

# The points of conjunction in Europe

Soumadeep Ghosh

Kolkata, India

## Abstract

In this paper, I describe the points of conjunction in Europe.  
The paper ends with "The End"

## Introduction

A **stock** is a good example of a risky asset. A **stock index** is a well-diversified portfolio of stocks that **usually** has a long-term trend. Most European nations have national stock exchange(s), often with a **blue-chip stock index**. Using data from these indices, namely, the European STOXX 600 and the indices of the major European nations of Austria, Brussels, Danmark, France, Germany, Greece, Italy, Russia, Spanish, Switzerland, the Netherlands, the United Kingdom and Turkey respectively, the points of conjunction in Europe can be recognized.  
In this paper, I describe the points of conjunction in Europe.

## The mathematical framework

For  $n$  stock indices, there are  $\frac{n(n-1)}{2}$  ordered pairs of stock indices. Each of them can be permuted in exactly 2 ways, to obtain a total of  $n(n-1)$  **scatter-plots**, each of 2 stock indices.

We can **fit a quadratic curve** in each of those  $n(n-1)$  scatter-plots. Then, the 2 quadratic curves of each ordered pair of stock indices can be **solved**, and if the solutions are **doubly positive** (i.e. both co-ordinates are positive), then we obtain the **points of conjunction**.

## Data

Data from 2003 to 2023 on the annual closing price was obtained from **Wikipedia** for the following stock indices:

1. The European STOXX 600 ([https://en.wikipedia.org/wiki/STOXX\\_Europe\\_600](https://en.wikipedia.org/wiki/STOXX_Europe_600))
2. The Netherlands' AEX 25 ([https://en.wikipedia.org/wiki/AEX\\_index](https://en.wikipedia.org/wiki/AEX_index))
3. The Greek ASE 60 ([https://en.wikipedia.org/wiki/Athens\\_Exchange](https://en.wikipedia.org/wiki/Athens_Exchange))
4. The Austrian ATX 20 ([https://en.wikipedia.org/wiki/Austrian\\_Traded\\_Index](https://en.wikipedia.org/wiki/Austrian_Traded_Index))
5. The Brussels' BEL 20 ([https://en.wikipedia.org/wiki/BEL\\_20](https://en.wikipedia.org/wiki/BEL_20))
6. The Turkish BIST 100 ([https://en.wikipedia.org/wiki/BIST\\_100](https://en.wikipedia.org/wiki/BIST_100))
7. The French CAC 40 ([https://en.wikipedia.org/wiki/CAC\\_40](https://en.wikipedia.org/wiki/CAC_40))
8. The German DAX 40 (<https://en.wikipedia.org/wiki/DAX>)

9. The British FTSE 100 ([https://en.wikipedia.org/wiki/FTSE\\_100\\_Index](https://en.wikipedia.org/wiki/FTSE_100_Index))
10. The Spanish IBEX 35 ([https://en.wikipedia.org/wiki/IBEX\\_35](https://en.wikipedia.org/wiki/IBEX_35))
11. The Italian MIB 40 ([https://en.wikipedia.org/wiki/FTSE\\_MIB](https://en.wikipedia.org/wiki/FTSE_MIB))
12. The Danish OMXC 25 ([https://en.wikipedia.org/wiki/OMX\\_Copenhagen\\_25](https://en.wikipedia.org/wiki/OMX_Copenhagen_25))
13. The Russian RTSI 50 ([https://en.wikipedia.org/wiki/RTS\\_Index](https://en.wikipedia.org/wiki/RTS_Index))
14. The Swiss SMI 20 ([https://en.wikipedia.org/wiki/Swiss\\_Market\\_Index](https://en.wikipedia.org/wiki/Swiss_Market_Index))

The data is available as a CSV file at <https://t.ly/A7MrV>.

## Methodology

First, we standardize the 14 indices listed above by taking only that time-frame that's common to all the indices. Furthermore, we divide each index with the number of companies in that index so that the size of a particular index doesn't under-weigh or over-weigh the value of that index.

For each of the 91 **ordered pair of indices**, we generate 2 **scatter plots** (one with each of the 2 indices being the Y-axis). Then, we **fit a quadratic curve** in each of them. For each of the 91 ordered pairs of indices, the **doubly positive** points of intersection of the 2 quadratic curves give us the **points of conjunction**.

## Code

The code is available as a Mathematica notebook at <https://t.ly/OnUVJ>.

## Plots

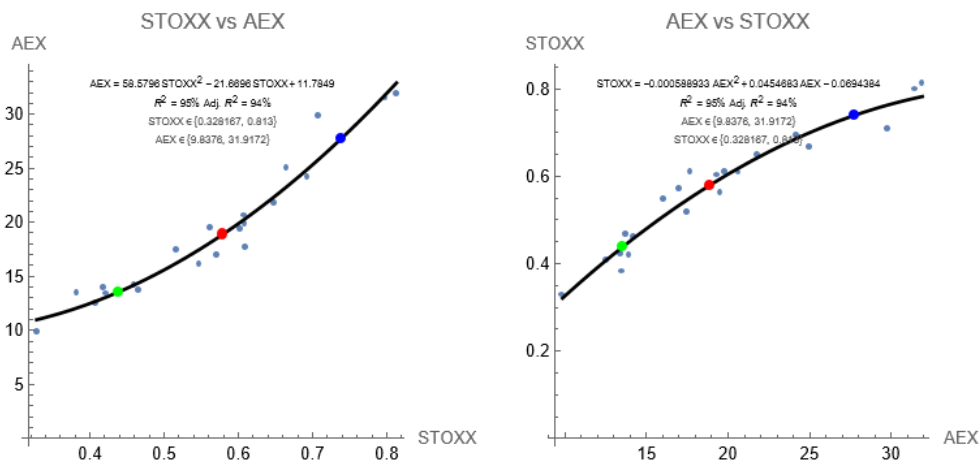
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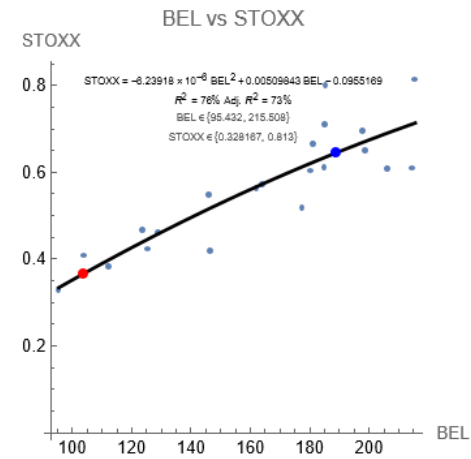
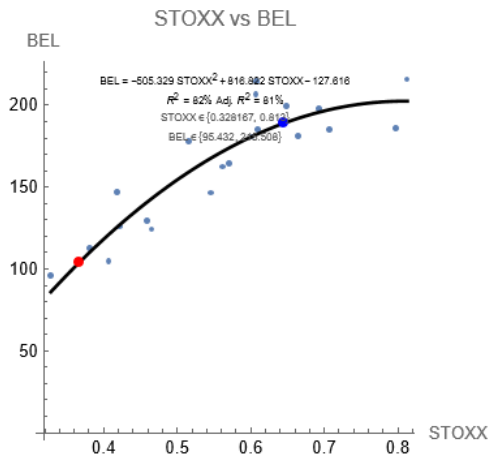
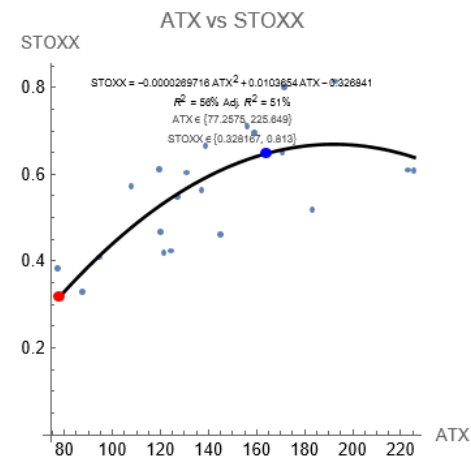
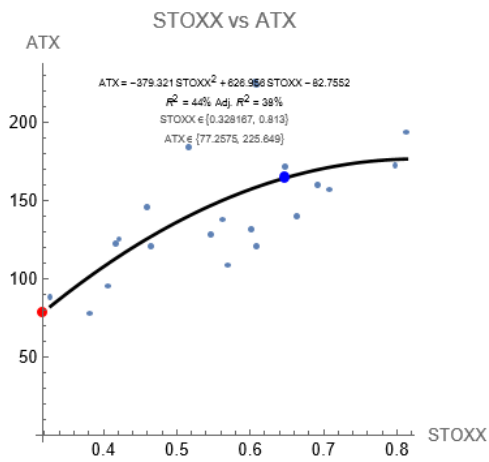
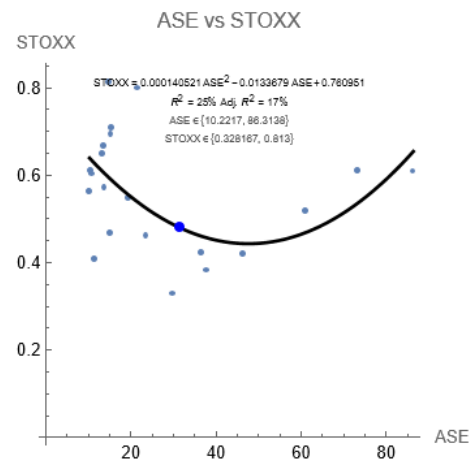
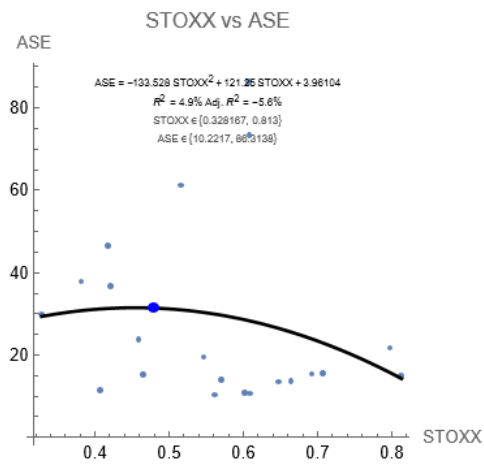
The **blue** point is the best possible point of conjunction.

