

Visual Financial Data Analysis

The large amounts of data on the financial market today pose many computational challenges. Currently, companies like Reuters deliver around 50.000 data updates per second of financial stock market data. Such amounts of data can be analyzed by data mining algorithms, but for understanding market mechanisms and in order to evaluate the characteristics of assets, innovative visualization techniques offer many advantages over numeric techniques with regard to knowledge discovery in financial markets as one image can communicate more insight than ten thousand numbers.

The main objective of this project is the development of new concepts and algorithms for pixel-based visualization techniques to overcome the shortcomings of traditional techniques, and which significantly improve the insight into the behaviour of financial markets. The work focuses on detailed performance analysis of assets with new focus-and-context techniques, inter-asset comparison of all assets on the market, pattern and trend recognition in different market sectors, portfolio analysis, and also includes the development of scalable techniques for high-resolution financial data analysis on large displays walls (powerwalls).

We have developed an advanced pixel-based approach that extends the ability of traditional line chart techniques, and visualizes the growth of all possible time intervals in only one image. Thus, each asset generates a unique finger print revealing the characteristics of the assets behaviour. Further visualization techniques specialize on the evaluation of long-term investments, and allow to use Weight Matrices in order to focus on an investors region of interest. We also implemented techniques for performance/risk analysis as well as Dominance Plots and Pareto efficiency curves to analyze sets of assets.

Right: Comparative analysis of the characteristics of assets from different market sectors and countries. Each image simultaneously reflects 18.000 time intervals for absolute growth and relative market performance in comparison with 12.000 other funds in the database in a single view.

Below: Visual comparison of assets using large display walls (powerwall) allows instant discovery of funds that behave different from all others.



Discovery of Atypical Behaviour in Financial Time Series Data using 2-dimensional Colormaps

