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Risk Profile Contingent Performance Analysis of Management Control Systems

Institut für Managementwissenschaften
Bereich Finanzwirtschaft und Controlling
Doctoral Thesis
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Agenda

- Motivation
- State-of-the-art
- Theory development
- Methodology

Motivation

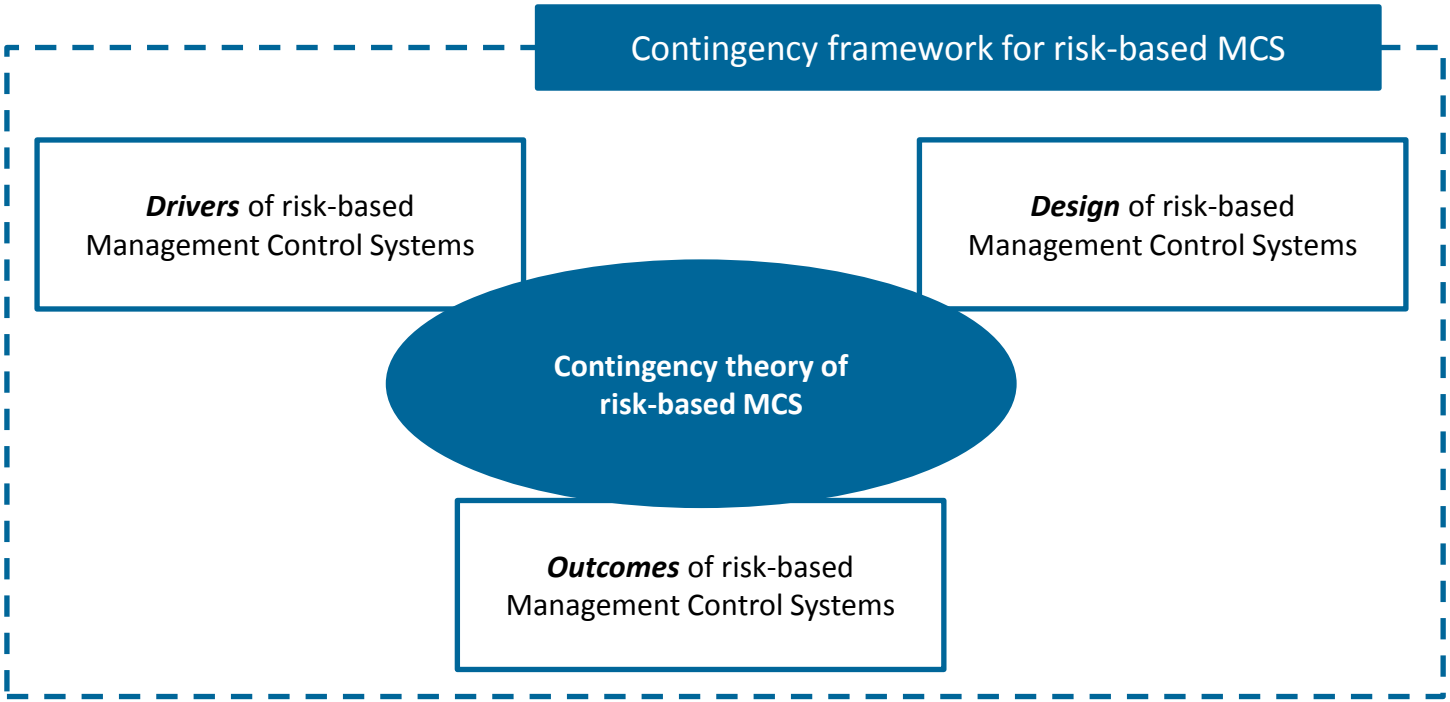
"[…] the literature of management control systems can help us make sense of enterprise risk management. In return, the existing body of work on management controls should be enriched by exploring ERM as another facet of organizational control […]." (Mikes, 2009, p. 19)

"Perhaps the single most important emerging issue has been that of risk management, and the realisation by management control researchers that it has been a neglected aspect of study." (Otley, 2012, p. 251)

"We propose that risk management will be most effective when it matches the inherent nature and controllability of the different types of risks the organization faces." (Mikes & Kaplan, 2014, p. 28)

Motivation

There is a call for future research to conceptualize „fit“ along the lines of progress made in management control research



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Definition of Management Control

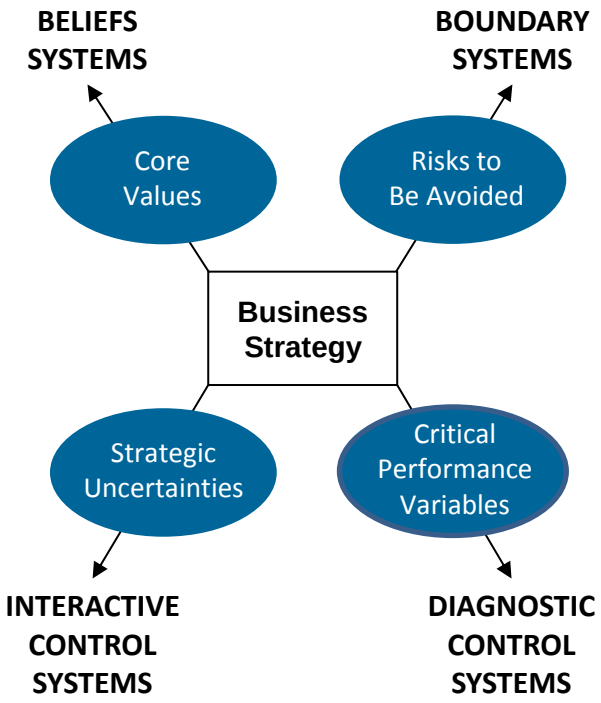
- "The problem of control is defined as that of choosing operating rules for members of an organization and enforcement rules for the operating rules so to maximize the organization's objective function" (Arrow, 1964, p. 397)
- „… the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives" (Anthony, 1965, p. 17)
- "… the formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities" (Simons, 1995, p. 5)
- " … is comprised of multiple control systems that work together" (Widener, 2007, p. 757; Otley, 1980)