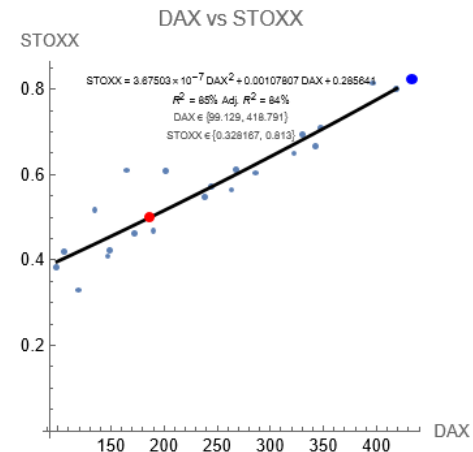
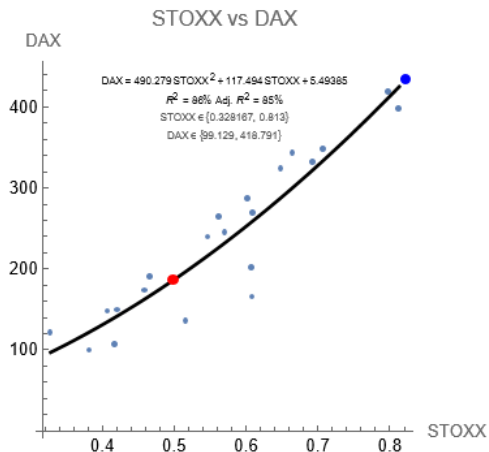
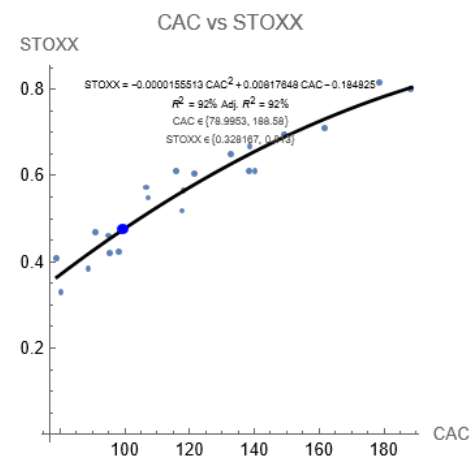
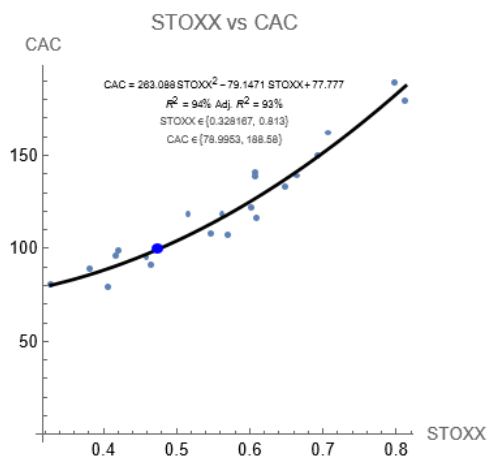
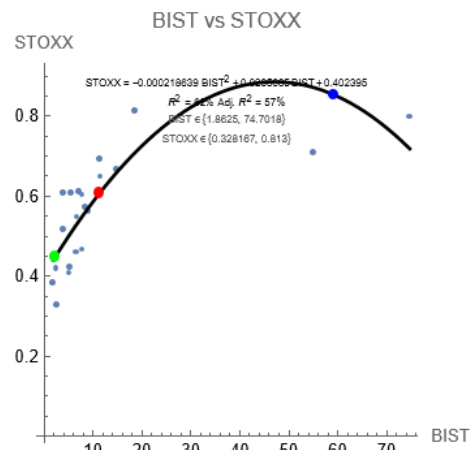
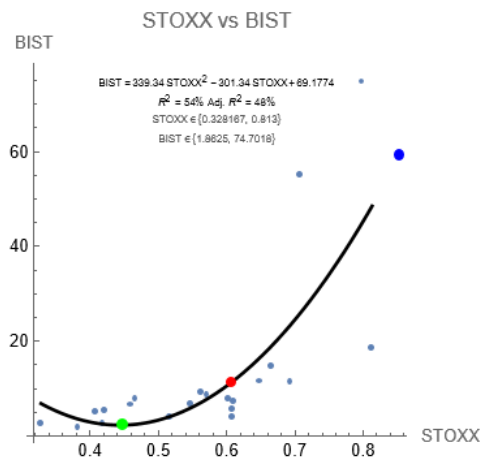
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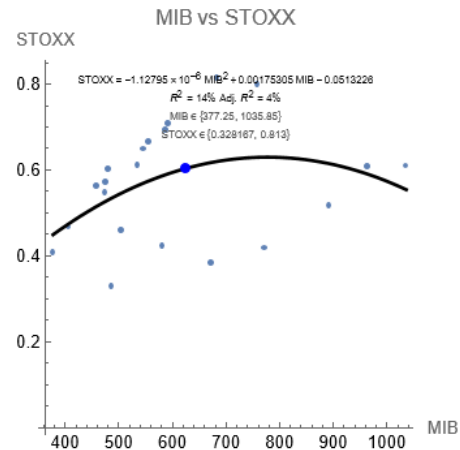
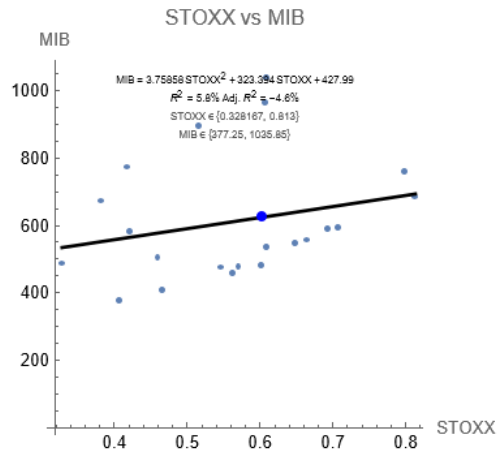
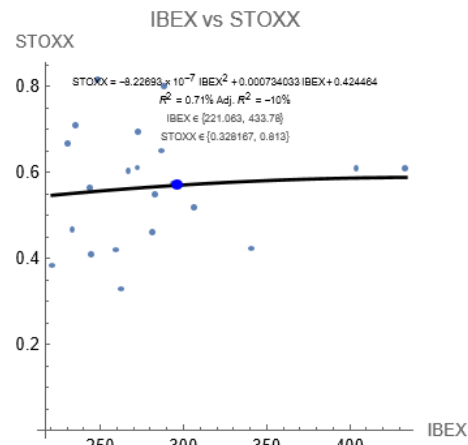
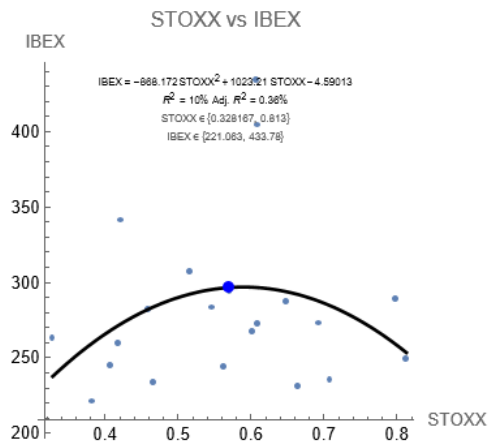
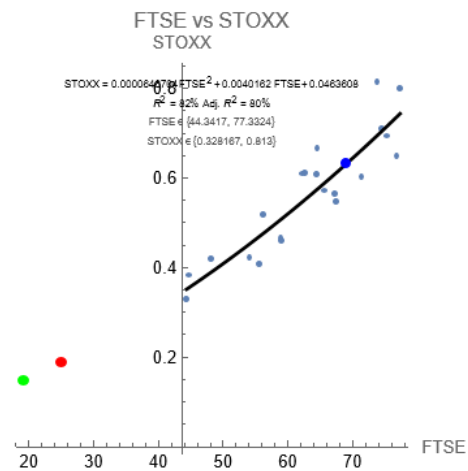
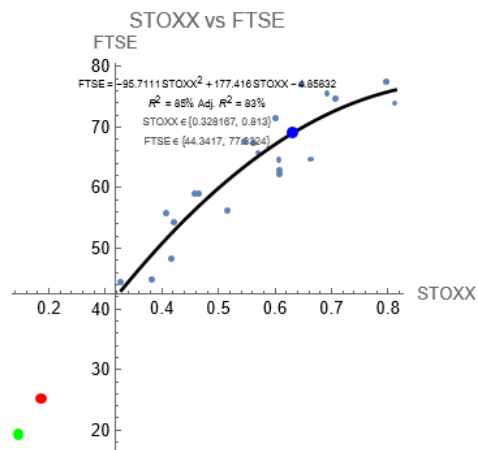
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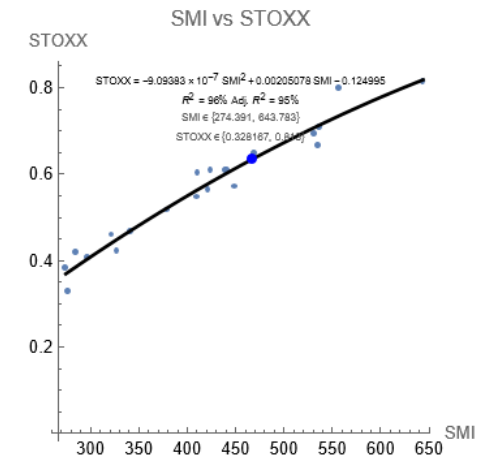
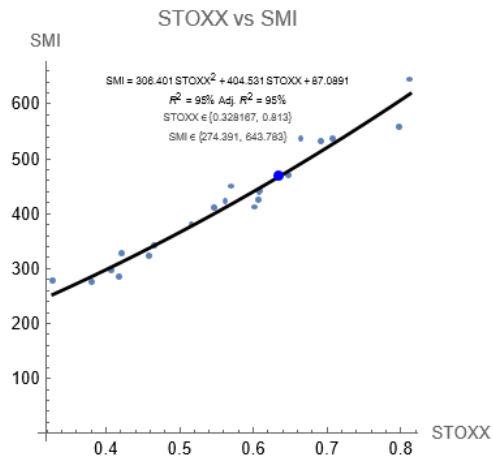
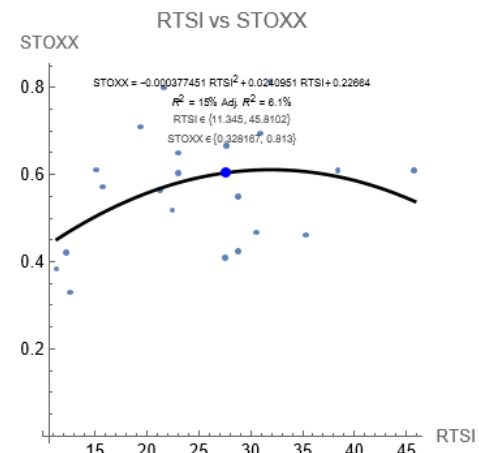
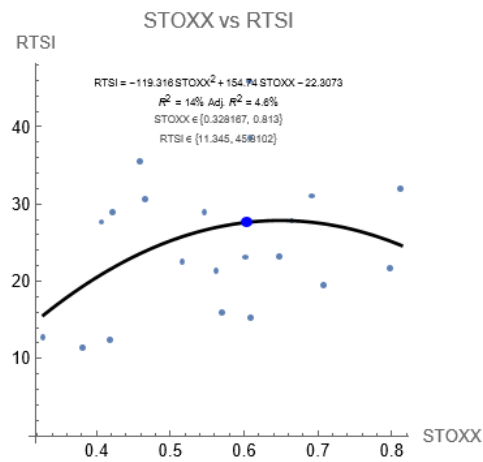
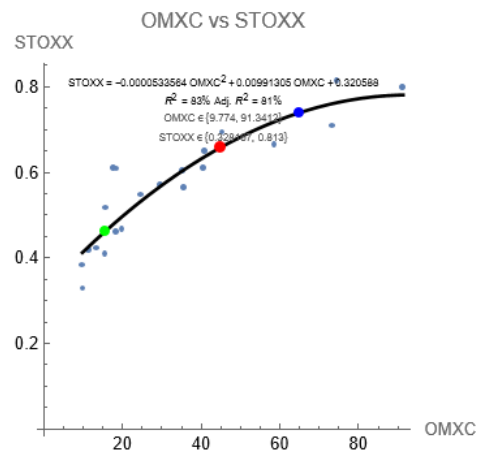
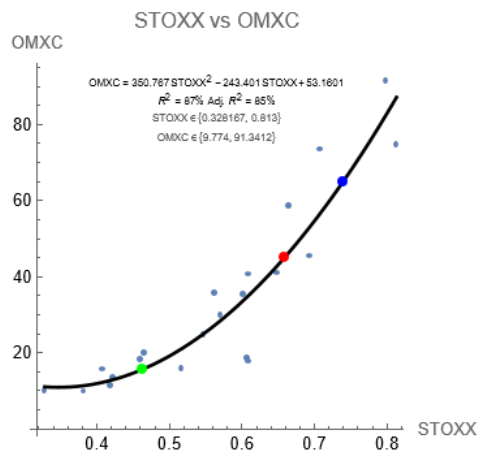
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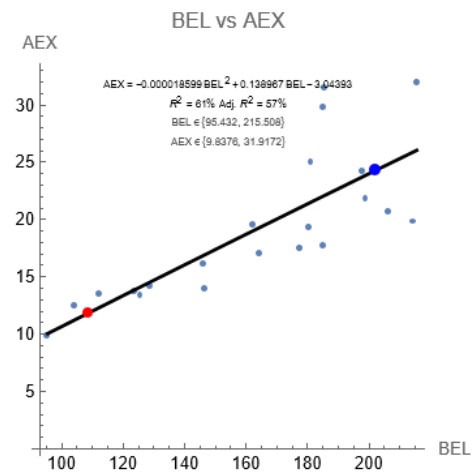
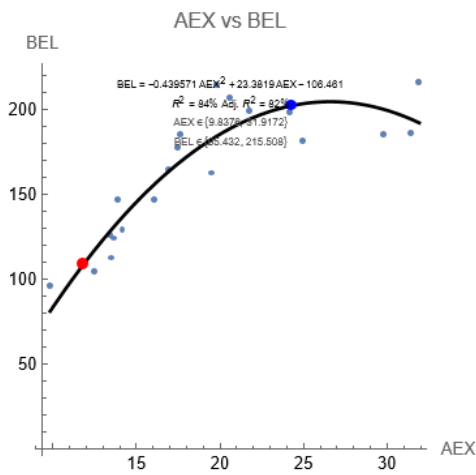
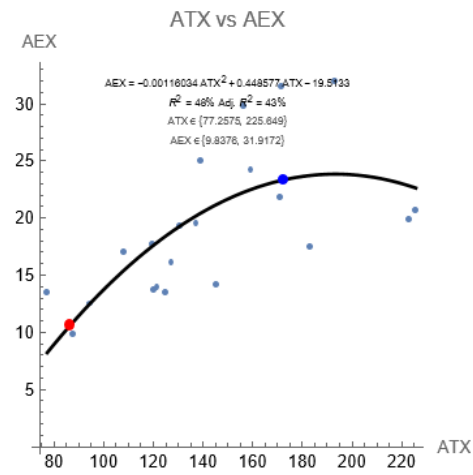
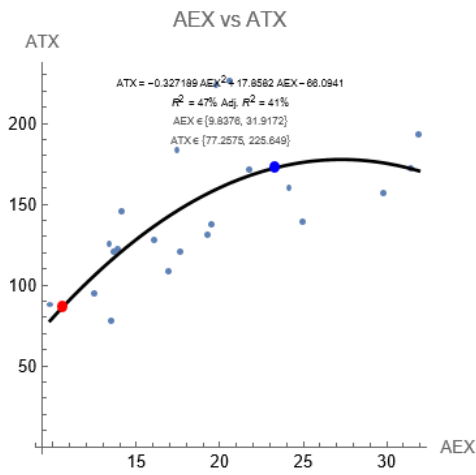
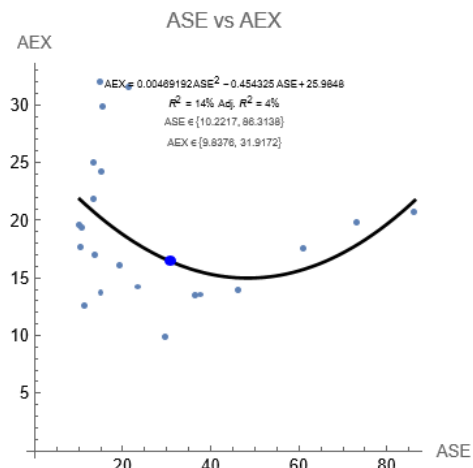
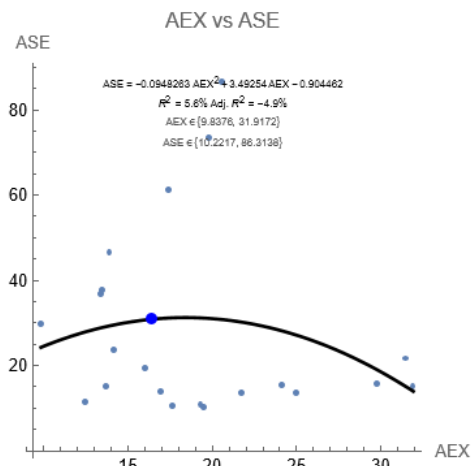


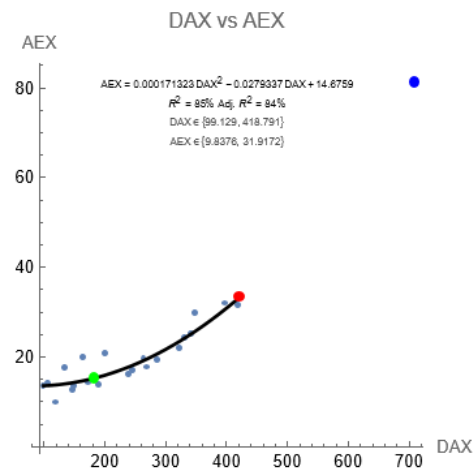
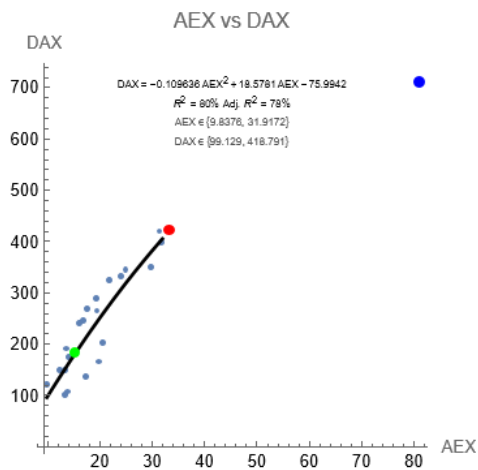
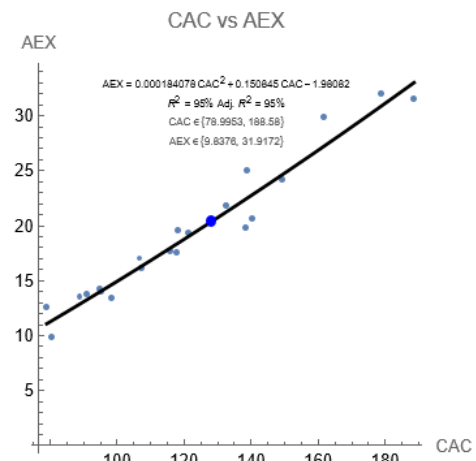
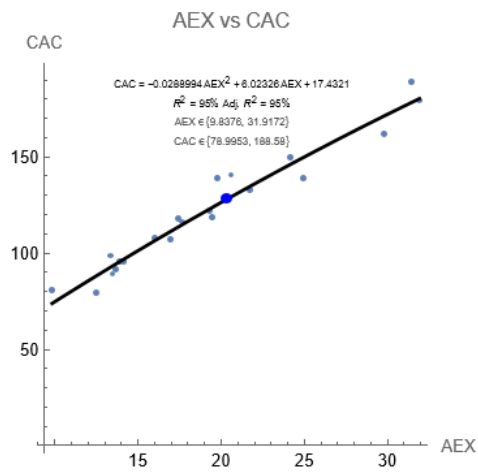
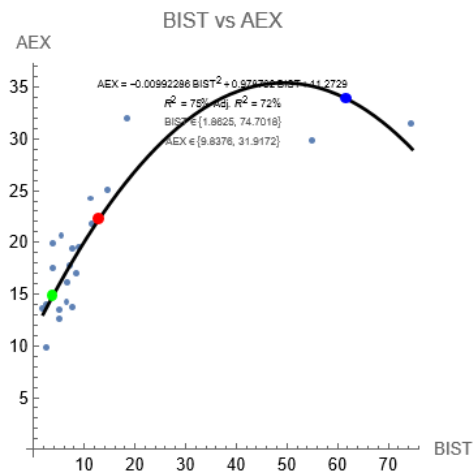
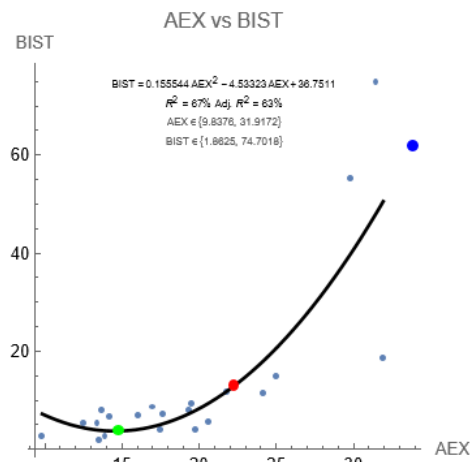




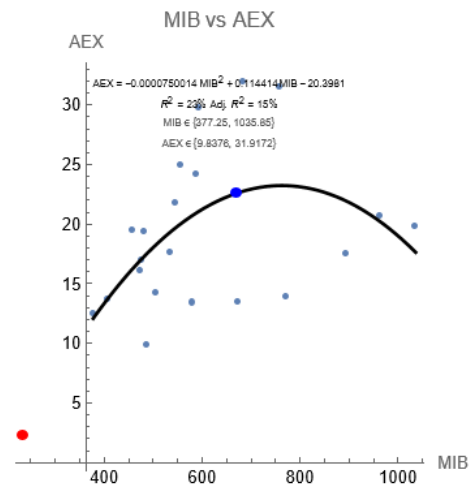
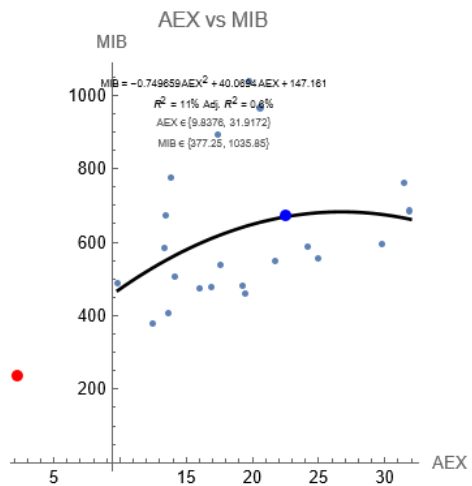
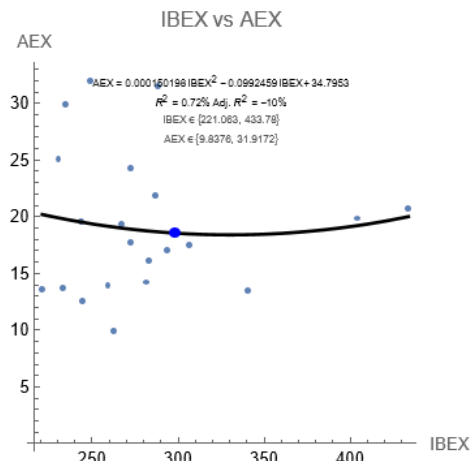
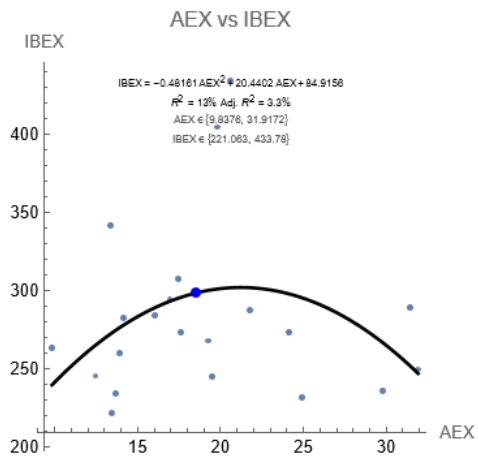
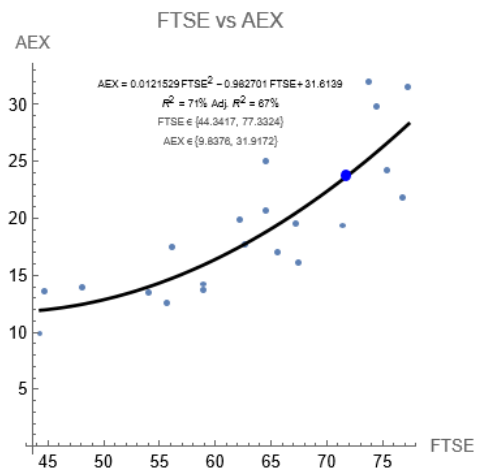
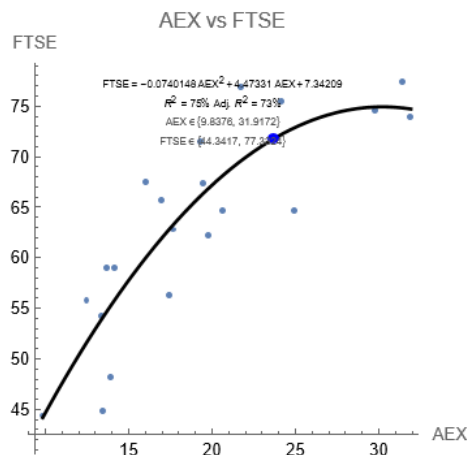


