Project: Manchester United: after Sir Alex Ferguson's age

Table of Contents

- Introduction
- Data Wrangling
- Exploratory Data Analysis
- Conclusions

Introduction

Sir Alex Ferguson, former manager of Machester United Football Club, is considered one of the greatest managers of all time, and he has won more trophies than any other manager in the history of football. After he retired in 2013, Manchester United FC faces a very difficult time when his successors failed to keep the club on the winning streak. In this report, we will try to investigate what differences between Ferguson's ManU and post-Ferguson's ManU.

This report will try to answer the following questions:

1. Is ManU weaker after Fergie's time based on the number of goals for and goals against?
2. Does ManU change the attacking stategy?

In order to answer above questions, we use the soccer database comes from Kaggle. This database is well suited for data analysis and machine learning. It contains data for soccer matches, players, and teams from several European countries from 2008 to 2016.

The database provides:

- +25,000 matches
- +10,000 players
- 11 European Countries with their lead championship
- Seasons 2008 to 2016
- Players and Teams' attributes* sourced from EA Sports' FIFA video game series, including the weekly updates
- Team line up with squad formation (X, Y coordinates)
- Betting odds from up to 10 providers
- Detailed match events (goal types, possession, corner, cross, fouls, cards etc…) for +10,000 matches

In [1]:
```
import pandas as pd
import numpy as np
import xml.etree.ElementTree as ET
import sqlite3
import matplotlib.pyplot as plt

%matplotlib inline
```

Data Wrangling

Load data

> We will use `sqlite3` package to load data from the given `database.sqlite` file.

In [2]:
```
conn = sqlite3.connect('database.sqlite')

tables = pd.read_sql("""SELECT *
                        FROM sqlite_master
                        WHERE type='table';""", conn)
tables
```

Out[2]:

	type	name	tbl_name	rootpage	sql
0	table	sqlite_sequence	sqlite_sequence	4	CREATE TABLE sqlite_sequence(name,seq)
1	table	Player_Attributes	Player_Attributes	11	CREATE TABLE "Player_Attributes" (\n\t`id`\tIN...
2	table	Player	Player	14	CREATE TABLE `Player` (\n\t`id`\tINTEGER PRIMA...
3	table	Match	Match	18	CREATE TABLE `Match` (\n\t`id`\tINTEGER PRIMAR...
4	table	League	League	24	CREATE TABLE `League` (\n\t`id`\tINTEGER PRIMA...
5	table	Country	Country	26	CREATE TABLE `Country` (\n\t`id`\tINTEGER PRIM...
6	table	Team	Team	29	CREATE TABLE "Team" (\n\t`id`\tINTEGER PRIMARY...
7	table	Team_Attributes	Team_Attributes	2	CREATE TABLE `Team_Attributes` (\n\t`id`\tINTE...

There are 8 tables and we need to pull out ManU's information from those. First, let's have a look at `Team` table

In [3]:
```
teams = pd.read_sql("""SELECT *
                       FROM Team
                       ORDER BY team_long_name;
                    """, conn)
teams.head()
```

Out[3]:

	id	team_api_id	team_fifa_api_id	team_long_name	team_short_name
0	16848	8350	29.0	1. FC Kaiserslautern	KAI
1	15624	8722	31.0	1. FC Köln	FCK
2	16239	8165	171.0	1. FC Nürnberg	NUR
3	16243	9905	169.0	1. FSV Mainz 05	MAI
4	11817	8576	614.0	AC Ajaccio	AJA

Let's find Manchester United from those

In [4]:
```
teams[teams['team_long_name'].str.contains('Manchester')]
```

Out[4]:

	id	team_api_id	team_fifa_api_id	team_long_name	team_short_name
161	3466	8456	10.0	Manchester City	MCI
162	3457	10260	11.0	Manchester United	MUN

Base on the above, we see that Manchester United `team_api_id=10260` . We will use this `team_api_id` to pull out ManU's information.

