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Though this be madness: A game-theoretic perspective on the Brexit negotiations

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Abstract

On June 19, 2017 the European Union and the British government officially commenced negotiations on the terms of the British exit from the union. The dominant view among most economic policy analysts and commentators seems to be that the cards are clearly stacked against Britain and that the high-handed behaviour of the British representatives is, at best, either a bluff or, at worst, a sign of a loss of reality. In this paper we develop a formal model to show how this uncertainty regarding the preferences and strategy of the British side may affect the dynamic of the negotiations and may lead to unanticipated outcomes.

JEL classification D78, E65, H12

Keywords Brexit, game theory, madman strategy, trembling-hand perfection

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Though this be madness, yet there is method in't.
(Hamlet, Act 2, Scene 2)

Introduction

Great Britain [after Brexit] cannot and will not have the same or even more rights as a member of the European Union. All 27 member states and the European institutions agree on this. Ladies and gentlemen, you may think that all this is self-evident. But I have to put this so clearly because I get the impression that some in Great Britain still have illusions about this, and that is a waste of time (Speech by Angela Merkel to the German Bundestag on April 27, 2017).

In this “uncharacteristically tough language” (The Economist, 2017a), the German chancellor Angela Merkel backed the draft of the Terms of Reference for the Article 50 Treaty on European Union negotiations—*viz.* the principles for the so called Brexit negotiations—issued by the President of the European Council, Donald Tusk, during a debate of the German Bundestag. Clearly her remarks were directed not so much at her German audience but rather at the British voters and Prime Minister Theresa May, who had just returned from a disastrous dinner with Jean-Claude Juncker, the President of the European Commission.¹ On his departure from this very dinner, Juncker had commented that he left Downing Street “ten times more sceptical than [he] was before” (ibid.). Taking perfectly the same line as Juncker and Merkel, the Frankfurter Allgemeine Sonntagszeitung, an influential, conservative German newspaper, implied that the British ideas for the design of the Brexit were an affront to the EU negotiators (Gutschker, 2017).

The start of the Brexit negotiations was generally assumed to be not necessarily harmonious but this early acrimony surprised many observers. German newspapers across

¹The rhetorical blitz was met with applause in the German press, which published parts of the speech the next day (see, e.g., Gutschker, 2017).

the political spectrum treated Theresa May’s stated views as evidence of a British “loss of reality” (Zastiral, 2017) and called on European leaders to make the moony Britons face the “unpleasant truths” soon enough (see Gutschker, 2017, p. 2). Theresa May, for her part, was quick to dismiss what she called a biased account of the Brexit dinner and reaffirmed her position that Brexit means (hard) Brexit and can be a success; after a week of continued political hostility from the continent she went on the counter-offensive claiming that the actions of her European counterparts had been “deliberately timed to affect the result of the general election” (Rayner, 2017).

All this is indicative of the fact that a wide chasm in perceptions of the post-Brexit world has opened along the English channel. Seen from the continent, the apparently high-handed behaviour of the Brexiteers, who seem to have considerable sway over the Prime Minister, is difficult to interpret. Many Europeans have difficulties to understand that, if a Brexit is indeed inevitable, the British government should not be eager to agree on an as-amicable-as-possible divorce as quickly as possible. The dominant explanation is that the British negotiators overestimate the benefits of a hard Brexit and, as a consequence, their bargaining power. In contrast to that, the Brexiteers appear to be genuinely sanguine about the opportunities that arise from Brexit (for such an optimistic view see e.g. Bourne, 2017; Longworth, 2017; Mason, 2016; Woodcock, 2016) and not to be in particular haste to come to an accommodation with the EU.

At this point, game theory can help to clear thing up by “providing a logical way of picking through the various claims and counter-claims of those in favour of and against leaving” (McCulloch, 2017). The existing applications of game theory to the Brexit negotiations (see, e.g., Busch et al., 2016; McCulloch, 2017; Kocher and Weyerstraß, 2017) offer interesting first insights² yet do not go beyond general explanations or simple normal-form games;

²Wiseman and Wiseman (2017) only analyse Brexit incidentally but also stress the possible benefits of

moreover, almost all assume a priori that Britain is in a fundamentally weaker position mainly because of the expected negative economic consequences of Brexit. As a result, the authors dismiss perhaps a little bit too quickly that the British government might actually have a rational game-plan. They also do not discuss the strategic implications of genuinely ‘wrong’ beliefs of the British side for the Brexit negotiations.

We contend that no one should be surprised that the Brexiteers seem to be out of touch with the realities of Brexit and disregard setting out a plan; this could either be a reflection of their beliefs or aimed at increasing British bargaining power vis-à-vis the EU. Put differently, instead of simply crediting the actions of the British government to incompetence, we take into account the possibility that there might be method in what seems to be madness; yet if there is no method in the madness, the madness itself can have effects that one should at least try to anticipate.

Our view is that it in fact makes perfect sense that the British government, egged on by the Brexiteers, reinforces upon its European counterparts the impression of being perfectly convinced that Britain will thrive outside the EU, and to declare that “no deal is better than a bad deal” (Masters, 2017) with the Europeans, making clear that the government is ready to walk out of negotiations if it does not get its own way. After all, the British government is facing the problem of having to negotiate in what many observers perceive to be a position of weakness. The conventional wisdom at least on the continent has it that Brexit will be much worse for the Britons than for the EU and that the negative consequences of Brexit increase with its ‘hardness’. Now a vital question arises: *Should the British government be realistic about this?* Realism would, in essence, mean to accept being in the position of a supplicant. A realistic British government would have to hope for pretending to be irrational. Kroll and Leuffen (2016) offer an enlightening analysis of the pre-referendum negotiations.

European goodwill in the negotiations and behave well in order to curry favour with the Europeans. But what would happen if the British government were sending a *credible* signal that it is truly willing to leave the EU the hard way, although this appears self-defeating to the Europeans? Such a signal would introduce an element of fundamental uncertainty into the negotiations and could, under the right circumstances, crucially affect their dynamic and outcome. The reasoning behind this prediction is that the uncertainty over whether the British side is just bluffing, or actually convinced that a hard Brexit is at least a second-best solution, can have—in the game-theoretic sense—strategic effects on the EU side. In this paper we scrutinize the conditions for such a scenario.