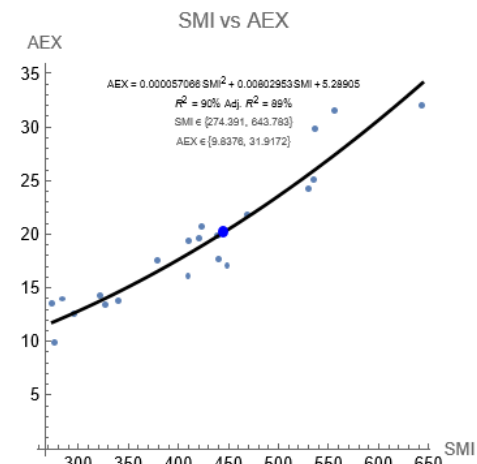
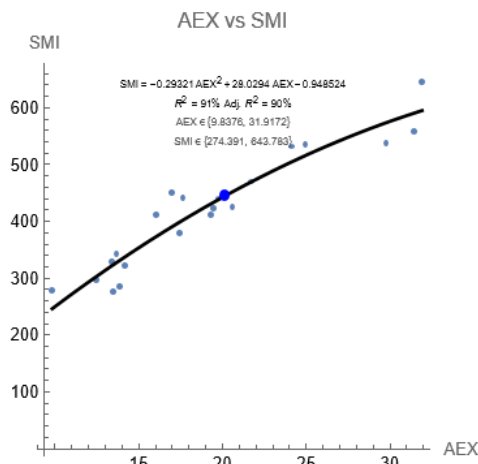
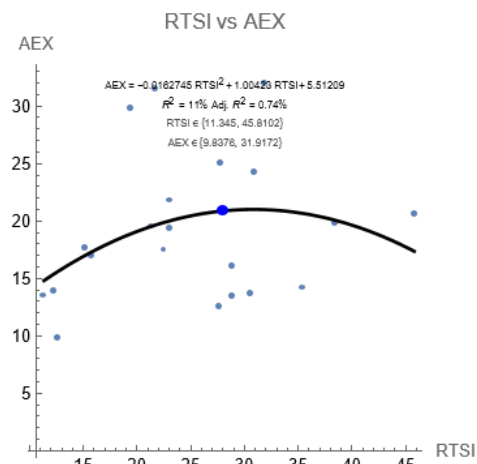
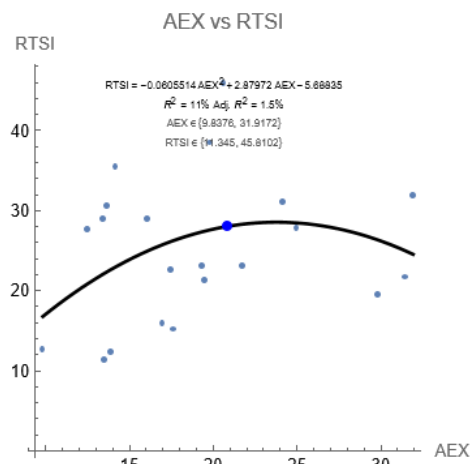
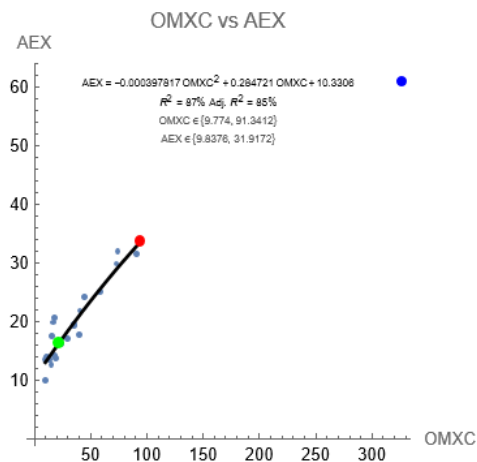
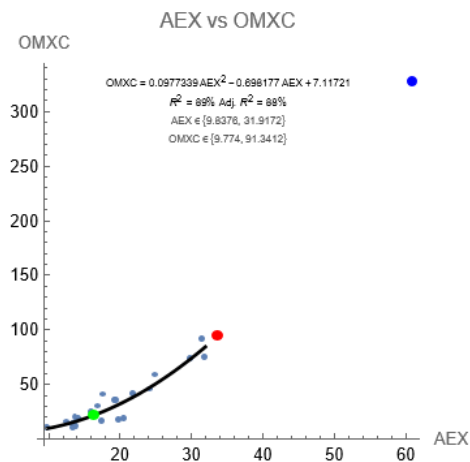


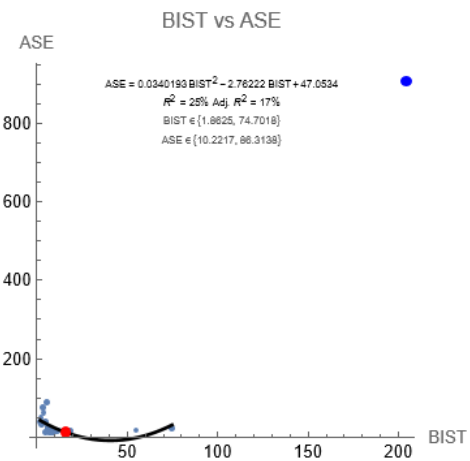
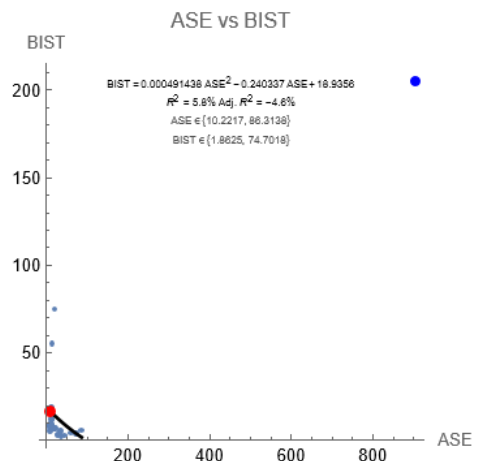
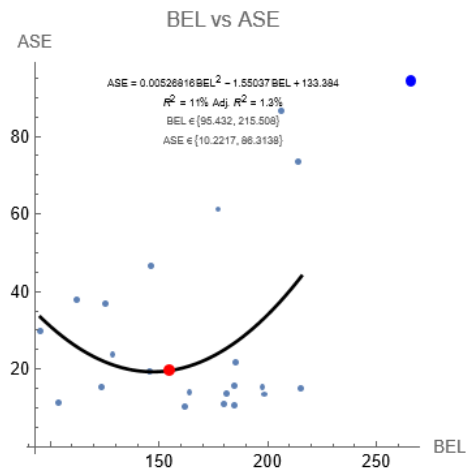
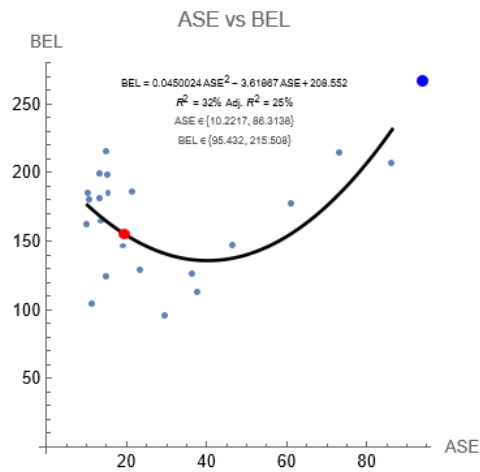
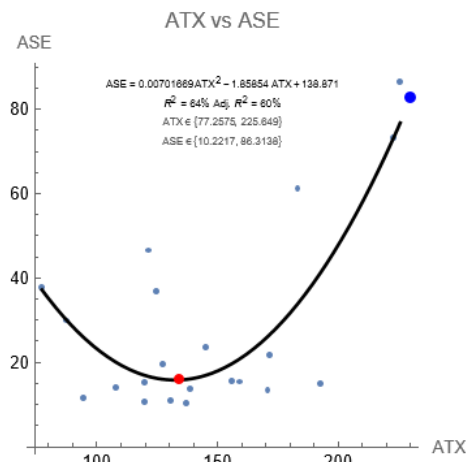
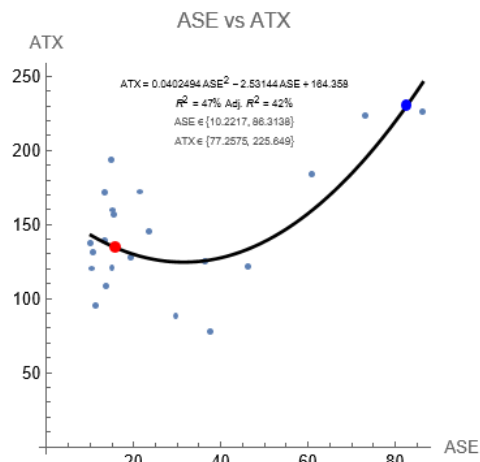


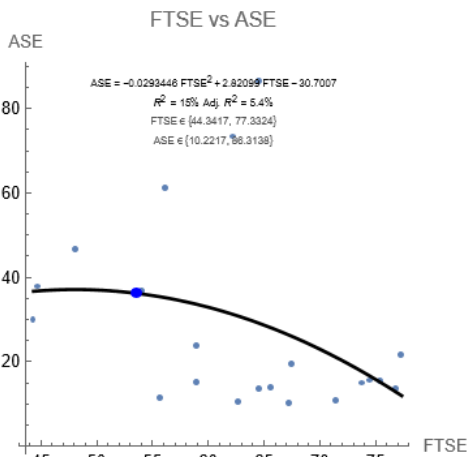
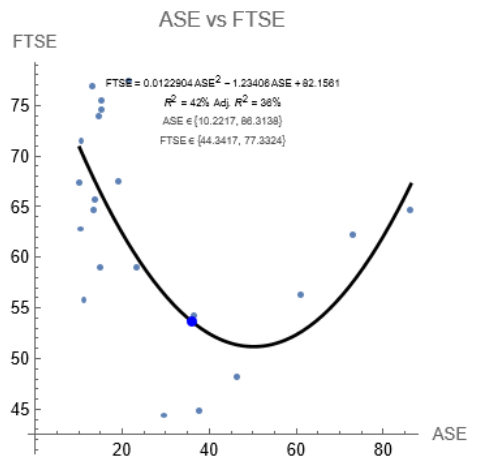
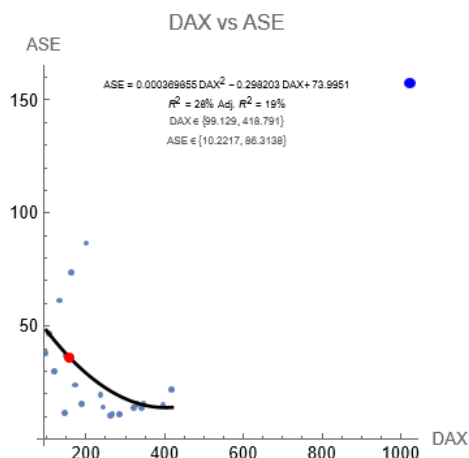
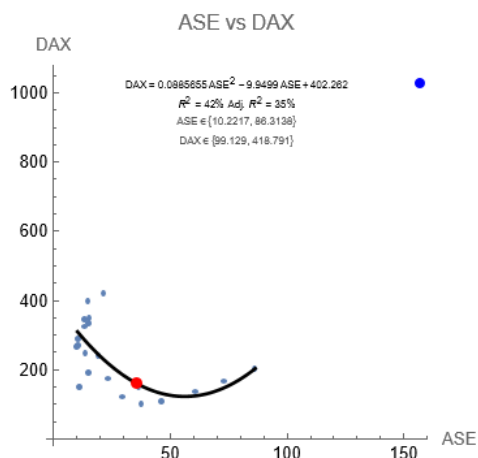
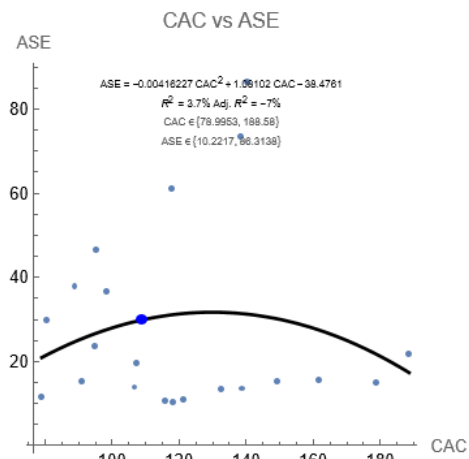
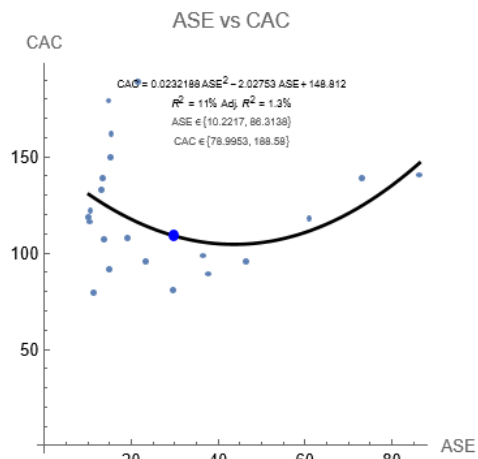