In [5]:
```
MU_id = teams[teams['team_long_name'].str.contains('Manchester United')]['team_api_id'].iloc[0]
MU_id
```

Out[5]: 10260

Now we want to pull out ManU's matches, let's have a look at the `Match` table

In [6]:
```
ManU = pd.read_sql("""
                        SELECT *
                        FROM Match
                        WHERE home_team_api_id == %s or
away_team_api_id ==%s
                    """ %(MU_id,MU_id),conn)
ManU.head()
```

Out[6]:

	id	country_id	league_id	season	stage	date	match_api_id	home_team_api_id	awa
0	1729	1729	1729	2008/2009	1	2008-08-17 00:00:00	489042	10260	
1	1739	1729	1729	2008/2009	10	2008-10-29 00:00:00	489132	10260	
2	1749	1729	1729	2008/2009	11	2008-11-01 00:00:00	489142	10260	
3	1759	1729	1729	2008/2009	12	2008-11-08 00:00:00	489152	9825	
4	1769	1729	1729	2008/2009	13	2008-11-15 00:00:00	489162	10260	

5 rows × 115 columns

General Properties

In [7]:
```
ManU.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 304 entries, 0 to 303
Columns: 115 entries, id to BSA
dtypes: float64(33), int64(72), object(10)
memory usage: 273.2+ KB
```

Data Cleaning

- The original data contains 304 features, most of them we don't need. In this report, to answer the questions we are interested in, we use the following features: (`season` , `date` , `home_team_api_id` , `away_team_api_id` , `home_team_goal` , `away_team_goal` , `goal`)
- We will use the `xml` text in the `goal` feature to extract the scoring time.
- We will use the `xml` text in the `possession` feature to extract the possession percentage in each match.

In [8]:
```
ManU = ManU[['season', 'date','home_team_api_id',
'away_team_api_id', 'home_team_goal', 'away_team_goal',
'goal','possession']]
ManU.head()
```

Out[8]:

	season	date	home_team_api_id	away_team_api_id	home_team_goal	away_team_goal
0	2008/2009	2008-08-17 00:00:00	10260	10261	1	1
1	2008/2009	2008-10-29 00:00:00	10260	8654	2	0
2	2008/2009	2008-11-01 00:00:00	10260	8667	4	3
3	2008/2009	2008-11-08 00:00:00	9825	10260	2	1
4	2008/2009	2008-11-15 00:00:00	10260	10194	5	0

We define:

- `get_score_time` function to extract score time
- `home_possession` function to extract possession percentage for the home team

Important note: in the raw data, there are many goal types which is encoded by `dg, n, npm, o, p, psm, rp` . However, only types `n,o,p` are actually goals.

In [9]:
```
def get_score_time(xml):
    root = ET.XML(xml)
    goal_for = []
    goal_against = []
    if len(root.getchildren())>0:
        for goal in root.getchildren():
            tags = [i.tag for i in goal]
            if 'goal_type' in tags:
                if list(goal.iter('goal_type'))[0].text in 'nop'
and int(list(goal.iter('team'))[0].text) == MU_id:
                    goal_for.append(int(list(goal.iter('elapsed'))
[0].text))
                else:

 goal_against.append(int(list(goal.iter('elapsed'))[0].text))
    return goal_for
```

In [10]:
```
def home_possession(xml):
    root = ET.XML(xml)
    return int(list(root.iter('homepos'))[-1].text)
```

In [11]:
```
ManU['score_time'] = ManU['goal'].apply(lambda x:
get_score_time(x))
ManU['possession'] = ManU['possession'].apply(lambda x:
home_possession(x))
```

In [12]:
```
ManU.drop(['goal'],axis=1,inplace=True)
ManU.head()
```

Out[12]:

	season	date	home_team_api_id	away_team_api_id	home_team_goal	away_team_goal
0	2008/2009	2008-08-17 00:00:00	10260	10261	1	1
1	2008/2009	2008-10-29 00:00:00	10260	8654	2	0
2	2008/2009	2008-11-01 00:00:00	10260	8667	4	3
3	2008/2009	2008-11-08 00:00:00	9825	10260	2	1
4	2008/2009	2008-11-15 00:00:00	10260	10194	5	0

Exploratory Data Analysis

Is ManU weaker after Fergie's time based on the number of goals for and goals against?

