

**When More Than Two Come to Tango:
Discretion, Complexity and Public Contract Renegotiations in the European Union**

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Abstract

Governments often face unforeseen contingencies or constraints in specifying a complete contract that make contract renegotiations unavoidable. Although the expectation of contract renegotiations may deter cooperation between contracting parties at the outset, a relational approach to contracting facilitated by discretion in the award process might conversely help the partners to align objectives, foster collaboration, and adapt, even in the context of contract complexity and rigidity. Using new data from the Tender Electronic Daily eProcurement platform based on EU Directives on public procurement, we examine links between the way contracts are awarded (formal vs. discretionary approach) and how they are renegotiated, as well as how contract complexity interacts with discretion to influence renegotiation orientation and outcomes. We find that when contracts are awarded through procedures allowing some discretion for the government, the time to renegotiation is longer, and renegotiations are less likely to be viewed as “adversarial” by contracting parties. Greater contract complexity, however, moderates (dampens) the influence of discretion on time to renegotiation and renegotiation sentiments. We also find that discretion is positively associated with contract value changes. Contract complexity again moderates this relationship, however; more complex contracts are associated with a reduced influence of discretion on contract value changes, possibly because more “guardrails” are placed on renegotiations. The results are in line with theories suggesting the potential of a “formal relational” approach to contracting to encourage cooperation among parties and facilitate adaptation to challenging circumstances in public procurement.

Introduction

Estimates of the size of public procurement—i.e., government purchases of goods and services from the private sector—suggest that regardless of a country’s income level, public procurement represents, on average, an ample 12-14 percent of Gross Domestic Product (GDP) (Bosio et al., 2022). Empirical studies conducted in various countries and industries also find that contracts governing public procurement are frequently renegotiated (Athias & Saussier, 2007; Beuve et al., 2023; Brogaard et al., 2021; Gagnepain et al., 2013; Guasch et al., 2008; Ryan, 2020). The resulting contract modifications often involve large amounts of public money and can entail significant additional costs for the public sector. Indeed, renegotiations are typically interpreted as a sign of a flaw or failure of the contractual relationship (Guasch et al., 2008). For example, aggressive bidding by competitors in conjunction with an ex-ante lack of commitment from the government can contribute to deadline extensions and cost increases, and it is not unusual for sizable cost overruns to appear in the press. One such prominent case involved the payment by results outsourcing of probation services in England: £467 million in additional payments were made to providers above the original terms of the contracts between 2016 and 2020, and the contract was terminated early.

Negative characterizations of contract renegotiations dominate the scant empirical literature as well. Typical explanations for the need to renegotiate include: ill-conceived contracts, unforeseen events, opportunistic behavior, and winner’s curse issues (i.e., the winning bid is overly optimistic, and the party will subsequently have to renegotiate). Other reasons documented in the literature are government corruption (Guasch, 2004) and political influence, such as when firms that win bids are also politically connected in ways that help them to

renegotiate ex post contracts (Brogaard et al., 2021; Ryan, 2020). Other research explores government-led renegotiations, such as those that enable incumbent governments to circumvent budgetary rules (Engel et al., 2009). Ultimately, regardless of which party is at the origin of the contract renegotiation process, renegotiation is primarily regarded as a negative event that rarely results in a good outcome for the contractual parties.

The broader literature on public contracting also recognizes, however, that public-private contracts often consist of a complex series of transactions with changing objectives in dynamic contexts, where it is not easy to anticipate future events that may disturb the relationship (Brown et al., 2013, 2016; Heinrich & Choi, 2007; Williamson, 1985). Hence, renegotiations might also be viewed as necessary adaptations to fill in the contractual blanks of the initial agreement and to address contingencies that arise ex post (Grossman & Hart, 1986). Such unforeseen events may be exogenous (e.g., economic crises, technological innovations, legislative changes, pandemics, war, etc.) or may result from internal needs of the contractual relationship (e.g., for more efficient service management) or because of inadequacies of the initial contract design. In many such cases, renegotiations may be necessary for better or more efficient outcomes and may also be associated with greater surplus for the public (Beuve & Saussier, 2021), such as when renegotiations contribute to improved contractual mechanisms, relationships, and/or cooperation among the contracting parties (Heinrich & Choi, 2007; Spiller, 2009), as long as they also minimize the ex-post costs of making changes (Tadelis, 2012).

To date, empirical research on contract renegotiations in public procurement and their net benefits or costs for the public has lagged behind theoretical and qualitative understandings of their intent and implications. In this research, we take advantage of new European Union (EU)

directives, voted on in 2014 and applied since 2016 all over Europe, that have made it possible to increase transparency around contractual renegotiations. For the first time, these directives are concerned with both the execution of public contracts and contract award procedures, and they also require public contractors to publish information on major contract modifications as notices in the Official Journal of the European Union. We web-scraped more than 80,000 of these contract modification notices (CMNs) that were published on the Tenders Electronic Daily (TED) website between January 2016 and August 2021.¹ We also used TED contract award notices (CANs) to compile information about contracts that were not renegotiated over this period.

We draw on the existing theoretical literature on public procurement and contract renegotiations to frame our empirical analysis and yield testable hypotheses of associations between contract features and procedures—in particular, contract complexity and the use of discretion in contracting procedures to cultivate relational aspects of the contract (Brown et al., 2010; Brunjes, 2020)—and how contract renegotiations are perceived (sentiment), managed (time to renegotiation) and revalued (renegotiation outcomes). We employ ordinary least squares (OLS) regression models to investigate the hypothesized relationships between contract award approaches (i.e., the level of discretion allowed in the contract award process) and three key concepts, namely renegotiation sentiment, time to renegotiation, and renegotiated outcomes (change in contract value). Additionally, we explore the association of contract complexity in conjunction with discretion on the aforementioned three factors.

¹ More than 100,000 CMNs have been published online since 2016 on the TED website.

We find associations between the way contracts are awarded (formal vs. discretionary procedures) and how they are renegotiated. When contracts are awarded through procedures involving some government discretion, renegotiations are viewed more positively by the contracting parties, and the time to renegotiation is longer. We also find that discretion is positively associated with contract value changes. Greater contract complexity, however, dampens the influence of discretion on renegotiation sentiments and on renegotiation outcomes. More complex contracts are associated with a reduced influence of discretion on contract value changes, possibly because more “guardrails” are placed on the renegotiations. The results are in line with insights from the public administration literature that investigates complex, public-private contracts (Brown et al., 2016, 2018; Kim & Brown, 2012) and with theories suggesting the potential of a “formal relational” approach to contracting to encourage cooperation among parties and facilitate adaptation to challenging or unexpected circumstances in public procurement (Frydlinger et al., 2019, 2021). Overall, our results imply that the exercise of discretion may be underutilized in public procurement procedures in the EU, given potential advantages it may offer (compared to more rigid approaches to contracting), particularly in contexts that necessitate flexibility and adaptation.

