# Election project

## By: Hans Michael Célestin

In [47]:

```
import pandas as pd
from pandas import Series, DataFrame
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style('whitegrid')
%matplotlib inline
import scipy.stats as pearsonr
from pandas_datareader import data, wb, DataReader
import numpy as np
from datetime import datetime
```

In [2]:

```
import requests # grab info from web
from io import StringIO
```

In [3]:

```
url = "http://elections.huffingtonpost.com/pollster/api/charts/2012-general-election-romney-vs-obama.csv"

source =requests.get(url).text
poll_data =StringIO(source) # avoid string io error
```

In [4]:

```
poll_df = pd.read_csv(poll_data)
```

In [5]:

```
poll_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 428 entries, 0 to 427
Data columns (total 13 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Obama                  428 non-null    float64
 1   Romney                 428 non-null    float64
 2   Undecided              276 non-null    float64
 3   Other                  137 non-null    float64
 4   poll_id                428 non-null    int64
 5   pollster               428 non-null    object
 6   start_date             428 non-null    object
 7   end_date               428 non-null    object
 8   sample_subpopulation   428 non-null    object
 9   sample_size            414 non-null    float64
 10  mode                   428 non-null    object
 11  partisanship           428 non-null    object
 12  partisan_affiliation   428 non-null    object
dtypes: float64(5), int64(1), object(7)
memory usage: 43.6+ KB
```

In [6]:

```
poll_df.head()
```

Out[6]:

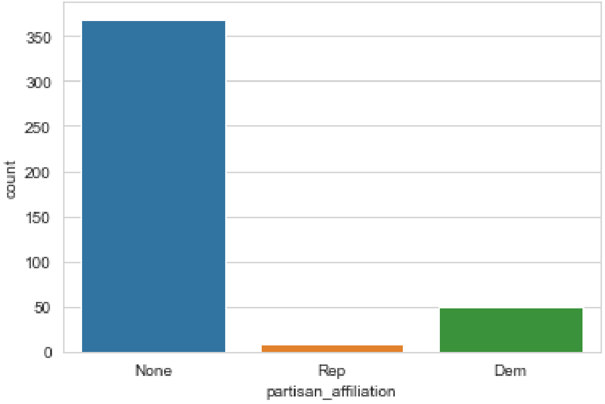
| | Obama | Romney | Undecided | Other | poll_id | pollster | start_date | end_date | sample_subpopulation | sample_size | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 47.0 | 47.0 | 6.0 | NaN | 16674 | Politico/GWU/Battleground | 2012-11-04 | 2012-11-05 | Likely Voters | 1000.0 | L |
| **1** | 49.0 | 47.0 | 3.0 | NaN | 16733 | YouGov/Economist | 2012-11-03 | 2012-11-05 | Likely Voters | 740.0 | |
| **2** | 48.0 | 48.0 | 4.0 | NaN | 16681 | Gravis Marketing | 2012-11-03 | 2012-11-05 | Likely Voters | 872.0 | A |
| **3** | 50.0 | 49.0 | NaN | 1.0 | 16679 | IBD/TIPP | 2012-11-03 | 2012-11-05 | Likely Voters | 712.0 | L |
| **4** | 48.0 | 49.0 | NaN | NaN | 16677 | Rasmussen | 2012-11-03 | 2012-11-05 | Likely Voters | 1500.0 | A |

In [7]:

```
sns.countplot('partisan_affiliation',data=poll_df)
```

```
C:\Users\hansm\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable
as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other argu
ments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

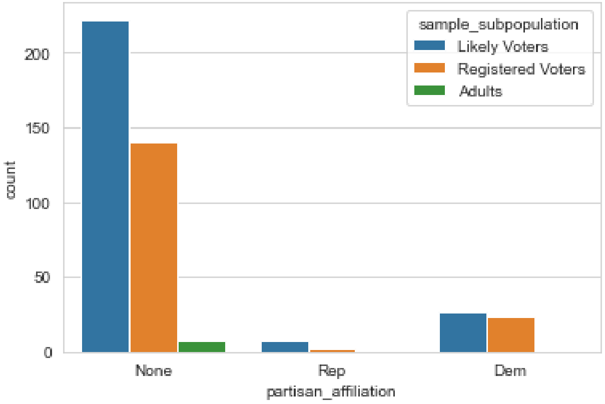
Out[7]: `<AxesSubplot:xlabel='partisan_affiliation', ylabel='count'>`



In [8]:
```
sns.countplot('partisan_affiliation',data=poll_df,hue='sample_subpopulation')
```

```
C:\Users\hansm\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable
as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other argu
ments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[8]: `<AxesSubplot:xlabel='partisan_affiliation', ylabel='count'>`