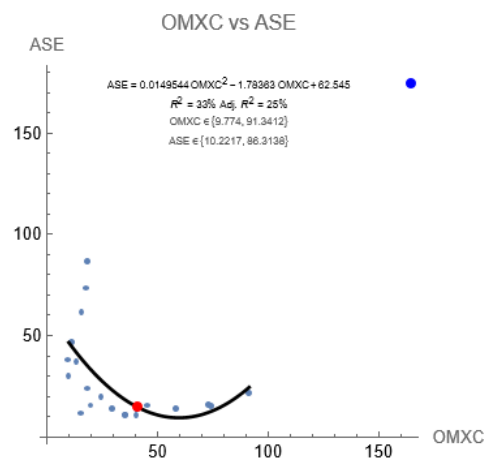
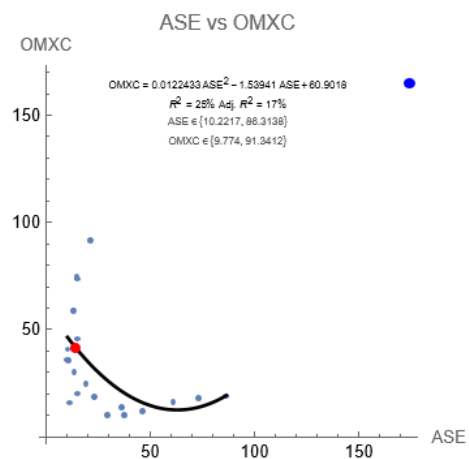
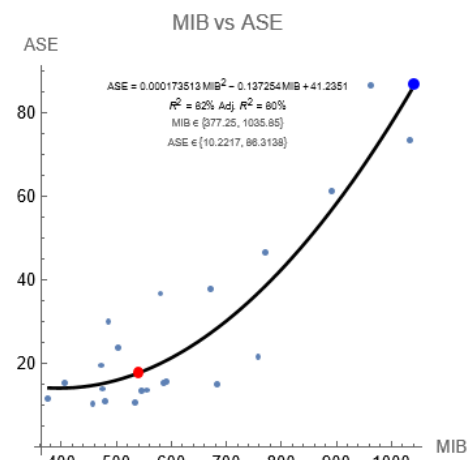
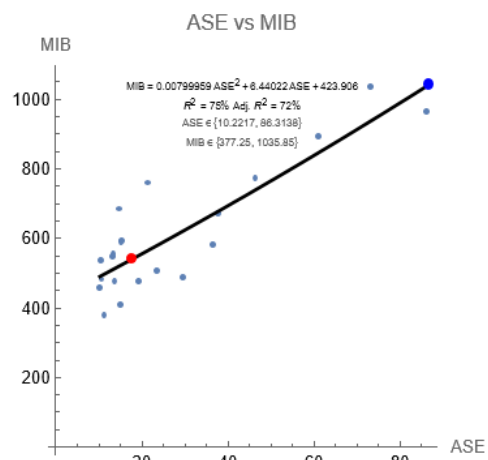
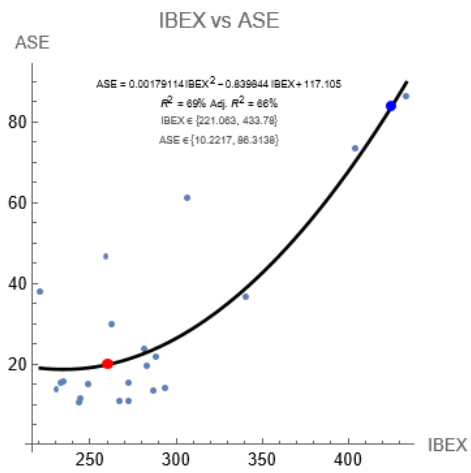
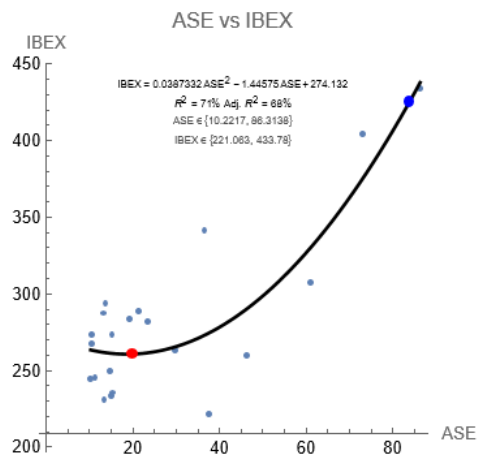


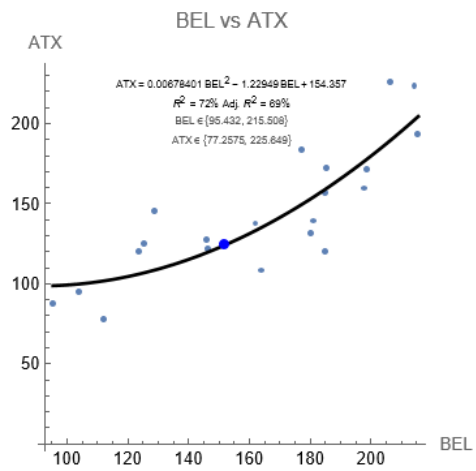
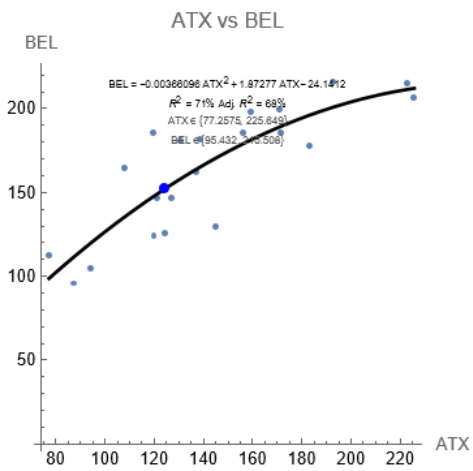
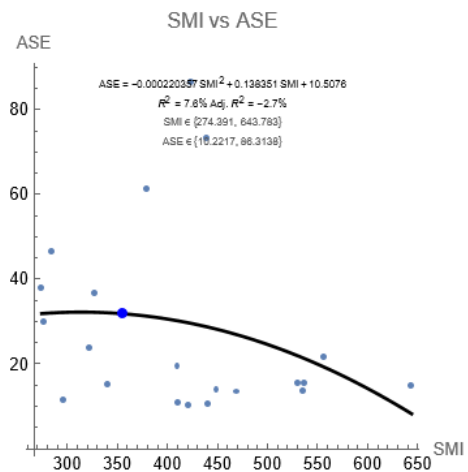
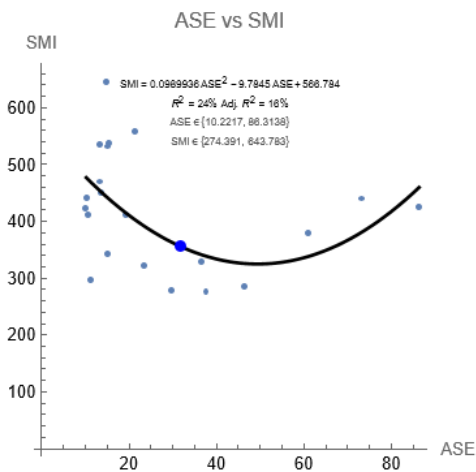
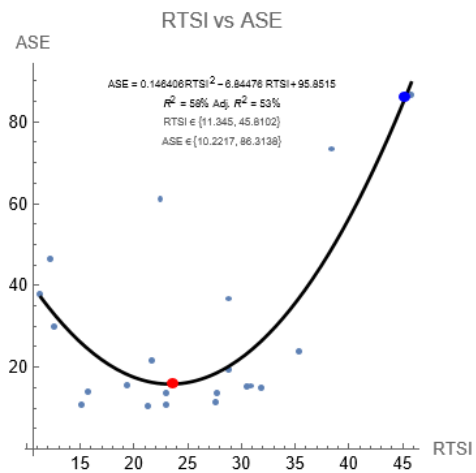
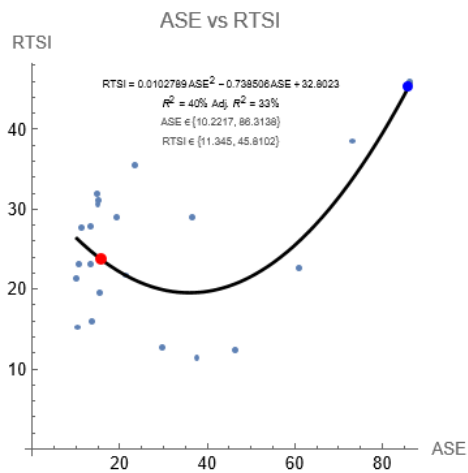


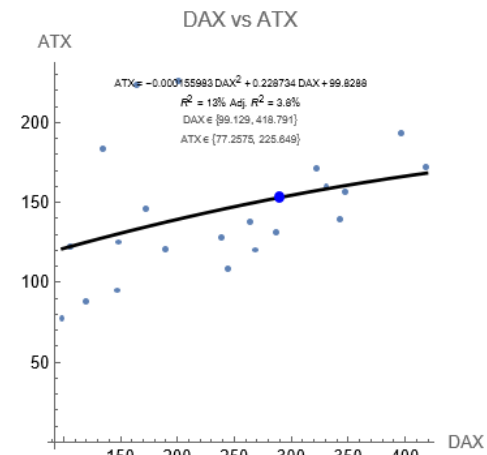
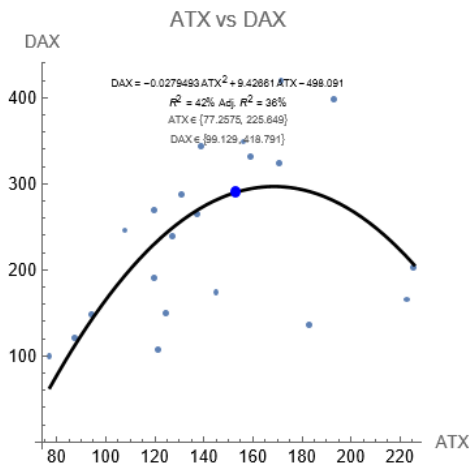
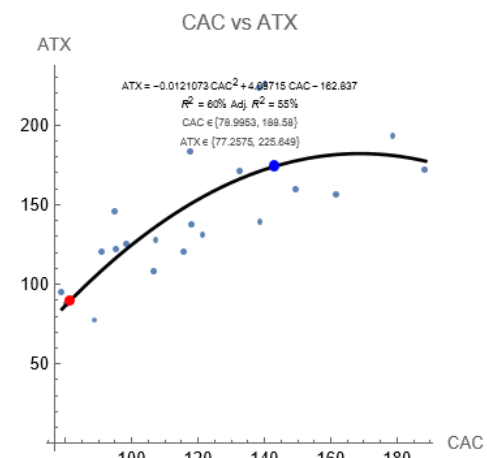
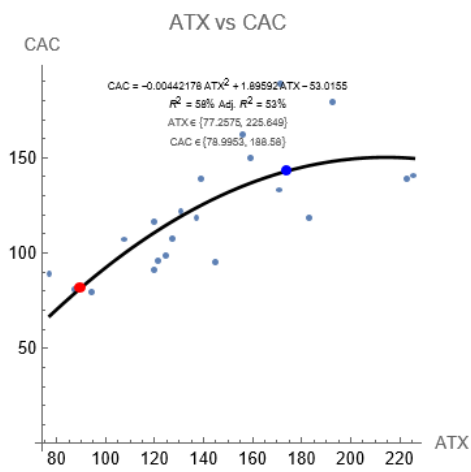
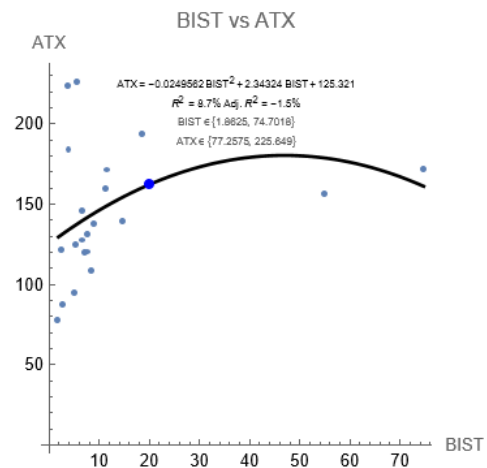
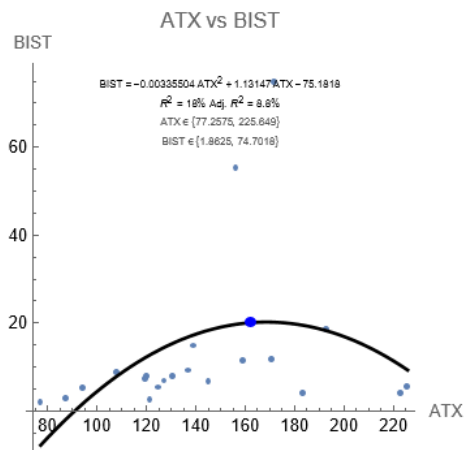


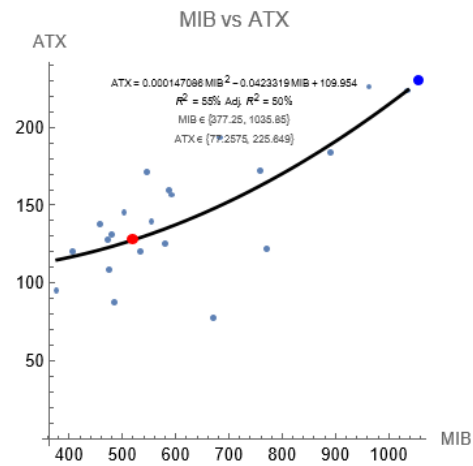
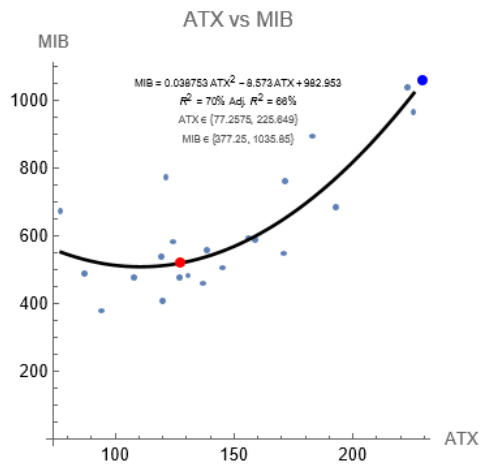
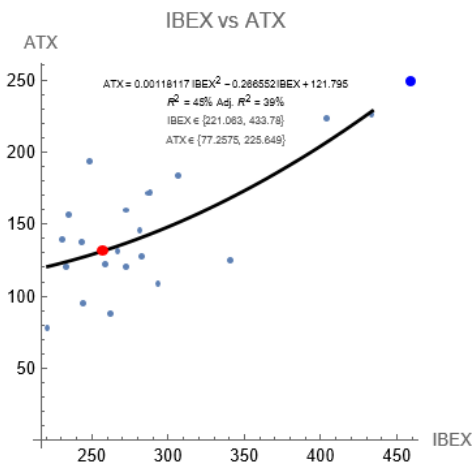
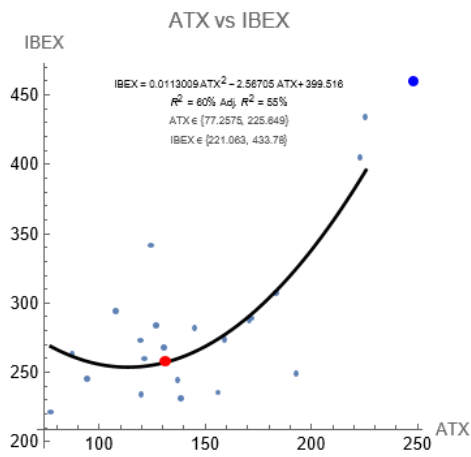
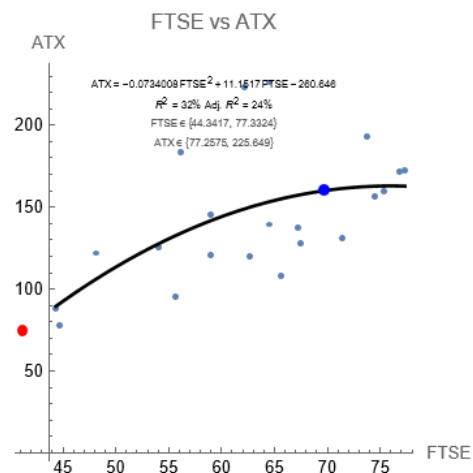
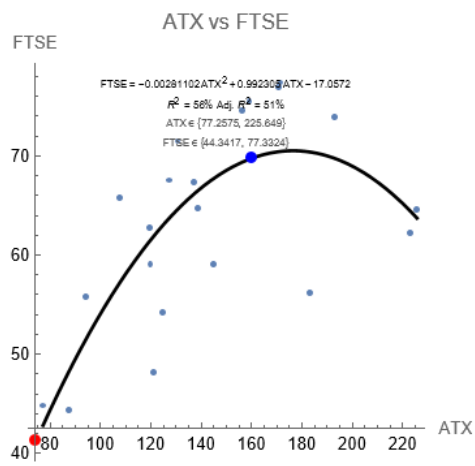