Theoretical Background

A contract is a formal and legally binding agreement. When awarded through a call for bids, the agreement emerges from a competitive process that helps to reveal the contractor’s costs (i.e., lessening adverse selection issues). It also generally includes clauses to incentivize the contractor to perform efficiently during the contract execution (i.e., addressing moral hazard issues). If the initial contract design achieves these objectives, then contract renegotiations might

distort the safeguards and incentives generated through the call for bids and the original arrangements and diminish the effectiveness of the contractual relationship (Gagnepain et al., 2013; Guasch et al., 2008).

With public procurement becoming more complex and public-private partnerships (PPPs) playing an increasingly central role in the delivery of public services, contract renegotiations are becoming more common (Bakker, 2016; Beuve & Saussier, 2021; Brogaard et al., 2021; Ryan, 2020). Not only are contracts inherently incomplete, but complex products and services bring additional uncertainties that complicate contractual arrangements and their execution (Brown et al., 2018; Hart & Moore, 1988). In many cases, turbulent times may render renegotiations unavoidable, such as with the worldwide COVID-19 pandemic or other challenges associated with economic, political or social disruptions that vary across countries and contexts (Heinrich & Choi, 2007; Schwartz, 2020). Adaptation costs generated by one or more rounds of renegotiation can be substantial. In fact, Bajari et al. (2014) questioned economists' emphasis on private information and moral hazard as primary sources of inefficiency when they found in their study of Californian highway paving contracts that renegotiations imposed adaptation costs that were much higher in comparison. Research also suggests that oversights, omissions, or ambiguities in contracts may contribute to behaviors on the part of contracting parties that are counter-productive to a constructive collaboration and may compel renegotiations in an antagonistic setting (Covey & Merrill, 2006). This suggests that efforts should be made to employ methods that minimize the costs of disputes between contractors and buyers during renegotiations.

At the same time, Brown et al. (2010) argue that while complex contracts are more susceptible to renegotiations, the prospect of renegotiations also opens the door for the

contracting parties to explore cooperative strategies to achieve their goals. The literature on public procurement and contracting has long recognized the importance of relying on relational mechanisms, such as trust, reputation, and reciprocity, to manage contractual dynamics and minimize the likelihood of adversarial relationships emerging among the partners, particularly in complex contracting arrangements (Bertelli & Smith, 2010; Brunjes, 2020; Macneil & Campbell, 2001). Developing relational aspects of contracts—such as “guiding principles” that allow parties to use judgment as circumstances change and other informal incentives to sustain cooperation—can help to reduce contractual disputes and support win-win adaptations for the contracting parties (Baker et al., 2002; Frydlinger et al., 2019, 2021).

We follow the recent work of scholars investigating how public procurement at the contract award stage promotes the selection of a contractor that is better suited to developing relational aspects of the contract and to cooperating in turbulent times (e.g., Brunjes, 2020; Coviello et al., 2018; Decarolis et al., 2020). We aim to advance knowledge in this area by unpacking the consequences of discretion in contract execution. More specifically, we expect discretionary procedures and the use of qualitative criteria in the calls for bids and awarding of contracts to encourage or incentivize cooperative behavior and reduce opportunistic or “shading behaviors” (e.g., free-riding, shirking on quality, or deliberately undermining cooperation) when renegotiations occur (Frydlinger et al., 2019, 2021). This could contribute to less costly renegotiations and more “win-win” outcomes and even the rewarding of cooperative behaviors in contract renewals.

We also recognize, however, the potential for contract complexity to interact with discretion (Brown et al., 2010, 2013; Brunjes, 2020) or mediate the relationship between

discretionary contract award procedures and the outcomes of contract renegotiations. For instance, contracts with multiple (more than two) parties are known to increase the complexity of decision-making (Huxham & Vangen, 2013). Moreover, as costs, risks and rewards have to be allocated across multiple parties—at the award stage and as the work evolves—this can increase uncertainties and contract stipulations intended to address them, while also making the stakeholders more risk-averse in any renegotiations (Anderlini & Felli, 1999; Brown et al., 2018; FitzGerald et al., 2021). In fact, Barthélemy and Quélin (2006) constructed a measure of contract complexity as the extent to which outsourcing or procurement contracts are composed of elaborate clauses (control, incentive, price, flexibility, and end of contract clauses) aimed at addressing risk and uncertainty.

Another factor regularly identified in the literature as contributing to contract complexity is the extent to which the contracting parties makes specialized investments in the primary work of the contract, where the assets brought to the exchange relationship cannot be utilized in another contract (Brown et al., 2010). The idea is that the parties making these investments will want to ensure that they realize the expected returns and will guard against risks of the relationship terminating early through actions by the other parties. A typical way to address these risks and protect their investment in the relationship is by building conditions (e.g., of contractual breach) into the contract, stipulations for roles and responsibilities and penalties for nonperformance of responsibilities, and other required actions or procedures for dispute resolution (Joskow, 1987). These provisions will similarly increase contract complexity, but also the costs associated with crafting and enforcing the contract (Williamson, 1985). Brown and Potoski (2003) observe that services contracts are more likely to involve specialized investments,

and their outcomes are also more difficult to assess (a lower level of service measurability), adding to complexity and the costs associated with writing a formal contract.

It is also suggested that fostering trust among the contracting parties will encourage a reciprocal approach to renegotiations and help to overcome the limits to adaptability of elaborate, highly structured contracts (Poppo & Zenger, 2002). Zhang and Chen (2020) considered two (alternative) hypotheses about the relationship between contract complexity and relational governance: (1) trust reduces perceptions of vulnerability and risk among contracting parties in the face of contract complexity, and (2) contract complexity leads the parties to feel constrained in the relationship, contributing to the deterioration of cooperation and trust among them. Using a 10-item measure of complexity, their empirical analysis of construction contracts found support for their first hypothesis that a relational approach to contracting reduces the negative perceptions that arise from contract complexity, but they did not find associations between perceptions of being constrained in complex contracts and a loss of trust. We further explore these relationships in our study by considering how contract complexity interacts with a relational approach (i.e., the allowance for discretion or flexibility) in government procurement procedures at the contract award stage.

Theory-informed model and hypotheses

In the appendix, we present a formal model of contracting for public procurement with two actors: the public procurer (contracting authority) and the provider of services (winning bidder). Below we intuitively describe the logic of model and its equilibrium predictions, leading to hypotheses applied to our empirical setting that are discussed next.

We begin with a baseline contract award value and the cost of services. We establish the expectation that the public procurer and provider can negotiate (and further renegotiate) the contract value, with an upper bound value aligned with EU public procurement renegotiation directives (mandating that contract modifications should not increase the contract value by more than 50% of the original award value). We also assume two different provider types: opportunistic (short-sighted), which only considers the outcomes of the current transaction, and relational-oriented (far-sighted), which considers the outcomes of future interactions or transactions with the procurer, although the provider type is not observable to the public procurer. This follows the logic of standard models with incomplete information on player ‘types’ (Kreps & Wilson, 1982)—in our context, expressed as contracting partners. We focus on how public procurers may be uncertain about the orientation of providers, and therefore may be reluctant to employ discretion and open room for renegotiations unless the provider is perceived as relational-oriented.