Simons' levers of control framework (1/2)

- Beliefs and Boundary Systems are formal systems that explicitly delineate the acceptable domain of activity for organizational participants, in terms of positive ideals and proscriptive limits (Simons, 1995; Tessier & Otley, 2012)

- Diagnostic controls are "formal information systems that managers use to monitor organizational outcomes and correct deviations from pre-set standards of performance" (Simons, 1995, p. 59)

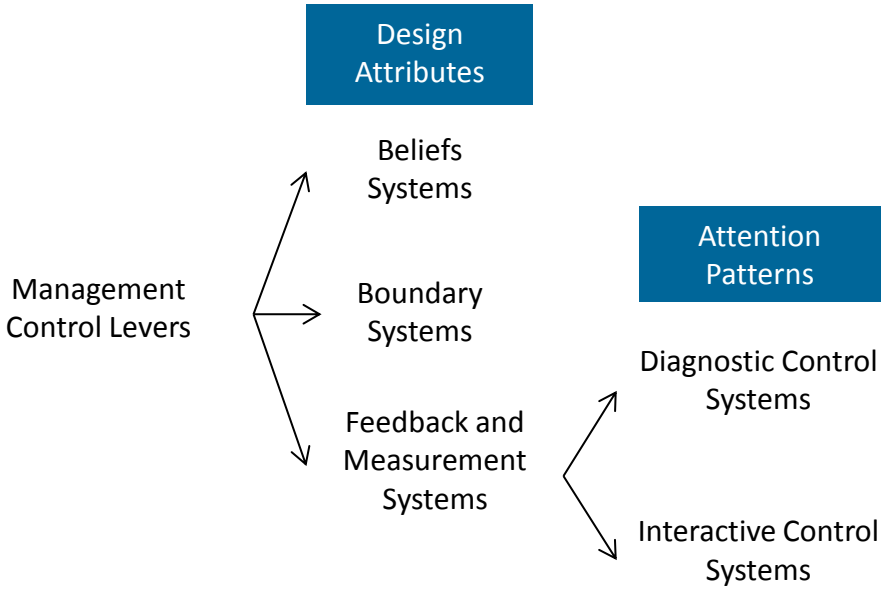
- Interactive controls are "formal information systems that managers use to involve themselves regularly and personally in the decision activities of subordinates" (Simons, 1995, p. 95)



Controlling Business Strategy (Simons, 1995, p. 7)

Simons' levers of control framework (2/2)

- Beliefs and Boundary Systems are used to frame the strategic domain (Simons, 1995; Tessier & Otley, 2012)
- Interactive and diagnostic controls focus on the intensity or style of use of controls, therefore being not a control system per se but descriptions of how managers use control (Simons, 1995; Tessier & Otley, 2012)



Distinguishing Features of Control Levers (Simons, 1995, p. 180)

Management Control and Risk

- The topic of risk management in management control research was first conceptualized by Simons (1995)
- The levers of control (LOC) framework of Simons asserts that strategic uncertainty and risk drive the choice and use of control systems (Simons, 1995; Simons, 2000; Widener, 2007)
- Recent literature illustrates that an organization's risk management system is part of its management control system (Otley, 2016; Arena, Arnaboldi & Azzone, 2010; Mikes, 2009; Merchant & Otley, 2007)
- Control under conditions of uncertainty is one of the abiding themes becoming apparent (Otley, 2012; Otley, 2016)

Kaplan & Mikes' categories of Risk

- Risks that companies face fall into three categories, each of which requires a different management approach (Kaplan & Mikes, 2012; Mikes & Kaplan, 2014)

Category 1	Category 2	Category 3
Preventable Risks	**Strategy Risks**	**External Risks**
Risks arising from within the company that generate no strategic benefits	Risks taken for superior strategic return	External, uncontrollable risks
Risk Mitigation Objective		
Avoid or eliminate occurrence cost-effectively	Reduce likelihood and impact cost-effectively	Reduce impact cost-effectively should risk event occur

Categories of Risk (Kaplan & Mikes, 2012, p. 55)

