

# USA Migrant Flow from 1980 to 2013

September 11, 2019

```
[120]: import numpy as np
import pandas as pd
```

```
[121]: df_usa = pd.read_excel('United States of America.xlsx')
df_usa
```

```
[121]:
```

	Type	Coverage	\
0	Immigrants	Foreigners	
1	Immigrants	Foreigners	
2	Immigrants	Foreigners	
3	Immigrants	Foreigners	
4	Immigrants	Foreigners	
5	Immigrants	Foreigners	
6	Immigrants	Foreigners	
7	Immigrants	Foreigners	
8	Immigrants	Foreigners	
9	Immigrants	Foreigners	
10	Immigrants	Foreigners	
11	Immigrants	Foreigners	
12	Immigrants	Foreigners	
13	Immigrants	Foreigners	
14	Immigrants	Foreigners	
15	Immigrants	Foreigners	
16	Immigrants	Foreigners	
17	Immigrants	Foreigners	
18	Immigrants	Foreigners	
19	Immigrants	Foreigners	
20	Immigrants	Foreigners	
21	Immigrants	Foreigners	
22	Immigrants	Foreigners	
23	Immigrants	Foreigners	
24	Immigrants	Foreigners	
25	Immigrants	Foreigners	
26	Immigrants	Foreigners	
27	Immigrants	Foreigners	
28	Immigrants	Foreigners	
29	Immigrants	Foreigners	

```

..      ...      ...
191 Immigrants Foreigners
192 Immigrants Foreigners
193 Immigrants Foreigners
194 Immigrants Foreigners
195 Immigrants Foreigners
196 Immigrants Foreigners
197 Immigrants Foreigners
198 Immigrants Foreigners
199 Immigrants Foreigners
200 Immigrants Foreigners
201 Immigrants Foreigners
202 Immigrants Foreigners
203 Immigrants Foreigners
204 Immigrants Foreigners
205 Immigrants Foreigners
206 Immigrants Foreigners
207 Immigrants Foreigners
208 Immigrants Foreigners
209 Immigrants Foreigners
210 Immigrants Foreigners
211 Immigrants Foreigners
212 Immigrants Foreigners
213 Immigrants Foreigners
214 Immigrants Foreigners
215 Immigrants Foreigners
216 Immigrants Foreigners
217 Immigrants Foreigners
218 Immigrants Foreigners
219 Immigrants Foreigners
220 Immigrants Foreigners

```

	OdName	AREA \
0	Afghanistan	935
1	Albania	908
2	Algeria	903
3	American Samoa	909
4	Andorra	908
5	Angola	903
6	Anguilla	904
7	Antigua and Barbuda	904
8	Argentina	904
9	Armenia	935
10	Aruba	904
11	Australia	909
12	Austria	908
13	Azerbaijan	935

14		Bahamas	904
15		Bahrain	935
16		Bangladesh	935
17		Barbados	904
18		Belarus	908
19		Belgium	908
20		Belize	904
21		Benin	903
22		Bermuda	905
23		Bhutan	935
24		Bolivia (Plurinational State of)	904
25		Bosnia and Herzegovina	908
26		Botswana	903
27		Brazil	904
28		British Virgin Islands	904
29		Brunei Darussalam	935
..		...	...
191		Tajikistan	935
192		Thailand	935
193		The former Yugoslav Republic of Macedonia	908
194		Togo	903
195		Tonga	909
196		Trinidad and Tobago	904
197		Tunisia	903
198		Turkey	935
199		Turkmenistan	935
200		Turks and Caicos Islands	904
201		Tuvalu	909
202		Uganda	903
203		Ukraine	908
204		United Arab Emirates	935
205		United Kingdom of Great Britain and Northern I...	908
206		United Republic of Tanzania	903
207		United States of America	905
208		United States Virgin Islands	904
209		Uruguay	904
210		Uzbekistan	935
211		Vanuatu	909
212		Venezuela (Bolivarian Republic of)	904
213		Viet Nam	935
214		Wallis and Futuna Islands	909
215		Western Sahara	903
216		Yemen	935
217		Zambia	903
218		Zimbabwe	903
219		Unknown	999
220		Total	999

	AreaName	REG	RegName	DEV \
0	Asia	5501	Southern Asia	902
1	Europe	925	Southern Europe	901
2	Africa	912	Northern Africa	902
3	Oceania	957	Polynesia	902
4	Europe	925	Southern Europe	901
5	Africa	911	Middle Africa	902
6	Latin America and the Caribbean	915	Caribbean	902
7	Latin America and the Caribbean	915	Caribbean	902
8	Latin America and the Caribbean	931	South America	902
9	Asia	922	Western Asia	902
10	Latin America and the Caribbean	915	Caribbean	902
11	Oceania	927	Australia and New Zealand	901
12	Europe	926	Western Europe	901
13	Asia	922	Western Asia	902
14	Latin America and the Caribbean	915	Caribbean	902
15	Asia	922	Western Asia	902
16	Asia	5501	Southern Asia	902
17	Latin America and the Caribbean	915	Caribbean	902
18	Europe	923	Eastern Europe	901
19	Europe	926	Western Europe	901
20	Latin America and the Caribbean	916	Central America	902
21	Africa	914	Western Africa	902
22	Northern America	905	Northern America	901
23	Asia	5501	Southern Asia	902
24	Latin America and the Caribbean	931	South America	902
25	Europe	925	Southern Europe	901
26	Africa	913	Southern Africa	902
27	Latin America and the Caribbean	931	South America	902
28	Latin America and the Caribbean	915	Caribbean	902
29	Asia	920	South-Eastern Asia	902
..	...	...	...	...
191	Asia	5500	Central Asia	902
192	Asia	920	South-Eastern Asia	902
193	Europe	925	Southern Europe	901
194	Africa	914	Western Africa	902
195	Oceania	957	Polynesia	902
196	Latin America and the Caribbean	915	Caribbean	902
197	Africa	912	Northern Africa	902
198	Asia	922	Western Asia	902
199	Asia	5500	Central Asia	902
200	Latin America and the Caribbean	915	Caribbean	902
201	Oceania	957	Polynesia	902
202	Africa	910	Eastern Africa	902
203	Europe	923	Eastern Europe	901
204	Asia	922	Western Asia	902

205		Europe	924		Northern Europe	901
206		Africa	910		Eastern Africa	902
207		Northern America	905		Northern America	901
208	Latin America and the Caribbean		915		Caribbean	902
209	Latin America and the Caribbean		931		South America	902
210		Asia	5500		Central Asia	902
211		Oceania	928		Melanesia	902
212	Latin America and the Caribbean		931		South America	902
213		Asia	920		South-Eastern Asia	902
214		Oceania	957		Polynesia	902
215		Africa	912		Northern Africa	902
216		Asia	922		Western Asia	902
217		Africa	910		Eastern Africa	902
218		Africa	910		Eastern Africa	902
219		World	999		World	999
220		World	999		World	999

	DevName	1980	...	2004	2005	2006	\
0	Less developed regions	722	...	2137	4749	3417	
1	More developed regions	30	...	3840	5947	7914	
2	Less developed regions	175	...	805	1115	1300	
3	Less developed regions	0	...	12	15	28	
4	More developed regions	2	...	0	0	0	
5	Less developed regions	194	...	107	188	272	
6	Less developed regions	148	...	22	35	32	
7	Less developed regions	972	...	414	440	570	
8	Less developed regions	2815	...	4805	7081	7327	
9	Less developed regions	0	...	1833	2591	6317	
10	Less developed regions	0	...	31	42	51	
11	More developed regions	1490	...	2604	3193	3249	
12	More developed regions	401	...	402	532	524	
13	Less developed regions	0	...	969	1523	2371	
14	Less developed regions	547	...	586	698	847	
15	Less developed regions	39	...	116	140	148	
16	Less developed regions	532	...	8061	11487	14644	
17	Less developed regions	2667	...	630	846	959	
18	More developed regions	0	...	2255	3503	3086	
19	More developed regions	426	...	638	859	716	
20	Less developed regions	1120	...	871	876	1252	
21	Less developed regions	32	...	185	193	275	
22	More developed regions	195	...	100	116	160	
23	Less developed regions	13	...	17	30	78	
24	Less developed regions	730	...	1768	2197	4025	
25	More developed regions	0	...	10552	14074	3789	
26	Less developed regions	10	...	34	54	53	
27	Less developed regions	1570	...	10556	16662	17903	
28	Less developed regions	255	...	35	41	47	