- It's not eay to answer this question, however, we can have a rough idea by looking at the number of goals for and number of goals against over the seasons and observe their changes.
- We also look at the average possession percentage in each season in order to see if Manchester United reduces its ball controlling time

Important Since in the data, in each match, Manchester United is either home team or away team. Let `home` to be 1 if Mancherter United is the home team and 0 if Manchester United is the away team. Then we can determine `home` by

```
home = (home_team_api_id==MU_id)
```

And then in the observed match, Manchester United's number of goals can be calculated using

```
home*home_team_goal + (1-home)*away_team_goal
```

In [13]:

```
ManU['goal_for'] = ManU.apply(lambda x:
(x['home_team_api_id']==MU_id)*x['home_team_goal']+
                                  (1-
(x['home_team_api_id']==MU_id))*x['away_team_goal'],axis=1 )
ManU['goal_against'] = ManU.apply(lambda x:
(x['home_team_api_id']!=MU_id)*x['home_team_goal']+
                                  (1-
(x['home_team_api_id']!=MU_id))*x['away_team_goal'],axis=1 )
ManU.drop(['home_team_api_id','away_team_api_id','home_team_goal','
away_team_goal'],axis=1,inplace=True)
ManU.head()
```

Out[13]:

	season	date	possession	score_time	goal_for	goal_against
0	2008/2009	2008-08-17 00:00:00	55	[24]	1	1
1	2008/2009	2008-10-29 00:00:00	60	[14, 30]	2	0
2	2008/2009	2008-11-01 00:00:00	51	[3, 29, 44, 57]	4	3
3	2008/2009	2008-11-08 00:00:00	52	[90]	1	2
4	2008/2009	2008-11-15 00:00:00	58	[4, 45, 49, 84, 89]	5	0

In [14]:

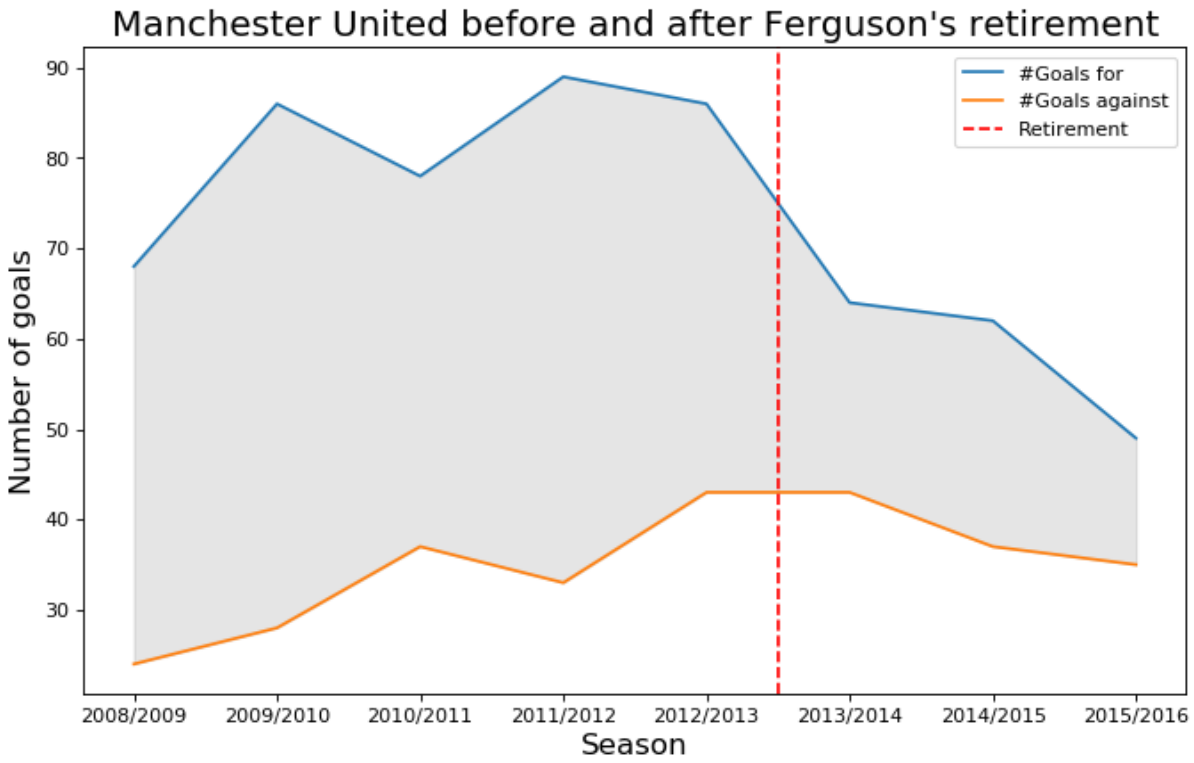
```
season =
ManU.groupby('season').agg({'goal_for':'sum','goal_against':'sum','
possession':'mean'})
season
```