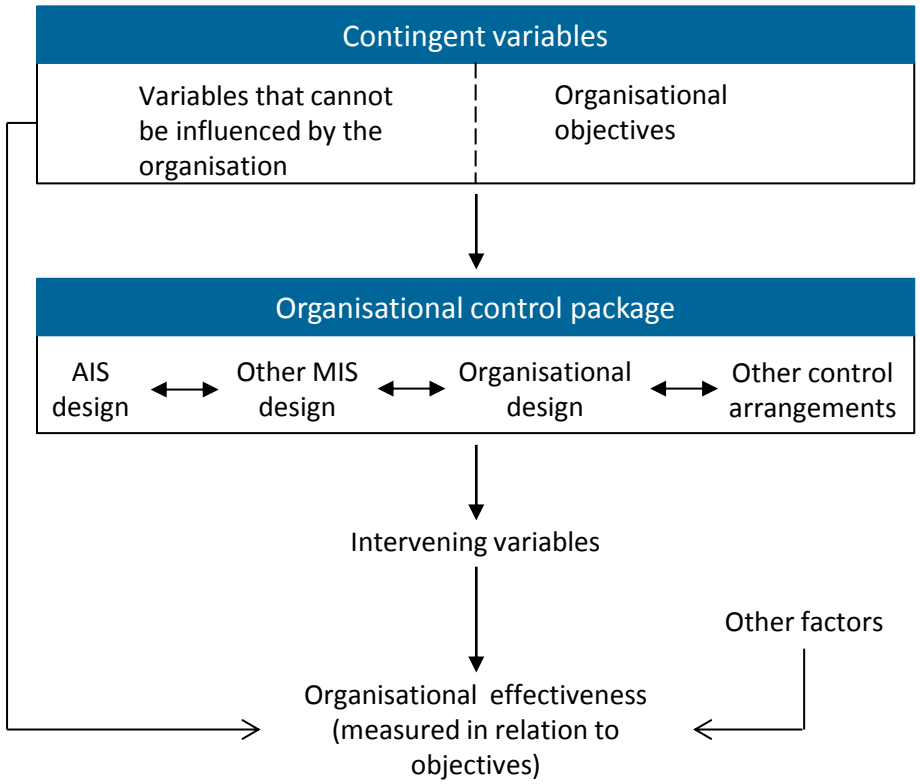
Fields of Research of empirical work on Risk Management

Selection Studies	Performance Studies	Variation Studies
Are plausible contingent factors (=drivers) correlated with the control mechanism in question?	Is organizational performance (=outcomes) correlated with the control mechanism in question?	How does RM work in a specific organization? Which parameters can explain observable variation?
Contextual factors related to RM adoption	Performance implications of RM implementations	Actual RM practices in actual organizations
„Survival of the fittest“ principle would apply only if RM was indeed a mature discipline	Underlying assumption that RM is universally good or bad is not in the spirit of contingency theory	Studies raise questions concerning the generalizability of the results regarding specific RM dynamics

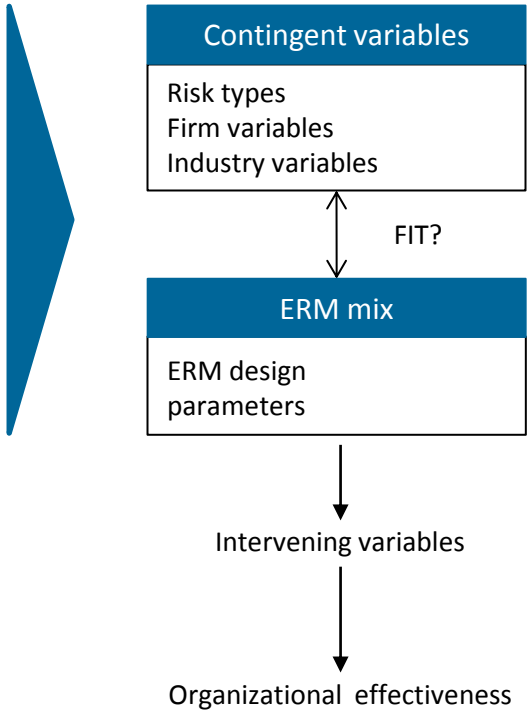
Contingency-based Studies

- Contingency theory posits that organizational structures and systems are a function of environmental and firm-specific factors (Chenhall, 2003; Gerdin & Greve, 2004)
- Fit denominates the alignment of the features of organizational control mechanisms, contingency factors and organizational performance
- A proper fit between contingency variables and organizational design parameters result in higher performance (Fisher, 1995)
- Few studies have addressed the contingency theory of ERM (Gordon, Loeb & Tseng, 2009; Mikes, 2009; Mikes & Kaplan, 2014)
- Gordon et al. find that the relation between ERM and firm performance is contingent upon the appropriate match between ERM and environmental uncertainty, industry competition, firm size, firm complexity, and board of directors' monitoring (Gordon, Loeb & Tseng, 2009)

