Abstract:

We report results of a study on processes of Organizational Learning (OL). Changes and suspensions of organizational rules are taken as indicators for OL. The empiric analysis is performed with personnel rules of a German bank. The aim of our study is to identify factors that have an impact on rule changes and suspensions and thereby on OL. These influence factors are, on the one hand, variables that reflect experiences of organizational members with rules and, on the other, variables which capture organizational and environmental shifts. An important finding of this study is that the processes of rule change and rule suspension follow quite different patterns. The changing of a rule is mainly influenced by experience variables. Two basic modes of experiential influences could be shown: habitualization and working one's way out of a failure trap. Experience variables also play a role in the process of rule suspension. The negative influence of rule age on the suspension process suggests that the habitualization of rules over time increases reluctance to abolish a rule. It could also be shown that the positive version age effect on the suspension rate, which indicated an obsolescence process during the existence of a rule version when no additional variables are controlled, is explained by ecological shifts. Organizational and environmental shifts hardly display any significant effects on the rate of rule change. On the other hand, these shifts represent distinct influences on rule suspension. When the environment of a rule changes the need for an abolishment of this rule rises. The attention towards rules which are no longer appropriate seems to be stimulated by these environmental and organizational shifts. These findings suggest that OL can consist of a type of learning which is rather independent of certain ecological triggers and it can also consist of a type of learning which is maintained in order to adapt to certain changes within and outside the organization.

1. Introduction: Organizational Rules as Facilitators and Barriers of Organizational Learning

Modern organizations are based on formal rules (Weber, 1978; Kieser, 1989). Formal rules define tasks, competencies, processes, and hierarchies in organizations, and they provide organizational members with programmed problem solutions. Thereby, they help to enable groups of individuals, who are only equipped with extremely restrained capacity for data processing, i.e., with limited rationality, to bring about impressive achievements like airplanes or expeditions to the moon (Simon, 1976; March and Simon, 1958). Formal organizational rules also represent major parts of the organizational memory (Walsh and Ungson, 1991; Walsh, 1995). Like computer programmes they provide information that is required for standardized problem solving.

If formal rules are such powerful tools which help individuals to overcome their limited rationality, why do we then not need super rational human beings who design them? The answer is that we can dispense with them since organizational rules can be gradually improved in trial and error processes. In other words: organizational rules are subjected to evolutionary processes or processes of organizational learning (OL). Rules which do not bring about satisfying solutions are changed, repeatedly if necessary, or replaced by other ones until the results of the problem solving procedures appear acceptable (Cyert and March, 1963; Nelson and Winter, 1982).

More recent approaches to OL point out that processes of OL are often impeded because they have to overcome four major barriers (March and Olsen, 1975; March, 1994):

(1) Sometimes the roles of organizational members are so enchained in the network of formal organizational rules that individuals do not succeed in reconstructing or replacing parts of them (role constraint learning).

(2) In other cases, organizational members are able to change their own behavior but do not succeed in convincing others to change the rules by which their behaviour is affected (audience learning).

(3) OL can also be impeded because organizational members are not capable of evaluating correctly which impact actions that are guided by changed rules have on the environment and on the results of the organization (superstitious learning).

(4) The last barrier of OL occurs when changes in the environment cannot be correctly identified. The organizational members are not able to make sense of the environment or to explain why certain changes took place at all (learning under ambiguity).

Formal rules are, to a large extent, responsible for the first two barriers discussed above. Therefore, we can state that formal rules facilitate and impede OL at the same time.

This conclusion brings up a number of questions which can only be answered on the basis of empirical studies. For example, the following ones:

(1) To what extent can changes in organizational rules be attributed to certain changes in the organizational environment?

(2) To what extent are changes in organizational rules attributable to internal changes internal in the organization, e.g. to succession of executives?

(3) Is it possible to identify characteristics of formal rules which facilitate or impede changes of these rules?

(4) In which ways do organizational members accumulate experience when applying rules and how does this experience affect the future of these rules? More specific: which kind of experience induces organizational members to change or to replace a certain rule?

Empirical research is needed in order to be able to learn more on OL, especially on the interdependence between individual learning, changes of organizational rules and OL.

Unfortunately, among the existing empirical studies on OL, the majority consists of case studies (e.g. Cangelosi and Dill, 1965; Argyris, 1990). Quantitative analyses of OL do not exist. This is mainly due to difficulties of securing data on OL processes over longer periods of time. Furthermore, most data sets that have been used in order to analyze changes in populations of organizations only contain information on major events in the history of the members of these populations, e.g. on deaths of organizations or on significant reorganizations (e.g., Carroll, 1984; Singh, House, and Tucker, 1986; Brüderl and Jungbauer-Gans, 1991; Brüderl and Schüssler, 1990; Amburgey, Kelly, and Barnett, 1993). OL as the result of a multitude of incremental learning episodes cannot be analyzed on the basis of data of this kind.

In this paper we report results of a study on the effects of experience variables on learning processes, i.e. variables that reflect experiences of organizational members with rules, in particular rules that concern a German bank's personnel decisions. Experience variables are, e.g., the age of a rule or the number of changes that a rule has undergone. In a second step, we study changes in these effects when variables that represent organizational and environmental events and developments have been included into the explanatory models. Organizational events are, e.g., changes in the composition of the board of directors (Vorstand), while the occurrence of a strike is an example for an environmental event. This means that organizational changes are part of the environment of a rule. Although these changes possibly also reflect learning processes, they can be treated as ecological influences since they are not directly

related to the organizational members' experiences in dealing with personnel rules. Of course, it is not possible to identify the learning that took place independently from organizational or external events or developments, because it simply is not possible to hold all environmental factors constant. However, it is possible to find out how stable the effects of experience variables are, when *certain* external and organizational factors are controlled for. Therefore, in this study we will present the results of a stepwise testing of the influence of

- experience variables,
- organizational events and developments
- events and developments outside the orgainzation

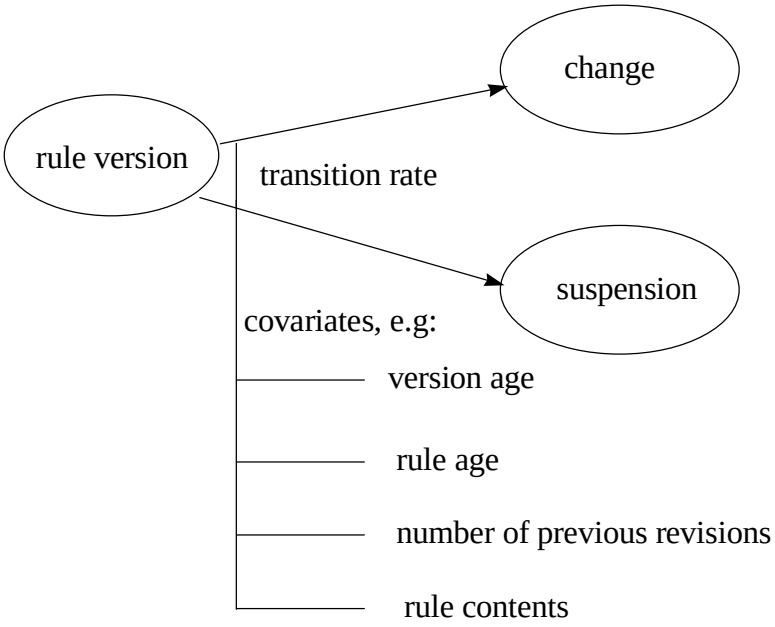
on the rate of changes and suspensions of personnel rules in a German bank.