29	Less developed regions	13	...	22	49	25
..	...	...	...	...	...	...
191	Less developed regions	0	...	167	207	239
192	Less developed regions	4115	...	4318	5505	11749
193	More developed regions	0	...	775	1070	1317
194	Less developed regions	9	...	2041	1523	1720
195	Less developed regions	453	...	327	309	437
196	Less developed regions	5154	...	5384	6568	8854
197	Less developed regions	92	...	457	495	510
198	Less developed regions	2233	...	3835	4614	4941
199	Less developed regions	0	...	117	148	248
200	Less developed regions	40	...	28	34	52
201	Less developed regions	0	...	0	0	0
202	Less developed regions	343	...	721	858	1372
203	More developed regions	0	...	14156	22745	17140
204	Less developed regions	32	...	586	812	1006
205	More developed regions	15485	...	14915	19800	17207
206	Less developed regions	339	...	747	829	949
207	More developed regions	206	...	57	183	333
208	Less developed regions	0	...	13	8	7
209	Less developed regions	887	...	787	1154	1664
210	Less developed regions	0	...	1995	2887	4015
211	Less developed regions	0	...	0	0	0
212	Less developed regions	1010	...	6220	10645	11341
213	Less developed regions	43483	...	31524	32784	30691
214	Less developed regions	0	...	0	0	0
215	Less developed regions	0	...	0	0	0
216	Less developed regions	160	...	1760	3366	4308
217	Less developed regions	178	...	359	499	672
218	Less developed regions	246	...	628	923	1049
219	World	14597	...	17285	23565	24541
220	World	530639	...	957883	1122257	1266129

	2007	2008	2009	2010	2011	2012	2013
0	1753	2813	3165	2017	1648	1617	2196
1	5737	5754	5137	4711	3612	3364	3186
2	1036	1037	1485	1305	1364	1369	1241
3	11	14	19	14	0	0	0
4	0	0	0	0	0	0	0
5	199	221	173	148	148	187	143
6	25	22	21	19	25	23	22
7	415	444	437	359	368	337	344
8	5645	5353	5780	4399	4473	4359	4372
9	4351	3586	3442	2979	2983	2681	2722
10	55	36	38	49	39	54	45
11	2518	2464	2622	2512	2343	2414	2759
12	485	443	512	442	424	407	415

13	1166	1071	834	781	728	663	637
14	738	682	751	652	668	619	630
15	133	96	120	104	119	104	115
16	12074	11753	16651	14819	16707	14705	12099
17	689	585	603	465	455	460	428
18	2328	2390	2407	2038	1964	1659	1970
19	638	642	686	592	567	574	675
20	1073	1077	1041	965	905	847	946
21	258	317	401	486	462	415	342
22	108	92	108	72	71	85	88
23	52	42	594	6109	10137	10198	8954
24	2590	2436	2837	2253	2173	1948	2071
25	1569	1491	1501	946	878	815	697
26	49	41	55	66	76	80	53
27	14295	12195	14701	12258	11763	11441	11033
28	40	53	46	46	37	39	45
29	32	18	26	20	25	19	21
..	...	...	...	...	...	...	...
191	172	231	265	299	382	411	550
192	8751	6637	10444	9384	9962	9459	7583
193	1227	1107	1128	963	1078	906	895
194	1565	1661	1680	1563	1506	1756	1257
195	438	365	379	343	408	276	348
196	6829	5937	6256	5435	5023	5214	4724
197	417	410	416	418	440	422	445
198	4425	4210	4958	4483	4403	4162	4144
199	217	274	290	224	260	223	210
200	31	35	31	29	33	30	50
201	0	0	0	0	0	0	0
202	1122	1174	1364	1085	1239	1340	1350
203	11001	10813	11223	8477	8292	7642	8193
204	758	693	697	779	707	854	910
205	14545	14348	15748	12792	11572	12014	12984
206	832	838	2773	1850	1427	1516	837
207	171	216	181	201	269	279	319
208	3	0	0	0	0	0	0
209	1418	1451	1775	1331	1553	1374	1352
210	4665	6375	5467	4770	5056	4726	4382
211	0	0	0	0	0	0	0
212	10692	10514	11154	9409	9183	9387	9572
213	28691	31497	29234	30632	34157	28304	27101
214	0	0	0	0	0	0	0
215	0	0	0	0	0	0	0
216	2396	1872	3134	3591	3361	2620	3532
217	576	613	704	628	652	643	505
218	1057	953	983	1274	1016	914	924
219	20120	19972	19488	16453	13740	9729	11698

```
220 1052415 1107126 1130818 1042625 1062040 1031631 990553
```

```
[221 rows x 43 columns]
```

```
[122]: print(df_usa.shape)
```

```
(221, 43)
```

Clean up data. We will make some modifications to the original dataset to make it easier to create our visualizations. Refer to Introduction to Matplotlib and Line Plots lab for the rationale and detailed description of the changes.

```
[123]: df_usa.head()
```

```
[123]:
```

	Type	Coverage	OdName	AREA	AreaName	REG	\
0	Immigrants	Foreigners	Afghanistan	935	Asia	5501	
1	Immigrants	Foreigners	Albania	908	Europe	925	
2	Immigrants	Foreigners	Algeria	903	Africa	912	
3	Immigrants	Foreigners	American Samoa	909	Oceania	957	
4	Immigrants	Foreigners	Andorra	908	Europe	925	

	RegName	DEV	DevName	1980	...	2004	2005	2006	\
0	Southern Asia	902	Less developed regions	722	...	2137	4749	3417	
1	Southern Europe	901	More developed regions	30	...	3840	5947	7914	
2	Northern Africa	902	Less developed regions	175	...	805	1115	1300	
3	Polynesia	902	Less developed regions	0	...	12	15	28	
4	Southern Europe	901	More developed regions	2	...	0	0	0	

	2007	2008	2009	2010	2011	2012	2013
0	1753	2813	3165	2017	1648	1617	2196
1	5737	5754	5137	4711	3612	3364	3186
2	1036	1037	1485	1305	1364	1369	1241
3	11	14	19	14	0	0	0
4	0	0	0	0	0	0	0

```
[5 rows x 43 columns]
```

**1. Clean up the dataset to remove columns that are not informative to us for visualization (eg. Type, AREA, REG).**

```
[124]: df_usa.drop(['AREA', 'REG', 'DEV', 'Type', 'Coverage'], axis=1, inplace=True)
df_usa.head()
```

```
[124]:
```

	OdName	AreaName	RegName	DevName	1980	\
0	Afghanistan	Asia	Southern Asia	Less developed regions	722	
1	Albania	Europe	Southern Europe	More developed regions	30	
2	Algeria	Africa	Northern Africa	Less developed regions	175	
3	American Samoa	Oceania	Polynesia	Less developed regions	0	
4	Andorra	Europe	Southern Europe	More developed regions	2	



	1981	1982	1983	1984	1985	...	2004	2005	2006	2007	2008	2009	\
0	1881	1569	2566	3222	2794	...	2137	4749	3417	1753	2813	3165	
1	11	23	22	32	45	...	3840	5947	7914	5737	5754	5137	
2	184	190	201	197	202	...	805	1115	1300	1036	1037	1485	
3	0	7	7	0	0	...	12	15	28	11	14	19	
4	3	2	1	0	0	...	0	0	0	0	0	0	

	2010	2011	2012	2013
0	2017	1648	1617	2196
1	4711	3612	3364	3186
2	1305	1364	1369	1241
3	14	0	0	0
4	0	0	0	0

[5 rows x 38 columns]

## 2. Rename some of the columns so that they make sense.

```
[125]: df_usa.rename(columns = {'OdName': 'Country', 'AreaName': 'Continent', 'RegName':
    → 'Region'}, inplace=True)
```

```
df_usa.head()
```

```
[125]:
```

	Country	Continent	Region	DevName	1980	\
0	Afghanistan	Asia	Southern Asia	Less developed regions	722	
1	Albania	Europe	Southern Europe	More developed regions	30	
2	Algeria	Africa	Northern Africa	Less developed regions	175	
3	American Samoa	Oceania	Polynesia	Less developed regions	0	
4	Andorra	Europe	Southern Europe	More developed regions	2	

