Production Portfolio Theory II - First Steps Towards a General Portfolio Theory and Numerical Examplifications

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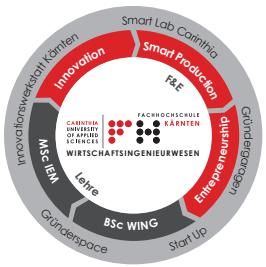
09/08/2023 Hybrid, Session 8, 11:30-12:45|Amstelpark



Content

Introduction

Introduction I

Motivation and Introduction:

- Autopoetic Systems [Kan06; Göt23]
- Selforganisational Theory [Kan06; Göt23]
- DCF Theory (DCF=Discounted Cash Flows) [Fis02; Fis09; FKM99]
- Portfolio Theory Markowitz [Mar52] → evolutionary approach, generalisation

Aim and goal:

- Statistical, numerical, methodological general framework for **Production** Portfolio Theory (building on [HT23a])
  - → Apply risk dimension
  - → Example

Production Portfolio Theory II

Production Portfolio Theory II - Portfolio Theory and DCF I

Portfolio Theory:

- Two dimensions - Return (r), Risk (σ)
- Minimum Variance (σ) Portfolio **MVP**

DCF

The variable ξ is denoting a *value* and a *medium* (as money (price), energy, products, etc.) are media, with regard to their observation space-time or event, which can be any variable as an extension of price, products, and energy, with the associated unit.
$\rightarrow$ total capital value of medium ξ is:

$$c_t^{\xi} = \underbrace{c_0^{\xi}}_{\text{initial growth}} + \underbrace{\sum_{i=1}^{t} \frac{c_i^{\xi}}{(1+\xi)^i}}_{\text{stabilisation}} + \underbrace{c_e^{\xi}}_{\text{decay}}. \tag{1}$$

[1]

[1] s.a. [Göt23] for evolutionary process structure.

