Chapter 2
Institutional change in economic transition as a coordination problem

2.1 Introduction

A distinctive feature of economic transition is its largely institutional character, as argued by for example Schmieding (1993). Following North (1990), institutions can be roughly defined as the rules of the (economic) game. They can be interpreted as ways of coping with coordination problems. Thus, institutional change in economic transition is a logical place for coordination problems to occur.

A coordination problem in its ‘purest’ form is a game in which the players have no preference for a particular action, as long as the other players aim for the same action. Thus, it does not matter what exactly is coordinated on, as long as coordination takes place. This makes the solutions to this kind of games somewhat arbitrary. There are some rough examples that quickly come to the mind. Who calls back (when our connection is broken)? Which side of the road do we drive on (when we meet an oncoming car)? It is also not hard to think of some rough examples in economics. Which product standard do we use? Which medium of exchange do we accept? In all these situations it potentially does not matter too much what we do, as long as we come to a coordination of actions, and we have to form an expectation of the action that the other will take. Institutions can help us doing so.

However, it may happen that one coordination ‘point’ is clearly superior to the other. To stick to one of the economic examples above: our present form of money is clearly easier to use than for example the one that once was in use on the Pacific island of Yap, stone wheels up to 12 feet in diameter carried around with a pole through a hole in their center, called ‘fei’. Yet, both forms of money have existed for a long period of time. The question then becomes whether spontaneous coordination on the efficient equilibrium (fiat money) is

* Previously published in Dutch as Moers (2000a).
11 See for example Mankiw (1997).
ensured, or the inefficient equilibrium (fei) may result as well. The 'right' institutions can help reaching the former equilibrium.

This paper aims to illustrate in which ways the understanding of institutional change in economic transition can be aided by the notion of coordination games, with particular reference to the question just raised and to the debate on 'shock therapy' versus 'gradualism'. Section 2.2 will more extensively introduce coordination games and some relevant concepts. Experimental evidence on whether the efficient equilibrium will naturally result in coordination games will be treated by way of a representative example in section 2.3. Section 2.4 will similarly treat historical evidence. The specific focus on institutional change in economic transition will begin in section 2.5. Section 2.6 will discuss some generalizations. A conclusion will finish-off in section 2.7.

2.2 Coordination games

For a coordination problem we need at least two players and two actions. The generic form of a 2 by 2 coordination game can be depicted as in table 2.1.

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<tr>
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<th>A</th>
<th>B</th>
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<tbody>
<tr>
<td>A</td>
<td>(y, y)</td>
<td>(0, x)</td>
</tr>
<tr>
<td>B</td>
<td>(x, 0)</td>
<td>(z, z)</td>
</tr>
</tbody>
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The payoff pairs (., .) denote the utility resulting from the several possible combinations of actions (A, B) for the row-player and the column-player respectively. Depending on the values of x, y and z this game has one or two Nash equilibria. Vromen (1995, p 176-77) nicely describes this central concept of game theory as follows: 'Informally stated, a set of actions is in Nash equilibrium if no individual can improve his or her situation by deviating from playing his or her part in the equilibrium, given that the other individuals play their part in the equilibrium. This implies that if all individuals expect the others to play their part in the Nash equilibrium, they are all better off when they play their part in it'. The resulting Nash equilibrium may or may not be Pareto efficient. This central concept of welfare theory is
defined in Gravelle and Rees (1992, p 476) as: ‘A Pareto efficient allocation has the property that there is no other feasible allocation which makes some individual better off and no individual worse off’.

In a pure coordination game all cells have the same payoff for each player, as in table 2.2, that is: $y \geq z > x = 0$.

**Table 2.2 Pure coordination game**

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<th>A</th>
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<tbody>
<tr>
<td>A</td>
<td>(2,2)</td>
<td>(0,0)</td>
</tr>
<tr>
<td>B</td>
<td>(0,0)</td>
<td>(1,1)</td>
</tr>
</tbody>
</table>

This game has two Nash equilibria, (A, A) and (B, B). If $y = z$, both equilibria are Pareto efficient. However, if $y > z$, only (A, A) is Pareto efficient, as in the example above. Particularly in the latter context, it is important to know which equilibrium will result, but, per se, the game does not contain sufficient information to infer this.