The case we are analysing in this paper is one where the European side is exposed to fundamental uncertainty over whether the British side follows a game-plan in a high-rolling negotiation about politically relevant concessions, or has genuinely ‘wrong’ beliefs about Brexit as well as a rather questionable capacity to keep on course. As we will show, the fact that the EU side cannot be sure whether its counterpart is just bluffing, too conceited to see the facts or perhaps seriously misguided has important consequences for the negotiations. Given that important European countries “are worried that a prolonged period of uncertainty laced with informal talks on a special deal for Britain would be a recipe for unravelling the EU with others making copycat efforts to blackmail Brussels” (Taylor, 2016) we also argue, counter-intuitively, that increasing the costs of a Brexit *for all* by delaying the negotiations can be rational for the British side.

The remainder of this paper is organized as follows. The next section briefly looks at the actions of the British government from the viewpoint of strategic irrationality. Making use of this concept we develop a model in the following section and, afterwards, discuss the implications. The final section sums up and concludes.

Strategic irrationality in the Brexit negotiations

Since the British citizens voted to leave the European Union on June 23, 2016, an intense discussion has flared up on both sides of the English Channel over the expected consequences of Brexit and over the right negotiation strategy. However, there was surprisingly little process in the actual Brexit negotiations. When British PM Theresa May officially initiated the process of the British withdrawal from the EU on March 29, 2017, there existed not even an informal agreement on the timetable of the negotiations. The handing-in of the British divorce petition opened an extremely tight two-year time frame for the negotiations, at the end of which the United Kingdom will leave the EU—if necessary without an agreement.³ But instead of speeding up the negotiations after their official start especially the British negotiators seemed to have slowed them down; the negotiation talks eventually started on June 19, 2017.

Although on both sides a somewhat tense start of the proper Brexit talks was expected, the sharpness of the tone surprised observers all over the political spectrum. According to George Osborne, “[h]igh-handed British arrogance and low leaks from the Europeans [had] poisoned the dialogue before it’s even started” (The Evening Standard, 2017). Although the relations between Britain and the EU calmed down and became thankfully “businesslike” again (The Economist, 2017c),⁴ very much bad blood had clearly been bred (see, e.g., Murphy, 2017). Things were certainly complicated by Theresa May’s catastrophic decision to hold a snap election. She clearly had gambled to increase her majority and, thus,

³This period could perhaps be extended by an unanimous vote of all other EU members. For an analysis of the questions, whether and how the process could be stopped or prolonged, see, e.g., Barnard (2017) or Dammann (2017).

⁴Nonetheless, the EU members flexed their muscles by predominantly *not* siding with the United Kingdom in an UN-vote on a dispute between Great Britain and Mauritius. Only four countries backed the UK. France, Germany and 20 others abstained, while Cyprus supported Mauritius (The Economist, 2017d, p. 27).

her bargaining power. Perhaps the elections had also served to further delay the Brexit negotiations for tactical purposes. In any case, the gamble backfired spectacularly. As if the domestic problems were not serious enough, the press became increasingly critical with the government's apparent unpreparedness and sloppiness (see, e.g., *The Economist*, 2017b, p. 57; Erlanger et al., 2017, p. A9).

Whereas Prime Minister May seems to be bewildered by the difficulty of trying to appeal to the voters at home while at the same time having to negotiate Brexit with Europe, the Brexiteers are outspoken about their somewhat elusive vision of how Britain should negotiate with the Europeans. Their policy on Brexit resembles Boris Johnson's declared policy on cake—"pro having it and pro eating it" (Taylor, 2016). Defying the evidence⁵ the Brexiteers indeed seem to expect that Britain can keep free trade with the EU while at the same time reducing payments to the EU and imposing curbs on migration from EU states.

To many observers it is very much unclear how strongly the Brexiteers' influence on the government's negotiation strategy actually is. Prime Minister May, for her part, has repeatedly stated her view that Brexit means hard Brexit. On many other topics under negotiation her position is yet not one hundred percent clear. What is also quite unclear is her willingness or capacity to coordinate with coalitions partners and ministers. This leads to uncertainty regarding her dependability and capacity to avoid mistakes. We argue that the combination of these uncertainties has an important effect on the dynamic and, perhaps, the outcome of the Brexit negotiations.

In this paper we explore this idea by help of a game-theoretic model in which we interpret the negotiations between the British government (the UK player) and the European

⁵See, e.g., the reports by Dhingra et al. (2016), PWC (2016), or Springford et al. (2016). See also Begg and Mushoevel (2016) for a summary of several studies. In addition, see also Kierzenkowski et al. (2016) or Baker et al. (2016). For the possible impact of tighter post-Brexit trade regulations see Ebell et al. (2016) or McGrattan and Waddle (2017).

negotiators (the EU player) as a game of reciprocal ‘coercive diplomacy’, where the objective of the coercer is to induce behavioural change in the coerced. Both sides exert pressure by showing their own willingness to risk a hard Brexit. The UK player could do so by delaying the negotiations, thus limiting the EU player’s flexibility. On the other hand, the EU player could refuse to grant concessions and, thus, wager that the UK player is just bluffing and might back down under pressure. In such a game it can be actually helpful to behave in a seemingly irrational fashion, just as the Brexiteers are doing.

In our analysis we approach the concept of irrationality in a way similar to Schelling (1960): What counts as irrational behaviour depends, *inter alia*, on the observers’s preferences or beliefs. An agent’s behaviour can be fully rational with regard to the own preferences but may appear irrational to an observer who has different preferences. In this context Schelling (1966, p. 37) has argued that “it does not always help to be, or to be believed to be, fully rational, cool-headed, and in control of oneself or of one’s country”. Instead “[s]ometimes we can get a little credit for *not* having everything quite under control, for being a little impulsive or unreliable” (see Schelling, 1966, p. 38, emphasis added).⁶

Our argument relies on Schelling’s idea of ‘tactical irrationality’. It assumes that the EU player cannot be perfectly certain about the UK player’s beliefs regarding the political-economic consequences of a hard Brexit. Even if the idea that Brexit will bring huge economic benefits (cf. Longworth, 2017) sounds outlandish to the Europeans they must (or at least should) take into account that this may not necessarily be a bluff but a sincere belief of their UK counterparts. Such ‘irrational’ expectations of the UK player, irrespective of their causes, can have real consequences for the negotiations as long as the prospect of a hard Brexit is a real threat to the European side. As we will show, suffering from Brexit illusions may actually *improve* the UK player’s bargaining power because it makes