In the first negotiation round, the partners decide the extent to which they will invest in their relationship and act cooperatively. They can then negotiate the contract value beyond the original baseline value. Renegotiations subsequently occur with a certain probability, given, for instance, external shocks. In the second (renegotiation) round, the contracting partners again agree on the contract value. The formal model elucidates that building relational ties between the provider and procurer requires time and effort (an initial sunk cost), but the cultivation of a more cooperative relationship also has the potential to produce payoffs in (less opportunistic) future bargaining and renegotiations. The model also yields the insight that the benefits of relationship building will increase with the probability that the contract will need modifications/adaptations.

This theorizing leads to our first hypothesis (H1a). We expect that public procurement procedures that allow the government greater discretion in making contract awards will contribute to more cooperation among partners when compared to more rigid, formalized procedures (e.g., Brunjes, 2020; Frydlinger et al., 2019, 2021). In other words, allowing more discretion in the selection of the contractor will support the development of relational mechanisms that should lead to a reduced degree of deceptive or opportunistic contract renegotiations.

Secondly, we expect that greater discretion in making contract awards (that allows for a more cooperative approach to execution of the contract work) will increase the length of time to the first renegotiation of the contract, assuming that the parties would be less likely to renegotiate in the face of smaller shocks to the arrangements or to opportunistically call for renegotiations (H1b). Quick renegotiations strongly suggest opportunistic behavior and seriously flawed concession and regulatory design (Guasch, 2004), so we expect discretion to be associated with a longer time to renegotiations. In sum:

Hypothesis 1a: The higher the levels of discretion accorded to the government at the contract award stage, the higher the likelihood that the contracting parties will approach renegotiations with a positive, cooperative sentiment vs. deceptive or opportunistic behavior.

Hypothesis 1b: The higher the levels of discretion accorded to the government at the contract award stage, the longer the time to the first renegotiation of the contract.

As discussed above, it is also important to consider the level of complexity in a contractual arrangement and how it may interact with discretion or mediate the relationship between discretion in contract award procedures and the contract renegotiation outcomes. In the

appendix, we model switching costs as a function of contract complexity: more complex contracts, composed of elaborate clauses addressing greater uncertainties and challenges, would not only be costly to execute, but would also be more specific or tied to the current contract arrangements and partners. As such, switching costs would ensure procurers would not have incentives to negotiate with opportunistic providers (Klein, 1996).

Brown et al. (2018) argued that complex contracts will not “bear fruit” in the absence of a cooperative approach to the relationship that discourages the parties from acting in self-interested, opportunistic ways (e.g., exploiting ambiguities or information asymmetries inherent in complex contracts). If contract complexity leads the contracting parties to layer on more rules, clauses, and schedules at the outset of the relationship (i.e., guardrails against opportunism and uncertainties), it may depress the influence of discretionary award criteria or procedures and reduce the likelihood that the parties approach renegotiations with a positive sentiment (H2a). Similarly, if contract complexity contributes to more rigidities and circumstances requiring adjustments to the arrangements, it could dampen the effects of discretion and reduce the time to renegotiation (H2b). We accordingly set forth the following hypotheses:

Hypothesis 2a: Higher levels of contract complexity will dampen (reduce) the positive association of discretion with the parties’ (cooperative) sentiment toward renegotiations.

Hypothesis 2b: Higher levels of contract complexity will dampen (reduce) the positive association of discretion with the length of time to contract renegotiations.

Incomplete contracts present a trade-off between using first-price auctions (to obtain a more competitive price) and poor ex post performance that induces renegotiations (Decarolis, 2014). This is at least in part because bids are not binding commitments, and private contractors

will anticipate future renegotiations. The cost of adapting contracts when the parties cultivate stronger relational ties should be lower compared to those bound by more formal agreements, given that contracting parties should be more likely to share common views of the contract objectives (i.e., lowering negotiation costs) and should be less likely to engage in ex-post shading (Frydlinger et al., 2019). In addition, a more cooperative relationship should compel the parties to find solutions that help them to avoid costly renegotiations. The relational ties and resulting increased prospects of contracting again in the future might also create incentives for the parties to withstand larger costs in turbulent times without renegotiating (Greif, 1993), expanding the range of perturbations for which contracts are self-enforcing (Klein, 1996). This leads to our next hypothesis (3a).

Hypothesis 3a: The higher the levels of discretion accorded to the government in public procurement, the lower the contract value change ensuing from renegotiations.

Alternatively, it is possible that a more relational approach to contracting—afforded by greater discretion at the contract award stage—allows for larger changes in the contract value through negotiations, if the parties are less constrained by price and control clauses or other contract rigidities (Brown et al., 2010). Public procurement contracts often carry more rigidity clauses in order to limit hazards from political opposition and other opportunistic interests (Beuve et al., 2019), as well as to prevent corruption that can take the form of more frequent and costly renegotiations (Brogaard et al., 2021; Ryan, 2020). If the contracting parties enter renegotiations with trust, respect, and confidence that each will act fairly and promote their collective interests (Frydlinger et al., 2019), they may be more open to a larger change in the

contract value, particularly in the case of unforeseen circumstances that can alter costs and benefits of the contracting arrangements for the parties.

Hypothesis 3b: The higher the levels of discretion accorded to the government in public procurement, the higher the contract value change ensuing from renegotiations.

These two alternative hypotheses underscore that the advantages of discretion in public procurement depend in part on the extent to which they are used for public benefit (collective gains) versus exploited for private gains (Decarolis et al., 2020). We test these hypotheses for both the contract value change measured as the spot modification percentage change and the contract-level cumulative value change.

We similarly expect contract complexity to depress the influence of discretionary award criteria or procedures on the contract value change that results from renegotiations. However, because we hypothesize that discretion could have either a positive or negative association with contract value change, we have a nondirectional expectation for how contract complexity will change this outcome of renegotiations.

Study Data and Methods

Empirical setting

Our empirical setting for this research corresponds to public procurement within the European Economic Area. We draw from a subset of the Tenders Electronic Daily (TED) data, encompassing information on both renegotiated contracts and those that were not renegotiated. Article 72 of the 2014/24/EU directive stipulates that contracts may be modified (or renegotiated) *without a new procurement procedure* in any of the following cases:

- (a) where the modifications, irrespective of their monetary value, have been provided for in the initial procurement documents in clear, precise and unequivocal review clauses, which may include price revision clauses or options;
- (b) for additional works, services or supplies by the original contractor that have become necessary and that were not included in the initial procurement, where a change of contractor cannot be made for economic or technical reasons such as requirements of interchangeability or interoperability with existing equipment, services or installations procured under the initial procurement;
- (c) where *all* of the following conditions are fulfilled:
 - (i) the need for modification has been brought about by circumstances that a diligent contracting authority could not foresee;
 - (ii) the modification does not alter the overall nature of the contract;
 - (iii) any increase in price is not higher than 50% of the value of the original contract or framework agreement. Where several successive modifications are made, that limitation shall apply to the value of each modification. Such consecutive modifications shall not be aimed at circumventing this directive;
- (d) where a new contractor replaces the one to which the contracting authority had initially awarded the contract;
- (e) where the modifications, irrespective of their value, are not substantial.