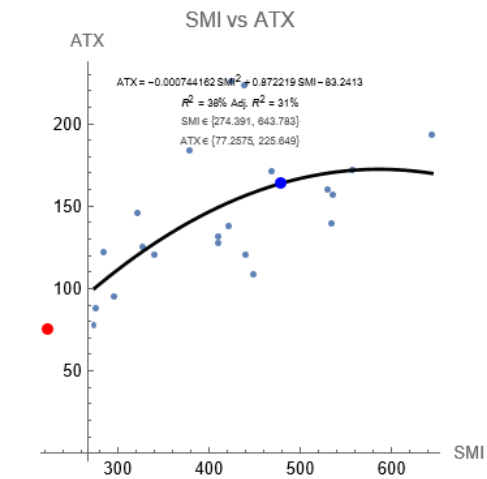
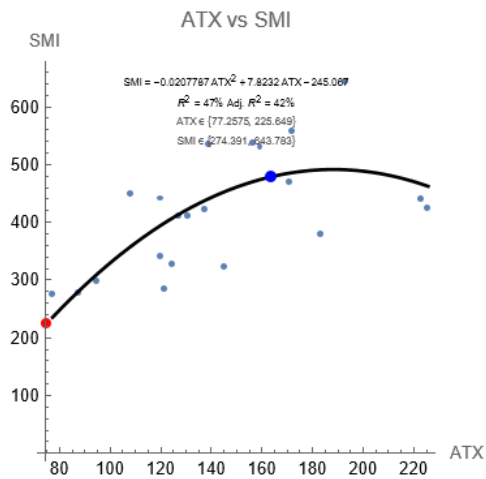
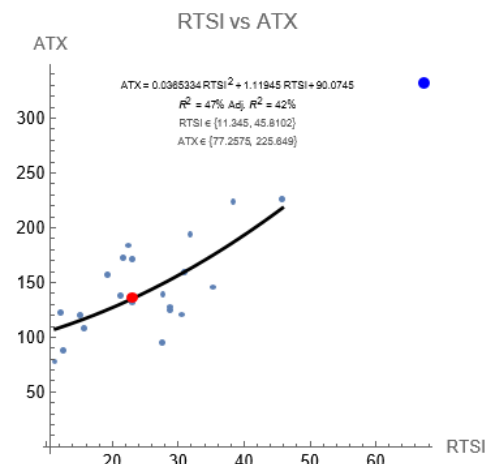
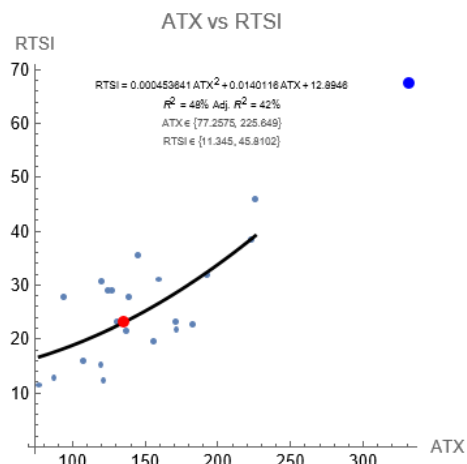
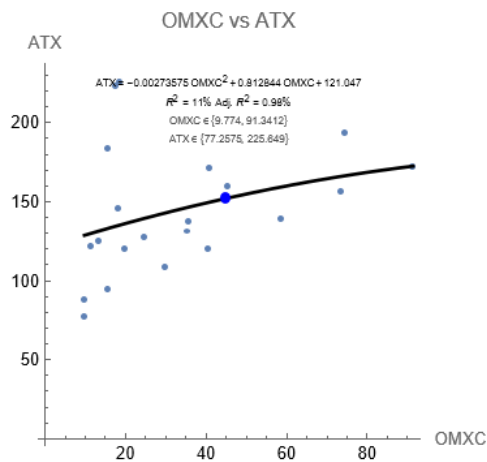
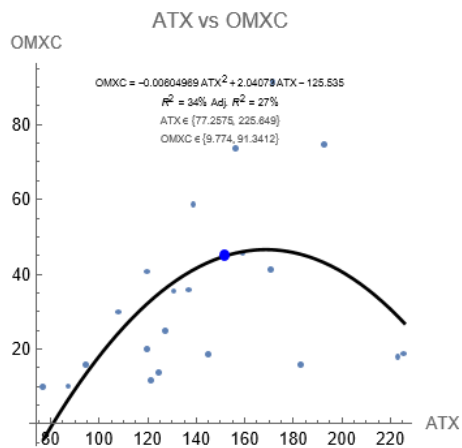


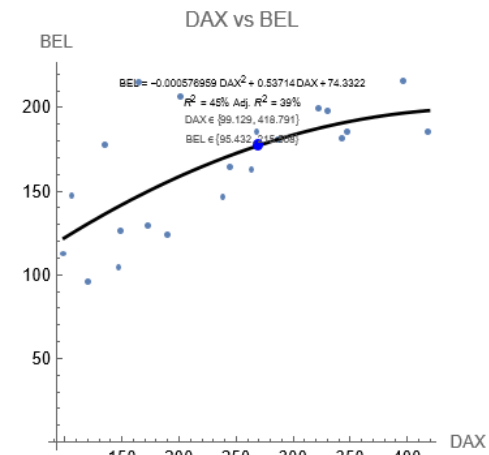
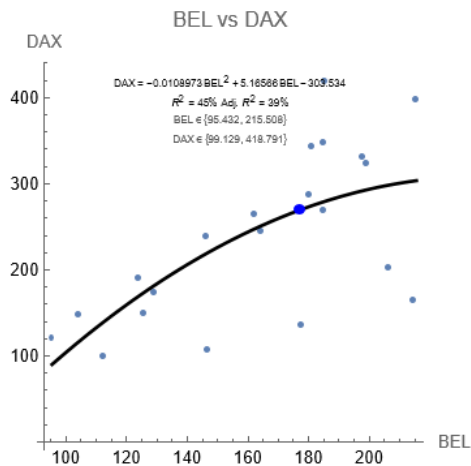
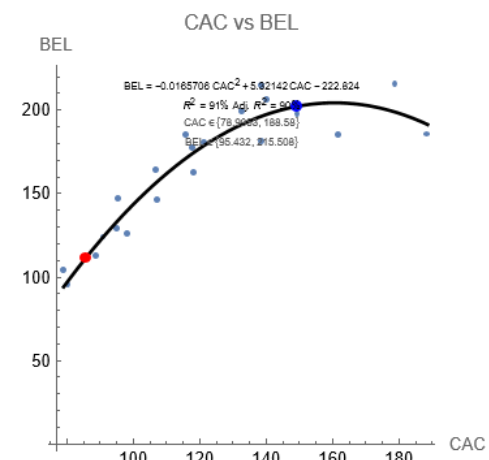
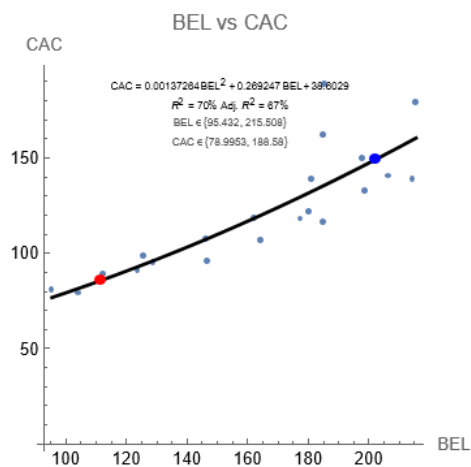
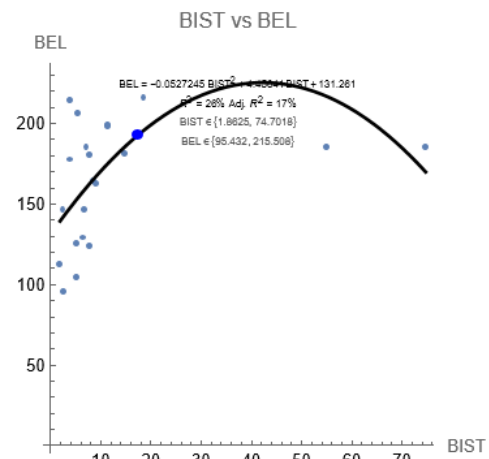
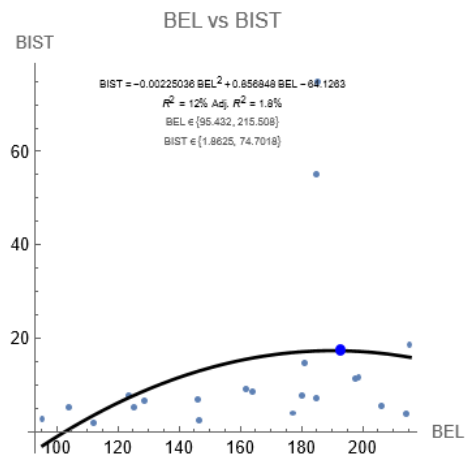


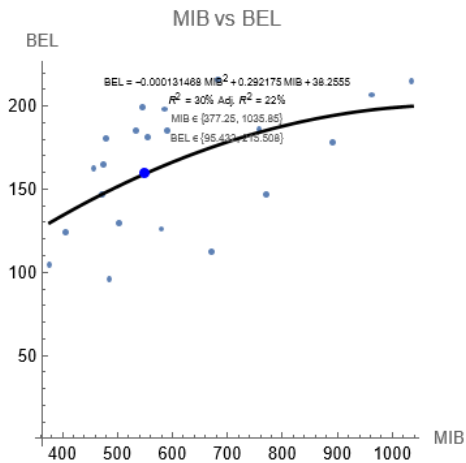
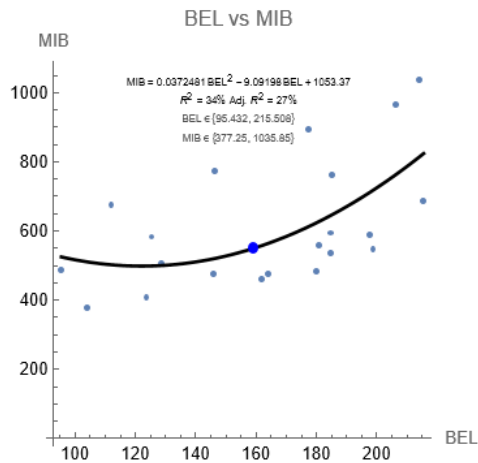
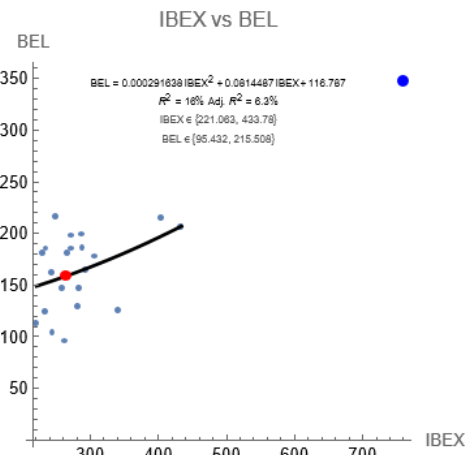
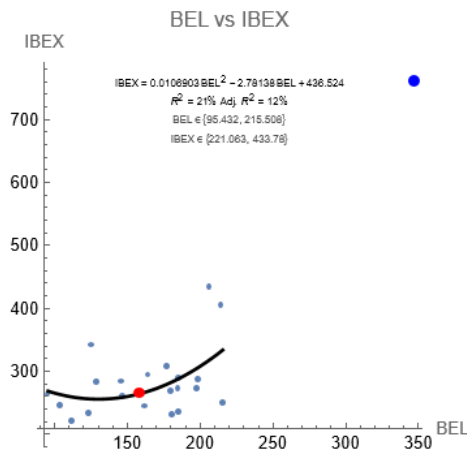
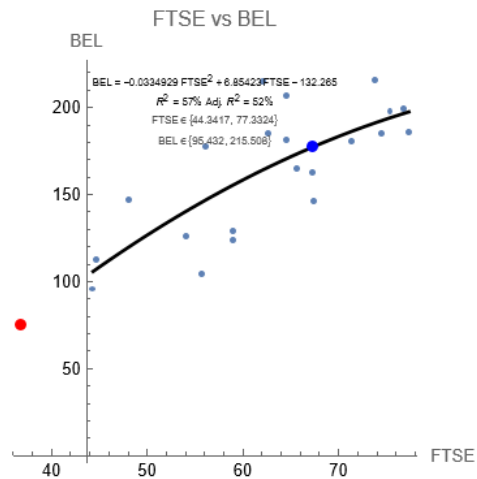
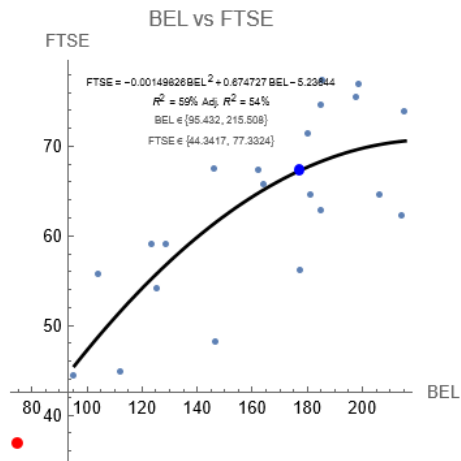


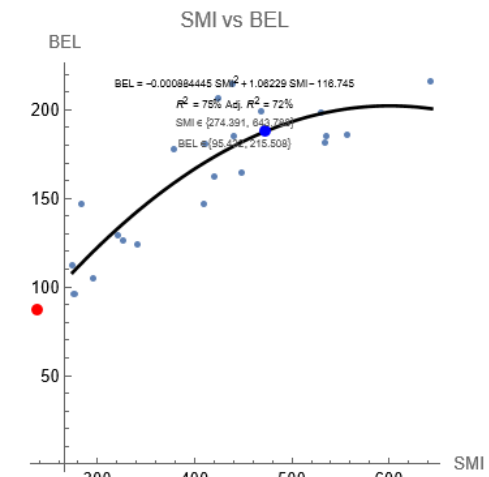
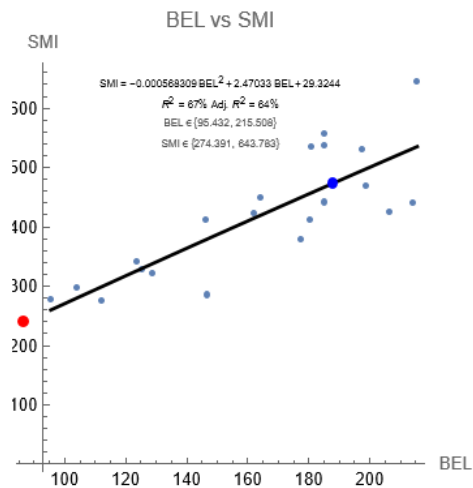
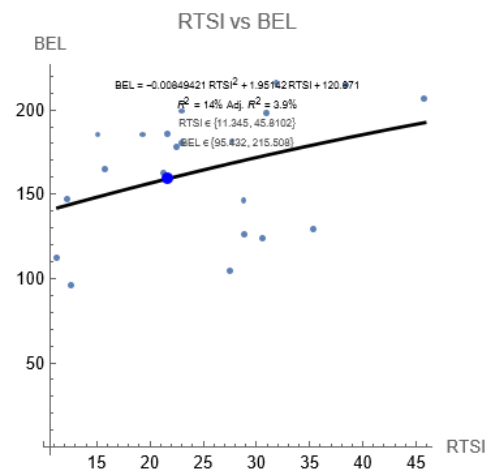
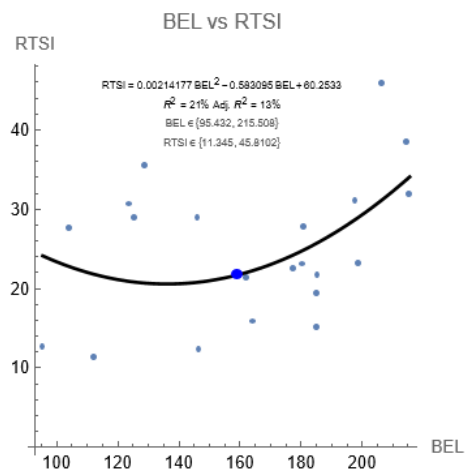
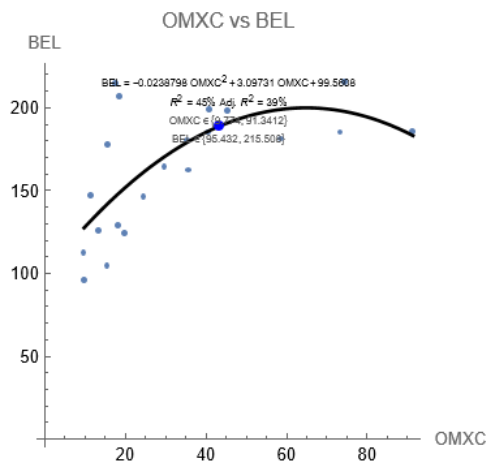
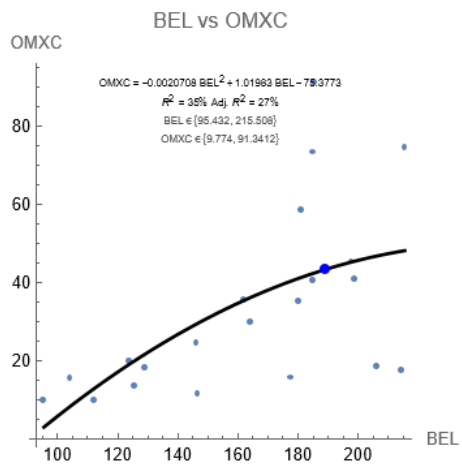