In his seminal work, Schelling (1960, p 57) has introduced the notion of a focal point as a source of suggestion for equilibrium selection: ‘People can often concert their intentions or expectations with others if each knows the other is trying to do the same. Most situations (...) provide some clue for coordinating behavior, some focal point for each person’s expectation of what the other expects him to expect to be expected to do’. Lewis (1969), the other classic in this field, has introduced the related notion of a convention, roughly a system of mutually consistent, self-enforcing expectations, which can result in one equilibrium becoming dominant in multi-person, repeated play of pure coordination games. He defines it exactly as: C is a convention in P if: 1) everyone does C; 2) everyone expects others to do C; 3) everyone prefers to conform to C on the condition that others do, where P is a coordination problem and C is an equilibrium.

However, it remains the case that both Nash equilibria are self-enforcing once enacted, so that the game does not guarantee which convention will spontaneously arise, or whether it will be Pareto efficient. In essence, there are (positive) externalities (complementarities) to coordinating actions per se.\(^{19}\) In multi-person, repeated play, pure coordination games thus

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\(^{19}\) Katz and Shapiro (1985) have dubbed these network externalities. See Katz and Shapiro (1994) for a more informal overview of the issues involved here. Diamond (1982) uses a modified version of the metaphor often
exhibit *path dependence*, the original starting point having a decisive influence on the long-run outcome, possibly resulting in *lock-in* in an inefficient equilibrium (*coordination failure*) and in *non-linearities*. In the context of two exclusive technologies competing for dominance, Arthur (1989, p 119) more exactly defines the potential dynamic inefficiency, saying ‘... that the process is *path efficient* if at all times equal development (equal adoption) of the technology that is behind in adoption would not have paid off better’.

A pure coordination game has no conflict of interests between the players, contrary to an *impure* coordination game. The most well known type of the latter is the *prisoners' dilemma* (*cooperation game*), where $x > y > z > 0$, as in table 2.3.

**Table 2.3 Impure coordination game: prisoners' dilemma**

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<tr>
<td>A</td>
<td>(2, 2)</td>
</tr>
<tr>
<td>B</td>
<td>(3, 0)</td>
</tr>
</tbody>
</table>

This game has only one Nash equilibrium, and it is not Pareto efficient, (B, B). Both players would be better off to coordinate (cooperate) on (A, A), which is Pareto efficient, but this is dominated by the individual incentive to defect (*free riding*), resulting in the inefficient Nash equilibrium. In this setting, individual rationality naturally leads to a collectively inefficient outcome, while in a pure coordination game that is ‘only’ a possibility.

In multi-person, repeated play a prisoners' dilemma thus has the following important differences with a pure coordination game: 1) initially there will be no random distribution among the alternative strategies, but a strong incentive for players not to choose the cooperative strategy at all; 2) if a growing number of players should choose the cooperative...
strategy, this, per se, would not imply that there is an increased incentive for other players also to choose this strategy, but, on the contrary, this increases the prospective gains from defecting; 3) if a behavioral regularity always to cooperate should, for some reason, become established in a group, it cannot be assumed to be self-enforcing. In any case, it is clear from theory that a Pareto (path) efficient equilibrium does not have to evolve spontaneously in a pure coordination game, and certainly not in a prisoners’ dilemma.

2.3 Experimental example

Since the resulting equilibrium of a coordination game crucially depends on players’ expectations about the strategies selected by other players, a means of evaluating which equilibrium is likely to come about is by experiment. A representative experimental study that has attracted attention is Cooper, DeJong, Forsythe and Ross (1990).

They study players’ behavior in coordination games of the form in table 2.4, with multiple Nash equilibria which are Pareto-rankable.