General Portfolio Theory I

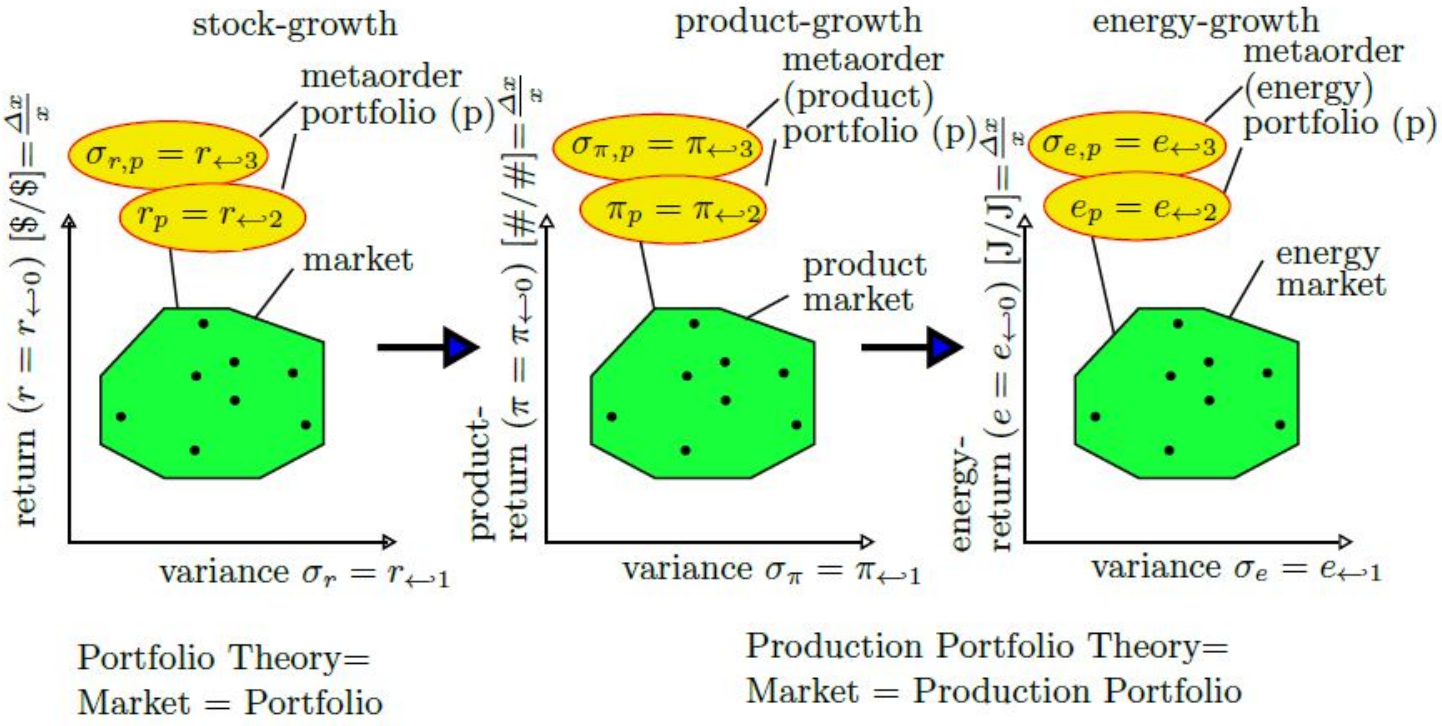


Figure 1: Production Portfolio- and Portfolio-Theory; Δx=profit, x=value (price or stock-price P, stock return r, product return π, product price P^π, energy return e, energy price P^e)

General Portfolio Theory II

Overall Implementation Process of Production Portfolio Theory:

(1) We define a value.

(2) We calculate the value for one scenario (this is the basis value with two dimensions, risk and value. Risk and value are here basically assumptions due to the specific environment).

(3) We make a bifurcation beginning by one additional case (scenario).

(4) All the cases are the market.

(5) Regarding all cases is a portfolio. Otherwise we have a subset portfolio.

(6) We make a portfolio optimisation according to the value goals (min(imum) risk, max(imum) value).

Example I

Table 1: Model Example for Production Portfolio (cf. a. [Fis02]), ρ=0.4, contract sold of product A 60% (x_A), and of product B 40% (x_B).

