Relative Performance in Bilateral Trade[1]

Christian Ewerhart[2]
University of Zurich

February 2007

First draft: Preliminary and incomplete

Abstract

Using the framework of Hart and Moore (1988), we show that concerns for relative performance make the occurrence of renegotiation more likely. While this mitigates the rent expropriation inherent to contractual renegotiation, incentives for relationship-specific investments need not generally be stronger when parties to the contract care for relative performance. We illustrate our point with the recent closure of the Druzhba pipeline between Russia and Belarus.

Keywords: Bilateral trade, incomplete contracting, relative performance, renegotiation, Druzhba pipeline.

JEL classification: C78, L22

[1]The idea for this paper has developed following discussions with Ernst Fehr and Oliver Hart. Of course, all remaining errors are my own.

[2]Institute for Empirical Research in Economics, Winterthurerstrasse 30, CH–8006 Zurich, Switzerland.

1. Introduction

In long-term trading relationships, it is not uncommon to observe that original price agreements are renegotiated at a later stage. Such renegotiation should be predicted, for instance, whenever just one party to the contract does not find trade profitable enough at the conditions of the original contract (Hart and Moore, 1988, MacLeod and Malcomson, 1993). An efficiency gain may then be possible only if the reluctant party obtains a more attractive contract offer before decisions about trade are made. The consequence of renegotiation to an efficient outcome is that long-term contracts ensure not always the protection of relationship-specific investments. Indeed, renegotiation, unless specifically designed by parties with commitment power (Chung, 1994, Aghion, Dewatripont, and Rey, 1994, Nöldeke and Schmidt, 1995), typically leads to an ex-post expropriation of rents, and therefore often to suboptimal levels of relationship-specific investments.

As we will argue in the present paper, this prevalent view on renegotiation as an improvement upon inefficient outcomes created by contractual incompleteness may not be general enough to capture all economic applications of general interest. For instance, when prices for oil and gas soared in recent years, the Russian authorities found it increasingly hard to accept that neighboring countries such as Belarus made significant profits from selling inexpensive oil deliveries from Russia at much higher prices to various European countries. This specific conflict culminated in January 2007 in the temporary closure of the important Druzhba pipeline by the Russian government.

We discuss the trade dispute between Russia and Belarus in more detail in Section 2 of the present paper. There, we point out that the renegotiations pushed by Russia since spring 2006 do not correspond to the traditional understanding in economic theory that renegotiations are aiming at an improvement in economic efficiency. Instead we argue that Russia started renegotiations because it was not "content" with a situation in which Belarus

made significant profits with subsidized oil imports from Russia. To discuss the situation also formally, we employ the linear model by Fehr and Schmidt (1999) to study concerns for relative performance in the fundamental incomplete contracting environment that had been proposed by Hart and Moore (1988). To concreteness, we assume that each contractual party compares itself with the respective other party, but in principle, the argument works analogously for alternative reference groups.

In the formal analysis, we show first that all else being equal, renegotiation is more likely to occur with concerns for relative performance. This result is obtained by the combination of two facts. First, there will be scenarios in which the seller, say, finds the price not too low to generate a positive sales margin, but too low in relation to the valuation of the buyer. Indeed, with a utility function that reflects concerns for relative performance, this seller would be credible to unilaterally decide against trade, and so the buyer, interested to get the deal through, would have to make a new contract offer that improves the conditions of the seller sufficiently to make trade attractive even with taking account of the concerns for relative performance. The other fact that is responsible for the monotonicity result is that a concern for relative performance can never lead to a situation in which an efficient trading possibility is not exploited by rational agents.

Our second main result is that under certain conditions, due to the increase in the probability of renegotiation, and due to the changes in the resulting ex-post division of the trading surplus, the incentives for relationship-specific investments are more pronounced when parties have concerns for relative performance than with a traditional utility characterization. The reason is that in the renegotiation game, relative performance considerations tend to induce the seller (buyer) that is willing to put the deal through to ask for a higher (lower) price. Under certain conditions discussed in the body of the paper, this effect is the dominant one, and leads to a reduced expropriation of rents, which provides stronger incentives to invest.

There is a significant body of literature that is related to the present paper.

The hold-up inefficiency, i.e., the financial risk associated with relationship-specific investments in uncertain or complex environments, has been described first by Williamson (1975, 1985). Klein, Crawford, and Alchian (1978) and Joskow (1987) offer insightful discussions of relevant case studies from the car and coal industry, respectively. The theoretical analysis of the hold-up began with Grout (1984) who studied renegotiation in the context of labor unions. The modeling idea has been extended in various directions, in particular by Grossman and Hart (1986) and Tirole (1986). Hart and Moore (1988) prove underinvestment in a fundamental bilateral trade problem. [...to be completed...]

The rest of the paper is structured as follows. Section 2 gives a brief account of the events related to the Druzhba pipeline closure. In Section 3, we offer a formal discussion of our point. Section 4 contains our second main result, the efficiency ranking. Section 5 concludes.