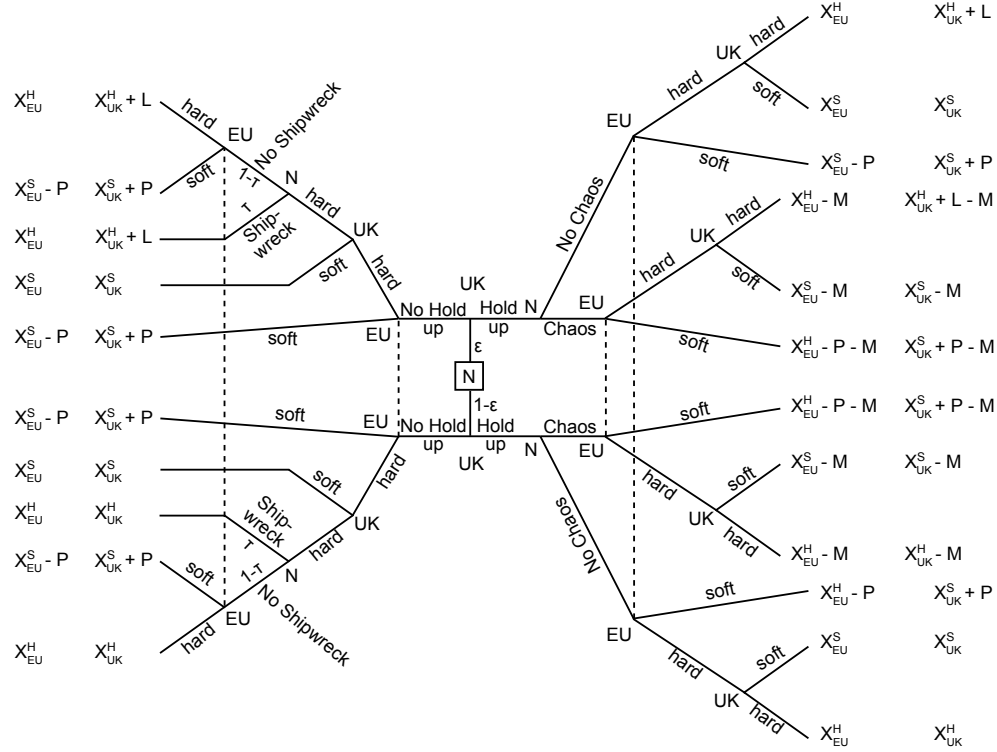
⁶See Schelling (1966, p. 36ff.) for several examples from international relations theory.

the threat of risking a hard Brexit credible. It follows that we should therefore expect a sophisticated UK player to deliberately project an image of irrationality: By doing so she could increase the range of policy options available (Mandel, 1984, p. 656f.). The EU player's strategy, in turn, depends on its belief of the likelihood of being faced with a UK player having genuine Brexit illusions.

Against this background things like the appointment of Boris Johnson as foreign secretary (cf. The Guardian, 2016c) must be seen as factors that increase the unpredictability of the government. Johnson is often regarded to be eccentric as well as “widely viewed as inherently untrustworthy” (see, e.g. The Guardian, 2016b,a; Hume and Masters, 2016). Especially in the eyes of the EU negotiators “he is seen as the man whose lies, opportunism and vaunting ego brought about Britain's disastrous EU exit” (see The Guardian, 2016c).⁷

Our main objective in what follows is to analyse the possible strategies of a UK player, who is actually just bluffing, and the reaction function of an EU player who is unclear about whether the UK player is bluffing or not, and believes that a (hard) Brexit is a negative outcome for both players. Ideally the model helps to better understand how the Brexit negotiations might play out and to avoid mistakes, which can have disastrous consequences.⁸

Figure 1: Game tree



Source: Own illustration.

Game-theoretic analysis

Model

We model the Brexit negotiations as a non-cooperative sequential asymmetric-information game $\Gamma = (K, P, S, u, \epsilon, \rho, \tau)$ with perfect recall. The game's structure is illustrated by the game tree K in Figure 1. We consider a set P of three players with player $i = \{B, E, N\}$, where E (the EU player) and B (the UK player) are opponents in competing for the

⁷Pitsoulis and Schwuchow (2017) argue that former Greek finance minister Yanis Varoufakis may have played a similar role in the 2015 Greek bailout negotiations.

⁸We indeed see similarities between the Brexit negotiations and the 2015 Greek bailout negotiations (see, e.g., Nixon, 2017), where extreme risk-taking behaviour on both sides of the table resulted in the worst outcome for all actors (for more on the game theory of the 2015 Greek bailout negotiations see Pitsoulis and Schwuchow, 2017; Hennessy, 2017).

distribution of the benefits of a Brexit⁹ or concessions. There exists two types of player B : A type B^I suffering from ‘Brexit illusions’ and ‘realistic’ type B^R . The UK player with illusions values a hard Brexit with an additional pay-off of $L \in \mathbb{R}^+$; the realistic type gets no additional pay-off from a hard Brexit.¹⁰ The actual type of the UK player is private information (i.e., only player B knows it). N is the player Nature, who determines all situations of incomplete information: (i) The type of B (with probability ϵ), (ii) the occurrence of delay-induced costs (with probability ρ), and (iii) the risk of shipwreck (with probability τ). S_i is the set of actions available to player i and u_i is the pay-off function for the same player. Both, the set of actions as well as the related pay-offs, can easily be derived from the game tree K in Figure 1.

Put briefly, our game tree tells the following story: At the start of the game player Nature determines the type of B . With probability ϵ player B has illusions, with probability $1 - \epsilon$ he is of the realistic type. After Nature has determined the UK player’s type, the latter has to decide whether she will delay the negotiations for tactical reasons. If the UK player, regardless of her type, decides to hold up the negotiations, Nature determines with probability $0 < \rho < 1$ whether the hold up causes political-economic turbulences (‘Chaos’) or not. In the case of chaos, we assume that all players have to bear additional costs of $M \in \mathbb{R}^+$, regardless of the game’s outcome.¹¹

After this hold up-stage we analyse how both actors choose their negotiation strategies. Both players can choose between taking a hard line in the negotiations (h) and taking a

⁹We use positive pay-offs for simplicity; the game can be analysed with no loss of generality or explanatory power with negative pay-offs

¹⁰The pay-off L can, without changing the results, alternatively be interpreted as additional costs costs a soft Brexit that result from breaking a commitment to a hard Brexit.

¹¹Pitsoulis and Schwuchow (2017) mention capital flight or reduced short-term growth prospects as negative consequences of a delayed conflict resolution (see Pitsoulis and Schwuchow, 2017, p. 9). Delaying the negotiations would definitely prolong the uncertainty for British citizens and firms. This should have a negative impact on the economy and the popularity of the British government.

soft line (s). A hard line reflects a lack of willingness of the EU player to offer concessions in exchange for a soft Brexit; for the UK player a hard line reflects a lack of willingness to settle for a soft Brexit without concessions. Here, the EU player has to decide first. If he chooses a soft line the game ends, both players agree on a soft Brexit and the EU player makes concessions worth $P \in \mathbb{R}^+$ to the UK player. Otherwise, the UK player has to decide on her strategy. If the UK player opts for a soft line in the negotiations the game ends and both agree on a soft Brexit; the EU player does not make any concessions in this case.