In [9]:
```
poll_df.head()
```

Out[9]:

| | Obama | Romney | Undecided | Other | poll_id | pollster | start_date | end_date | sample_subpopulation | sample_size | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 47.0 | 47.0 | 6.0 | NaN | 16674 | Politico/GWU/Battleground | 2012-11-04 | 2012-11-05 | Likely Voters | 1000.0 | L |
| **1** | 49.0 | 47.0 | 3.0 | NaN | 16733 | YouGov/Economist | 2012-11-03 | 2012-11-05 | Likely Voters | 740.0 | |
| **2** | 48.0 | 48.0 | 4.0 | NaN | 16681 | Gravis Marketing | 2012-11-03 | 2012-11-05 | Likely Voters | 872.0 | A |
| **3** | 50.0 | 49.0 | NaN | 1.0 | 16679 | IBD/TIPP | 2012-11-03 | 2012-11-05 | Likely Voters | 712.0 | L |
| **4** | 48.0 | 49.0 | NaN | NaN | 16677 | Rasmussen | 2012-11-03 | 2012-11-05 | Likely Voters | 1500.0 | A |

In [10]:
```
avg =pd.DataFrame(poll_df.mean())
avg.drop(['poll_id','sample_size'],axis =0 ,inplace=True)
```

In [11]:
```
avg.head()
```

Out[11]:

| | **0** |
|---|---|

|  | 0 |
|---|---|
| **Obama** | 47.161215 |
| **Romney** | 45.228972 |
| **Undecided** | 5.615942 |
| **Other** | 2.686131 |

In [12]:
```
std =pd.DataFrame(poll_df.std())
std.drop(['poll_id','sample_size'],axis =0 ,inplace=True)
```

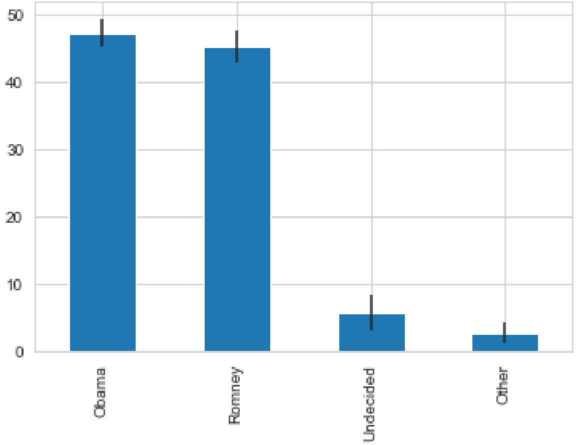
In [13]:
```
std.head()
```

Out[13]:

|  | 0 |
|---|---|
| **Obama** | 2.100449 |
| **Romney** | 2.370565 |
| **Undecided** | 2.629407 |
| **Other** | 1.612232 |

In [14]:
```
avg.plot(yerr=std,kind='bar',legend=False)
```

Out[14]:
```
<AxesSubplot:>
```



In [15]:
```
poll_avg = pd.concat([avg,std],axis=1)
poll_avg.columns= ['Avarage','STD']
poll_avg
```

Out[15]:

|  | Avarage | STD |
|---|---|---|
| **Obama** | 47.161215 | 2.100449 |
| **Romney** | 45.228972 | 2.370565 |
| **Undecided** | 5.615942 | 2.629407 |
| **Other** | 2.686131 | 1.612232 |

In [17]:
```
poll_df.head()
```

Out[17]:

|  | Obama | Romney | Undecided | Other | poll_id | pollster | start_date | end_date | sample_subpopulation | sample_size |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 47.0 | 47.0 | 6.0 | NaN | 16674 | Politico/GWU/Battleground | 2012-11-04 | 2012-11-05 | Likely Voters | 1000.0 | L |
| **1** | 49.0 | 47.0 | 3.0 | NaN | 16733 | YouGov/Economist | 2012-11-03 | 2012-11-05 | Likely Voters | 740.0 |  |
| **2** | 48.0 | 48.0 | 4.0 | NaN | 16681 | Gravis Marketing | 2012-11-03 | 2012-11-05 | Likely Voters | 872.0 | A |

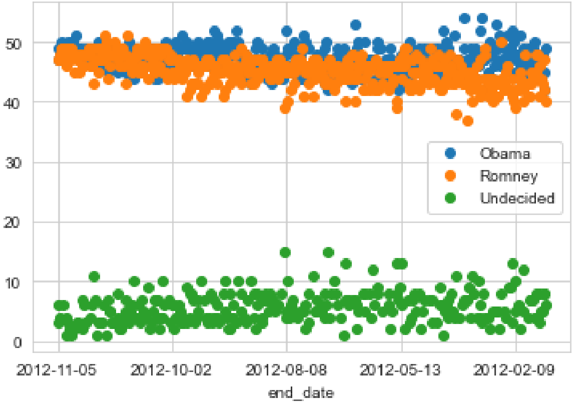
| | Obama | Romney | Undecided | Other | poll_id | pollster | start_date | end_date | sample_subpopulation | sample_size | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **3** | 50.0 | 49.0 | NaN | 1.0 | 16679 | IBD/TIPP | 2012-11-03 | 2012-11-05 | Likely Voters | 712.0 | L |
| **4** | 48.0 | 49.0 | NaN | NaN | 16677 | Rasmussen | 2012-11-03 | 2012-11-05 | Likely Voters | 1500.0 | A |

In [20]:

```
poll_df.plot(x='end_date',y=['Obama', 'Romney','Undecided'],linestyle='',marker='o')
```