2. The Druzhba pipeline dispute

Connecting the rich oil fields of Western Siberia, the Ural, and the Caspian Sea with refineries located in various continental European countries, the Druzhba pipeline system with a length of about 2,500 miles is usually considered as one of the main energy backbones of Europe. Especially Germany and Poland, but also the Czech Republic, Slovakia, Ukraine, and Hungary rely on the undisturbed working of this connection with its capacity of about 2 million barrels per day.[3] As can be seen in Figure 1, the pipeline transports crude oil over the territory of Belarus, a former "fraternal socialist ally" at the times of the Soviet Union. Contractual arrangements about prices of oil deliveries date back to times of mutual political support. The name Druzhba means "friendship" in Russian.

Investments into pipelines are clearly of a relationship-specific nature. All parties involved suffer significant losses even from temporary disruptions of

[3]The average supply during 2006 had been about 1.2 million barrel per day (a barrel corresponds to approximately 159 liters).

supplies. Russia is dependent on the transit through Belarus because of the size of the regular oil deliveries. Redirecting all of the oil normally sent through the transit connection may be difficult if not economically unfeasible. For instance, Ukraine has not a sufficient capacity to replace Belarus as a transit country for oil deliveries. On the other hand, the well-being of the Belarusian economy hinges on the performance of the oil sector. In fact, it has been argued in the media that, to avoid a potential crisis, the country needs to implement economic reforms more urgently before Russian demands can be satisfied.

The Druzhba trade conflict was not an isolated event, but represented an escalation of negotiations about the prices for gas and oil that had been ongoing for some years between the governments of Russia and Belarus. As Gennady Chuffrin, deputy director of the Institute for World Economy and International Relations, put it recently: "Russia doesn't see any returns on its investments in Belarus." While a deal for gas deliveries and company shares had been struck with much effort in late December of the year 2006, the problem of an appropriate price for oil proved to be more difficult to resolve. The contractual agreement of 1995 was that Russia delivers oil at low prices to Belarus, which in turn should have send 85 percent of its profits back to Russia (which it never did). During spring 2006, the Kremlin tried actively to buy itself into the Belarusian energy sector, targeting in particular the gas monopolist Beltransgaz. With Minsk remaining firm, the dispute between Russia and Belarus assumed a new dimension in late 2006. After announcements made in December 2006, Russian authorities took two measures in early January of the year 2007 directed at preventing Belarus from re-exporting inexpensive Russian resources to Western Europe at world market prices. First, the state-controlled Gazprom company raised the price of its gas to Belarus from USD 46 to USD 100 per 1,000 cubic meter. Second, Russia introduced an export tariff vis-à-vis Belarus of USD 80 per ton of oil.

The government in Minsk sought to impress Russia in return by imposing a transit duty of USD 45 per ton for oil delivered from Russia to Europe.

However, Transneft, the Russian oil company operating the Druzhba pipeline, refused to pay this "illegal" fee, arguing that such a fee could not be applied to goods in transit. But then, at least according to Russian sources, Minsk responded by confiscating, from January 6 onwards, oil from the transit pipeline, oil that was destined for European customers. Over the following two days, 79.000 tons out of 91.000 tons had apparently been drawn from the pipeline. On Monday, January 8, Russia, publicly accusing Belarus of stealing oil from the pipeline, halted its oil exports to Central and Western Europe passing through Belarus. In fact, Russian authorities threatened to further disrupt European supplies. These dramatic steps taken by the Russian government brought the conflict to the attention of the general population in Europe (see, e.g., Financial Times, 2007, Business Week Online, 2007).

After three days of uncertainty, in which the behavior of the Russian government was openly condemned by various national authorities and international organizations, the issue was finally settled. Belarusian President Alexander Lukashenko conceded, in a phone call with his Russian counterpart Vladimir Putin, to drop the transit fee on Russian oil. With more than half of the exports from Belarus going to Russia, Putin had a significant bargaining power that might have helped him in the negotiation with Lukashenko. On the evening of Wednesday, January 10, Russia resumed deliveries through the pipeline system. Simultaneously, Belarus began releasing nearly 80,000 tons of oil from the country's depots to its foreign customers, as a compensation of the purportedly tapped oil resources. However, it is generally perceived by insiders that the compromises obtained, both in the case of gas and in the case of oil, will not resolve the trade conflict between Russia and Belarus in the long term.

The Druzhba cutoff was not the first event of this sort. Starting in 2005, the Russian government has persuaded a number of former members of the Soviet Union into accepting higher prices for gas and oil. Georgia, Moldova, and Azerbaijan are among these. A year ago, Russian gas supplies to Europe

were interrupted for four days following a price dispute between Russia and Ukraine.

3. The model

The case of the transit dispute illustrates the possibility that renegotiation may be the consequence of the unilateral perception by one party to a contract to receive an inappropriate share of the surplus created by the trade. Indeed, with oil prices rising (with some temporary downswings) to higher and higher levels, the Russian government might have observed the comparably sound development of the Belarusian economy in recent years with mixed feelings. This section outlines a model of a trading relationship between two parties that care for relative economic performance.