2. Concept and Hypotheses

2.1 Transition Processes of Organizational Rules

Since OL is conceptualized as suspending and changing rules, rules can be changed several times. As a consequence, it can be possible that during the lifetime of one single rule different versions of this rule exist. Therefore, rule versions are taken as the units of analysis. A rule version ceases to exist, either by introducing a new version of this rule, or by abolishing it. This means that there are two different kinds of transition from a present state of existence (the present rule version) to a new state of existence (a new version or the state of non-existence). This rate of transition is influenced by different factors that are contained in our general model of rule change and rule suspension processes **(**Figure 1).

Figure 1: General Model of the Change and Suspension Processes



Hypotheses on possible influences on transition rates are formulated in the following section. Although both events are regarded as indicators of OL, one cannot assume that context variables exert the same pattern of influence on both. The suspension of a rule is a much more significant action than a rule change. Most of the rules encompass several organizational activities. Therefore, in most cases a rule change implies that only one of these actions has been changed. On the other hand, the abolishment of a rule implies that all actions that had been specified by this rule have to be formulated in form of a new rule (provided that these actions are still relevant). Therefore, we have decided to treat rule abolishment and rule change as distinct events. Nevertheless, the hypotheses will be largely the same for rule suspensions and changes. This is the case, simply because the theories on OL do not treat rule abolishment and rule change seperately.

2.2 Experience Variables

As mentioned above, the theories on Organizational Learning (Cyert and March, 1963; Levitt and March, 1988; March and Olsen, 1975; Nelson and Winter, 1982), to which this paper refers, all emphasize the importance of experience in the process of learning. Experience with the existing rules may lead to insights that induce the organization to change some rules. The accumulation of experience in dealing with organizational rules over time can be measured in three different ways:

- by using the (time dependent) age of a rule version. This variable measures the time span a rule has been in use since its last revision or – if it is the first version – since its birth, until its next revision or its suspension. The longer a version of a rule exists the more experience has been accumulated in dealing with this *present* version of a rule;
- by measuring the overall age of a rule. This variable represents the whole time span of the rule's existence since its birth. This time span is measured at the starting point of each rule version. This is done in order to take into account the experience that has been accumulated with a rule *including* the different versions of that rule;
- by including the number of previous rule changes. This variable measures the problem content of a rule. It can be assumed that the more problematic a rule is to handle the more often it is changed.

Since experience is a concept which cannot be measured directly, these variables represent proxies which try to capture the different forms of experience that organizational members can accumulate. Of course, a complete representation of all possible modes of experience is not feasible. The following hypotheses on organizational experience heavily build up on the analysis of Schulz (1993) and Zhou (1991; 1993) who are, as yet, the only scholars to have engaged in work which is similar to our study.

2.2.1 Rule Age and Rule Version Age

Zucker (1983; 1987; 1988; 1991; see also Walgenbach, 1995) argues that once certain organizational actions have been institutionalized, it is no longer necessary to instruct new organizational members of the value of of these actions by other organizational members. It is also not necessary that they internalize these actions or that they develop a rational orientation towards them according to which it is advantageous for them to perform their tasks in the institutionalized ways. The knowledge that a task has to be carried out in a special way is enough to take these actions for granted. This tendency becomes even stronger, the more obvious the history of a routine seems to be. ”The basic assumption, then, is that continuity casually produces objectification and exteriority.” (Zucker, 1991: 87) As a consequence, this microinstitutionalist theory suggests the assumption that the longer a rule exists the more it is perceived as objective and the higher the chances are that forces develop which resist changes of this rule.

The concept of competency traps (Levitt and March, 1988; Levinthal and March, 1993) can also serve to explain effects of rule age on rule changes and abolishments. In this concept it is maintained that organizational members are inclined to repeat those routines which they can perform successfully. Their competence in dealing with these routines is increased through repetition and their inclinition to take alternatives into consideration is reduced. ”[A]

competency trap can occur when favorable performance with an inferior procedure leads an organization to accumulate more experience with it, thus keeping experience with a superior procedure inadequate to make it rewarding to use." (Levitt and March, 1988: 322) Since it takes time to develop competencies through the repetitive use of routines it is likely that with increased age the probability of changing or suspending a rule declines.

The liability of newness thesis (Stinchcombe, 1965; Freeman, Carroll, and Hannan, 1983) can be applied to explain the relationship between the age of a rule and the probability of its change or suspension. This theory was originally developed to explain the survival and death of whole organizations. However, it can also be applied to the life courses of rules. The liability of newness thesis postulates that the risk of organizational death is highest just after the founding of an organization because the organizational members cannot yet sufficiently cope with their new roles. Also, trust between organizational members has not yet been developed and the relationships to sources of external support have not been established (Stinchcombe, 1965: 148). With regard to organizational rules, one can now argue that, according to this thesis, the highest probability of change or suspension is to be expected immediately after the setting up of the rule. Organizational members have to accept that the practice they have been used to is altered, they have to come to terms with the new rule and they have to learn the new role elements which are necessary in order to behave according to the new rule. In these circumstances resistence against the new rule is likely to emerge, which can affect rule changes or rule suspensions. The longer the rule exists the weaker this tendency should become, because organizational actors have had time to get used to it and to discover its usefulness (Hannan and Freeman, 1989).

These influences – which subsequently will be called *habituation effects* – should especially have an impact on rules which have been in use for a long time *without* having been changed. Therefore, it makes sense to distinguish between the effects of version age and rule age. Consequently, the following hypotheses can be formulated:

The rate of rule change decreases with rule version age (H1a).

The rate of rule suspension decreases with rule version age (H1b).

The rate of rule change decreases with rule age (H2a).

The rate of rule suspension decreases with rule age (H2b).

Barron, West and Hannan (1994) point out that in many cases the liability of newness phenomenon concerning the survival of organizations is due to different sizes of organizations. Larger organizations have a better chance of survival and most organizations grow when they get older. Therefore, a negative age effect can be detected when size is not controlled for. This effect could also apply to rules: It can be assumed that more voluminous rules are not subjected to the same risk of getting abolished as are less voluminous rules because they cover more items, and abolishing a large rule means the loss of an extensive coordination effect. This may mean a negative rule age dependence of the suspension rate when rule size is not controlled for, simply because larger rules survive longer periods of time. As a consequence, more voluminous rules should be more susceptible to rule changes because one single rule is associated with more coordination activities all of which have to be revised in the case of change. Therefore, rule versions of more voluminous rules should have a higher risk of being changed and shorter durations of existence than less voluminous rules. This could lead to a negative version age dependency of the change rate. Therefore it is necessary, at least for testing hypotheses 2b and 1a, to control for the time varying size of a rule. To control for the time varying size is necessary because rules can grow over the life time just as organizations can grow.