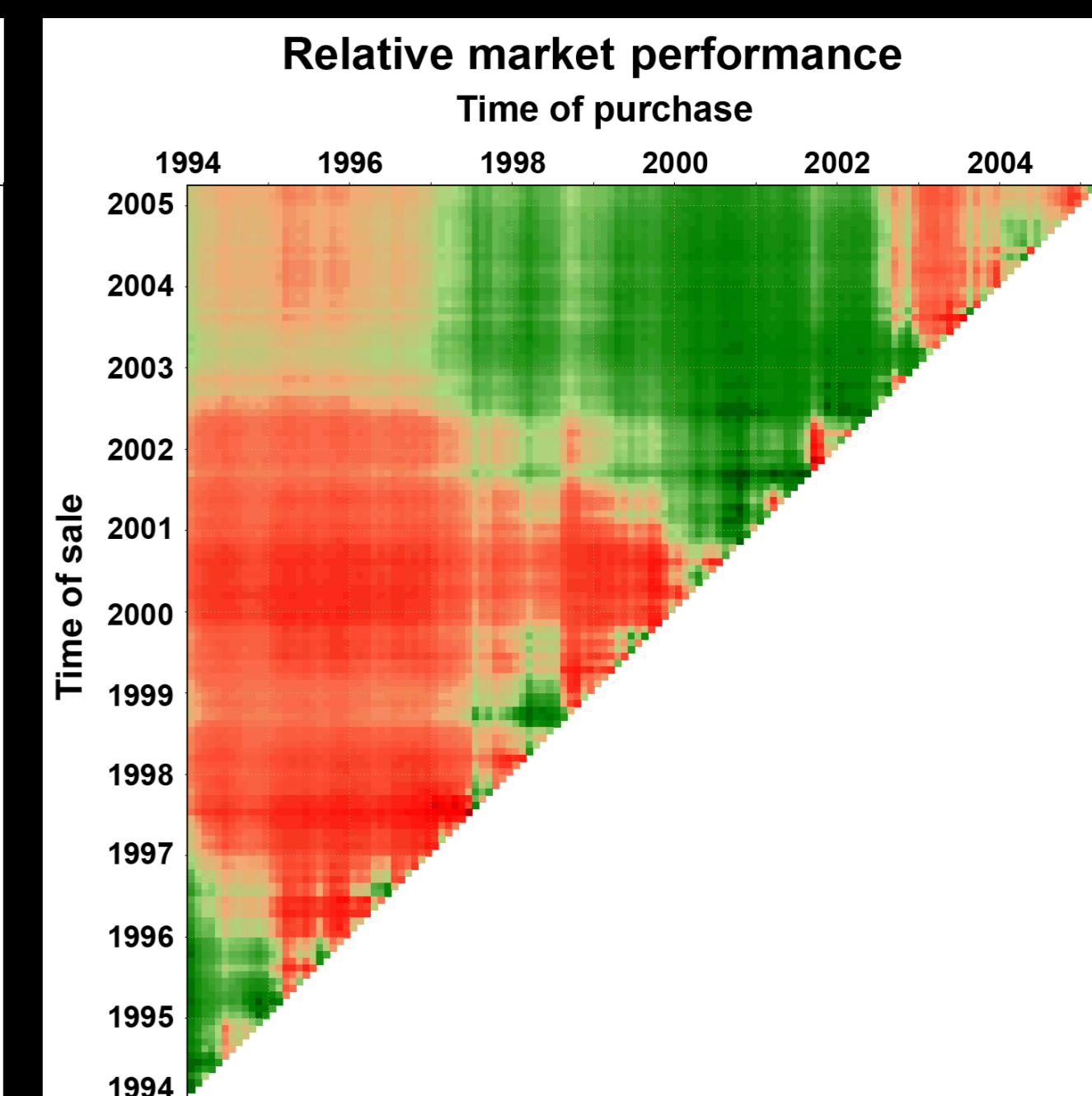
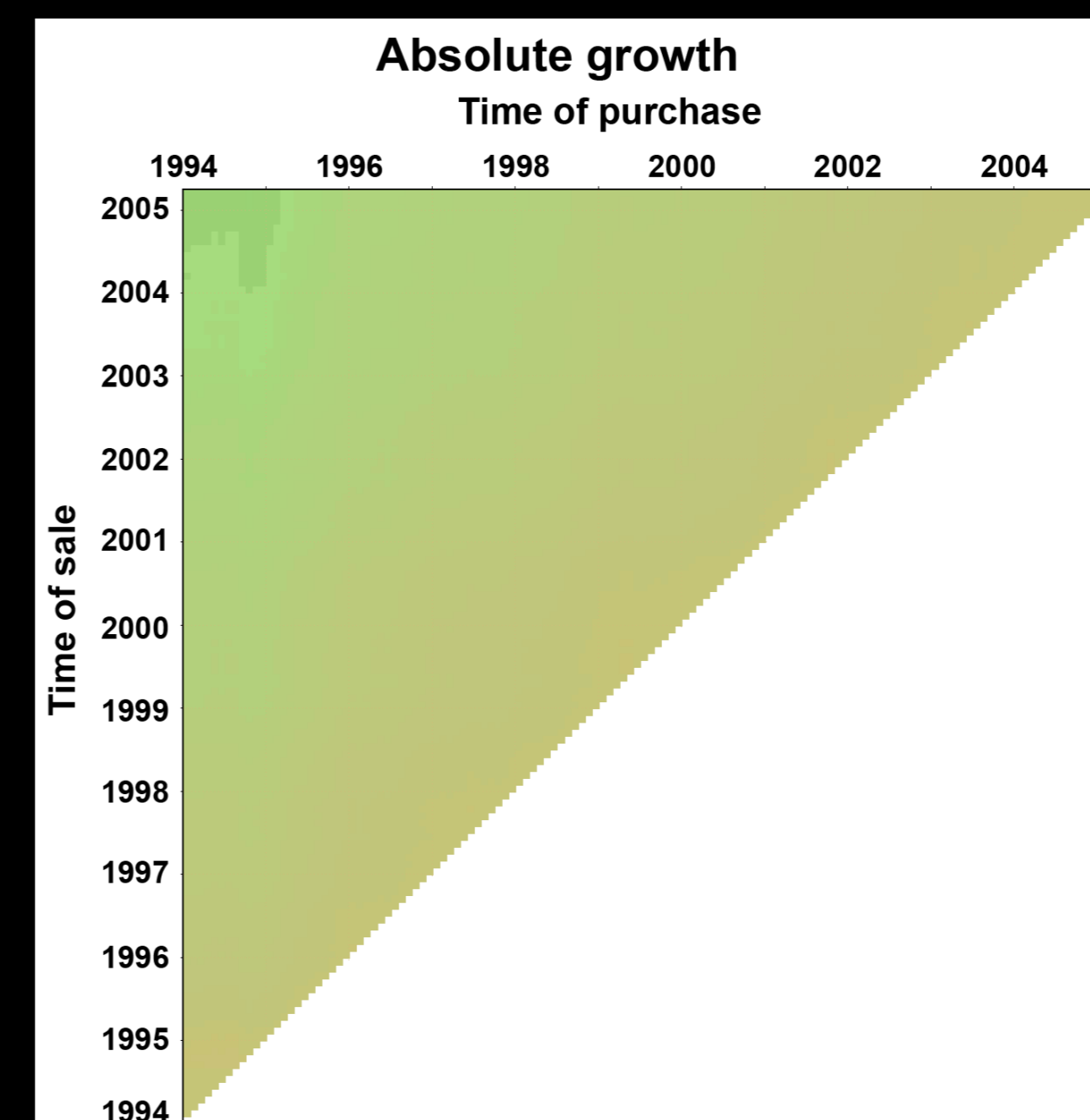
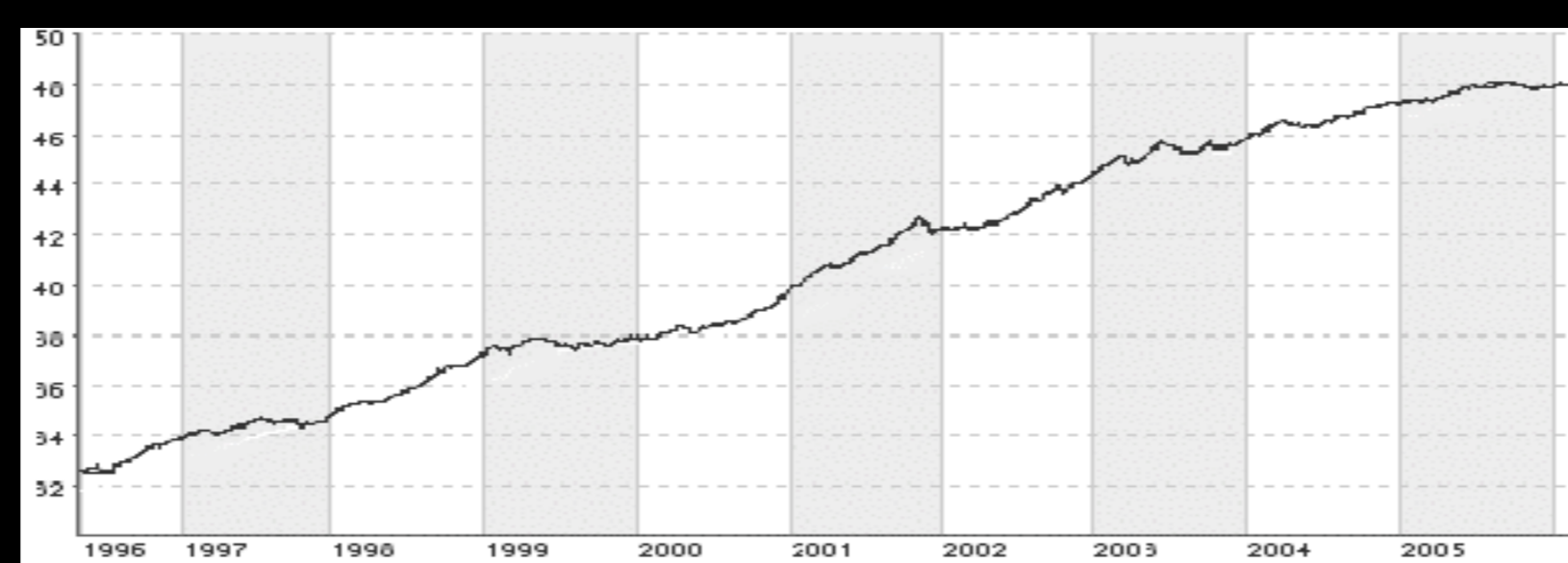
Combining the triangle matrices for absolute growth and relative market performance into one unified triangle can be achieved by constructing a two-dimensional colormap (right) that reflects all possible combinations of absolute growth and relative market performance [2]. This allows to recognize assets that perform worse the market median while still generating overall positive revenues (see example of DWS Select-Rent above, indicating that other assets are better investments for given time intervals and shown by yellow color on the right), or assets that have exceptional stability during crisis (=perform better than the market median although the whole stock market has losses, see blue areas in the triangles on the right).

