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# The void at the heart of rules: routines in the context of rule-following. The case of the Paris Metro Workshop

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This paper is an attempt to understand how rules operate in organizations. I focus on the links between organizational routines and rules that are incomplete in their application. I analyse the role of routines in managing the incompleteness of rules. I present a case study where management introduced a productivity bonus in the middle of 1992. This allows for the study of the extent to which the new rule modifies the prevailing routines of work organization. Based on team observations, interviews and statistics that I carried out over a period of nine years (1992–2000), I show that in an initial period, the productivity bonus has partially biased the task selection process. In a second period—‘the normal period’—our observations indicate that following the rules consists in translating the abstract rules into concrete reference points, and adding in what the rules have not specified. The translation process conducts to a routine since the interpretation is stabilized. Routines provide a pragmatic, local and temporary solution to the incompleteness of rules. Since routines emerge only in the course of action, they come with no guarantee of success. That constitutes their dynamic.

## 1. Introduction

Much of organization theory has been concerned with how to coordinate the activities of individuals in organizations (March and Simon, 1958; Stinchcombe, 1960, 1990). Rules and organizational routines are two main forms of coordination used in organizations.<sup>1</sup>

On the one hand, some scholars (Blau, 1955; March and Simon, 1958; March, 1988, 1994; Zhou, 1993, 1997; Schulz, 1998, 2003; March *et al.*, 2000) focus on rules. In a broad perspective, rules are similar to the ‘*bureaucratic procedures*’ defined by Blau (1955: 23):

A bureaucratic procedure can be defined as a course of action prescribed by a set of rules designed to achieve a given objective uniformly. Agency-wide

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<sup>1</sup>Plans, scripts and procedures are other forms of coordination.

rules must be abstract in order to guide the different courses of action necessary for the accomplishment of an objective in diverse situations.

In the 1940s and 1950s, scholars built the bureaucratic theory of vicious circles in which rules, considered as potential sources of organizational dysfunction, are the main pillars (Merton, 1940; Gouldner, 1954; Blau, 1955; Crozier, 1964). To Gouldner, bureaucratic rules are used to substitute for the managerial supervision. As Zhou (1997: 260) emphasizes, 'Rules become substitutes for direct authority relationships.' During the same period, Simon developed an administrative decision theory (Simon, 1945), and later with March a decision theory in which rules were seen as essential building blocks (March and Simon, 1958). In his further researches, March (1981, 1988, 1994) claims that much of organizational behaviour involves rule-following that consists in matching a set of rules to a situation by criteria of appropriateness. Rules are procedures that people follow to fulfil their identities (March, 1994: 57). Individuals try to match appropriate rules to identities: 'An identity is a conception of self organized into rules for matching actions to situations' (March, 1994: 61). A rule-following process refers to the logic of appropriateness rather than calculation of consequences (March, 1981: 565, 1988: 8). The recognition that rule-following behaviour is a central process of the ongoing organizations (March, 1981: 565) then directs attention to how rules are founded and changed (Blau, 1955; March, 1981, 1988: 8; Levitt and March, 1988; Zhou, 1993, 1997; March *et al.*, 2000).

On the other hand, other scholars adopt a micro-micro level of analysis, that of organizational routines (Cyert and March, 1963; Nelson and Winter, 1982; Cohen, 1991; Cohen and Bacdayan, 1994; Pentland and Reuter, 1994; Cohen *et al.*, 1996; Feldman, 2000, 2003; Feldman and Pentland, 2003). As Becker (2004: 643) emphasizes, 'Many ambiguities and inconsistencies in the literature dealing with routines prevail still today.' Becker uses the word 'ambiguity', but this is an understatement. Among the different meanings given to the notion of routine there is a dividing line between scholars who consider routines and scripts as mindless repetitions (March and Simon, 1958; Ashforth and Fried, 1988), and those who use the grammatical analogy to think of routines as a set of actions people can choose (Pentland and Reuter, 1994). Performing a routine is an 'effortful and ongoing accomplishment' (Feldman, 2000: 613, 2003; Feldman and Pentland, 2003).

The respective issues that arise from these two opposite views differ radically. The former studies the lack of change. The latter analyses the change processes. In this rather confusing and contradictory literature, it will be a major challenge to arrive at a definition of organizational routines that will fit the conception of rule I adopt.

Whether focusing on rules, or on organizational routines, the two approaches emphasize only one aspect of the organization where they are applied. On the one hand, the routines-based analysis focuses on strategies adopted by individuals to achieve organizational goals. However, almost no research attempts to link the organizational routines to more general principles such as rules. On the other hand, in the rules-based perspective, researchers pay attention to the cohesion of the organization

(March and Simon, 1958), to the reasons *why* people follow rules (March, 1988), and to the ability of organizational rules to deal with external and internal shocks (March *et al.*, 2000). Nevertheless, the unanswered question is to understand *how rules operate in organizations* or rather, *how workers follow rules*. I argue that a misunderstanding of what rules are is causing the gap between these two approaches in the research landscape. A majority of scholars denies the incompleteness of rules when it comes to their application. Yet, agreement on this property would bring about a new way of understanding the relationships between rules and routines.

The paper is organized as follows. Section 2 provides theoretical considerations on rules and routines. These highlight the novelty of my approach. Section 3 presents the case study: the Electronic Equipment Maintenance Workshop of the Paris Metro (hereafter the Workshop). This fieldwork was part of a larger study relating to rules dynamics which I published in Reynaud (2002). Among the different issues I have explored, I focus in this paper on the relationships between rules and routines. As management introduced a productivity bonus in the middle of 1992, this gives the opportunity to study the extent to which the new rule modifies the prevailing routines of work organization. I draw on team observations, interviews and statistics that I carried out over a period of nine years (1992–2000). First, I show that in an initial period, the productivity bonus has partially biased the task selection process. The fact that the new rule contains negative externalities supports this evidence. Some tasks that pay more than the others do are no longer a short-term priority for the Workshop. The application of the rule itself stops this process. Then I offer a new insight of how *usually* workers follow rules governing task selection after this distressed period. Finally, section 4 offers conclusions.

