



TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LTD

NYSE:TSM

Team Members

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About TSM

\$68.56

↓ 1.08%

-0.75 Today

After hours: \$68.60 (↑ 0.058%) +0.040

Closed: 30 Sept, 18:16:57 GMT-4 · USD · NYSE · Disclaimer

- **Taiwan Semiconductor Manufacturing Co., Ltd.** (NYSE -TSM) engages in the manufacture and sale of integrated circuits and wafer semiconductor devices. It was founded in 1987 as a joint venture of Philips, the government of Taiwan, and private investors
- TSM is the First Taiwan Company to be listed on NYSE on **October 8, 1997**(9:30am New York time)
- The foundry leader has an illustrious **customer base**, including **Apple, AMD and Nvidia**



Stock Fact Sheet

Stock Information

Market Cap USD 345.18 billion

Share Outstanding 5.19 billion

52 Weeks Range
USD 67.760 - USD 128.660

Average Volume 10.63 million



History



- Since 1994, TSMC has had a compound annual growth rate (CAGR) of 17.4% in revenue and a CAGR of 16.1% in earnings.
- The image below shows the Stock Split History of TSMC

Date	Ratio
Jul. 15, 2009	1:1
Jul. 16, 2008	1:1
Jun. 08, 2007	1:1
Jun. 20, 2006	1:1
Jun. 13, 2005	1.1:1
Jun. 14, 2004	1.1:1
Jul. 07, 2003	1.1:1
Jun. 19, 2002	1.1:1
Jun. 26, 2001	1.4:1
May 15, 2000	1.3:1
Aug. 16, 1999	1.2:1
Aug. 26, 1998	1.5:1

News

- TSMC has acquired 1 company. It has also divested 1 asset. TSMC's **largest** acquisition to date was in **2000**, when it acquired **WaferTech** for \$350M. TSMC has acquired in 1 US state. The Company's most targeted sectors include semiconductors(100%).
- The largest catalyst to TSMC's growth during covid actually occurred in **July 2020**, when **Intel** announced that they had to delay their 7nm chip due to production problems. These consequences of Intel's announcement caused a huge boost to TSMC's share price, from **\$67 to \$83** within two days of the announcement, a **62%** increase.



- **Taiwan Semiconductor Manufacturing Company Ltd. (TSM) is Attracting Investor Attention:**

For the current quarter, TSMC is expected to post earnings of \$1.67 per share, indicating a change of +54.6% from the year-ago quarter. For the current fiscal year, the consensus earnings estimate of \$6.21 points to a change of +50.7% from the prior year. For the next fiscal year, the consensus earnings estimate of \$6.44 indicates a change of +3.6% from what TSMC is expected to report a year ago.

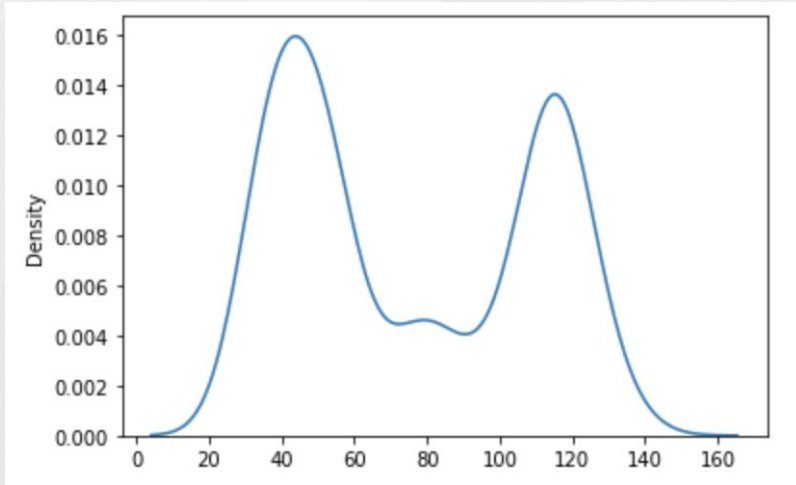
When the earnings estimates for a company goes up, the fair value for its stock goes up as well. And when a stock's fair value is higher than its current market price, investors tend to buy the stock, resulting in its price moving upward.

- Taiwan Semiconductor Manufacturing revenue for the quarter ending June 30, 2022 was \$18.161B, a 36.33% increase year-over-year.