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<th>A</th>
<th>B</th>
<th>C</th>
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<tbody>
<tr>
<td>A</td>
<td>(350, 350)</td>
<td>(350, 250)</td>
<td>(700, 0)</td>
</tr>
<tr>
<td>B</td>
<td>(250, 350)</td>
<td>(550, 550)</td>
<td>(1000, 0)</td>
</tr>
<tr>
<td>C</td>
<td>(0, 700)</td>
<td>(0, 1000)</td>
<td>(600, 600)</td>
</tr>
</tbody>
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Table 2.4 Representative experimental coordination game in Cooper, DeJong, Forsythe and Ross (1990)

This game has two Nash equilibria, (A, A) and (B, B), of which the latter is Pareto dominant. However, if the players could cooperate and thus jointly determine their strategies, the Pareto efficient outcome (C, C) could even be attained, but this cooperative strategy is dominated by Nash equilibrium (B,B) (on its own, this square in the bottom-right corner of table 4 is a prisoners’ dilemma).

Cooper, DeJong, Forsythe and Ross (1990) find that the observed pattern of play is accurately predicted by the Nash equilibrium concept. However, the Pareto dominant Nash equilibrium is not always the experimental outcome. This result is important in light of the
argument often advanced that the Pareto dominant Nash equilibrium is a natural focal point. Instead coordination failures can emerge in which the outcome is the Pareto inferior Nash equilibrium.

2.4 Historical example

Next to experimental economics, economic history also provides evidence on the existence of coordination failures. The classic historical example is the dominant, but arguably inefficient keyboard layout for typing referred to as ‘QWERTY’, by the first six letters on its topmost row of letters, as discussed by David (1985).

QWERTY first originated in typewriters and there, initially, it had a clear technological reason. QWERTY resulted from the typewriter developers’ trial-and-error rearrangements of the alphabetical key ordering aimed at minimizing the frequency of typebar clashes and jams, which were a particularly serious defect in the first typewriters. Subsequent technological developments freed typewriters from these problems however. Moreover it was shown that other keyboard designs could lead to much faster typing and that this increased efficiency would amortize the cost of retraining typists quite quickly. Nevertheless QWERTY was not competed away by more sensible keyboard layouts and it is still dominant even in this age of computers, while surely nothing in the engineering of computer terminals demands it.

David (1985) essentially shows that QWERTY survived because it took its place as an element of a larger, rather complex system of production that was technically interrelated, and thus requiring coordination, but really nobody’s design. In addition to the manufacturers and buyers of typewriters, this system involves typewriter operators and the variety of organizations that undertake to train people in such skills. The need for coordination between keyboard ‘hardware’ and ‘software’, represented by a typist’s memory of a particular keyboard layout, means that the expected value of a typewriter in production is dependent on the availability of compatible software created by typists’ decisions as to the keyboard layout they should learn. The more typists on QWERTY, the higher the expected value of a typewriter with this keyboard layout, and the higher the costs of individual deviation. Thus, a network externality led to the lock-in of QWERTY, which had gained its original lead by the
'historical accident' of the initial problems with typebar clashes and jams. As David (1985, p 333) eloquently states: 'The agents engaged in production and purchase decisions in today's keyboard market are not the prisoners of custom, conspiracy, or state control. But while they are, as we now say, perfectly "free to choose", their behavior, nevertheless, is held fast in the grip of events long forgotten and shaped by circumstances in which neither they nor their interests figured. Like the great men of whom Tolstoy wrote in War and Peace, "(e) very action of theirs, that seems to them an act of their own free will, is in an historical sense not free at all, but in bondage to the whole course of previous history..." (Bk. IX, ch. 1)'.

In fact then, this historical example illustrates how an equilibrium, which may have been initially efficient, fails to be changed when new circumstances, out of those same efficiency considerations, demand coordination on a different equilibrium.

### 2.5 Institutional change

Of course, the practical relevance of the above depends on just how important the setting of coordination problems and the potential resulting inefficiencies are in reality, in the context of this paper: the reality of economic transition. Here, as argued in the introduction, a prime field where coordination problems seem to arise is that of institutional change.

