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# JENA ECONOMIC RESEARCH PAPERS



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## **A Nash Threat Game of Passing Through Exchange Rate Mechanism II**

by

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# A Nash Threat Game of Passing Through Exchange Rate Mechanism II

Christian Fahrholz<sup>1</sup>

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## **Abstract**

Following entrance into the European Union, Central Eastern European Countries (CEECs) are expected to join the European Monetary Union (EMU). These countries may incur considerable costs over the course of their passing through the required Exchange Rate Mechanism II (ERM-II). However, with enough bargaining leverage CEECs may be able to pass some of these costs on to current EMU-members. In turn, a CEEC's leverage depends on their ability to wield successful brinkmanship via an exchange-rate policy characterized by a 'threaten-thy-neighbor' strategy. A two-stage Nash-threat game captures the essentials of the CEECs' phase of ERM-II pass through.

**KEYWORDS:** Threat game, Nash-bargaining solution, exchange-rate policy, EU-enlargement, EMU.

**JEL:** C72, C78, F33, F51

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## Introduction

The prospective formation of exchange-rate policies in Central Eastern European Countries (CEECs) and their Exchange-Rate Mechanism II (ERM-II) pass through, which is required for European Monetary Union (EMU) membership, has received little attention as a research subject matter. After the admittance of ten new member countries to the European Union (EU) in 2004 these countries are expected to join ERM-II at the beginning of 2007.<sup>2</sup>

This article deals with the CEECs' exchange-rate policies when passing through ERM-II. Maastricht criteria such as ERM-II are applied in order to guarantee that participating countries are not too heterogeneous. Fulfilling the requirements of Maastricht implies accepting particular convergence costs in terms of an output gap, which implies more unemployment. In terms of real convergence costs, the process of catching-up is paid particular attention to in this paper, as Maastricht criteria address rather nominal convergence costs. The real convergence costs crop up in terms of less output and particularly additional unemployment. The prospective EMU-members basically bear the burden of these convergence costs alone. However, strategic exchange-rate policy choices particularly in the form of a brinkmanship strategy may enable CEECs to pass some of the costs involved in passing through ERM-II on to the current members of EMU and EU respectively. The reason is that CEECs in exchange-rate turmoil may provoke further unwanted externalities in terms of stalling the entire European integration process. Such erosion of political stability would also make the 'ins' worse off. Hence, they may have an incentive to provide a helping hand to CEECs running up to EMU-membership.

This analysis demonstrates that the new EU-members and prospective EMU-members, respectively, may threaten to jeopardize the entire European integration process in order to

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<sup>2</sup> The new EU-members are Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic and Slovenia. Note that Cyprus and Malta are not considered because these countries do not fit into the subsequently developed argumentation. The same applies to the so-called 'members with a derogation' Denmark, Sweden, and United Kingdom.

elicit compensation for agreeable policy behavior from current members. In this respect, ERM-II membership may enable CEECs to load considerable convergence costs on to current EMU-members. We accordingly propose that the transition phase in ERM-II is perceived as a bargaining game with regard to redistributing the convergence costs between prospective and current EMU-members.<sup>3</sup> The prospective EMU-member countries' leverage is based on their threats to implement exchange-rate policies that considerably aggravate the probability of provoking an exchange-rate crisis. Such threatening may intimidate current EMU-members because of its potential to deteriorate political stability, which means here infuriating a constituency with a government's course towards continued European integration. The according stance of exchange-rate policy is denoted as 'threaten-thy-neighbor' strategy and serves to exploit the detrimental external effects of exchange-rate policy. In this respect, the 'threaten-thy-neighbor' strategy may possibly force current EMU-members to provide some kind of pecuniary assistance as an act towards preserving European integration. Upon their admittance to the EU, bargaining between the CEECs and the EU-15 occurs on a level-playing field. The provisions of ERM-II prepare the ground for a CEEC's bargaining leverage, whereas the brinkmanship strategy may represent a deterrent threat forcing the 'ins' back to the negotiation table. The entire CEECs' run-up process to the EMU is depicted as a two-stage Nash-threat game.

The remainder of the paper is structured as follows: In section 2 we lay the foundations for the game-theoretic model and elaborate on the transmission mechanism of a 'threaten-thy-neighbor' strategy in ERM-II. The respective brinkmanship follows as a formalized two-stage Nash-threat game with a subsequent Nash-bargaining solution in section 3. Section 4 serves as a summary.

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<sup>3</sup> Basically, EMU is the successor to the EU-integration process. However, it can be presumed that current

### **Some Reflections**

This section inquires into the crucial junctures of the two-stage Nash-threat game. While the first stage is merely a CEEC's choice regarding the participation in ERM II or not, the second stage comprises a brinkmanship, i.e. the 'threaten-thy-neighbor' strategy, and a subsequent bargaining game.