Out[20]:

```
<AxesSubplot:xlabel='end_date'>
```



In [21]:

```
poll_df['Difference'] = (poll_df.Obama-poll_df.Romney)/100
```

In [22]:

```
poll_df
```

Out[22]:

| | Obama | Romney | Undecided | Other | poll_id | pollster | start_date | end_date | sample_subpopulation | sample_size |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 47.0 | 47.0 | 6.0 | NaN | 16674 | Politico/GWU/Battleground | 2012-11-04 | 2012-11-05 | Likely Voters | 1000.0 |
| **1** | 49.0 | 47.0 | 3.0 | NaN | 16733 | YouGov/Economist | 2012-11-03 | 2012-11-05 | Likely Voters | 740.0 |
| **2** | 48.0 | 48.0 | 4.0 | NaN | 16681 | Gravis Marketing | 2012-11-03 | 2012-11-05 | Likely Voters | 872.0 |
| **3** | 50.0 | 49.0 | NaN | 1.0 | 16679 | IBD/TIPP | 2012-11-03 | 2012-11-05 | Likely Voters | 712.0 |
| **4** | 48.0 | 49.0 | NaN | NaN | 16677 | Rasmussen | 2012-11-03 | 2012-11-05 | Likely Voters | 1500.0 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **423** | 44.0 | 44.0 | 5.0 | NaN | 12456 | YouGov/Economist | 2012-01-07 | 2012-01-10 | Registered Voters | 715.0 |
| **424** | 48.0 | 43.0 | 5.0 | 4.0 | 12444 | Ipsos/Reuters | 2012-01-05 | 2012-01-09 | Registered Voters | 900.0 |
| **425** | 45.0 | 47.0 | 8.0 | NaN | 12422 | CBS | 2012-01-04 | 2012-01-08 | Registered Voters | 1247.0 |
| **426** | 42.0 | 42.0 | 8.0 | 8.0 | 12401 | Rasmussen | 2012-01-03 | 2012-01-04 | Likely Voters | 1000.0 |
| **427** | 49.0 | 40.0 | 6.0 | NaN | 12402 | YouGov/Economist | 2011-12-31 | 2012-01-03 | Registered Voters | 715.0 |

428 rows × 14 columns

In [24]:

```
poll_df = poll_df.groupby(['start_date'],as_index=False).mean()
poll_df.head()
```

Out[24]:

| | start_date | Obama | Romney | Undecided | Other | poll_id | sample_size | Difference |
|---|---|---|---|---|---|---|---|---|

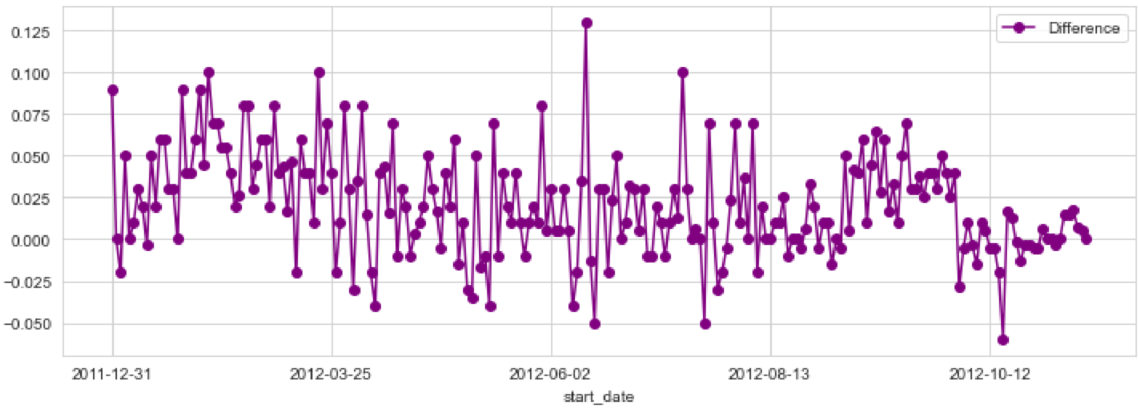
|   | start_date | Obama | Romney | Undecided | Other | poll_id | sample_size | Difference |
|---|---|---|---|---|---|---|---|---|
| **0** | 2011-12-31 | 49.0 | 40.0 | 6.0 | NaN | 12402.0 | 715.0 | 0.09 |
| **1** | 2012-01-03 | 42.0 | 42.0 | 8.0 | 8.0 | 12401.0 | 1000.0 | 0.00 |
| **2** | 2012-01-04 | 45.0 | 47.0 | 8.0 | NaN | 12422.0 | 1247.0 | -0.02 |
| **3** | 2012-01-05 | 48.0 | 43.0 | 5.0 | 4.0 | 12444.0 | 900.0 | 0.05 |
| **4** | 2012-01-07 | 44.0 | 44.0 | 5.0 | NaN | 12456.0 | 715.0 | 0.00 |

In [27]:

```
poll_df.plot('start_date','Difference',figsize=(12,4),marker='o',linestyle='-',color='purple')
```