Out[14]:

season	goal_for	goal_against	possession
2008/2009	68	24	52.131579
2009/2010	86	28	52.473684
2010/2011	78	37	51.078947
2011/2012	89	33	53.210526
2012/2013	86	43	51.026316
2013/2014	64	43	50.131579
2014/2015	62	37	52.052632
2015/2016	49	35	51.763158

In [15]:

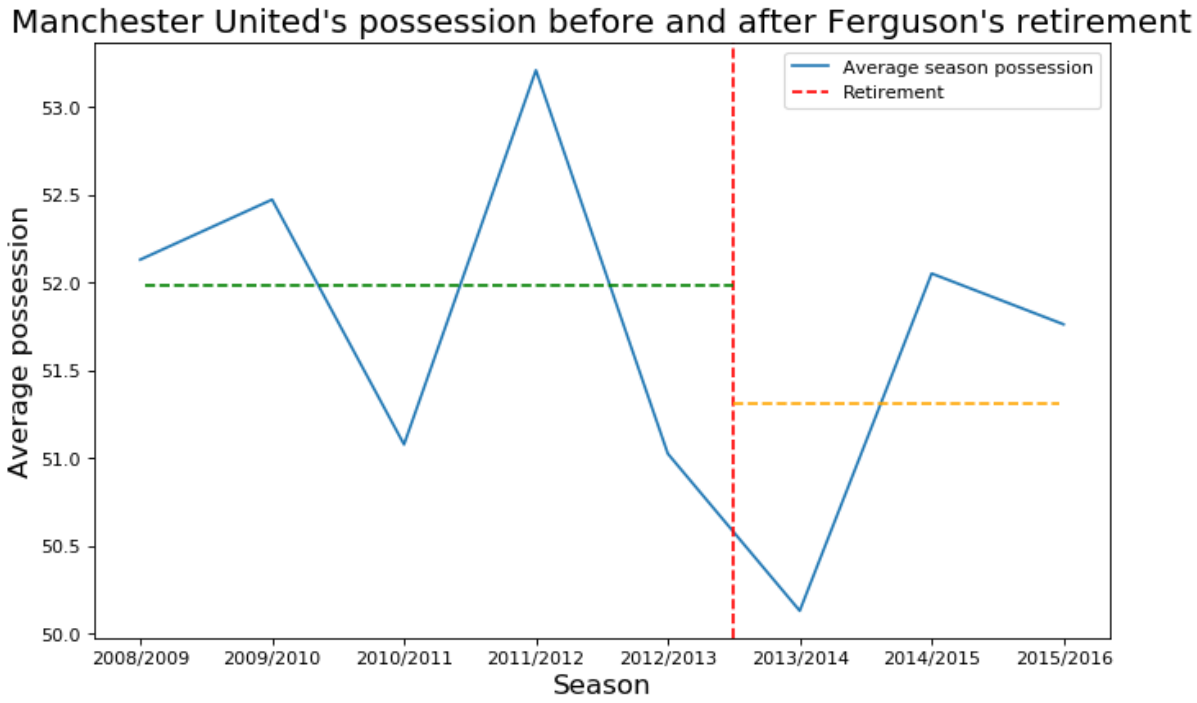
```
plt.figure(figsize=(10, 6), dpi= 80, facecolor='w', edgecolor='k')

plt.plot(season.index,season['goal_for'])
plt.plot(season.index,season['goal_against'])
plt.axvline(x=4.5,ls='--',color='r')
plt.fill_between(season.index,season['goal_for'],season['goal_against'],color='grey',alpha=0.2)
plt.legend(['#Goals for','#Goals against','Retirement'])
plt.title('''Manchester United before and after Ferguson's retirement''',fontsize=18);
plt.xlabel('Season',fontsize=15)
plt.ylabel('Number of goals',fontsize=15);
```



So by the graph above, we see that the number of goals Manchester United had scored descreased quickly after Sir Alex Ferguson retired. This might show that the attacking line is weaker. Now we will investigate the possession

In [16]:

```
plt.figure(figsize=(10, 6), dpi= 80, facecolor='w', edgecolor='k')
plt.plot(season.index,season['possession']);
plt.axvline(x=4.5,ls='--',color='r')
plt.legend(['Average season possession','Retirement'])
plt.title('''Manchester United's possession before and after
Ferguson's retirement''',fontsize=18);
plt.xlabel('Season',fontsize=15)
plt.ylabel('Average possession',fontsize=15);
before = season.loc[:'2012/2013']['possession'].mean()
after = season.loc['2013/2014':]['possession'].mean()
plt.axhline(y=before,xmin=0.05,xmax=0.63,ls='--',color='green')
plt.axhline(y=after,xmin=0.63,xmax=0.95,ls='--',color='orange');
```



So obviously that Manchester United losing its ball controlling time after Sir Alex Ferguson retired.

