[T.True]    -0.0206      0.076     -0.272      0.786      -0.170       0.128
y_2019[T.True]    -0.3290      0.073     -4.527      0.000      -0.472      -0.186
y_2020[T.True]    -0.8278      0.067    -12.384      0.000      -0.959      -0.696
y_2021[T.True]    -0.5621      0.068     -8.263      0.000      -0.696      -0.428
House_price       -0.0045      0.000    -17.637      0.000      -0.005      -0.004
==============================================================================
Omnibus:                      237.368   Durbin-Watson:                   0.041
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              872.706
Skew:                          -1.957   Prob(JB):                    3.12e-190
Kurtosis:                       7.622   Cond. No.                     1.29e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 1.29e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) coef - Value is positive.

Figure 10

- Figure 10 is the regression analysis of Revenue and House Price and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.713

Coefficient of house price – (-0.0045)

P-value - 0

```
Fmodel3 = smf.ols(formula='log_House_price ~ Real_income+y_2013+y_2014+y_2015+y_2016+y_2017+y_2018+y_2019+y_2020+y_2021', data=Sdatamerge)
Fresults3 = Fmodel3.fit()
print(Fresults3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:        log_House_price   R-squared:                       0.954
Model:                            OLS   Adj. R-squared:                  0.954
Method:                 Least Squares   F-statistic:                     1173.
Date:                Mon, 04 Dec 2023   Prob (F-statistic):               0.00
Time:                        00:07:09   Log-Likelihood:                571.57
No. Observations:                 571   AIC:                            -1121.
Df Residuals:                     560   BIC:                            -1073.
Df Model:                          10
Covariance Type:            nonrobust
==============================================================================
                     coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept          2.5280      0.019    133.774      0.000       2.491       2.565
y_2013[T.True]    -0.0941      0.023     -4.150      0.000      -0.139      -0.050
y_2014[T.True]    -0.1006      0.025     -4.026      0.000      -0.150      -0.051
y_2015[T.True]    -0.1454      0.024     -6.120      0.000      -0.192      -0.099
y_2016[T.True]    -0.1303      0.023     -5.607      0.000      -0.176      -0.085
y_2017[T.True]    -0.1393      0.025     -5.621      0.000      -0.188      -0.091
y_2018[T.True]    -0.1505      0.024     -6.339      0.000      -0.197      -0.104
y_2019[T.True]    -0.1896      0.023     -8.242      0.000      -0.235      -0.144
y_2020[T.True]    -0.2654      0.022    -12.208      0.000      -0.308      -0.223
y_2021[T.True]    -0.2245      0.022    -10.389      0.000      -0.267      -0.182
Real_income        0.0001   1.55e-06     84.070      0.000       0.000       0.000
==============================================================================
Omnibus:                       62.514   Durbin-Watson:                   0.030
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              107.258
Skew:                           0.699   Prob(JB):                     5.12e-24
Kurtosis:                       4.599   Cond. No.                     1.36e+05
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 1.36e+05. This might indicate that there are
strong multicollinearity or other numerical problems.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) coef - Value is positive.

Figure 11

- Figure 11 is the regression analysis of House Price and Real Income and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.954

Coefficient of real income – 0.0001

P-value - 0

```
Gmodel3 = smf.ols(formula='log_Real_income ~ Interest_rate+y_2013+y_2014+y_2015+y_2016+y_2017+y_2018+y_2019+y_2020+y_2021', data=Asdata)
Gresults3 = Gmodel3.fit()
print(Gresults3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:        log_Real_income   R-squared:                       0.864
Model:                            OLS   Adj. R-squared:                  0.864
Method:                 Least Squares   F-statistic:                     6254.
Date:                Mon, 04 Dec 2023   Prob (F-statistic):               0.00
Time:                        00:07:13   Log-Likelihood:                 8590.4
No. Observations:                9826   AIC:                        -1.716e+04
Df Residuals:                    9815   BIC:                        -1.708e+04
Df Model:                          10
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      9.0828      0.003   3518.312      0.000       9.078       9.088
y_2013[T.True]  -0.1313      0.006    -20.568      0.000      -0.144      -0.119
y_2014[T.True]  -0.0395      0.008     -5.263      0.000      -0.054      -0.025
y_2015[T.True]   0.0003      0.007      0.048      0.962      -0.013       0.013
y_2016[T.True]  -0.0125      0.006     -1.973      0.048      -0.025   -8.31e-05
y_2017[T.True]   0.0706      0.007     10.066      0.000       0.057       0.084
y_2018[T.True]   0.1755      0.006     28.452      0.000       0.163       0.188
y_2019[T.True]   0.0999      0.006     17.446      0.000       0.089       0.111
y_2020[T.True]   0.0429      0.005      8.592      0.000       0.033       0.053
y_2021[T.True]   0.1044      0.005     22.883      0.000       0.095       0.113
Interest_rate  -0.1731      0.001   -171.301      0.000      -0.175      -0.171
==============================================================================
Omnibus:                      882.927   Durbin-Watson:                   0.003
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             1313.601
Skew:                           0.700   Prob(JB):                    5.69e-286
Kurtosis:                       4.117   Cond. No.                         20.2
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) coef - Value is positive.