However, if the UK player chooses a hard line in the negotiations the game's further course depends on whether a hold up occurs. If the UK player has already chosen a hold up earlier, the game definitively ends after the UK player's decision and the result is a hard Brexit; no concessions are made. Otherwise player Nature determines whether the EU player will have the opportunity to make a final decision on making concessions to the UK player. With probability $0 < \tau < 1$ the disagreement of both players results in a shipwreck where both sides part in anger; in this case the game ends with a hard Brexit and no additional costs. If no shipwreck occurs the EU player can make one last decision on how to negotiate. Both players settle for a soft Brexit with concessions if the EU player decides to take a soft line in the negotiations now. Otherwise the negotiations end with a hard Brexit.

Regarding the players' pay-offs, we assign positive pay-offs to all outcomes. The pay-off for a soft Brexit is $X_j^S \in \mathbb{R}^+$ with $j = B, E$ and $X_j^H \in \mathbb{R}^+$ for a hard Brexit. We assume that the conditions

$$X_B^S - X_B^H + P > L > X_B^S - X_B^H > 0 \quad (1)$$

and

$$X_E^S - X_E^H > P > X_B^S - X_B^H > 0 \quad (2)$$

apply. According to inequality (1), the UK player without illusions prefers a soft Brexit to a hard Brexit, whereas the UK player with illusions prefers a hard Brexit to a soft Brexit. However, both types prefer a soft Brexit if they get a sufficient compensation in a form of concessions from the EU player. In addition, according to inequality (2), the EU player prefers a soft Brexit to a hard Brexit, irrespective of whether he has to pay a compensation.

We solve this game by looking for Perfect Bayesian equilibria, using backwards induction while allowing the players to update their beliefs with the information they receive. Since a complete solution of the game would be beyond the scope of this paper we confine the analysis to situations that illustrate when and why the UK player has incentives to delay the negotiations and how the EU player would react to this. In doing so we focus particularly on how the possibility of non-rational decisions changes the players' strategies using the concept of trembling-hand perfect equilibria.

This game is, of course, too simple to fully reflect the negotiations between the British government and the European negotiators on the conditions for a Brexit, but it can still offer some insights into how the actors' grand strategies perhaps look like. Moreover, it helps to develop scenarios from first principles on how the negotiations might develop. In this context the pay-offs to the games' players are not meant to reflect the costs and benefits for societies as a whole. Our focus lies on the political actors who are motivated by self-interest; the game's pay-offs reflect the players' political considerations (like popularity, legitimacy etc.), many of which are most certainly strongly contingent of the general economic situation of their countries and the particular economic situation of their constituents.

In order to solve the game we start with the EU player's decision at the final node without a hold up, followed by the UK player's decision if the latter had earlier decided not to hold up.

Lemma 1. *The EU player always decides in favour of a soft line in the negotiations in the*

final decision node if a hold up has not occurred earlier.

Proof. Inequality (2) implies $u_E(h, h, s) = X_E^S - P > X_E^H = u_E(h, h, h)$. \square

According to Lemma 1 the EU player suffers a loss of bargaining power in the last stage of the game since both types of the UK player anticipate that the willingness of the EU player to offer concessions increases. This consequently weakens the threat of failed negotiations for the realistic UK-player type at the earlier decision nodes. Yet the latter has still to anticipate that Nature might prevent this last stage and, thus, imposes a hard Brexit. Taking these considerations into account, by anticipating Lemma 1, the realistic UK always opts for a hard line in the negotiations if

$$u_{BR}(h) = \tau(X_B^H) + (1 - \tau)(X_B^S + P) > X_B^S = u_B(s). \quad (3)$$

Regarding the threshold for the risk of a shipwreck, this yields

$$\tau < \frac{P}{P + X_B^S - X_B^H}. \quad (4)$$

In other words, if the risk (τ) of a shipwreck to occur is low, the realistic UK player would risk a hard Brexit to induce the EU player to offer concessions. At the same time, according to inequality (1), the UK player with illusions would never choose a soft line in the negotiations. Hence a hard Brexit is no threat and both types of the UK player always choose hard negotiations if inequality (4) applies. By reversing the argument this implies that both types of the UK player would behave differently for

$$\tau \geq \frac{P}{P + X_{UK}^S - X_{UK}^H}. \quad (5)$$

In this case the UK player with illusions would still choose a hard line in the negotiations while the type without illusions would change her strategy and prefer a soft Brexit.

Lemma 2. *The EU player always avoids the risk of a shipwreck by choosing a soft line in the negotiations in the first place if he has observed no hold up, given inequality (4) applies.*

Proof. This follows directly from $u_E(h) = \tau(X_E^S - P) + (1 - \tau)(X_E^H) > X_E^S - P = u_E(s)$. \square

Using Lemma 2 we can now explain the UK player's behaviour for small risks of a shipwreck.

Proposition 1. *Given inequality (4) applies, no UK player would delay the negotiations by choosing a hold up at the first decision node.*

Proof. Given Lemma 2, both UK-player types anticipate that the EU player will choose soft negotiations after observing no hold up; this results in the best outcome for the UK player. As choosing the hold up option always carries the risk-costs of chaos for all players, no hold up is the dominant action in that case. \square

According to Proposition 1 small risks of a shipwreck completely destroy the EU player's bargaining power. Hence the UK player could benefit from a strategy that leaves open a back door for a last-minute agreement offered by the EU. Interestingly, the proposition of the British government to table a proposal for a Brexit procedure similar to Protocols 21/36 to the Treaty of Lisbon¹² could be interpreted in this direction. Although unpopular in Europe such a solution could still be offered by the EU members as a last resort in order to prevent a Brexit without any agreement.

For higher probabilities of a shipwreck the situation and, thus, the players' strategies do however completely change. If inequality (5) applies the realistic UK player always reacts by choosing a soft line in the negotiations to the choice of a hard line by the EU player. Hence, the EU player should become more willing to opt for hard negotiations.

¹²Those protocols, *inter alia*, provide an opt-in/opt-out possibility regarding several provisions on police and judicial cooperation for the UK; in other words the discretion to decide which provisions to accept.

Proposition 2. *Assumed inequality (5) applies, the EU player always chooses a hard line in the negotiations for*

$$\epsilon < \epsilon_L = \frac{P}{X_E^S - X_E^H} \quad (6)$$

and a soft line for

$$\epsilon > \epsilon_U = \frac{P}{P + \tau (X_E^S - X_E^H - P)}. \quad (7)$$

In both cases both types of UK player never choose a hold up earlier in the game.