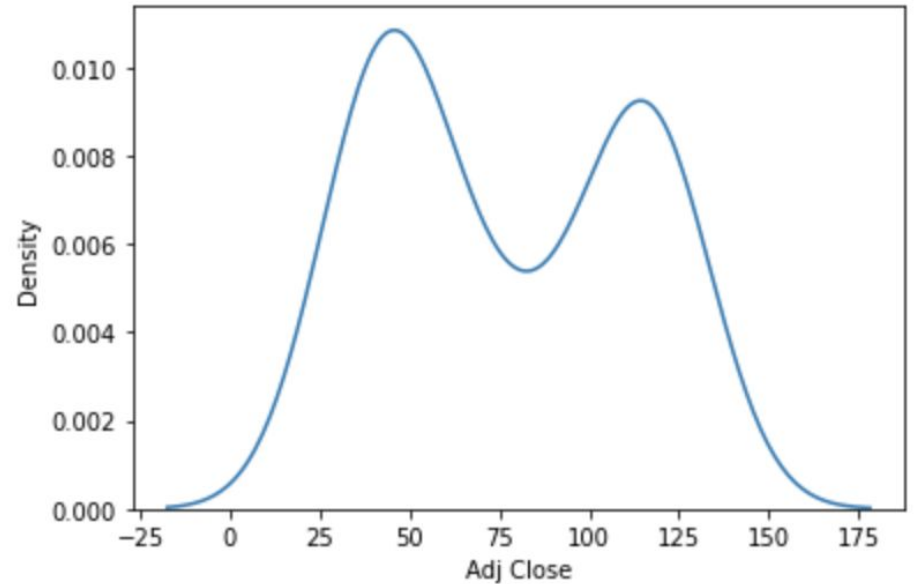
Stock Distribution

- TSM stock price modelling
- Timeframe - 1st January, 2019 to 4th February, 2022

Distribution:



After smoothing:



Preliminary Mixture Modelling

- TSM stock price modelling
- Timeframe - 1st January, 2019 to 4th February, 2022

Low peak:

Mean = 118;

Sigma1 = 121;

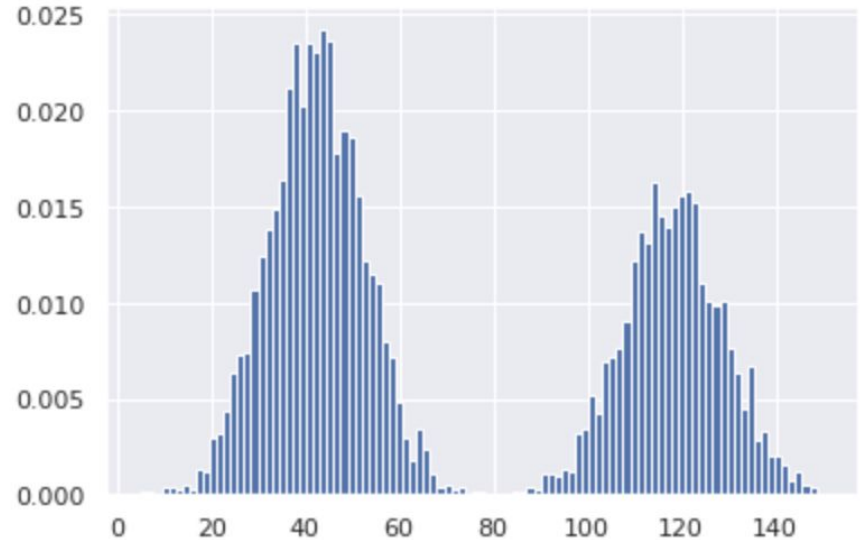
Range - (80, 150)

High peak:

Mean = 42;

Sigma2 = 100;

Range - (5, 80)