Our set-up is as follows. Two contractual parties, a seller (S) and a buyer (B), perceive the possibility to enter a potentially profitable trading relationship. The time horizon decomposes into an ex ante and an ex post period. Ex ante, parties may agree on some contract for future trade. We will assume a trading technology that allows trading at will (cf. Hart and Moore, 1988), so that a court can only observe whether there has been trade or not. Under this assumption, contracts will be of the form $(\widehat{p}_0, \widehat{p}_1)$, where $\widehat{p}_0$ is the transfer from the buyer to the seller in case of no trade, and $\widehat{p}_1$ is the transfer from the buyer to the seller in the case of trade. This type of contract is consistent with the take-or-pay provisions that have been reported for natural gas by Masten and Crocker (1985).

After signing the contract, but still ex ante, seller and buyer each select a respective level of relationship-specific investments $i_S \geq 0$ and $i_B \geq 0$. Without loss of generality we assume that investments cause no additional costs to either buyer or seller.[4] Investments are not contractible, but parties can observe mutual investment levels and are consequently symmetrically informed

[4]When actual costs differ from investments, then a straightforward application of the chain rule shows that all results of the paper remain valid in the more general set-up.

throughout the trading relationship. Throughout the analysis, investments are assumed to be selfish, i.e., the seller's investments do not increase the buyer's valuation of the traded good, nor do the buyer's investments lower the seller's cost of production.

Ex post, the observable, but non-contractible state of the world $\omega \in \Omega$ realizes, where Ω denotes the set of possible states of the world, and through its realization, a cost function $c(i_S, \omega)$ for the seller, and a value function $v(i_B, \omega)$ for the buyer. The cost is an opportunity cost, and must be paid only if trade occurs. Similarly, the value is understood to be relative to the best alternative, for the buyer, in the ex-post situation. We assume the following simplified renegotiation protocol:

- If both parties prefer trade over no trade at the conditions of the original contract, then there is no renegotiation.
- If the seller (buyer) prefers trade, and buyer (seller) prefers no trade at the conditions of the original contract, then the seller (buyer) may send a new offer p_1 to the buyer (seller).
- If mutually beneficial trading is not possible, parties do not renegotiate.

As shown by Nöldeke und Schmidt (1995), this trading protocol corresponds to a subgame-perfect equilibrium outcome of a fully tractable message game between buyer and seller.

After the completion of the renegotiation stage, the parties decide simultaneously whether to trade or to not trade at the (potentially new) conditions (p_0, p_1). The seller's net reward is then given by

$$x_S(i_S, \omega) = p_q - qc(i_S, \omega) - i_S,$$

where p_q denotes the price paid by the buyer to the seller in the ex-post stage. Analogously, the buyer's net reward is given by

$$x_B(i_S, \omega) = qv(i_B, \omega) - p_q - i_B.$$

Contractual parties may have concerns for relative performance. For specificity, the utility functions are defined as in Fehr in Schmidt (1999), that is

$$\begin{aligned} u_S &= x_S - \alpha_S \max\{x_B - x_S, 0\} \\ u_B &= x_B - \alpha_B \max\{x_S - x_B, 0\}, \end{aligned}$$

where we dropped the arguments of the functions x_S and x_B. We assume that parameters measuring the extent of disutility from unequal relative performance are given by $\alpha_S \in [0; 1)$ and $\alpha_B \in [0; 1)$. Apparently, the limit case $\alpha_S = \alpha_B = 0$ corresponds to the traditional linear specification of the utility function. Note also that, because social preferences are invariant under monotone affine transformations of the utility function, the model would be no more general with a second term for "altruistic" inequity aversion.[5]

The first best is the traditional efficient investment ex ante, trade ex-post if and only if $v \geq c$, and a price $p_q^{\mathrm{FB}}(\omega)$ that equalizes the utilities, i.e.

$$p_q^{\mathrm{FB}}(\omega) - qc(i_S, \omega) - i_S^{\mathrm{FB}} = qv(i_B, \omega) - p_q^{\mathrm{FB}}(\omega) - i_B^{\mathrm{FB}}.$$

Rearranging yields

$$p_q^{\mathrm{FB}}(\omega) = q\frac{v(i_B, \omega) + c(i_S, \omega)}{2} + \frac{i_S^{\mathrm{FB}} - i_B^{\mathrm{FB}}}{2}.$$

More generally, we write

$$p_q^{\#}(i_S, i_B, \omega) = q\frac{v(i_B, \omega) + c(i_S, \omega)}{2} + \frac{i_S - i_B}{2}$$

for the *fair ex-post price*.