Contingency Frameworks

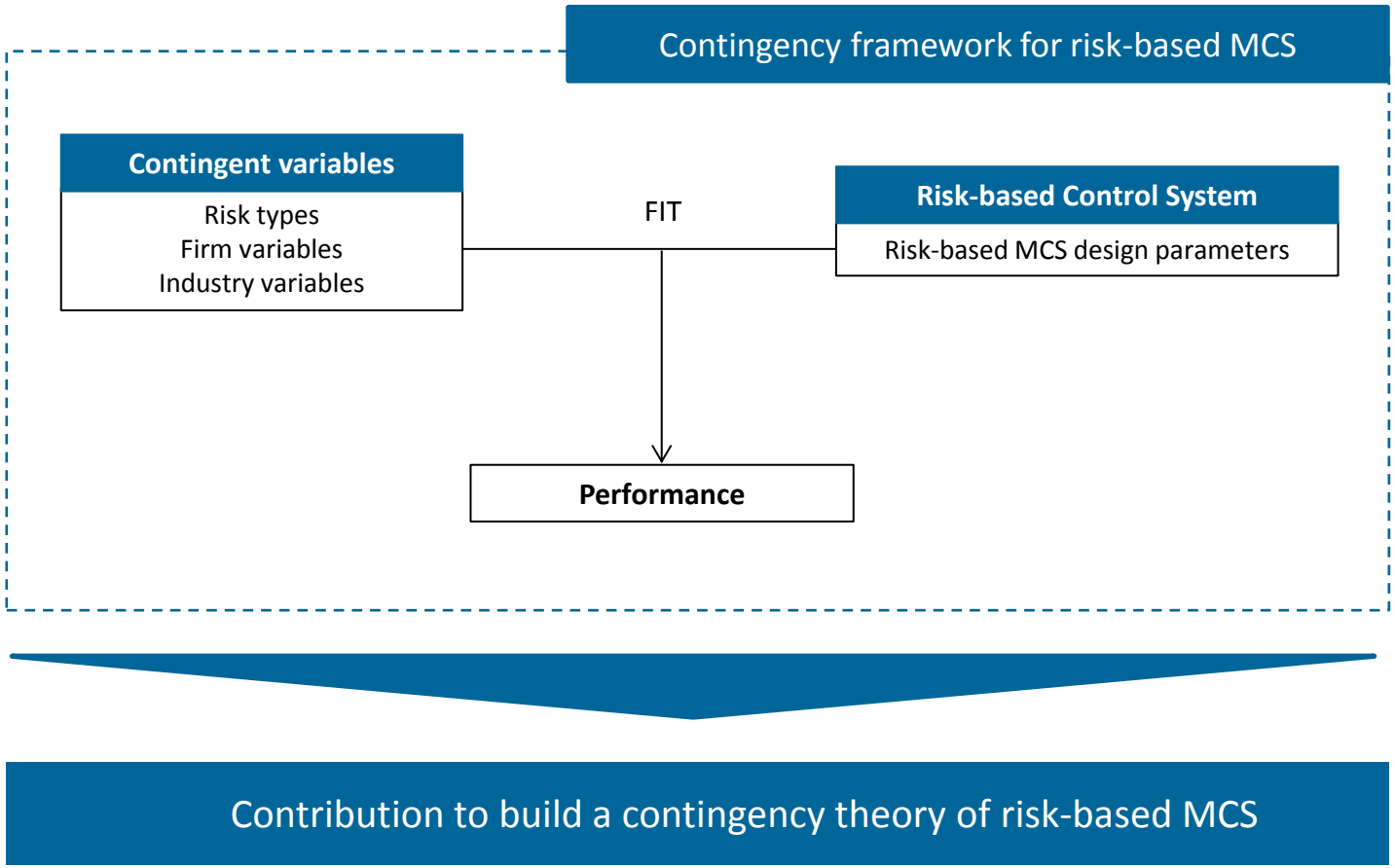


The minimum necessary contingency framework
(Otley, 1980, p. 421)



Minimum Necessary Contingency Framework for ERM
(Mikes & Kaplan, 2014, p. 38)

Research Framework



Research Questions

RQ1: Are the choices of risk-based Control Systems associated with the nature of the firms' risk profile?

RQ2: Are there different configurations of risk-based MCS (=clusters) which are put in place in practice and does the risk profile differ between these clusters?

RQ3: Are business performance and the perceived risk management performance related to the fit between risk-based MCS design and the firms' risk profile?

I hypothesize that the choice among the categories of risk-based MCS reflects the firms' risk profile, and that firms that choose risk-based MCS better suited to their risk profile perform better than others

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Operationalizing risk-based Management Control Systems

- I argue that firms have to take a risk-based approach to execute their strategy and therefore integrate their risk management systems into existing control and performance management systems (Woods, 2008)

- To operationalize risk-based MCS I adapt a framework for categorization from the Management Control research, namely Simons' levers of control framework

- Risk-based diagnostic controls provide routine information to managers about key measures and progress towards goals in terms of risk information or risk measures

- Risk-based interactive controls are characterized by an active and frequent dialogue throughout the organization in terms of risk information or risk measures

Linking Mikes & Kaplan (2014) with Simons (1995; 2000)

- A feature of the LOC framework is that managers must decide how much emphasis they will place on each of the four types of control systems (Merchant & Otley, 2006)

