**Strategy – Pair Trading - Copula**

Archimedean Copula

An Archimedean Copula with a strict generator has the form :

Kendall’s Tau

The Relation between Copula generation function and Kendall rank correlation tau

Proof:

(1)

Note that

(2)

Where

(3)

By the substitution ,   
Then the Jocobian

Then

For more details, please refer to “The Joy of Copulas : Bivariate Distribution with Uniform Marginals” written by Christian Genest and Jock MacKay

Copula Strategy

Step 1 : Selecting the Paired Stocks

(1)Selecting (Fundamentally) related pairs

(2)Filter the trading pair with statistical correlation  
Graphical user interface

Description automatically generated with low confidence

Finding the Kendall Rank Correlation of the Pairs’ log-return (Using the SciPy Stat Functions : kendalltau)

Selecting the pair with highest Kendall’s tau

Step 2 : Estimating Marginal Distributions of log-return ()  
Using the Empirical distribution (Using statsmodel library : ECDF)

Step 3 : Estimating Copula Parameters  
-Clayton Copula  
Generator Function :

-Gumbel Copula  
Generator Function :

-Frank Copula  
Generator Function :

Step 4 : Selecting the Best Fitting Copula  
By AIC

|  |  |
| --- | --- |
| Copula | Copula density |
| Clayton |  |
| Gumbel Copula |  |
| Frank Copula |  |

Step 5 : Generating the Trading Signals

Basic Idea  
We execute the pair trade when the following case (similar as u , v swap) since such probability show the high likelihood of reversing motion

In other words

Long X short Y when   
Short X Long Y when

The Marginal CDF of different Copula

|  |  |
| --- | --- |
| Copula | Marginal CDF |
| Clayton |  |
| Gumbel Copula |  |
| Frank Copula |  |

Background:  
Training Formation Period : 5 years (2016 - 2021)  
Rolling Formation Period : 1 year

We would use Rolling 1 year data to estimate (1) ,(2) Empirical CDF ,(3) selecting the best fitting Copula  
We would update it at the beginning of each month (Step 1 to 4)  
We would fit the daily data every day for the selected pair and check whether the trading signal is generated