pluto_aggregate_analysis_19v1

September 12, 2019

[1]:
```
from pyspark.sql.functions import randn, rand, sum, col, round, lit
from pyspark.sql.types import StringType
from pyspark.context import SparkContext
from pyspark.sql.session import SparkSession
import numpy as np
import time
import pandas as pd
import datetime
print(datetime.datetime.now())
import matplotlib.pyplot as plt

sc = SparkContext('local')
spark = SparkSession(sc)
```

```
2019-08-29 20:18:10.614390
```

0.0.1 Import Data

[2]:
```
df19v1 = spark.read.csv('../data/pluto.csv', header=True)
df18v2_1 = spark.read.csv('../data/pluto_18v2_1.csv', header=True)
df18v1 = spark.read.csv('../data/pluto_18v1.csv', header=True)
```

[3]:
```
df19v1 = df19v1.withColumn('exemptland', lit(None).cast(StringType()))
```

0.0.2 convert column names all to lower case

[4]:
```
df18v1 = df18v1.select([col(A).alias(A.lower()) for A in df18v1.schema.names])
df18v2_1 = df18v2_1.select([col(A).alias(A.lower()) for A in df18v2_1.schema.
 ↪names])
df19v1 = df19v1.select([col(A).alias(A.lower()) for A in df19v1.schema.names])
```

[5]:
```
cols = df18v1.columns
```

[6]:
```
df18v1 = df18v1.select(cols)
df18v2_1 = df18v2_1.select(cols)
df19v1 = df19v1.select(cols)
df19v1 = df19v1.drop(df19v1.version).withColumn('version', lit('19v1'))
```

```
df18v1 = df18v1.drop(df18v1.version).withColumn('version', lit('18v1'))
df18v2_1 = df18v2_1.drop(df18v2_1.version).withColumn('version', lit('18v2.1'))
```

[7]:
```
df =df19v1.union(df18v2_1).union(df18v1)
```

[8]:
```
start_time = time.time()
summary = df.groupBy("version").agg(sum("unitsres"),
                                    sum("lotarea"),
                                    sum("bldgarea"),
                                    sum("comarea"),
                                    sum("resarea"),
                                    sum("officearea"),
                                    sum("retailarea"),
                                    sum("garagearea"),
                                    sum("strgearea"),
                                    sum("factryarea"),
                                    sum("otherarea"),
                                    sum("assessland"),
                                    sum("assesstot"),
                                    sum("exemptland"),
                                    sum("exempttot"),
                                    sum("firm07_flag"),
                                    sum("pfirm15_flag")).toPandas()
elapsed_time = time.time() - start_time
```

[9]:
```
elapsed_time
```

[9]:
```
47.94258785247803
```

[10]:
```
agg_cols = ['version','UnitsRes','LotArea','BldgArea','ComArea',
 'ResArea','OfficeArea','RetailArea','GarageArea',
 'StrgeArea','FactryArea','OtherArea','AssessLand',
 'AssessTot','ExemptLand','ExemptTot','FIRM07_FLAG',
 'PFIRM15_FLAG']
```

[11]:
```
summary.columns = agg_cols
```

[12]:
```
summary
```

[12]:

	version	UnitsRes	LotArea	BldgArea	ComArea	ResArea
0	18v1	3555871.0	6.815806e+09	5.484765e+09	1.816284e+09	3.470204e+09
1	18v2.1	3572157.0	6.813542e+09	5.504286e+09	1.820455e+09	3.477582e+09
2	19v1	3672400.0	6.779098e+09	5.653129e+09	1.826757e+09	3.488915e+09

	OfficeArea	RetailArea	GarageArea	StrgeArea	FactryArea
0	652968426.0	276388698.0	122406091.0	102263027.0	116348116.0
1	654410227.0	276896354.0	120942956.0	100257225.0	116612843.0
2	658083625.0	276478137.0	121189885.0	99740459.0	116553134.0

	OtherArea	AssessLand	AssessTot	ExemptLand	ExemptTot
0	524094223.0	9.779918e+10	3.955918e+11	4.414227e+10	1.422077e+11

```
1  524200834.0  9.782664e+10  3.936520e+11  4.456274e+10  1.446245e+11
2  527118742.0  1.137527e+11  4.766000e+11           NaN  1.665695e+11

   FIRM07_FLAG  PFIRM15_FLAG
0      34562.0       65618.0
1      34683.0       65688.0
2      34951.0       65712.0
```