## 2. Defining rules and routines

### 2.1 *From rules to their practices: the emergence of rules incompleteness*

Chester Barnard, in his seminal work *The Function of the Executive* (1938), emphasized that personal contacts and interactions develop within formal organizations. He considered the fact that people fail to conform to the prevailing rules as a necessary condition to the ongoing nature of organizations (1938: 2):

Informal organizations are necessary to the operations of formal organizations as a means of communication, of cohesion, and of protecting the integrity of the individual.

Blau (1955) exploited this idea. In his study of a state employment agency, he analysed the process of rules modification that occurs when workers interpret and apply rules in particular situations. Blau highlighted three forms of rules transformation: the adjustment of the procedure, which does not imply a modification of the organizational

objectives; the modification or redefinition of the procedure, characterized by a redefinition of the objectives, and the amplification (expansion) of the procedure. However, Blau has a narrow conception of rules application, which only happens with changes in the context. His major contribution consisted in showing that bureaucratic structures continually create conditions that modify these structures. In this perspective, rules are one piece of the organization's puzzle.

I go further than Blau's conception of rules application. I claim that rules application (or interpretation<sup>2</sup>) is coextensive to an essential rules property. They are incomplete because each one needs to be applied in the light of knowledge, of information contained in the other rules, as well as custom, and practice, and context. A rule in itself neither strictly determines individual choices and behaviours nor guides them. Rather than being autonomous, rules form a system. If a majority of scholars shares this view, it lies in the ambiguity of the statements: rules incompleteness and 'rule-following'. For some scholars, the incompleteness of rules arises from a lack of information, which is seen either as a technical problem (contacts theory) or as a deliberate strategy of employers to prevent workers from minimizing their effort (Gouldner, 1954). Gouldner considers the incompleteness of rules as a voluntary lack of information that occurs as rules operate. He confuses the formal level with the practical level. The former deals with rules statements, the latter concerns operating rules. In my framework, the incompleteness of rules is structural. Rules are explicit and public statements that trigger an action with a certain degree of predictability, but do not determine it. My perspective rests on a conception of rules that first draws a distinction between formal rules and applied rules, and secondly attributes to each one of them a specific property. The former is complete, but at a general and a syntactical level. The latter is incomplete because rules must be abstract and general since they are designed for a diversity of concrete cases. Moreover, they have to deal with new elements that arise in the course of operations. Although most continental law scholars<sup>3</sup> share this point, I underline it to draw on another property of rules: the distance between rule and solution. This is the reason why one has to interpret rules. Indeed, rules make it possible to find a solution to a problem,<sup>4</sup> but they do not provide that solution in any detail (Atias, 1982: 216):

If the content of the rule corresponded exactly to the actual hypothesis, the prescription would be valid only for the very limited number of hypotheses expressly considered. Even the slightest difference in circumstances would make it impossible to infer the solution from the rule.

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<sup>2</sup>We consider the two terms as synonymous.

<sup>3</sup>See Virally (1960), Carbonnier (1985) and, for a recent synthesis, de Béchillon (1997).

<sup>4</sup>Reaching an objective is considered here as a kind of problem solving.

Otherwise, there should be as many rules as problems to solve, which would destroy the rules distinctiveness in favour of another category that continental law calls decision:<sup>5</sup>

It uses up its effect in an instant even though its consequences may be lasting. In contrast to norms (or rules), which can be applied in a limitless number of cases through the effect of a single edict, decisions only exert their effects gradually. (Jeammaud and Lyon-Caen, 1982: 57)

In other words, the incompleteness of rules refers to an *uncertainty of rules effects*, which is distinct from *rules uncertainty*.

This perception of rules as involving incompleteness is close in some respects to the notion of *rule implementation*, developed by March *et al.* (1986, 2000), March (1997), Zhou (1997). ‘Rules are ambiguous; more than one rule may apply in a particular situation; and the behaviour required by the rule may be shaped through interpretation’ (March, 1997: 20).<sup>6</sup> For March *et al.* (2000: 22), rule implementation refers to ‘the complications involved in translating rules into action’. Nevertheless, they do not explore this problem in their book (March *et al.* 2000: 202). Knowing March’s (1997: 19–20) hard criticisms addressed to scholars who consider ‘rules implementation as taken for granted’, this abandonment is quite surprising. However, for the authors rule-following refers to a behaviour that is either pre-programmed by implicit rules, or based on explicit rules (Zhou, 1997: 258); accordingly, their position is consistent (see also March, 1988, 1997).

In fact, the novelty of my perspective consists in grasping the incompleteness of rules in the rule-following process. Yet, even though rule-following is not a ‘pre-programmed’ behaviour, nevertheless I do not share the view of some philosophers, such as Saul Kripke (1982), who adopt a sceptical position. Considering that rules application is not context dependent, Kripke claims that *rule-following* behaviour may lead to a regression of rules to infinity because one rule needs another one, which determines its condition of application. In turn, that rule also needs another rule to operate, and so on. This problem called the ‘Kripke–Wittgenstein paradox’ is only a logical problem. In practice, the regression process does not occur since rules are embedded in a context shaped by custom and practices. As Bouveresse (1976: 551) writes, ‘the notion of use is irreducible’. The following example shows the meaning of the incompleteness of rules.

Taking Taylor’s differential piecework as an example, the hypothesis that rules can regress to infinity is untenable, as it comes up against the power of usages. Taylor built this wage rule on an assessment of the exact time allowed for each task. In his view, one has to measure the work rate of the average worker, which in fact does not exist.

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<sup>5</sup>This meaning of decision is distinct from the notion of decision as rules-based action developed by March (1997: 17–18).

<sup>6</sup>Before March’s work, Pressman and Wildavsky (1973) developed the problem of rule implementation.

However, it is possible to assess the work rate of the average worker in an indirect fashion, by means of rules. To obtain the average work rate, Taylor (1911: 168) takes that of the excellent worker as a starting point, to which he applies a standard deduction:

Perhaps the greatest difficulty rests upon the fact that no two men work at exactly the same speed. The writer has found it best to take his time observations on first-class men only, when they can be found; and these men should be timed when working at their best. Having obtained the best time of a first-class man, it is a simple matter to determine the percentage which on average he will fall short of this maximum.

To apply the deduction rule, the rate-fixer refers to his *subjective judgement*. Taylor's or Brown's description of rate fixing has become a byword for the intractability of this problem. Brown (1962: 29–33) devotes a whole chapter to 'The inaccuracy of rate-fixing': '...neither piecework prices nor time allowances are the result of *measurement*. . . . Both result from the use of *judgement* by rate-fixers'. He defines what measurement is:

Measurement is the process of ordering data or observations to a scale of length by means of objectively definable operations. Measurement is not to be confused with guessing, counting, appraisal, evaluation or assessment.