	1981	1982	1983	1984	1985	...	2004	2005	2006	2007	2008	2009	\
0	1881	1569	2566	3222	2794	...	2137	4749	3417	1753	2813	3165	
1	11	23	22	32	45	...	3840	5947	7914	5737	5754	5137	
2	184	190	201	197	202	...	805	1115	1300	1036	1037	1485	
3	0	7	7	0	0	...	12	15	28	11	14	19	
4	3	2	1	0	0	...	0	0	0	0	0	0	

	2010	2011	2012	2013
0	2017	1648	1617	2196
1	4711	3612	3364	3186
2	1305	1364	1369	1241
3	14	0	0	0
4	0	0	0	0

[5 rows x 38 columns]

```
[126]: df_usa.applymap(np.isreal).head() # this code finds any non-integer and returns
    → a boolean
```

```
[126]: Country Continent Region DevName 1980 1981 1982 1983 1984 1985 \
0 False False False False True True True True True True
1 False False False False True True True True True True
2 False False False False True True True True True True
3 False False False False True True True True True True
4 False False False False True True True True True True

... 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
0 ... True True True True True True True True True True
1 ... True True True True True True True True True True
2 ... True True True True True True True True True True
3 ... True True True True True True True True True True
4 ... True True True True True True True True True True

[5 rows x 38 columns]
```

### 3. For consistency, ensure that all column labels of type string.

```
[127]: df_usa.columns = list(map(str, df_usa.columns))
all(isinstance(column, str) for column in df_usa.columns)
```

```
[127]: True
```

### 4. Set the country name as index - useful for quickly looking up countries using .loc method.

```
[128]: df_usa.set_index('Country', inplace=True)
df_usa.head()
```

```
[128]: Continent Region DevName 1980 1981 \
Country
Afghanistan Asia Southern Asia Less developed regions 722 1881
Albania Europe Southern Europe More developed regions 30 11
Algeria Africa Northern Africa Less developed regions 175 184
American Samoa Oceania Polynesia Less developed regions 0 0
Andorra Europe Southern Europe More developed regions 2 3

1982 1983 1984 1985 1986 ... 2004 2005 2006 2007 \
Country
Afghanistan 1569 2566 3222 2794 2831 ... 2137 4749 3417 1753
Albania 23 22 32 45 53 ... 3840 5947 7914 5737
Algeria 190 201 197 202 183 ... 805 1115 1300 1036
American Samoa 7 7 0 0 0 ... 12 15 28 11
Andorra 2 1 0 0 1 ... 0 0 0 0

2008 2009 2010 2011 2012 2013
Country
Afghanistan 2813 3165 2017 1648 1617 2196
Albania 5754 5137 4711 3612 3364 3186
```

Algeria	1037	1485	1305	1364	1369	1241
American Samoa	14	19	14	0	0	0
Andorra	0	0	0	0	0	0

[5 rows x 37 columns]

Notice how the country names now serve as **indices**.

## 5. Add total column.

```
[149]: df_usa['Total'] = df_usa.sum(axis=1)
df_usa.head()
```

```
[149]:
```

	Continent	Region \
Country		
Total	World	World
Mexico	Latin America and the Caribbean	Central America
Philippines	Asia	South-Eastern Asia
China	Asia	Eastern Asia
India	Asia	Southern Asia

	DevName	1980	1981	1982	1983	1984 \
Country						
Total	World	530639	596600	594131	559763	543903
Mexico	Less developed regions	56680	101268	56106	59079	57557
Philippines	Less developed regions	42316	43772	45102	41546	42768
China	Less developed regions	27651	25803	27100	25777	23363
India	Less developed regions	22607	21522	21738	25451	24964

	1985	1986	...	2005	2006	2007	2008 \
Country			...				
Total	570009	601708	...	1122257	1266129	1052415	1107126
Mexico	61077	66533	...	161445	173749	148640	189989
Philippines	47978	52558	...	60746	74606	72596	54030
China	24787	25106	...	69933	87307	76655	80271
India	26026	26227	...	84680	61369	65353	63352

	2009	2010	2011	2012	2013	Total
Country						
Total	1130818	1042625	1062040	1031631	990553	59092272
Mexico	164920	139120	143446	146406	135028	11887040
Philippines	60029	58173	57011	57327	54446	3488852
China	64238	70863	87016	81784	71798	3108228
India	57304	69162	69013	66434	68458	2930636

[5 rows x 38 columns]

```
[150]: df_usa.drop(df_usa.index[[0]], inplace=True)
df_usa.head()
```

[150]:

		Continent		Region \					
Country									
Mexico	Latin America and the Caribbean			Central America					
Philippines		Asia	South-Eastern Asia						
China		Asia	Eastern Asia						
India		Asia	Southern Asia						
Viet Nam		Asia	South-Eastern Asia						
		DevName	1980	1981	1982	1983	1984	\	
Country									
Mexico	Less developed regions	56680	101268	56106	59079	57557			
Philippines	Less developed regions	42316	43772	45102	41546	42768			
China	Less developed regions	27651	25803	27100	25777	23363			
India	Less developed regions	22607	21522	21738	25451	24964			
Viet Nam	Less developed regions	43483	55631	72553	37560	37236			
		1985	1986	...	2005	2006	2007	2008	2009 \
Country									
Mexico	61077	66533	...	161445	173749	148640	189989	164920	
Philippines	47978	52558	...	60746	74606	72596	54030	60029	
China	24787	25106	...	69933	87307	76655	80271	64238	
India	26026	26227	...	84680	61369	65353	63352	57304	
Viet Nam	31895	29993	...	32784	30691	28691	31497	29234	
		2010	2011	2012	2013	Total			
Country									
Mexico	139120	143446	146406	135028	11887040				
Philippines	58173	57011	57327	54446	3488852				
China	70863	87016	81784	71798	3108228				
India	69162	69013	66434	68458	2930636				
Viet Nam	30632	34157	28304	27101	2468650				

[5 rows x 38 columns]

```
[151]: print('Data dimension: ', df_usa.shape)
```

Data dimension: (220, 38)

The shape above shows 221 rows and 38 columns including the newly added 'Total' column

6. Finally, let's create a list of years from 1980 - 2013. This will come in handy when we start plotting the data

```
[210]: years = list(map(str, range(1980, 2014)))
years
```

```
[210]: ['1980',
        '1981',
        '1982',
```

```
'1983',  
'1984',  
'1985',  
'1986',  
'1987',  
'1988',  
'1989',  
'1990',  
'1991',  
'1992',  
'1993',  
'1994',  
'1995',  
'1996',  
'1997',  
'1998',  
'1999',  
'2000',  
'2001',  
'2002',  
'2003',  
'2004',  
'2005',  
'2006',  
'2007',  
'2008',  
'2009',  
'2010',  
'2011',  
'2012',  
'2013']
```

## 1 Visualizing Data using Matplotlib

```
[153]: %matplotlib inline  
  
import matplotlib as mpl  
import matplotlib.pyplot as plt  
  
mpl.style.use('ggplot')  
  
print('Matplotlib ' + ' version: ', mpl.__version__) # to check the latest  
→version
```

Matplotlib version: 3.0.0

## 2 Area Plots

Top 5 countries that contributed immigrants to the US from 1980 to 2013

```
[154]: df_usa.sort_values(['Total'], ascending=False, axis=0, inplace=True)

df_top5 = df_usa.head()

df_top5 = df_top5[years].transpose()

df_top5.head()
```