[13]:
```
summary.to_csv('19v1-18v2.1-18v1-aggregate_value_comparison.csv')
```

[14]:
```
summary
```

[14]:
```
  version   UnitsRes       LotArea      BldgArea       ComArea       ResArea  \
0    18v1  3555871.0  6.815806e+09  5.484765e+09  1.816284e+09  3.470204e+09
1  18v2.1  3572157.0  6.813542e+09  5.504286e+09  1.820455e+09  3.477582e+09
2    19v1  3672400.0  6.779098e+09  5.653129e+09  1.826757e+09  3.488915e+09

    OfficeArea   RetailArea   GarageArea    StrgeArea   FactryArea  \
0  652968426.0  276388698.0  122406091.0  102263027.0  116348116.0
1  654410227.0  276896354.0  120942956.0  100257225.0  116612843.0
2  658083625.0  276478137.0  121189885.0   99740459.0  116553134.0

     OtherArea    AssessLand     AssessTot    ExemptLand     ExemptTot  \
0  524094223.0  9.779918e+10  3.955918e+11  4.414227e+10  1.422077e+11
1  524200834.0  9.782664e+10  3.936520e+11  4.456274e+10  1.446245e+11
2  527118742.0  1.137527e+11  4.766000e+11           NaN  1.665695e+11

   FIRM07_FLAG  PFIRM15_FLAG
0      34562.0       65618.0
1      34683.0       65688.0
2      34951.0       65712.0
```

[15]:
```
summary.index = summary.version
# summary = summary.reindex(['18v1', '18V2_1', '19v1'])
```

[16]:
```
summary
```

[16]:
```
         version   UnitsRes       LotArea      BldgArea       ComArea  \
version
18v1       18v1  3555871.0  6.815806e+09  5.484765e+09  1.816284e+09
18v2.1   18v2.1  3572157.0  6.813542e+09  5.504286e+09  1.820455e+09
19v1       19v1  3672400.0  6.779098e+09  5.653129e+09  1.826757e+09

               ResArea   OfficeArea   RetailArea   GarageArea    StrgeArea  \
version
18v1     3.470204e+09  652968426.0  276388698.0  122406091.0  102263027.0
18v2.1   3.477582e+09  654410227.0  276896354.0  120942956.0  100257225.0
19v1     3.488915e+09  658083625.0  276478137.0  121189885.0   99740459.0

          FactryArea    OtherArea    AssessLand     AssessTot    ExemptLand  \
```

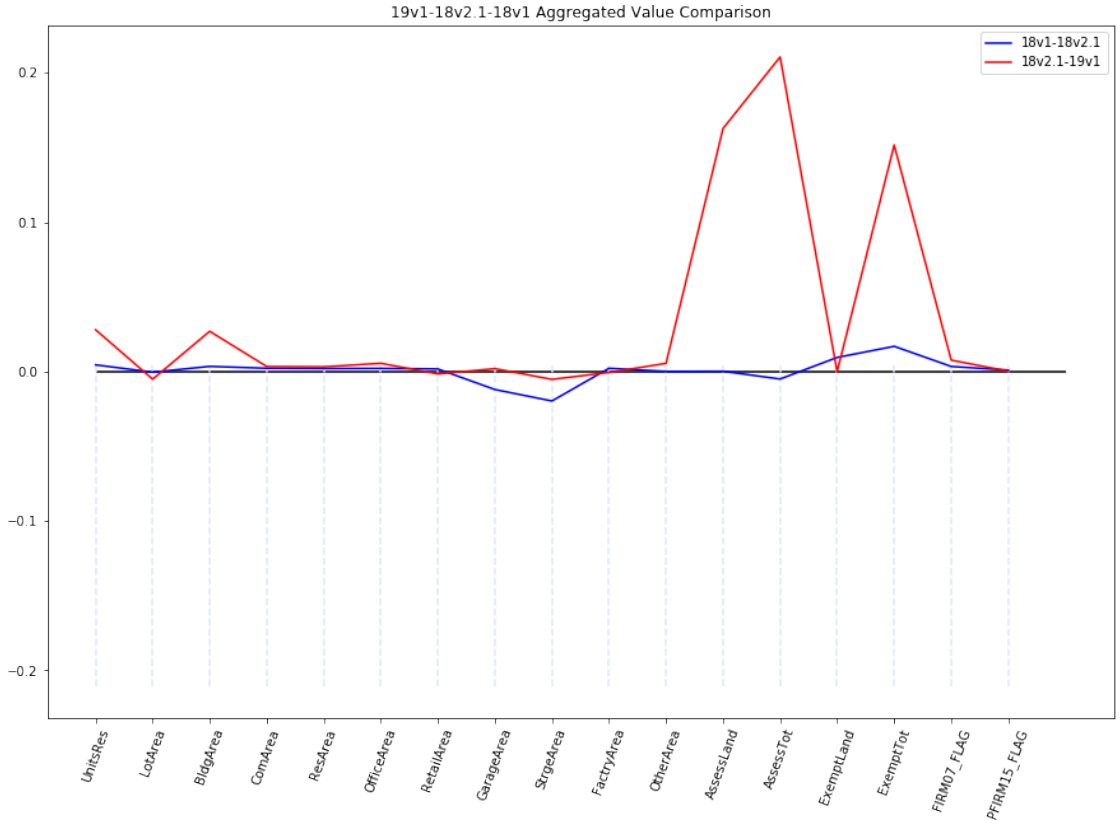
```
version
18v1     116348116.0  524094223.0  9.779918e+10  3.955918e+11  4.414227e+10
18v2.1   116612843.0  524200834.0  9.782664e+10  3.936520e+11  4.456274e+10
19v1     116553134.0  527118742.0  1.137527e+11  4.766000e+11           NaN

            ExemptTot  FIRM07_FLAG  PFIRM15_FLAG
version
18v1     1.422077e+11      34562.0       65618.0
18v2.1   1.446245e+11      34683.0       65688.0
19v1     1.665695e+11      34951.0       65712.0
```

