Zeitschrift für Wirtschafts- u. Sozialwissenschaften (ZWS) 119 (1999), S. 191 – 204
Duncker & Humblot, Berlin

Multiple Equilibria, Equilibrium Selection and Economic Policy*

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1. Introduction

Irrespective of the particular topics they are concerned with, economists seem to share a fairly general view of the mechanics by which economic policy measures affect important economic variables such as quantities and prices: a shift in policy parameters forces firms and households to revise their plans concerning prices, supply and demand. This leads to a myriad of microeconomic adjustments which express themselves in relocations of individual reaction curves (i.e. supply and demand schedules). Next, the overall effect of the policy under consideration can be calculated by looking for those actions which are both individually rational and mutually compatible. Within this framework expectations are incorporated by assuming that rational agents are able to anticipate the other players' reaction curves, which tell them which behavior to expect under various circumstances.

Two recommendations which could be written into a policy-maker's manual follow from this view:

(i) In order to be effective in the sense of changing the actions chosen by the private sector, any policy is required to affect at least one agent's reaction curve.

(ii) If the equilibrium value of some activity variable is an increasing (decreasing) function of some policy parameter, a large expansion of the parameter leads to a greater increase (reduction) of the activity level than that of a small expansion.

In the present paper it is demonstrated that both propositions may turn out to be wrong as soon as multiple equilibria coexist. To illustrate the basic reason for this result, consider a situation in which the interactions between an arbitrary number of agents leads to two equilibria *'A'* and *'B'*. Two coex-

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* Verantwortlicher Herausgeber / editor in charge: U.S.

** I thank Urs Schweizer and two anonymous referees for helpful comments on an earlier version of this paper. I also thank discussants at the 1998 Annual Congress of the Verein für Socialpolitik in Rostock. The usual disclaimer applies.

isting equilibria allow for self-fulfilling expectations: Provided that all agents expect equilibrium A to occur and act accordingly, this equilibrium will in fact be established. As the same applies with respect to equilibrium B agents have to forecast which of the two equilibria is going to be the final outcome of the game in order to be able to choose optimal actions. In this paper it is argued that agents' expectations concerning which out of multiple equilibria will finally be established depend on the structure of payoffs of the game considered. Hence, these expectations can be influenced by economic policy variables. A small change in some policy variable may lead agents to expect equilibrium B and adjust individual actions accordingly where equilibrium A had been both expected and realized before. This is an example of what we call a *coordination effect* of economic policy to indicate that it results from a sudden change in the equilibrium upon which private agents coordinate self-fulfilling expectations. It is demonstrated below that such a discrete jump from one equilibrium to a coexisting one in response to a change in policy parameters can occur even without a shift in optimal demand and supply (reaction curves). This disproves proposition (i). Of course discrete jumps between equilibria may come along together with shifts in reaction curves. In this case it can be shown that even though all (Nash-) equilibrium values of some variables increase in response to a change in policy parameters, the total effect on the realized values of these variables may be negative. This contradicts proposition (ii).

The present analysis refers to three different strands of existing literature: To begin with, there is a long list of (mainly macroeconomic) papers in which multiple equilibria exist under reasonable assumptions.[1] This indicates that, at least from a theoretical point of view, multiple equilibria should be taken seriously. However, these papers fail to model the process by which agents build expectations concerning which equilibrium is going to be realized. In order to resolve this indeterminacy we use an approach developed in the theory of strategic games under the heading of equilibrium selection (see Section III for detailed references). As far as the author is aware the present paper is the first one to link this strand of literature to problems of economic policy. The third branch of research deals with the roles which history and expectations have to play in selecting equilibria.[2] The main idea of the historical approach to equilibrium selection is that the

[1] Multiple equilibria may emerge due to imperfect competition (see for instance Gali (1994, 1996) Matsuyama (1995), Silvestre (1993), Cooper and John (1988), Ball and Romer (1991), Blanchard and Kiyotaki (1987) or Heller (1986)) search externalities (Diamond (1982) and Howitt, McAfee and Preston (1987)), the private provision of public goods (Palfrey and Rosenthal (1984) and Gradstein and Nitzan (1990)) or overlapping generations (Geanakoplos and Polemarchakis (1986)) to give just some examples.

[2] See for example Krugman (1991), Chen (1995) or Vega-Redondo (1997) for illustrative expositions of this debate.

dynamics describing a sequence of temporary equilibria may imply multiple steady states. Hence, whether the economy converges to one or another steady state depends on the starting point which is defined by the equilibrium values of the endogenous variables in the initial period $t = 0$. To see how this argument relates to the simple one-shot scenario analyzed in the present paper, two cases have to be distinguished[3]: First, let the temporary equilibrium at $t = 0$ be unique for all historically given values of the state variables of the system. In this case history 'selects' one long-run equilibrium by locating the economy on a path converging to steady state A for some values of the state variables while putting it on a path converging to a different steady state B for others. Although it is true that the equilibrium path selected in general depends on policy parameters (eg. by influencing the laws of motion of the system, the location and the stability of steady states), we will not deal with this case. As has been said above the main focus of the present paper is on multiple self-fulfilling expectations. But if the whole sequence of temporary equilibria is uniquely determined by the initial state of the economy, multiple systems of rational expectations cannot coexist. Secondly, the starting point need not be completely determined by history. Assume that at the historically given initial state multiple temporary equilibria at $t = 0$ exist. In this case we are referred back to the problem of determining which self-fulfilling expectations are going to prevail. If all agents expect the economy to converge to steady state A and act accordingly, the system will be located on the corresponding path. Again the same applies for steady state B. Note that in this case after having solved for the different equilibrium paths, the problem of choosing one of them essentially becomes a static one: At time $t = 0$ agents have to build expectations on whether equilibrium (path) A or the coexisting equilibrium (path) B will finally be realized. After these expectations have been built and the corresponding temporary equilibrium has occured, the further development of the system is completely determined by its dynamic properties. Hence, provided that the dichotomy of history versus expectations allows for multiple self-fulfilling expectations, the structure of the problem can be described as a N-person one-shot game with multiple Nash-equilibria.

2. A Simple Model with Multiple Equilibria

In order to analyze how economic policy affects endogenous variables when multiple equilibria coexist we consider a simple model of two firms 'i' and 'e' which simultaneously choose their respective outputs x_i and x_e. They face a price p which depends negatively on the sum of outputs according to

[3] See Krugman (1991) or Chen (1995) for graphical illustrations of these cases.

$p := a - x_i - x_e, a > 0$. Firm i has constant unit costs c_i. Marginal costs of firm e are denoted by c_e. Additionally this firm has to bear fixed setup costs $F^2 > 0$ (fixed costs are denoted by F^2 instead of F in order to avoid expressions containing square roots). Within this setting a Nash-equilibrium is defined as a combination of outputs (x_i, x_e) with the following properties:

$$x_i \text{ maximizes } \pi_i(x_i, x_e) = (p - c_i)x_i \text{ st. } x_i \geq 0 \ ,$$

$$x_e = \begin{cases} z_e \text{ for } \pi_e(z_e\ , x_i) \geq 0 \\ 0 \text{ otherwise} \end{cases}$$

$$\text{where } z_e \text{ maximizes } \pi_e(z_e, x_i) = (p - c_e)z_e - F^2 \text{ st. } z_e \geq 0 \ .$$

By defining $\zeta_i := (a - 2c_i + c_e)/3$ and $\zeta_e := (a - 2c_e + c_i)/3$ the firms' reaction functions can be written as

$$(1) \qquad R_e(x_i) := \begin{cases} \zeta_e + \frac{\zeta_i - x_i}{2} \text{ for } x_i \leq \zeta_i + 2\zeta_e - 2F \\ 0 \text{ for } x_i > \zeta_i + 2\zeta_i - 2F \end{cases}$$

$$R_i(x_e) := \begin{cases} \zeta_i + \frac{\zeta_e - x_e}{2} \text{ for } x_e \leq \zeta_e + 2\zeta_i \\ 0 \text{ for } x_e > \zeta_e + 2\zeta_i \end{cases}$$

Depending on the parameters a, c_e, c_i and F various types of equilibria can occur. For the sake of simplicity we concentrate on the situation which is depicted in figure 1.

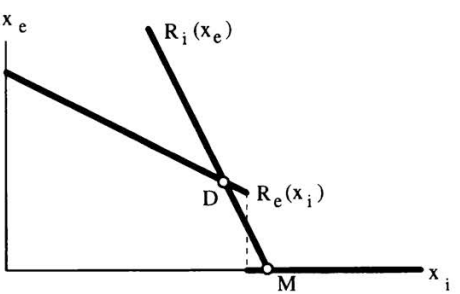

Figure 1

Both firms' reaction functions are linear in the opponent's output. Fixed setup cost for firm e imply that e's reaction function is discontinuous at firm i's limit output $x_i = \zeta_i + 2\zeta_e - 2F$. Due to this discontinuity both firms' reaction functions can intersect twice: two Nash-equilibria coexist. One equilibrium (point D) can be described as a standard situation of (Cournot-)duo-

poly. Both firms produce strictly positive outputs $x_i = \zeta_i$ and $x_e = \zeta_e$. In the other equilibrium (point M), firm e does not enter the market ($x_e = 0$) and firm i acts as a monopolist, producing $x_i = \zeta_i + \zeta_e/2$ which exceeds firm i's limit output.

Up to this point nothing can be said as to which of the two equilibria is going to be the solution of the game. If both firms expected the duopoly to occur, each of them would choose its best response to the opponent's duopoly output and the duopoly situation would indeed be established. The same applies with respect to the monopoly equilibrium. Both sets of expectations are rational in the sense of correctly predicting the overall outcome when individual actions are based on the opponent's expected behavior.

3. Equilibrium Selection According to Risk-Dominance: A Brief Outline

The indeterminacy of expectations has given rise to a colorful variety of concepts such as Keynes' Animal Spirits, the mechanics of self-fulfilling prophecies, Schelling's focal points or sunspot equilibria. However, being interested in the details of how economic policy affects expectations, we have to be more explicit on how expectations are built. To this end we refer to the game-theoretic literature on equilibrium selection. Equilibrium selection aims to single out exactly one equilibrium from of a set of (possibly equally perfect) equilibria. This equilibrium being characterized by some outstanding properties is called the *solution* of the game which indicates that it is meant to describe the way the game will actually be played.[4] The common feature of various approaches to equilibrium selection is the assumption that players refer to the structure of payoffs of the game when building expectations concerning which equilibrium is going to be the solution. Various approaches to the problem of equilibrium selection have been proposed, the most prominent one being risk-dominance as developed by Harsanyi and Selten (1988). Risk-dominance has the attractive features of giving a solution for almost any game with multiple equilibria and being established as the result of quite different formulations of how expectations are built.[5] This explains why risk-dominance is used in this paper to illustrate how economic policy affects the solution of the game.

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[4] It should be clear from the above that equilibrium selection actually deals with players' expectations. In this respect the term 'equilibrium selection' is somewhat misleading since there is no individual player who deliberately chooses between equilibria.

[5] In the wake of Harsanyi's and Selten's '*General Theory of Equilibrium Selection of Games*' which presents two different approaches to justify risk-dominance, other authors have established this criterion as a result from learning (Kandori, Mailath

Risk-dominance as a criterion of equilibrium selection can be made clear by studying the table of payoffs from both equilibrium strategies:

		Firm e	
	$\pi_e(x_e, x_i)$ $\pi_i(x_i, x_e)$	$x_e = \zeta_e$	$x_e = 0$
Firm i	$x_i = \zeta_i$	$\zeta_e^2 - F^2$ ζ_i^2	0 $(\zeta_i + \zeta_e)\zeta_i$
	$x_i = \zeta_i + \zeta_e/2$	$\frac{1}{2}\zeta_e^2 - F^2$ $\zeta_i^2 - \frac{1}{4}\zeta_e^2$	0 $(\zeta_i + \zeta_e/2)^2$

Table 1

Each firm knows that output combinations other than $(x_i, x_e) \in \{\zeta_i, \zeta_i + \zeta_e/2\} \times \{\zeta_e, 0\}$ cannot occur. When choosing between $x_e = \zeta_e$ and $x_e = 0$ firm e has to take into consideration that producing the duopoly output ζ_e possibly yields $\pi_e(\zeta_e, \zeta_i + \zeta_e/2)$ instead of $\pi_e(\zeta_e, \zeta_i)$ when firm i enters the market with its monopoly output. As $\pi_e(\zeta_e, \zeta_i + \zeta_e/2) < 0$ since firm i's monopoly output is larger than its limit output, firm i runs a strategic risk by entering the market. Firm i anticipates that firm e's willingness to accept the risk implied by ζ_e is increasing in both $\pi_e(\zeta_e, \zeta_i)$ and $\pi_e(\zeta_e, \zeta_i + \zeta_e/2)$. Hence, for sufficiently high values of these payoffs firm i expects firm e to play $x_e = \zeta_e$. Of course similar considerations have to be made for the strategic risk implied for firm i by playing either the monopoly or the duopoly strategy. Therefore, in order to form expectations with regard to equilibrium selection, players have to compare the strategic risks of their own equilibrium strategies and those of their opponent. This comparison is as follows:

Let $\omega_i \in [0, 1]$ denote the probability which firm i assigns to the event '$x_e = \zeta_e$' and $\omega_e \in [0, 1]$ be the probability which firm e assigns to the event '$x_i = \zeta_i'$. The probabilities $1 - \omega_i$ and $1 - \omega_e$ are assigned to the events '$x_e = 0$' and '$x_i = \zeta_i + \zeta_e/2$', respectively. Based on these expectations best-response quantities can be calculated as

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and Rob (1993), see also Robson and Vega-Redondo (1996)), from noisy observations of opponent's payoffs (Carlsson and van Damme (1993)) rational introspection (Olcina and Urbano (1994)) or players' relative incentives (Elberfeld (1997)).

$$(2) \qquad x_i(\omega_i) = \begin{cases} \zeta_i \text{ if } \omega_i \geq \overline{\omega}_i \\ \zeta_i + \zeta_e/2 \text{ if } \omega_i \leq \overline{\omega}_i \end{cases} \quad \text{and} \quad x_e(\omega_e) = \begin{cases} \zeta_e \text{ if } \omega_e \geq \overline{\omega}_e \\ 0 \text{ if } \omega_e \leq \overline{\omega}_e \end{cases}$$

where firm i is indifferent between $x_i = \xi_i$ and $x_i = \xi_i + \xi_e/2$ at $\omega_i = \overline{\omega}_i$ and firm e is indifferent between $x_e = \xi_e$ and $x_e = 0$ at $\omega_e = \overline{\omega}_e$. Firm e does not know which value of ω_i the competing firm actually employs. Having no sufficient reason to do otherwise firm e treats ω_i as a random variable which is equally distributed on [0, 1]. As the same applies with respect to firm i's treatment of ω_e players' expectations can be calculated from (2):

$$(3) \qquad \begin{aligned} \omega_e &= \text{prob}(\omega_i \geq \overline{\omega}_i) = 1 - \overline{\omega}_i \\ \text{and} \quad \omega_i &= \text{prob}(\omega_e \geq \overline{\omega}_e) = 1 - \overline{\omega}_e \ . \end{aligned}$$

Substituting these expectations into the best-response functions (2) yields unique results concerning equilibrium selection for those cases in which $\overline{\omega}_i + \overline{\omega}_e \neq 1$. The solution of the game consists of a combination of outputs such that

$$(4) \qquad (x_i, x_e) = \begin{cases} \zeta_i, \zeta_e \text{ for } \overline{\omega}_i + \overline{\omega}_e < 1 \\ (\zeta_i + \zeta_e/2, 0) \text{ for } \overline{\omega}_i + \overline{\omega}_e > 1 \end{cases}$$

To see this assume $\overline{\omega}_i + \overline{\omega}_e < 1$. By (3) this implies $\omega_e = 1 - \overline{\omega}_i > \overline{\omega}_e$ and $\overline{\omega}_i = 1 - \overline{\omega}_e > \overline{\omega}_i$. As $\omega_e > \overline{\omega}_e$ and $\omega_i > \overline{\omega}_i$ both firms choose their duopoly outputs according to (2). By the same procedure it is easy to show, that a monopoly occurs for $\overline{\omega}_i + \overline{\omega}_e > 1$.[6]

4. Economic Policy in a Multiple-Equilibria Framework

Augmenting the model by a criterion which says which of the two equilibria is established as the solution of the game allows us to be precise on the effects of various economic policy measures.

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[6] Our presentation does not address the question of why players stick to their expectations according to (3) while both can easily recognize that according to the solution of the game the $\omega_j, j = i, e$ can only equal zero or one instead of $0 < \omega_j < 1$. Harsanyi and Selten solve this problem by suggesting a procedure (the tracing procedure) by which players update their beliefs. We chose not to complicate things by presenting the tracing procedure, especially since Harsanyi and Selten show that the tracing procedure converges towards the same solution as the process of forming preliminary expectations outlined above (see Harsanyi, Selten (1988), Lemma 4.17.7 p. 183).

a) Coordination Effects with Constant Reaction Curves: The Case of a Linear Tax on Monopoly Profits

Consider the case of a linear tax on monopoly profit.[7] At first glance it seems to be quite obvious that the value of the tax rate τ should have no influence on the firms' supply decisions: an output x_j which maximizes $\pi_j(x_j, 0)$ continues to do so when it comes to maximizing net profits $(1-\tau)\pi_j(x_j, 0), \tau < 1$. Hence, the firms' reaction curves do not shift in response to variations in τ. According to proposition (i) mentioned in the introduction, firms' outputs can be expected to remain unchanged. However, in the case of multiple equilibria absolute net profits affect expectations concerning equilibrium selection. To derive the consequences we express $\overline{\omega}_i$ as a function of the tax rate τ by using net profits for firm i in table 1 at $x_e = 0$:

$$\overline{\omega}_i(\tau) = \frac{1-\tau}{2-\tau} \,. \tag{5}$$

Now consider the criterion for risk-dominance (4) and assume that $\overline{\omega}_i(0) + \overline{\omega}_e > 1$ such that at a tax rate $\tau = 0$ the monopoly equilibrium is risk-dominant. As τ increases $\overline{\omega}_i(\tau)$ approaches zero from above. With $\overline{\omega}_e < 1$ we conclude that at a sufficiently high tax rate τ expectations shift from the monopoly to the duopoly equilibrium. Hence, even without shifting reaction curves, economic policy can have far-reaching consequences. In order to stress, that the driving force behind this effect is a sudden switch in expectations, we call it a *coordination effect* to indicate that it comes about via a change in the equilibrium upon which agents coordinate their expectations. Obviously a coordination effect can occur only if multiple equilibria coexist. In this sense the coordination effect is the central feature which distinguishes the working of economic policy within a multiple equilibrium framework from single equilibrium economics as it has been sketched in the introductory proposition.

The mechanism generating a coordination effect is simple: An increase in τ lowers firm i's net profit from being the only supplier. This increases the strategic risk of both the monopoly and the duopoly strategy. Due to $\pi_i(\zeta_i + \zeta_e/2, 0) > \pi_i(\zeta_i, 0)$ the strategic risk implied by the monopoly strategy $x_i = \zeta_i + \zeta_e/2$ increases by more than the risk generated by the duopoly strategy $x_i = \zeta_i$. Hence, the relative risk of the monopoly strategy increases

[7] Note that we do not attempt to give an explanation of why the government might wish to introduce various policy measures (raising of government funds, increasing the total supply of goods under imperfect competition, regulating monopolies etc.). Instead our aim is to offer a simple positive analysis of how economic policy affects realized allocations under multiple equilibria by referring to policy parameters which are easily introduced into our model.

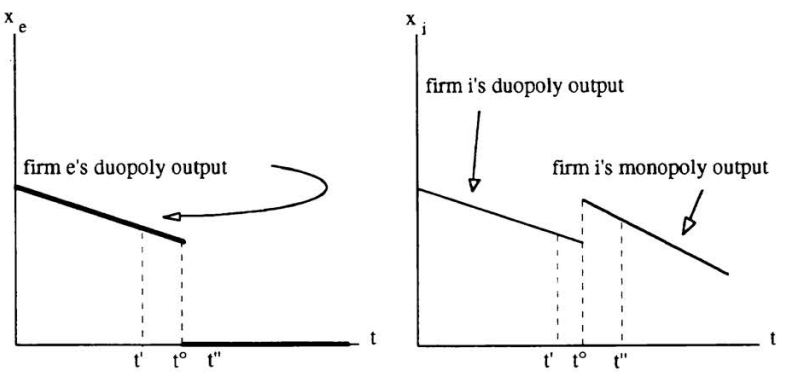
which finally leads to a reversal of the dominance relation as τ exceeds a certain critical value. This effect can be rationally anticipated by firm e in order to predict firm i's choice.

b) Allocation and Coordination Effects of Economic Policy: The Case of a Linear Output Tax

We now turn to policy instruments which distort marginal incentives such as a linear tax on output. Let both firms be taxed by a common rate of $t \geq 0$ per good supplied. The introduction of an output tax lowers each firm's marginal (net) profit which causes reaction curves in figure 1 to shift inwards. The amount of goods supplied by firm j in the duopoly equilibrium changes from ζ_j to $\zeta_j - t/3, j = i$, e. Accordingly, the new monopoly output of firm i is given by $\zeta_i + \zeta_e/2 - t/2$, where ζ_i and ζ_e denote Cournot-outputs at $t = 0$. As could have been expected, equilibrium outputs depend on the tax rate t. This is the *allocation effect* which results from an increase or a reduction in the tax rate. If both equilibria coexist (which is assumed in what follows) we have to check the risk-dominance relation between oligopoly and monopoly. Substitution of $\zeta_j - t/3$ for ζ_j in Table 1 and using the resulting expressions to calculate $\overline{\omega}_e(t)$ and $\overline{\omega}_i(t)$ yields

$$\overline{\omega}_i(t) + \overline{\omega}_e(t) \gtrless 1 \Longleftrightarrow 4F^2 - 3(\zeta_e - t/3)^2 \gtrless 0. \tag{6}$$

This indicates that in addition to the allocation effect, an increase in t can lead to a coordination effect which implies a discrete jump from the duopoly to the monopoly equilibrium.



a.) Firm e's realized output b.) Firm i's realized output

Figure 2

As a consequence of the coincidence of both an allocation effect and a coordination effect, the total effect of changes in t may be quite unexpected. In order to illustrate what can happen both firms' realized outputs are depicted as functions of the tax rate t in figure 2.

Consider an increase in t such that t rises from $t' < t^o$ to $t'' > t^o$. As t passes t^o a coordination effect occurs. Figure 2-a illustrates that at t'' firm e stays out whereas it would have entered the market at t'. This clearly is not due to the fact that making non-negative profits is impossible at t''. Note that an equilibrium at $x_e = \zeta_e - t''/3$ coexists with the equilibrium in which firm e chooses not to produce. The point is that with increased taxes the strategic risk of entering the market is too high as compared to the strategic risk of staying out. Hence, it is basically the coordination effect which drives firm e out of the market. Obviously for x_e both the allocation and the coordination effect of an increase in t point to the same direction: for increasing t the allocation effect can be depicted in figure 2-a as a downward movement along firm e's duopoly output schedule. The coordination effect expresses itself as a sudden reduction in output from $x_e = \zeta_e - t/3$ to $x_e = 0$ as t passes t^o. This indicates that coordination effects possibly amplify the sensitivity of economic variables with respect to policy parameters. Coordination effects induce an expectations-driven multiplier which has to be taken into account when policy instruments are to be used to reach a certain target allocation.[8]

Within our model it is easy to demonstrate that there is no stable relationship between the signs of the allocation and the coordination effect. As can be seen from figure 2-b, the coordination effect may well run contrary to the allocation effect as it is the case with respect to x_i. In this situation, the sensitivity of endogenous variables with respect to policy parameters is weakened. Of course the positive coordination effect may be strong enough not only to dampen but to override the negative allocation effect. To see this consider values of t' and t'' in the close neighborhood of t^o where firm i's output increases in response to a change in t from t' to t''. Note that this increase in x_i comes about although both firm i's monopoly and duopoly output are strictly decreasing in t! This contradicts proposition (ii) which we formulated in the introductory section.[9]

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[8] Multiplier effects have been shown to exist as a consequence of strategic complementarities which in turn are an important condition for multiple equilibria to exist (see Cooper and John (1988) and Matsuyama (1995)). But this strain of thought is quite different from the analysis presented above since it refers to the allocation effect whereas here a multiplicative effect occurs due to a shift between equilibria.

[9] This example demonstrates that more powerful tools which allow comparative-static exercises with a set of equilibria instead of just one single equilibrium (see for instance Milgrom and Roberts (1994) and Milgrom and Shannon (1994)) can possibly lead to false conclusions as they do not incorporate a criterion to determine which of the equilibria is going to be established.

5. Summary and General Conclusions

This paper is intended as an attempt to shed light on the question of how economic policy affects endogenous variables when multiple self-fulfilling expectations exist. To be precise we chose the simplest model which allows us to derive some hints on what the answer could look like. Piecewise linear reaction curves in a two-player game is the most primitive input required in order to generate at least two equilibria. Risk-dominance as a description of how players form expectations serves only illustrative purposes although it has the merit of being a well-established approach to equilibrium selection.

It should be clear that the effects demonstrated within this simple framework can also occur in more complex multiple-equilibrium models with more than two players and strategy variables other than quantities. Hence, some general conclusions can be drawn from the above analysis: When multiple equilibria coexist, economic policy can affect economic activities via coordination effects in addition to ordinary allocation effects, provided that self-fulfilling expectations are built according to the structure of payoffs of the game. Taking coordination effects into consideration may open up an entirely new approach to economic policy which could finally lead to the development and suitable employment of innovative policy instruments. These instruments should be designed so that they allow to switch expectations between equilibria eg. by providing insurance against strategic risks. Our analysis shows that such instruments should not be ignored due to their having no (allocation) effect within a traditional single equilibrium framework, since they in fact can prove to be quite effective when multiple equilibria exist. Moreover the implementation of these instruments promises that only a relatively small amount of distortionary govermental intervention is required. For example, in order to achieve an expansion of certain activities governmental authorities could either exploit the allocation effect by subsidizing private agents or employ the coordination effect by insuring them against the strategic risk of choosing a higher activity level (ie. compensating them for the loss from unilaterally deviating from the low-level equilibrium). As in response to the latter strategy expectations switch from the low-level to the coexisting high-level equilibrium, no payments will actually have to be made.