Proof. See Appendix A.1 □

It is intuitively plausible that the EU player opts for a hard line in the negotiations in the case of a low probability of being confronted with a UK player with illusions. It follows that the UK player has an incentive to strengthen the EU player's belief that the former is of the unrealistic type. The UK player could also have an additional incentive to increase the costs of a hard Brexit (i.e. to lower X_j^H) for *both* players: Using comparative statics, we can easily see that

$$\frac{\partial \epsilon_L}{\partial X_E^H} = \frac{P}{(X_E^S - X_E^H)^2} > 0. \quad (8)$$

Obviously the EU player's ϵ_L threshold for a hard line in the negotiations decreases as the EU player's pay-off for a hard Brexit decreases. In other words, for higher costs (or lower pay-offs) in case of a hard Brexit, the EU player would prefer a soft line in the negotiations more strongly. At the same time, the higher own costs of hard Brexit would not be relevant for the UK player if this strategy is successful.¹³

Proposition 2 carries an interesting implication: The risk of a hold up by the UK player

¹³This argumentation is similar to what Schelling (1966, p. 36) calls the “paradox of deterrence”: The negative consequences that an actor might suffer from carrying out a threat are not important if the opposite actor, who is being threatened, believes in the threat and complies.

improves the bargaining power *of the EU player* if the risk τ is relatively high but no hold up occurs. In other words, because the possibility exists that the EU player makes a final offer that includes concessions to the unrealistic type of UK player, the former may be more willing to negotiate in a tough fashion and risk a hard Brexit in order to separate the UK player types. Under these circumstances both types of UK player could have an incentive to adopt the hold up strategy with the aim of forcing the EU player to adopt a soft line; whether this happens depends on the ‘price’ M (i.e. the political-economic costs) of a hold up and on the probability τ that those costs arise.

Proposition 3. *The EU player chooses a hard line in the negotiations if he has observed no hold up and a soft line without a previous hold up for*

$$\frac{P}{X_E^S - X_E^H} < \epsilon < \frac{P}{P + \tau(X_{EU}^S - X_{EU}^H - P)}. \quad (9)$$

Both types of UK player initially choose a hold up for

$$\rho < \rho_L = \frac{\tau[(X_U^S + P) - (X_U^H + L)]}{M} < \frac{P}{M} = \rho_U. \quad (10)$$

Proof. See Appendix A.2 □

Proposition 3 reveals another interesting and perhaps surprising detail: The realistic UK player has a *higher* willingness to take the risk of political-economic chaos, since she benefits more from limiting the EU player’s scope of action and, thus, the latter’s ability to separate both UK player types by announcing a hard line in the negotiations. However, as the EU player could distinguish between both types of UK player if they acted differently, the realistic UK player type has to imitate the unrealistic type.

Proposition 4. *Given inequality (9) applies, the realistic UK player type imitates the*

unrealistic type by choosing no hold up in the first phase of the game for all

$$\rho_L = \frac{\tau(X_U^S - X_U^H + P - L)}{M} < \rho < \frac{P}{M} = \rho_U. \quad (11)$$

Proof. In the case given by inequality (11) the UK player without illusions would choose a hold up if the EU player would choose a soft line in the negotiations. However, the EU player would anticipate the behaviour of the UK player type with illusions according to Proposition 3, update his beliefs about the type of the player if he observes a hold up and, based on this update, also choose a hard line in the negotiations. As the unrealistic type of UK player anticipates this change of behaviour due to the EU player's update of beliefs, she would also choose no hold up. \square

Our model so far offers some interesting and counter-intuitive insights: (i) By opting for a hold up, both UK player types could induce the EU player to adopt a soft line in the negotiations by depriving the latter of the chance to make a last-minute offer to the revealed UK player type with illusions. At the same time, the realistic UK player is not able to fully exploit her willingness to take risks because this would reveal her type. In the next section we will analyse how loosening the assumptions regarding perfect rationality and common knowledge might further affect the players' behaviour.

Considering 'irrational' behaviour

In our model, the realistic type of UK player is characterized by a higher willingness to risk a hard Brexit in order to force the EU player to make concessions. She also has to imitate the unrealistic type since otherwise a perfectly rational EU player can separate the UK player types. Interestingly, this could change if we abandon the assumption of perfect rationality and assume instead that the players may make mistakes, e.g. due to insufficient cognitive

capabilities or ill-preparedness. As we see it, such an assumption would make the model more realistic, since in reality there are no perfectly rational, individual actors who interact with each other in an environment where almost everything is common knowledge. Given that in reality there are no actors like ‘the UK player’ or ‘the EU player’ but governments, negotiators, ministers, commissions, parliaments, law courts and other sorts of actors, who could in some way or another influence the outcome of the Brexit negotiations, it certainly makes sense to account for the impossibility to make reliable predictions.

Our approach so far also (implicitly) assumed that all players’ beliefs are common knowledge. However, in the model the UK player’s decisions *inter alia* depend on the expected political-economic costs resulting from delayed negotiations. Such variables are *ex ante* unknown and estimates not only error-prone but also highly subjective. Moreover, both players must decide on the basis of estimates of the counterpart’s estimates. Every actor consequently has to take into account that his/her negotiating partner might base his/her decision on false assumptions/estimates and, thus, may act completely different from what was expected.

A game-theoretic approach that accounts for the possibility of such flawed decisions is the trembling-hand perfect equilibrium (Selten, 1975). Put briefly, it covers the possibility that there is a small risk of irrational decisions of players (i.e., actions which are not optimal under perfect rationality).¹⁴ A strategy is trembling-hand perfect if it is not affected by such small risks; an equilibrium is trembling-hand perfect if it is the combination of trembling-hand perfect strategies.

In our analysis we only consider the question whether the UK player’s behaviour could

¹⁴In what follows, we label a hold up, which would not be optimal under perfect rationality, an ‘irrational hold up’, even if it is a rational response to the existing uncertainty. Apologizing to the reader for the gruesome expressions, we also call the decision (not) to hold up the negotiations a ‘rational (no) hold up’ if it is a best response under perfect rationality.

change at the hold-up stage if the EU player might incorrectly react to ‘irrational’ behaviour of the former.¹⁵ As we will show, even small uncertainty about the expected behaviour of the UK player could induce the EU player to change his strategy. Put differently, the EU player reacts ‘irrationally’ if he expects that the probability of an error does not differ widely between both UK player types, even if the overall risk is small. On the other hand, there are no convincing motives why the EU player should also react ‘irrationally’ to ‘rational’ behaviour of the UK player. Accordingly, we assume that the EU player may react by taking a soft line in the negotiations to an irrational hold up but not to a ‘rational no hold up’.¹⁶

To show this we introduce $0 < \gamma \leq 1$ as the probability that the EU player does not update his beliefs about ϵ if he observes a hold up all the while inequality (9) applies. The variable $0 < \beta \leq 1$ stands for the probability that the realistic UK player type makes an error, $0 < \delta \leq 1$ denotes the unrealistic type’s error probability.