Out[27]:

```
<AxesSubplot:xlabel='start_date'>
```



In [29]:

```
row_in =0
xlimit= []
for date in poll_df['start_date']:
    if date[0:7] == '2012-10' :
        xlimit.append(row_in)
        row_in +=1
    else:
        row_in +=1
print( min(xlimit))
print( max(xlimit))
```

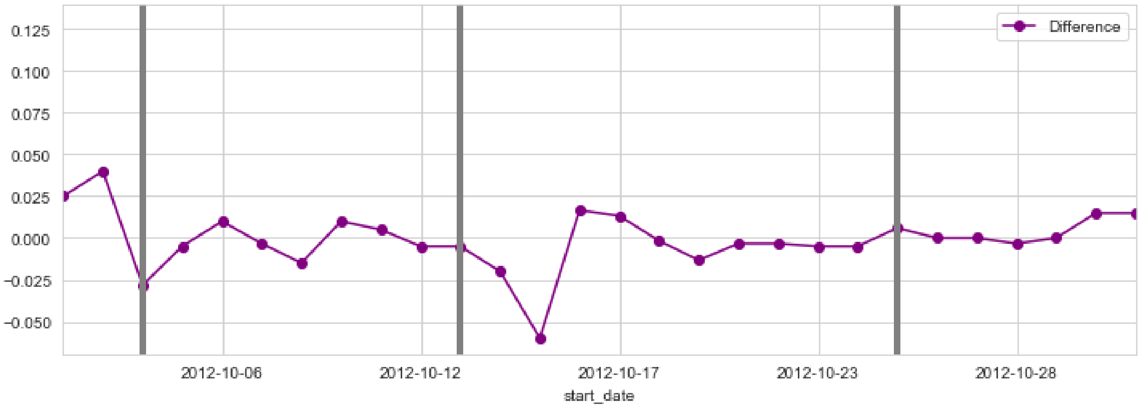
```
191
218
```

In [35]:

```
poll_df.plot('start_date','Difference',figsize=(12,4),marker='o',linestyle='-',color='purple',xlim=(191,218))
plt.axvline(x=191+2,linewidth =4, color='grey')
plt.axvline(x=191+10,linewidth =4, color='grey')
plt.axvline(x=191+21,linewidth =4, color='grey')
```

Out[35]:

```
<matplotlib.lines.Line2D at 0x1ace00e02b0>
```



DONOR DATA

In [36]:

```
donor_df =pd.read_csv('Election_Donor_Data.csv')
```

```
C:\Users\hansm\anaconda3\lib\site-packages\IPython\core\interactiveshell.py:3146: DtypeWarning: Columns (6) have
```

```
mixed types.Specify dtype option on import or set low_memory=False.
  has_raised = await self.run_ast_nodes(code_ast.body, cell_name,
```

In [39]:

```
donor_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1001731 entries, 0 to 1001730
Data columns (total 16 columns):
 #   Column             Non-Null Count    Dtype  
---  ------             --------------    -----  
 0   cmte_id            1001731 non-null  object 
 1   cand_id            1001731 non-null  object 
 2   cand_nm            1001731 non-null  object 
 3   contbr_nm          1001731 non-null  object 
 4   contbr_city        1001712 non-null  object 
 5   contbr_st          1001727 non-null  object 
 6   contbr_zip         1001620 non-null  object 
 7   contbr_employer    988002 non-null   object 
 8   contbr_occupation  993301 non-null   object 
 9   contb_receipt_amt  1001731 non-null  float64
 10  contb_receipt_dt   1001731 non-null  object 
 11  receipt_desc       14166 non-null    object 
 12  memo_cd            92482 non-null    object 
 13  memo_text          97770 non-null    object 
 14  form_tp            1001731 non-null  object 
 15  file_num           1001731 non-null  int64  
dtypes: float64(1), int64(1), object(14)
memory usage: 122.3+ MB
```

In [40]:

```
donor_df.head()
```

Out[40]:

|   | cmte_id | cand_id | cand_nm | contbr_nm | contbr_city | contbr_st | contbr_zip | contbr_employer | contbr_occupation | contb_ |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | C00410118 | P20002978 | Bachmann, Michelle | HARVEY, WILLIAM | MOBILE | AL | 3.6601e+08 | RETIRED | RETIRED | |
| **1** | C00410118 | P20002978 | Bachmann, Michelle | HARVEY, WILLIAM | MOBILE | AL | 3.6601e+08 | RETIRED | RETIRED | |
| **2** | C00410118 | P20002978 | Bachmann, Michelle | SMITH, LANIER | LANETT | AL | 3.68633e+08 | INFORMATION REQUESTED | INFORMATION REQUESTED | |
| **3** | C00410118 | P20002978 | Bachmann, Michelle | BLEVINS, DARONDA | PIGGOTT | AR | 7.24548e+08 | NONE | RETIRED | |
| **4** | C00410118 | P20002978 | Bachmann, Michelle | WARDENBURG, HAROLD | HOT SPRINGS NATION | AR | 7.19016e+08 | NONE | RETIRED | |