	A	B
$E(\pi_j)$	0.08	0.15
$\sigma_{\pi_j,p}$	0.1	0.2

Example II

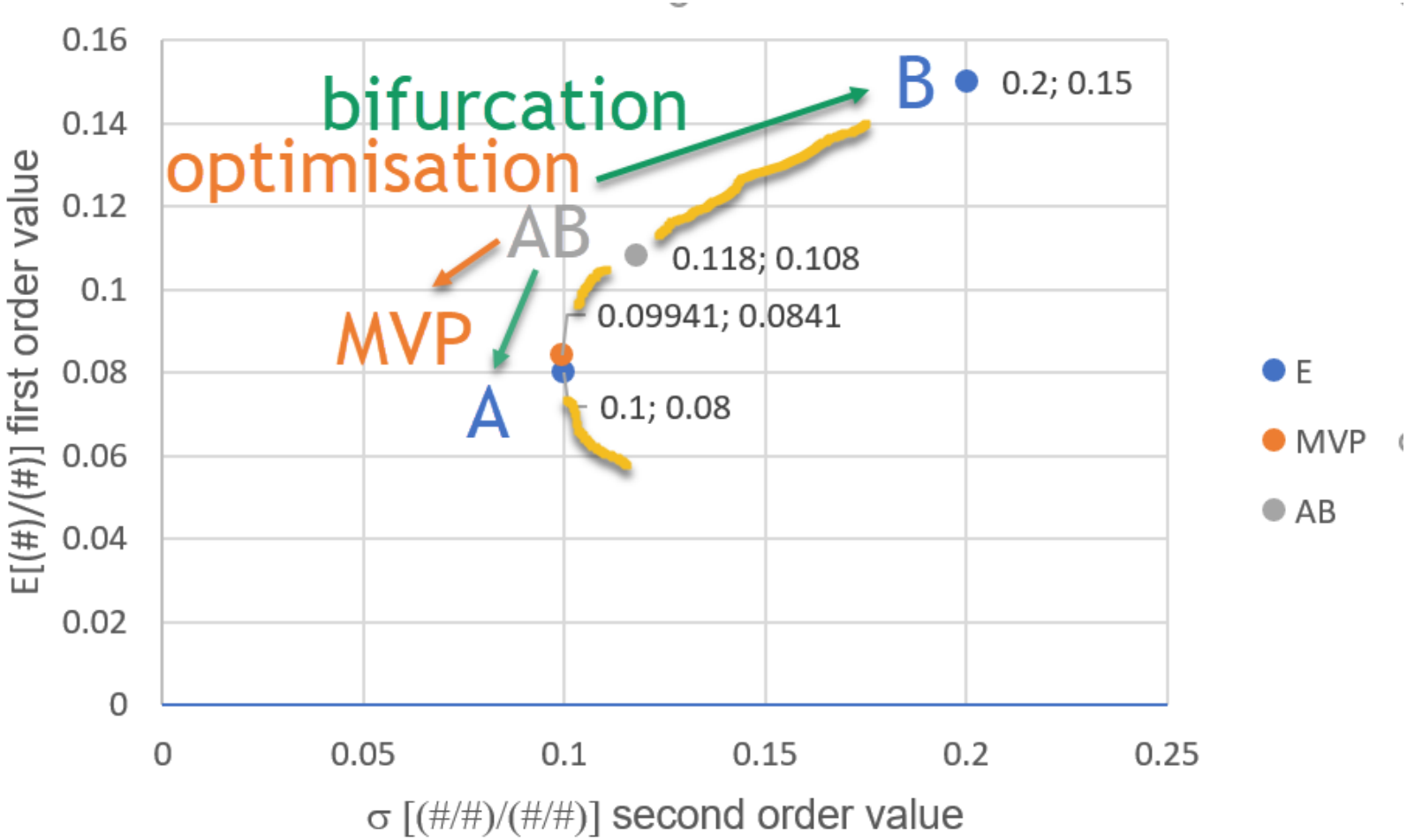


Figure 2: E,σ diagram example solution.