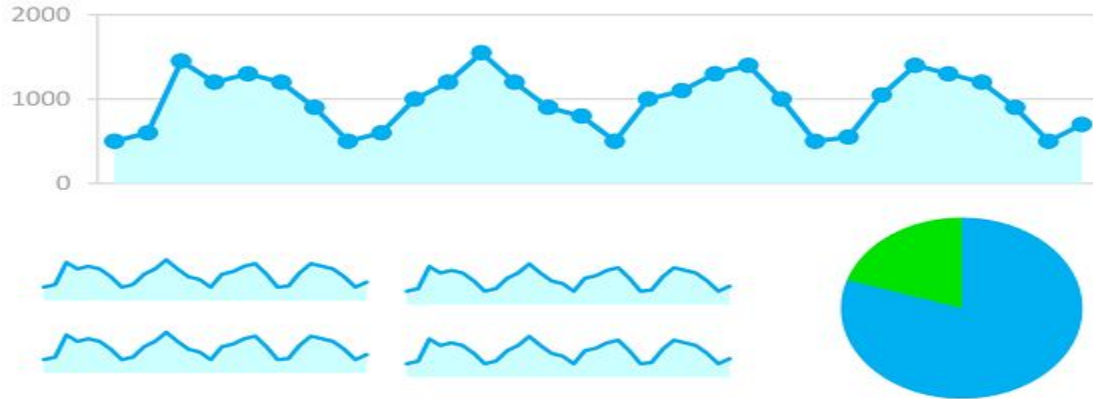


Estimation from mean and std deviation

EDA

Colab link:

<https://colab.research.google.com/drive/1iqgVwADIB556pZaVtyQFN1QfefdH0Rk8?usp=sharing>



Kalman Filter

- Kalman Filter model is used to forecast market prices [Parameter Estimation]
- Uses time varying mean and volatility
- Used to correct the noisy time-series data
- The general process for a Kalman Filter model involves two steps:
 1. Prediction step
 2. Correction/Updation step

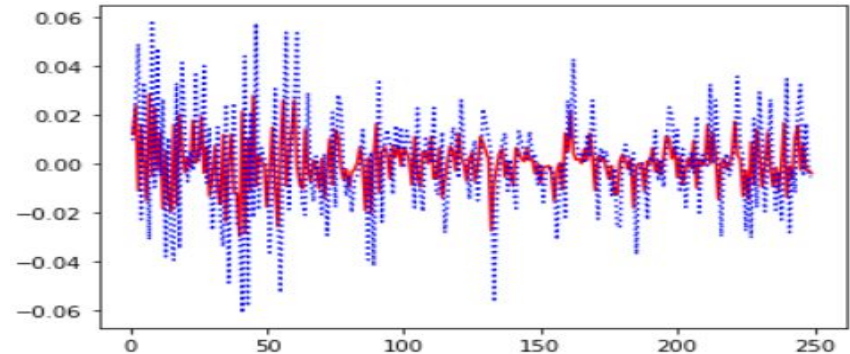
[Colab Python File](#)

State Equation

$$\alpha_{t+1} = \alpha_t + \eta_t \quad \eta_t \sim N(0, \sigma_\eta^2)$$

Observation (or Measurement) Equation

$$y_t = \alpha_t + \varepsilon_t \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2)$$