In [42]:

```
donor_df['contb_receipt_amt'].value_counts()
```

Out[42]:

```
100.00    178188
50.00     137584
25.00     110345
250.00     91182
500.00     57984
           ...  
97.15          1
122.32         1
188.65         1
122.40         1
132.12         1
Name: contb_receipt_amt, Length: 8079, dtype: int64
```

In [44]:

```
don_mean =donor_df['contb_receipt_amt'].mean()
don_std =donor_df['contb_receipt_amt'].std()
print( 'the avrg donation was %.2f with a std %.2f' %(don_mean,don_std))
```

```
the avrg donation was 298.24 with a std 3749.67
```

In [56]:

```
top_donor= donor_df['contb_receipt_amt'].copy()
top_donor.sort_values(ascending=False)
top_donor
```

Out[56]:

```
0            250.0
1             50.0
2            250.0
3            250.0
```

```
4           300.0
            ...
1001726    5000.0
1001727    2500.0
1001728     500.0
1001729     500.0
1001730    2500.0
Name: contb_receipt_amt, Length: 1001731, dtype: float64
```

In [60]:

```
top_donor =top_donor[top_donor > 0]
top_donor.sort_values(ascending=False)
top_donor.value_counts().head(10)
```

Out[60]:

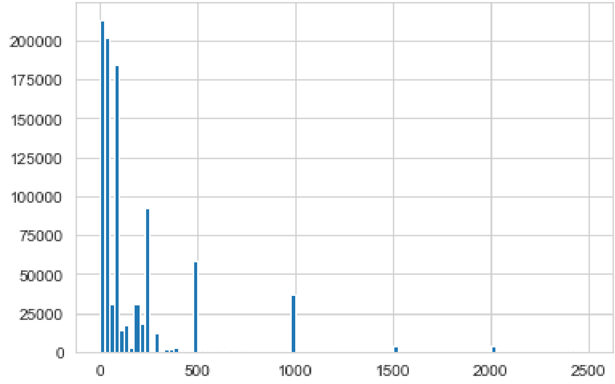
```
100.0     178188
50.0      137584
25.0      110345
250.0      91182
500.0      57984
2500.0     49005
35.0       37237
1000.0     36494
10.0       33986
200.0      27813
Name: contb_receipt_amt, dtype: int64
```

In [63]:

```
com_don = top_donor[top_donor<2500]
com_don.hist(bins=100)
```

Out[63]:

```
<AxesSubplot:>
```



In [68]:

```
candidate = donor_df.cand_nm.unique()
candidate
```

Out[68]:

```
array(['Bachmann, Michelle', 'Romney, Mitt', 'Obama, Barack',
       "Roemer, Charles E. 'Buddy' III", 'Pawlenty, Timothy',
       'Johnson, Gary Earl', 'Paul, Ron', 'Santorum, Rick',
       'Cain, Herman', 'Gingrich, Newt', 'McCotter, Thaddeus G',
       'Huntsman, Jon', 'Perry, Rick'], dtype=object)
```

In [70]:

```
party_map = {'Bachmann, Michelle': 'Republican',
           'Cain, Herman': 'Republican',
           'Gingrich, Newt': 'Republican',
           'Huntsman, Jon': 'Republican',
           'Johnson, Gary Earl': 'Republican',
           'McCotter, Thaddeus G': 'Republican',
           'Obama, Barack': 'Democrat',
           'Paul, Ron': 'Republican',
           'Pawlenty, Timothy': 'Republican',
           'Perry, Rick': 'Republican',
           "Roemer, Charles E. 'Buddy' III": 'Republican',
           'Romney, Mitt': 'Republican',
           'Santorum, Rick': 'Republican'}

donor_df['Party'] = donor_df.cand_nm.map(party_map)
```

In [72]:

```
donor_df =donor_df[donor_df.contb_receipt_amt > 0]
```

In [74]:

```
donor_df.head()
```

Out[74]:

| | cmte_id | cand_id | cand_nm | contbr_nm | contbr_city | contbr_st | contbr_zip | contbr_employer | contbr_occupation | contb_r |
|---|---|---|---|---|---|---|---|---|---|---|

| | cmte_id | cand_id | cand_nm | contbr_nm | contbr_city | contbr_st | contbr_zip | contbr_employer | contbr_occupation | contb_ |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | C00410118 | P20002978 | Bachmann, Michelle | HARVEY, WILLIAM | MOBILE | AL | 3.6601e+08 | RETIRED | RETIRED | |
| **1** | C00410118 | P20002978 | Bachmann, Michelle | HARVEY, WILLIAM | MOBILE | AL | 3.6601e+08 | RETIRED | RETIRED | |
| **2** | C00410118 | P20002978 | Bachmann, Michelle | SMITH, LANIER | LANETT | AL | 3.68633e+08 | INFORMATION REQUESTED | INFORMATION REQUESTED | |
| **3** | C00410118 | P20002978 | Bachmann, Michelle | BLEVINS, DARONDA | PIGGOTT | AR | 7.24548e+08 | NONE | RETIRED | |
| **4** | C00410118 | P20002978 | Bachmann, Michelle | WARDENBURG, HAROLD | HOT SPRINGS NATION | AR | 7.19016e+08 | NONE | RETIRED | |