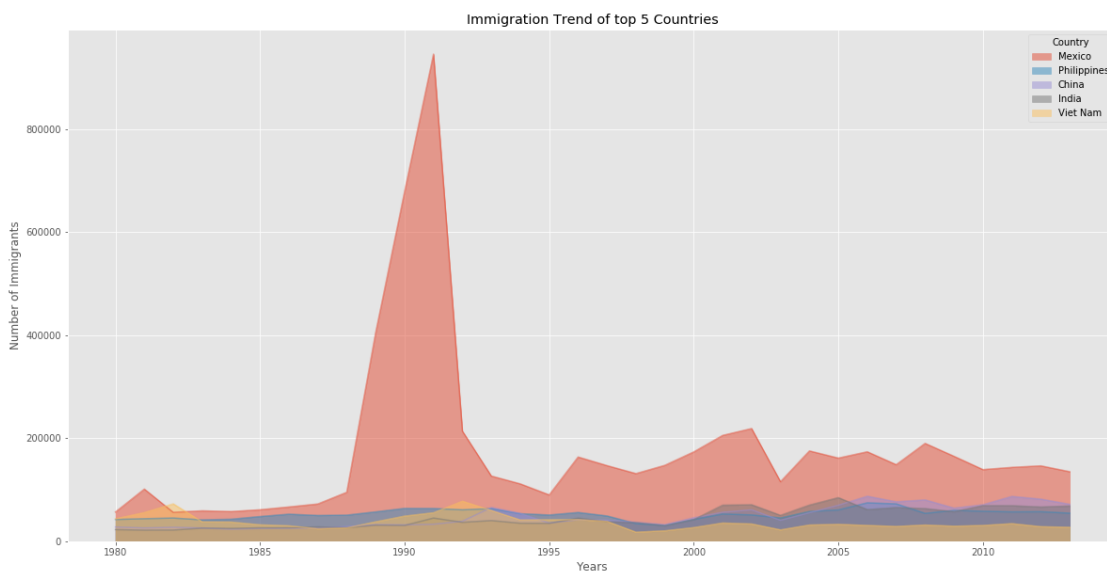
```
[154]: Country  Mexico  Philippines  China  India  Viet Nam
1980      56680      42316   27651   22607    43483
1981     101268     43772   25803   21522    55631
1982      56106     45102   27100   21738    72553
1983      59079     41546   25777   25451    37560
1984      57557     42768   23363   24964    37236
```

### 7. Using the scripting layer (procedural method using matplotlib.pyplot as plt) to plot

```
[155]: df_top5.index = df_top5.index.map(int)
df_top5.plot(kind='area', stacked=False, figsize=(20, 10))

plt.title('Immigration Trend of top 5 Countries')
plt.ylabel('Number of Immigrants')
plt.xlabel('Years')

plt.show()
```

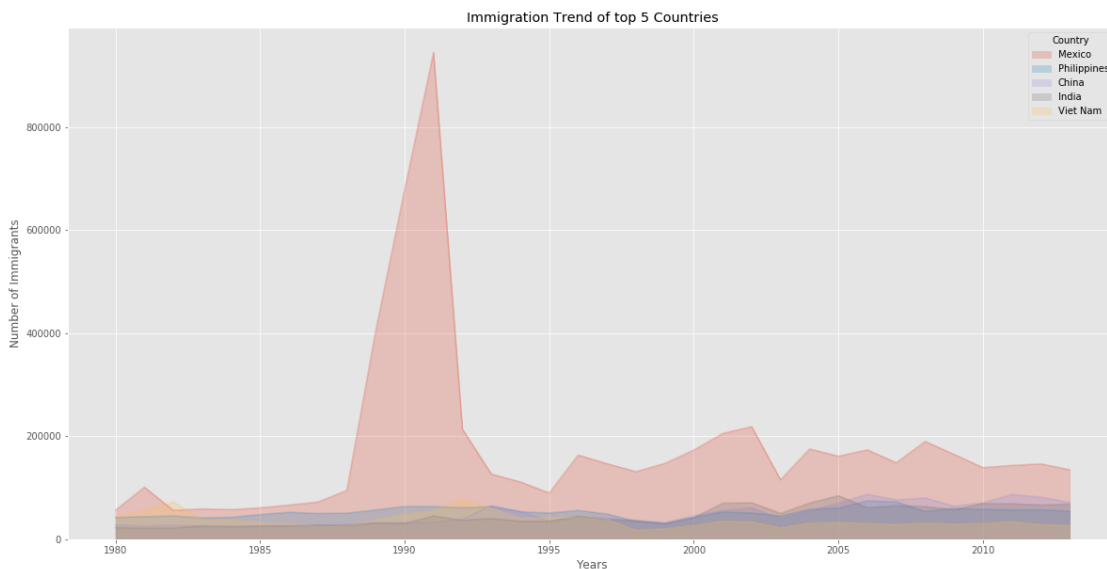


The unstacked plot has a default transparency (alpha value) at 0.5. We can modify this value by passing in the alpha parameter.

```
[156]: df_top5.index = df_top5.index.map(int)
df_top5.plot(kind='area', alpha=0.25, stacked=False, figsize=(20, 10))

plt.title('Immigration Trend of top 5 Countries')
plt.ylabel('Number of Immigrants')
plt.xlabel('Years')

plt.show()
```

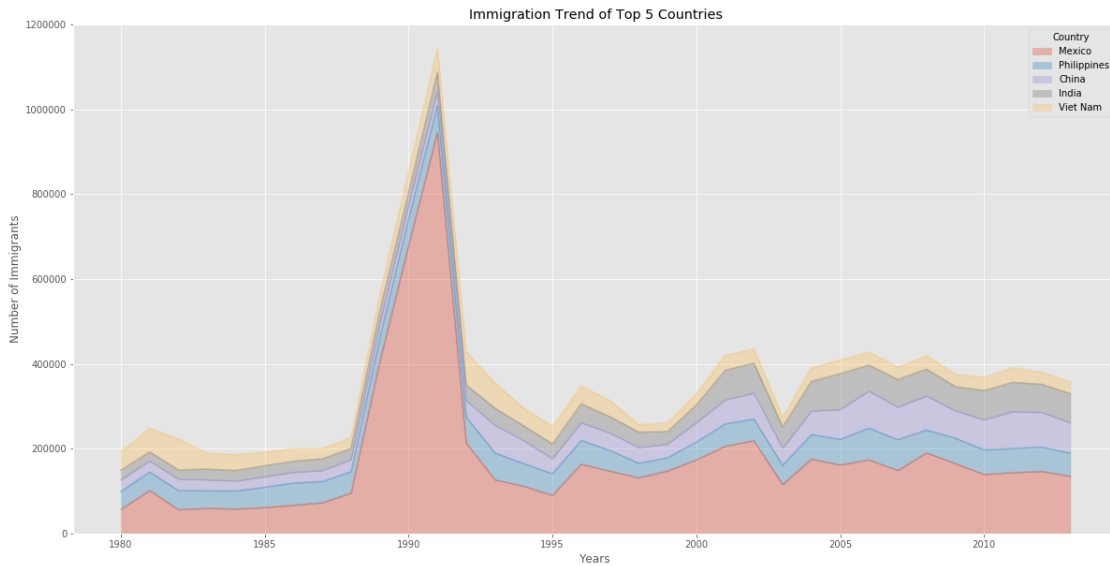


## 7. Plotting using the artist layer (object oriented method using an Axes instance from Matplotlib)

```
[157]: ax = df_top5.plot(kind='area', alpha=0.35, figsize=(20, 10))

ax.set_title('Immigration Trend of Top 5 Countries')
ax.set_ylabel('Number of Immigrants')
ax.set_xlabel('Years')
```

```
[157]: Text(0.5, 0, 'Years')
```



## 8. Countries that contributed the least to immigration to the United States from 1980 to 2013

```
[158]: df_least5 = df_usa.tail(5)

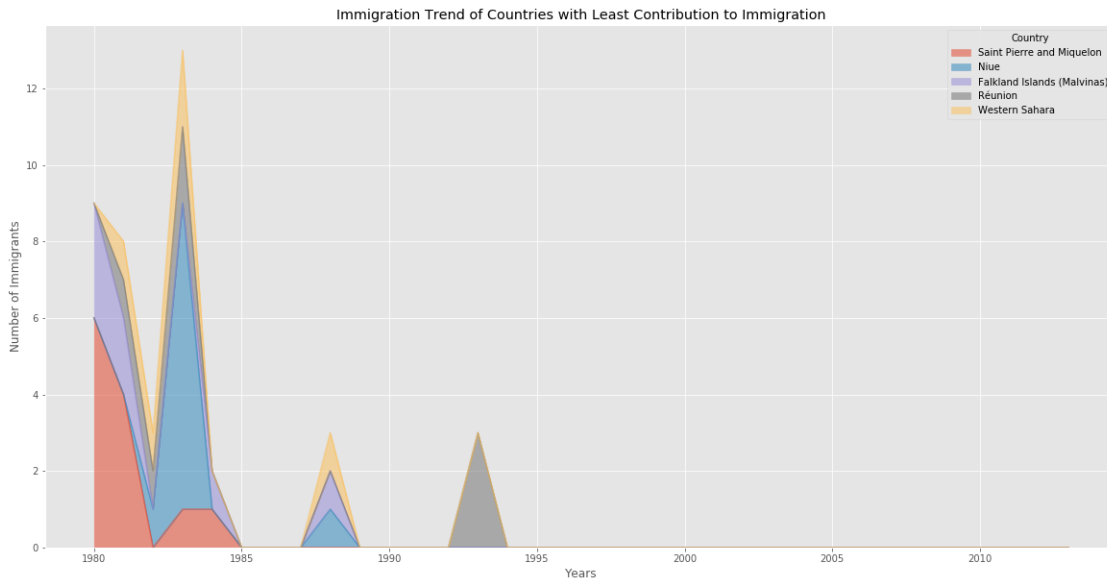
df_least5 = df_least5[years].transpose()

df_least5.index = df_least5.index.map(int)
df_least5.plot(kind='area', alpha=0.55, figsize=(20, 10))

plt.title('Immigration Trend of Countries with Least Contribution to_
→Immigration')
plt.ylabel('Number of Immigrants')
plt.xlabel('Years')

plt.show()
```





