

# Simulation modeling of stock prices for predictions

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Stocks are regularly traded and their price changes continuously. There exist many theories and forecasting methods trying to predict the price developments. But a causal model that predicts and explains the price development is missing. This work provides such a system dynamics simulation model which can both predict the price development and provide a causal reasoning.

## Introduction

Stocks are important means of financing and are continuously traded. Their prices change constantly. Publicly traded stocks can be analyzed, and their price development predicted. There exist many theories and forecasting methods that try to predict the price changes over time. However, most of these forecasting methods consider either historical data, trends, or investor opinions to determine the stock price. Currently, a causal model is missing. With a causal model, the links between the factors that influence the price of a stock and their effects on each other could be analyzed and demonstrated. The goal of this work is to develop a system dynamics simulation model to predict stock prices.

## Background

Many factors can influence stocks and their prices. In this project, four key areas of influence are chosen and considered: (1) the quantitative and qualitative fundamental analysis of the company, (2) the technical analysis of the stock price development, (3) the psychological analysis of the investors, and (4) the analysis of the economic environment. Combined, these four areas influence the price development of stocks (see Figure 1).

## Results

For the system dynamics simulation model, the key factors influencing the stock price development were

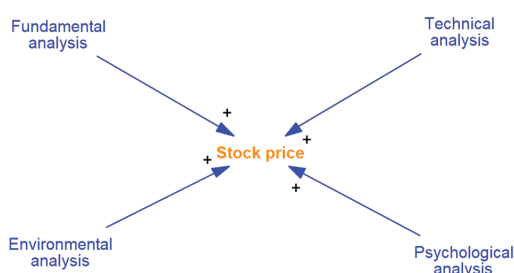


Figure 1: The four key areas influencing the stock price

identified and included. The four key areas mentioned before were considered in the development of the model. The resulting stock and flow diagram provides an overview of the causalities and influences for predicting a stock's price. The model includes causal loops that show the feedback dynamics in the factors influencing the stock price. To validate the model, its behavior was fitted to the historic data from the BKW (Bernische Kraftwerke AG) as an example stock. The historic data was matched with a mean relative error of 5.7% (see Figure 2).

## Conclusion

The developed system dynamics simulation model shows the key causalities and factors influencing the stock price development. Furthermore, the model can predict the stock price and account for different scenarios. How well the model can predict the future development of a stock's price is dependent on the decision maker's policies and knowledge about the influencing factors and the stock itself.



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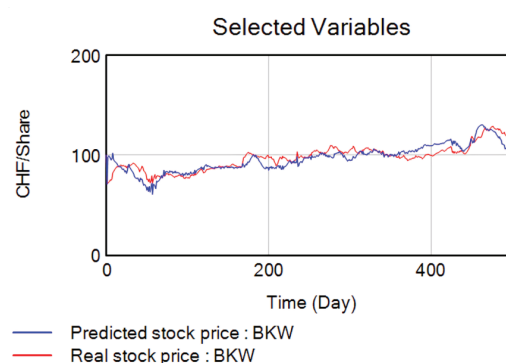


Figure 2: Predicted and real stock prices of the BKW from 2020 to 2021