Contracting authorities that modify a contract in the cases set out under points (b) and (c) above are required to publish a notice to that effect in the Official Journal of the European Union. These constitute the CMNs data that we use in this study (more than 80,000 gathered

though web-scraping the information published on the TED website between January of 2016 and August of 2021). We then merged the CMNs data with contract awards (CANs) data, which is publicly available at the TED website (up to 2020).²

Description of sample and measures

The public data from which we draw our analytic sample include all of the CANs from 2016 to 2020 and their respective CMNs through the end of September 2021 (for those that have been renegotiated). We disregard information from CANs before 2016, as older contracts could have been renegotiated before the new European directives were in place; the directives were voted on in 2014 but did not apply all over Europe until 2016. This assures that we only have CANs that, if renegotiated, should have the respective CMNs listed in our database. In cleaning the data, we excluded contracts: i) with more than 10 associated CMNs, which was less than 1% of the total number of contracts³; ii) with contract award value smaller than 1,000 Euros (approximately 3% of the sample); and iii) those with contract value renegotiations that reduced or increased the value by more than 90% (less than 2,000 observations).⁴ The data cleaning yielded an initial sample size of 745,410 CANs. Given that contract duration was not a mandatory field of the CANs in TED, we were only able to identify contract end dates for contracts with a CMN (the ones which ever got renegotiated within the timeframe of this study). In the absence of a contract

² <https://data.europa.eu/data/datasets/ted-csv>

³ This corresponds to 3% of our renegotiated contracts. We exclude those observations as they likely refer to duplicates in the data that reflect misreporting or sequential renegotiations related to multiple contract lots. The contract with most associated renegotiations had 285 CMN. Although there were only 428 contracts with more than 10 renegotiations, they corresponded to 12,553 CMNs.

⁴ These outliers in contract award value and further change might represent misreporting because of wrongly inputting the contract award or renegotiated values in 'millions', for instance. We rather drop these observations to be sure our data is precisely representing the percentage change in renegotiations.

end date, we are not able to observe whether those CANs were ever renegotiated or never renegotiated. Therefore, the analytic sample – used in the regression analysis – is intentionally restricted to the 12,189 CANs with observed renegotiations within the study sample (1.6%), corresponding to a total of 21,117 CMNs.

We performed descriptive analyses to compare contracts that were ever renegotiated to the larger sample of CANs that do not have an end date (and may yet be renegotiated). Contracts for which we do not observe an end date (or renegotiation) over the study period had lower average contract values (see Figure 1) and were more likely to be supply contracts and less likely to be work contracts. They were also significantly more likely to be framework agreements⁵ and to be awarded by a central purchasing body, and they were significantly less likely to be subcontracted or to involve joint procurement. We did not find any difference in whether discretion was allowed in the contract procedures by whether or not we have an end date for the contracts.

Figure 2 presents the number of renegotiation (CMNs) as a proportion of the number of contracts (contract award notices, CANs) by country. It shows a wide distribution of the proportion of renegotiations across the EU countries. Hungary leads by far (0.4 CMNs per CAN on average), followed by Slovakia (0.15 CMNs per CAN), and then the Czech Republic and Bulgaria with 0.08 CMNs per CAN on average.⁶ Figure 3, focusing on the subsample of contracts that were renegotiated, depicts the average number of renegotiations *per renegotiated*

⁵ A framework agreement is an “umbrella” agreement executed with one or more providers that enables the buyer to place orders for services without lengthy full tendering exercises.

⁶ In absolute numbers, Hungary and Germany lead with more than 3,000 CMNs each and Czechoslovakia, Poland and Bulgaria follow with more than 2,000 CMNs each.

contract (i.e., CANs with at least one CMN) by country. The average number of renegotiations per renegotiated contract ranged from one to approximately four, with Germany, the Netherlands and Czechoslovakia topping the rest of the EU countries and five countries averaging only one renegotiation (Sweden, Norway, Malta, Iceland and Cyprus). These distributions suggest the importance of controlling for country fixed effects in the analysis of how contract award discretion relates to renegotiations.

Figure 1 – Contract award values for renegotiated and non-renegotiated contracts (CAN-level data)

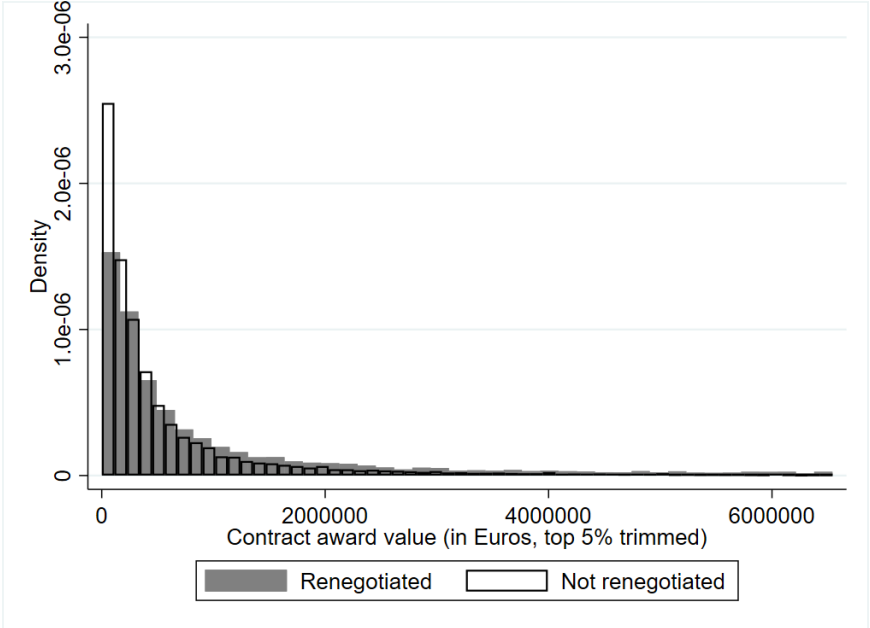


Figure 2 – Proportion of renegotiations (CMNs) per number of contracts (CANs) by country