## 9. Using the artist layer

```
[159]: df_least5 = df_usa.tail(5)

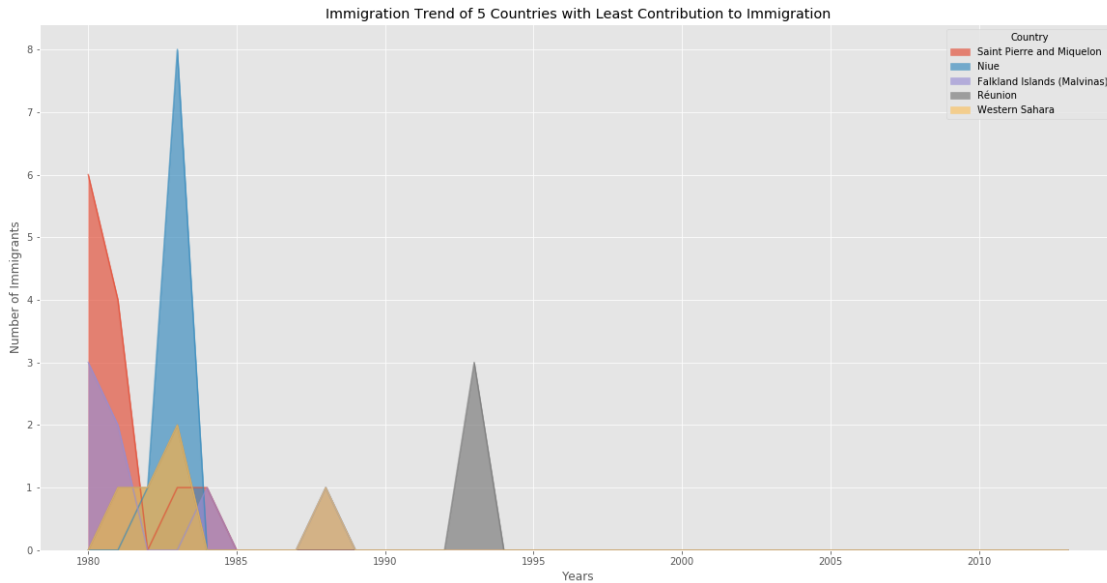
df_least5 = df_least5[years].transpose()
df_least5.head()

df_least5.index = df_least5.index.map(int)

ax = df_least5.plot(kind='area', alpha=0.65, stacked=False, figsize=(20, 10))

ax.set_title('Immigration Trend of 5 Countries with Least Contribution to Immigration')
ax.set_ylabel('Number of Immigrants')
ax.set_xlabel('Years')
```

```
[159]: Text(0.5, 0, 'Years')
```



## 10. What is the frequency distribution of the number (population) of new immigrants from the various countries to the United States in 2013?

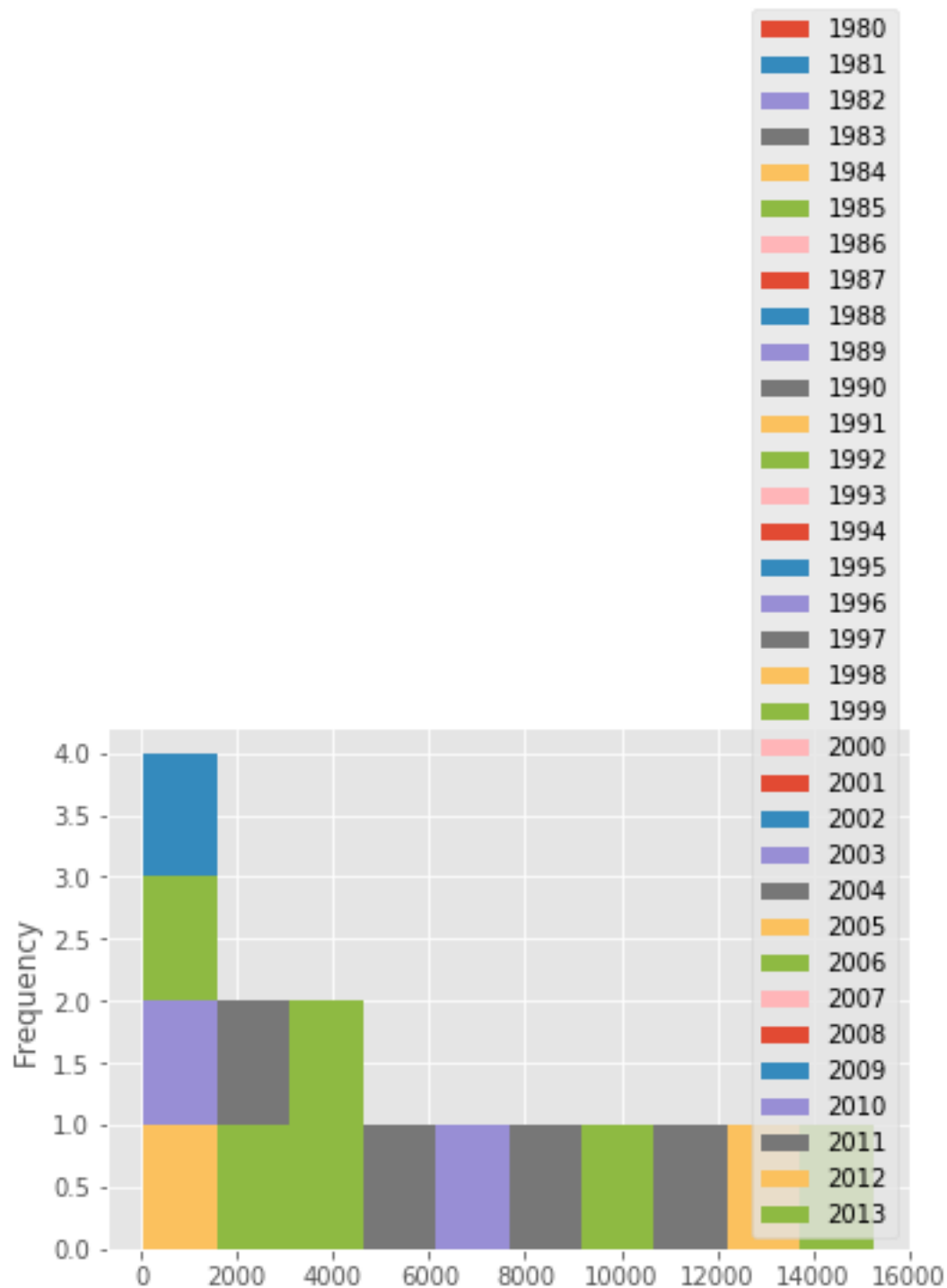
```
[160]: df_usa.loc[['Liberia', 'Ghana', 'Nigeria', 'Cameroon', 'Sierra Leone'], years]
```

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	\
Country											
Liberia	426	556	593	518	585	618	618	622	769	1175	
Ghana	1159	951	824	976	1050	1041	1164	1120	1239	2045	
Nigeria	1896	1918	2257	2354	2337	2846	2976	3278	3343	5213	
Cameroon	65	69	95	92	145	123	130	132	157	187	
Sierra Leone	267	277	283	319	368	371	323	453	571	939	
...		2004	2005	2006	2007	2008	2009	2010	2011		\
Country	...										
Liberia	...	2757	4880	6887	4102	7193	7641	4837	4151		
Ghana	...	5337	6491	9367	7610	8195	8401	7429	8798		
Nigeria	...	9374	10597	13459	12448	12475	15253	13376	11824		
Cameroon	...	1309	1458	2919	3392	3771	3463	4161	4754		
Sierra Leone	...	1596	2731	3572	1999	2795	2687	2011	1985		
	2012	2013									
Country											
Liberia	4109	3334									
Ghana	10592	10265									
Nigeria	13575	13840									
Cameroon	3815	3908									
Sierra Leone	1688	1651									