If however the rate-fixer supplements his measurement with

his assessment as to whether the individual timed is working at normal pace and, on the basis of that measurement and that assessment, he states a time target in units of minutes, he has *not* produced that target by measurement. . . . Rate-fixers can measure the time, which physical work takes to perform, with a high degree of consistency. . . . but they are measuring one aspect of the work, its physical manifestations which can be observed with the eye. They are not measuring the degree of responsible judgement shown by an operator in doing work.<sup>7</sup>

Brown emphasizes the intuition the rate-fixer requires to ascertain whether an operative is working at a normal pace and to assess his physical and mental concentration. The risk is that the average observed by the rate-fixer merely reflects the minimum work rate required to complete a given task, since workers are likely to be indulging in 'systematic soldiering'. In order to minimise this risk, the rate-fixer has recourse to a 'coefficient of reduction'. This is not an explicit rule, enshrined in some written document. The coefficient selected is the result of the rate-fixer's past experience and of his knowledge of current practices in respect of work rates.

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<sup>7</sup>Original italics.

This example helps to specify the research question: *how do rules operate in a framework characterized by an incompleteness of rules?* In the following, I will highlight the specificity of the incompleteness of rules relating to closed concepts.

## 2.2 *Specificity of the incompleteness of rules relating to closed concepts*

On the one hand, the incompleteness of rules is not reducible to uncertainty. Some theorists (Thompson, 1967; Galbraith, 1973; Egelhoff, 1991) consider uncertainty in organizations a result of the information process ‘defined as including the gathering of the data, the transformation of data into information, and the communication and storage of information in the organization’ (Egelhoff, 1991: 343). Moreover, for Galbraith (1973), uncertainty is the difference between the amount of information required to perform the task and the amount of existing information. Among the different ways of absorbing uncertainty, Galbraith listed rules and programs (Galbraith, 1973: 15). While in my perspective, the incompleteness of rules creates uncertainty that a new rule cannot diminish, Galbraith’s theory claims the opposite.

On the other hand, economic literature suggests three characteristics of competencies—tacitness, complexity, and specificity—that can be simultaneously sources of advantage and of ambiguity. In my perspective, the incompleteness of rules implies that workers develop a ‘tacit knowledge’, which consists in completing by the observation of concrete situations what rules do not specify. Polanyi (1967) defines tacit knowledge as an accumulation of experience that practices redefine. For workers, it entails an inability to codify rules of decision that underlie their work performance. For Reed and Defillippi (1990), tacit knowledge associated with complexity and specificity of the competencies may be a source of ‘causal ambiguity’.

## 2.3 *Defining routines*

In analysing the case study, I will argue that routines contribute to managing the incompleteness of rules. Therefore, it is essential to present an overview of routine in the literature and its intellectual context to specify our own concept. Historically, the notion of routine comes from artificial intelligence. It is to Hayek and, in particular Simon,<sup>8</sup> that we owe its introduction into the social sciences. Simon is not only a theorist of organizations, but also a specialist in artificial intelligence and cognitive psychology (see Newell and Simon, 1972). As for Hayek, he is one of the founders of cybernetics. We underline this point since it explains their conception of routines as mindless repetitions.<sup>9</sup>

A reading of the principal texts on the topic (March and Simon, 1958; Cyert and March, 1963; Nelson and Winter, 1982; Cohen, 1991; Dosi *et al.*, 1992; Cohen and

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<sup>8</sup>Both are Nobel Laureates in Economics.

<sup>9</sup>I will develop this point in the following paragraph.

Bacdayan, 1994; Pentland and Reuter, 1994; Cohen *et al.* 1996;<sup>10</sup> Feldman, 2000, 2003) reveals two possible points of entry into the notion of routine.

In the first, *routines are patterns of behaviour, or action or interactions*. The content of the patterns differs among the scholars.<sup>11</sup> For Nelson and Winter (1982), routines are ‘patterns of regular and predictable behaviours’. Egidi (1993: 1) defines routines as ‘sequences of patterns of actions that lead to the realization of a final goal’. Dosi *et al.* (1992: 191) consider routines as ‘patterns of interactions which represent efficient solutions to particular problems’.

Another ambiguity in the literature deals with the level at which the concept is applied. Does it apply to individuals, organizations, or to both? In that case, one has to spell out the passage from the individuals’ level to the organizations level. Cohen *et al.* (1996: 683) gave an example in which both individual and collective levels interplay. They define a routine as ‘an executable capability for repeated performance in some context that has been learned by an organization in response to selective pressures.’ For Nelson and Winter (1982: 97), routines may ‘refer to a repetitive pattern of activity in an entire organization, (or) to an individual skill’. Rare are those, such as Cohen and Bacdayan (1994), who specify that skills refer to individuals, while routines are organizational.

The second point of entry defines a *routine as a capacity to learn*, which in fact contains two essential and linked questions. *How is learning defined? Are routines mindless repetitions, or effortful accomplishments?* Learning as a capability to replicate a task fits with routines as mindless repetitions. Likewise, learning considered as a capability to increase his (her) knowledge fits with routines as *effortful accomplishments*. Stinchcombe (1990: 63) describes the mindless vision of routines as follows:

The parts of an individual’s skill which are completely routinized are the parts that he or she does not have to think about—once a routine is switched on in the worker’s mind-it goes on to the end without further consultation of the higher faculties.

This position argues the efficiency of repetitive tasks that prevail in forms of management and of work organization (assembly line). For March and Simon (1958: 142), a behaviour becomes a routine when it has reached the highest degree possible to develop a fixed response to a given stimuli. The authors describe routines as automatic skills, which they compare to computer programs. Routine has the historical meaning of computation theory. Cyert and March (1963) and Nelson and Winter (1982) have also likened organizational routines to computer programs and subprograms. Workers

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<sup>10</sup>Cohen *et al.* refer to a scholars’ group that met at the Santa Fe Institute in 1995. *Industrial Corporate Change* published the group’s report in Cohen *et al.* (1996).