Above, the definition of institutions encompasses not only 'formal' institutions (enforced by the state), but also 'informal' institutions (self-enforced by convention). In the following, to be clear, the definition given by for example van der Lecq (1996, p 397-98) will be used. Her survey nicely interprets conventions and institutions as ways of coping with coordination problems: 'By way of introduction, conventions and institutions can roughly be described as rules of behaviour in situations that call for coordination. Conventions are often said to be self-enforcing, that is, once they are established, agents tend to conform to them. Institutions enforce compliance to a selected equilibrium by means of a sanction mechanism'. Institutions may thus prevent an inefficient convention from sustaining itself or from evolving at all. An efficient institution in effect changes the payoff structure of the (coordination) game, so that it is driven towards the efficient equilibrium. For example, in table 2.2 and 2.3 (an institution) enforcing a sanction bigger than 1 on choosing B would do the job.
A major problem in economic transition is the fact that it inherently takes time to get in place well-functioning institutions and conventions needed for market coordination. At the same time, institutions of plan coordination have already been destroyed, while its conventions disappear much slower, often even have increased strength, and in many ways fill the ‘institutional vacuum’. The latter may alleviate short-term economic hardship, but threaten to lock the economy in to an inefficient equilibrium. In terms of the pure coordination problem in table 2.2, at the start of economic transition the situation is much like the following. Plan coordination fits with the inefficient equilibrium (B, B). Proper market coordination can potentially result in the efficient equilibrium (A, A). Since plan institutions have been destroyed, while well-functioning market institutions and conventions are not yet in place, ‘collapse’ (A, B) and/or (B, A) frequently occurs. It is important to understand that this would even be the case if the state could immediately enforce proper market institutions, since plan conventions would still only disappear slower. In the meantime they may help to prevent collapse, still aiming for (B, B), but threaten to leave the economy stuck there.

A story like this for example seems to be able to go a long way towards explaining the uniform output collapse in the first stage of economic transition, particularly because of the complex, specialized, and highly interdependent nature of the plan economy. As Murrell (1992, p 41) puts it: ‘Because the stock of existing routines, behavioral patterns, and expectations - organizational structure for short - is suited to the existing environment, it is unlikely to be suitable for a new market environment. A radical change in the economic system requires large changes in organizational structure, which will induce much poorer economic performance during the lengthy and difficult process of changing organizational routines and reallocating managerial personnel’. Roland and Verdier (1997) is one of the few studies so far that formally model an explanation of this kind. They base the output collapse on search frictions combined with relation-specific investments that take place only after a new long-term partner is found (a new convention results). Economic transition (liberalization) means the freedom for enterprises to search for new clients and suppliers, but search by many bad agents may reduce the quality of overall matches (outcomes (A, B) and/or (B, A) result). While many enterprises prefer to keep searching output collapses.

A host of further stylized facts of economic transition linked to institutional change seem liable to be modeled as coordination problems. Most of these fall under the heading of
the previously noted persistence of plan conventions, which are often even fallen back on in increased extent in a situation where neither plan nor market institutions properly function. Often the setting is more like a prisoners' dilemma than like a pure coordination problem, since economic transition is both about efficiency and distribution.

One further example is the lack of tax payment discipline. Under the plan economy most tax payments came straight from state enterprises, as an integral part of the plan, income tax was collected at source and value added tax did not exist. Thus, a convention to pay taxes never properly evolved. During the transition from plan to market, this has come to the surface as one of the main factors contributing to a drop in government revenues. Schelling's (1960, p 92) seminal words exactly fit here: 'It may be the same phenomenon that makes it possible to collect income tax in some countries and not in others: if appropriate mutual expectations exist, people will expect evasion to be on a scale small enough not to overwhelm the authorities and may consequently pay up either out of a sense of reciprocated honesty or out of fear of apprehension, thus together justifying their own expectations'.