[5 rows x 34 columns]

```
[161]: df_usa.loc[['Liberia', 'Ghana', 'Nigeria', 'Cameroon', 'Sierra Leone'], years].  
       →plot.hist()
```

[161]: <matplotlib.axes.\_subplots.AxesSubplot at 0x7f1b7379ebe0>



Transpose the above data structure

```
[162]: df_tr = df_usa.loc[['Liberia', 'Ghana', 'Nigeria', 'Cameroon', 'Sierra Leone'],
    →years].transpose()
df_tr.head()
```

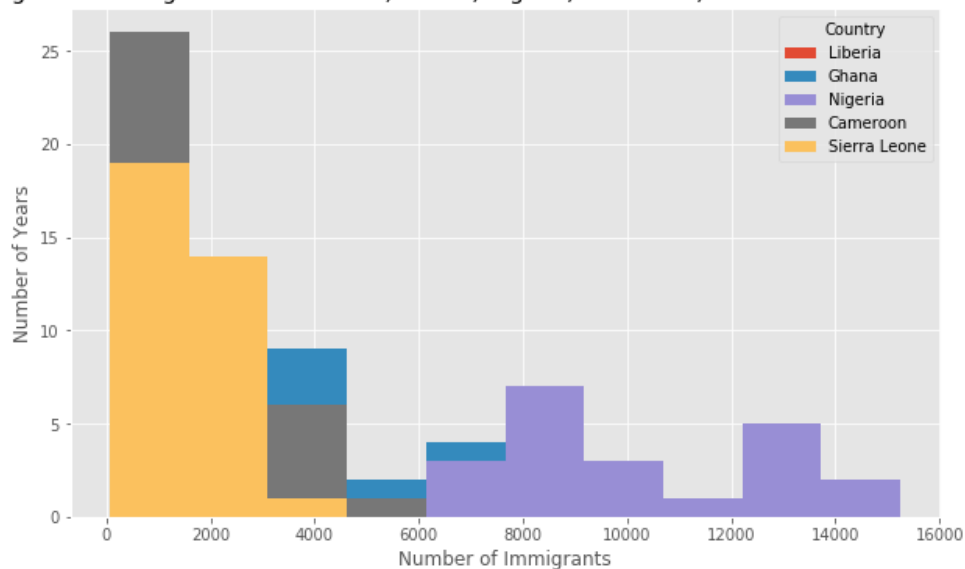
```
[162]: Country Liberia Ghana Nigeria Cameroon Sierra Leone
1980      426  1159   1896      65      267
1981      556   951   1918      69      277
1982      593   824   2257      95      283
1983      518   976   2354      92      319
1984      585  1050   2337     145      368
```

```
[163]: df_tr.plot(kind='hist', figsize=(10, 6))

plt.title('Histogram of Immigration from Liberia, Ghana, Nigeria, Cameroon,
    →Sierra Leone from 1980 - 2013')
plt.ylabel('Number of Years')
plt.xlabel('Number of Immigrants')

plt.show()
```

Histogram of Immigration from Liberia, Ghana, Nigeria, Cameroon, Sierra Leone from 1980 - 2013



## 11. Bar chart

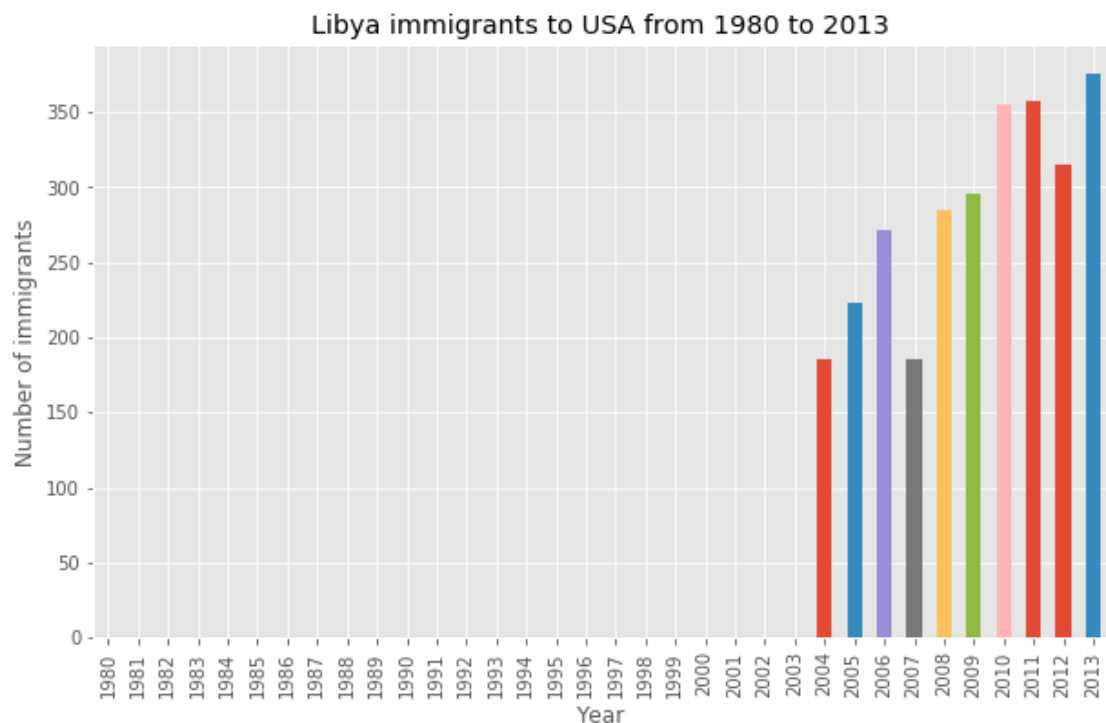
```
[164]: df_libya = df_usa.loc['Libya', years]
df_libya.head()
```

```
[164]: 1980    0
      1981    0
      1982    0
      1983    0
      1984    0
      Name: Libya, dtype: object
```

```
[165]: df_libya.plot(kind='bar', figsize=(10, 6))

plt.xlabel('Year')
plt.ylabel('Number of immigrants')
plt.title('Libya immigrants to USA from 1980 to 2013')

plt.show()
```



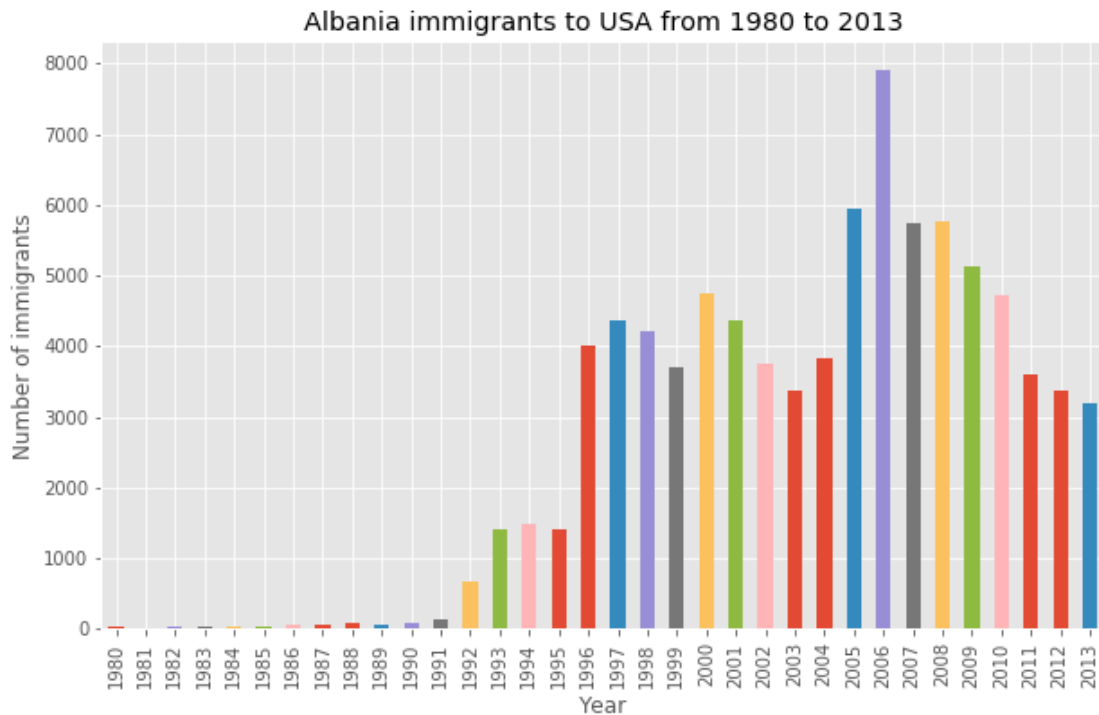
```
[174]: df_albania = df_usa.loc['Albania', years]
      df_albania.head()
```

```
[174]: 1980    30
      1981    11
      1982    23
      1983    22
      1984    32
      Name: Albania, dtype: object
```

```
[175]: df_albania.plot(kind='bar', figsize=(10, 6))

plt.xlabel('Year')
plt.ylabel('Number of immigrants')
plt.title('Albania immigrants to USA from 1980 to 2013')

plt.show()
```