When analyzing the EU-enlargement process, it is assumed that it has essentially been driven by political rationale. This is to say that both old and new members of the EU agreed on the need to stabilize the region of Central Eastern Europe (CEE) in view of their specific geopolitical concerns and security policy interests: At the beginning of the 1990s after the fall of the iron curtain, political systems in the CEECs changed fundamentally. They entered a rather uncertain phase. For that reason, western European governments suggested an enlargement of the EU at the 1993 intergovernmental conference in Copenhagen. In doing so, they were offering to export an established institutional system to the CEECs. This history indicates that political gains are at the core of enlargement, and serve to reduce the uncertainty of state-interaction and stabilize the CEE region politically (cf. Baldwin et al., 1997). Therefore, we consider the entire Eastern enlargement process as an investment in the political stability of Central Eastern Europe. The project 'EU enlargement' acts as a key to political stability. However, political stability is a public good, in which both CEECs and the EU-15 act as investors competing to share the burden of investment costs.

This 'EU enlargement' project exhibits a considerably different approach towards Euro adaptation than the former EMU creation process. Contrary to the period of 1995-1997, Maastricht criteria no longer provide a sophisticated, hand-tying strategy for EMU-founders, thereby assuring a smoothly functioning EMU. Political stability and public support for European integration seems to be less consolidated in CEECs (cf. Birch, 2001). If one of the

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members of the EMU would draw on other 'member states with a derogation' to bear the respective burden as

CEECs were to enter ERM-II and experience, immediately thereafter, a currency crisis, such a crisis would most likely undermine the CEECs' aspiration to EMU-membership, as well as to European integration in general. As a consequence of this fragility, CEECs are likely to exhibit moral-hazard behavior such as brinkmanship. Thus, if CEECs can credibly risk the success of the 'EU-enlargement' project they will elicit the current EMU-members' actual willingness to pay for ensuring the provision of the public good 'political stability' in the long run.

This process resembles, for example, the Cuban missile crisis, at which the US has credibly threatened to escalate a mutually detrimental world war in order to coerce the Soviet Union to retract their missiles from Cuba (see, for instance, Powell (1989) and Wagner (1991) who provide formal modelling of brinkmanship in the Cuban missile crisis). Here, CEECs act as the US part.

The main challenge for CEECs has been and still is to make the strategy of entering the EMU compatible with their economic and political necessities. However, the political incentives generated by prerequisite, though crises-prone, soft pegs in ERM-II often fail to provide sufficient fiscal restraints to avoid possible currency crises: Soft pegs allow governments to comfort voters with additional budget spending, while such fiscal laxity undermines the stability of a soft peg only after some time.<sup>4</sup> Therefore, when assuming that the time horizon of politicians is sufficiently short, a government may not act with fiscal prudence (Tornell and Velasco, 1995). Such moral-hazard problems intensify because CEECs are already credibly committed to joining the EMU for political reasons (Natalucci and Ravenna, 2002). With regard to the concurrent capital account liberalization, such political behavior even exacerbates the likelihood of exchange rate crises (Begg et al., 2003). Thus, there is an impending risk of an exchange rate slump and a reversion of capital inflows,

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well. Thus, the terms 'EU-15' and 'current members of the EMU' are synonymous.

thereby possibly deteriorating the overall European integration process.

Deliberately neglecting prudent fiscal and exchange-rate policy making, respectively, may constitute moral-hazard behavior. In this respect, brinkmanship is a stricter form of moral hazard which we denote as a ‘threaten-thy-neighbor’ strategy. Brinkmanship means here threatening to aggravate the risk of provoking an exchange-rate crisis. In line with the canonical Obstfeld argument (1994, 1995), such a CEEC’s government makes use of a trade-off in terms of weighing the advantages of maintaining the present soft peg against the hardship of voter alienation. In this manner, CEECs menace current members with deteriorating the investment project ‘EU-enlargement’ and as a result, the public good ‘political stability’.

In general, a currency crisis provokes substantial losses in terms of output and employment, which we denote as default costs. The default costs usually exceed the convergence costs, and have to be paid by mature EU-members as well. This is due to the fact that the new EU-members have rather direct access to European structural funds. More transfers to CEECs may be necessary in order to reassure infuriated voters who might retract their support for completing the ‘EU-enlargement’ project. Moreover, a spreading currency crisis would even exacerbate economic and political problems in the European integration process. However, this is an incident that both mature and new EU-members hope to avoid. Thus, armed with the knowledge that the ‘ins’ are willing to pay for smoothing the EMU transition, CEECs could threaten to slacken the reins of prudent fiscal policy-making. In this way, these countries endanger the stability of soft-pegging in ERM-II and, thus, risk losing public support for European integration at the domestic level. In line with Nalebuff (1986) revamping the brinkmanship idea of Schelling (1960), a possible default would spoil the

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<sup>4</sup> In contrast to such fixed exchange rates, budget deficits tend to lead to an immediate depreciation in instances of currency floating.



investment project ‘EU enlargement’ and the according provision of the public good ‘political stability’.

This is why we argue that the implied convergence costs during the pass through phase of ERM-II may render exchange-rate policies of CEECs a tightrope act. In the course of the Maastricht qualification process, CEECs will likely make the most of the opportunity to load a portion of the convergence costs on to mature EU-members.