One can also assume that more important rules have a higher susceptibility of being changed and suspended because of the higher attention organizations pay to important rules. E.g., rules concerning working time are probably more important than rules on general organizational conduct. As a consequence, there could also be a negative age dependence of rule change and rule suspension which might be caused by the unobserved heterogeneity of the importance of rules. The importance of rules cannot be measured directly (the unobserved heterogeneity cannot be made observable). However, we assume that the content of rules, which is reflected in the subheading of the rule book and can be coded as dummy variables, is correlated with importance. Therefore, the rule content should also be held constant in order to test the hypotheses 1a - 2b correctly.

On the other hand Barron, West and Hannan (1994) found that there are strong indications for a growing mortality rate of organizations with organizational age when size is controlled for. This can be explained by the obsolescence of organizations. The older they get the less they fit the changed surrounding conditions (see also Carroll, 1983). Schulz (1993) showed that this can also be true for rules. Rules are likely to lose their environmental fit when they grow older. However, if we assume that organizations can restore the environmental fit of a rule by revising it, obsolescence should develop only during the existence of rule versions. Therefore two additional contradicting hypotheses can be formulated:

The rate of rule change increases with rule version age (H3a).

The rate of rule suspension increases with rule version age (H3b).[1]

2.2.2 Number of Previous Changes

Organizational change itself can become routinized when executed frequently for the same procedures, since organizational members perceive this repetitive change as a part of the organization´s repertory (Amburgey, Kelly, and Barnett, 1993; Swaminathan and Delacroix, 1991). This tendency will rise, the more often a rule has been changed already. On the other hand, an organization has to face the problem that rule change does not have a successful outcome. As a response, management has to adjust to failure by changing the rule again. This response can lead into a failure trap (Levinthal and March, 1993) in which rules are continuously changed but do not produce satisfying results, because "[m]ost new ideas are bad ones, so most innovations are unrewarding" (Levinthal and March, 1993: 106) and because it is harder for an organization to adjust aspirations downward than to adjust them upward.[2] Consequently, an organization will be more inclined to change a rule the more often it has already been changed, because the pressure of creating a rule with successful results becomes more and more important. These two theoretical views of repetitive rule change lead to the following hypothesis:

The rate of rule change increases with the number of previous rule changes (H4a).

However, if repetitive rule change is due to a failure trap and the organization becomes aware of this, then the organization should be anxious to stop this development by abolishing that rule. Management should finally realize that the chances for achieving a successful result by additional rule changes are low. Therefore, the concept of failure trap suggests the following hypthesis:

The rate of rule suspension increases with the number of previous changes of that rule (H4b).

Although arguing in this direction suggests that rates of rule change and rule suspension should grow when rules are changed over and over again, one should not rule out the possibility that the organization might eventually find a way to refine rules, so that the need of further changes

[1] Of course, if indications of an obsolescence process can be detected, the age variable can no longer be regarded as a mere experience variable because obsolescence is dependent on changing ecological factors.

[2] The argument that organizational members do not have time to collect enough experience with the new rule when it is changed so often does not hold in this argumentation, because in all models rule age will be controlled for.

or a final suspension decreases after it has reached a peak[3]. Therefore the hypotheses will be tested with regard to the linearity of the influence of previous changes.

2.3 Organizational Events and Developments

In this study, incidents and developments in the bank's history are regarded as the first category of external influences on the processes of changing and abolishing rules. We selected two variables for an estimate of the effects of altered organizational conditions: growth of organizational size, measured by number of employees, and changes in the board of directors. A reform of the rule book which took place in 1989, and on which we will report in more detail later, is treated as an additional organizational event, since it can be assumed that the anticipation of that event increased the attention towards the rules, which should become evident in higher rates of change and suspension. Thus, this year will be introduced in the multivariate models as a covariate. However no specific hypothesis concerning this event will be formulated, because of the lack of an adequate theory or concept.

2.3.1 Organizational Size

The impact of organizational size on organizational change has been a popular item within organizational research (for an overview see Kimberly, 1976; Haveman, 1993). The consequences of growth on organizational structures is aptly described by structural complexity models (Child, 1973; Child and Kieser, 1981; Kieser, 1995; Kieser and Kubicek, 1992; Blau and Schoenherr, 1971). According to these models, the growth of an organization necessitates a higher degree of delegation and differentiation of tasks and, as a consequence of this, the introduction of an intensified formalization. Larger organizations want to take advantage of specialists who are considered capable of implementing cutting edge knowledge and new ideas (Child, 1973; Moch and Morse, 1977). However, specialists are likely to change existing rules. Consequently, the possibility that old rules are no longer adequate increases. Therefore, one can hypothesize that

The rate of rule change increases with the size of the organization (H5a).

The rate of rule suspension increases with the size of the organization (H5b).

[3] This was another result of Schulz (Schulz, 1993).

2.3.2 Succession of Board Members

Managerial succession has also been suggested as a way to bring new knowledge and insights into the organization. Generally, it is assumed that new top managers represent reservoirs of innovation and change and are therefore able to bring about improvements in the organization's performance (Nystrom and Starbuck, 1984; Virany, Tushman, and Romanelli, 1992). However, managers sometimes also get caught in a competency trap by overestimating their past successes and underestimating their failures. Therefore, top managers often stick too long to the procedures which, in their view, were responsible for these successes (March, 1995; Levitt and March, 1988; Nystrom and Starbuck, 1984). In order to keep the organization on the path to success, it is necessary to replace managers after some time so that a steady input of innovative ideas can be sustained. The succession of a manager in the board of directors should then become visible in an increase in the number of rule activities. Therfore, it can be postulated:

The rate of rule change increases after a change in the composition of the bank's board (H6a).

The rate of rule suspension increases after a change in the composition of the bank's board (H6b).

2.4 External Events

In this study, environmental shocks and developments *outside* the organization's borders are regarded as the second category of external influences on processes of changing and suspending rules. The selected variables which represent changes of this kind are: occurrence of strikes in the bank industry and the unemployment rate of the economy.

2.4.1 Strikes

One major threat that organizations have to face is the occurrence of strikes in their industry. Even if the members of the organization do not participate in the strike themselves, management has to be aware that this happens, and it can also be assumed that the motivation of the organizational members will be negatively affected by strikes in the industry. Strikes represent events which are hard to predict and to which an organization has to adapt quickly. Although it seems most appropriate for organizations to counter strikes by long term strategies, they also provide an opportunity for the organization to develop new unorthodox

routines (Meyer, 1982), especially with regard to personnel policies which is the set of rule's which we analyzed in detail. Therefore, it can be argued that

The rate of rule change increases in years in which strikes occurred in the banking industry (H7a).

The rate of rule suspension increases in years in which strikes occurred in the banking industry (H7b).

2.4.2 Unemployment Rate

Environmental changes not only take the form of discrete steps, but can also develop more steadily. Economic crises do not appear out of nowhere and disappear suddenly. They develop and diminish slowly. Organizations have to respond to crises by improving their solutions (Zhou, 1993: 1142). The general unemployment rate can be regarded as an indicator for the situation the economy is in. A rising unemployment rate increases pressures on the performance of the organizational members, since competition between them increases. Consequently, one can expect that organizational rules are reformulated in order to transmit higher requirements to individual and group performance. This argumentation is captured by the two final hypotheses:

The rate of rule change increases with positive jumps of the yearly unemployment rate (H8a).

The rate of rule suspension increases with positive jumps of the yearly unemployment rate (H8b).

3. Data and Methods

The data set of our study consists of all of the 947 different versions of the 255 personnel rules of a German bank which were formulated between December 1970 and November 1989**.** As mentioned earlier, the rule versions, i.e. stages in the existence of the rules in which no change occurred, are our units of analysis. When a rule is founded, the first rule version lasts from this ”rule birth” until the first change of the rule or, if it is not changed, until its death. If a rule change occurs, the point in time of this change equals the starting point of the second rule version. Rule changes and rule suspensions are modelled as competing risks. Therefore, a rule version is considered to end with either of the two events.

The rule book of the bank was introduced in December 1970 and still exists, however, in a totally different form. Containing only a few rules when it came into existence, it grew both continuously and rapidly. At first, the organizational members concerned were informed almost daily about new releases or changes of rules. Subsequently, this was only done approximately once a week. Therefore, one week was chosen as the time unit to measure the transition processes. One year was divided in 53 weeks.

In November 1989, the rule book was significantly redesigned. The main purpose of this redesign was to make it leaner. Rules were merged, moved to different sections of the rule book or were formulated in a more concise manner. However, not all the rules were changed at this point in time. Some remained as they were and were taken out of the rule book at a later date. Since it was nearly impossible to figure out all of the dates of rule changes during this major reform, the third week in November - the date of the ”official” reform - was taken as the final point of observation. Rules which were taken off the rule book and replaced by new ones at this time, could also not be observed any further. It is not possible to treat these events as ”suspensions” because of event history analysis; the method with which we analyzed the processes cannot be used when the events are not independent. This requirement would be violated by treating the date of the rule book reform as a suspension of rules.

3.1 Statistical concepts

The risks of rule changes and rule suspensions over time have been analyzed with the help of event history analysis (Diekmann and Mitter, 1984; Blossfeld, Hamerle, and Mayer, 1986; Tuma and Hannan, 1984; Blossfeld and Rohwer, 1995; Yamaguchi, 1991).

The central statistical concept of event history modelling is the transition or hazard rate $r(t)$ which is defined as:

$$r(t) = \lim_{\Delta t \to 0} \frac{1}{\Delta t} P(t \leq T < t + \Delta t | T \geq t).$$

Hence, the hazard rate expresses for those rule versions which have not yet experienced an event (change or suspension) at time t the limit of the probability to have an event within the interval $t+\Delta t$. Therefore, a hazard rate of rule change of $r(5) = 0.02$ means that for all versions which have not yet been changed until $t=5$, the risk of being changed in the interval $5+1$ is two percent. The hazard rate can also be expressed as

$$r(t) = \frac{f(t)}{G(t)},$$

whereby $f(t)$ stands for the instantaneous transition density and $G(t)$ represents the survivor function. This is - in this case - the proportion of rule versions which have not been changed up to time t. This formula expresses the relative significance of an event. The same density of events at the beginning and at the end of a transition process leads to a higher rate at the end, because the survivor function is lower than it was at the beginning.

The hazard rate can be constructed as a dependent variable in multivariate models in many different ways. We decided to take an exponential model which can be written as

$$r(t) = \exp\left(\boldsymbol{\beta}_0 + \mathbf{x}'\boldsymbol{\beta}\right).$$

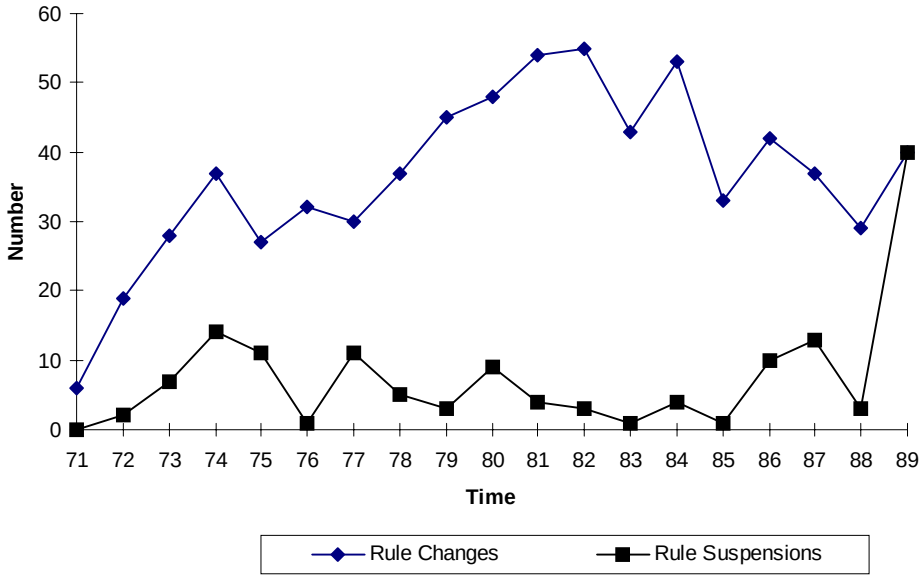
This means that the baseline rate of the examined process is held constant, and a vector of covariate influences on this baseline rate is estimated. Generally, in event history analysis the effects of the covariates are measured in a log linear manner. This is done in order to prevent the hazard rate from taking values below zero. The assumption of a constant baseline rate seems to be quite restrictive. Nonetheless, through the technique of episode splitting (splitting the rule versions into smaller subepisodes or spells) it is possible to allow the hazard rate to vary over time, when process time (which is the same as the age of rule version) is introduced in the model as a covariate[4].

3.2 Distribution of events

Before concentrating on the results of the multivariate analysis, the distribution of rule changes and rule suspensions between 1971 and 1989 are presented (in 1970 no event occurred) in Figure 2. As it can be seen, much more changes than suspensions were implmented. Overall, there have been 695 changes of rules and 142 suspensions. This confirms the assumption that suspensions of rules are more dramatic events than changes.

[4] See Blossfeld and Rohwer (1995) for a more extended discussion of this technique.

Figure 2: Rule Changes and Rule Suspensions 1971-1989



Even during the rule book's first year some changes of the personnel rules occurred. The number of rule changes increased until 1974. After this point in time the number of rule changes decreased slightly, followed by another increase until the highest number of yearly changes was reached in 1982. Afterwards, the number of changes inconsistantly decreased.

The first increase of changes is certainly due to the building up of the rule book. This becomes even more evident by an inspection of the development of rule suspensions. Although suspensions of rules start to occur one year later and are executed much less often than changes, they also increase until 1974. However, until 1988 the number of yearly suspensions does not reach the level of 1974. In 1989, this pattern changes significantly. In this year there are as many suspensions crried out as changes are. (Note that these suspensions took place *before* the reform of the rule book). Hence, some preparations had obviously been made in expectation of the rule book reform, just as we had assumed.

3.3 Descriptive Statistics

The exceptionally high number of suspensions in the year of the rule book reform carries the risk that multivariate models of rule suspensions are biased by a strong period effect (previous results confirmed this assumption). Therefore, the last week in 1988 was taken as the date of censoring for the parametric and non-parametric rule suspension models. As a consequence, only 102 suspensions were taken into consideration and the number of spells for the multivariate models of rule suspension was lower than for the change models. In both cases,

the present data set was considerably enlarged by episode splitting. It grew from originally 947 to 25,270 records for the rule change models and to 23,877 records for the suspension models. The maximum length of one spell was set to one month (between four and six weeks). Since the descriptive statistics did not show significant differences for the two data sets, only the statistics for the larger data set, in which the last year of observation was coded as a period dummy, are displayed.

In Table 1 one can find the figures of the descriptive statistics of the covariates for which hypothes have been formulated. As mentioned above, rule age and rule version age were measured weekly. However, the effects in the multivariate models denote the influences of these variables per year. The oldest rule version measured was 15.5 years old. The oldest rule was not that much older: 18.1 years. Because there were signs that the number of previous changes displayed nonlinear effects, the quadratic term of that variable was included as well. The variable ”board manager succession” was operationalized by adding a three month time span coded 1, beginning with the month the respective new member joined the board of directors. (If the date of entering the board was in the second half of a month, the following month was counted as the month the manager joined the board). Although no hypotheses had been formulated about the quitting of a manager from the board of directors, this incident was taken as a covariate as well. This explorative variable could be included, since the dates of quitting and of succession coincided only very rarely.

Table 1: Descriptive Statistics

	Minimum	Maximum	Mean	Standard Deviation
Version age/53	0.000	15.528	2.673	2.838
Rule age/53	0.000	18.189	3.193	4.182
Number of previous changes	0.000	54.000	2.509	4.956
Number of previous changes squared	0.000	2916.000	30.853	160.309
1989	0.000	1.000	0.055	0.228
Number of employees/ 1000	9.706	12.136	11.055	0.523
Board member succession	0.000	1.000	0.110	0.313
Board member quitting	0.000	1.000	0.182	0.386
Difference of Unemployment rate/10	-0.800	2.100	0.382	0.889
Strike	0.000	1.000	0.177	0.381

The number of employees and the unemployment rate were measured yearly. The univariate distributions of these covariates are displayed in Figures 2 and 3. From 1970 until 1988 the bank experienced a considerable growth. The number of employees grew from 9,706 to 12,136. However, the growth was not continuous. After 1973 and at the beginning of the eighties, a decrease in the number of employees can be observed. Between 1984 and 1988 the number of organizational members increased considerably. In 1989, again, there was a small decline.

Figure 3: Development of the Number of Employees

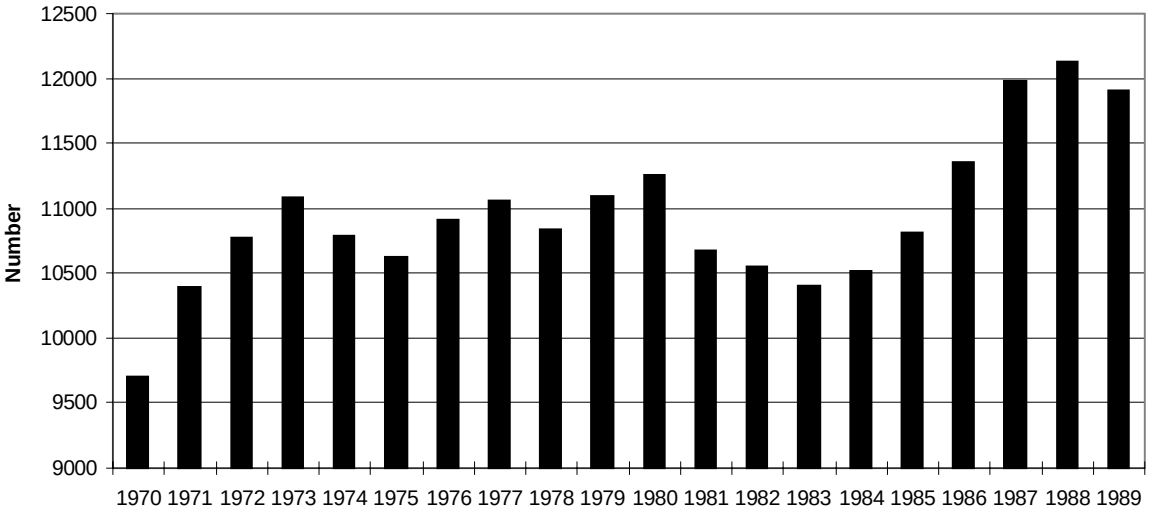
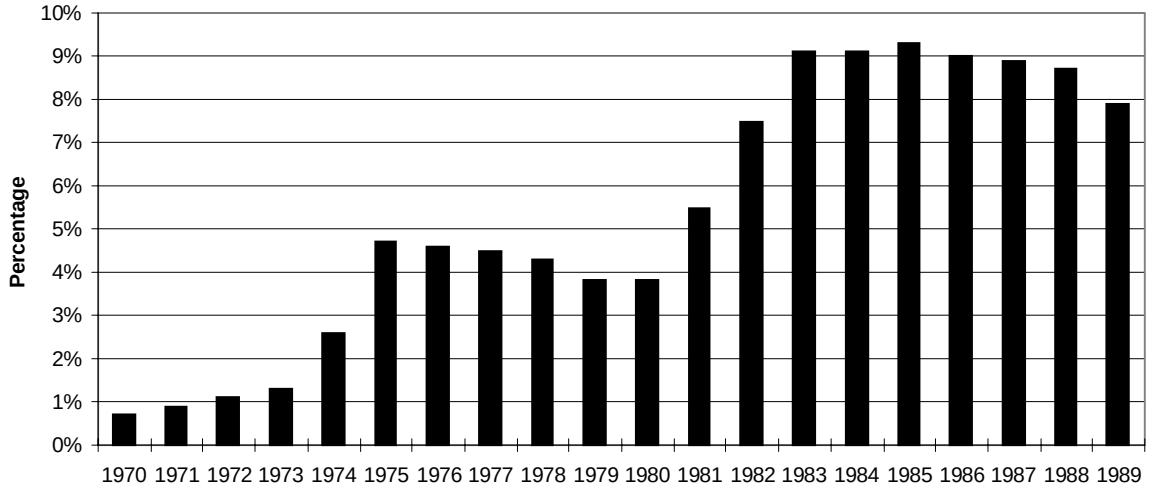


Figure 4: Development of the Yearly Unemployment Rate



Concerning the unemployment rate, some more or less sudden increases from 1973 to 1975 and from 1981 to 1983 can be observed. Immediately after these jumps, the unemployment rates remained relatively stable, although they gradually decreased. Overall, a dramatic rise of the unemployment rate was recorded. As an indicator for crises, it was not the yearly unemployment rates themselves that were taken, but the shifts between the different unemployment rates. As a consequence, the positive jumps, which stood for a sudden decrease of the employment situation, measured the occurrence of a crisis, while the smaller negative jumps measured the slight relief of the employment situation. Moreover, since also age and cohort effects were included in the multivariate models and the development of the

unemployment rate approximated a time trend, this construction of a crisis variable prevented a confoundation of age, period, and cohort effects.