[17]:
```
summary_pct = summary.iloc[:, 1:].pct_change()
```

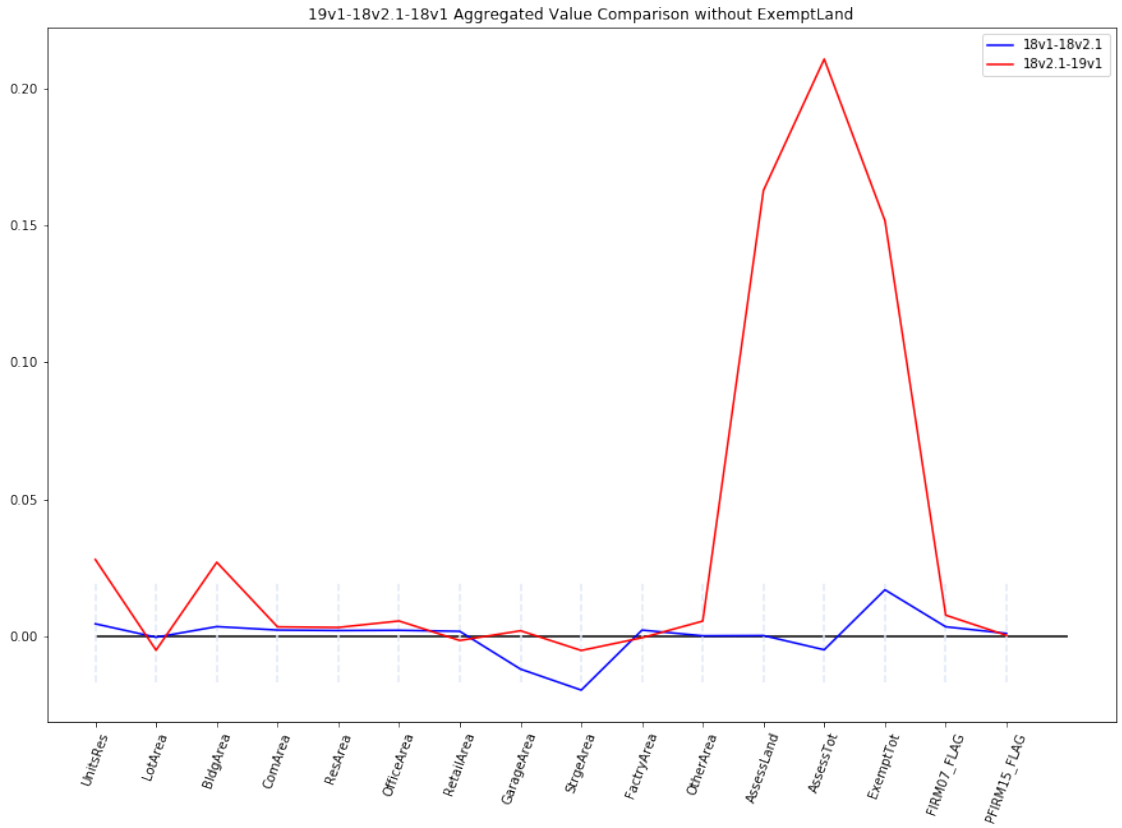
[18]:
```
summary_pct
```

[18]:
```
         UnitsRes   LotArea  BldgArea   ComArea   ResArea  OfficeArea  \
version
18v1          NaN       NaN       NaN       NaN       NaN         NaN
18v2.1   0.004580 -0.000332  0.003559  0.002297  0.002126    0.002208
19v1     0.028062 -0.005055  0.027041  0.003462  0.003259    0.005613

         RetailArea  GarageArea  StrgeArea  FactryArea  OtherArea  AssessLand  \
version
18v1            NaN         NaN        NaN         NaN        NaN         NaN
18v2.1     0.001837   -0.011953  -0.019614    0.002275   0.000203    0.000281
19v1      -0.001510    0.002042  -0.005154   -0.000512   0.005566    0.162799

         AssessTot  ExemptLand  ExemptTot  FIRM07_FLAG  PFIRM15_FLAG
version
18v1           NaN         NaN        NaN          NaN           NaN
18v2.1   -0.004904    0.009525   0.016995     0.003501      0.001067
19v1      0.210714    0.000000   0.151738     0.007727      0.000365
```

[19]:
```
plt.figure(figsize=(15, 10))
plt.plot(range(17), summary_pct.iloc[1, :], color = 'blue', label='18v1-18v2.1')
plt.plot(range(17), summary_pct.iloc[2, :], color = 'red', label='18v2.1-19v1')
plt.hlines(0, 0, 17, color = 'black')
for i in range(17):
    plt.vlines(i, min(-summary_pct.iloc[2, :]), max(-summary_pct.iloc[2, :]),␣
 ↪color = '#e1e9f7', linestyles='dashed')
plt.xticks(range(17), summary_pct.columns, rotation=70)
plt.title('19v1-18v2.1-18v1 Aggregated Value Comparison')
plt.legend()
plt.savefig('19v1-18v2.1-18v1-Aggregated_Value_Comparison.png',␣
 ↪bbox_inches='tight')
plt.show()
```



[20]:
```
plt.figure(figsize=(15, 10))
summary_pct = summary_pct.drop(['ExemptLand'], axis=1)
plt.plot(range(16), summary_pct.iloc[1, :], color = 'blue', label='18v1-18v2.1')