### **The Theoretical Model**

This analysis explores the scope and limits of the two-stage Nash threat game. The according brinkmanship refers to the phase of CEECs as so-called ‘members with a derogation’, which is basically the period of ERM-II. At the same time, the analysis inquires into the Nash-bargaining solution (NBS) for that conflict. We demonstrate to what extent CEECs may pass convergence costs on to mature EU-members. The entire phase of ERM-II is modeled as a compound game that consists of the brinkmanship and the subsequent bargaining game. Finally, we determine a sub-game perfect equilibrium for this two-stage Nash-threat game.

The analysis unfolds in three steps: First, we discuss the basic characteristics of the brinkmanship game. Second, the brinkmanship is elaborated in the form of a sequential game. Third, we set forth the subsequent bargaining for redistributing the convergence costs in ERM-II.

A single CEEC<sub>*i*</sub> (denoted as player  $j=1$ , whereas  $i=1,\dots,n$ ) and the EU-15 (player  $j=2$ ) are two risk-neutral players with quasi-linear preferences for the public good ‘political stability’. The first player has complete but imperfect information (Harsanyi 1967) regarding the EU-15’s strategy choice. In addition, we assign bargaining power to both players, while  $\alpha_i$  is the bargaining power of a CEEC<sub>*i*</sub> and  $\beta_{-i}$  the particular corresponding bargaining power of an EU-15 with  $\alpha_i + \beta_{-i} = 1$ . At the heart of our Nash-threat game is the

haggling between the  $CEEC_i$  and the EU-15 over sharing the investment costs of the ‘EU-enlargement’ project and the public good ‘political stability’ respectively. These costs are the Maastricht convergence costs in ERM-II denoted as  $C_i^C$  for the specific  $CEEC_i$ . The according benefits with respect to a single  $CEEC_i$  are denoted here as  $B_i$ . These benefits stand for the completion of the ‘EU enlargement’ project ensuring the provision of the public good ‘political stability’ in CEE. Generally, bearing the entire  $C_i^C$  reflects each player’s maximum willingness to pay for a successful passing through of the ERM-II phase. In line with this reasoning, every prospective member is equally indifferent regarding admittance and non-admittance to the EMU in instances of bearing  $C_i^C$  entirely alone, as stipulated by the Treaty establishing the European Community. This also applies to the EU-15 who will never pay more than the total  $C_i^C$  to a single  $CEEC_i$ . Bearing the entire burden of the  $CEEC_i$ ’s convergence costs makes the EU-15 just as indifferent to the accession and non-accession of  $CEEC_i$ . This trick allows for a specific adaptation of the two-stage threat game  $G$  that considerably simplifies further analysis.

We base the Nash-threat game on the action of two players, a unitary EU-15 and a single  $CEEC_i$ . There are good reasons for proceeding this way. Considering a single  $CEEC_i$  is quite plausible due to competition among all CEECs: In respect of the delineated pay-off structure of the brinkmanship game, there is a chance that each  $CEEC_i$  which refrains from brinkmanship comes away empty-handed. This is to say, that this country would miss out on any compensation when the EU-15 is in a position to provide financial assistance solely in instances where a particular  $CEEC_i$  practices brinkmanship. For this reason, we conceptualize a single  $CEEC_i$  that rushes into brinkmanship. At the same time, it seems to be quite legitimate to consider a unitary player EU-15. This is because all current EMU-

members have the common interest of wanting to avoid sharing the burden of a CEEC<sub>*i*</sub>'s convergence costs. Therefore, we design the passing through phase as a two-player game.<sup>5</sup>

Further reservations regarding the delineated basic characteristics of this brinkmanship game are as follows: First, the question that mainly arises is whether the CEECs should form a cartel in order to intensify their threatening gestures. Second, one may state that the EU-15 can announce in advance that they will heavily punish the first country which dares to practice brinkmanship. This is to say, that current EMU-members pursue an enter-deterrence game. Regarding the latter we simply presume that such a course of the EU-15's policy action conflicts with the principle of equal treatment, particularly regarding exceptional country-specific arrangement in the context of European structural policies. Therefore, the occurrence of an enter-deterrence game seems to be rather implausible. In reference to CEECs' incentives to form a cartel the vulnerable point of such a strategy is its impact on international coordination for policy and market reactions. If it becomes evident that some CEECs explicitly coordinate their 'mis-policy efforts' then this will allow the EU-15, as well as markets, to discriminate between the mis-behaving and other well-behaving CEECs (cf. Fearon, 2002). Accordingly, only the former will experience a speculative attack. A group of such 'depraved' CEECs is poorly advised to develop initiatives that allow the EU-15 and markets to discriminate. Therefore, we assume that CEECs will not form a cartel for buttressing brinkmanship.

If the brinkmanship is credible both players will not maximize their piece of the pie, but minimize their respective share of the convergence costs during negotiations. The present bargaining problem is thus characterized by the tuple  $(C_i, d)$  where  $C_i \subset R_+^{*2}$  is a vector

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<sup>5</sup> There also exist (multi-stage) n-person extensions of this straight-forward, though non-oversimplifying threat game (see, for instance, Mao 1993). However, the reader may note that we make concessions to our conceptualization of a two-player game in the form of explicitly modelling the benefits of the public good 'political stability' as a two-player affair. For that reason, we have added a subscript *i* to the according benefits of integration *B*.

combination of feasible (dis)utility allocations. The disagreement point  $d$  is the bargaining outcome if both parties' negotiations break down. In that case, markets will notice that both CEEC<sub>*i*</sub> and the EU-15 cannot agree on an appropriate policy mix for CEEC<sub>*i*</sub> in ERM-II. This will trigger a speculative attack and a currency crisis ensues. The following costs arise in this game  $G(C_i, d)$ : First, there are the above mentioned 'convergence costs'  $C_i^C$  around which the bargaining revolves. If the according negotiations on distributing  $C_i^C$  were to break down, then a currency crisis will occur, and both players will be stuck with the disagreement point  $d$  comprising the 'default costs'  $C_i^D$ .