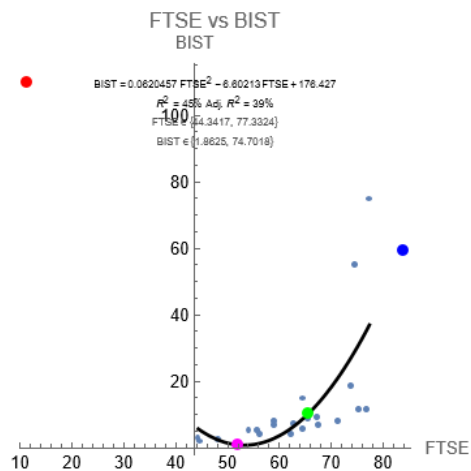
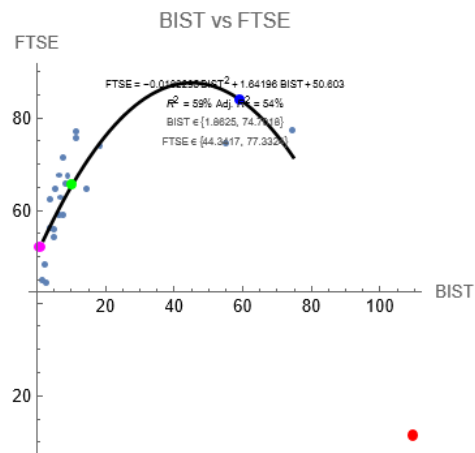
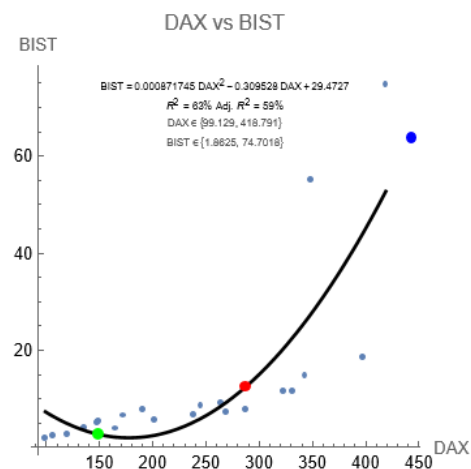
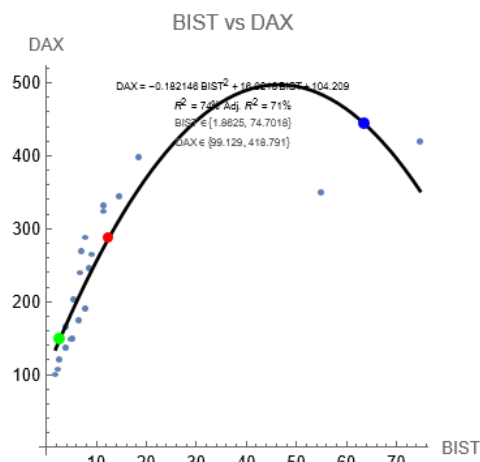
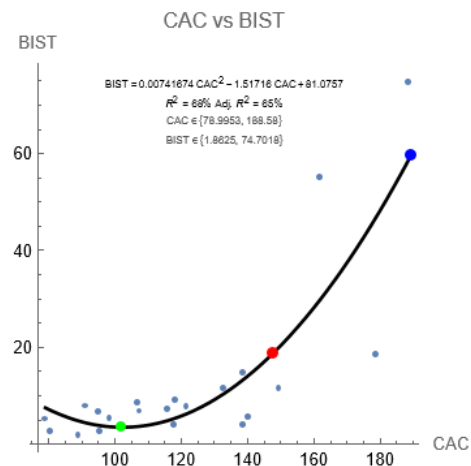
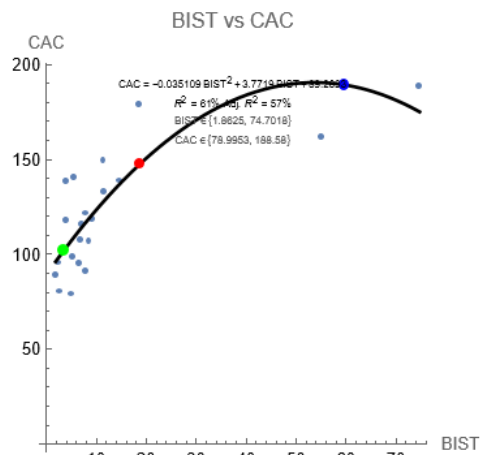


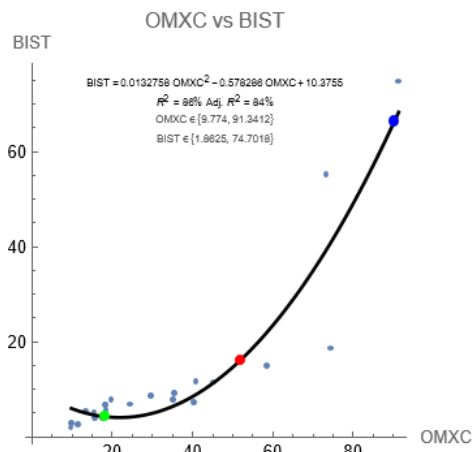
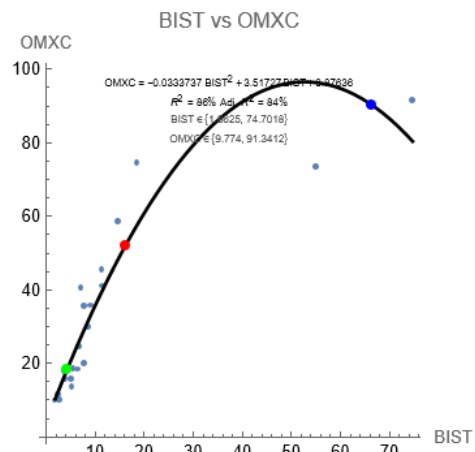
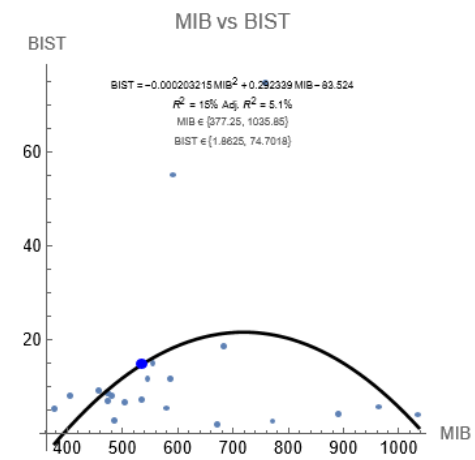
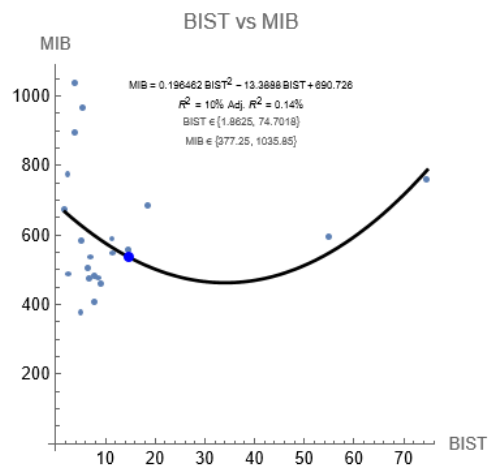
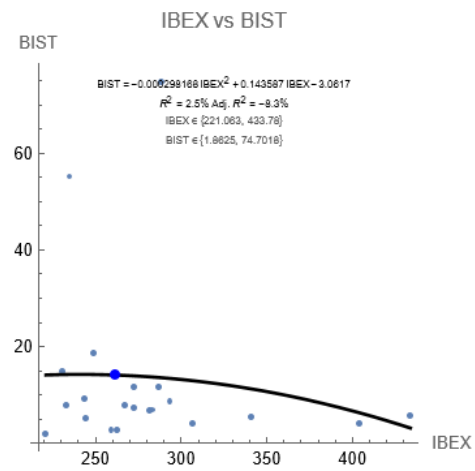
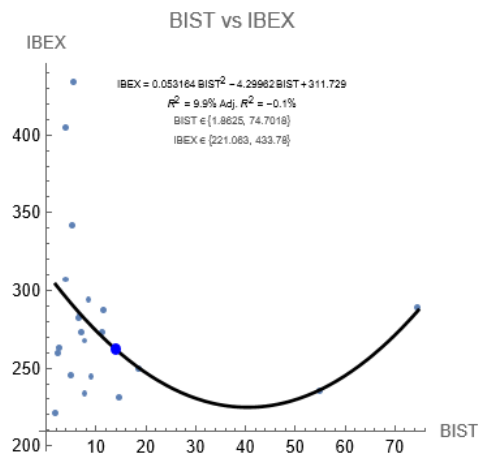


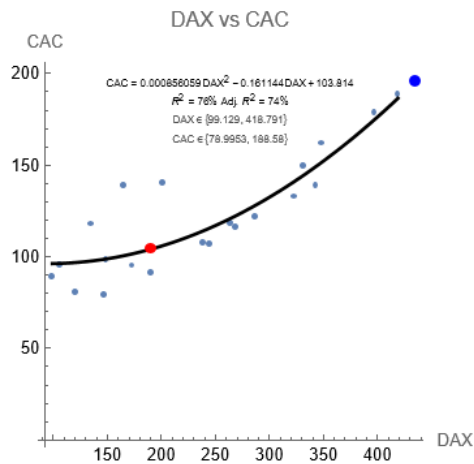
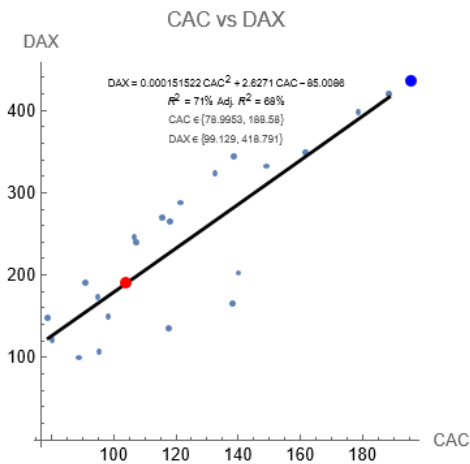
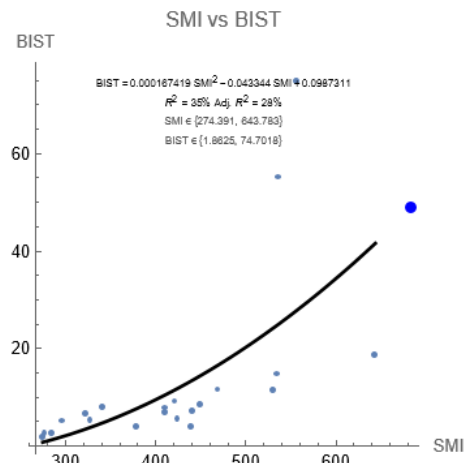
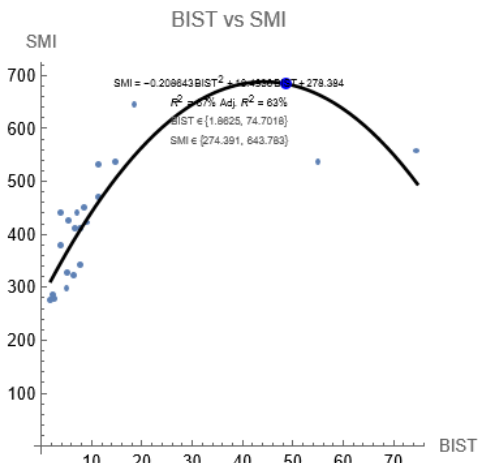
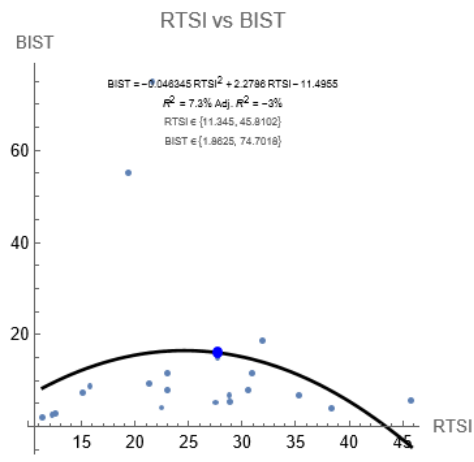
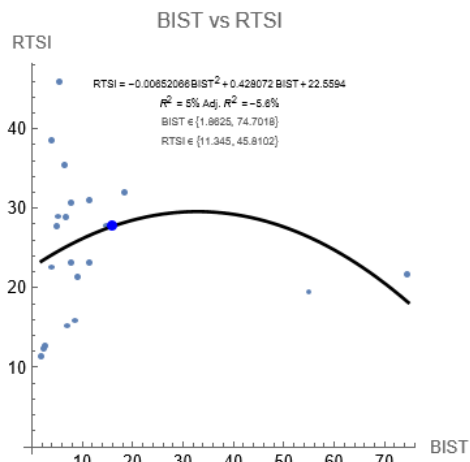


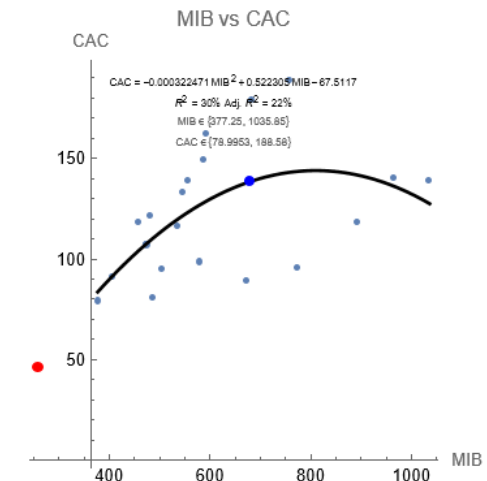
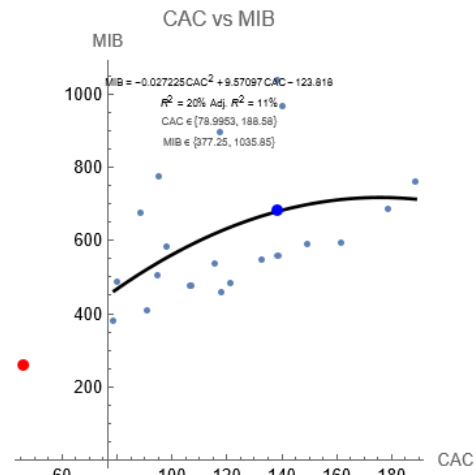
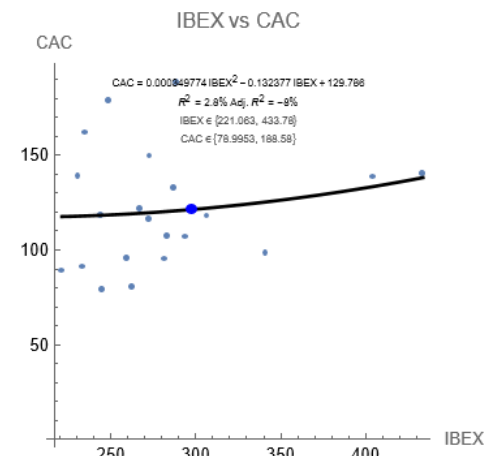
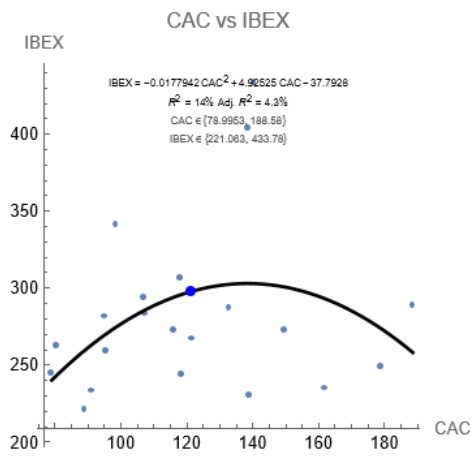
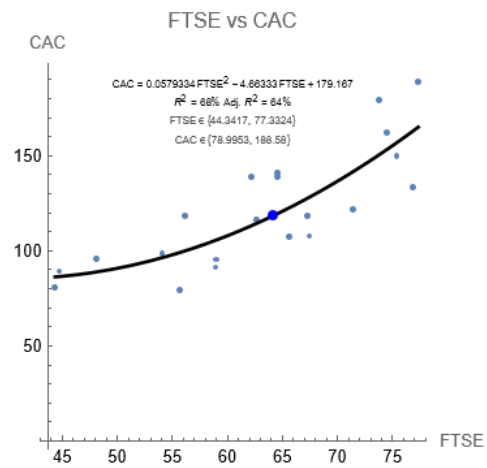
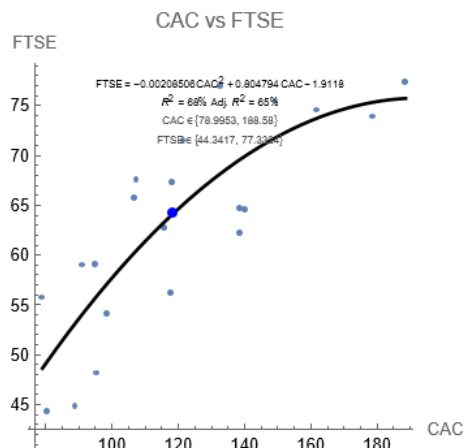