plt.plot(range(16), summary_pct.iloc[2, :], color = 'red', label='18v2.1-19v1')
plt.hlines(0, 0, 16, color = 'black')
for i in range(16):
    plt.vlines(i, min(-summary_pct.iloc[1, :]), max(-summary_pct.iloc[1, :]),␣
 ↪color = '#e1e9f7', linestyles='dashed')
plt.xticks(range(16), summary_pct.columns, rotation=70)
plt.title('19v1-18v2.1-18v1 Aggregated Value Comparison without ExemptLand')
plt.legend()
plt.savefig('19v1-18v2.1-18v1_Aggregated_Value_Comparison_wo_ExemptLand.png',␣
 ↪bbox_inches='tight')
plt.show()
```



1 Condo

[21]:
```
condo = df.filter(df['lot'].rlike(r'^75'))
```

[22]:
```
start_time = time.time()
condo_summary = condo.groupBy("version").agg(sum("unitsres"),
                                             sum("lotarea"),
                                             sum("bldgarea"),
                                             sum("comarea"),
                                             sum("resarea"),
                                             sum("officearea"),
                                             sum("retailarea"),
                                             sum("garagearea"),
                                             sum("strgearea"),
                                             sum("factryarea"),
                                             sum("otherarea"),
                                             sum("assessland"),
                                             sum("assesstot"),
                                             sum("exempttot"),
                                             sum("firm07_flag"),
```

```
                                    sum("pfirm15_flag")).toPandas()
elapsed_time = time.time() - start_time
```

[23]:
```
condo_summary.index = condo_summary.version
condo_summary_pct = condo_summary.iloc[:, 1:].pct_change()
condo_summary_pct
```

[23]:

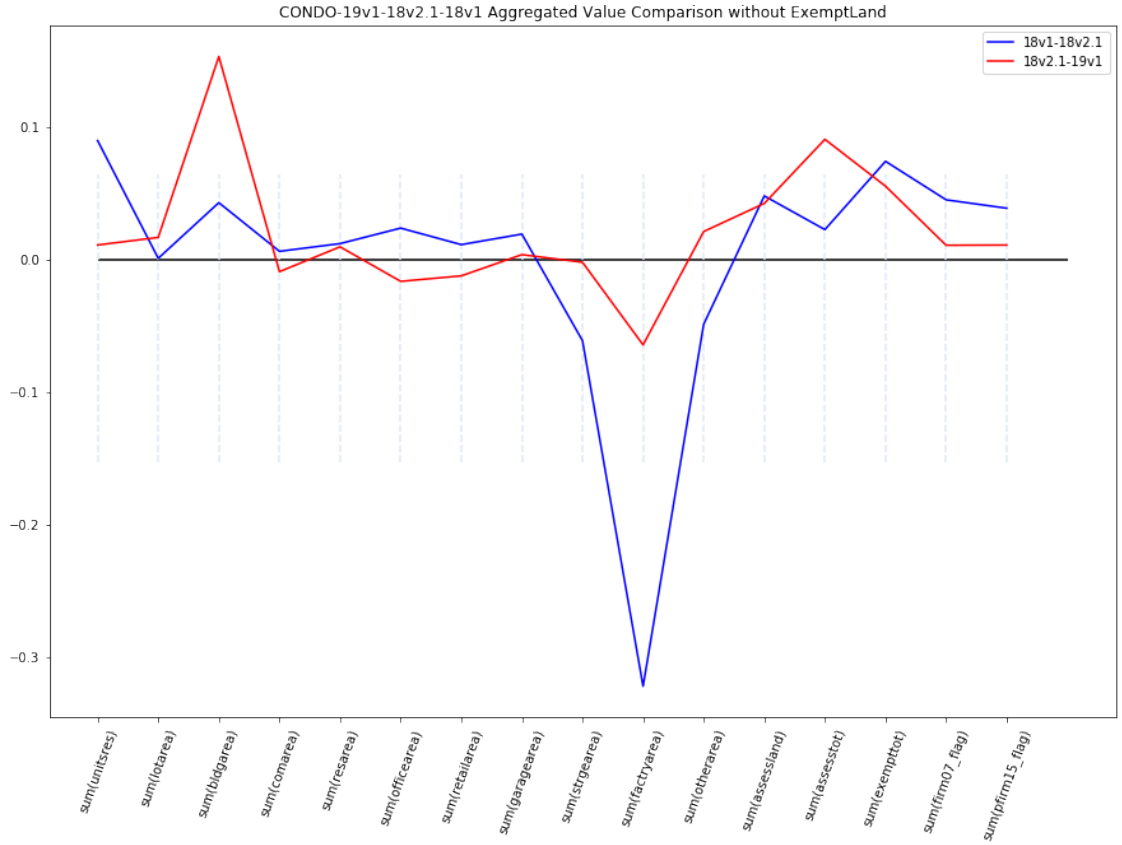
version	sum(unitsres)	sum(lotarea)	sum(bldgarea)	sum(comarea)
18v1	NaN	NaN	NaN	NaN
18v2.1	0.089811	0.000895	0.042926	0.006184
19v1	0.010970	0.016673	0.153330	-0.009182

version	sum(resarea)	sum(officearea)	sum(retailarea)	sum(garagearea)
18v1	NaN	NaN	NaN	NaN
18v2.1	0.012011	0.023733	0.011243	0.019199
19v1	0.009596	-0.016491	-0.012351	0.003685

version	sum(strgearea)	sum(factryarea)	sum(otherarea)	sum(assessland)
18v1	NaN	NaN	NaN	NaN
18v2.1	-0.061308	-0.322279	-0.048891	0.048036
19v1	-0.002074	-0.064473	0.021144	0.042363

version	sum(assesstot)	sum(exempttot)	sum(firm07_flag)	sum(pfirm15_flag)
18v1	NaN	NaN	NaN	NaN
18v2.1	0.022583	0.074171	0.045089	0.038752
19v1	0.090783	0.055398	0.010786	0.010919

[24]:
```
plt.figure(figsize=(15, 10))
plt.plot(range(16), condo_summary_pct.iloc[1, :], color = 'blue',␣
 ↪label='18v1-18v2.1')
plt.plot(range(16), condo_summary_pct.iloc[2, :], color = 'red', label='18v2.
 ↪1-19v1')
plt.hlines(0, 0, 16, color = 'black')
for i in range(16):
    plt.vlines(i, min(-condo_summary_pct.iloc[2, :]), max(-condo_summary_pct.
 ↪iloc[2, :]), color = '#e1e9f7', linestyles='dashed')
plt.xticks(range(16), condo_summary_pct.columns, rotation=70)
plt.title('CONDO-19v1-18v2.1-18v1 Aggregated Value Comparison without␣
 ↪ExemptLand')
plt.legend()
plt.savefig('CONDO-19v1-18v2.1-18v1_Aggregated_Value_Comparison_wo_ExemptLand.
 ↪png', bbox_inches='tight')
plt.show()
```



[25]:
```
import os

os.system('jupyter nbconvert --to pdf pluto_aggregate_analysis_19v1.ipynb')
```

[25]: 0