Series/DataFrame/GroupBy

pct_change() (Percentage change) 百分比变化

- periods: 偏移量
- freq: 频率(时间索引)
    i. "D", "W", "M", "MS", "B"
    ii. DateOffset, Timedelta
- limit: 最多连续填充空值个数

```
20  import pandas as pd
```

```
21  s = pd.Series([1,2,3,4])
    s
```

```
21  0    1
    1    2
    2    3
    3    4
    dtype: int64
```

```
23  s.pct_change()
```

```
23  0         NaN
    1    1.000000
    2    0.500000
    3    0.333333
    dtype: float64
```

```
24  s.pct_change(periods=2)
```

```
24  0    NaN
    1    NaN
    2    2.0
    3    1.0
    dtype: float64
```

```
25  s = pd.Series([1,2,None,None,3,4])
    s
```

```
25  0    1.0
    1    2.0
    2    NaN
    3    NaN
    4    3.0
    5    4.0
    dtype: float64
```

```
26  s.pct_change(limit=1)
```

```
26  0         NaN
    1    1.000000
    2    0.000000
    3         NaN
    4         NaN
    5    0.333333
    dtype: float64
```

```
    s.pct_change(limit=2)
```

27

```
0         NaN
1    1.000000
2    0.000000
3    0.000000
4    0.500000
5    0.333333
dtype: float64
```

28

```
index = pd.date_range(
    '20200101',
    '20200131',
    freq='D'
)
index
```

```
DatetimeIndex(['2020-01-01', '2020-01-02', '2020-01-03', '2020-01-04',
               '2020-01-05', '2020-01-06', '2020-01-07', '2020-01-08',
               '2020-01-09', '2020-01-10', '2020-01-11', '2020-01-12',
               '2020-01-13', '2020-01-14', '2020-01-15', '2020-01-16',
               '2020-01-17', '2020-01-18', '2020-01-19', '2020-01-20',
               '2020-01-21', '2020-01-22', '2020-01-23', '2020-01-24',
               '2020-01-25', '2020-01-26', '2020-01-27', '2020-01-28',
               '2020-01-29', '2020-01-30', '2020-01-31'],
              dtype='datetime64[ns]', freq='D')
```

29

```
df = pd.DataFrame({
    'A': range(1, len(index)+1)
}, index=index)
df
```

	A
2020-01-01	1
2020-01-02	2
2020-01-03	3
2020-01-04	4
2020-01-05	5
2020-01-06	6
2020-01-07	7
2020-01-08	8
2020-01-09	9
2020-01-10	10
2020-01-11	11
2020-01-12	12
2020-01-13	13
2020-01-14	14
2020-01-15	15
2020-01-16	16

	A
2020-01-17	17
2020-01-18	18
2020-01-19	19
2020-01-20	20
2020-01-21	21
2020-01-22	22
2020-01-23	23
2020-01-24	24
2020-01-25	25
2020-01-26	26
2020-01-27	27
2020-01-28	28
2020-01-29	29
2020-01-30	30
2020-01-31	31

32

```
df['B'] = df['A'].pct_change(
    freq='7D'
)
df
```

32

	A	B
2020-01-01	1	NaN
2020-01-02	2	NaN
2020-01-03	3	NaN
2020-01-04	4	NaN
2020-01-05	5	NaN
2020-01-06	6	NaN
2020-01-07	7	NaN
2020-01-08	8	7.000000
2020-01-09	9	3.500000
2020-01-10	10	2.333333
2020-01-11	11	1.750000
2020-01-12	12	1.400000
2020-01-13	13	1.166667

	A	B
2020-01-14	14	1.000000
2020-01-15	15	0.875000
2020-01-16	16	0.777778
2020-01-17	17	0.700000
2020-01-18	18	0.636364
2020-01-19	19	0.583333
2020-01-20	20	0.538462
2020-01-21	21	0.500000
2020-01-22	22	0.466667
2020-01-23	23	0.437500
2020-01-24	24	0.411765
2020-01-25	25	0.388889
2020-01-26	26	0.368421
2020-01-27	27	0.350000
2020-01-28	28	0.333333
2020-01-29	29	0.318182
2020-01-30	30	0.304348
2020-01-31	31	0.291667

33
```
df['B'] = df['A'].pct_change(
    freq='B'
)
df
```

33

	A	B
2020-01-01	1	NaN
2020-01-02	2	1.000000
2020-01-03	3	0.500000
2020-01-04	4	NaN
2020-01-05	5	NaN
2020-01-06	6	1.000000
2020-01-07	7	0.166667
2020-01-08	8	0.142857
2020-01-09	9	0.125000
2020-01-10	10	0.111111

	A	B
2020-01-11	11	NaN
2020-01-12	12	NaN
2020-01-13	13	0.300000
2020-01-14	14	0.076923
2020-01-15	15	0.071429
2020-01-16	16	0.066667
2020-01-17	17	0.062500
2020-01-18	18	NaN
2020-01-19	19	NaN
2020-01-20	20	0.176471
2020-01-21	21	0.050000
2020-01-22	22	0.047619
2020-01-23	23	0.045455
2020-01-24	24	0.043478
2020-01-25	25	NaN
2020-01-26	26	NaN
2020-01-27	27	0.125000
2020-01-28	28	0.037037
2020-01-29	29	0.035714
2020-01-30	30	0.034483
2020-01-31	31	0.033333