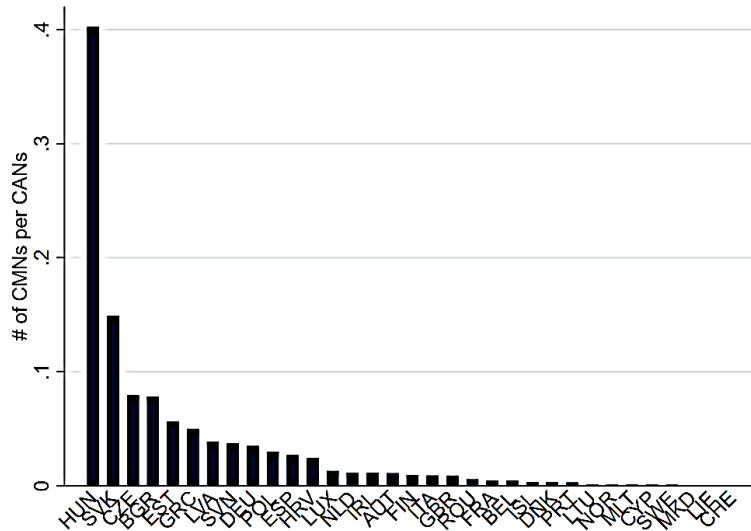
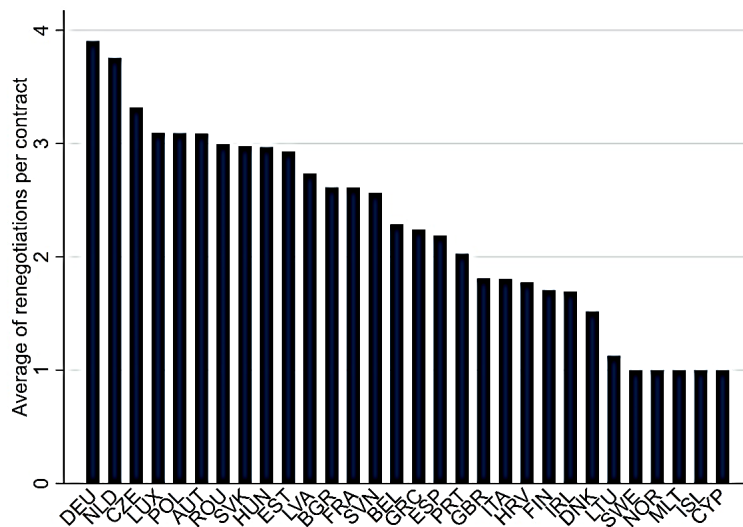


Figure 3 – Average number of renegotiations (CMNs) per renegotiated contract (CANs with at least one CMN) by country



In addition, it appears that the number of renegotiations was relatively higher post-COVID (through end period of our data, August 2021). In fact, more than 10% of all CMNs within the sample directly referred to the pandemic as reasons for contract renegotiation.

Although CMNs were most often related to “construction work”, per the 2-digit initial Common Procurement Vocabulary (CPV) code⁷, different CPV-type contracts were renegotiated with comparable frequency at an average of about four renegotiations per contract.

Dependent variable measures. We constructed three dependent variables for the analysis of how discretion in contract awards affects renegotiations *orientation* and *outcomes*. The first two are related to the *renegotiation orientation*: the *sentiment of renegotiation* and *time to renegotiation*. The sentiment captures whether the renegotiations were more positive or negative, relying on a sentiment analysis (Jockers & Thalken, 2020) of the stated reasons for contract modification. The information for this measure was drawn from an open text field that describes the motivation for renegotiations from the perspective of the contracting parties. These data were used to generate average *polarity scores*, where polarity score values less (more) than zero indicate negative (positive) sentiments, and a value of zero represents a neutral sentiment (i.e., interval [-1,+1]). This method draws on a dictionary following a natural language processing framework⁸ for sentiment analysis (Nelson et al., 2021). Since the contracts in our sample involve numerous European countries and include textual information in various local languages, we translated them into English to allow for consistent text analysis. In this approach to classification, “positive” renegotiations were assumed to be “cooperative,” while “negative” renegotiations were regarded as adversarial. For instance, renegotiations classified as negative often refer to deadlines, emergencies, and “massive disturbances.” Neutral renegotiations are often brief and generic, for instance, “circumstances were known only after starting

⁷ Standard system of classification for public procurement.

⁸ This is based on open-source Python’s *TextBlob* library for sentiment analysis.

construction.” Positive renegotiations typically indicate joint efforts to achieve collaboration, such as “a careful and administratively coordinated process of purchasing”, “safety-relevant requirements” and “changes due to quality assurance.”

The second dependent variable, *time to renegotiation*, captures another angle of orientation. It is constructed as the time in days from the date of the contract award to the date of the first contract renegotiation. We take the logged value of the number of days to renegotiation given the long right-hand tail (skew) in the distribution of this measure.

To capture the *renegotiation outcomes*, we utilize a third dependent variable that considers the *change in contract value* from the initial contract award to the renegotiated contract value. This is measured in two ways: (a) the *spot modification percentage change* (considering the contract value just before a specific contract modification) and (b) the *cumulative value change* (considering the contract value up to that modification).

Independent variables. In identifying the level of *discretion* in the contract award procedures, we followed Decarolis et al. (2020) and assessed discretion along two dimensions: the procedure type and the award criteria. We expect two types of procedures – “open procedures” (OPE) and “restricted procedures” (RES) – to allow fewer opportunities for contracting authorities to exercise discretion, as these do not involve rounds of negotiation with the bidders. While OPE is a one-stage process through which any organization can respond to the advertised contract notice and submit a tender, RES is a two-stage process. In RES, suppliers are first shortlisted, and then all tenders are evaluated in line with the award criteria and methodology set out in the tender documentation. The other procedures allow room for negotiation with bidders during the procurement process; these include “competitive dialogue”

(COD), “negotiated procedures with prior publication” (NIC/NIP), and “negotiated procedures without prior publication” (NOC/NOP).

In addition to the contract award procedure type, there is also potential for contracting authorities to have higher discretion in making contract awards based on the award criteria. We distinguish the “lowest price” criterion from the “most economically advantageous tender” (MEAT), where discretion is greater for the latter. We simplify this information on the award criteria by constructing a binary measure that takes a value of 1 for higher discretion awards and 0 if the lowest price criterion was applied. We also created another measure of the level of discretion with three values that considers both the contract award procedure and award criteria in characterizing discretion in renegotiations: (i) no discretion on these dimensions, (ii) discretion associated with either procedure type or award criteria, and (iii) discretion in both procedure type and award criteria.⁹ We use this measure that combines information on discretion in the contract award procedure and the award criteria as our primary measure of discretion in the analysis.¹⁰

The other primary independent variable of interest is *contract complexity*, which we operationalized using multiple indicators that describe the number of parties to arrangement, the structural complexity, and the primary work of the contract. We used measures of multiple contract authorities, multi-country contracts, and group awards to create an indicator of multi-

⁹ Our analyses do not consider contracts awarded “without prior publication of a contract notice” (AWP), as we are not able to determine the level of discretion involved in the procurement process; these contracts constitute less than three percent of the analytic sample.