Another issue concerns the limited liability feature of mature EU-members, which is the extent to which the EU-15 pays for the CEECs' admittance to the EMU. A currency crisis entails above all costs for CEEC<sub>*i*</sub>. However, the EU-15 can also suffer from rising costs. When a CEEC<sub>*i*</sub> experiences excessive output losses, they automatically attract additional funding via European structural policies. Also important in this context is the CEEC<sub>*i*</sub>'s potential for drawing out and blocking decision-making processes in all European policy fields. In order to ensure smooth functioning within European legislative decision-making bodies, the EU-15 may view the making of side payments as an indispensable tool when seeking a CEEC<sub>*i*</sub>'s consent to any agreement. This generally applies as soon as the CEECs have become EU-members. Assuming that currency crises interfere with 'political stability', the EU-15 may provide extra-funding. However, the EU-15 has a particular subsidiary role: When an exchange-rate crisis occurs, then CEEC<sub>*i*</sub> will first and foremost have to bear the burden of the costs. Albeit, CEEC<sub>*i*</sub> will not accept costs higher than total  $C_i^C$  in exchange for the provision of 'political stability' (see above). Hence, if  $C_i^D > C_i^C$ , then the EU-15 will have to administer financial assistance within the limits of their maximum willingness to pay.

Accordingly, the EU-15 will have limited liability amounting to the share  $\lambda_i$  of total  $C_i^C$  with  $0 < \lambda_i \leq 1$ . This is to say, that the EU-15 will at most transfer funds amounting to a total of  $C_i^C$  to CEEC<sub>*i*</sub> because beyond that point their willingness to pay for ‘political stability’ would be exhausted. The following proposition can be derived from these considerations:

$$\lambda_i = \begin{cases} 0 & \text{if } C_i^C \geq C_i^D \\ 0 < \lambda_i < 1 & \text{if } C_i^C < C_i^D < 2C_i^C \\ 1 & \text{else} \end{cases} .$$

The rationale of such brinkmanship is that CEEC<sub>*i*</sub> threatens to realize the overall worst pay-off represented in the disagreement point  $d$ . In doing so, it can under identifiable conditions redistribute some convergence costs  $C_i^C$ . Successful brinkmanship is especially dependent on the two given probabilities  $p$  and  $q_i$  that are independent of each other and endogenous. The latter depicts the fact that the cost structure determines the probability values.

From the perspective of a CEEC<sub>*i*</sub>,  $p$  denotes the probability of encountering a frugal EU-15. The more frugal the EU-15, the lower is the probability of executing successful brinkmanship. At this point, we take into account that a CEEC<sub>*i*</sub> will already be an EU-member and has a say in European decision-making matters. Accordingly, we assume that values of  $p$  are smaller than 1. At the same time  $p > 0$  because the EU-15 has at least some willingness to pay for the completion of the ‘EU-enlargement’ project and the provision of the public good ‘political stability’. Hence we reject according corner solutions of  $p$ , so that  $0 < p < 1$ .

The probability  $q_i$  basically describes the likelihood of voter alienation when incurring the convergence costs  $C_i^C$ . Similar to Iida (1993) we argue that political imponderability on the national level may bring about a bargaining leverage in international negotiations. In our particular case, uncertainty regarding the constituency’s reaction to aggravating

unemployment rates in the course of adhering to ERM-II and other Maastricht-criteria rules may buttress CEECs' bargaining position in negotiations vis-à-vis current EMU-members. In this respect, we assume that national voters in new EU-member countries weigh these convergence costs – i.e. higher unemployment and less output respectively – against the potential benefits of EMU-accession. If they were apathetic, then there would be no market testing of a government's propensity to defend a soft peg in ERM II and, thus, to hazard voter alienation. This would be the case if a constituency were indifferent towards any surges in unemployment levels. In fact, the probability  $q_i$  for devaluation would be zero in such circumstances. At the same time, we expect that voters as well as their delegated governments must also rank the benefits  $B_i$  as valuable. Otherwise, any convergence costs would be unacceptable, and a government would be unable to craft consensus towards completion of the 'EU-enlargement' project in the domestic arena. Hence, in such an instance there would be no European integration process at all. In line with the aforementioned reasoning, we exclude according corner solutions – i.e.  $0 < q_i < 1$  – and, thus, there exist some resources on the national level, which governments in CEECs may play off against current EMU-members in international negotiations.