Lemma 3. *Assumed the inequalities (9) and (11) apply simultaneously, for*

$$\delta > \delta_T = \frac{\beta P}{\epsilon \beta (X_U^S - X_U^H) + (1 - \beta) (X_U^S - X_U^H - P)} \quad (12)$$

the EU player chooses soft negotiations if he observes an irrational hold up.

Proof. See Appendix A.3. □

According to Lemma 3, the EU player still chooses a soft line in the negotiations if he believes that the error probability (β) of the realistic UK player type does not differ much from the other type’s probability (δ).¹⁷ The implications of this result are quite interesting: Even for small chances of an error of the unrealistic UK player type, the EU player changes

¹⁵I.e., we assume that the EU player may react with taking a soft line in the negotiations to an irrational hold up but never to a ‘rational no hold up’—we apologize again for the unsightly phrases.

¹⁶For the proof see Appendix A.3.

¹⁷See Appendix A.3 for details.

his original strategy, since it is not trembling hand perfect. In other words, if we relax the assumption of perfect rationality somewhat, it cannot longer be ruled out that the EU player definitely adapts his strategy if he observes an irrational hold up. Under these circumstances the realistic UK player type could indeed benefit from a ‘irrational hold up’, since this might induce the EU player to take a soft line in the negotiations.

Proposition 5. *Assumed the inequalities (9) and (11) simultaneously apply, for*

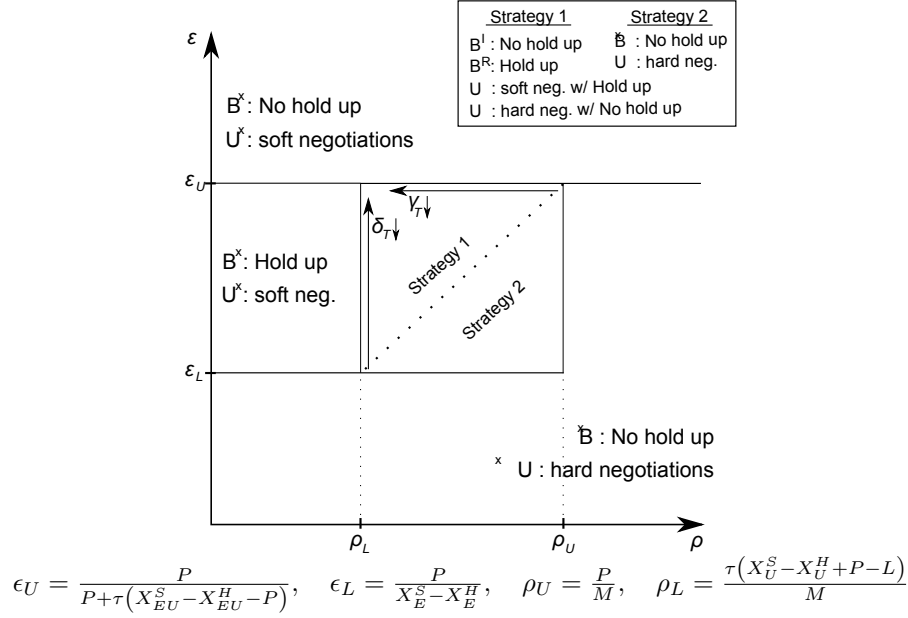
$$\gamma > \frac{\rho M}{P} \tag{13}$$

the unrealistic UK player type does not imitate the realistic type and chooses an irrational hold up.

Proof. See Appendix A.4. □

According to Proposition 5, for large risks of seemingly irrational moves by the EU player, the realistic UK player refrains from imitating the other type and chooses an irrational hold up in order to induce the EU player to offer concessions. At first glance, this seems unrealistic, but a high value of γ is absolutely possible as we showed in Lemma 3: For small values of δ (and a not too large values of β), the EU player changes his strategy, opting for soft negotiations, i.e., γ assumes the value of one ($\gamma = 1 > \rho M/P$). Put differently, as long as the EU player cannot completely rule out that the observed irrational hold up is the move of an unrealistic UK player, the EU player will take a soft line in the negotiations. In this case a realistic UK player, anticipating that reaction, would rationally choose a hold up.

Figure 2: Equilibrium strategies in $\varepsilon\rho$ space



Source: Own illustration.

Discussion

For those who analyse the Brexit negotiations between the British government and the EU two issues are particularly important. The first is the question what strategies the two sides actually have; the second is the question how optimal strategies would look like. Our game-theoretic analysis offers some interesting insights on both questions.

Many observers have noted that a lot of time has been spent on the discussion of general questions, timetables and procedures instead on proper negotiations. It is of course perfectly possible that what is being reported on the negotiations in the media is just a play staged for the electorates. But could it be part of a rational strategy to waste time? Our game-theoretic analysis suggests that delaying the negotiations could be fully rational for the UK player, although doing so generates additional costs and risks for everyone. Wasting so much time that last-minute agreements become impossible could indeed put pressure

on the EU side. Delaying tactics could thus help the British side to achieve European concessions, which would otherwise remain out of reach. Interestingly, in our game, the realistic type of UK player benefits the most from such a strategy. Figure 2 illustrates our argument: For small risks of delay-induced costs ($\rho < \rho_L$) and medium probabilities of the EU player being confronted with the unrealistic UK player type ($\epsilon_L < \epsilon < \epsilon_U$), both UK player types would delay the negotiations, forcing the EU side to take a soft line in the negotiations. Moreover, depending on the strength of the EU player's doubts about the UK player's degree of 'realism' (i.e., the risks of irrational moves δ and β), the realistic UK player type could also benefit from this strategy (called Strategy 1 in Figure 2) even for medium risks of delay-induced costs ($\rho_L < \rho < \rho_U$).

In our model, objective common-knowledge factors only have little impact on the players' optimal strategies. Instead, the players are more strongly affected by beliefs regarding the state of the world, by beliefs regarding the degree of the other player's rationality, and by expectations of future developments, which are highly uncertain today and, hence, object to diverging (subjective) evaluations. Moreover, the players' optimal strategies are affected by their beliefs regarding the opponent's beliefs. Rational players will then always take into account that their opponent could be simply wrong. As we have already argued earlier, what counts here is whether a player believes that the other side is truly believing something. If a player is believing something, he or she will act accordingly; this will be taken into account by the other player(s).