Figure 12

- Figure 12 is the regression analysis of Real Income and Interest Rate and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.864

Coefficient of interest rate – (-0.1731)

P-value - 0

```
Hmodel3 = smf.ols(formula='log_revt ~ Interest_rate+y_2019+y_2020+y_2021+y_2022', data=Ajdata)
Hresults3 = Hmodel3.fit()
print(Hresults3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:               log_revt   R-squared:                       0.225
Model:                            OLS   Adj. R-squared:                  0.218
Method:                 Least Squares   F-statistic:                     32.40
Date:                Mon, 04 Dec 2023   Prob (F-statistic):           5.05e-29
Time:                        00:07:27   Log-Likelihood:                -1250.5
No. Observations:                 564   AIC:                             2513.
Df Residuals:                     558   BIC:                             2539.
Df Model:                           5
Covariance Type:            nonrobust
=====================================================================================
                    coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------------
Intercept          5.5607      0.193     28.871      0.000       5.182       5.939
y_2019[T.True]     1.2133      0.537      2.261      0.024       0.159       2.267
y_2020[T.True]     0.3615      0.498      0.726      0.468      -0.617       1.340
y_2021[T.True]     0.6648      0.472      1.409      0.159      -0.262       1.592
y_2022[T.True]     1.5256      0.449      3.396      0.001       0.643       2.408
Interest_rate     -0.7204      0.078     -9.235      0.000      -0.874      -0.567
==============================================================================
Omnibus:                       36.798   Durbin-Watson:                   1.860
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               42.880
Skew:                          -0.671   Prob(JB):                     4.88e-10
Kurtosis:                       2.844   Cond. No.                         15.1
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) Coef - Value is positive

Figure 13

- Figure 13 is the regression analysis of House Price and Real Income and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.864

Coefficient of interest rate – (-0.1731)

P-value - 0

```
Hmodel3 = smf.ols(formula='log_revt ~ Interest_rate+y_2019+y_2020+y_2021+y_2022', data=Ajdata)
Hresults3 = Hmodel3.fit()
print(Hresults3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:               log_revt   R-squared:                       0.225
Model:                            OLS   Adj. R-squared:                  0.218
Method:                 Least Squares   F-statistic:                     32.40
Date:                Mon, 04 Dec 2023   Prob (F-statistic):           5.05e-29
Time:                        00:07:27   Log-Likelihood:                -1250.5
No. Observations:                 564   AIC:                             2513.
Df Residuals:                     558   BIC:                             2539.
Df Model:                           5
Covariance Type:            nonrobust
================================================================================
                   coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------
Intercept        5.5607      0.193     28.871      0.000       5.182       5.939
y_2019[T.True]   1.2133      0.537      2.261      0.024       0.159       2.267
y_2020[T.True]   0.3615      0.498      0.726      0.468      -0.617       1.340
y_2021[T.True]   0.6648      0.472      1.409      0.159      -0.262       1.592
y_2022[T.True]   1.5256      0.449      3.396      0.001       0.643       2.408
Interest_rate   -0.7204      0.078     -9.235      0.000      -0.874      -0.567
==============================================================================
Omnibus:                       36.798   Durbin-Watson:                   1.860
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               42.880
Skew:                          -0.671   Prob(JB):                     4.88e-10
Kurtosis:                       2.844   Cond. No.                         15.1
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) Coef - Value is positive

Figure 14

- Figure 14 is the regression analysis of Revenue and Interest Rate for the Covid period (2019 – 2022) and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.225

Coefficient of interest rate – (-0.7204)

P-value - 0

Figure 15

- Figure 15 is the regression analysis of Revenue and Interest Rate of real estate crisis during 1978 – 1983 and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.213

Coefficient of interest rate – (-0.6856)