If the conditions for successful brinkmanship are met, then the EU-15 will dance obligingly to the CEEC<sub>*i*</sub>'s tune and share some convergence costs  $C_i^C$ . In such a situation CEEC<sub>*i*</sub> is indifferent towards practicing brinkmanship and keeping track of the prescribed passing through the phase of ERM-II. In the following paragraphs, we determine the Nash-strategies, i.e. the mutually best responses which will in the end constitute a sub-game perfect Nash equilibrium of the two-stage threat game.

*The Brinkmanship Game*

We start out the analysis of the game-theoretic model by simplifying things without any loss of generality: Given that both players' maximum willingness to pay for integration in terms of realizing the benefits  $B_i$  from completing the 'EU-enlargement' project corresponds to the total  $C_i^C$ , we can normalize  $C_i^C = B_i = 1$ . Hence, we can transform the threat game  $G(C_i, d)$  to the form of  $\Gamma(\zeta_i, d)$  with  $0 < c_{ij} \leq 1, c_{ij} \in \zeta_i, \zeta_i \subset \mathbb{R}_+^{*2}$ . In doing so, we define a bargaining solution set that excludes the corner solution  $c_i = 0$ , at which a CEEC<sub>*i*</sub> would be indifferent between the pay-offs for the first and second stage. This way we can incorporate the conventional economic benefits of a common currency, such as reducing transaction costs in trading. The standard assumption holds that  $c_i$  is a non-empty, convex and compact set comprising any convex combination of vector  $c_{ij} = (c_{i1}, c_{i2})$ . In this game  $\Gamma(\zeta_i, d)$  CEEC<sub>*i*</sub> quasi maximizes the EU-15's share of convergence costs. The bargaining may lead to a new outcome  $c_i$  for CEEC<sub>*i*</sub>. In turn, CEEC<sub>*i*</sub> burdens the EU-15 with the share  $1 - c_i$ . Accordingly, the players' continuous utility functions  $u_{(i)j}(c_{(i)j})$  are:

$$\begin{aligned} u_{i1}(c_{i1}) &= c_{i1} = c_i \\ u_2(c_{i2}) &= c_{i2} = (1 - c_i) \end{aligned}$$

The disagreement point  $d$  represents CEEC<sub>*i*</sub>'s threat, where the pay-off is  $(-1, -\lambda_i)$ .

Figure 1 depicts the pay-off structure of the game  $\Gamma(\zeta_i, d)$ .<sup>6</sup> Two different sub-games of  $\Gamma(\zeta_i, d)$  due to complete but imperfect information have to be taken into consideration. First, CEEC<sub>*i*</sub> does not know whether it will encounter a frugal or a generous EU-15. In this context, specific default costs have to be considered. On the one hand, a single crisis has the potential to trigger further defaults all  $n$  CEEC<sub>*i*</sub>. This would be the overall worst pay-off

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<sup>6</sup> The indices in this figure's formulae are suppressed in order to simplify the graphical representation of the

(see second branch of the lower sub-game in figure 1).

Insert Figure 1 about here

Fearing such exorbitant costs the primary goal of the EU-15 would be to sustain the support for the 'EU-enlargement project' in each CEEC<sub>*i*</sub> by any means necessary. From this point of view, it may be more beneficial to be generous. Second, the EU-15 may display a reluctant attitude towards providing extra-funding because any obvious generosity would intensify moral-hazard behavior which possibly requires to transfer  $n$ -times of  $c_i$  (see upper branch of the upper sub-game in figure 1). Due to this uncertainty concerning the EU-15's attitude towards providing extra-funding, the CEEC<sub>*i*</sub>'s pay-offs have to be weighted with a probability  $p$  for encountering a frugal and  $(1-p)$  for a generous EU-15.

The CEEC<sub>*i*</sub>'s feasible set of strategies in stage 1 is comprised of two choices: CEEC<sub>*i*</sub> can choose 'ERM-II' or it can choose 'no access'.<sup>7</sup> In the latter case, it would not only forgo the microeconomic advantages of sharing a common currency but also the benefits of integration, thus stalling the completion of the 'EU-enlargement' project. The EU-15 would also not receive any benefits of integration. However, at the same time it will not be confronted with providing extra-funding for that CEEC<sub>*i*</sub>. This applies, because we rule out the possibility of default when CEEC<sub>*i*</sub> is following an ERM-II incompatible but optimal national policy mix, allowing for full utilization of production factors. A respective economic

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game-theoretic analysis.

<sup>7</sup> NB: In stage 1, we simply act as if the current members of the EMU have no say in deciding whether a CEEC<sub>*i*</sub> enters ERM-II or not. This is on no account arbitrary: Even if the current members of the EMU would deny a CEEC<sub>*i*</sub> access to the ERM-II, sovereign 'members with a derogation' could certainly resort to crises-prone fixed



policy formation would rule out voter alienation as well as the occurrence of a speculative attack. After having chosen 'ERM-II' and entering stage 2,  $CEE C_i$  implements a policy mix that satisfies the Maastricht requirements. By definition this policy mix cannot be altered during stage 2: once implemented some convergence costs will arise in any case. In stage 2,  $CEE C_i$  can choose to 'refrain' and to 'threaten'. The latter strategy consists of practicing brinkmanship in terms of threatening to lose track of prudent fiscal and exchange-rate policy respectively. Respective fiscal measures are announced, but not yet implemented. If implemented, this would indeed trigger a speculative attack and a subsequent devaluation. In this case,  $CEE C_i$ 's strategy of brinkmanship would have failed. A current exchange-rate policy formation, particularly the underlying fiscal policy, may be deemed unsustainable with the soft peg in place. Hence, in view of possibly disastrous fiscal policy the players' reactions will likely be immediate.