Growth Matrix Approach

The Growth Matrix approach[1] allows a comparison of growth rates of a fund for all possible combinations of time of purchase and time of sale at one glance. Instead of using traditional line charts, we analyze all possible time intervals (with the time of purchase on the x-axis and the time of sale on the y-axis) by spanning triangular matrices and coding the growth rate with the color. The triangles can display the absolute growth (green=profits, red = losses), or can be used to analyze the relative market performance which compares the performance of a fund against a database of 12.000 funds for a given time interval, revealing the time intervals where an asset has performed better or worse than its competitors on the financial market.

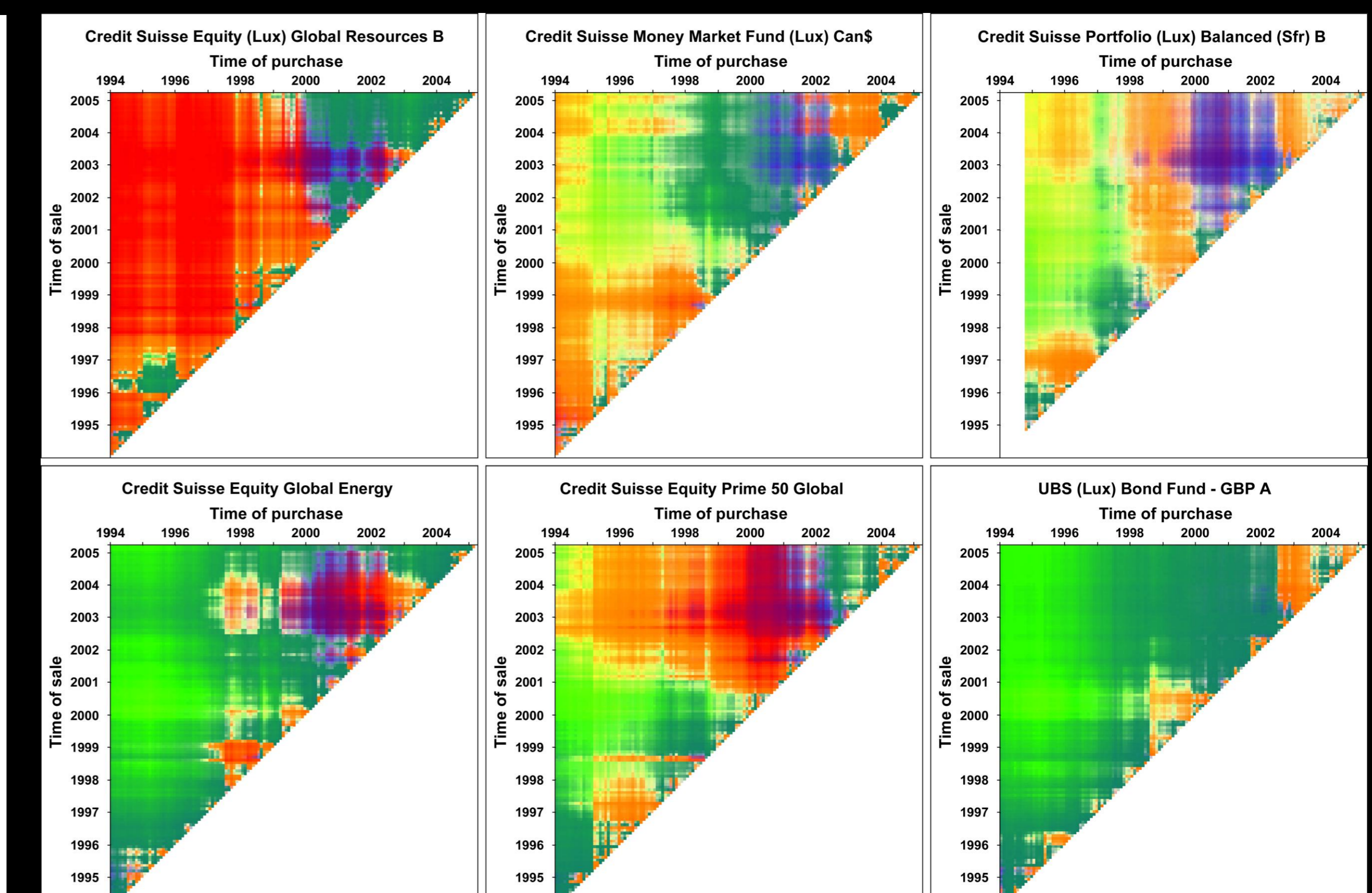
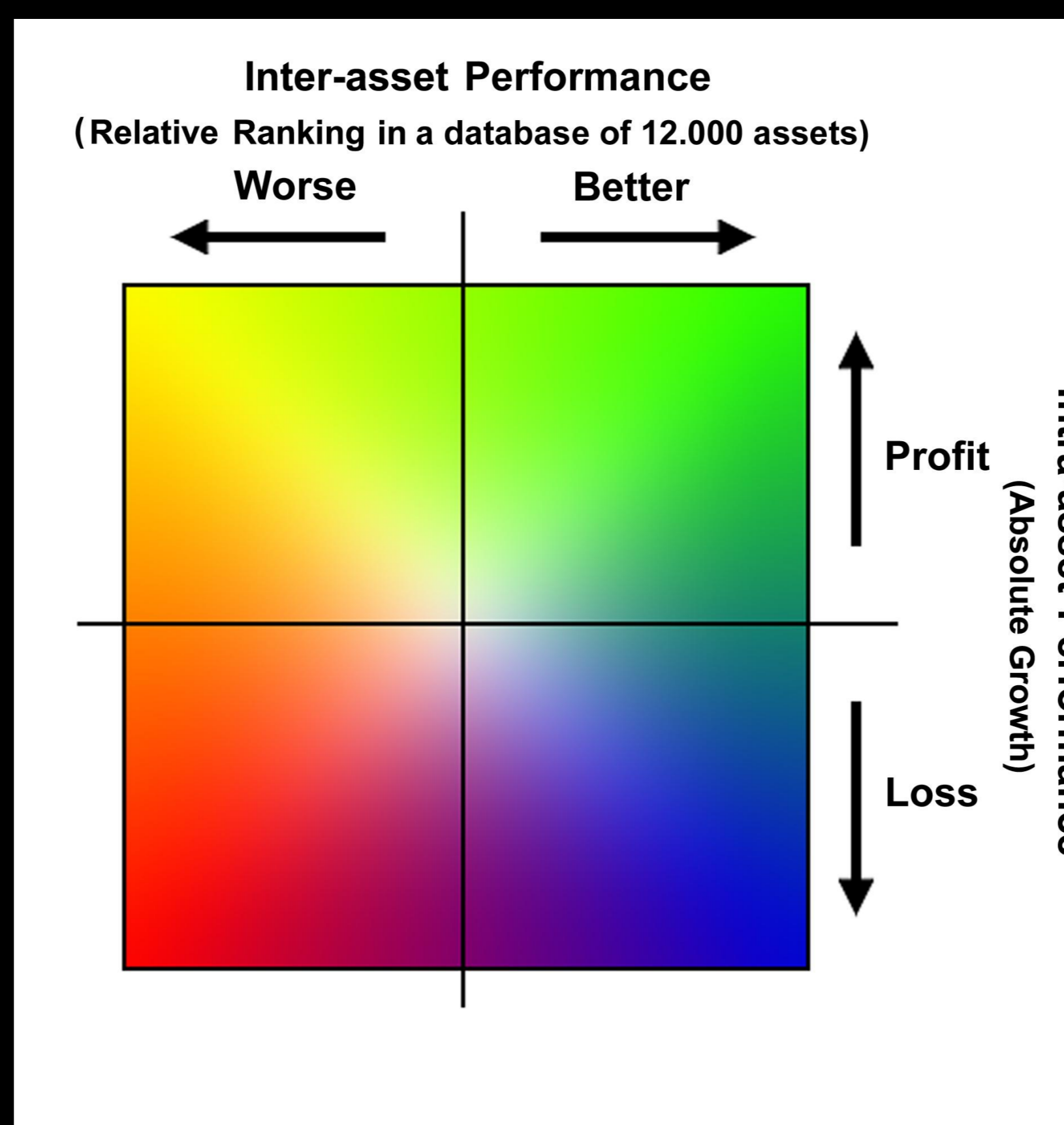
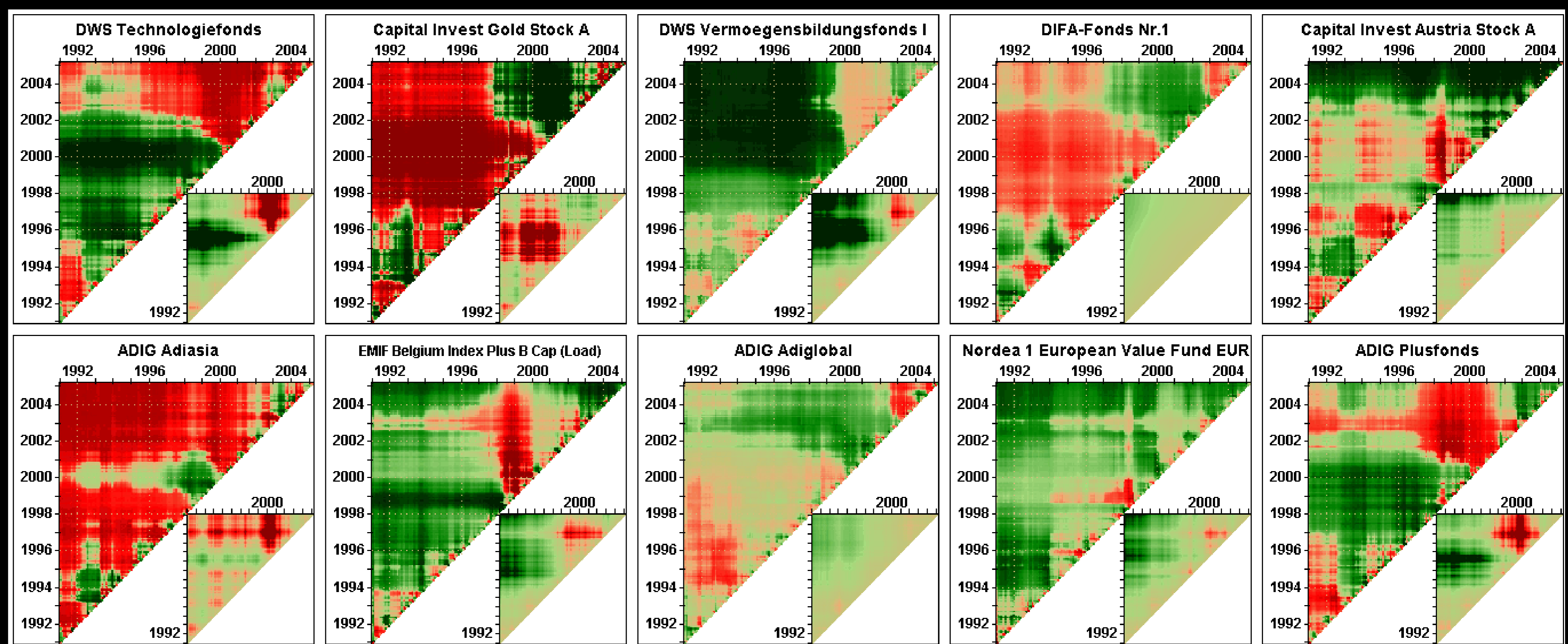
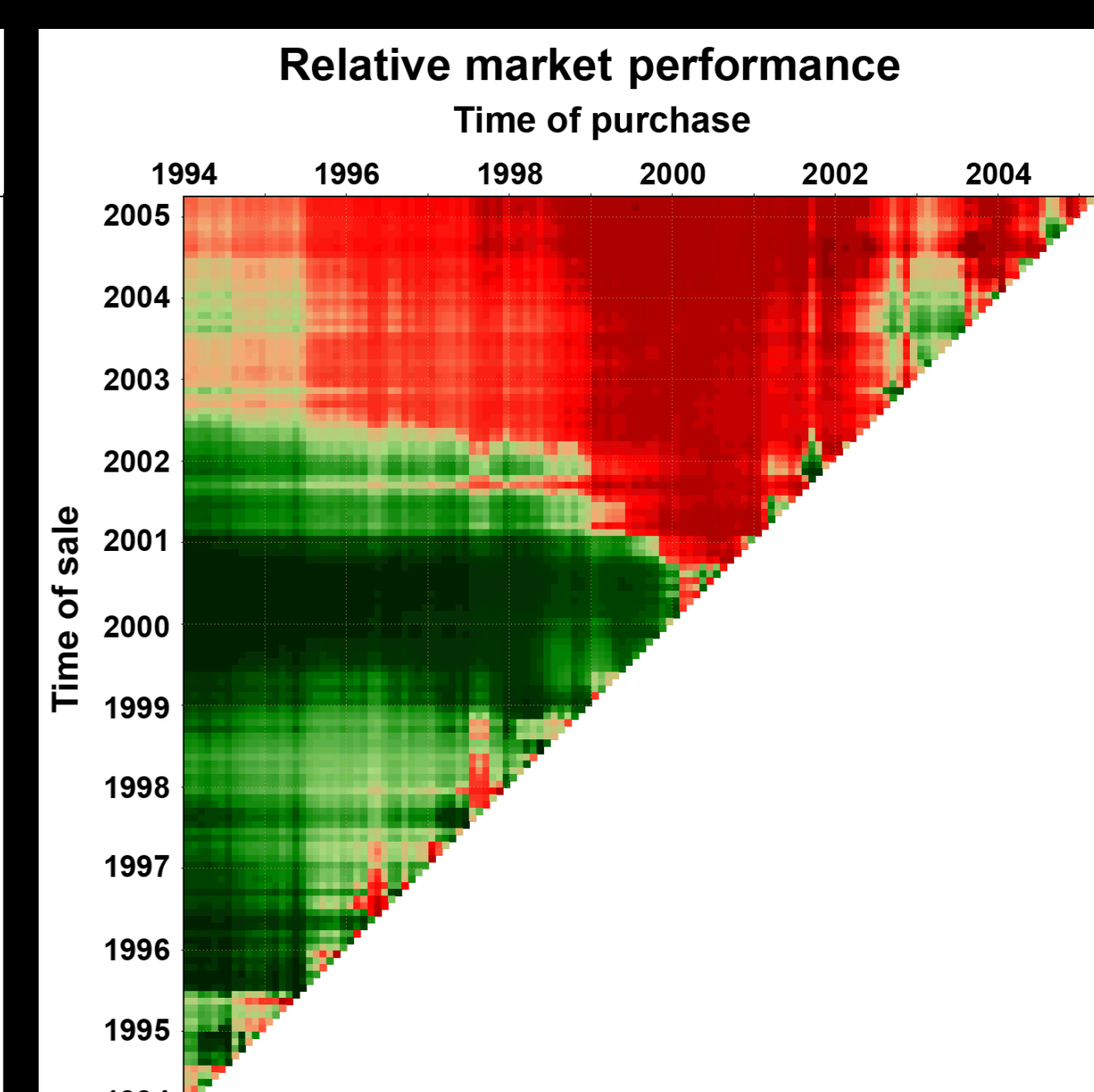