Strikes in the bank industry rarely occurred during the period covered by our study. In 1974, there was a strike in the savings bank industry (which is public domain) and in 1986/87 strikes and intensive union activities hit the whole bank industry. Because it is assumed that the strike in the savings bank industry had some impact on the activities of the private bank industry, these years have been coded as periods in which strikes occurred.

3.4 Control Variables

In every multivariate model that will be presented later, some variables, whose effects are not displayed, are held constant. First of all, there are the heterogeneity variables ”rule content” and size of rule, measured by the number of pages a rule encompasses. The size of the rule was measured with every new rule version. This measurement does not lead to a time varying construction of this control variable in the strict sense of this technique, because this would require recording changes during the existence of a rule version. However, since rule size cannot change during a version’s existence, this kind of construction fully suffices the need for recording the changes of rule size during the lifetime of a rule. As it was explained in the section on the formulation of hypotheses, this variable was included in order to diminish the risk of getting a version age effect, because of unobserved heterogeneity. Another variable that is held constant is the year cycle, measured in months. This is done in order to control for the possibility that special periods of high rule activities occur in every year. Finally, the date of rule birth, which can be regarded as an indicator of the overall modernizing process, is controlled.

4. Results

4.1 Distribution of Hazard Rates

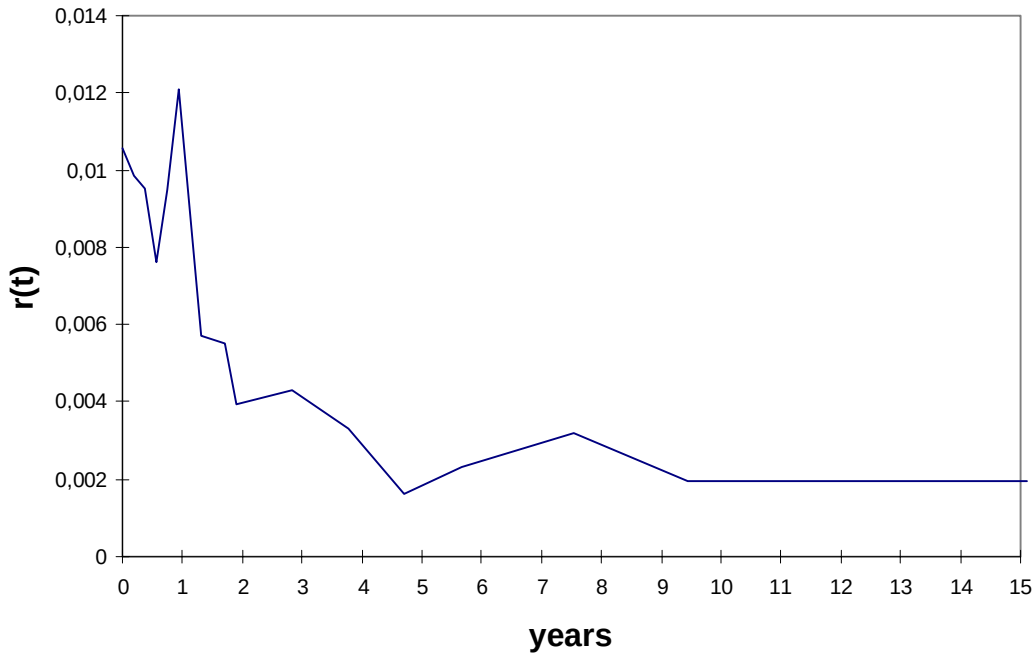
The non parametric patterns of the hazard rates of rule change and rule suspension represent the influence of version age without controlling for any other variables. Therefore, the Life Table estimators of the two different hazard rates in Figures 5 and 6 which have been calculated for increasing lengths of intervals[5], provide an impression of how the risk of

[5] The Life Table estimator of the hazard rate is

$$\hat{r}_i = \hat{r}(t_{mi}) = \frac{2\hat{q}_i}{h_i\left(\hat{p}_i + 1\right)},$$

changing or suspending a rule changes with the increasing age of the rule version. A clear decline of the hazard rate of rule change can be observed. This means that the risk of changing a rule decreases with version age, which is in line with the habituation effect model. However, hypothesis 1a should not be regarded as confirmed unless this effect is tested in a multivariate model.

Figure 5: Smoothed Life-Table Hazard Rate of Rule Change



The hazard rate of rule suspension exhibits a different pattern. The risk of abolishing a rule does not decrease but increase with version age! Although there was no monotonic rise of the rate of rule change, a general tendency to an increasing risk during a rule's life course could be observed. These findings contradict hypothesis 1b and support hypothesis 3a. No habituation effect concerning rule suspension could be identified but there are indications for an obsolescence process. One possible explanation for the opposite patterns of the change and suspension rates: When organizational members get more and more used to organizational rules, these rules tend to become increasingly obsolete (see Schulz, 1993). The longer a rule remains unchanged – this means adapted to additional organizational experience – the less it fits into the new conditions that emerge. When this situation is identified, changing the rule may no longer be appropriate. Abolishing the complete rule and designing a new one appears

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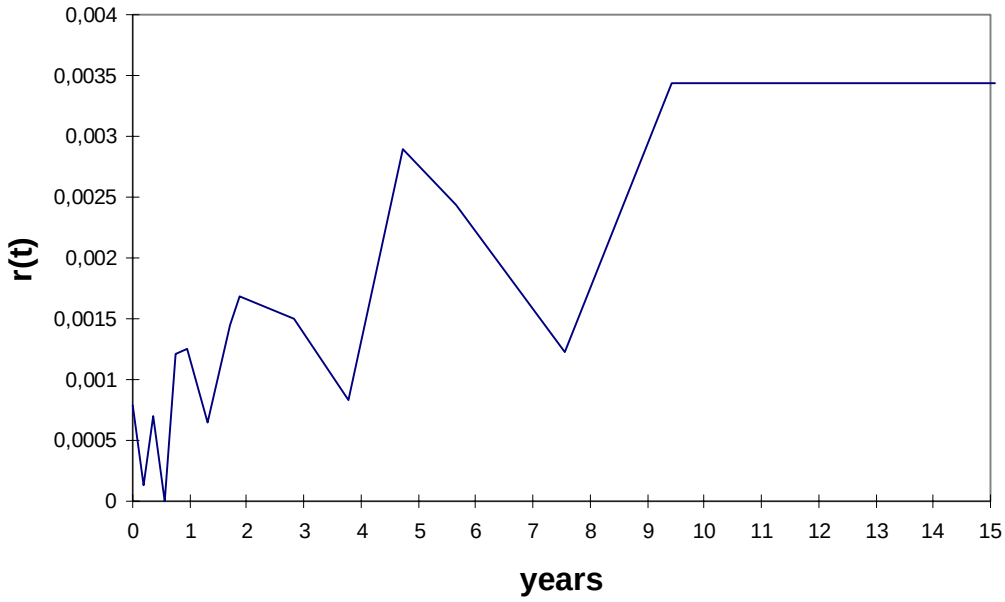
where t_{mi} is the midpoint of the interval, $\hat{q}_i$ is the estimator of the conditional transition probability and $\hat{p}_i$ is the estimator of the conditional survival probability.

more economical. Consequently, the two different influences of version age on the processes of changing and supending rules seem to complement each other. Again, this assumption should not be regarded as substantiated before multivariate testing.