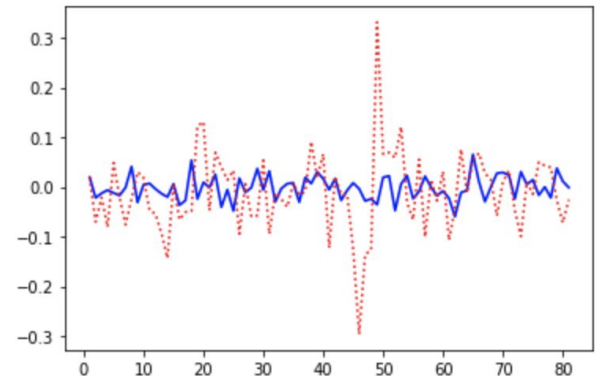


GARCH

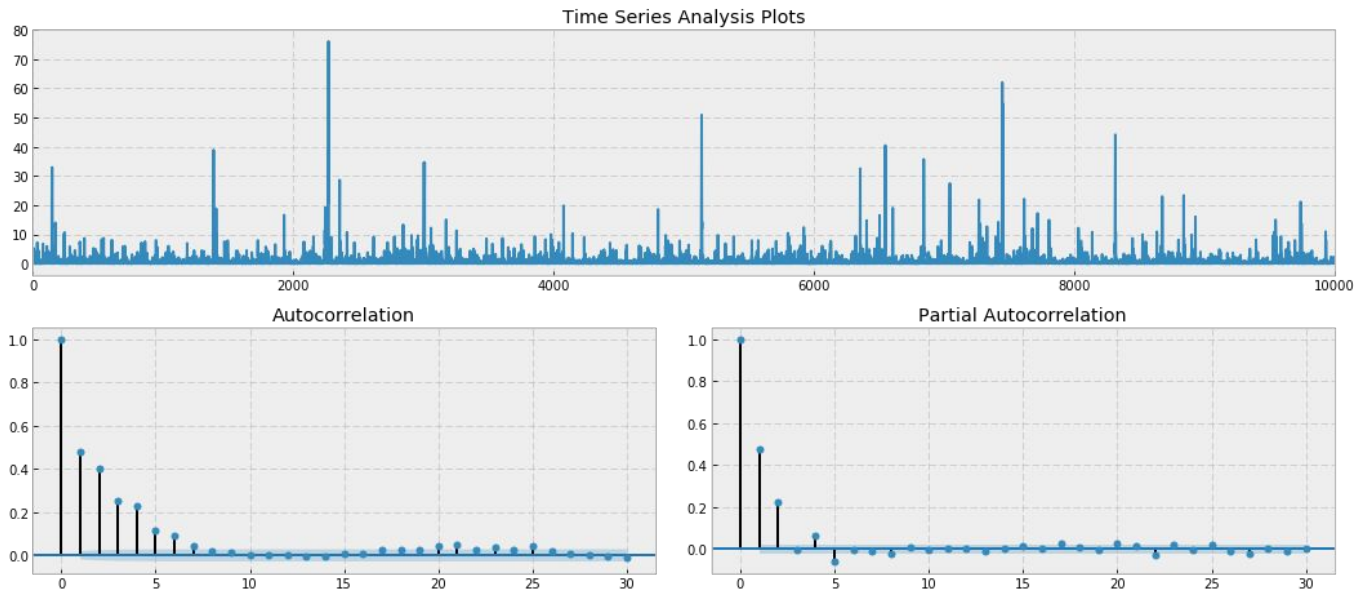
- The generalized autoregressive conditional heteroskedasticity (GARCH) process is an approach to estimating the volatility of financial markets
- Used in analyzing time-series data where the variance error is believed to be serially auto-correlated
- AutoRegressive component (past returns)
- Moving Average component
- Parameters -
 - alpha (how volatility reacts to new information)
 - beta(persistence of volatility)
 - Omega (constant coefficient of variance equation)
- The general process for a GARCH model involves three steps:
 1. Estimate a best-fitting autoregressive model
 2. Compute to autocorrelations of the error term
 3. Test for significance

Analysis for 4 months:

<https://colab.research.google.com/drive/17SeVIIZeDC5WFLF3KuH6ygRV1MBaJ3ta?usp=sharing>



GARCH Modelling Process



- The popular GARCH(1,1) model is defined by

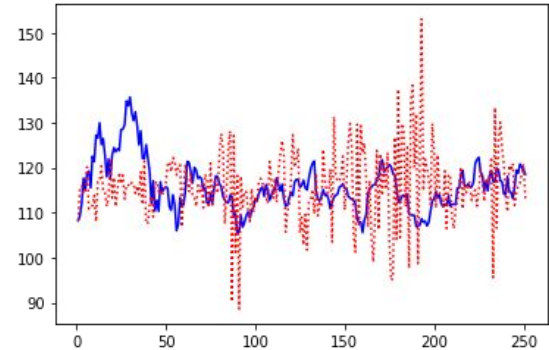
$$\sigma_t^2 = \omega + \alpha_1 \epsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2.$$

For σ_t^2 to be non-negative we require the coefficients to be non-negative.

GARCH - T

- GARCH student's T is similar to GARCH Model except, this model allows inference through small samples.
- This looks like normal distribution but has fatter tails, which allows higher dispersion of variables since there is more uncertainty in real-time.
- Major difference between both models comes from degrees of freedom; Here we have n-1 degrees of freedom because sample standard deviation itself is a random variable which we are calculating.
- Formula used:

$$t_{n-1,\alpha} = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$



<https://colab.research.google.com/drive/1JuLBF3ggCS0TtyLVSulphWW5atRg6vPW?usp=sharing>