Optimisation I

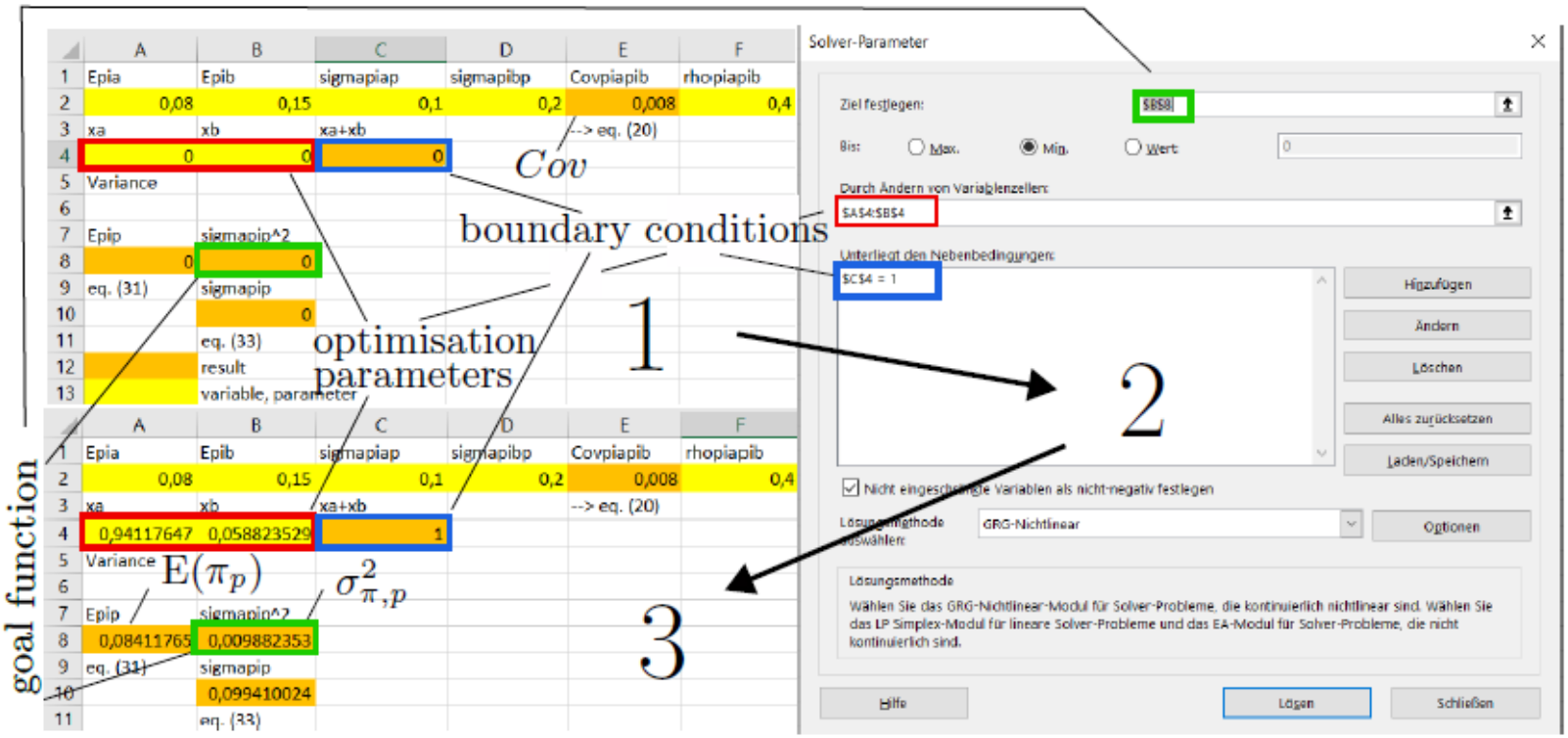


Figure 3: Optimisation in Microsoft® Excel® with the Solver Add-in

Conclusion and Outlook

Conclusion and Outlook I

Conclusion:

- Return (Stock) to Value (ξ) transformation $\rightarrow$ general production portfolio theory
- Hierarchical order increase (value-o$_{1..3}$)
- **Numerical** application example given for Production Portfolio Theory
- Method helps to **reduce risk** in production

Outlook:

- Ready to be applied in economy, computational science $\rightarrow$
- Further description and methods to reduce risks
  - greater systems (computation)
  - integration with AI tools (Natural Language Processing (Chat GPT), Deep Learning...)
- Industrial Applications

Thank you cordially for your attention!

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PS.: The presentation can also be found at:

http://www.dr-heiden.com/Vortraege.htm

Bibliography I

[1] Thomas Bauernhansl, Michael ten Hompel, and Birgit Vogel-Heuser. *Industrie 4.0 in Produktion, Automatisierung und Logistik*. Ed. by Birgit Vogel-Heuser. Springer Vieweg Verlag, Wiesbaden, 2014.

[2] Hans Benker. *Mathematische Optimierung mit Computeralgebrasystemen*. Springer Berlin Heidelberg, 2003. 514 pp. ISBN: 3540441182.

[3] Aswath Damodaran. *The Dark Side of Valuation*. 2. Upper Saddle River: FT Press, Fifth Printing, 2013.

Bibliography II

[4] Albert Einstein and Marian von Smoluchowski. *Studies on the theory of Brownian motion - Treatise on Brownian motion and related phenomena, original in German: Untersuchungen über die Theorie der Brownschen Bewegung - Abhandlung über die Brownsche Bewegung und verwandte Erscheinungen*. Vol. 199/207. Ostwalds Klassiker der exakten Wissenschaften. contains the original 1905 Einstein paper: "Über die von der molekularkinetischen Theorie der Wärme geforderte Bewegung von in ruhenden Flüssigkeiten suspendierten Teilchen" (Aus den Annalen der Physik, 4. Folge, Band 17, 1905, Seite 549-560) and other works on the particle-osmotic analogy. Verlag Harri Deutsch, Frankfurt am Main, 2001.

Bibliography III

[5] Klaus Erlach. *Value stream design - the path to a lean factory, original in German: Wertstromdesign – Der Weg zur schlanken Fabrik*. 2nd. Springer Verlag, Berlin-Heidelberg, 2010.

[6] Edwin O. Fischer. *Finanzwirtschaft für Anfänger*. Ed. by Edwin O. Fischer. 5. Oldenburg Verlag, München, 2009 (cit. on p. 4).

[7] Edwin O. Fischer. *Finanzwirtschaft für Fortgeschrittene*. Ed. by Edwin O. Fischer. 3. Oldenburg Verlag, München, 2002 (cit. on pp. 4, 9).

[8] Edwin O. Fischer, Christian Keber, and Dietmart G. Mahringer. *Arbeitsbuch zur Finanzwirtschaft für Anfänger*. Ed. by Edwin O. Fischer. 2. Nachdruck. Oldenburg Verlag, München, 1999 (cit. on p. 4).

Bibliography IV

[9] Immanuel Fruhmann. "Zur differenzierenden Offenheit wissenschaftlicher Systeme Epistemologisch-sprachphilosophische Zugänge". MA thesis. Institut für Philosophie, 2011. URL: https://unipub.uni-graz.at/obvugrhs/content/titleinfo/213194/full.pdf.

[10] Johann Götschl. *Vorlesung: Einführung in die Philosophie der Gegenwart (Organisation und Selbstorganisation im Natur- Kulturgefüge); Translated: Lecture: Introduction to Contemporary Philosophy (Organization and Self-Organization in the Structure of Nature and Culture)*. Lecture. Karl-Franzens Universität, Graz, 2023 (cit. on pp. 4, 6).