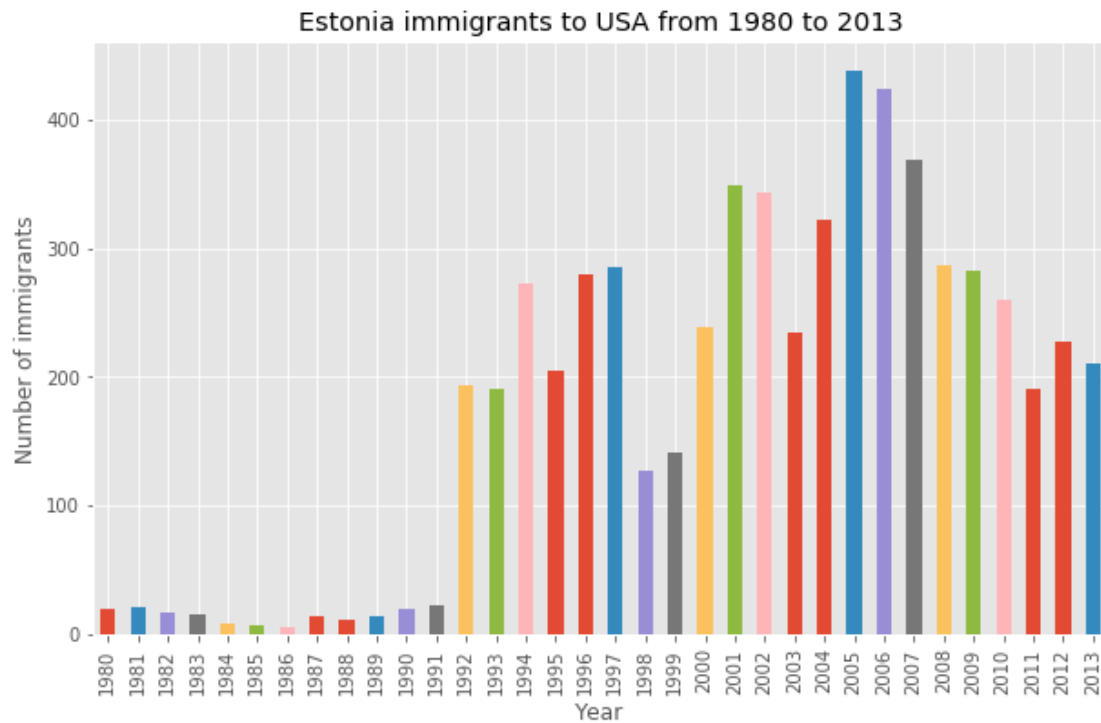
```
[168]: df_estonia = df_usa.loc['Estonia', years]
df_estonia.head()
```

```
[168]: 1980    20
1981    22
1982    17
1983    16
1984     9
Name: Estonia, dtype: object
```

```
[169]: df_estonia.plot(kind='bar', figsize=(10, 6))

plt.xlabel('Year')
plt.ylabel('Number of immigrants')
plt.title('Estonia immigrants to USA from 1980 to 2013')

plt.show()
```



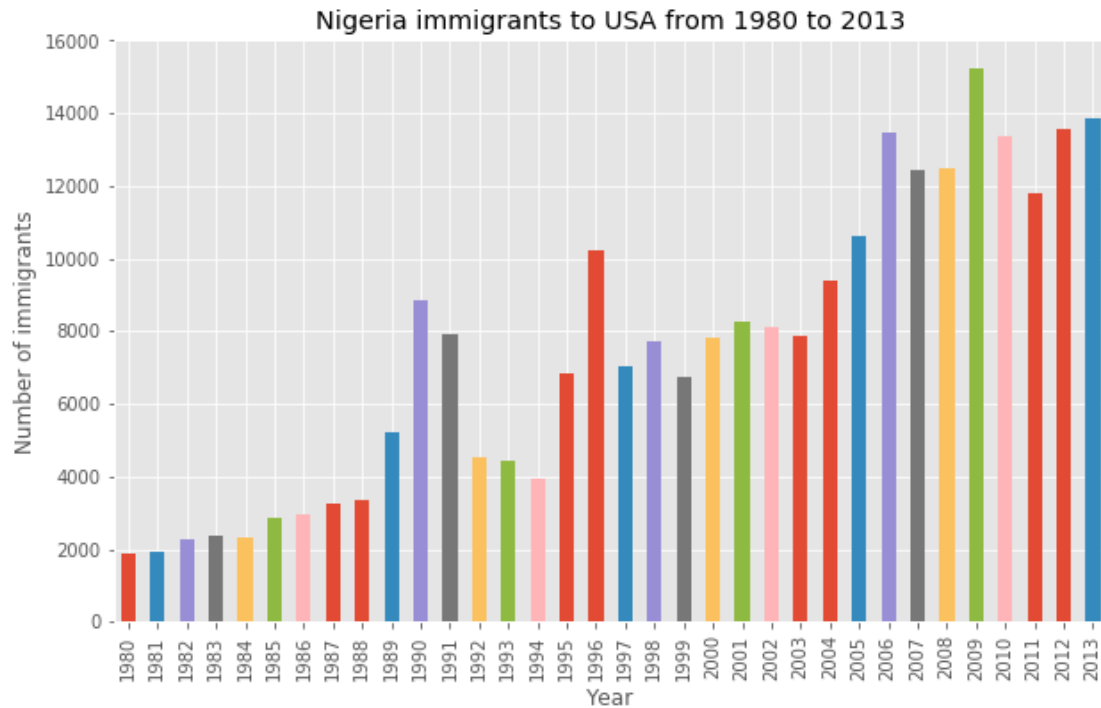
```
[170]: df_nigeria = df_usa.loc['Nigeria', years]
df_nigeria.head()
```

```
[170]: 1980    1896
1981    1918
1982    2257
1983    2354
1984    2337
Name: Nigeria, dtype: object
```

```
[171]: df_nigeria.plot(kind='bar', figsize=(10, 6))

plt.xlabel('Year')
plt.ylabel('Number of immigrants')
plt.title('Nigeria immigrants to USA from 1980 to 2013')

plt.show()
```



```
[172]: df_liberia = df_usa.loc['Liberia', years]
df_liberia.head()
```