In [76]:
```
donor_df.groupby('cand_nm')['contb_receipt_amt'].count()
```

Out[76]:
```
cand_nm
Bachmann, Michelle                 13082
Cain, Herman                       20052
Gingrich, Newt                     46883
Huntsman, Jon                       4066
Johnson, Gary Earl                  1234
McCotter, Thaddeus G                  73
Obama, Barack                     589127
Paul, Ron                         143161
Pawlenty, Timothy                   3844
Perry, Rick                        12709
Roemer, Charles E. 'Buddy' III      5844
Romney, Mitt                      105155
Santorum, Rick                     46245
Name: contb_receipt_amt, dtype: int64
```

In [78]:
```
donor_df.groupby('cand_nm')['contb_receipt_amt'].sum()
```

Out[78]:
```
cand_nm
Bachmann, Michelle                2.711439e+06
Cain, Herman                      7.101082e+06
Gingrich, Newt                    1.283277e+07
Huntsman, Jon                     3.330373e+06
Johnson, Gary Earl                5.669616e+05
McCotter, Thaddeus G              3.903000e+04
Obama, Barack                     1.358774e+08
Paul, Ron                         2.100962e+07
Pawlenty, Timothy                 6.004819e+06
Perry, Rick                       2.030575e+07
Roemer, Charles E. 'Buddy' III    3.730099e+05
Romney, Mitt                      8.833591e+07
Santorum, Rick                    1.104316e+07
Name: contb_receipt_amt, dtype: float64
```

In [81]:
```
cand_amount = donor_df.groupby('cand_nm')['contb_receipt_amt'].sum()
i=0
for don in cand_amount:
    print('the candidate %s raise %.0f dollars' %(cand_amount.index[i],don))
    print('\n')
    i+=1
```

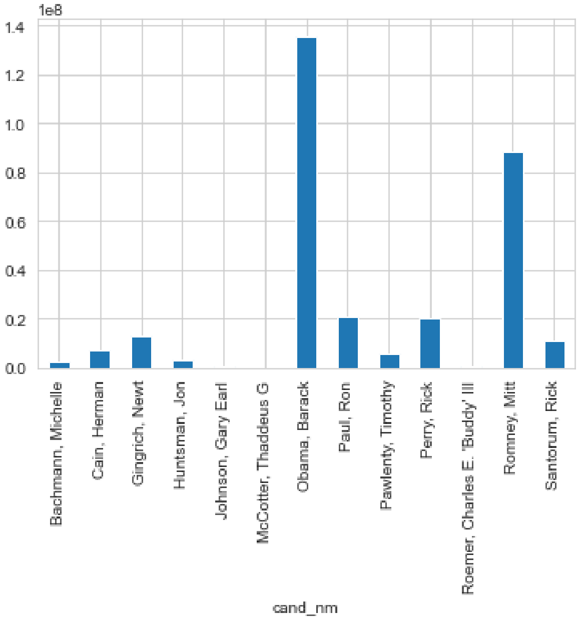
```
the candidate Bachmann, Michelle raise 2711439 dollars


the candidate Cain, Herman raise 7101082 dollars


the candidate Gingrich, Newt raise 12832770 dollars


the candidate Huntsman, Jon raise 3330373 dollars


the candidate Johnson, Gary Earl raise 566962 dollars


the candidate McCotter, Thaddeus G raise 39030 dollars
the candidate Obama, Barack raise 135877427 dollars

the candidate Paul, Ron raise 21009620 dollars

the candidate Pawlenty, Timothy raise 6004819 dollars

the candidate Perry, Rick raise 20305754 dollars

the candidate Roemer, Charles E. 'Buddy' III raise 373010 dollars

the candidate Romney, Mitt raise 88335908 dollars

the candidate Santorum, Rick raise 11043159 dollars
```

In [83]:

```
cand_amount.plot(kind='bar')
```

Out[83]:

```
<AxesSubplot:xlabel='cand_nm'>
```

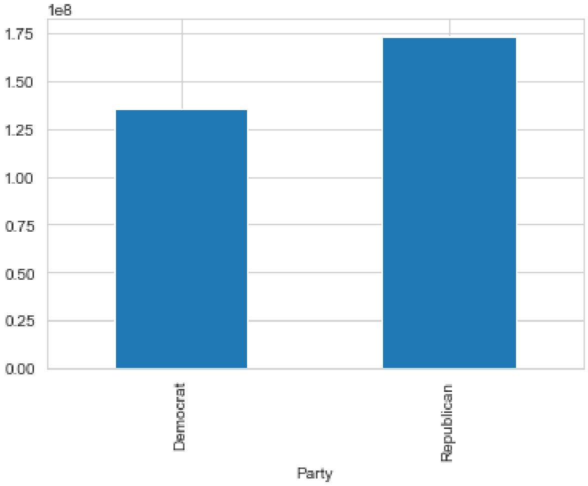


In [85]:

```
donor_df.groupby('Party')['contb_receipt_amt'].sum().plot(kind='bar')
```

Out[85]:

```
<AxesSubplot:xlabel='Party'>
```



In [88]:

```
occupation_df =donor_df.pivot_table('contb_receipt_amt', index='contbr_occupation', columns ='Party', aggfunc='su
occupation_df
```