Preventable risks

Rules-based control model

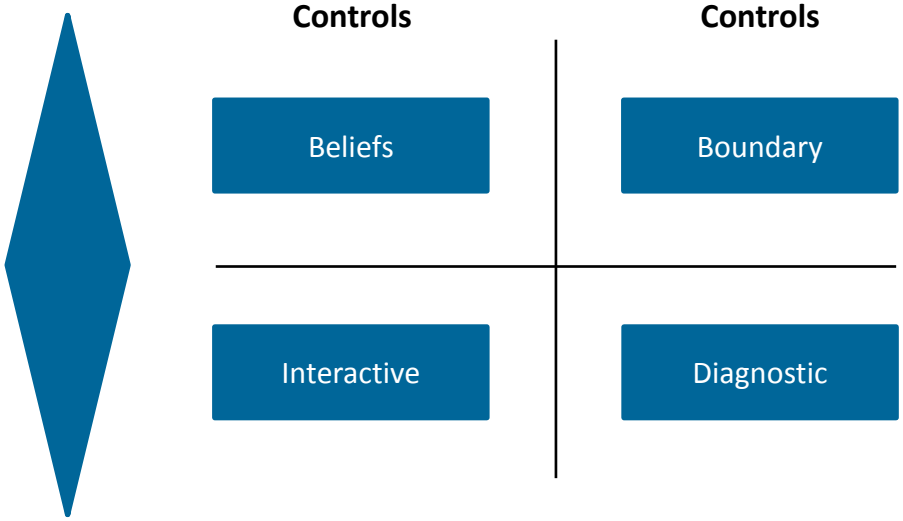
Strategy risks

Interactive,
enabling control model

External risks

Interactive,
envisioning control model

(Kaplan & Mikes, 2012)



(Simons, 1995)

Association between preventable risks and controls

- First line of defense against preventable risks is an integrated culture-an-compliance model comprising monitoring, values as well as rules and boundary systems (Kaplan & Mikes, 2012)
- Diagnostic use is described as a negative force that creates constraints and ensures compliance with orders (Simons, 1995; Henri, 2006)
- Features of diagnostic style of use are tight control of operations and highly structured channels of communication and restricted flows of information (Henri, 2006)

H1a: Firms facing preventable risks to a greater extent will introduce risk-based diagnostic controls more intensively than firms facing preventable risks to a lower extent.

H1b: Firms facing preventable risks to a greater extent will introduce belief and boundary systems more intensively than firms facing preventable risks to a lower extent.

Association between strategy risks and controls

- The control model for strategic risks are interactive discussions about risks to strategic objectives (Kaplan & Mikes, 2012)
- Interactive use is described as a positive force that focuses attention and forces dialogue throughout the organization (Simons, 1995; Henri, 2006)
- Features of interactive style of use are loose and informal controls reflecting norms of cooperation and communication as well as open channels of communication and free flow of information (Henri, 2006)
- Related research finds that firms rely on formal control systems when facing uncertainty, e.g. hostile and turbulent conditions (Widener, 2006)

H2a: Firms facing strategy risks to a greater extent will introduce risk-based interactive controls more intensively than firms facing strategy risks to a lower extent.

H2b: Firms facing strategy risks to a greater extent will introduce belief and boundary systems more intensively than firms facing strategy risks to a lower extent.

Association between external risks and controls

- The control model for external risks is interactive envisionment using experience, intuition and imagination to identify the non-controllable external events that can cause the strategy to fail (Kaplan & Mikes, 2012)
- Interactivity leads to a process of confrontation potentially able to prepare managers for black swans (Arena, Arnaboldi & Azzone, 2010)
- Empirical research shows that interactive systems are effective in firms facing various types of risk and uncertainty, including competitive, market, and technological risk and environmental uncertainty (Simons, 1995; Bisbe & Otley, 2004; Widener, 2006)

H3a: Firms facing external risks to a greater extent will introduce risk-based interactive controls more intensively than firms facing external risks to a lower extent.

H3b: Firms facing external risks to a greater extent will introduce belief and boundary systems more intensively than firms facing external risks to a lower extent.

Theory development and hypotheses: RQ2

Association between packages of risk-based MCS and Risks

- Based on prior research on MCS as a package I expect to find several packages (=clusters) of risk-based MCS that differ significantly in their risk profile
- As this study will be exploratory I will not develop ex ante assumptions what these relationships look like

H4a: There are types of risk-based MCS (=clusters) which are put in place in practice.

H4b: Risk profiles differ significantly across risk-based MCS clusters.

Theory development and hypotheses: RQ3

Competitive advantage through matching risk-based MCS and risks

- I argue that competitive advantage can be gained through matching combinations of risk-based MCS design and types of risk an organization faces.
- In addition, I assume that firms that have a competitive advantage to have a higher performance than their competitors.

H5a: Firms with a better fit between their risk-based MCS and their risk profile experience a superior business performance.

H5b: Firms with a better fit between their risk-based MCS and their risk profile experience a higher perceived usefulness of its risk-based MCS.

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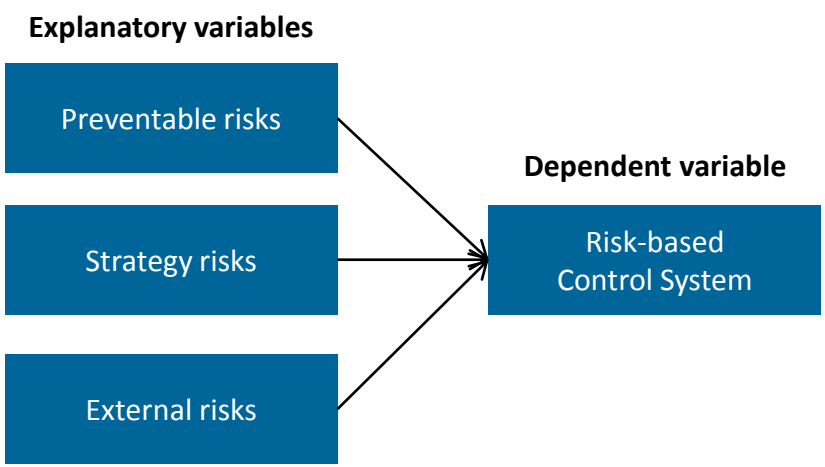
Hypotheses 1-3: Method