How does knowing this help to better understand the Brexit negotiations? The key to linking the model's predictions to reality lies in understanding the actions of the negotiation parties as communication devices to influence the other side's beliefs. Our analysis suggests that the British side may benefit from the Brexiteers' reputation for believing in irrationally unrealistic Brexit scenarios in two ways: First, the British negotiators could improve their

bargaining power if their European counterparts cannot rule out that the UK side acts on totally unrealistic beliefs about the future effects of a Brexit. As illustrated by Figure 2, in the game the UK player types generally benefit from rather larger probabilities of having illusions (ϵ) and rather small risks of delay-induced costs (ρ). Indeed, for (i) small ($\epsilon < \epsilon_L$) and for (ii) large probabilities ($\epsilon > \epsilon_U$) of being confronted with an unrealistic UK player, the chances of delay-induced costs become irrelevant as the UK player's bargaining power is (i) too small to affect the EU side by delaying the negotiations or (ii) too high to need a delay respectively.

Second, our results suggest that it could be beneficial for the British side (in the game this is so at least for the realistic type of UK player), to deliberately reinforce the (false) impression of not being fully capable of understanding the own position correctly. In the game, this is in particular so for a certain range of probabilities of being confronted with the unrealistic UK player type ($\epsilon_L < \epsilon < \epsilon_U$) and of a certain range of delay-induced costs ($\rho_L < \rho < \rho_U$). According to our model, already for small risks (δ, β) that either UK player type could choose irrational moves the EU player could be forced to make concession through an 'irrational' delay of the negotiations by the UK player (see Strategy 1 in Figure 2). The interpretation is straightforward: If the EU side is unsure whether the British representatives might choose wrong strategies it may become less willing to run risks and thus more willing to offer concessions.

What are the implications? If the British side, out of madness or method, takes actions that appear irrational to the EU side it may actually increase its *a priori* rather limited bargaining power. To publicly and repeatedly announce to the British citizens that a hard Brexit would be more beneficial than a soft one, that no deal would be better than a bad deal, and to publicly claim that the EU would have to compensate Britain after leaving (instead of the other way round), the expectations and beliefs of the own citizens can be

influenced in such a manner that the hand of the British side is strengthened rather than weakened. The EU negotiators are therefore well advised to take into account that there might be method in the madness, if they want to avoid a catastrophic miscalculation.

Conclusion

In this paper we offered a game-theoretic interpretation of the Brexit negotiations in general and the actions of the British government and the European negotiators in the months between the British referendum and the official start of the negotiations in particular. We focused on the delays and the peculiar absence of demonstrated willingness to compromise on the British side. In contrast to many observers we conclude that the British side may actually profit from being seen in Europe as being deluded about Brexit, unprepared and altogether rather unreliable.

In our game-theoretic model a reputation for irrationality has strategic effects that it influences the best responses of other players. First, a dose of unpredictability introduces uncertainty as to whether a player is actually reliable or not. We reflected this in the game by introducing two UK player types, a ‘realistic’ one and an ‘irrational’ one, and a veil of uncertainty that prevents the EU player from identifying the correct type. This accounts for the uncertainty whether the UK player is just bluffing or indeed genuinely believing in the success of her course of action. Because of this the EU player can never be sure against whom he plays the negotiation game. Second, a dose of doubts regarding the capacity of the UK player to actually do the right thing at the right time increases the EU player’s risk-costs if he takes a hard line in the negotiations, since the result might be a catastrophic mistake by the other side. Combining both kinds of irrationality can be, at least seen from a game-theoretic perspective, quite smart a thing. In our game, too, the dose of doubts

regarding the UK player’s capacity to avoid costly mistakes intensifies the effect of the dose of unpredictability. Yet acting ‘irrationally’, while under circumstances beneficial for one side, comes at the cost of an increased risk of mutual damage.

Our analysis shows the importance of influencing the other player’s beliefs. In our model a UK player, who actually correctly anticipates the negative economic effects of a hard Brexit, might under the right circumstances nonetheless delay the negotiations in order to prevent last-minute agreements and, thus, increase the pressure on the European side. Whether this delaying tactic works does depend on the European side’s (unobservable) beliefs regarding the UK player’s rationality and on the correctness of the UK player’s beliefs regarding the beliefs of the EU side. However, without verifiable information about the opponent’s beliefs, all parties must decide on the basis of incomplete information.

As we see it, the European negotiators in particular would be well advised to take into account the possibility that the British side may actually try to improve its bargaining power by employing a strategy of ‘tactical irrationality’ such as the one sketched in this paper. Given the risk of a fiasco stemming from a strategic blunder, the European negotiators are well advised not to disregard this scenario.

A Appendix

A.1 Proof of Proposition 2

If the condition

$$\tau \geq \frac{P}{P + X_{UK}^S - X_{UK}^H} \quad (5)$$

applies the EU player chooses a soft line in the negotiations when he has not observed a hold up as long as

$$\begin{aligned}
E[u_E(n, h)] &= \epsilon [\tau (X_E^H) + (1 - \tau) (X_E^S - P)] + (1 - \epsilon) (X_E^S) \\
&< \\
X_E^S - P &= u_E(n, s).
\end{aligned} \tag{14}$$

This condition can be rearranged to

$$\epsilon > \epsilon_U = \frac{P}{P + \tau (X_E^S - X_E^H)}. \tag{6}$$

The EU player always chooses a hard line in the negotiations when he has observed a hold up as long as

$$\begin{aligned}
E[u_E(u, h)] &= \\
\epsilon [\rho (X_E^H - M) + (1 - \rho) (X_E^H)] &+ (1 - \epsilon) [\rho (X_E^S - M) + (1 - \rho) (X_E^S)] \\
&> \\
\rho (X_E^S - P - M) &+ (1 - \rho) (X_E^S - P) \\
&= u_E(u, s).
\end{aligned} \tag{15}$$

This yields

$$\epsilon < \epsilon_L = \frac{P}{X_E^S - X_E^H} \tag{7}$$

as the threshold for the probability of the existence of the unrealistic UK player type.

As $\epsilon_L < \epsilon_U$ is always true the EU player would always choose a hard line in the negotiations if inequality (7) applies and a soft line if inequality (6) applies, regardless of whether he observed a hold up earlier in the game. Anticipating this, both UK player types would never choose a hold up.