Bibliography V

[11] Bernhard Heiden. *Wirtschaftliche Industrie 4.0 Entscheidungen - mit Beispielen - Praxis der Wertschöpfung*. Akademiker Verlag, Saarbrücken, 2016.

[12] Bernhard Heiden and Bianca Tonino-Heiden. "First Elements of Production Portfolio Theory: A New Industrial Engineering Scientific Method". In: *Proceedings of 2023 The 12th International Conference on Informatics, Environment, Energy and Applications (IEEA 2023)*. ICITIM 2023 Conference/2023 The 12th International Conference on Informatics, Environment, Energy and Applications (IEEA 2023). ICPS / ACM (The Association for Computing Machinery), 2023. ISBN: 979-8-4007-0012-5. DOI: 10.1145/3594692.3594705 (cit. on p. 4).

Bibliography VI

[13] Bernhard Heiden and Bianca Tonino-Heiden. "Lockstepping Conditions of Growth Processes: Some Considerations towards their Quantitative and Qualitative Nature from Investigations of the Logistic Curve". In: *Lecture Notes in Networks and Systems* (2022). Ed. by Kohei Arai, pp. 695–705. DOI: 10.1007/978-3-031-16078-3_48.

[14] Bernhard Heiden and Bianca Tonino-Heiden. *Philosophische Untersuchungen - Spezielle Orgitontheorie (unpublished)*. 2023.

Bibliography VII

[15] Bernhard Heiden et al. "Framing Artificial Intelligence (AI) Additive Manufacturing (AM)". In: *Procedia Computer Science*. 14th International Symposium "Intelligent systems" (INTELS'20), 14.-16. Dec. 2020. (Lomonosov Moscow State University, Online). Vol. 186. Moscow, Russia: Elsevier B.V., 2021, pp. 387–394. DOI: 10.1016/j.procs.2021.04.161.

[16] Robert C. Hilborn. *Chaos and Nonlinear Dynamics - An Introduction for Scientists and Engineers*. Oxford University Press, New York, 1994.

Bibliography VIII

[17] Bernulf Kanitscheider. "Chaos und Selbstorganisation in Natur- und Geisteswissenschaft". In: *Selbstorganisation: Ein Denksystem für Natur und Gesellschaft*. Ed. by Milos Vec, Marc Thorsten Hütt, and Alexandra Freund. Böhlau Verlag, Köln, 2006, pp. 66–90 (cit. on p. 4).

[18] Niklas Luhmann. *Soziale Systeme*. 17th ed. Suhrkamp Verlag AG, 2018. 675 pp. ISBN: 3518282662.

[19] Harry M. Markowitz. "Portfolio Selection*". In: *The Journal of Finance* 7.1 (1952), pp. 77–91. DOI: https://doi.org/10.1111/j.1540-6261.1952.tb01525.x (cit. on p. 4).

Bibliography IX

[20] OpenAI. *ChatGPT: Optimizing Language Models for Dialogue*. Nov. 30, 2022. URL: https://openai.com/blog/chatgpt/ (visited on 01/15/2023).

[21] Hilary Putnam. *Die Bedeutung der "Bedeutung"*. Klostermann Texte, 2004.

[22] Richard Rorty. *Der Spiegel der Natur. Eine Kritik der Philosophie*. Suhrkamp, 2000. ISBN: 9783518282861.

[23] Gilbert Ryle. *Der Begriff des Geistes*. Reclam, Ditzingen, 1969, p. 464. ISBN: 9783150083314.

[24] Carsten Teichert. "WITNESS - Logistik". In: *Mit Innovationsmanagement zu Industrie 4.0*. Ed. by Peter Granig, Erich Hartlieb, and Bernhard Heiden. Springer Gabler Verlag, Wiesbaden, 2018, pp. 34–42.

Bibliography X

[25] Bianca Tonino-Heiden, Bernhard Heiden, and Volodymyr Alieksieiev. "Artificial Life - Investigations about a Universal Osmotic Paradigm (UOP)". In: *Intelligent Computing, LNNS*. Computing Conference 2021, 15.-16. July 2021. Ed. by K. Arai. Vol. 285. Virtual / London: Springer Nature, 2021, pp. 595–605. DOI: 10.1007/978-3-030-80129-8_42.