- With hypotheses 1-3 I test a form of cartesian type of fit, as the focus is how single contextual factors – types of risk – are associated with different Controls
- I will use univariate and multivariate analysis to provide empirical evidence on the association
- Firms that are facing a specific type of risk to a greater extent (above sample median) are compared to those that are facing this risk to a lower extent
- I conduct a multiple regression analysis and I will develop three models, one for each tested control system
- To improve the validity of my model and to avoid spurious correlation I control for size, age and ownership of the firms

Hypotheses 1-3: Method

$rbMCS\_design_{j,i} = f(PREVENTABLE\_risk_i, STRATEGY\_risk_i, EXTERNAL\_risk_i, CONTROLS_i)$



Risk-based Control Systems:
- Belief and Boundary System
- Risk-based Diagnostic Controls
- Risk-based Interactive Controls

Control variables:
- Firm Size
- Firm Age
- Ownership

Hypotheses 4a: Method

- With hypothesis 4a I test if there are certain packages (=clusters) of risk-based Management Control Systems
- I analyze whether firms build certain groups or clusters based on their risk-based MCS, measured as belief & boundary systems, risk-based diagnostic controls and risk-based interactive controls
- I will use the two-step cluster analysis to be able to tell what types of risk-based MCS the firms in the different clusters use
- To validate my results I additionally conduct a discriminant analysis and use a F test (Wilks‘ lambda) to test if the discriminant model as a whole is significant

Hypotheses 4b: Method

- With hypothesis 4b I test if certain clusters of rbMCS differ in terms of their risk profile
- I will conduct a one-way ANOVA to find out if there are significant differences in the means of preventable risks, strategy risks and external risks between the groups
- Additionally, I include control variables to the model and conduct a MANOVA to find the overall differences
- To validate my results I test for homogeneity of variances and, for MANOVA, for homogeneity of covariance matrices
- To check the normality assumption I inspect the data visually by using histograms and P-P plots and confirm the results of the ANOVA through an additional Kruskal-Wallis test

Hypothesis 4a and 4b: Expected results

- For example, managers of firms of cluster 1 perceive that they rely much more on risk-based interactive controls and much less on risk-based diagnostic controls than managers from cluster 2

- I expect that the risk-based MCS clusters differ significantly in terms of their risks, e.g. managers of firms of cluster 1 perceive their risks to be significantly higher than managers of firms of cluster 2

Cluster distribution

		N	% of Total
Cluster	1	xxx	xx,x%
	2	xxx	xx,x%
	i	…	…
	Total	xxx	xx,x%

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Preventable risks	Between Groups	xxx,xxxx	xxx	xxx,xxxx	x	x
	Within Groups	xxx,xxxx	xxx	xxx,xxxx		
	Total	xxx,xxxx	xxx	xxx,xxxx		
Strategy risks	…	…	…	…	…	…
External risks	…	…	…	…	…	…
Size	…	…	…	…	…	…
Age	…	…	…	…	…	…
Ownership	…	…	…	…	…	…

MANOVA

Effect		Value	F	Hypo-thesis df	Error df	Sig.
Intercept	Pillai's Trace	,xxx	xx,xxx°	x,xxx	xxx,xxx	,xxx
	Wilks' Lambda	,xxx	xx,xxx°	x,xxx	xxx,xxx	,xxx
	Hotelling's Trace	,xxx	xx,xxx°	x,xxx	xxx,xxx	,xxx
	Roy's Largest Root	,xxx	xx,xxx°	x,xxx	xxx,xxx	,xxx
…	…	…	…	…	…	…

Hypothesis 5: Method

- With hypothesis 5a and 5b I test whether firm performance and perceived risk-based MCS performance relates to the fit between risk-based MCS and risk profile

$$PERFORMANCE_i = f\,(FIT_i, CONTROLS_i)$$

- With a multinomial logit model I yield a model of fit between the category of risk-based MCS chosen by a firm and its risk profile

$$rbMCS\_category_i = f\,(STRATEGY\_risk_i, PREVENTABLE\_risk_i, EXTERNAL\_risk_i, CONTROLS_i)$$