A.2 Proof of Proposition 3

According to Proposition 2 (see Appendix A.1), the EU player chooses a hard line in the negotiations when he has not observed a hold up if the condition

$$\epsilon < \epsilon_U = \frac{P}{P + \tau(X_E^S - X_E^H)} \quad (6)$$

applies and a soft line when he has observed a hold up if the condition

$$\epsilon > \epsilon_L = \frac{P}{X_E^S - X_E^H} \quad (7)$$

applies. As $\epsilon_L < \epsilon_U$ is always true, the EU player's behavior depends on the observed behavior of the UK player for all

$$\frac{P}{X_E^S - X_E^H} < \epsilon < \frac{P}{P + \tau(X_{EU}^S - X_{EU}^H - P)}. \quad (9)$$

The EU player takes a hard line in the negotiations after a hold up and a soft line otherwise.

Anticipating this reaction, the unrealistic type of UK player chooses a hold up if

$$\begin{aligned} u_{BI}(h) &= \\ \rho(X_B^S - M + P) + (1 - \rho)(X_B^S + P) &> \tau(X_B^H + L) + (1 - \tau)(X_B^S + P) \\ &= u_{BI}(n). \end{aligned} \quad (16)$$

This yields

$$\rho < \rho_L = \frac{\tau[(X_U^S + P) - (X_U^H + L)]}{M} \quad (17)$$

as the ρ -threshold for which the unrealistic UK player type would choose a hold up. The realistic UK player type for her part chooses a hold up if the condition

$$u_{BR}(h) = \rho(X_U^S - M + P) + (1 - \rho)(X_U^S + P) > X_U^S = u_{BR}(n). \quad (18)$$

applies. This, in turn, yields

$$\rho < \rho_U = \frac{P}{M} \quad (19)$$

as the threshold for which the realistic UK player type would choose a hold up. It follows that both types would choose a hold up if inequality (10) applies.

A.3 Trembling-hand perfect equilibria

An equilibrium is trembling hand perfect if small probabilities of errors of the antagonists do not affect the players' strategies. We assume that the EU player anticipates that the unrealistic UK player type chooses a hold up by mistake with probability δ and the other UK player type with probability β when

$$\frac{P}{X_E^S - X_E^H} < \epsilon < \frac{P}{P + \tau(X_{EU}^S - X_{EU}^H - P)} \quad (9)$$

and

$$\frac{\tau(X_U^S - X_U^H + P - L)}{M} < \rho < \frac{P}{M} \quad (11)$$

apply. Under these circumstances the EU player takes, irrespective of Proposition 4, a soft line in the negotiations if

$$\begin{aligned} E(u_E(u, h)) &= \\ \beta\delta [\epsilon(X_E^H - \rho M) + (1 - \epsilon)(X_E^S - \rho M)] &+ \delta(1 - \beta)(X_E^H - \rho M) + \beta(1 - \delta)(X_E^S - \rho M) \\ &< \\ [1 - (1 - \beta)(1 - \delta)](X_E^S - P - \rho M) & \\ &= E(u_E(u, s)) \end{aligned} \quad (20)$$

applies. This yields

$$\delta > \delta_T = \frac{\beta P}{\epsilon \beta (X_E^S - X_E^H) + (1 - \beta) (X_E^S - X_E^H - P)} \quad (12)$$

for the relation of β and δ . This means that the EU player would change his mind if the error probabilities for both types of the British player are not very different, even if they are overall rather small. The comparative statics of inequality (12) reveal that

$$\frac{\partial \delta_T}{\partial \beta} = \frac{P (X_E^S - P - X_E^H)}{[\epsilon \beta (X_E^S - X_E^H) + (1 - \beta) (X_E^S - P - X_E^H)]^2} > 0 \quad (21)$$

and

$$\lim_{\beta \rightarrow 0} \delta_T = 0 \quad \text{and} \quad \lim_{\beta \rightarrow 1} \delta_T = \frac{P}{\epsilon (X_E^S - X_E^H)} < 1 \quad (22)$$

always hold true. At the same time, $\delta_T \geq \beta$ is true for $P > 1/2 (X_E^S - X_E^H)$ and

$$\beta \leq \frac{X_E^S - X_E^H - 2P}{(1 - \epsilon)(X_E^S - X_E^H) - P} \quad (23)$$

whereas $\delta_T < \beta$ is true for $P \leq 1/2 (X_E^S - X_E^H)$ or

$$\beta > \frac{X_E^S - X_E^H - 2P}{(1 - \epsilon)(X_E^S - X_E^H) - P}. \quad (24)$$

Regarding the EU player's optimal strategy for no hold up, the EU player *would not*

change his strategy and still take a hard line in the negotiations if

$$\begin{aligned}
E(u_E(n, h)) &= \\
(1 - \beta)(1 - \delta) [\epsilon (\tau X_E^H + (1 - \tau)(X_E^S - P)) + (1 - \epsilon) X_E^S] \\
&\quad \delta(1 - \beta) [\tau X_E^H + (1 - \tau)(X_E^S - P)] + \beta(1 - \delta)(X_E^S) \\
&> \\
[1 - (1 - \beta)(1 - \delta)](X_E^S - P) \\
&= E(u_E(n, s))
\end{aligned} \tag{25}$$

applies. Based on inequality (25), the EU player's strategy is stable for

$$\delta \leq \frac{P}{X_E^S} \quad \text{and} \quad 0 < \beta < 1 \tag{26}$$

or for

$$\delta > \frac{P}{X_U^S} \tag{27}$$

and

$$\beta < 1 - \frac{\delta X_U^S - P}{2\delta(X_U^S - P) - \tau[\epsilon(1 - \delta) + \delta](X_U^S - X_U^H - P) - [\epsilon(1 - \delta)]P}. \tag{28}$$

For small β or δ , the EU player would still react with a hard line to the UK player not choosing a hold up in a trembling-hand perfect strategy.

A.4 Proof of Proposition 5

Assuming that the EU player would react by taking a soft line negotiations to an irrational hold up with probability γ but, at the same time, would never react incorrectly to a rational

no hold up, the realistic UK player type would choose an irrational hold up if

$$E(u_{BR}(n, h)) = \gamma (X_B^S - \rho M + P) + (1 - \gamma) (X_B^S - \rho M) > X_B^S = E(u_{BR}(n, s)) \quad (29)$$

applies. This yields

$$\gamma > \gamma_T = \frac{\rho M}{P} \quad (13)$$

as the threshold for the realistic UK player. At the same time, a rational yet unrealistic UK player would never choose an irrational hold up as inequality (10) applies and, thus, a hold up has prohibitive costs for this player.

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