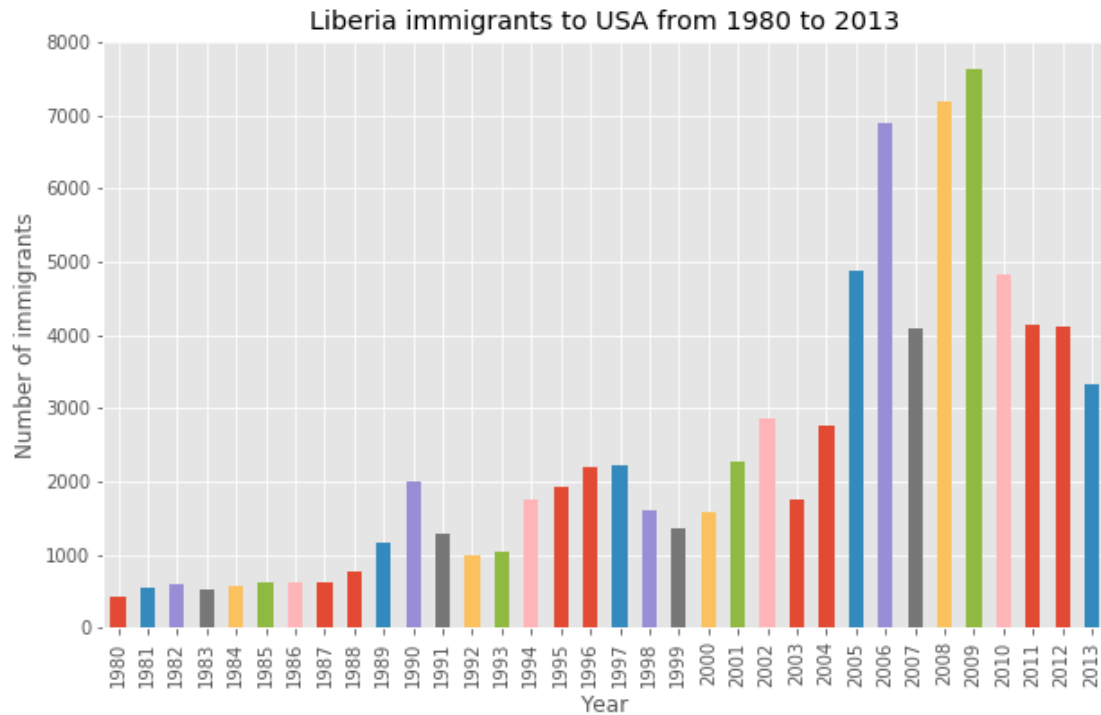
```
[172]: 1980    426
      1981    556
      1982    593
      1983    518
      1984    585
      Name: Liberia, dtype: object
```

```
[173]: df_liberia.plot(kind='bar', figsize=(10, 6))

plt.xlabel('Year')
plt.ylabel('Number of immigrants')
plt.title('Liberia immigrants to USA from 1980 to 2013')

plt.show()
```





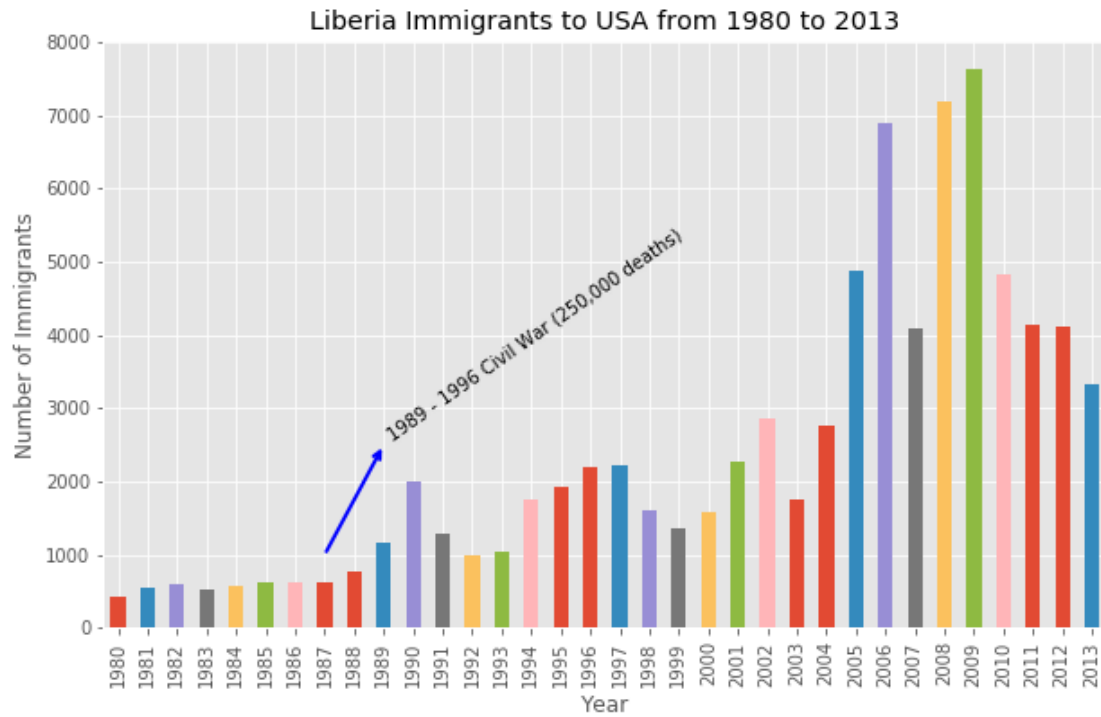
```
[206]: df_liberia.plot(kind='bar', figsize=(10, 6), rot=90)

plt.xlabel('Year')
plt.ylabel('Number of Immigrants')
plt.title('Liberia Immigrants to USA from 1980 to 2013')

# Annotate arrow
plt.annotate('',
             xy=(9, 2500),
             xytext=(7, 1000),
             xycoords='data',
             arrowprops=dict(arrowstyle='->', connectionstyle='arc3',
                             →color='blue', lw=2)
             )

# Annotate Text
plt.annotate('1989 - 1996 Civil War (250,000 deaths)',
             xy=(9, 2500),
             rotation=35,
             va='bottom',
             ha='left',
             )

plt.show()
```



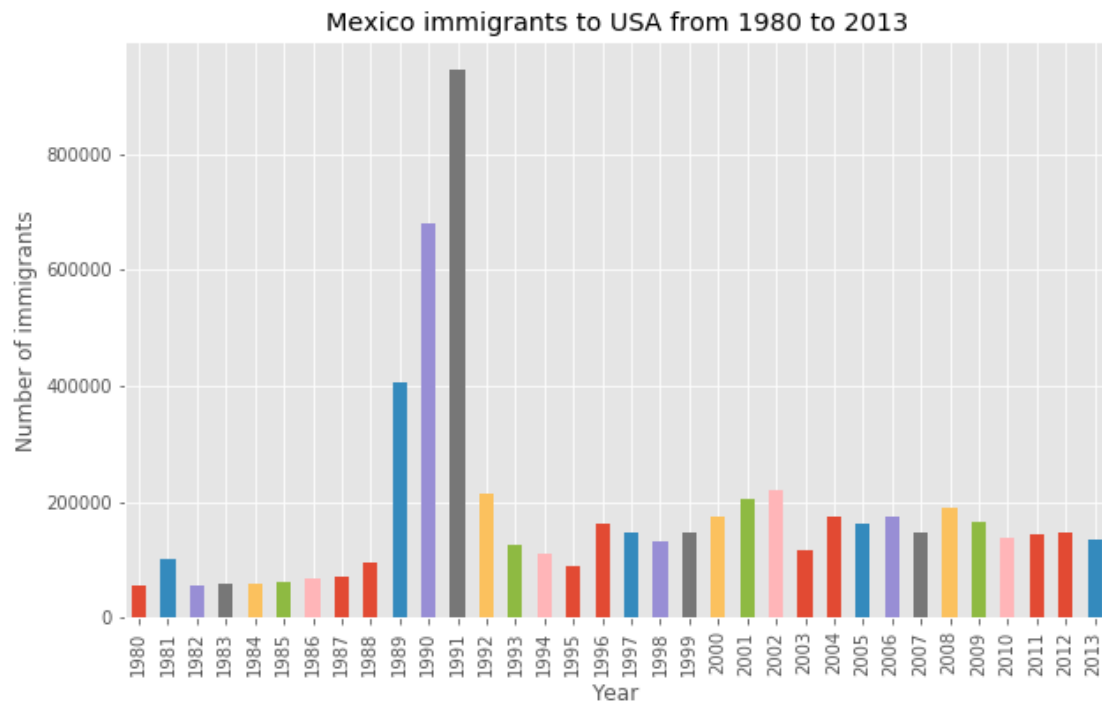
```
[207]: df_mexico = df_usa.loc['Mexico', years]
df_mexico.head()
```

```
[207]: 1980      56680
1981     101268
1982      56106
1983      59079
1984      57557
Name: Mexico, dtype: object
```

```
[208]: df_mexico.plot(kind='bar', figsize=(10, 6))

plt.xlabel('Year')
plt.ylabel('Number of immigrants')
plt.title('Mexico immigrants to USA from 1980 to 2013')

plt.show()
```



[ ]: