

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from pylab import mpl
mpl.rcParams['font.sans-serif'] = ['SimHei']
mpl.rcParams['axes.unicode_minus'] = False

S = pd.read_excel(r'C:\Users\jzc05\OneDrive\Desktop\腾讯控股.xlsx', header = 0, sheet_name = 0, index_col = 0)
S.describe()
```

Out[1]:

腾讯控股	
count	1147.000000
mean	261.111334
std	101.799082
min	112.800000
25%	158.150000
50%	244.800000
75%	349.800000
max	474.600000

In [2]:

S.tail()

Out[2]:

腾讯控股	
日期	
2019-08-26 00:00:00	326.0
2019-08-27 00:00:00	326.2
2019-08-28 00:00:00	319.0
2019-08-29 00:00:00	320.2
2019-08-30 00:00:00	324.8

In [7]:

```
R = np.log(S['腾讯控股'] / S['腾讯控股'].shift(1))  
R = R.dropna()  
R
```

Out[7]:

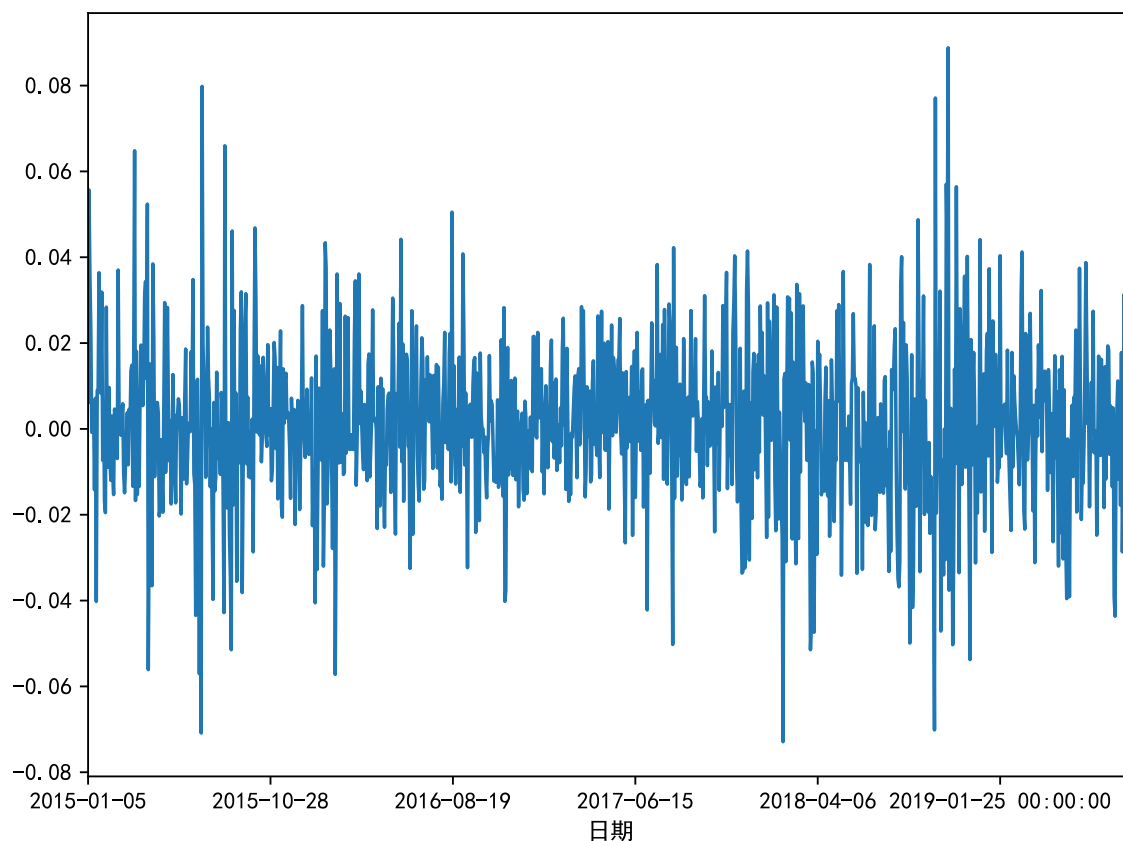
```
日期  
2015-01-05          0.006186  
2015-01-06          0.055689  
2015-01-07          0.036010  
2015-01-08          0.023044  
2015-01-09         -0.000786  
...  
2019-08-26 00:00:00 -0.024842  
2019-08-27 00:00:00  0.000613  
2019-08-28 00:00:00 -0.022320  
2019-08-29 00:00:00  0.003755  
2019-08-30 00:00:00  0.014264  
Name: 腾讯控股, Length: 1146, dtype: float64
```

In [40]:

```
R.plot(figsize = (8, 6))
```

Out[40]:

<matplotlib.axes._subplots.AxesSubplot at 0x1e8efe2c8c8>



In [16]:

```
mu = np.mean(R) * 252
sigma = np.std(R) * np.sqrt(252)
print('The expected annual return is: ', round(mu, 4))
print('The annual vol is: ', round(sigma,4))
```

The expected annual return is: 0.2326

The annual vol is: 0.2926

In [36]:

```

import numpy.random as npr
date = pd.DatetimeIndex(start = '2015-01-02', end = '2019-08-30', freq = 'B')
N = len(date)
I = 10dt = 1.0 / 252
mu = np.array(mu)
sigma = np.array(sigma)
S_GBM = np.zeros((N, I))
S_GBM[0] = 112.8
#S_GBM[0] is already set
for t in range(1,N):
    epsilon = npr.standard_normal(I)
    S_GBM[t] = S_GBM[t - 1] * np.exp((mu - 0.5 * sigma ** 2) * dt + sigma * epsilon * n
p.sqrt(dt))
S_GBM = pd.DataFrame(S_GBM, index = date)
S_GBM

```

C:\Users\jzc05\AppData\Local\Programs\Python\Python37\lib\site-packages\ipykernel_launcher.py:2: FutureWarning: Creating a DatetimeIndex by passing range endpoints is deprecated. Use `pandas.date_range` instead.

Out[36]:

	0	1	2	3	4	5	6
2015-01-02	112.800000	112.800000	112.800000	112.800000	112.800000	112.800000	112.800000
2015-01-05	111.607261	113.241254	115.759169	113.522305	110.894163	113.603985	109.105637
2015-01-06	112.030071	113.468772	116.731750	112.434894	110.523836	111.678902	111.351205
2015-01-07	109.847411	114.989672	117.852546	111.822059	112.999170	108.445400	109.863757
2015-01-08	107.266852	114.647709	116.701844	112.647551	110.223685	111.443696	108.467196
...
2019-08-26	109.231579	301.430742	356.408429	153.406777	159.524390	203.796624	74.228929
2019-08-27	108.482187	297.940520	362.861303	148.201707	158.752237	204.352533	75.130920
2019-08-28	105.450199	284.205504	361.989691	147.997168	161.502114	203.882724	71.985875
2019-08-29	105.997105	284.059481	358.996890	147.195876	164.345912	209.083628	72.390362
2019-08-30	106.090800	283.205033	350.498006	148.814536	167.714824	207.576667	72.082661

1216 rows × 10 columns

In [42]:

```
plt.figure(figsize = (8, 6))
plt.plot(S_GBM.iloc[:, 0 : 10])
plt.xlabel(u'日期', fontsize = 13)
plt.ylabel(u'股价', fontsize = 13, rotation = 0)
plt.xticks(fontsize = 13, rotation = 30)
plt.yticks(fontsize = 13)
plt.title(u"服从几何布朗运动的腾讯股价模拟前十条路径(2015-2018年)", fontsize = 13)
plt.grid("True")
plt.show()
```