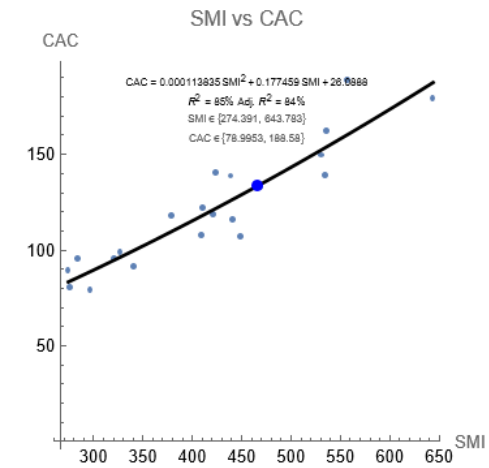
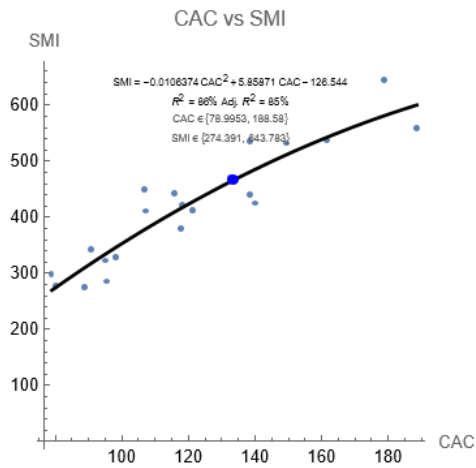
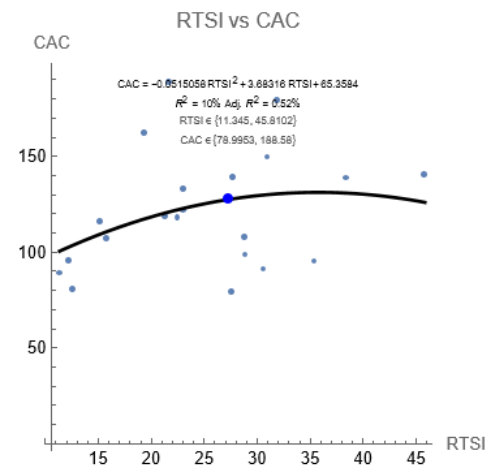
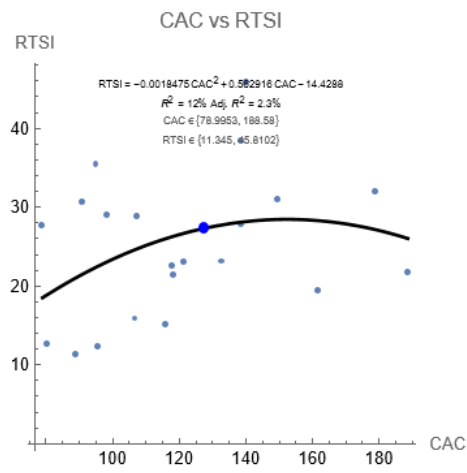
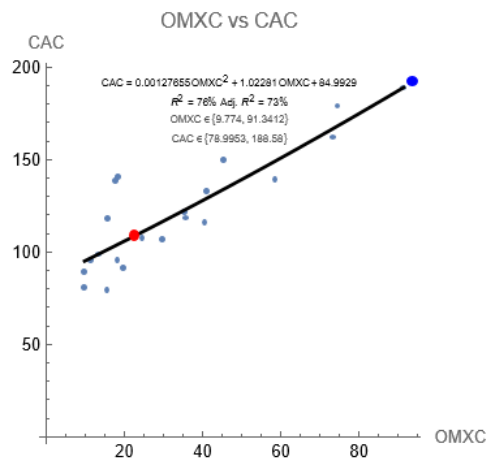
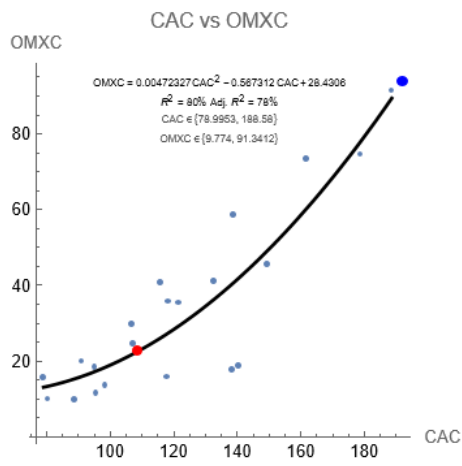


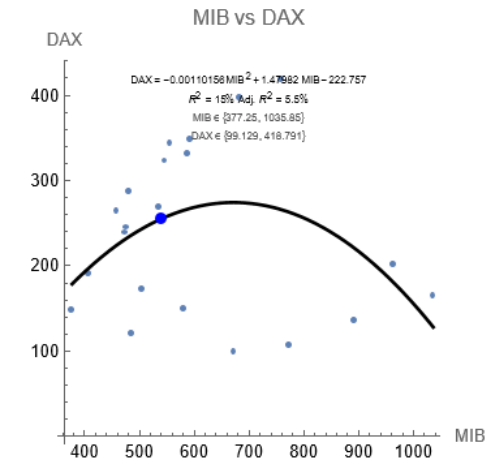
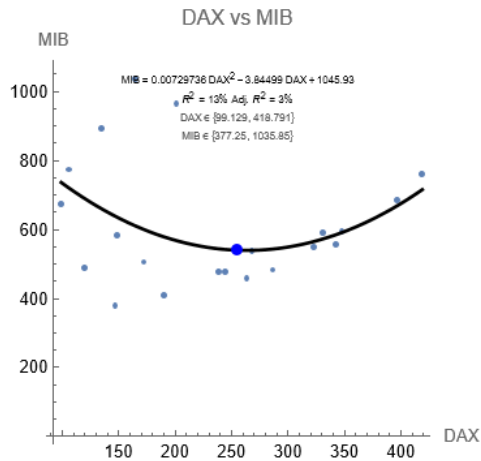
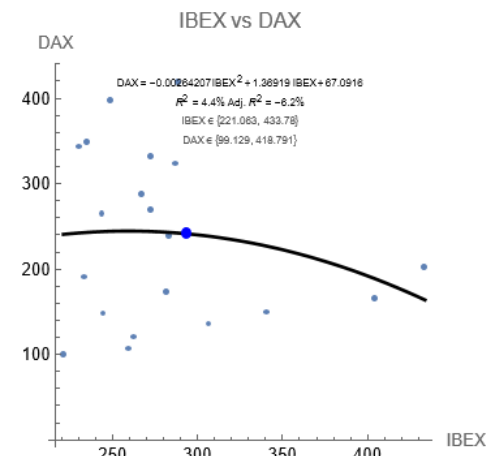
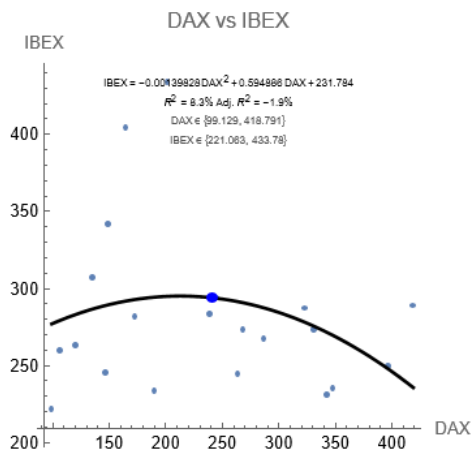
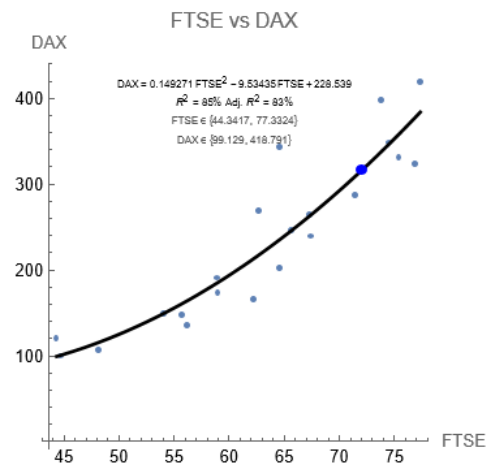
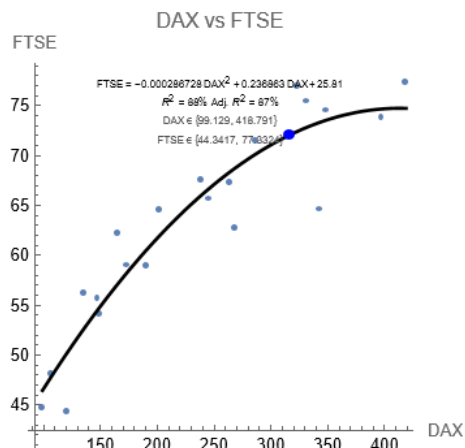


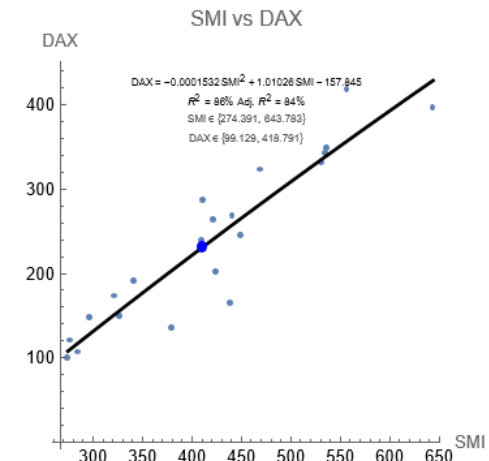
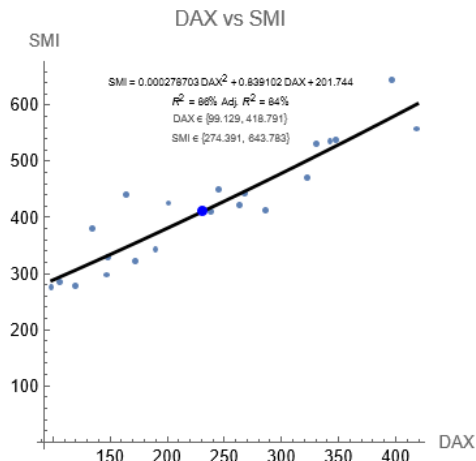
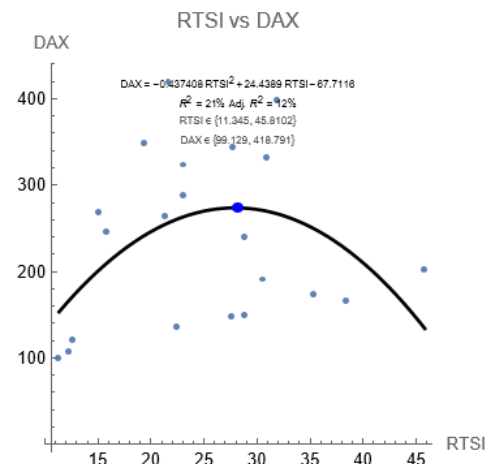
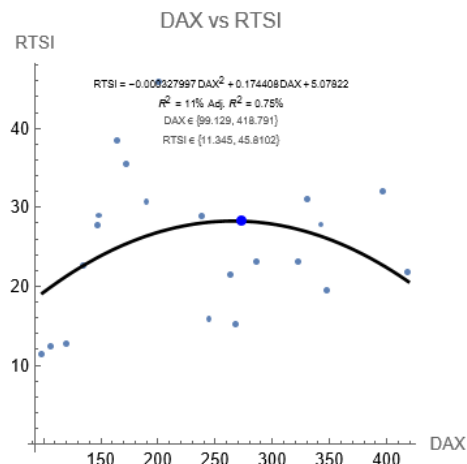
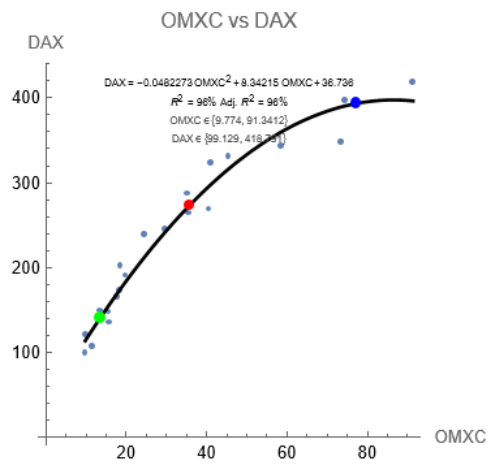
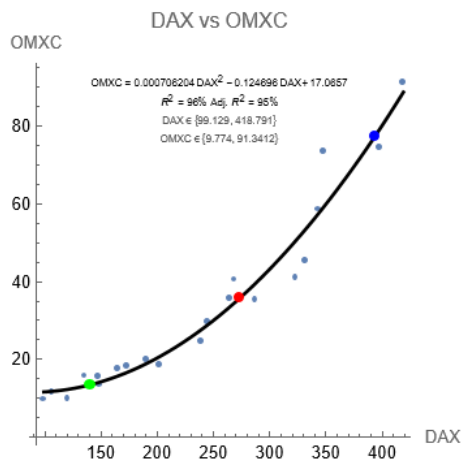


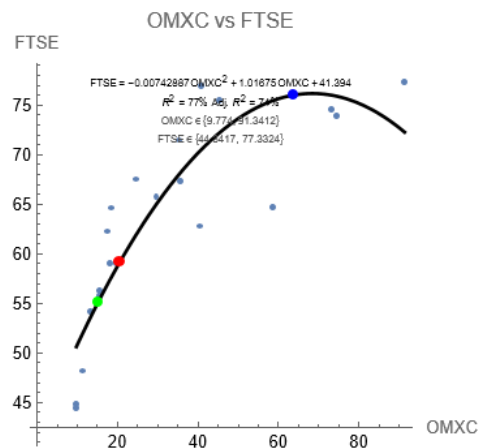
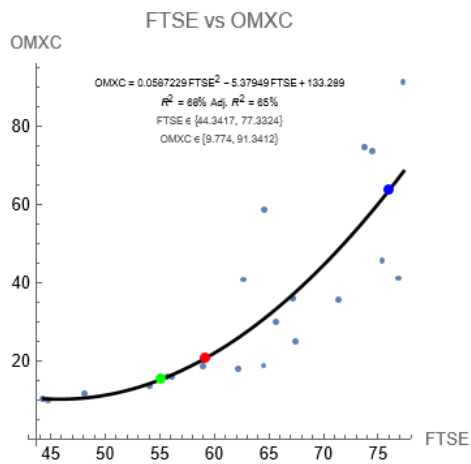
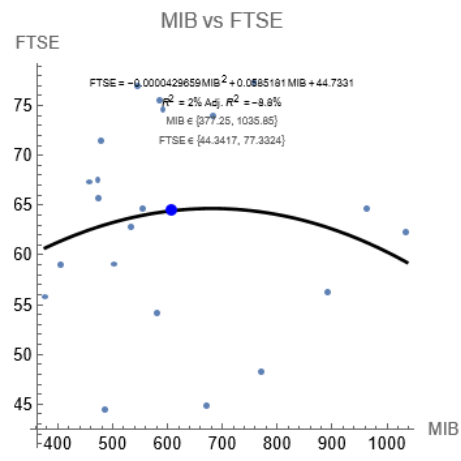
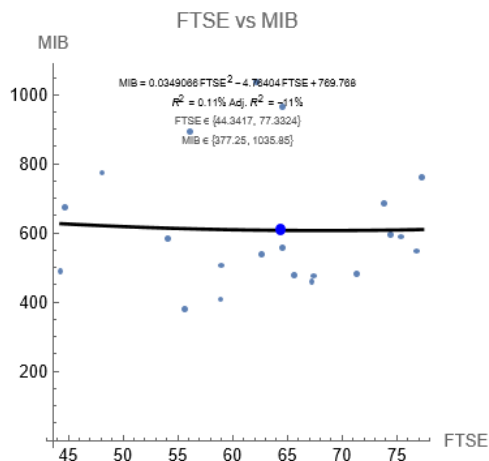
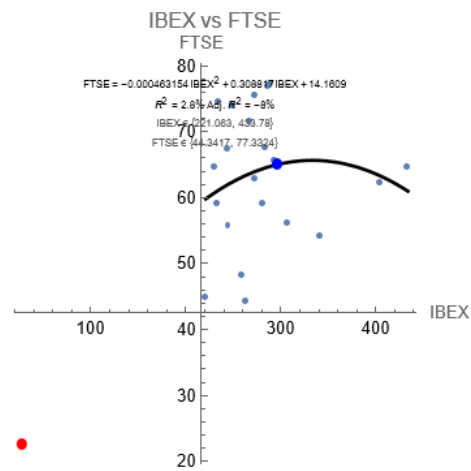
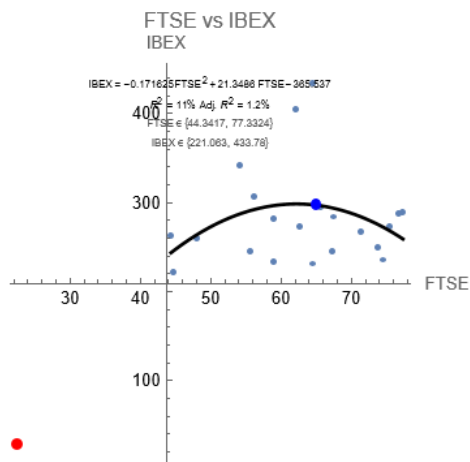