Another example is the frequent occurrence of large-scale inter-enterprise arrears. In the centrally-planned economy, an enterprise that could not serve its obligations anymore, could always count on the state to bail it out. This convention persisted in the transition from plan to market, which meant that tight macroeconomic policies often simply provoked increased arrears, in the mutual expectation that bailout would come if things went wrong. These expectations were sometimes validated by the state, laying the basis for the next arrears crisis. Perotti (1998) offers a formal model of this kind, explaining 'opportunistic' arrears.

Furthermore, the large economic effects of 'nomenklatura', corruption, Mafia, 'dollarization', home and allotment-garden products and services, and the 'shadow' economy in general, are all stylized facts of economic transition that fit into a similar scheme. Each was already more or less a characteristic of the plan economy, but now thrives in the absence of either well-functioning plan or market institutions. Individual incentives to deviate often seem insufficient to prevent getting locked in to this inefficient state of affairs.

Thus, there is a role for the state in enforcing market institutions as to help 'steering' economic transition towards an efficient equilibrium. If neither plan nor market institutions properly function conventions can 'take over', possibly getting the economy stuck in an inefficient equilibrium. If institutions and conventions are not coordinated to 'fit' collapse can
occur. Given that conventions can inherently only change relatively slowly, the above has also been used as an argument in favor of gradualism in transitional reforms. In this view gradualism can limit coordination collapse between institutions and conventions, give the latter the extra time needed to adjust, and thus minimize the adjustment costs of economic transition. Murrell (1992, p 42, italics added) for example argues: *Given a non-linear relation* between organizational performance and degree of adversity, and given that declines in performance in one sector due to adversity will produce adversity in others, then it could well be that slow reform results in a larger sum of discounted national income over the relevant time period than does fast reform*.20 The italics are crucial here, and the next section will show the connected reason why the theoretical case for either shock therapy or gradualism is not clear-cut.

### 2.6 Some generalizations

One of the things the previous section, in essence, showed is that institutions and conventions are complementary. Some studies have analyzed the issue of complementarity in transitional reforms in general. Informally, the point was first forcefully made by Lipton and Sachs (1990), as quoted by Gates, Milgrom and Roberts (1996, p 2): ‘The transition process is a seamless web. Structural reforms cannot work without a working price system; a working price system cannot be put in place without ending excess demand and creating a convertible currency; and a credit squeeze and tight macroeconomic policy cannot be sustained unless prices are realistic, so that there is a rational basis for deciding which firms should be allowed to close. At the same time, for real structural adjustment to take place under the pressures of this demand, the macroeconomic shock must be accompanied by other measures, including selling off state assets, freeing up the private sector, establishing procedures for bankruptcy, preparing a social safety net, and undertaking tax reform. Clearly, the reform process must be comprehensive’. Thus, the argument is that the payoff of transitional reforms packed together, that is: coordinated, is bigger than the sum of the payoffs of just one or just the other.

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20 Some of Murrell’s (1992) arguments are formally modeled in Murrell and Wang (1993), focusing on privatization.
Correspondingly, each individual reform makes undertaking the others more attractive. Per se, this can be used as an argument in favor of shock therapy.

Gates, Milgrom and Roberts (1996) look how this works out formally at the level of the firm. Here, two natural complementary transitional reforms are for example the implementation of incentives for managers to generate profits and price liberalization. Their analysis shows that complementarity between different reforms is necessary for optimality of shock therapy, but not sufficient, because there are also adjustment costs, which are likely to be convex. One form of such adjustment costs is coordination collapse because conventions can inherently only change relatively slowly, as mentioned in the previous section (see the italics at its end). Therefore, complementarities between different reforms are only sufficient for optimality of shock therapy if they outweigh convex adjustment costs. The potential for this is increased if complementarities of reform over time are added, under which gradualism leads to costly distortions such as dumping and hoarding, which shock therapy avoids. Gates, Milgrom and Roberts (1996) stress that there is no reason to suppose that all reforms are characterized by extensive complementarities. The outcome of the trade-off between complementarities and convex adjustment costs is to a large degree determined by the details of the circumstances at the start of transitional reforms.