If  $CEE C_i$  chooses to 'refrain' from the brinkmanship, it forgoes the opportunity to pass a share  $c_i$  of convergence costs on to the EU-15. This would be the best pay-off from the perspective of the EU-15 (see figure 1). When  $CEE C_i$  relies on a strategy of choosing 'threaten', the outcome ultimately depends on the reaction of the EU-15. The EU-15 can choose a strategy of 'give in' when  $CEE C_i$  pursues the brinkmanship or it can 'buck' by withholding any payments. Furthermore, it can also choose a strategy of 'no access' which would imply to cut  $CEE C_i$  out.<sup>8</sup> The outcome is the same as in the breaking off of negotiations as portrayed by the disagreement point  $d$ . The according pay-offs are as follows: If  $CEE C_i$  chooses a strategy of 'refrain', then it receives zero, whereas the EU-15 receives the entire benefits of completing the 'EU-enlargement' project amounting to 1. If

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exchange-rate regimes.

<sup>8</sup> This is what Kilgour and Zagare (1991) denote as a player's uncertainty about the other player's attitude towards 'retaliation'.

CEEC<sub>*i*</sub> chooses to ‘threaten’, the EU-15 can ‘give in’, ‘buck’ or pick the strategy ‘no access’. When the EU-15 gives in, then CEEC<sub>*i*</sub> receives the aspired alleviation of convergence costs in amount of  $c_i$ . In this case the EU-15 receives a pay-off  $(1 - c_i)$ . Although, the EU-15 may also have to deal with transferring payments to all CEEC<sub>*i*</sub> amounting to  $n$  times the size of  $(1 - c_i)$ . If the EU-15 chooses to ‘buck’, CEEC<sub>*i*</sub> may be stuck with default costs amounting to  $(-q_i)$ . Simultaneously, the EU-15 receives the pay-off  $(-q_i \lambda_i + 1 - q_i)$  respectively  $(-q_i \sum_{i=1}^N \lambda_i + 1 - q_i)$  in the case of spreading defaults among all CEEC<sub>*i*</sub>. If the EU-15 chooses ‘no access’ after CEEC<sub>*i*</sub> has introduced the ‘threaten-thy-neighbor’ strategy, then both players will be left without the completion of the ‘EU-enlargement’ project. At the same time, CEEC<sub>*i*</sub> will have to bear the full burden of the convergence costs (since altering a once implemented policy mix is impossible) thus receiving  $(-1)$ , whereas the EU-15 is stuck with costs in amount of  $(-\lambda_i)$  according to their limited liability.

A ‘threaten-thy-neighbor’ strategy has to meet some prerequisite conditions. In particular, a successful brinkmanship has to be effective and acceptable. The effectiveness condition of such brinkmanship rests on the extent of CEEC<sub>*i*</sub>’s default; as the EU-15 is increasingly affected by costs, a CEEC<sub>*i*</sub>’s threat gains more credibility. In this respect, the probability of a currency crisis is subject to a critical threshold: If the respective probability is too small, the EU-15 cannot be coerced into providing financial assistance. However, the credibility of the brinkmanship strategy is also dependent on whether the outcome is acceptable to CEEC<sub>*i*</sub>. If the probability of an exchange-rate crisis is too high and, hence, the acceptability condition cannot be accomplished, then CEEC<sub>*i*</sub> will choose to ‘refrain’ from such a hazardous exchange-rate policy. In turn, this player will entirely incur the envisioned convergence costs particularly in terms of higher unemployment rates.

The CEEC<sub>*i*</sub>'s brinkmanship will be successful, which means eliciting the desired extra funds amounting to  $c_i$ , if it constitutes a deterrent threat. In this regard, CEEC<sub>*i*</sub>'s brinkmanship may be effective, if the expected pay-off of the EU-15 from a choice to 'give in' is higher than from a decision to 'buck' when taking into account possible contagion. Therefore,

$$(-q_i \sum_{i=1}^N \lambda_i + 1 - q_i) < (1 - c_i).$$

Accordingly, the minimum probability  $q_{i,min}$  has to be:

$$q_{i,min} > \frac{c_i}{\sum_{i=1}^N \lambda_i + 1}.$$

The probability  $q_{i,min}$  for currency crisis in CEEC<sub>*i*</sub> is the lower bound of the brinkmanship. Below this level the EU-15 would choose a strategy of 'buck', even if it is generous. However, with a probability of  $p$  CEEC<sub>*i*</sub> may feel that the strategy 'threaten' is too risky when encountering a frugal EU-15. At the same time, CEEC<sub>*i*</sub> will encounter a generous EU-15 with a probability of  $(1-p)$ , which will choose a strategy of 'give in' given that the effectiveness condition holds. Thus, for a given  $0 < q_i < 1$  CEEC<sub>*i*</sub> will pose a probabilistic threat, if its expected pay-off is higher than a zero pay-off from choosing to 'refrain':