<sup>11</sup>As Becker (2004: 645) emphasizes, there are differences between these terms. Behaviour is a subset of action. Moreover, behaviour is observable, while action is not observable. Interaction is a subset of action, and refers to a collective level.

perform such tasks as standard operative procedures (Blau, 1955; Cyert and March, 1963) or as habitual responses to familiar situations (Weiss and Ilgen, 1985; Gersik and Hackman, 1990).

Other researchers have challenged the traditional understanding of organizational routines, for which routines are mindless repetitions, fixed behaviours and a source of inertia. Pentland and Reuter (1994) and Pentland (1995) did the pioneering work, introducing the idea that routines evolve and change. In the first paper, the authors claim that organizational routines operate as grammars. This insight entails a new understanding of routines. Routines are a set of possibilities called 'repertoires of actions'. 'A grammar does not specify a fixed outcome; it defines a set of possibilities among which members accomplish specific sequences of action' (Pentland and Reuter, 1994: 485). The choice among them depends on previous actions and the grammar or rules that fit actions together. In a similar approach, Feldman (2000) emphasizes that 'change is more than choosing among a repertoire of responses, and that the repertoire itself, and the rules that govern choice within a repertoire, can also change' (2000: 613). Scholars use the terms 'routines as effortful accomplishments' to sum up this new understanding. However, I will call it 'routines as sense making repetitions' alluding to Weick's book (1995), *Sensemaking in Organizations*. It offers a better contrast to the traditional view, 'routines as mindless repetitions'.

This divided line—mindless routines versus '*sense making* routines'—partly match up with another opposition between static and dynamic routines. 'Static routines embody the capacity to replicate certain previously performed tasks. Needless to say, routines are never entirely static, because with repetition routines can be constantly improved'. Learning curves concretely display the operation of this type of routine. Dynamic routines, on the other hand, 'are explicitly directed at learning' (Dosi *et al.*, 1992: 192).

I propose to combine these two distinctions—individual/organizational and mindlessness/*sense making*—to highlight four meanings of the notion of routine. Each of the numbered cells in Table 1 shows the concept that best characterizes each of the four pairings of one row and one column. Note that I have not sought to provide a unified vision of the notion of routine (no such thing exists).

#### Cell I

Mindless learning capacity at the individual level is best characterized as skills. They express a capacity to execute the same task repeatedly. Nelson and Winter (1982) devoted an entire chapter to routines as skills that define the capacity for coordination in a normal situation. Routines have another property: they are a form of tacit knowledge. As Polanyi (1967: 4) notes: 'We know more than we can tell.' Thus, routines form a set of implicit arrangements that individuals, who adhere to them, do not recognize as such.

**Table 1** The multiple meanings of the term 'routine'

Learning Capacity	Types of behaviour	
	Individual	Organizational
Mindlessness	I 'Skills' or 'routines in a narrow sense' (March and Simon, 1958; Nelson and Winter, 1982; Cohen and Bacdayan, 1994; Lararic, 2000)	II 'Standard operating procedures' or 'rules of thumb' (Blau, 1955; Cyert and March, 1963; March, 1981; Nelson and Winter, 1982)
Sense making	III 'Individual capability to solve new problems' or 'search' (Dosi <i>et al.</i> , 1992; Winter in Cohen <i>et al.</i> , 1996)	IV 'Organizational routines' (Pentland and Reuter, 1994; Pentland, 1995; Feldman and Rafaelli, 2002; Feldman, 2000, 2003)

### Cell II

Mindless learning capacity governing the organization level defines the 'standard operating procedures' or 'rules of thumb' (Blau, 1955; Cyert and March, 1963: 101; Nelson and Winter, 1982: 17). These are simple decision-making rules adopted by the firm that need minimal information. For example, *standard operating procedures* make it possible to establish the output level of the firm in various contexts (Nelson, 1995: 69). They constitute 'an organization's memory' (Cyert and March, 1963: 101; Nelson and Winter, 1982: 99).

### Cell III

'Sense making' learning capacity operating at the individual level deals with an individual's ability to solve new problems without undermining the general functioning of the organization. The terms *search* and *individual learning* match up closely to this notion. Nelson and Winter (1982: 171–172) underline the fact that *search* defines the capability to advance through a process of trial and error. *Search* makes use of heuristics to provide a common framework to solve similar problems (Winter in Cohen *et al.*, 1996: 663).

### Cell IV

This cell describes a new insight among a few scholars in the last ten years. Organizational routines are patterns of behaviours operating at the organizational level and involving 'sense making' learning capacity. Indeed, they operate as grammars that express a set of

possibilities called ‘repertories of actions’ (Pentland and Reuter, 1994). The novelty consists in underlying the change ability of organizational routines. This change comes from either a change of the repertory or of the rules governing the repertory (Feldman, 2000).

#### 2.4 *The contrast between routines and algorithms*

In a first approach, I define routines as a transformation devices based on cognitive resources to reach a particular result. Cognitive resources are both internal (the capability of adaptation) and external (the ability to make use of reference points). Therefore, routines are *located* devices, embedded in particular contexts, since the problems they should solve are susceptible only to local exploration: individuals do not have full knowledge of the world. This is perhaps a point on which I beg to differ with Egidi (1992: 170, n. 4), for whom ‘routine’ is here a synonym of ‘not completely specified procedure’, which might lead one to think that a complete specification were possible. I also disagree on this point with Dosi *et al.* (1990: 243, 1992: 192), for whom the complexity of individual behaviour stands in the way of a codification of routines and their transformation into rules.

*Procedure or algorithm*<sup>12</sup> is both close to and opposite of individual routine. Algorithm is close to individual routine to the extent that both contribute to the decision process. Nevertheless, they act in very different ways: implicitly for routines and explicitly for procedures. They are opposed on several other points. For Lassègue (1994: 49),

An algorithm is a finite list of instructions that have to be followed in a given order. By following the instructions gradually, one should arrive at a result after a finite number of steps. The result should be reproducible in the infinitude of individual cases that are all dealt with in the same manner.

A computer program is an example of an algorithm.