Does ManU change the attacking stategy?

- This is also a hard question that is not easy to answer. We will try to give a simple idea using the number of goals Manchester United scored in 6 time intervals:

`[0,15),[15,30),[30,45),[45,60),[60,75),[75,90]`

In [17]:

```
ManU['[0,15)'] = ManU['score_time'].apply(lambda x: sum([i in range(0,15) for i in x]))
ManU['[15,30)'] = ManU['score_time'].apply(lambda x: sum([i in range(15,30) for i in x]))
ManU['[30,45)'] = ManU['score_time'].apply(lambda x: sum([i in range(30,45) for i in x]))
ManU['[45,60)'] = ManU['score_time'].apply(lambda x: sum([i in range(45,60) for i in x]))
ManU['[60,75)'] = ManU['score_time'].apply(lambda x: sum([i in range(60,75) for i in x]))
ManU['[75,90]'] = ManU['score_time'].apply(lambda x: sum([i in range(75,91) for i in x]))
interval_df = ManU[['season','[0,15)','[15,30)','[30,45)','[45,60)','[60,75)','[75,90]']]
interval_df.head()
```

Out[17]:

	season	[0,15)	[15,30)	[30,45)	[45,60)	[60,75)	[75,90]
0	2008/2009	0	1	0	0	0	0
1	2008/2009	1	0	1	0	0	0
2	2008/2009	1	1	1	1	0	0
3	2008/2009	0	0	0	0	0	1
4	2008/2009	1	0	0	2	0	2

In [18]:

```
intervals = interval_df.groupby('season').sum()
intervals['total'] = intervals.sum(axis=1)
intervals
```

Out[18]:

season	[0,15)	[15,30)	[30,45)	[45,60)	[60,75)	[75,90]	total
2008/2009	8	13	8	9	16	15	69
2009/2010	3	5	13	17	13	25	76
2010/2011	10	10	10	12	14	20	76
2011/2012	9	14	12	17	18	19	89
2012/2013	13	16	12	12	13	17	83
2013/2014	3	11	11	16	11	12	64
2014/2015	8	14	9	10	8	12	61
2015/2016	4	7	6	12	8	11	48

Compute the percentage of goals in each intervals

In [19]:

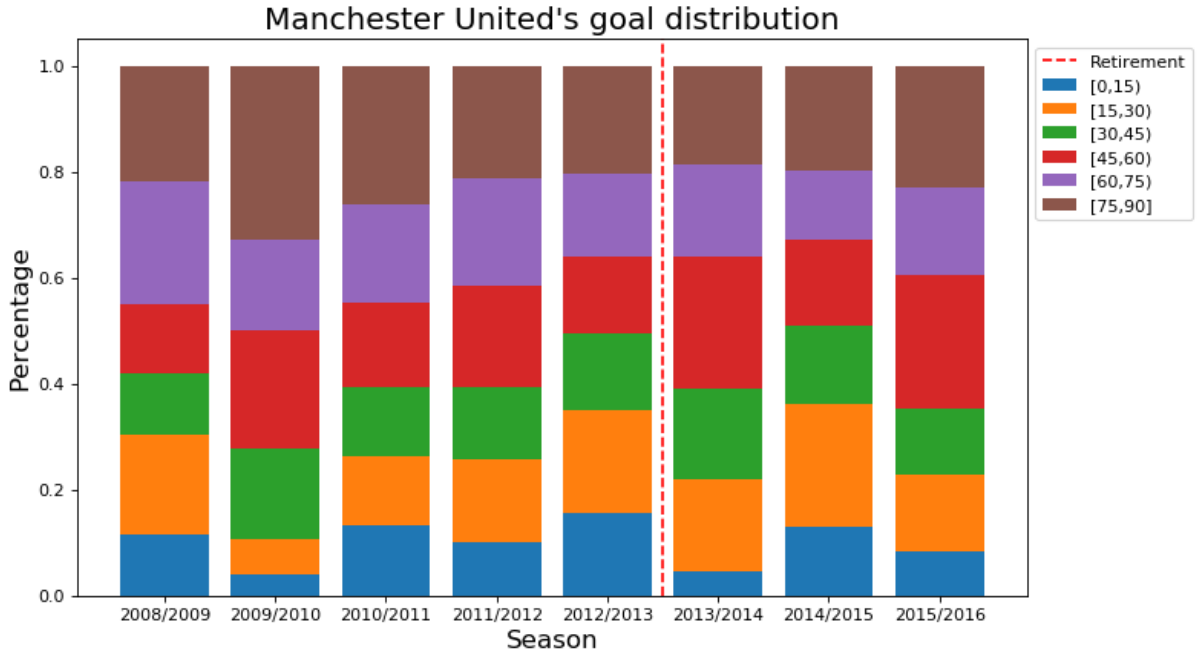
```
for col in list(intervals.columns)[:-1]:
    intervals[col] = intervals[col]/intervals['total']
intervals
```