¹⁰ In separately estimated regression models, we entered the two measures of discretion in the contract award procedures as individual predictors. Both predict the renegotiation outputs in the same direction, so we use the combined measure in our primary models for simplicity and efficiency/precision.

party contracts. We captured structural complexity with measures of whether the contract was subcontracted, if it was a framework agreement, and whether it involved joint procurement. And we distinguished simple supply (procurement) contracts from more complex work or service contracts, in which the parties may be more likely to bring contract-specific investments to the relationship (Brown & Potoski, 2003). We combined these indicators into a scalar measure that takes on values from zero (no contract complexity) to five (including all of the above dimensions of complexity). About 4 percent of the contracts in our sample were not complex (0 on the scalar measure); approximately 30 percent of the contracts were complex along one of these dimensions; a little over 44 percent had two dimensions of complexity, and the rest (a little over 20 percent) had three or more dimensions of complexity. The most common aspect of complexity was a work or service contract (about 79 percent of the contracts), followed by multiparty awards and subcontracted arrangements (about 21 percent of the contracts each).

Control variables. We developed a set of control variables to represent key factors that might mediate the relationship between discretion in contract awards and the renegotiation outcomes, including *renegotiation reasons or context*, and *contract features*. Although we do not construct measures for every possible reason for renegotiations, we distinguished two reasons that were particularly relevant for our period of study. One of these is a binary measure that indicates whether the contract was renegotiated in the context of the COVID-19 pandemic. The other binary measure is intended to account for Green Public Procurement (GPP) initiatives that have shaped procurement decisions for sustainability-related reasons. Both of these control variables were generated based on word searches of the web-scraped data that included the “reasons for modification” and “modification description”. The coding of COVID-19 context

was based on the presence of specific keywords related to the pandemic (i.e., COVID, pandemic, lockdown, SARS). In the coding of GPP, we followed Badell and Rosell (2021) and executed a word search for “environment” and “sustainable.” Another context variable—the Stringency Index from OxCGRT Hale et al. (2020)—indicates the level of government containment measures in response to COVID-19 at the time of renegotiation. The stringency index is a composite measure based on nine response indicators that account for school closures, workplace closures, and travel bans, re-scaled to fit within the range of 0-100 (where 100 = strictest).

The final set of control variables describe specific contract features, including the contract initial value, whether the supplier was a small or medium enterprise (SME), the contracting authority type (also following TED coding¹¹), the country in which the contract was based, and the CPV code. We use the 2-digit CPV code for procurement class fixed effects and control for contract signature and renegotiation dates (as time fixed effects) in the empirical models. Table 1 presents descriptive statistics for each of the measures used in this study for the sample of renegotiated contracts. The last two columns show the mean and standard deviation when we consider only the observations with no missing information for any of the measures we use (i.e., ‘full data’, representing the observations used in regressions). We see no statistical differences between these and the full sample metrics.

¹¹The types of contracting authority in the TED database consider 10 different categories, including ‘regional or local authority’, ‘national or deferral agency’, and more specific ones such as ‘water, energy, transport and telecommunication sectors’.

Table 1 – Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Mean Full data, w/ no missing (n=16,978)	Std. Dev.
Polarity Score (sentiment)	20958	.045	.119	.044	.119
Days to renegotiate	21112	522.282	358.191	527.715	347.702
ΔContract Value (% , spot modification)	20487	3.71	21.14	3.542	21.289
ΔContract Value (% , cumulative)	20483	7.62	26.26	7.326	26.06
High-discretion (binary, CAN-level)	21117	.578	.494	.596	.491
Complexity index (CAN-level)	17164	1.356	.915	1.358	.918
COVID-related (binary)	21117	.1	.3	.097	.296
Sustainability-related (binary)	21117	.029	.167	.031	.174
Stringency index	21117	30.883	31.727	28.665	31.254
Contract award value (Euros, CAN-level)	20507	10651477	1.783e+08	10255619	1.832e+08
SME (binary, CAN-level)	20841	.566	.496	.591	.492

Notes: Notes: All these observations consider the CMN as unit of analysis, but some of the measures refer to the CAN (such as the discretion and complexity measures). Other control variables included in regression specifications as fixed effects are: country, contracting authority type (following TED dataset, 10 categories including, for instance, ‘regional or local authority’ and ‘ministry or any other national or federal authority’), CPV code (2-digit), and CAN and CMN dates (year and month interactions).

Methods

We conduct Ordinary Least Squares (OLS) regression analyses, including regressions with and without fixed effects, to test the hypotheses that assert a relationship between the level of discretion in the contract award and renegotiation sentiment (H1a) and time to renegotiation (H1b). In investigating H1a, we estimate an OLS model with the polarity score that captures the sentiment of renegotiations (negative/neutral/positive) as the dependent variable and the combined discretion measure as the key independent variable of interest, while including controls for the other measures described above. We then similarly estimate an OLS model with time to renegotiation as the dependent variable, discretion as the key independent variable, and the same set of control variables to test H1b. To assess how contract complexity interacts with discretion in influencing the parties’ sentiment toward renegotiations (H2a) and time to

renegotiation (H2b), we interacted the measures of discretion (the combined measure) with the scalar measure of contract complexity and added the interaction term to the models predicting renegotiation sentiment and time to renegotiation. In these models estimated on the sample of contract renegotiations (CMNs), we clustered the robust standard errors at the contract (CAN) level. Of the 21,117 CMNs, there are 12,224 clusters, of which 37 percent were renegotiated only once, and 22% twice (median=2, mean=2.8, s.d.=2.2). As Abadie et al. (2023) show, because of the large fraction of contracts with a single renegotiation, there is some risk that our standard errors will be inflated, but this reduces the risks of false positives, a tradeoff we accept.

To investigate H3a and H3b, we use the two different measures of contract value change as the dependent variables—namely (i) the contract value change per CMN, which illuminates the effect of discretion on individual modifications, and (ii) the cumulative contract value change since the initial CAN award value, which enlightens us about the effect of discretion on the overall change in a given contract's value. Assuming again that contract complexity moderates the influence of discretion in contract renegotiations, we estimated the same models predicting the change in contract value for a given renegotiation with the interaction between discretion and contract complexity included. Because the model with cumulative contract value change is estimated at the contract level, we do not cluster the standard errors by contract in this model.

Results and Discussion

In this section, we begin by assessing our hypotheses regarding the renegotiation orientation (H1 and H2), then investigate the association between discretion and complexity with renegotiation outcomes, (H3) and follow with some robustness checks of the results.

Renegotiation orientation: sentiment and timing of renegotiation

Sentiment of renegotiations. In Table 2, we present the results of the regressions estimated to assess the relationship between discretion (or a relational approach to contracting) and the sentiment of the renegotiations. There are four alternative specifications shown in this table: (1) no controls; (2) interaction with complexity added; (3) controls added, and (4) fixed effects (FE) added for country, contracting authority, CPV, CMN dates, and CAN dates.