Out[88]:

| Party | Democrat | Republican |
|---|---|---|
| **contbr_occupation** | | |
| **MIXED-MEDIA ARTIST / STORYTELLER** | 100.0 | NaN |
| **AREA VICE PRESIDENT** | 250.0 | NaN |
| **RESEARCH ASSOCIATE** | 100.0 | NaN |
| **TEACHER** | 500.0 | NaN |
| **THERAPIST** | 3900.0 | NaN |
| **...** | ... | ... |
| **ZOOKEEPER** | 35.0 | NaN |
| **ZOOLOGIST** | 400.0 | NaN |
| **ZOOLOGY EDUCATION** | 25.0 | NaN |
| **\NONE\** | NaN | 250.0 |
| **~** | NaN | 75.0 |

45067 rows × 2 columns

In [92]:

```
occupation_df.shape
```

Out[92]:

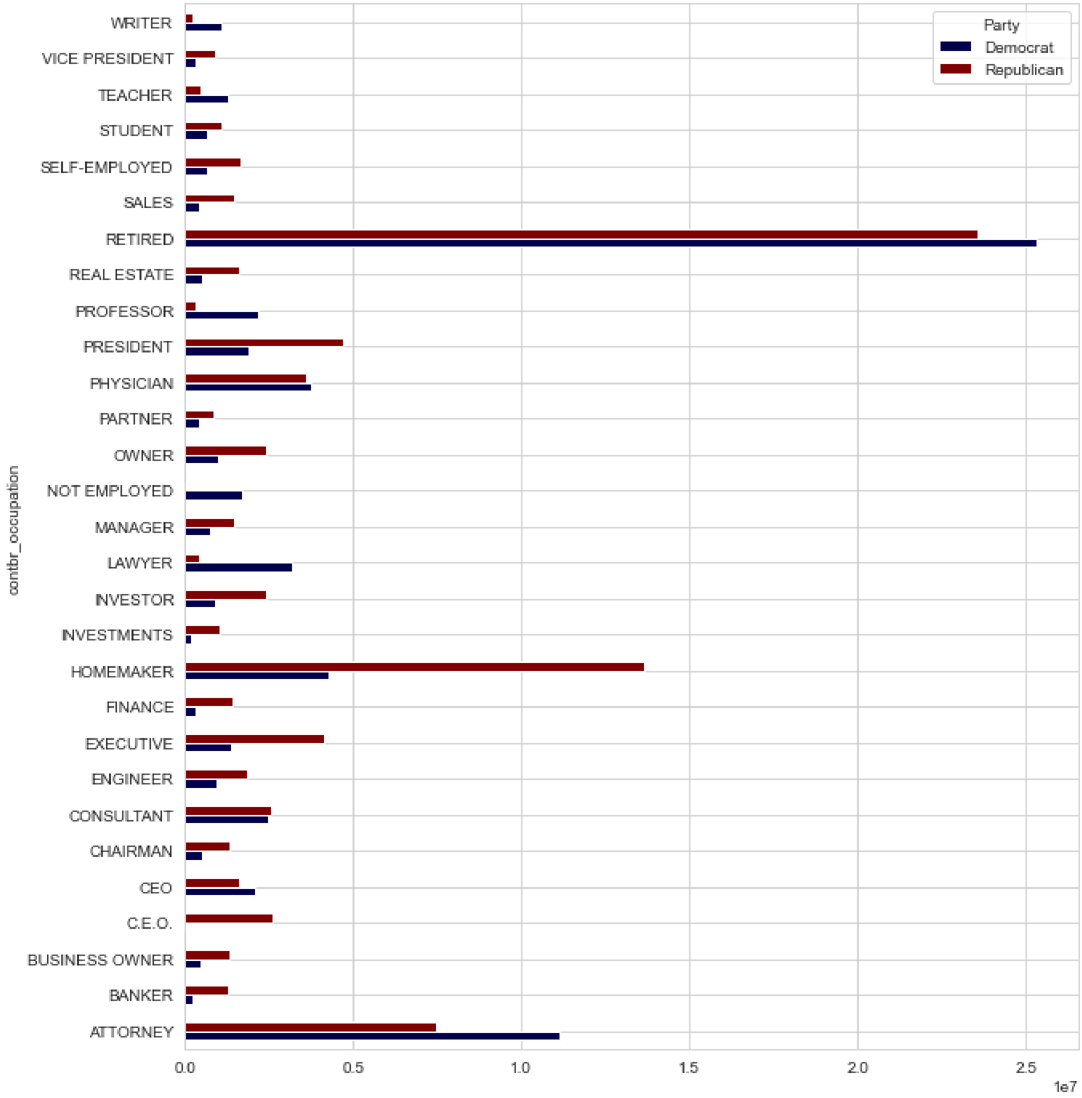
```
(45067, 2)
```

In [106…

```
occupation_df = occupation_df[occupation_df.sum(1) > 1000000]
occupation_df.shape
occupation_df.plot(kind='barh',figsize=(10,12),cmap='seismic')
```