I distinguish between these notions according to the nature of reasoning required to apply them. The reasoning may be either entirely made of cognitive elements—calculation, selection, search for an algorithm, and so on (hypothesis H1)—or wholly made of *located* dimensions. In that case, the context leaves so little choice that the application is almost overdetermined (hypothesis H2). The former is an algorithmic procedure. The latter defines a routine. Under hypothesis H1, agents are purely *cognitive beings* who make their calculations in a world without context. H1 does not fit with real individuals. Hypothesis H2 means that agents react to a

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<sup>12</sup>I consider these terms as synonymous. On that point I agree with Egidi, who writes: ‘I use the word “procedure” in the precise sense of algorithm, which (by Church’s thesis) can be represented by means of a Turing Machine and mechanically executed’ (1992: 170, n. 4).

context characterized by a limited number of choices. Among all the options, theoretically available, very few of them are applicable. H2 implies that agents are *pseudo-reactive beings*.

Procedures and routines differ in other respects. The decisive reasoning with regard to future action is performed at different points in time: before the execution of a procedure and in the course of the application of a routine. Procedures are explicit and codified, routines are tacit. The execution of a procedure does not require any interpretation given that it takes place in the domain of syntax and of the calculable. This kind of rationality is procedural in Simon's sense of the term (1976). On the contrary, routines are based on 'making sense' since they operate in an area that is pre-delimited by an interpretation that has already been done. That is the reason why routines are governed by an adaptive rationality that puts the emphasis on the experimental learning undertaken by individuals and groups (Cyert and March, 1963). By contrasting routines with algorithms, one may grasp their respective degree of cognition. While algorithms are mindlessness, routines do not present this property. They are *sense making*. On this point, I agree with Feldman's (2000) thesis that considers routines as effortful and ongoing accomplishments. Table 2 sums up these differences.

**Table 2** Procedures and routines

Procedure (or algorithm)	Routine
A finite list of instructions to be followed in a given order and leading to a reproducible result.	A routine is a mechanism for effecting transformations with a view to obtaining a result. A routine is a way of acting.
Non-context bound, since one has explored <i>the all possibilities</i> .	Context-bound, since one has explored <i>locally</i> the problem.
<i>The solution</i> is guaranteed either with a certain probability (probabilistic algorithm) or with certainty (deterministic algorithm).	<i>A solution</i> is not guaranteed by the application of a routine.
The problem has been explored <i>systematically</i> , at least to a certain point.	The problem is explored <i>pragmatically</i> : in adopting routines, the solution may be found. One cannot find the solution in advance.
Explicit, codified character of the procedure. ⇒ Transferable or reproducible.	Tacit, non-codified nature of the routine. ⇒ Not transferable from one firm to another, unless the contexts are very similar.
<i>Carried out automatically</i> (mindless).	' <i>Making-sense</i> ' is required for the selection of a routine.
Procedural rationality <sup>a</sup> (Simon, 1976).	Adaptive rationality (Cyert and March, 1963).

<sup>a</sup>Procedural rationality and adaptive rationality are not radically different from each other; see March and Simon (1958: ch. 7) and March (1988).

This outline of the multiple meanings of the notion of routine in organization and evolutionary theories conveys the impression that routines are everywhere and therefore nowhere in economic life. How can we make sense of this? The radical difference between our concept of routines and the algorithm of a Turing machine highlights the fact that the application of rules is closely linked to the adoption of routines. My approach to routines is quite different from that of evolutionary theorists, and in particular, from Nelson and Winter for whom routines are a 'catch-all' notion, as Winter himself recognizes (1986: 165):

Nelson and I use the word *routine*<sup>13</sup> as the generic term for a way of doing things. It is simultaneously the counterpart of a wide range of terms employed in everyday life and in various theoretical languages, including those of orthodox and behavioral economic theory; among these terms are decision, rule, technique, skill, standard operative procedure, management practice, policy, strategy, information system, information structure, program, script and organization form.

### 3. The case study: revisiting rules and routines

#### 3.1 *The data gathered*

The fieldwork is the Electronic Equipment Maintenance Workshop of the Paris Metro that I studied shortly after the introduction of the productivity bonus in July/August 1992, from February 1993 until June 2001. I obtained straightaway the agreement of management. However, the research could not start without the agreement of shop stewards and operatives on the objectives and method of my research. Workers were sceptical of the observations at work. Shop stewards thought I was an agent of the management. Nevertheless, the fact that management did not pay me played in my favour. At the end of a long meeting, they agreed to my proposal. Then I gathered data in three stages. Each of them was useful—sometimes partially—for the purpose of this paper.

First, between February and April 1993, I engaged in five interviews with management and 30 with workers. I asked managers how the new pay rule lies within the policy framework of the Workshop. I asked workers what their understanding of the productivity bonus (hereafter PB) was, and for which reasons they either agreed or not to the PB.

Secondly, I carried out observations during a period of three months (December 1994–February 1995) with an ergonomist from the National Agency for the Improvement of Working Conditions (ANACT). Together we observed three teams, each of them working with a different technology (control electronics, power electronics and micromechanics). In each team, we did an immersion of two days during which our

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<sup>13</sup>Original italics.

working day extended over the longest time slot worked by the operatives (7 a.m.–7 p.m.). We observed them at work and questioned them about what they were doing, how and why, in what order, and so on. Our attention was concentrated on the nature of the cooperation between the operatives, and on the methods of tasks selection. We kept our field notes. Our reports came up for discussion with operatives who validated them. Afterwards, they handed them to management.

The last stage consisted in reconstituting from 1992 until 2000 monthly statistics related to output, labour productivity, fault recurrence rates and debt in volume terms for the three teams whose strategies I examined in detail (EK1, EK3 and micromechanics).<sup>14</sup> These teams are those for which I did observations between December 1994 and February 1995. Moreover, they are representative of the activity in the Workshop. Taking these monthly figures as a starting point, I calculated the quarterly figures corresponding to the bonus payment periods (six months). I also gathered the percentage of the maximum bonus obtained by each team at the end of each bonus period. From these indicators, I inferred team routines that I exposed to management and to the supervisor concerned. After discussions, which sometimes led me to change some interpretations, they validated my conclusions.

### *3.2 The work process*

The Workshop is responsible for the maintenance of the electronic and micromechanical equipment and the relays of the Paris Metro.<sup>15</sup> The operatives of the Workshop are required to deliver the repaired equipment without any delay to the 'line operators' of each Metro line. (In the following, I will often refer to the latter as 'lines'.) As I will explain, the delivery of the components at the due date is a rather complex activity. Before analysing this issue, an outline is required of the operatives' organization, and of the rules they have to follow.