Second best. We drop the argument ω in the sequel. Assume that buyer and seller agreed on a contract (p_0, p_1). Then the *seller* prefers trade provided that

$$\begin{aligned} &p_1 - c - \alpha_S\{(v - p_1 - i_B) - (p_1 - c - i_S)\}^+ \\ &\geq p_0 - \alpha_S\{(-p_0 - i_B) - (p_0 - i_S)\}^+, \end{aligned}$$

[5]For alternative approaches to modeling concerns for relative performance, see Bolton (1991) and Bolton and Ockenfels (2000), for instance.

or, equivalently, if

$$p_1 - p_0 - c \geq 2\alpha l S(\{p_1^{\#}(i_S, i_B) - p_1\}^+ - \{p_0^{\#}(i_S, i_B) - p_0\}^+).$$

On the other hand, the *buyer* will wish to trade at the conditions of the original contract provided that

$$\begin{aligned} & v - p_1 - \alpha_B\{p_1 - c - i_S) - (v - p_1 - i_B)\}^+ \\ & \geq -p_0 - \alpha_B\{(p_0 - i_S) - (-p_0 - i_B)\}^+. \end{aligned}$$

Rewriting yields

$$v - p_1 + p_0 \geq 2\alpha_B(\{p_1 - p_1^{\#}(i_S, i_B)\}^+ - \{p_0 - p_0^{\#}(i_S, i_B)\}^+).$$

Consider Figure 2, which exhibits the indifference curves (between trade and no trade under the conditions of the original contract) for buyer and seller in (c, v)-space. Concerns for relative performance are reflected here as by kinks of the respective indifference curves at the intersection point with the cross diagonal defined by the equation

$$\frac{v + c}{2} = \widehat{p}_1 - p_0^{\#}. \tag{1}$$

Indeed, when (1) is satisfied, then

$$x_B - x_S = (v - \widehat{p}_1 - i_B) - (\widehat{p}_1 - c - i_S) = 2(\frac{v + c}{2} - \widehat{p}_1 + p_0^{\#}) = 0.$$

so that the economic performances of buyer and seller coincide. When

$$\frac{v + c}{2} > \widehat{p}_1 - p_0^{\#},$$

then the buyer is better off, while for the reversed inequality, the seller is better off. We can show the following result.

Proposition 1. *For any initial contract* $(\widehat{p}_0, \widehat{p}_1)$ *and for any pair of investment levels* $i_S \geq 0$ *and* $i_S \geq 0$*, the probability of ex-post renegotiation*

is never lower with concerns for relative economic performance than under the traditional utility specification. However, concerns for relative economic performance do never impede efficient trade.

Proof. There are two cases that need to be distinguished because they generate different economic situations. Depending on the parameters $\widehat{p}_0, \widehat{p}_1, i_S$, and i_B, either the buyer is relatively better off than the seller in the case of no trade, i.e., $\widehat{p}_0 \leq p_0^{\#}$, or the seller is relatively better off, i.e., $\widehat{p}_0 > p_0^{\#}$. Give the proofs for the two cases are very similar, we focus on the first case, i.e., we assume that

$$\widehat{p}_0 \leq p_0^{\#} = \frac{i_S - i_B}{2}.$$

Under this condition, the seller will prefer trade over no trade at the conditions of the original contract whenever

$$c \leq \widehat{p}_1 - \widehat{p}_0 + 2\alpha_S(p_0^{\#} - \widehat{p}_0) - 2\alpha_S\{\frac{v+c}{2} + p_0^{\#} - \widehat{p}_1\}^+.$$

Thus, for

$$\frac{v+c}{2} < \widehat{p}_1 - p_0^{\#},$$

the indifference curve of the seller will run parallel to the v-axis at value

$$c = \widehat{p}_1 - \widehat{p}_0 + 2\alpha_S(p_0^{\#} - \widehat{p}_0).$$

But upwards from its intersection point with the line of equal performance

$$\frac{v+c}{2} = \widehat{p}_1 - p_0^{\#},$$

the seller's indifference curve tilts to the left-hand side and crosses the point $(\widehat{p}_1 - \widehat{p}_0; \widehat{p}_1 - \widehat{p}_0)$. In contrast, for $\alpha_S = 0$, the indifference curve would run, over its whole length, parallel to the v-axis at value $c = \widehat{p}_1 - \widehat{p}_0$. Thus, there is a wedge where renegotiation occurs between agents that care for relative economic performance, but not between agents with a traditional utility specification. Another area where this appears as well is an upper-left wedge starting at the intersection point of the line of equal performance

with the line $v = \widehat{p}_1 - \widehat{p}_0$ (cf. Figure 2). To prove Proposition 1, it remains to be shown that agents with concerns for relative performance will start a renegotiation whenever agents with traditional utility specification do so. Assume first that trade is efficient (i.e., $v \geq c$), but that a seller with traditional utility specification would be unwilling to trade at the conditions of the original contract (i.e., $c > \widehat{p}_1 - \widehat{p}_0$). A buyer with traditional utility specification would make a new contract offer to the seller. We have to show that also between agents with concerns for relative performance, there would be a renegotiation. We know that a seller with concerns for relative performance would also not want to trade. But the buyer must be relatively better off than the seller in this situation (cf. Figure 2), and so the buyer will propose a higher price that makes the seller indifferent between trade and no trade, i.e., the buyer proposes a new price p_1 such that

$$\begin{aligned} & p_1 - c - i_S - \alpha_S((v - p_1 - i_B) - p_1 - c - i_S)) \\ = \; & \widehat{p}_0 - i_S - \alpha_S(-\widehat{p}_0 - i_B - (\widehat{p}_0 - i_S)) \end{aligned}$$