Out[19]:

season	[0,15)	[15,30)	[30,45)	[45,60)	[60,75)	[75,90]	total
2008/2009	0.115942	0.188406	0.115942	0.130435	0.231884	0.217391	69
2009/2010	0.039474	0.065789	0.171053	0.223684	0.171053	0.328947	76
2010/2011	0.131579	0.131579	0.131579	0.157895	0.184211	0.263158	76
2011/2012	0.101124	0.157303	0.134831	0.191011	0.202247	0.213483	89
2012/2013	0.156627	0.192771	0.144578	0.144578	0.156627	0.204819	83
2013/2014	0.046875	0.171875	0.171875	0.250000	0.171875	0.187500	64
2014/2015	0.131148	0.229508	0.147541	0.163934	0.131148	0.196721	61
2015/2016	0.083333	0.145833	0.125000	0.250000	0.166667	0.229167	48

In [20]:

```
plt.figure(figsize=(10, 6), dpi= 80, facecolor='w', edgecolor='k')
plt.bar(intervals.index,intervals['[0,15)'])
plt.bar(intervals.index,intervals['[15,30)'],bottom =
intervals['[0,15)'])
plt.bar(intervals.index,intervals['[30,45)'],bottom =
intervals[['[0,15)','[15,30)']].sum(axis=1))
plt.bar(intervals.index,intervals['[45,60)'],bottom =
intervals[['[0,15)','[15,30)','[30,45)']].sum(axis=1))
plt.bar(intervals.index,intervals['[60,75)'],bottom =
intervals[['[0,15)','[15,30)','[30,45)','[45,60)']].sum(axis=1))
plt.bar(intervals.index,intervals['[75,90]'],bottom =
intervals[['[0,15)','[15,30)','[30,45)','[45,60)','[60,75)']].sum(a
xis=1))
plt.axvline(x=4.5,ls='--',color='r')
plt.legend(['Retirement','[0,15)','[15,30)','[30,45)','[45,60)','[6
0,75)','[75,90]'],bbox_to_anchor=(1, 1))
plt.xlabel('Season',fontsize=15)
plt.ylabel('Percentage',fontsize=15);
plt.title('''Manchester United's goal distribution''',fontsize=18);
```



So by the plot we see that:

- Before Sir Alex Ferguson's retirement, Manchester United seems to put their best in final minutes and actually they are famous about that characteristic.
- After Sir Alex Ferguson's retirement, Manchester United seems to be effective in attacking after the break time.

Conclusions

Although we chose questions that are not easy to answer, the investigation suggests the following:

Question 1: Is ManU weaker after Fergie's time based on the number of goals for and goals against?

- The number of goals Manchester United had scored descreased quickly after Sir Alex Ferguson retired. This might show that the attacking line is weaker.
- Manchester United is losing its ball controlling time after Sir Alex Ferguson retired

Question 2: Does ManU change the attacking stategy?

- Before Sir Alex Ferguson's retirement, Manchester United seems to put their best in final minutes and actually they are famous about that characteristic.
- After Sir Alex Ferguson's retirement, Manchester United seems to be effective in attacking after the break time.

References

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3. Deepesh Nair, https://towardsdatascience.com/processing-xml-in-python-elementtree-c8992941efd2 (https://towardsdatascience.com/processing-xml-in-python-elementtree-c8992941efd2)