Friedman and Johnson (1996) more specifically go into the latter, using a model of reform with complementarities and convex adjustment costs combined. They show that the optimal pace of reform is higher, first, the larger the initial crisis. This is intuitively obvious, because if current payoffs are lower, the reformer will want to move away from this position faster. It is higher, second, the stronger pro-reform institutions and, third, the greater immediate potential entrepreneurship, both simply because they lower adjustment costs and increase the payoffs to reform.

An alternative view of convex adjustment costs in a model with complementarity of reforms is given by Dewatripont and Roland (1996), in assuming that reversing one reform is less costly than reversing more reforms. Their model combines this with a stress on the role of uncertainty: it acknowledges that the model of market economy towards which economic transition should converge is not necessarily clear. In this setting gradualism is still more costly than shock therapy because of the complementarity of reforms, but less costly because it allows for an option value of early reversal after uncertainty resolution. If early reversal (one
reform) is less costly than full reversal (all reforms) and the first reform is informative for uncertainty resolution, gradualism is preferable to shock therapy provided learning is fast enough relative to the interim loss due to not taking advantage of complementarity of reforms.

Murphy, Shleifer and Vishny (1992) show how complementarity can also be used as an argument to oppose partial (not in all sectors/firms) compared to full (in all sectors/firms) implementation of one reform, presenting a surprisingly simple, but illustrative graphical analysis. They model a privatized and a state firm which compete for the same complementary input, but only the former is allowed to offer a liberalized price, whereas the latter is still constrained by a regulated price. This partial price liberalization encourages the diversion of input away from their traditional users toward the privatized firm, because it can offer better deals to the supplier, even when the state firm values this input more. This results in less efficient rationing, whereby the marginal valuation of input in the state firm is much higher than in the private firm, while full price liberalization would have equalized marginal valuations leading to higher welfare. Murphy, Shleifer and Vishny (1992) do not model any adjustment costs however, making their story a less balanced appraisal than the ones treated above.

Summarizing: despite the fact that transitional reforms may require coordination, general a priori conclusions about their optimal speed do not seem justified, because of the (uncertain) trade-off between complementarities and convex adjustment costs involved. The specific circumstances of each individual case should be carefully evaluated before deciding on (the speed/sequencing of) reforms.

2.7 Conclusion

Coordination problems show path dependence and illustrate that lock-in in an inefficient equilibrium is a clear possibility. Both experimental and historical evidence confirm that

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21 The trade-off may be complicated further by political economy considerations, as in Dewatripont and Roland (1996), who show that these can both strengthen the case for shock therapy (taking advantage of the ‘window of opportunity’ to introduce reforms that are costly to reverse, thus reducing ex post political constraints) and the case for gradualism (reducing ex ante political constraints by creating irreversibility through correct sequencing, building constituencies for further reform).
Cooperation failures can emerge. For the reality of economic transition coordination problems do seem relevant, but applications are few so far. Coordination problems point to the relevance of institution-building as to help steering economic transition towards an efficient equilibrium and to prevent coordination collapse in a situation where plan institutions have already been destroyed, but well-functioning market institutions and conventions are not yet in place (an explanation for the transitional output collapse for example). Moreover, they illustrate how falling back on the remaining plan conventions can lead economic transition to lock-in in an inefficient equilibrium (an explanation for the lack of tax payment discipline and the frequent occurrence of large-scale inter-enterprise arrears for example). Given that conventions can inherently only change relatively slowly, this, per se, is an argument in favor of gradualism. Moreover, adjustment costs of transitional reform seem convex overall. This makes that there is a trade-off with the need for coordination because of the complementarity of transitional reforms in general, which, per se, is an argument in favor of shock therapy. However, given that in economic transition there is simply so much to reform, it is practically impossible to do everything at once (or coordinated), which ensures that the issue of sequencing anyhow deserves attention.