P-value - 0

```
Jmodel3 = smf.ols(formula='log_revt ~ Interest_rate+y_2012+y_2013+y_2014+y_2015+y_2016+y_2017+y_2018', data=Ajdata)
Jresults3 = Jmodel3.fit()
print(Jresults3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:               log_revt   R-squared:                       0.237
Model:                            OLS   Adj. R-squared:                  0.226
Method:                 Least Squares   F-statistic:                     21.59
Date:                Mon, 04 Dec 2023   Prob (F-statistic):           1.11e-28
Time:                        00:07:38   Log-Likelihood:                -1246.0
No. Observations:                 564   AIC:                             2510.
Df Residuals:                     555   BIC:                             2549.
Df Model:                           8
Covariance Type:            nonrobust
================================================================================
                   coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------
Intercept        6.1850      0.194     31.919      0.000       5.804       6.566
y_2012[T.True]  -2.0946      0.534     -3.926      0.000      -3.143      -1.047
y_2013[T.True]  -1.1110      0.567     -1.960      0.050      -2.224       0.002
y_2014[T.True]  -0.6028      0.614     -0.982      0.327      -1.809       0.603
y_2015[T.True]  -0.3033      0.577     -0.525      0.600      -1.437       0.831
y_2016[T.True]  -0.4999      0.564     -0.886      0.376      -1.608       0.609
y_2017[T.True]   0.5435      0.593      0.917      0.360      -0.621       1.708
y_2018[T.True]   1.0352      0.554      1.869      0.062      -0.053       2.123
Interest_rate   -0.9232      0.077    -11.990      0.000      -1.074      -0.772
==============================================================================
Omnibus:                       32.687   Durbin-Watson:                   1.882
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               37.274
Skew:                          -0.623   Prob(JB):                     8.05e-09
Kurtosis:                       2.822   Cond. No.                         18.2
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

Observation :

1) Prob (F-statistic) - This value is <0.1, so we will consider this regression analysis.

2) R-squared - Value is significant as it is between 0 to 1.

3) Coef - Value is Negative.

Figure 16

- Figure 16 is the regression analysis of Revenue and Interest Rate of Financial recovery during 1983 - 1990 and below is its summary.

Prob(F-stat) – It is <0.1

R2 – 0.237

Coefficient of interest rate – (-0.9232)

P-value - 0

21) **Definition of the statistical terms (e.g., F-stat, etc.) you use above:**

a) F-Statistics – It is also known as F-Value. It is used to test weather means of two or more populations are different significantly. It is calculated by F=MSB/MSE.[9]

b) R^2 - It is also know as coefficient of determination. It is a statistical tool that describes how a regression analysis explains the variance in dependent variable.[10]

c) Coefficient – The relationship between the dependent and independent variable is described by a numerical value known as coefficient. It can also be used to predict the unknown variable by using the known variable.[11]

d) P-Value – It is a statistical number that determines whether the relationship present in the sample is also present in the large population. Null hypothesis is tested that there is no correlation between dependent and independent variables.[12]

Conclusion

- **Business implication**

22) **This is for Clark & Co., a consulting company. What do we learn from this analysis?**

From this analysis we can see that there is negative relationship between the revenue and interest rate while the relationship between revenue & house income and revenue & real income is positive. Real estate is significantly affected by the interest rates, as the interest rate increase the house sales comes down, as people are not ready to take mortgage for their property purchase. Meanwhile when the house income and real income increase the revenue also increases, as people tend to invest more in real estate.

- **Limitations of this research:**

o There are only 3 economic indicators used in this research which are Interest rate, House price and Real income. So, this research may not exactly show the perfect results.

o Sample size is also small as we considered only one company which may not be accurate to research for the whole industry.

o The scope of this research is limited due to which the predictions are not exact or they may be insignificant.

- **Potential project**

23) **If you adopt 1) predictive and 2) prescriptive analytics, what research questions you can explore with the data you examine? Write at least one research question corresponding to each analytic (predictive and prescriptive individually):**

Predictive Analytics: Will there be a boom or recession in the real estate in the future?

Prescriptive Analytics: How to overcome recession without major loss?

24) **Include brief definitions of predictive and prescriptive analytics**

Predictive analysis uses the historical data to predict the future events. Tools like machine learning, statistical algorithms and historical data are used to study the trends or patterns, based on which the future behavior is predicted.[13]

Prescriptive analysis is the analysis of what we should do in the future and the best course of action based on the past data. It uses both predictive and descriptive analytics to make the conclusions. Email automation is the best example of this analysis.[14]

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[1] https://en.wikipedia.org/wiki/Compustat

[2] https://en.wikipedia.org/wiki/Federal_Reserve_Economic_Data

[3] https://www.alacra.com/alacra/outside/lei/info/cik.html

[4] https://www.alacra.com/alacra/outside/lei/info/gvkey.html

[5] https://www.investopedia.com/terms/h/house-price-index-hpi.asp

[6] https://www.investopedia.com/mortgage/mortgage-rates/housing-market/#:~:text=The%20interest%20rate%20is%20the,economy%20and%20your%20personal%20circumstances.

[7] https://www.investopedia.com/terms/r/realincome.asp

[8] https://www.alchemer.com/resources/blog/regression-analysis/

[9] https://www.statisticshowto.com/probability-and-statistics/f-statistic-value-test/

[10] https://www.investopedia.com/terms/r/r-squared.asp

[11] https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression

[12] https://blog.minitab.com/en/adventures-in-statistics-2/how-to-interpret-regression-analysis-results-p-values-and-coefficients

[13] https://cloud.google.com/learn/what-is-predictive-analytics#:~:text=Predictive%20analytics%20is%20the%20process,that%20might%20predict%20future%20behavior.

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https://www.qlik.com/us/augmented-analytics/prescriptive-analytics#:~:text=Prescriptive%20analytics%20is%20the%20use,%E2%80%9CWhat%20should%20we%20do%3F%E2%80%9D