$$(-q_i p) + c_i(1 - p) > 0.$$

After resolving we obtain:

$$q_{i,max} < c_i \frac{1-p}{p}.$$

Accordingly, the acceptability condition depends on values for  $p$ . Therefore, values for  $p$  have to be below a critical threshold. Otherwise,  $q_{i,max}$  would have to be smaller than  $q_{i,min}$  for some high values of  $p$ . That would render any brinkmanship fruitless as it indeed

becomes effective but not acceptable. From the proposition  $q_{i,min} < q_{i,max}$  it follows that the upper bound is:

$$p_{max} < \frac{\sum_{i=1}^N \lambda_i + 1}{\sum_{i=1}^N \lambda_i + 2} < 1.$$

If the probability  $p$  for a frugal EU-15 satisfies the acceptability condition, then the following proposition must be valid:

$$p^* \in P^*, \quad P^* := \{p^* \mid p^* < p_{max} < 1, p^* \in R_+^*\}$$

In the end, the probability  $q_i$  in a brinkmanship strategy has to remain below the critical threshold  $q_{i,max}$ . Above that value CEEC<sub>*i*</sub> will refrain from a strategy of ‘threaten’ because it fears mutual detrimental effects. Therefore, for every given probability  $\bar{p}^*$  the probabilistic threat is credible when a country-specific  $q_i^*$  is an element of the finite set  $Q_i^*$ . The according proposition is:

$$q_i^* \in Q_i^*, \quad Q_i^* := \{q_i^* \mid q_{i,min} < q_i^* < q_{i,max}, q_i^* \in R_+^*\}$$

When the endogenous effectiveness and acceptability conditions for the parameters  $p$  and  $q_i$  are satisfied, CEEC<sub>*i*</sub> will resort to such hazardous exchange-rate policy and a ‘threaten-thy-neighbor’ strategy respectively. The EU-15’s response to CEEC<sub>*i*</sub>’s brinkmanship is to immediately burden itself with convergence costs amounting to the share  $c_i$ . This is equivalent to CEEC<sub>*i*</sub> passing the respective portion of convergence costs on to current EMU-members. In this case, CEEC<sub>*i*</sub> will commit to Maastricht obligations, since there are no further opportunities to pass costs on to current members of the EMU. This is because beyond that point the EU-15 is no longer willing to pay for the realization of the joint investment project ‘EU enlargement’ prerequisite for the provision of the public good ‘political stability’. The remainder of the game-theoretic analysis focuses on the Nash-bargaining solution for

distributing the CEECs' convergence costs during their passing through ERM-II. This is to say that we ascertain each players' portion of the convergence costs.

*The Bargaining Game*

In general, the NBS (Nash, 1953, 1950) has been the first bargaining solution ever. The bargaining is characterized by complete information. It is finite in that only one offer and no counter-offers are possible when bargaining. The bargaining revolves around arguing over sharing the investment costs of the 'EU enlargement' project and disputing the convergence costs during the phase of ERM-II respectively. Given that all characteristics of the game are common knowledge, the players look ahead and anticipate the reciprocal best responses. Due to this backward induction, negotiation time is irrelevant and the bargaining game comes to an immediate solution.

The game  $\Gamma(c_i, d)$  in stage 2 ends with Nash-bargaining on the non-empty, convex and compact set comprising any convex combination of vector  $(c_1, c_2)$  in  $R_+^{*2}$ . According to the NBS it has to be dealt with Pareto-efficient solutions only. The particular share  $c_i$  of convergence costs, which CEEC<sub>*i*</sub> can load on to the EU-15, is the bargaining outcome. The NBS is derived from the Nash-product (NP) weighted with the respective bargaining power:

$$\max_{c_{ij}} NP(\Gamma(\zeta_i, d)) = (u_{i1}(c_{i1}) - u_{i1}(d_1))^{\alpha_i} (u_2(c_{i2}) - (u_2(d_2)))^{\beta_{-i}}$$

$$\text{with } c_{ij} \geq d_j, c_{ij} \in \zeta_i, \alpha_i \geq 0, \beta_{-i} \geq 0, \text{ and } \alpha_i + \beta_{-i} = 1.$$

Given the players' utility functions the maximization problem in light of  $d = (-1, -\lambda_i)$  is:

$$\max_{c_{i1}, c_{i2}} \Gamma(\zeta_i, d) = (c_i + 1)^{\alpha_i} ((1 - c_i) + \lambda_i)^{\beta_{-i}}$$

The according first-order condition is:

$$\frac{dNP}{dc_i} = \alpha_i (c_i + 1)^{\alpha_i - 1} ((1 - c_i) + \lambda_i)^{\beta_{-i}} - (c_i + 1)^{\alpha_i} \beta_{-i} ((1 - c_i) + \lambda_i)^{\beta_{-i} - 1} = 0.$$