Then

$$p_1 = \widehat{p}_0 + \frac{c(1+\alpha_S) + \alpha_S v}{1 + 2\alpha_S}.$$

The buyer compares her utility from trading at p_1, with her outside option of not trading and paying $\widehat{p}_0$ to the seller. But as

$$\begin{aligned} v - p_1 - i_S &= v - \widehat{p}_0 - \frac{c(1+\alpha_S) + \alpha_S v}{1 + 2\alpha_S} - i_S \\ &= \frac{1+\alpha_S}{1+2\alpha_S}(v - c) - \widehat{p}_0 - i_S \\ &> -\widehat{p}_0 - i_S, \end{aligned}$$

we have proved that the buyer will make precisely the offer p_1. The other possible cases can be treated in a similar fashion, so that we omit these cases here. □

The crucial part of Proposition 1 is in the second sentence. Even though trading partners may perceive a disutility from being less well off than the

other party, it can never happen that this disutility makes it impossible to implement efficient trade. The first part of the Theorem follows more or less immediately from the second. It captures the point of this paper that economic agents that care about relative performance are more likely to renegotiate an existing contract.

To understand why Proposition 1 is true, the crucial point to note is that the intersection point of the indifference curves of buyer and seller lays on the efficiency frontier. This feature of the equilibrium allows buyer and seller to find, in all states of the world where trade is efficient, a new price p_1 that makes trade attractive for both parties. Why is it the case that the intersection point of the indifference curves lays on the efficiency frontier? Ultimately, this has to do with the fact that concerns for relative performance are also present in the no-trade scenario. If an efficient opportunity to trade is left out by rational agents with concerns for relative economic performance, this can only happen (given that in each scenario at most one party has negative feelings about the outcome) when one party is strictly worse off than the other party in the trade scenario, and the other party is strictly better off than the other party in the no-trade scenario. But this is impossible in bilateral trade!

When the support of the distribution of cost and value parameters is sufficiently dispersed, then Proposition 1 can be strengthened as follows:

Proposition 2. *Fix an initial contract $(\widehat{p}_0, \widehat{p}_1)$, and a pair of relationship-specific investment levels $i_S \geq 0$ and $i_B \geq 0$. Assume that the pair of random variables $(c; v)$ has support $[\underline{c}; \overline{c}] \times [\underline{v}; \overline{v}]$ for constants $0 < \underline{c} < \overline{c}$ and $0 < \underline{v} < \overline{v}$. Then, provided that*

$$\underline{c} < \widehat{p}_1 - \widehat{p}_0 < \overline{v}, \tag{2}$$

the probability of ex-post renegotiation is strictly higher for parties with concerns for relative performance than for parties with a traditional utility specification. For any sufficiently high realization of v, a seller with concerns for relative performance will initiate renegotiation even with probability one.

Proof. We will prove the first assertion for the case $\widehat{p}_0 \leq p_0^{\#}$ (the other case $\widehat{p}_0 > p_0^{\#}$ can be dealt with in a completely analogous way). In this case, the buyer is relatively better off than the seller in the no trade scenario. Fix parameters $\varepsilon_1 > 0$ and $\varepsilon_2 > 0$, not too large and with $\varepsilon_1/\varepsilon_2$ sufficiently small. Then, renegotiation between agents with concerns for relative performance will take place for realizations

$$\begin{aligned} c &= \widehat{p}_1 - \widehat{p}_0 - \varepsilon_1 \\ v &= \widehat{p}_1 - \widehat{p}_0 + \varepsilon_2, \end{aligned}$$

but not so for agents with a traditional utility specification. By our support assumption (2), this situation occurs with positive probability. This proves the first assertion of Proposition 2. The second assertion follows from these considerations for the case $\widehat{p}_0 \leq p_0^{\#}$ by letting ε_2 grow over all boundaries. For the case $\widehat{p}_0 > p$, the argument is similar, and therefore omitted. □

Proposition 2 captures formally the point that strongly increasing oil prices can induce oil producing countries to start renegotiations with all their customers and transit partners, even if

- the variable costs for production do not change
- the efficient quantity is not significantly affected by the price change
- a positive profit margin would result for both parties also in the case of the originally agreed price level.

This point illustrates our point that considerations of relative performance, and not only of efficiency, can be the trigger for contractual renegotiation.

4. Incentives for investment

We have seen in the previous section that concerns for relative performance tend to increase the likelihood of renegotiations. Contractual agreements

made at the ex ante stage are therefore less reliable as a predictor of the trading conditions in the ex post stage. A natural question to ask is therefore whether this effect leads to diminished incentives for relationship-specific investments.