Table 2 – Associations between discretion and contract complexity and renegotiation sentiment (H1a and H2a)

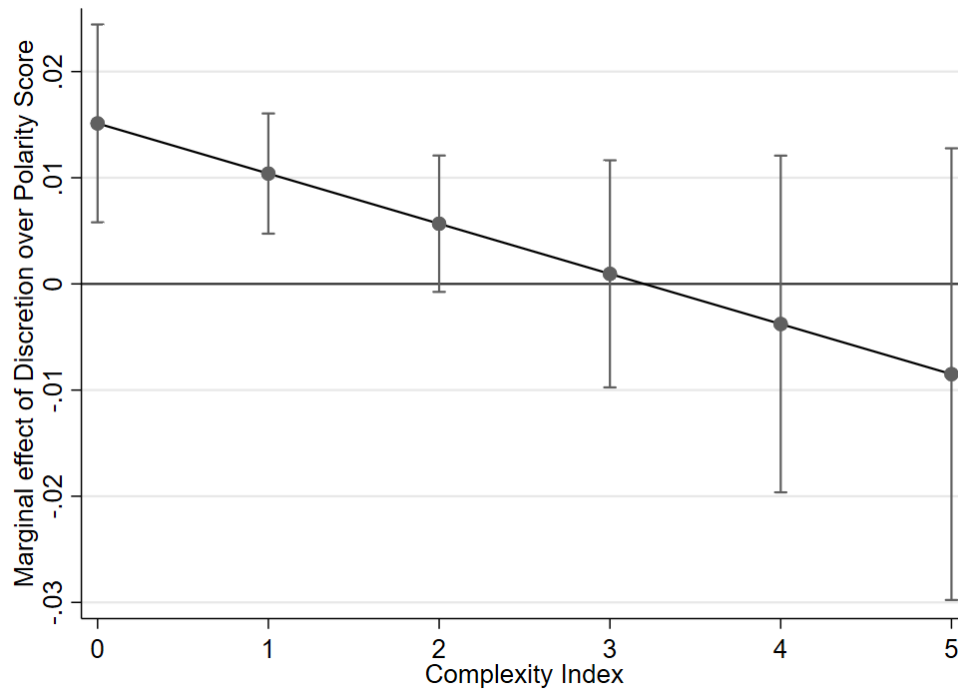
OLS regressions (CMN-level, clustered at CAN)	(1) No Controls	(2) Add interaction	(3) Controls	(4) FE
DV: Polarity Score				
Hypothesized relationships				
High-discretion	0.0110 (0.0000)	0.0226 (0.0000)	0.0230 (0.0000)	0.0151 (0.0015)
Complexity index	0.0003 (0.8145)	0.0057 (0.0224)	0.0056 (0.0235)	0.0026 (0.2958)
High-discretion * Complexity index		-0.0089 (0.0039)	-0.0086 (0.0051)	-0.0047 (0.1016)
Control variables				
COVID-related (binary)			-0.0187 (0.0000)	-0.0155 (0.0003)
Sustainability-related (binary)			0.0153 (0.0020)	0.0101 (0.0486)
Stringency Index			0.0000 (0.3813)	0.0001 (0.6968)
Contract award value			0.0000 (0.7437)	-0.0000 (0.4988)
SME (binary)			0.0085 (0.0006)	0.0096 (0.0001)
Country, contracting authority, CPV, CAN and CMN dates FE	N	N	N	Y
Constant	0.0371 (0.0000)	0.0306 (0.0000)	0.0255 (0.0000)	0.1768 (0.0040)
Observations	17,021	17,021	16,996	16,992
R-squared	0.0021	0.0032	0.0067	0.0647

Notes: The table presents OLS regression estimates explaining the renegotiation sentiment, proxied by the polarity score (as detailed in the methodological section). Specifications 1 to 4 differ only by the set of regressors included. Robust standard errors are clustered at the CAN level (p-values in parentheses).

The findings presented in Table 2 provide support for H1a. We can see that the coefficient for *high-discretion* is statistically significant and precisely estimated ($p < 0.01$) across specifications, with a coefficient value of $\beta = 0.015$ in the final specification including the interaction with complexity, controls, and fixed effects. Given the mean value of the polarity score (0.045), this represents an increase of one third of the mean value (in the positive sentiment toward renegotiations) if we do not consider the interaction with contract complexity. While the scalar measure of complexity is not a statistically significant predictor in this model, the coefficient on the interaction between complexity and discretion is negative in sign and statistically significant at $p < 0.01$ in the second and third models and weakly significant in the model including FEs (at $p = 0.10$). This finding lends some support to H2a that higher levels of contract complexity are likely to reduce the positive association of discretion – in this case by about one third, coefficient = -0.0047) – with the parties' (cooperative) orientation toward renegotiations. Figure 4 plots the marginal effects for our discretion measure at the different levels of complexity, showing positive and statistically significant associations at initial levels, but not as precisely estimated as contract complexity increases.

Interestingly, both COVID and sustainability – as reasons for modifications – are also statistically significant predictors, albeit with opposite signs. While renegotiations for COVID-related reasons are negatively associated with the renegotiation sentiment, sustainability-related renegotiations are positively associated with the sentiment at renegotiation. Small and medium enterprises were likewise statistically significant and positive predictors of the polarity (sentiment) score.

Figure 4 – Marginal effects of *High-discretion* over *Polarity Score* (sentiment) by the level of contract complexity



Notes: The figure shows 95% confidence intervals; standard errors are estimated by the delta method.

Time to renegotiations. Table 3 presents the findings of the model that estimates the relationship of a high level of discretion at the time of the contract award to the time to renegotiation (in days, logged value) to test H1b; the interaction term with contract complexity is added to the model to test H2b. Focusing on the final specification in the table including the interaction with complexity, controls, and fixed effects, a high level of discretion is a positive (and statistically significant) predictor of the time to renegotiation (confirming H1b). The mean logged value of time to renegotiation is 5.93 and the coefficient on discretion is 2.66, implying an approximately 45% increase over the mean time to renegotiation when there is a high level of discretion in the contract award process, but without considering the interaction with complexity.

Contract complexity is not a statistically significant predictor of time to renegotiation, but when interacted with discretion, the coefficient value is negative (and statistically significant at $p < 0.01$), again suggesting that complexity moderates (reduces) the association of discretion with the time to renegotiation, as hypothesized in H2b.