After rearranging we receive the equilibrium solution:

$$c_i^* = \begin{cases} \text{not defined} & \text{if } \frac{(1+\lambda_i)\alpha_i - \beta_{-i}}{\alpha_i + \beta_{-i}} \leq 0 \\ 0 < c_i \leq 1 & \text{if } 0 < \frac{(1+\lambda_i)\alpha_i - \beta_{-i}}{\alpha_i + \beta_{-i}} \leq 1. \\ 1 & \text{else} \end{cases}$$

Here, it becomes obvious that the EU-15's actual willingness to pay for CEEC<sub>*i*</sub>'s integration depends on the distribution of bargaining power. The less bargaining power  $\beta_{-i}$  the EU-15 exhibits the higher are the values for  $c_i^*$ . Consequently, CEEC<sub>*i*</sub> can elicit more funds amounting to  $c_i^*$  from the EU-15, as their bargaining power  $\alpha_i$  increases and they are willing to accept more risk. We recall that  $c_i^*$  is the share of convergence costs  $C_i^C$  that is acceptable to the EU-15. With respect to the complete two-stage Nash-threat game  $\Gamma(\zeta_i, d)$  the NBS is, hence,

$$\text{NBS: } \Gamma^*(\zeta_i, d) = (c_i^*, (1 - c_i^*)).$$

Considering the specific characteristics of the NBS, the combination of both players' Nash-strategies [(‘ERM-II’, ‘threaten’), ‘give in’] can also be represented in terms of their respective reaction functions  $R_{ij}$ . Due to complete information CEEC<sub>*i*</sub> can anticipate the EU-15's optimal choice, thus its own best response is:

$$R_{i1}(c_{i2}^*) = \begin{cases} \text{not defined} & \text{if } \frac{(1+\lambda_i)\alpha_i - \beta_{-i}}{\alpha_i + \beta_{-i}} \leq 0 \\ 0 < c_i \leq 1 & \text{if } 0 < \frac{(1+\lambda_i)\alpha_i - \beta_{-i}}{\alpha_i + \beta_{-i}} \leq 1. \\ 1 & \text{else} \end{cases}$$

From the perspective of the EU-15 the corresponding reaction function is:

$$R_{i2}(c_{i1}^*) = \begin{cases} \text{not defined} & \text{if } \frac{2\beta_{-i} - \lambda_i\alpha_i}{\alpha_i + \beta_{-i}} \leq 0 \\ 0 < (1 - c_i) \leq 1 & \text{if } 0 < \frac{2\beta_{-i} - \lambda_i\alpha_i}{\alpha_i + \beta_{-i}} \leq 1. \\ 1 & \text{else} \end{cases}$$

The players' reaction functions  $R_{ij}$  constitute the unique sub-game perfect Nash-equilibrium

incorporating a specific NBS of the entire game  $\Gamma(\zeta_i, d)$  and  $G(C_i^C, d)$  respectively for every fixed  $\bar{p}|\bar{p}^* \in P^*$  and  $\bar{q}|\bar{q}^* \in Q^*$ . This is to say that for effective and acceptable brinkmanship, the EU-15's response to CEEC<sub>*i*</sub>'s credible 'threaten-thy-neighbor' strategy is to immediately burden itself with convergence costs  $C_i^C$  amounting to the share of  $c_i$ . Thus, CEEC<sub>*i*</sub> passes the respective convergence costs on to current members of the EMU. When obtaining a share  $c_i$  of convergence costs, CEEC<sub>*i*</sub> will abstain from further attempts to promote a hazardous exchange-rate policy in ERM-II, and will behave well. CEEC<sub>*i*</sub> will then push the Maastricht criteria through, since there are no further opportunities to pass costs on to current members of the EMU. This is because, at that point, their willingness to pay for the realization of the joint investment project 'EU enlargement' and thus, for contributing to the provision of the public good 'political stability' in CEE, is exhausted.

#### 4. Conclusion

The focus of the preceding analysis has been on the particularities of CEECs' exchange-rate policies, especially in the wake of their ERM-II entry. We have shown that curved incentives for exchange-rate policy making contribute to excessive moral-hazard behavior due to the EU-15's willingness to pay for CEECs' admittance to EMU. The according brinkmanship makes allowance for the subsequent bargaining on convergence costs. The transmission mechanism runs through exchange-rate policy that is utilized as a 'threaten-thy-neighbor' strategy. This policy constitutes a deterrent threat dependent on the expounded effectiveness and acceptability condition. Deterrence rests on credibly threatening to trigger an exchange-rate crisis, thus spoiling the 'EU-enlargement' project and, consequently, the public good 'political stability' in Central Eastern Europe. The subsequent application of the Nash-bargaining solutions results in a sub-game perfect Nash equilibrium of the two-stage Nash-

threat game.

Summarily, the ERM-II phase has the potential for serious political conflict. The two-stage threat game appropriately depicts the constellation of CEECs as ‘members with a derogation’ coming into full EMU-membership. Instead of simply adhering to the Maastricht provisions, CEECs are better off by utilizing the perverted incentive structure within the framework of ERM-II. The theoretical analysis has shown that there may be risks involved during the CEECs’ passing through ERM-II which have not been recognized yet. The analysis paved the way for an empirical study of CEECs’ actual inclination to practice a ‘threaten-thy-neighbor’ strategy.



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Figure 1