To study this question, we consider the expected utility U_S of the seller and U_B of the buyer at the ex ante stage as a function of the pair of investments. Note that the capital letters refer to the ex ante utilities. Let $\mu(c,v) = \mu(c,v|i_S,i_B)$ denote the probability measure of the two-dimensional random variable (c,v), given investments (i_S,i_B).

Assume that $\widehat{p}_0 \leq p_0^{\#}$, i.e., that the buyer is relatively (weakly) better off than the seller in the case of no trade. The seller can end up in one of six scenarios:

- No trade ($q=0$), and $x_B > x_S$:

$$\begin{aligned} u_S^I &= \widehat{p}_0 - i_S - 2\alpha_S(p_0^{\#} - \widehat{p}_0) \\ &= (1+2\alpha_S)\widehat{p}_0 - (1+\alpha_S)i_S + \alpha_S i_B. \end{aligned}$$

- Trade according to original contract, and $x_S > x_B$.

$$u_S^{II} = \widehat{p}_1 - c - i_S$$

- Trade according to original contract, and $x_B > x_S$:

$$\begin{aligned} u_S^{III} &= \widehat{p}_1 - c - i_S - 2\alpha_S(\frac{v+c}{2} + p_0^{\#} - \widehat{p}_1) \\ &= (1+2\alpha_S)\widehat{p}_1 - (1+\alpha_S)c - \alpha_S v - (1+\alpha_S)i_S + \alpha_S i_B \end{aligned}$$

- Trade following buyer's proposal (this implies $x_B > x_S$). The seller is made indifferent between trade and no-trade by a higher price p_1. Note that the buyer has no incentive to increase $\widehat{p}_0$. The new price p_1 satisfies the indifference equation

$$p_1 - \widehat{p}_0 - c = 2\alpha_S(\frac{v+c}{2} + p_0^{\#} - p_1) - 2\alpha_S(p_0^{\#} - \widehat{p}_0).$$

Solving for p_1 yields

$$p_1 = \widehat{p}_0 + \frac{c(1+\alpha_S) + \alpha_S v}{1+2\alpha_S}.$$

and

$$\begin{aligned} u_S^{IV} &= \widehat{p}_0 - i_S - 2\alpha_S(p_0^{\#} - \widehat{p}_0) \\ &= (1+2\alpha_S)\widehat{p}_0 - (1+\alpha_S)i_S + \alpha_B i_B. \end{aligned}$$

- Trade following seller's proposal, and $x_S > x_B$. The buyer is made indifferent between trade and no trade by a lower sales price p_1. This price satisfies

$$v - p_1 + \widehat{p}_0 = 2\alpha_B(p_1 - p_0^{\#} - \frac{v+c}{2}),$$

or equivalently,

$$p_1 = \widehat{p}_0 + \frac{\alpha_B c + (1+\alpha_B)v}{1+2\alpha_B} + \frac{2\alpha_B}{1+2\alpha_B}(p_0^{\#} - \widehat{p}_0).$$

The seller's terminal utility in this scenario is given by

$$\begin{aligned} u_S^V &= p_1 - c - i_S \\ &= \widehat{p}_0 + \frac{1+\alpha_B}{1+2\alpha_B}(v-c) + \frac{2\alpha_B}{1+2\alpha_B}(p_0^{\#} - \widehat{p}_0) - i_S \\ &= \frac{1}{1+2\alpha_B}\widehat{p}_0 + \frac{1+\alpha_B}{1+2\alpha_B}(v-c) - \frac{1}{1+2\alpha_B}i_S - \frac{2\alpha_B}{1+2\alpha_B}i_B \end{aligned}$$

- Trade following seller's proposal, and $x_B > x_S$. Again, the buyer is made indifferent between trade and no trade by a lower sales price p_1. However, this time, the buyer is better off and the price p_1 satisfies

$$p_1 = v + \widehat{p}_0,$$

The seller's terminal utility in this scenario is given by

$$\begin{aligned} u_S^{VI} &= p_1 - c - i_S - \alpha_S((v - p_1 - i_B) - (p_1 - c - i_S)) \\ &= v + \widehat{p}_0 - c - i_S - \alpha_S((\widehat{p}_0 - i_B) - (v + \widehat{p}_0 - c - i_S)) \\ &= (1+\alpha_S)(v-c) + \widehat{p}_0 - (1+\alpha_S)i_S + \alpha_S i_B. \end{aligned}$$

As a consequence of these considerations, we obtain our next result.

Proposition 3. *Concerns for relative economic performance lead to a mitigation of rent expropriation through renegotiation. For instance, when the seller is not willing to take part in an efficient exchange at the conditions of the initial contract, then the renegotiated price proposed by the buyer will amount to*

$$p_1 = \widehat{p}_0 + \frac{c(1+\alpha_S) + \alpha_S v}{1+2\alpha_S},$$

which is weakly greater than $\widehat{p}_0 + c$, the renegotiated price in the model with traditional utility specification. However, investment levels for buyer and seller are not necessarily higher with concerns for relative performance than without.