The 122 operatives are divided into eight teams: five of them are specialized in repair and maintenance, two are in charge of logistics, and one constitutes the engineering and design department. However, for my purpose, I will concentrate on the five repair teams that are responsible for maintenance of the electronic circuit boards, power electronics, micromechanical equipment, and relays used in critical failure mode on the various Metro lines. One of the difficulties of the work results from the fact that electronic operatives have to repair three generations of equipment, dating from 1955 to today. Therefore, operatives must deal with a multiplicity of models (around 500 models in electronics), which requires extended knowledge. While operatives are members of a same team, the tasks performed are individual.

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<sup>14</sup>It was obviously necessary to reconstitute these data for all the teams in order to assess the degree of diversity within the results as a whole, in terms of both productivity and work quality. The results are provided in Reynaud (2002).

<sup>15</sup>In September 2000, there were 162 employees: 8 managers, 35 supervisors and 122 operatives.

The *line operators*' tasks consist in inspecting the state of the trains and then removing the faulty equipment; these tasks constitute *curative operations* or *corrective procedures*. The *lines* are the sole judges of which items of the equipment should be removed for repair. For example, they decide to remove either a single faulty circuit board or all the boards in a train. Electronic equipment undergoes only corrective procedures. Conversely, as micromechanics and relays are subject to wear and tear, the *lines* apply security rules that govern the cycles of maintenance procedures. They depend on the number of kilometres travelled. However, these are twofold: the *major services* every 25,000 km consist of technical inspections that involve dismantling, cleaning and removing the grease marks of the units. The *standard services*, which include safety inspections every 8300 km, are more superficial. To sum up, corrective procedures are random while preventive operations are scheduled.

The logistics builds on two rules dealing with the organization of work. First, the *schedule for the major services and the standard services*, based on the number of kilometres travelled, has a time horizon ranging between one and three months. Secondly, logistics writes down, updates and displays the so-called '*debt sheet*' for the corrective tasks, based on the state of the rolling stocks and the removed equipment. The '*debt sheet*' is a listing that shows operatives on a twice-weekly basis that the amount of the various units and electronic circuit boards required. The expression '*debt sheet*' refers to different kinds of delay that a team may encounter. The first one is a delivery delay to the logistics, which is in charge of sending back the items to the *line operators*. This delay involves a *store debt*<sup>16</sup> that arises if the logistics does not have enough stock of a given part to meet the needs of the *line operators*. The *store debt* makes up a safety margin, ensuring that logistics can always meet demand from the *lines*. It acts as an alarm signal. The logistics technicians determine the level of debt, which depends on the existing stock, frequency of breakdowns, and the age of the equipment (and so on), and therefore varies from component to component. The second delay is more serious. A *line debt* arises when the *line operator* puts a train out of service because he cannot replace the faulty unit by a new one. During the strikes in 1988, *line debts* were frequent.

### 3.3 *The definition of the productivity bonus*

In the following, I present the productivity bonus that management introduced in the middle of 1992 to increase labour productivity. Before that date, the direction's Workshop considered as normal that work hours could vary between an upper and lower threshold, respectively 6.50 hours and 5.80 hours, the working time being 7.60 hours. The former, called the '*statutory working time*', is calculated by subtracting from the '*legal working time*' (7.60 hours), the 1.1 hours spent on changing, showering, being paid, cleaning the work stations weekly and statutory absences. The latter, called the '*normal or average working time*', resulted from management evaluation. The

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<sup>16</sup>The '*store debt*' refers to the store of the logistics team.

**Table 3** Working times—'normal' and statutory hours—according to the Workshop rule

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7.60 hours spent at work: legal working time
6.50 effective hours of statutory time ( $5.8 \times 1.12$ ) $\Rightarrow$ $PB_{\max}$
6.34 effective hours by team 1
5.80 minimum 'normal' hours $\Rightarrow$ $PB_{\min}$

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difference of 12% originated in the various lost hours tolerated by management. Officially termed 'recuperation time', they amounted to a production loss (see Table 3). In setting up the new pay rule, the direction no longer considered working less than 5.80 hours as normal. Essentially, the PB aimed at increasing the intensity of work by reducing the difference between statutory and real working times.

For these two thresholds, production equivalents were defined, since the PB was to be obtained, not by staying a certain hours at work but by achieving an output equal in terms of quantity and quality to some fixed minimum. The average number of effective work hours was reckoned to be at such a feeble level that management decided to fix the equivalent in output terms of the lower threshold of 5.80 hours as a minimal objective. In the same way, the equivalent input of the upper threshold of 6.80 hours is the maximal objective. In Table 3, team 1 that works an average of 6.34 effective hours has only to improve its production by 0.16 hour to get the  $PB_{\max}$  if the quality indicators have reached the top level.

Half of the bonus depends on output volumes. Since the time spent to repair each unit is very different from the others, management decided to apply a unique 'weighting coefficient' to each team activity. Thus, the output has one measure, the 'weighted output unit'.<sup>17</sup> It is obvious that many inequalities remain.<sup>18</sup> First example: corrective maintenance procedures, equipment modifications and preventive maintenance operations have the same 'weighted coefficient'. This means one considers them as equal outputs. In fact, they take very different lengths of time to complete. Second example: the shortest corrective operation takes half an hour, while the preventive maintenance of some parts may require 13 hours' work.

The other half of the bonus depends on work quality that has two aspects. Internal quality is a measure of the ability of each team to carry out repairs within the times allotted. The level of the team's *debts* to the logistics evaluates this capability. External quality depends on client satisfaction. This is a function of the failure rate of repaired equipment, defined by a breakdown in the six months following the corrective

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<sup>17</sup>The 'weighted output unit' is the product of one intervention pondered by the 'weighted coefficient' of the team.

<sup>18</sup>In each team, breakdowns are not equally difficult to repair: some are simple, other are complex.

procedure.<sup>19</sup> The productivity bonus varies linearly between two intervals. If the team attains only the  $PB_{\min}$  the bonus is nil; it is maximal (around 8% of the operative's salary) if the team attains or goes over the  $PB_{\max}$ .