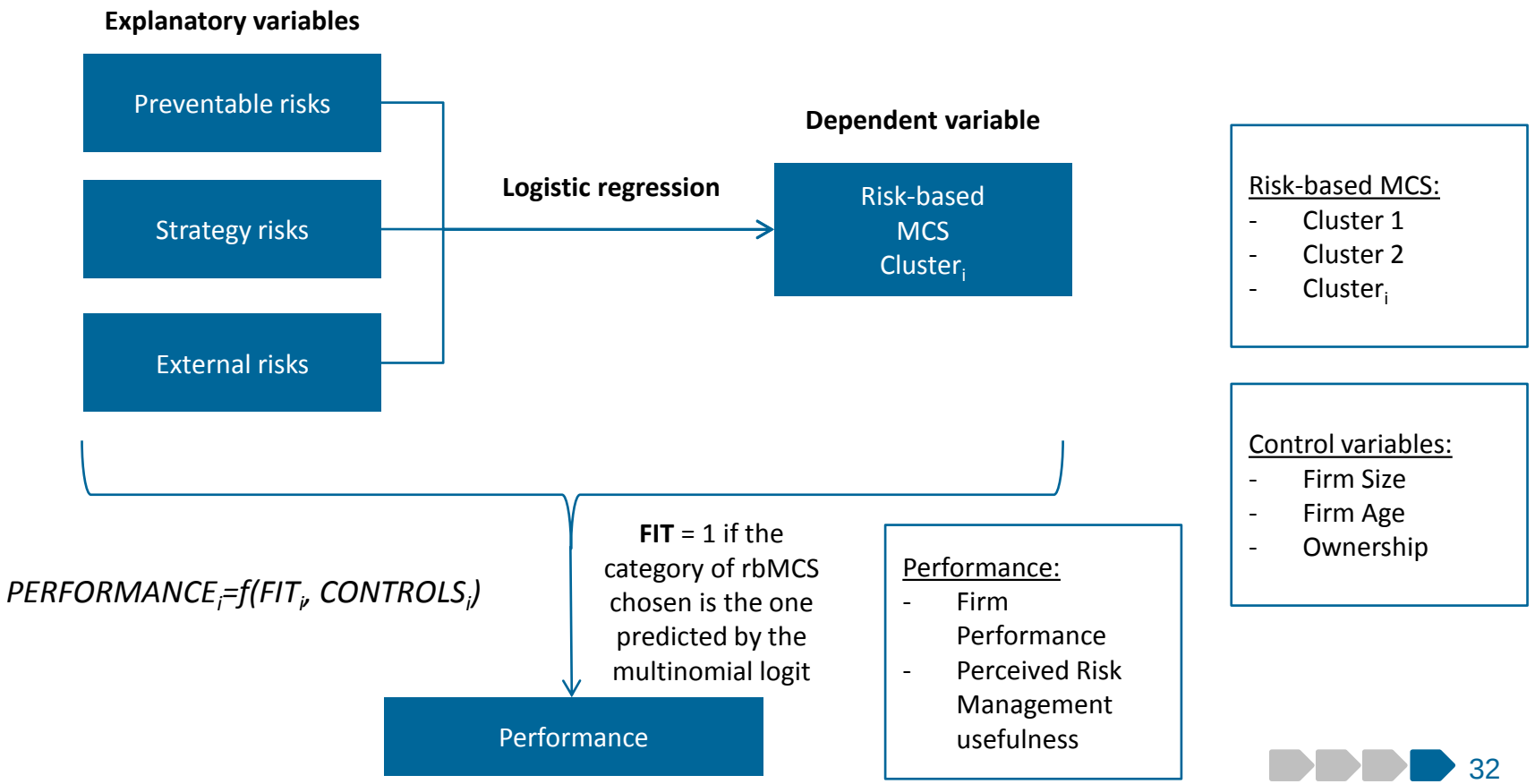
- I assume that the multinomial logit model captures, on average, optimal behaviour, and I use deviations from the model's predictions to answer research question 3

Hypothesis 5: Method

- In the previous section I derived actual risk-based MCS clusters, with the multinomial logit model I derive predicted risk-based MCS clusters
- Through comparison of the actual and predicted cluster membership of each firm, I calculate a dummy variable FIT, equal to 1 if the firm actually chose that predicted category of risk-based MCS, and 0 otherwise
- As a result, firms are classified into “High-Fit” (FIT=1) and “Low-Fit” (FIT=0)
- I conduct regression analysis to compare these two groups in terms of their performance
- To improve the validity of my model and to avoid spurious correlation I control for size, age and ownership of the firms
- To validate my results, I test if the necessary assumptions for logistic regression analysis like linearity, independence errors and multicollinearity are met

Hypothesis 5: Method

$rbMCS\_category_i = f(PREVENTABLE\_risk_i, STRATEGY\_risk_i, EXTERNAL\_risk_i, CONTROLS_i)$



Hypotheses 5: Expected results

Mean differences test

	Mean for Subsample				
Performance Variable	High-Fit FIT = 1	Low-Fit FIT = 0	Difference in Means	t-test (Pr > t)	Wilcoxon Test (Pr > z)
FIRM_PERF	x,xx	x,xx	+	,xxx**	,xxx**
RBMCS_PERF	x,xx	x,xx	+	,xxx**	,xxx**

Multivariate setting

	Dependent variable	
	FIRM_PERF Beta	RBMCS_PERF Beta
FIT	x.xxx**	x.xxx**
Size	x.xxx	x.xxx
Age	x.xxx	x.xxx
Ownership	x.xxx	x.xxx
R^2	x.xx**	x.xx**

- I expect firms with a better fit based on the multinomial logit and the associated risk-based MCS (High-Fit) to perform better than the other firms (Low-Fit) in terms of perceived and actual performance