Sketch of proof: For the first assertion, see the text before the Proposition. To prove the second, consider a degenerated distribution of cost and value parameters, with a finite number of states of the world. One can then easily construct an example in which equilibrium investments are not higher for agents with concerns for relative performance than for agents with traditional utility specification. [...to be completed...] □

5. Conclusion

In a world with incomplete contracting possibilities, partners to a trading relationship may find themselves in a situation where they would like to rewrite the original contract to reach a mutually beneficial outcome. In this paper, we have argued that this efficiency-improving view on renegotiation may not always reflect the true motives for ex-post quarreling by a contractual party. As an example illustrating our claim, we have discussed the recent closure of the Druzhba pipeline that, under normal circumstances, delivers crude oil from Russia to Europe in transit of the territory of Belarus, and secures thereby a significant part of the energy requirements for several developed economies, including Germany and various Central European countries. Based on this

example, we have argued that unwillingness to trade under the conditions of an existing contract may not be a necessary prerequisite for renegotiation to occur, when parties to the trading relationship care also about relative economic performance. Renegotiation may also occur, so we argued, when only one party is unhappy with the idea that the other party ends up with a significant surplus while the own surplus appears much smaller.

We have also shown that less expropriation of rents is to be expected between parties with concerns for relative economic performance, but that this need not necessarily imply improved incentives to invest. The reason for this result is that the relationship-specific investment improves only the value of the trade, not the outside option. Thus, even if rent expropriation is reduced in absolute terms, the deleterious effect that one party can be brought down to the level of utility corresponding to her outside option provides sufficient scope for the hold-up problem to be sustainable even between agents with concerns for relative economic performance.[6]

[6]If take-it-or-leave-it offers are not feasible, and trading is feasible at several points in time, then the situation changes dramatically. In Ewerhart (2006), we show that, for a sufficiently productive technology, concerns for relative performance allow approximating the first best incentives as parties get increasingly patient.

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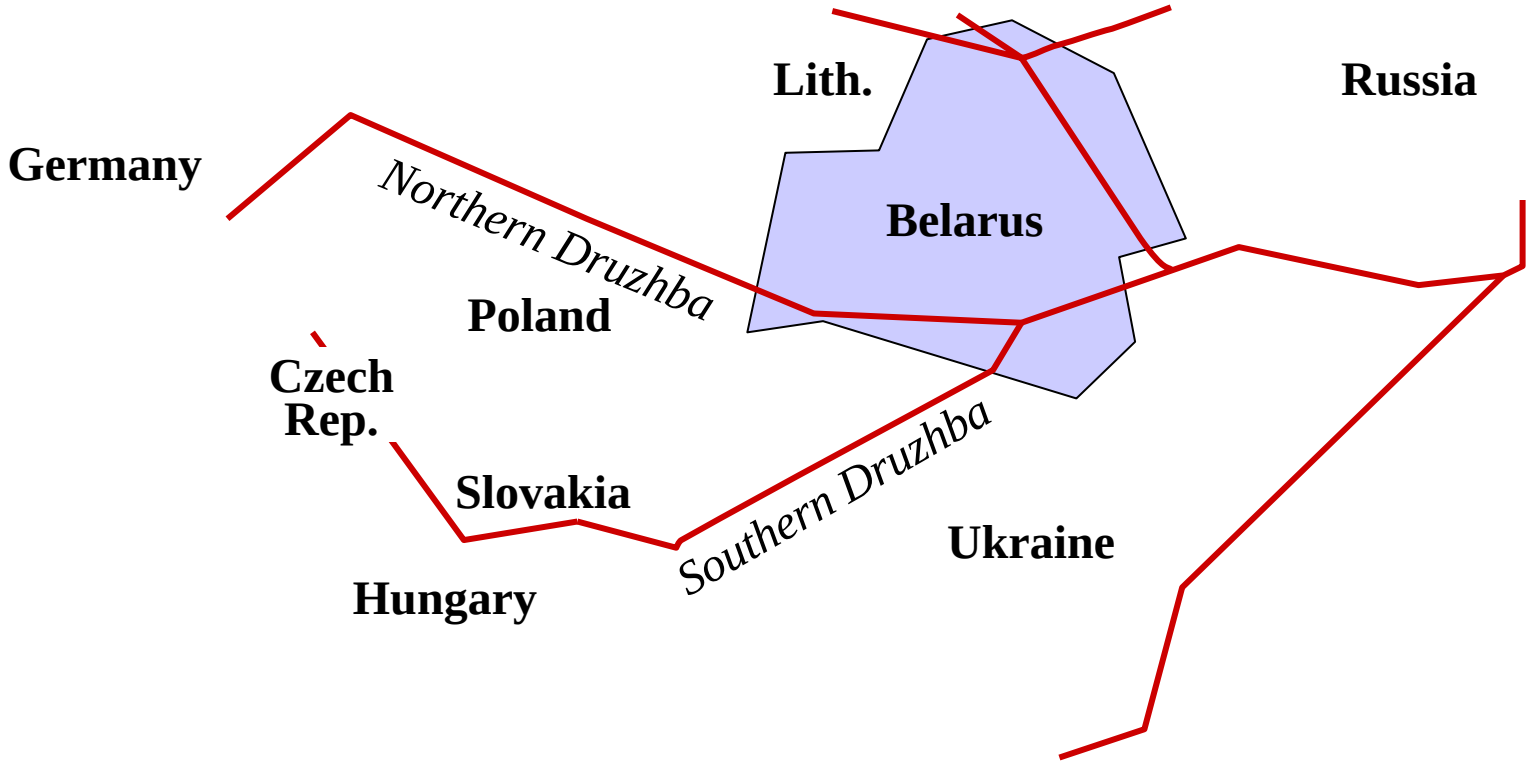