Figure 6: Smoothed Life-Table Hazard Rate of Rule Suspension



4.2 Multivariate Models

Four different multivariate models were estimated for rule change and rule suspension. The ”experience model” encompasses only those variables which measure, as proxies, the experience of the organizational members. In addition to these variables, in the ”organizational event model” the events and developments of the bank are included. In the ”external event model”, these variables were excluded and replaced by the variables which measure the outside developments and events. In the overall model, all variables were tested.

Concerning rule change, version age displayed the same effects that were expected by looking at the Life Table distribution of the hazard rate. In all of the four models the effect of version age is negative, highly significant and hardly changes when external variables are included. In each model the rate of rule change decreases by about 12 per cent each year of version age. A similar pattern is visible by looking at the effect of rule age. In every model, a highly significant yet negative effect of this variable can be detected again, although it is not as strong as the version age effect. In every additional year of rule age the rule change rate diminishes by 5.7 per cent.

Table 2: Multivariate Exponential Models of Rule Change

	Experience Model	**Organisational Event Model**	**External Event Model**	**Overall Model**
Constant	-5.509*** (0.189)	-5.301*** (1.103)	-5.540*** (0.194)	-5.046*** (1.489)
Version age/53	-0.129*** (0.021)	-0.127*** (0.022)	-0.127*** (0.022)	-0.128**** (0.022)
Rule age/53	-0.056*** (0.014)	-0.055*** (0.016)	-0.055*** (0.015)	-0.056*** (0.016)
Number of previous changes	0.124*** (0.018)	0.123*** (0.018)	0.123*** (0.018)	0.123*** (0.018)
Number of previous changes squared	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
1989		0.143 (0.196)		0.205 (0.205)
Number of employees /1000		-0.016 (0.102)		-0.041 (0.136)
Board member succession		-0.525*** (0.171)		-0.515*** (0.172)
Board member quitting		-0.011 (0.116)		-0.024 (0.119)
Differ. of Unemployment rate/10			0.330 (0.437)	0.125 (0.564)
Strike			0.030 (0.104)	0.111 (0.117)
Log-Likelihood	-3954.12	-3946.66		
DF	24	28	-3953.8 26	-3946.1 30

*p<0.10 **p<0.05 ***p<0.01

N(spells): 25270, Events: 695

Figures in brackets: standard deviation

Thus, hypotheses 1a and 2a are sustained: The older a rule version got and the longer a rule existed the less likely it was that this rule was changed. The stronger effect of the version age indicates that it is not so much the length of existence of the whole rule which is responsible for a habitualization process. Reluctance to change a rule seeems to develop more intensely within the duration of the *unchanged* existence of a rule. How can this finding be explained? One possible answer to this question is as follows: When a rule is altered the content changes and new elements of a rule are introduced. Therefore, the habitualization process concerning

these new elements starts anew. This leads to the strong negative version age effect. If all elements were changed, each version's risk of change would start on the same level and no rule age effect would be detectable. However, since in most cases not all elements of a rule are altered when there is a rule change, the stable parts of a rule continue to exist and organizational members can develop competencies and trust concerning these parts and increasingly take them for granted. This is not distorted by rule changes. Taken together, the continuous habitualization of stable rule elements and the beginning of new habitualization processes concerning new rule elements after every change lead to a negative influence of rule age which is not as strong as the influence of version age (see also Schulz, 1993: 161-162).

The number of previous changes also display a highly significant and very stable positive effect, which sustains hypothesis 4a. However, as expected, the effect is not linear. The influence pattern follows an inverted U-shaped curve. The maximum of that curve is reached at about 30 previous changes. Because there are only very few rules which have been altered that often, the dominant influence pattern is positive but with decreasing increments. Concerning the theoretical considerations of hypothesis 4b, this result either means that there is a maximum in the routinization of changing a rule or that some way out of a failure trap can be discovered - the organization finally finds a better way to adapt the rules to the requirements, even if adaptation attempts have failed several times before (see also Schulz, 1993).

The variables of organizational events and developments in the rule change models do not exhibit the expected effects. The year 1989, the time before the reform of the rule book, does not show any significant impact on the rate of rule change. The number of employees do not exhibit any effect on the rate of rule change. The effect of the board member succession in both models (organizational event and overall model) is surprising. This is both negative and highly significant. The quitting of a board member does not produce any effect. The outside events and developments also do not show the anticipated effects. Neither the differences of the unemployment rate nor the occurrence of strikes have a significant influence on the rule change rate. Before interpreting these unexpected results we should first interpret the effects in the rule suspension models.

In the experience model of rule suspension, the effect of version age is positive and significant, which is consistent with the Life Table distribution of the hazard rate of rule suspension. However, when organizational or environmental events and developments are included, the effect loses its significance and diminishes considerably, as can be seen in the second, third and fourth model. Thus, the version age effect of the rule suspension model is largely explained by organizational and environmental developments and events. As a consequence, the interpretation of the hazard rates of rule changes and suspension has to be extended. It seems that the abolishment of rules, of which a majority had an increased version age by the time that

certain organizational or environmental shifts occurred, was triggered by exactly these shifts. Therefore, it is rather the change in the conditions of the organization and not so much the increased version age of a rule which made the content of the rule inappropriate and led to its suspension. Thus, the assumption made previously, that an increasing need for abolishing a rule arises because of the decreasing rate of rule change has to be revised. Rather, it seems that young and old rules are in a similar danger of losing fitness when certain shifts occur. It only seems that on average the whole stock of personnel rules is older when these shifts take place.

However, the rule age effect is negative and highly significant, which complies with hypothesis 2b. In the overall model the suspension rate decreases by almost 26 per cent with every additional year of the existence of a rule. Thus, there is also a strong indication of a habitualization process concerning rule suspensions. However, in contrast to the rule change models the habitualization does not take place within the existence of a rule version, but only within the existence of the whole rule. This means that while the reluctance of suspending a rule decreased since its birth, the level of reluctance was more or less constant during each rule version (according to models II-IV). There is no easy explanation for this finding. One possibility is that, again, the different parts of a rule have different susceptibilities to rule abolishment. The stable parts of a rule lead to accumulation of competencies and trust towards these parts. This leads both to a decreasing rule change rate and a decreasing rule suspension rate the older the age of the rule gets. However, the unstable parts which are altered by rule revisions lead to a constant need of suspending a rule although the rate of rule change decreases with version age. As a consequence, the two events of rule change and suspension seem to be neither complementary nor alternative as far as the influence of version age is concerned. This result rather indicates that the action of abolishing a rule is independent from the action of change.