### 3.4 How the new rule modifies the prevailing routines of task selection

Before examining to what extent the new rule modifies the routines of task selection, let us first observe how, and in what environment, an operative visualizes the work to do. Every morning, the logistics brings in the equipment and places it on different shelves depending on the type of procedure required, or puts it on racks in the case of identical units. The operative takes note of the equipment waiting for repair or maintenance, and sees the colour of the tags attached to the equipment awaiting his attention: white for *corrective procedures* and yellow for *major services* and *standard services*. These tags indicate the due date of the equipment to the logistics. The operative also sees the *debt sheet* brought to him twice a week by the logistics. This listing does not give the precise order of repairs to be done, but indicates the quantity of each item that has to be repaired before the next debt sheet arrives.

I studied in detail the strategies of the same three teams I observed before. In a first period, two of them—control electronics (EK1) and power electronics (EK3)—changed their prevailing routines. The third one (micromechanics) had no choice but that of following the scheduled work since the entire activity consists of major and standard services.

Shortly after the introduction of the PB scheme, the operatives of team EK1 gave priority to the procedures that generated the most 'Weighted Output Units' in a minimum of time, by repairing single circuit boards rather than whole units, etc. This strategy, adopted during the first two six-month periods (November 1992–October 1993), immediately proved to be profitable. Labour productivity reached an output figure 11.3% above that triggering the maximum bonus while debt levels and fault recurrence rates were also good. Thus, the operatives received the full bonus. Obviously, maximizing the output is no longer compatible with quality standards, whether external (fault recurrence rates) or internal (debt levels). First, the productivity strategy reduces the reliability of repairs that increases the fault recurrences and as a consequence, the debt levels. This effect is particularly strong in team EK1 where the equipment is ageing. It is the reason why the fault recurrence rate rises very sharply, which leads to massive indebtedness. Secondly, maximization of the output is no longer compatible with adherence to the priorities detailed on the *debt sheets*. This is the second factor that contributed to the massive indebtedness from May 1994 onwards (see Figure A1 in the Appendices). The team found itself in a critical situation that forced it to follow all rules constituting the PB.

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<sup>19</sup>However, an item could be 'shipped' only well after this period of six months, because lines often hold stocks of the different items during a period of over six months.

The other team, EK3, followed suit. The strategy of maximizing labour productivity by concentrating on procedures that take little time came into conflict with the rule imposed by the *debt sheet* and telephone calls from the *line operators*. When debts and productivity in volume increase simultaneously, as they did between April 1994 and April 1996, this means that operatives select the easiest tasks (see Figure A2 in the Appendices). In other words, they are not *continuously* adhering to the priorities imposed by the *debt sheets*; otherwise debt levels would have declined significantly as labour productivity rose. After this period, a new supervisor takes over the management of the team and implicitly forced operatives to follow all rules defining the PB.

These two examples show how a new rule may change the prevailing routines, even if it is not in the management's interest. However, the PB may play its incentive role, if some authority uses the existing rules to call back the deviating routines.

### 3.5 *Following the rules that govern task selection in the Workshop*

For an economist-observer, one of the unresolved questions is to know how, in a normal period, the operatives follow the complex rules of task selection without any delay. Our observations indicate that following the rules consists in translating abstract rules into concrete reference points, and adding in what the rules have not specified. In so doing, operatives rely on existing usage or routines in the broad sense of 'a way of doing things' (Winter, 1986: 165). I observed two examples of usages. First, maintenance procedures need to be anticipated for any equipment that has been withdrawn for corrective procedure and that has reached two-thirds of its kilometre service. There is no written trace of this usage. However, all operatives know it and account for it. Second, in order to avoid any temptation to choose the easiest procedures, an old usage, a working practice established a long time ago, consists in taking the equipment to repair first, and only afterwards looking at the tag attached to it. The aim of this practice is to dispel finally the notion that unfair work strategies are acceptable to preserve a good working atmosphere. According to one operative, 'it's an implicit rule that new recruits apply instinctively'.<sup>20</sup> The fact that new operatives work alongside an experienced hand for about six months makes it easier to pass on such practices. These two examples deal with routines as tacit knowledge that explains behaviour patterns.

Moreover, the necessity to add in what the rules do not specify means that the operatives have to anticipate the future in several respects. The operatives cannot select the items to repair in a random order. If they did, they would surely return the repairs with a delay. They have to account for their anticipation of several events, such as the breakdown of a test bench, the lack of a component or of a spare part, and so on. Each operative has to determine the sequence of procedures to select, based on anticipation dealing with their work environment. Moreover, each operative also has to anticipate which items will soon be in deficit, since the *debts* notified on a Tuesday

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<sup>20</sup>The term 'implicit rule' was used by the operatives; from my point of view, a rule is always explicit.

will have to be discharged by Thursday, and so on. The reason is that operatives have a better sense of the stock statement than the logistics. The *line operators* do not plan for these contingencies. For example, in one team, an operative carries out a daily inspection of all the drawers containing the components required for repairs—the so-called *advance stock*—and goes down to the logistics in order to obtain fresh supplies.

Finally, the operatives have to draw on a number of very different resources. First, they rely on explicit knowledge contained in other rules. Secondly, tacit knowledge improves itself by personal experience: knowledge about the state of the rolling stock, wear and tear on machinery, quantities of spare parts held in stock, and so on. Finally, they use existing usages and practices encapsulated in phrases such as: ‘We don’t look at the tag before taking the unit to be repaired’ and ‘we like to build up as much advance stock as possible’. Thus, the repetition of certain patterns of behaviour, such as glancing at the shelves in order to assess debt levels, is an example of a routine: a gesture of which an operative is not aware, and which in reality is a rule already interpreted.

In fact, operatives follow a whole system of rules governing work organization, safety, and so on. One important property of rules emerges from this: they form a structure made up of several interlinked subsets, somewhat like a network. Thus explanations, which supplement the previous ones, such as—‘We check out the MS (major services) shelves. If the parts are piling up, they have to be done; the debts will have to wait,’ or: ‘we glance briefly at the shelves’—reveal in very concrete terms how the operatives follow rules. They have found tangible reference points that equate with the written instructions that all these rules constitute. This key element in this particular situation enables them to dispense with formal rules as new information or problems appear. In this example, the operatives have created for themselves a rule governing task selection: rising demand for *major services*, which is all too evident from the growing piles of parts on the shelves, triggers a decision to give priority to preventive maintenance procedures over corrective procedures. Such a rule is not self-evident: the operatives could have chosen to ignore the growing piles of parts requiring major services in favour of corrective procedures, which are often more profitable in terms of bonus payments. This clearly represents the stabilization of an interpretation of the reference point, which we denote by the term routine. It would be particularly misleading to think that the act of ‘glancing briefly at the shelves’ constitutes a rule. Such a gesture, made without being aware of it, is a routine.