Figure 1. The Druzhba pipeline system.

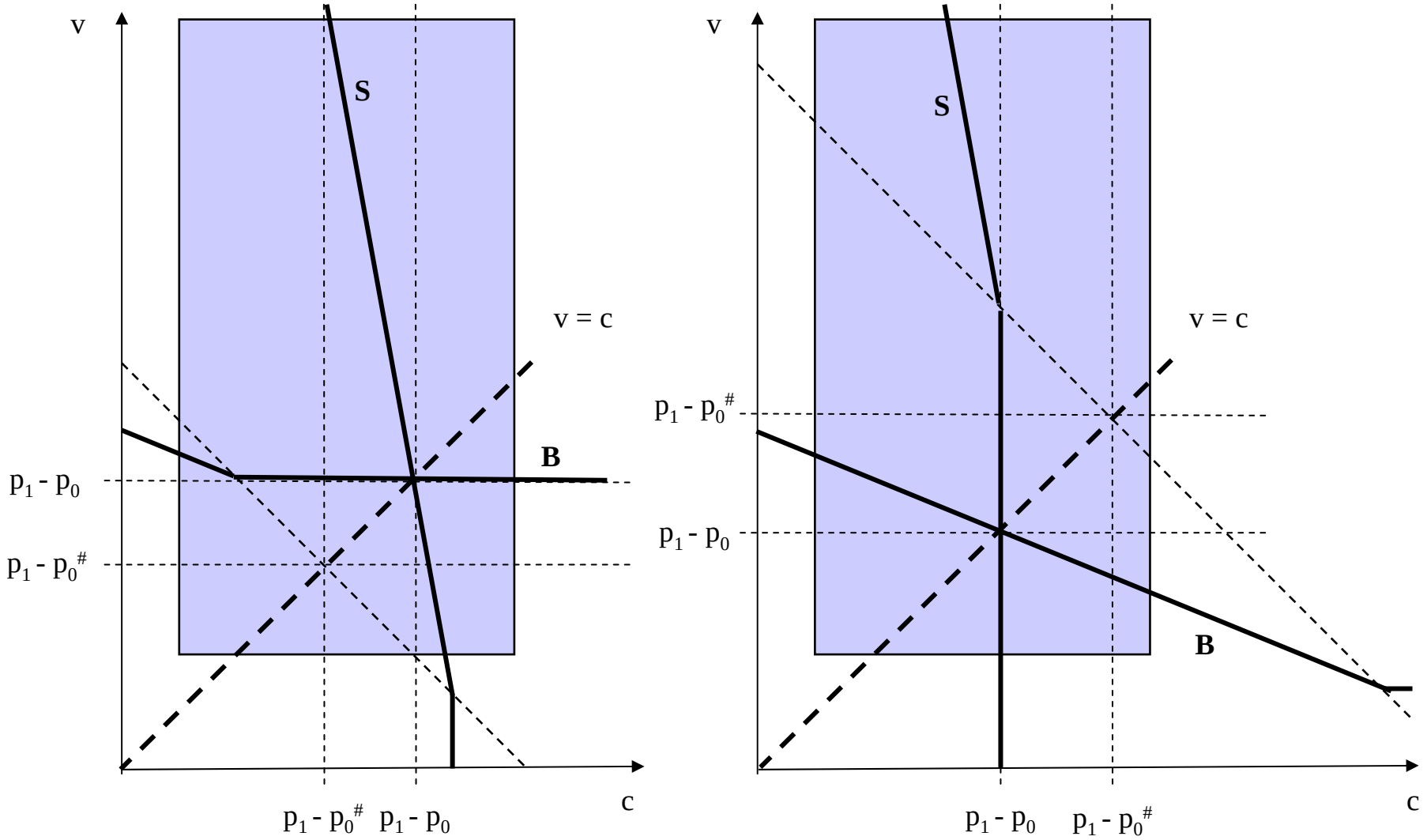

Figure 2. Indifference curves of seller (S) and buyer (B).