The previous number of changes has a similar effect as in the rule change model: the probability of a rule suspension first rises with the number of previous changes until the eighth revision of a rule and then decreases again. However, the quadratic term is only significant on the 20 per cent level. Nevertheless it can be stated that the final solution for a rule which has got into a failure trap is to abolish this rule, as it was stated in hypothesis 4b. However it also seems that the development of a failure trap can be stopped – the need for suspension decreases when rules are altered very often. Instead of abolishing a problematic rule it might only be necessary to change this rule again. This could explain why the peak of the non-linear influence of this variable on the change rate is reached at a much higher number of previous changes.

Table 3: Multivariate Exponential Models of Rule Suspension

	Experience Model	**Organisational Event Model**	**External Event Model**	**Overall Model**
Constant	-6.737*** (0.461)	-16.108*** (3.121)	-6.801*** (0.472)	-14.028*** (4.428)
Version age/53	0.060* (0.033)	0.018 (0.036)	0.037 (0.033)	0.012 (0.036)
Rule age/53	-0.250*** (0.074)	-0.292*** (0.075)	-0.261*** (0.055)	-0.299*** (0.074)
Number of previous changes	0.274* (0.154)	0.295** (0.152)	0.272* (0.152)	0.284* (0.151)
Number of previous changes squared	-0.018 (0.014)	-0.019 (0.014)	-0.017 (0.013)	-0.017 (0.013)
Number of employees /1000		0.894*** (0.293)		0.677* (0.411)
Board member succession		0.201 (0.344)		0.413 (0.352)
Board member quitting		-0.584* (0.334)		-0.774** (0.354)
Diff. of Unemployment Rate/10			-0.205 (1.255)	1.612 (1.629)
Strike			1.103*** (0.210)	0.989*** (0.253)
Log-Likelihood	-778.6	-769.2	-766.5	-759.0
DF	24	27	26	29
*p<0.10 **p<0.05 ***p<0.01				
N(spells): 23877, Events: 102				
Figures in brackets: standard deviation				

The growing size of the organization increases the risk of rule suspension. The rate of rule suspension increased by 97 per cent when the number of employees grew by a thousand. This means that, as it was stated in hypothesis 5b, rules are in high danger of not fitting the needs of an expanding organization. As expected, the succession of a board member increases the risk of rule suspension (however not significantly), while the quitting of a board member has a decreasing effect on the suspension rate. It seems that organizational events and developments generally redirect the attention of the organization away from changing and on to suspending rules. If an important shift in the structure of the organization occurs, like the growing size or a board member succession, the appropriate reaction concerning rule activities seems to be to abolish rules rather than to try to adapt the existing rules to the changed situation. This seems

to be especially true when a new member enters the board of directors. A new board member is eager to implement his new ideas not by refining the existing rules but by abolishing them. Therefore, the hazard rate of rule change decreases while the suspension rate increases when a new member joins the board of directors. The quitting of a board member leads to a decrease of the suspension rate. Since a director who left the organization's board often was not immediately replaced, the decreasing risk of rule suspensions might be explained by a period in which no director was responsible for a certain section of rules.

The effect of the differences of the unemployment rate is quite unstable and not at all significant. Hence, neither in the rule change models nor in the rule suspension models does the this variable display the expected effects significantly. So far, we cannot offer any reasonable explanation for this phenomenon. However, the effect of the occurrence of strikes is comparable with those of internal shifts. This effect is highly significant in both the external event and the overall model of rule suspension. As a consequence, one can argue that the occurrence of a strike leads to more radical reactions by the organization. Since the rate of rule change is not affected when there are strikes in the bank industry, the increasing suspension rate indicates that outside crises are better faced by abolishing the old structures rather than repairing them.

5. Discussion

An important finding of this study is that the processes of rule change and rule suspension follow quite different patterns. The changing of a rule is mainly influenced by experience variables. Two basic modes of experiential influences could be shown: habitualization and working one's way out of a failure trap. Habitualization processes are indicated by the negative influences of rule age and rule version age on the rate of rule change. Since habitualization of some rule elements starts anew when a new version is released the influence of rule age is not as strong as the influence of version age. Indications for working one's way out of a failure trap are provided by the non-linear pattern of the effect of previous rule changes. After a maximum of positive influences of previous changes on the rule change rate is reached the influence turns negative. This might mean that, finally, a fitting solution for a problematic rule that could not be successfully adapted several times before can be found.

Experience variables also play a role in the process of rule suspension. The negative influence of rule age on the suspension process suggests that the habitualization of rules over time increases reluctance to abolish a rule. It could also be shown that the positive version age effect on the suspension rate, which indicated an obsolescence process during the existence of a rule version when no additional variables are controlled, is explained by ecological shifts. The

initial susceptibility to rule suspension at the beginning of every version which decreases with rule age does not change significantly during the existence of a version when these shifts are held constant. This can also be explained by the possibility that a rule consists of different elements which have a different degree of stability. There are also indications that the risk of rule suspension rises with the number of previous changes at first and then is lowered, after a maximum of suspension risk is reached. Since this maximum is at a lower number of changes than in the rule change models, the need for abolishing problematic rules seems to be changed into a need for changing them again.

Organizational and environmental shifts hardly display any significant effects on the rate of rule change. Only the succession of a board member has a clear influence on the rule change rate. However, this influence is negative. On the other hand, these shifts represent distinct influences on rule suspension. When the environment of a rule changes, i.e. the size of the organization increases or strikes occur in the bank industry, the need for an abolishment of this rule rises. The attention towards rules which are not appropriate any more seems to be stimulated by these environmental and organizational shifts. That these shifts only stimulate the rule suspension process and not the change process supports the assumption that ecological changes necessitate more radical organizational reactions. In the case of board member succession it seems that organizational attention is less focussed on revising rules than on abolishing them. These results show that it is important to separate the organizational activities of changing and suspending a rule because they may represent distinct reactions to different processes triggered by internal and external factors.

Hence, it can be concluded that environmental factors play a very important role mainly in the process of changing and suspending rules. Rule changes do not seem to be stimulated by shifts in the structure of the bank that we have studied or by outside events or crises. As a consequence, mere adaptation to changed environmental conditions does not seem to be the only mode of OL. Self induced learning which we have defined as changing and suspending rules because of additional organizational experience can be observed both in the rule change and the rule suspension models. This finding suggests that OL can consist of a type of learning which is rather independent of certain ecological triggers and it can also consist of a type of learning which is maintained in order to adapt to certain changes within and outside the organization.

Rule changes are, as we have seen, mainly influenced by experience variables. Rule suspensions are much more dramatic interventions. This might be the reason why suspensions are susceptible to both influences, experience variables and ecological shifts. Possibly, the action of rule change can be more easily decoupled from important shifts.

All these findings are very preliminary. In addition to the statistical and theoretical specification of the presented results, e.g. through qualitative interviews, which is planned to take place in the near future, it is highly desirable to compare these results with similar studies in other organizations. If some of the findings that we have presented can be confirmed in other studies at other organizations, more definite conclusions about the ways in which organizations learn can be drawn.

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