Another implication of what has been said above is that in order to reach certain target allocations it may be necessary to complement ordinary policy instruments by coordination devices in order to back the target equilibrium up against undesired coordination effects. Virtually every policy instrument which is employed with the intention of achieving a certain allocation effect may induce a coordination effect. This may lead to overshooting in the sense

of a total effect which exceeds the variation aimed at. It may, however, be the case that the coordination effect counteracts the allocation effect so that the sign of the total change in economic activities is the opposite of what had been aimed for. Such failures can be avoided by using two instruments simultaneously. One instrument is employed so that the desired allocation constitutes an equilibrium. A second one is used as a complementary device which coordinates expectations.

The phenomenon of small variations in payoffs leading to a reversal of the dominance relationship between coexisting equilibria thereby having large-scale effects can be interpreted in an interesting way: assume that private agents have incomplete information concerning their opponents' characteristics such as their payoffs or the strategies available to them. This situation can be described as a Bayesian game in which players must hold beliefs (probability distributions) concerning the other players types in order to estimate the expected payoffs from alternative strategies. Let this game have two equilibria and let us further assume that private agents think that public authorities have information on the state of the economy which is superior to their own information. Within this context all that is communicated through the mass media with regard to official statements, comments or assessments is going to be used as signals by private agents. As they update their beliefs conditional on the signals they have received, the expected payoffs of the game change. Due to small changes in the structure of expected payoffs the dominance relationship between equilibria can be reversed so that official bulletins can trigger off large real effects even without containing valuable information on future governmental activities.

It goes without saying that all of the above considerations concerning the effects of variations in policy parameters apply equally to other variables which are exogenous to private agents. Small changes in preferences or technological parameters can lead to large adjustments in economic activity due to coordination effects. This makes economies with multiple equilibria considerably more volatile than their single equilibrium counterparts. Therefore, stabilizing the economy against the consequences of exogenous shocks may be more desirable when multiple equilibria coexist. Recognizing the possibility of multiple equilibria not only enforces the role of stabilization policy, it also offers an alternative approach to how stabilization can be achieved. Traditionally stabilization policy aims at compensating for the allocation effects of exogenous shocks eg. creating additional demand in response to an exogenous decline in demand. Alternatively measures can be taken which lead private agents to expect that an adverse shock will not lead to a major recession. These measures are not required to compensate for a decline in demand but to rearrange strategic risks in favour of the high-level equilibrium.[10]

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10 '[A] simple commitment to a policy of intervening to stabilize *if it ever were necessary* could, by assuring people that fluctuations will not occur, prevent the occasion for intervention from ever arising.' Woodford (1991), 103, emphasis contained in the original text.

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Zusammenfassung

Im Rahmen eines einfachen Modells mit zwei Gleichgewichten wird untersucht, wie sich wirtschaftspolitische Maßnahmen auswirken, wenn mehrere Gleichgewichte existieren. Um die Erwartungsbildung zu modellieren, wird das Konzept der Risikodominanz ins Modell eingeführt. Eine Unterscheidung zwischen Allokationseffekten (stetigen Verlagerungen gegebener Gleichgewichte) und Koordinationseffekten (diskreten Sprüngen zwischen koexistierenden Gleichgewichten) zeigt, daß Wirtschaftspolitik im Kontext multipler Gleichgewichte grundsätzlich anders wirkt, als wenn nur ein einziges Gleichgewicht vorläge. Daraus lassen sich Schlußfolgerungen für die Konzeption wirtschaftspolitischer Maßnahmen ziehen, welche die mögliche Existenz mehrerer Gleichgewichte berücksichtigen.

Abstract

Within a simple model the effects of economic policy in the presence of multiple equilibria are analyzed. Expectations concerning equilibrium selection are assumed to be formed according to the risk-dominance criterion. A distinction is made between allocation effects (continuous shifts of equilibria) and coordination effects (discontinuous jumps between coexisting equilibria). We show that economic policy in the presence of multiple equilibria has effects which differ fundamentally from those to be expected within a single-equilibrium framework. From this we draw some conclusions on how the multiplicity of equilibria has to be taken into account when designing economic policy.

JEL-Klassifikation: E 60