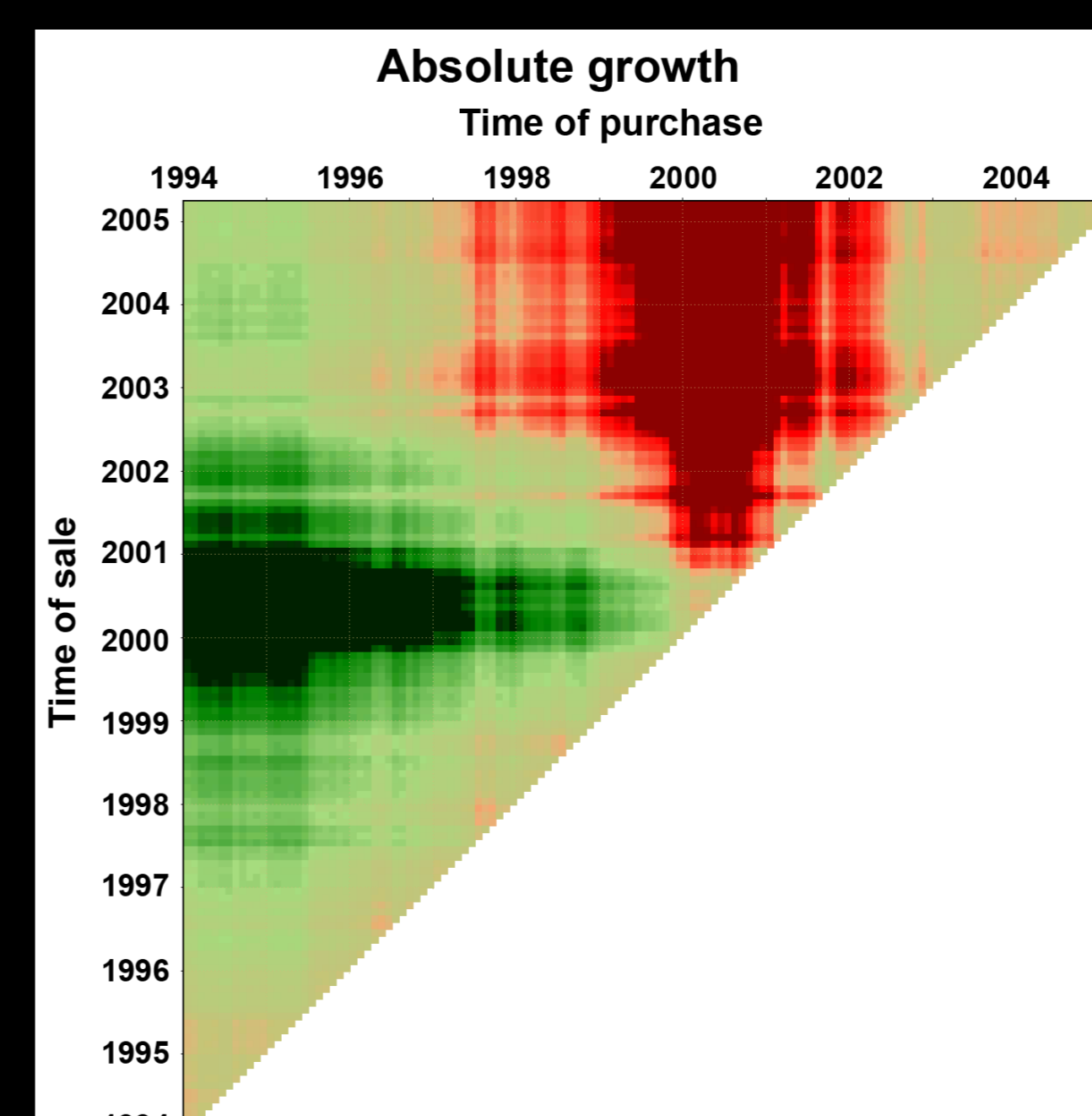
DWS Select-Rent

This example shows a bond with a stable growth of nearly 2 % per year. While being continuously profitable and never experiencing significant losses, the relative market performance reveals that in the time intervals show by red color most other funds on the market performed better, and so a different investment would have returned more profit for our investment.



DWS Technology Fund

This example shows a technology fund, which was highly profitable in the time intervals shown in dark green color. During the dot-com crisis in 2000/2001, the fund lost 2/3 of its original value. Note that the DWS Select-Rent bond above with its 2% growth was a good investment in the time when the stock market crashed.



References

[1] Keim, D., Nietzsche, T., Schelwies, N., Schneidewind, J., Schreck, T., Ziegler, H.; "A spectral visualization system for analyzing financial time series data". Proc. EuroVis 2006: Eurographics/IEEE-VGTC Symposium on Visualization, Lisbon, Portugal, May 2006

[2] Ziegler, H., Nietzsche, T., Keim, D., Visual Exploration and Discovery of Atypical Behaviour in Financial Time Series Data using Two-Dimensional Colormaps, Symposium on Visual Data Mining, Information Visualization 07 (IV'07), Zürich, Switzerland, July 2007

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