#### 4. Routines and ‘the void at the heart of rules’<sup>21</sup>

Let us take the following example. An operative, who is repairing a printed circuit board, solves the problems himself by applying, for example, the rules of basic electronics. The operative does not need to draw on all the rules of electronics, electricity, etc., which he

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<sup>21</sup>The expression is borrowed from Pierre Bourdieu. Cf. Bourdieu (2005: 160).

knows, but just on those he considers necessary as the repair proceeds. Consequently, his action is governed by a restricted set of rules that summarizes the relevant interactions between the tasks to be performed and the set of appropriate actions. The operative's mental processes consist in recognizing the models that trigger the appropriate action, the repetition of which leads to an apparently 'routinized' pattern of behaviour. However, the 'routinization' is only apparent, since the operative must be able to change rules when he encounters radically new problems. This means that routines are not mindlessness, but *sense making* repetitions. In such processes, routines appear to be interpreted rules or pragmatic, interpretative working practices. This point highlights the thin line that separates the act of following rules from that of adopting routines.

In my view, the first difference between rules and routines is that the former are *arrangements awaiting interpretation*, while the latter are *rules already interpreted*. The second difference deals with the opposition between explicit and implicit: in our definition, rules are *explicit*, while routines are *more often implicit*. The third difference rests on the distinction between the *theoretical* way of thinking and the *pragmatic* one. Since the fundamental characteristic of rules is their general nature (which explains their distance from the solution<sup>22</sup>), routines are a form of *pragmatic resolution* that can be applied to problems to which rules give only a *theoretical, abstract and general response*. Thus, in my observations, routines emerge as one of the ways of following rules. To force the point a little, one can say that it is through routines that rules operate. Rules constitute the background for routines. In other words, routines are rule-based patterns of behaviour, as Egidi points out (in Cohen *et al.*, 1996: 687). The distinction that Argyris and Schön (1974: 7) make between the 'theory-in-use' and the 'espoused theory' of the members of an organization helps to clarify the difference between rules and routines.

The 'espoused theory' is the theory to which an actor gives allegiance and which he communicates to others when they ask. On the other hand, the theory that governs his actions is his 'theory-in-use', which may or may not be compatible with the 'espoused theory'. Moreover, the agent may or may not be aware of the compatibility between the two theories.

Rules reflect the organization's 'espoused theory', while routines reflect the actors' various 'theories-in-use'.

Routines emerge from the development and the repetition of fair modes of behaviour. In a sense, routines provide a pragmatic, local and temporary solution to the incompleteness of rules. Since routines appear only in the course of action, they come with no guarantee of success. That constitutes their dynamic. This analysis of the role of routines in managing the incompleteness of rules is very close to what Bourdieu (2005: 160) says with regard to the way rules operate: 'It is habitus that fills the void at the heart of rules'.<sup>23</sup>

<sup>22</sup>Since rules help in the search for a solution, but do not provide it. See Reynaud (1992: ch 2).

<sup>23</sup>Pierre Bourdieu has expressed similar ideas on the incompleteness of rules and the scope that exists for interpreting them. Cf. in particular, Bourdieu (1990, 2005: ch 3, 156–165).

## Appendices

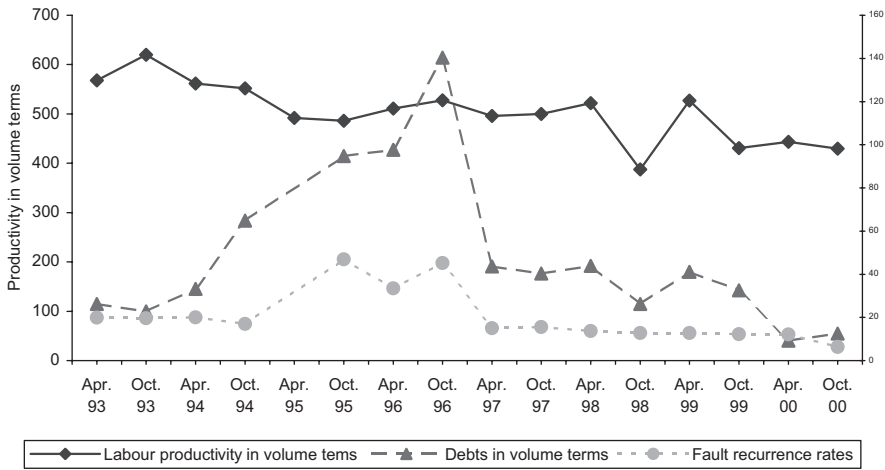


Figure A1 EK1—evolution of labour productivity, debts and fault recurrence rates (1993–2000).

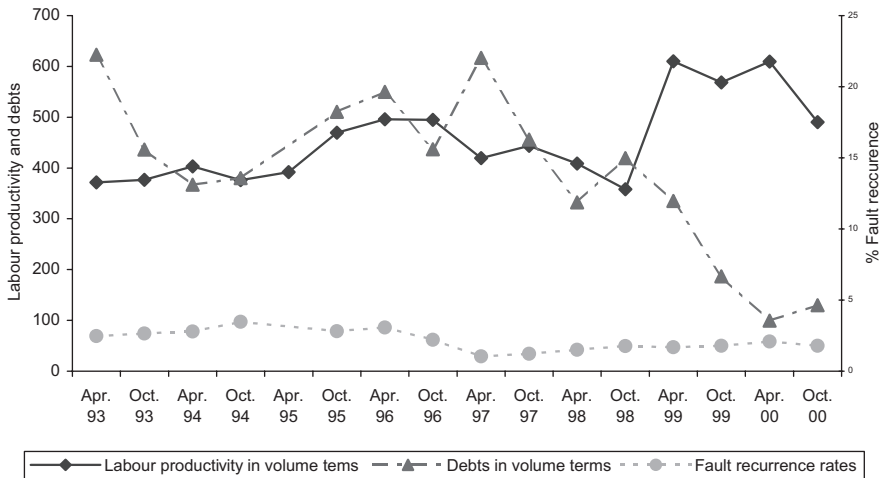


Figure A2 EK3—evolution of labour productivity, debts and fault recurrence rates (1993–2000).

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