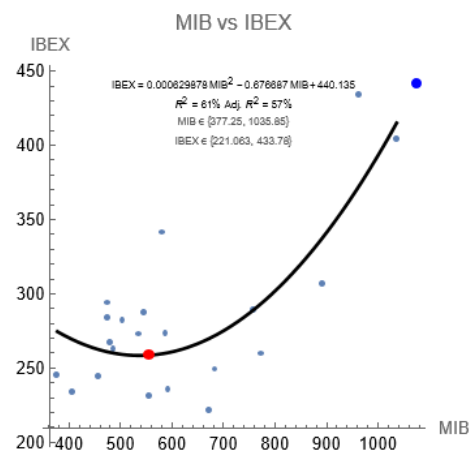
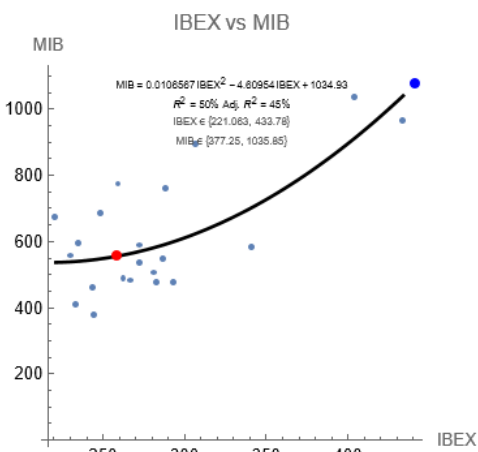
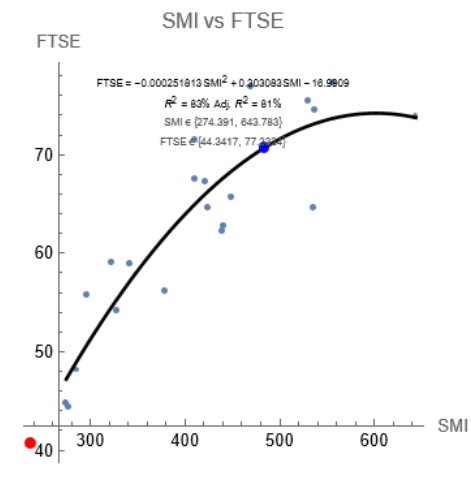
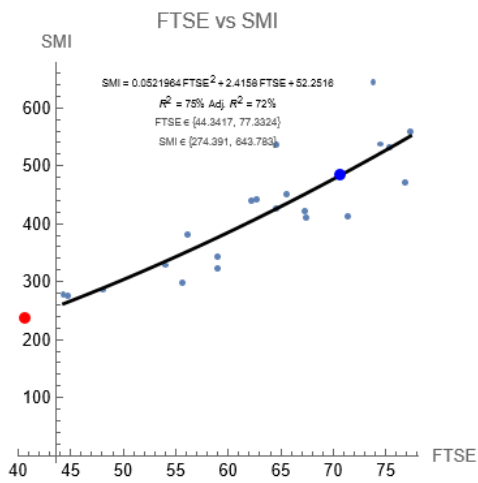
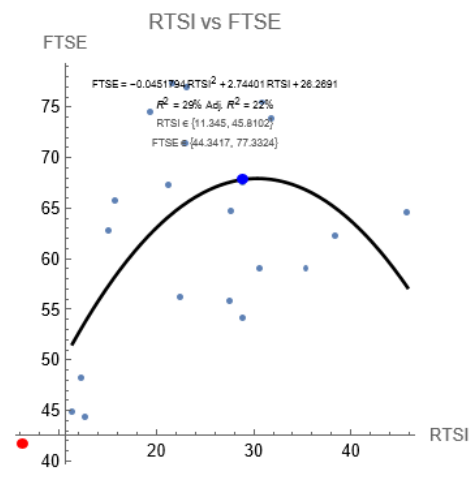
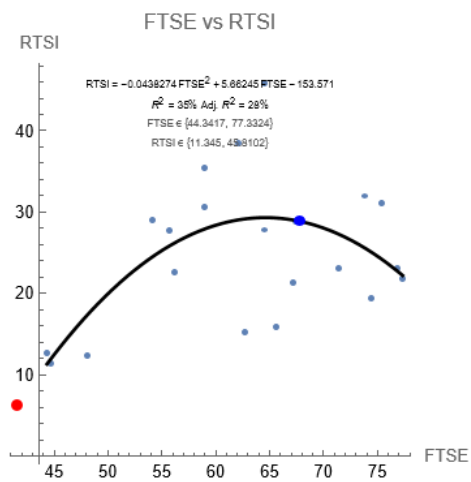


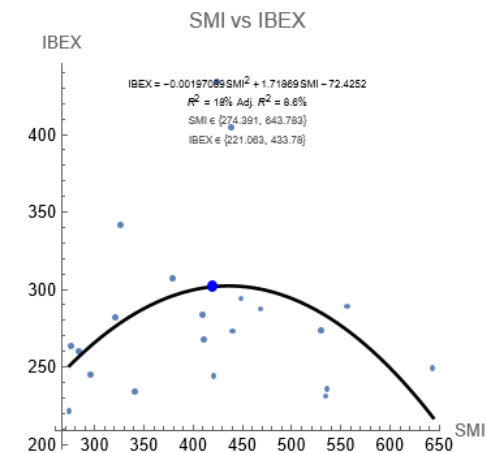
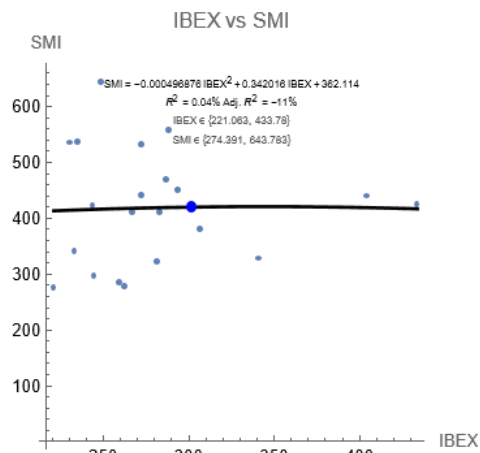
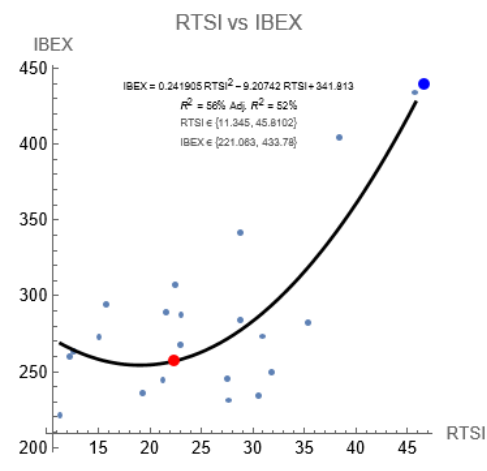
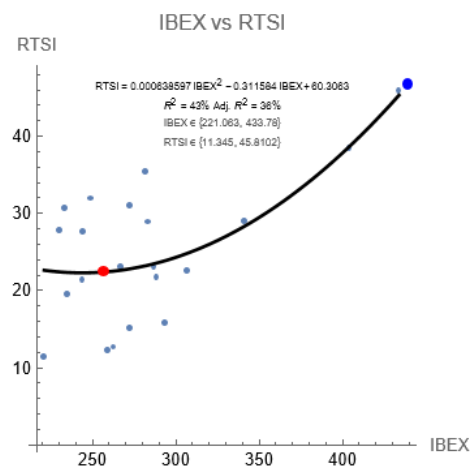
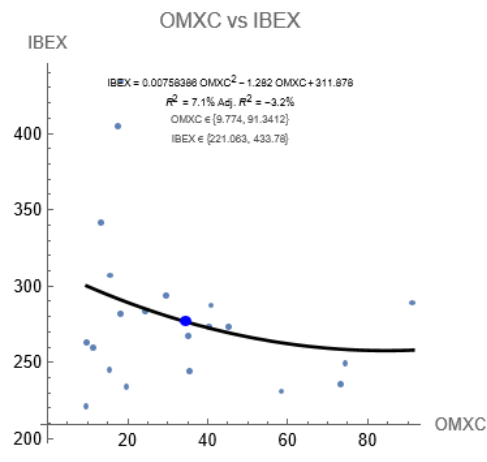
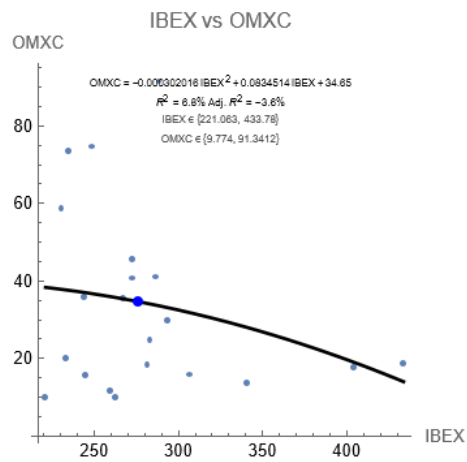


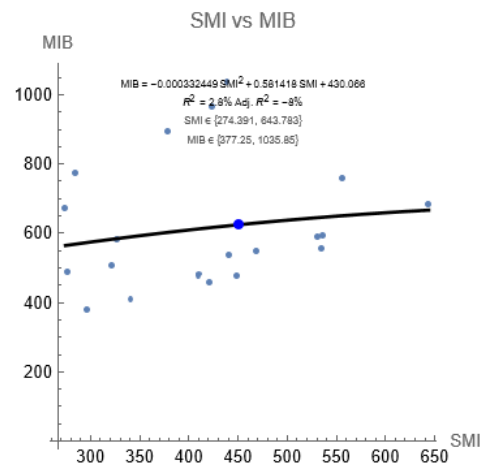
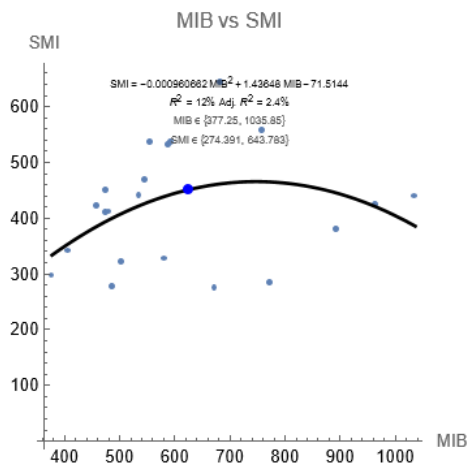
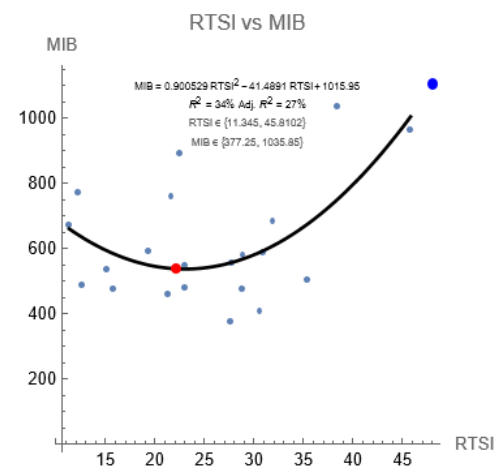
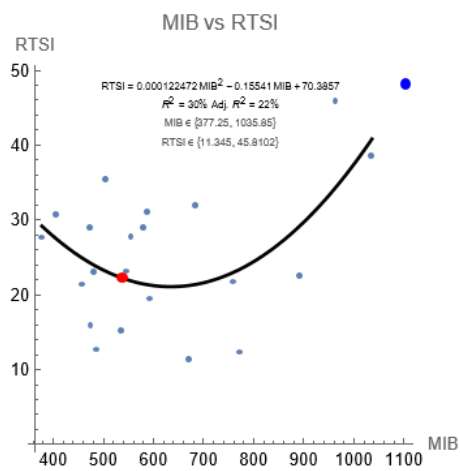
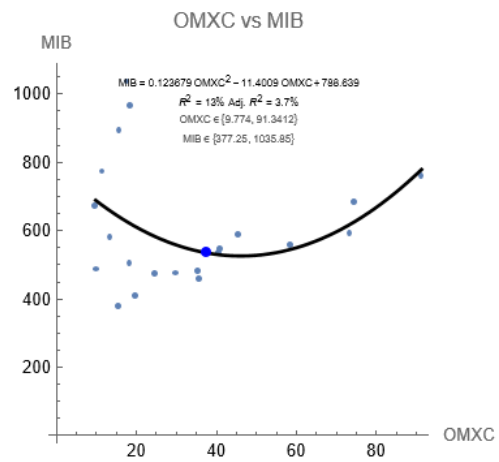
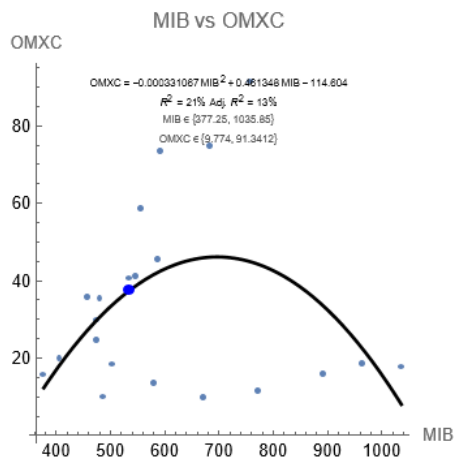


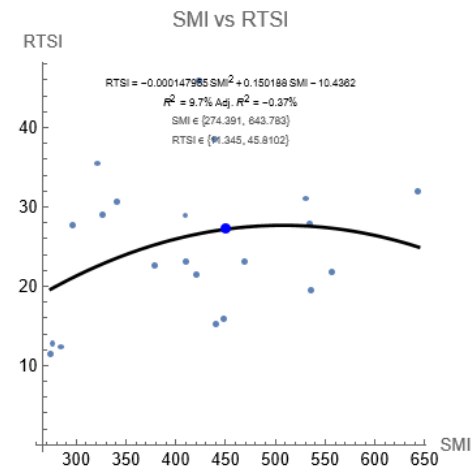
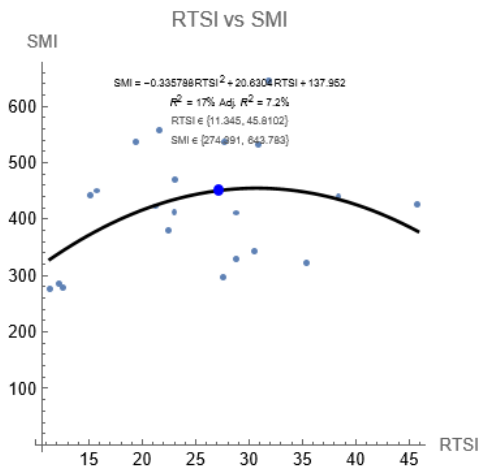
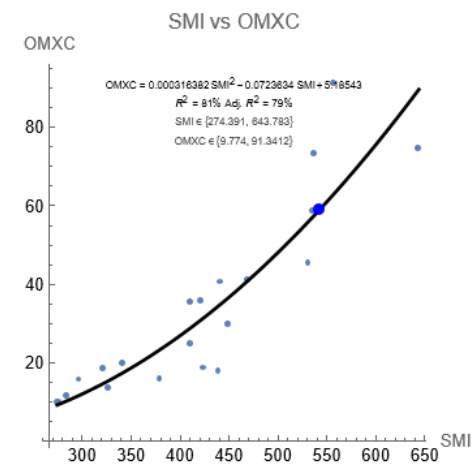
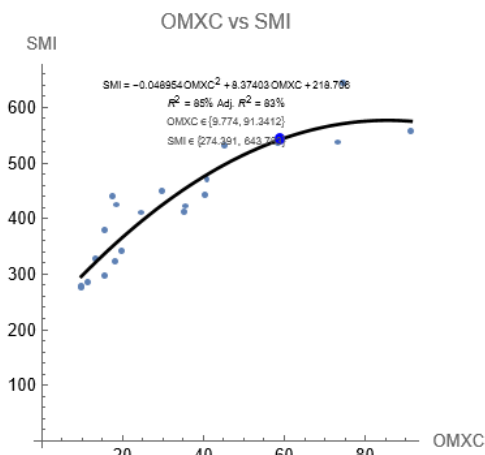
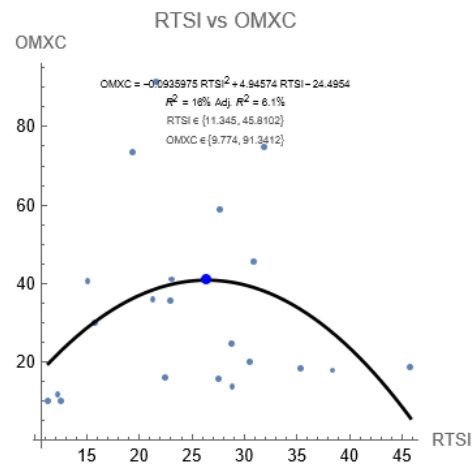
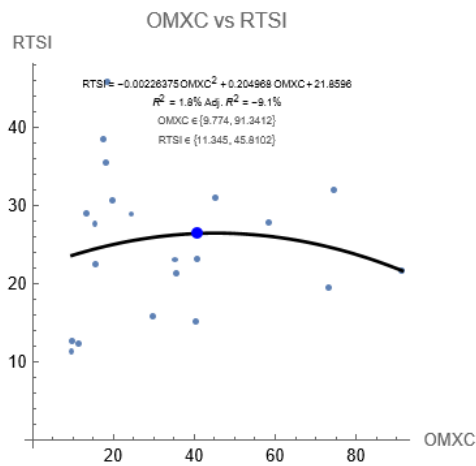












The End