Out[106…

```
<AxesSubplot:ylabel='contbr_occupation'>
```

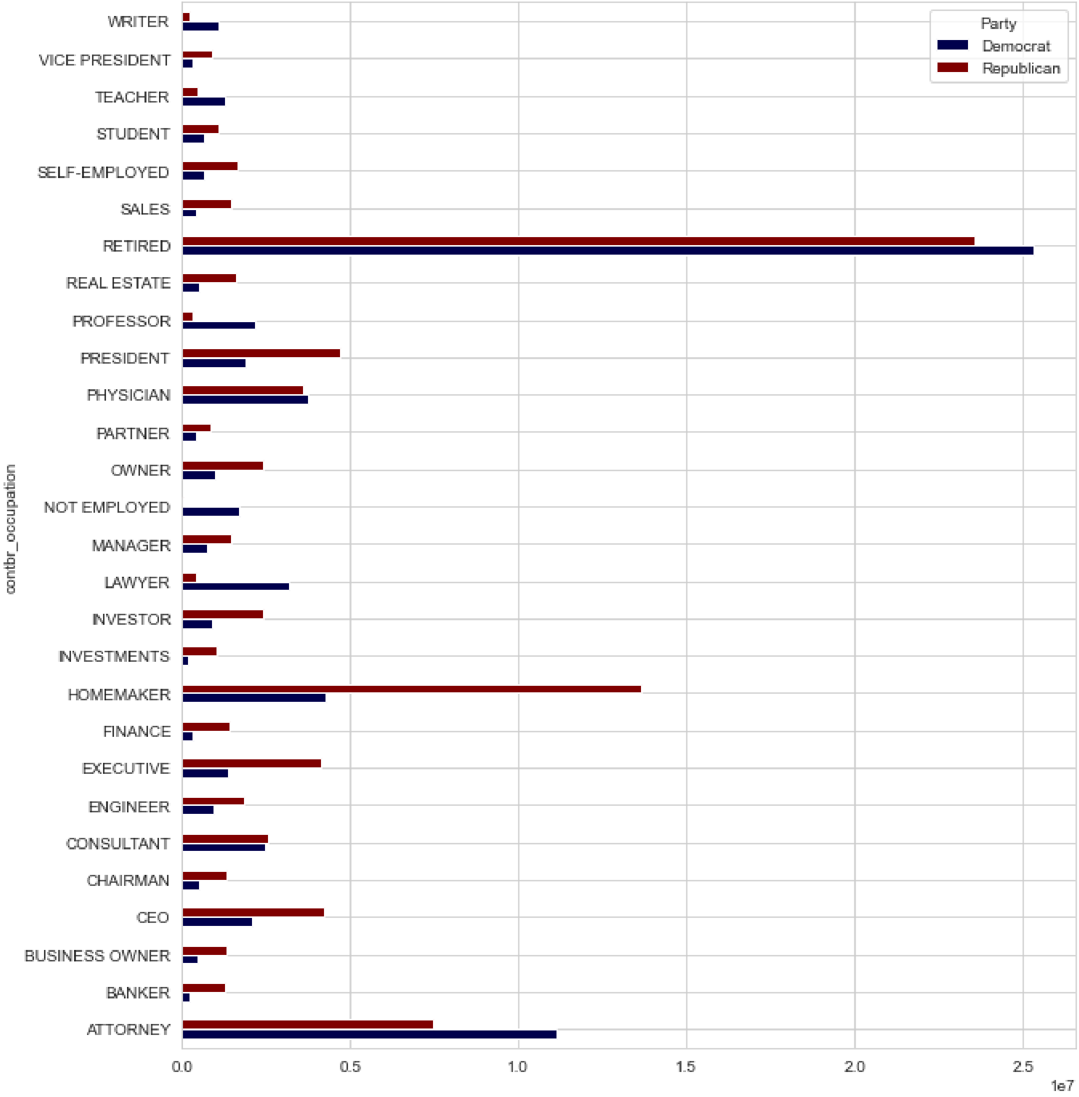


In [108…

```
# occupation_df.drop(['INFORMATION REQUESTED PER BEST EFFORTS','INFORMATION REQUESTED'],axis=0,inplace=True)
occupation_df.loc['CEO'] =occupation_df.loc['CEO']+ occupation_df.loc['C.E.O.']
occupation_df.drop('C.E.O.',inplace=True)
occupation_df.plot(kind='barh',figsize=(10,12),cmap='seismic')
```

Out[108…

```
<AxesSubplot:ylabel='contbr_occupation'>
```


Party
Democrat
Republican
contbr_occupation
WRITER
VICE PRESIDENT
TEACHER
STUDENT
SELF-EMPLOYED
SALES
RETIRED
REAL ESTATE
PROFESSOR
PRESIDENT
PHYSICIAN
PARTNER
OWNER
NOT EMPLOYED
MANAGER
LAWYER
INVESTOR
INVESTMENTS
HOMEMAKER
FINANCE
EXECUTIVE
ENGINEER
CONSULTANT
CHAIRMAN
CEO
BUSINESS OWNER
BANKER
ATTORNEY
0.0
0.5
1.0
1.5
2.0
2.5
1e7