Empirical design overview

	Purpose	Method
Hypothesis 1-3	Analysis of the association between risk-based controls and types of risks	Mean differences test Multiple Regression analysis $rbMCS\_design_{j,i}=f(PREVENTABLE\_risk_i, STRATEGY\_risk_i, EXTERNAL\_risk_i, CONTROLS_i)$
Hypothesis 4	Identification of clusters of rbMCS Comparing the risks of the different clusters	Cluster analysis ANOVA/MANOVA
Hypothesis 5	Developing a choice model with a categorical variable describing the categories of rbMCS Comparing the performance of firms with matching rbMCS and risks with firms with non-matching rbMCS and risks	Multinomial logit model $rbMCS\_category_i=f(PREVENTABLE\_risk_i, STRATEGY\_risk_i, EXTERNAL\_risk_i, CONTROLS_i)$ Mean differences test Regression analysis $PERFORMANCE_i=f(FIT_i, CONTROLS_i)$

Data Set

- A quantitative approach is used to answer the research questions raised above
- I conduct an empirical study in the Austrian and German mechanical engineering industry exploring medium-sized firms that have between 50 and 250 employees, which allows not only to control for industry effects but to gain insight into risk-based MCS design in a specific cultural and institutional context as well
- The Bureau van Dijk database with the classification C28 (mechanical engineering) is used to develop the sampling frame, the target population consists of 2.309 firms
- The data is going to be collected through a structured online questionnaire, I am using a single respondent approach and sending the questionnaire to the CEO of the firms

Data Collection Process and Questionnaire

- Data collection based on the online tool 2ask
- Questionnaire structured into four main parts:
  - types of risks
  - risk-based controls
  - organizational performance
  - statistical data
- Most variables are operationalized through several items and the response measured with a seven point Likert scale
- Whenever possible, items from previous research are used
- Content and construct validity have to be assessed to establish validity of the survey variables

Preliminary Executive Summary

- In this dissertation I follow a contingency approach through analyzing the interrelationship between risk-based MCS design, risk profile and performance.
- I propose that firms that have risk-based MCS design consistent with their risk profile will differ in their performance from firms that have risk-based MCS design inconsistent with their risk profile.
- A categorization of risk-based MCS design, an introduction and testing of new contingency variables and their impact on performance as well as insights into specific cultural and institutional aspects are novel in this study and add to the developing literature of risk-based control systems.
- Besides contributing to the academic literature on risk-based MCS, the practical output of this dissertation will be a more integrated picture of different natures of risk-based MCS design and the surrounding factors, allowing the mechanical engineering sector to take benchmarks and stimulate selective improvements to gain competitive advantage.

Literature

Anthony, R. (1965). Planning and Control Systems: A Framework for Analysis. *Boston: Harvard Business Press.*

Arena, M., Arnaboldi, M. & Azzone, G. (2010). The organizational dynamics of Enterprise Risk Management. *Accounting, Organizations and Society 35,* 659–675

Arrow, K. J. (1964). Control in Large Organizations. *Management Science, 10(3)*, 397-408.

Bisbe, J. & Otley, D. (2004): The effects of the interactive use of management control systems on product innovation. *Accounting, Organizations and Society 29,* 709-737.

Chenhall, R.H. (2003): Management control systems design within its organizational context: findings from contingency-based research and directions for the future. *Accounting, Organizations and Society 28*, 127–168.

Fisher, J. (1995): Contingency-based research on management control systems: Categorization by level of complexity. *Journal of Accounting Literature, 14,* 24-53.

Gerdin, J. & Greve, J. (2004): Forms of contingency fit in management accounting Research - a critical review. *Accounting, Organizations and Society 29,* 303-326.

Gorden, L. A., Loeb, M. P. & Tseng C.-Y., (2009): Enterprise risk management and firm performance: A contingency perspective. *J. Account. Public Policy 28,* 301-327.

Henri, J.-F. (2006): Management control systems and strategy: A resource-based perspective. *Accounting, Organizations and Society 31,* 529-558.

Kaplan, R. S. & Mikes, A., (2012). Managing Risks_ A New Framework. *Harvard Business Review, June,* 49-60.

Literature

Merchant, K. A. & Otley, D. (2007). A Review of the Literature on Control and Accountability. *Handbook of Management Accounting Research,* 785-802.

Mikes, A. (2009). Risk management and calculative cultures. *Management Accounting Research, 20,* 18-40.

Mikes, A., & Kaplan, R. S. (2014). Towards a Contingency Theory of Enterprise Risk Management. *Working Paper 13-063, Harvard Business School,* 1-47.

Otley, D. (1980). The contingency theory of management accounting: achievement and prognosis*. *Accounting, Organizations and Society, 5(4),* 413-428.

Otley, D. (2012). Performance management under conditions of uncertainty: some valedictory reflections. *Pacific Accounting Review, 24(3),* 247-261.

Otley, D. (2016). The contingency theory of management accounting and control:1980–2014. *Management Accounting Research, xxx,* 18 pages.

Simons, R. (1995). Levers of Control. *Boston: Harvard Business School Press.*

Simons, R. (2000): Performance measurement and control systems for implementing strategies. *Upper Saddle River: Prentice Hall.*

Tessier, S. & Otley, D. (2012). A conceptual development of Simons' Levers of Control framework. *Management Accounting Research 23,* 171-185.

Widener, S. K. (2007). An empirical analysis of the levers of control framework. *Accounting, Organizations and Society 32,* 757-788.

Woods, M. (2008): Linking risk management to strategic controls: a case study of Tesco plc. *International Journal of Risk Assessment and Management, 7(8),* 1074–1088.