Table 3 – Associations between discretion and contract complexity and time to renegotiation (H1b and H2b)

OLS regressions (CMN-level, clustered at CAN)	(1)	(2)	(3)	(4)
DV: Ln(Days to Renegotiation)	No	Add	Controls	FE
	Controls	interaction		
Hypothesized relationships				
High-discretion	-1.3409 (0.0276)	0.7975 (0.4732)	0.9460 (0.3947)	2.6653 (0.0178)
Complexity index	0.1765 (0.5663)	1.1691 (0.0169)	1.1399 (0.0205)	0.6475 (0.2300)
High-discretion * Complexity index		-1.6436 (0.0089)	-1.6008 (0.0111)	-1.9711 (0.0017)
Control variables				
COVID-related (binary)			-4.2384 (0.0000)	-4.4004 (0.0000)
Sustainability-related (binary)			-0.4398 (0.8037)	-0.1244 (0.9331)
Stringency Index			0.0436 (0.0000)	-0.0171 (0.5936)
Contract award value			-0.0000 (0.2581)	-0.0000 (0.3489)
SME (binary)			-0.5530 (0.3341)	0.5065 (0.3786)
Country, contracting authority, CPV, CAN and CMN dates FE	N	N	N	Y
Constant	7.9689 (0.0000)	6.7872 (0.0000)	6.2112 (0.0000)	25.5176 (0.0003)
Observations	17,137	17,137	17,122	17,118
R-squared	0.0006	0.0014	0.0051	0.0775

Notes: The table presents OLS regression estimates explaining the renegotiation orientation in terms of the ‘timing of renegotiation’, proxied by the number of days from contract award to the renegotiation date (logarithmic form, as detailed in the methodological section). Specifications 1 to 4 differ only by the set of regressors included. Robust standard errors are clustered at the CAN level (p-values in parentheses).

Change in contract value at renegotiation and cumulative contract value change

Tables 4 and 5 present our findings investigating the associations between a high level of discretion in the contract award process and the change in contract value. We evaluate the hypothesis that higher levels of discretion lead to a lower contract value change (H3a) against the alternative hypothesis that higher levels of discretion are associated with a larger contract value change (H3b) at renegotiation, as discussed above. Table 4 shows the results from the model with the contract value change measured as the *spot modification percentage change*, and Table 5 presents the findings from the model with the *cumulative value change* at the contract level as the dependent variable, which considers the total effect of successive renegotiations on the contract value. The same four specifications are included in each table, adding the interaction with contract complexity, the controls, and fixed effects, although the models in Table 5 do not include standard errors clustered by contract, given that it is a contract level estimation.

The results in Table 4 (looking at the final specification) show a positive, statistically significant relationship between a high level of discretion and the percentage (spot) change in contract value. The mean percentage change in contract value is 3.71, and the coefficient on the discretion variable (1.76) suggests that discretion increases the percentage point change in contract value by nearly 50 percent. One possible explanation is that public procurement with higher discretion or a more relational approach to contracting is less likely to turn to formal renegotiations when the anticipated changes in value are small (Frydlinger et al., 2019, 2021), i.e., minor adaptations would be made collaboratively and without a renegotiation of the contract.

Table 4 – Associations between discretion and contract complexity and renegotiation outcomes: Change in contract value (CMN-level, spot renegotiations) (H3a and H3b)

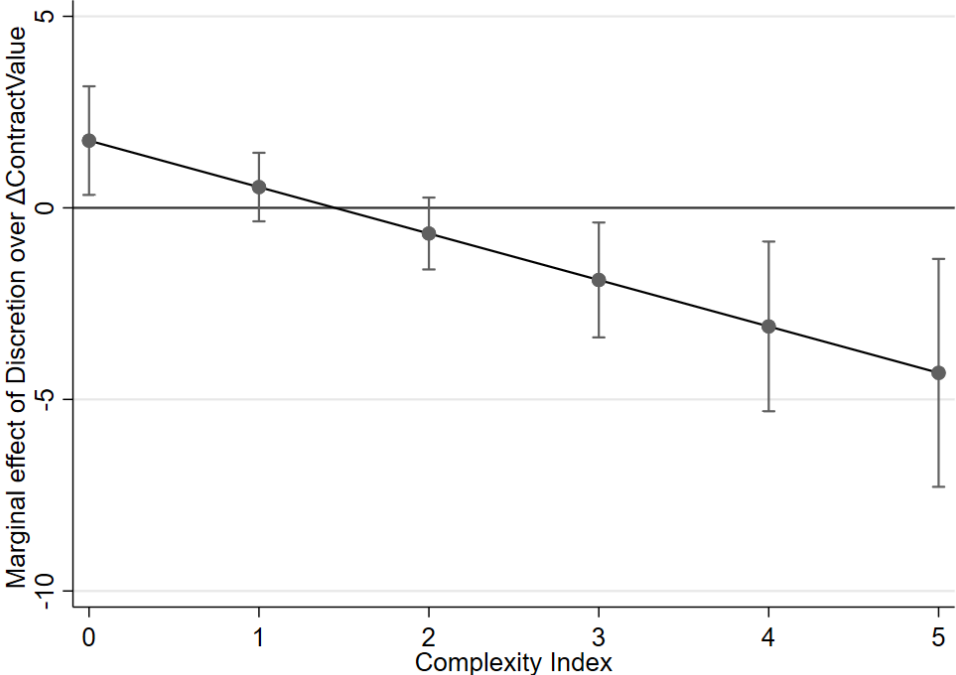
OLS regressions (CMN-level, clustered at CAN)	(1) No Controls	(2) Add moderation	(3) Controls	(4) FE
DV: ΔContractValue (%)				
Hypothesized relationships				
High-discretion	-0.0110 (0.9745)	1.3139 (0.0595)	1.3947 (0.0462)	1.7552 (0.0152)
Complexity index	0.2577 (0.2094)	0.8727 (0.0050)	0.8622 (0.0056)	0.1030 (0.7641)
High-discretion * Complexity index		-1.0185 (0.0137)	-1.0038 (0.0150)	-1.2124 (0.0031)
Control variables				
COVID-related (binary)			-1.7468 (0.0086)	-2.3502 (0.0009)
Sustainability-related (binary)			0.8654 (0.4003)	0.3456 (0.7175)
Stringency Index			0.0115 (0.0442)	0.0019 (0.9347)
Contract award value			-0.0000 (0.3553)	-0.0000 (0.3158)
SME (binary)			-0.1769 (0.6091)	0.5855 (0.0987)
Country, contracting authority, CPV, CAN and CMN dates FE	N	N	N	Y
Constant	3.2173 (0.0000)	2.4852 (0.0000)	2.3649 (0.0000)	9.6173 (0.1068)
Observations	17,140	17,140	17,125	17,121
R-squared	0.0001	0.0006	0.0013	0.0611

Notes: The table presents OLS regression estimates explaining the renegotiation outcomes in terms of the ‘change in contract value’, proxied by the percentage change in each renegotiation (as detailed in the methodological section). Specifications 1 to 4 differ only by the set of regressors included. Robust standard errors are clustered at the CAN level (p-values in parentheses).

We again see that the interaction between discretion and complexity is negative in sign and statistically significant. Figure 5 plots the marginal effects of discretion considering the different levels of complexity. The coefficient magnitude implies that the percentage change in contract value is smaller when contracts are more complex, with greater rigidity possibly forcing the parties to the renegotiation table to make changes. Figure 5 also shows negative value changes for the highest levels of complexity, although the estimates are less precise, suggesting

that support may exist for both of our alternative hypotheses, H3a and H3b, depending on the level of contract complexity.

Figure 5 – Marginal effects of *High-discretion* over $\Delta ContractValue$ by the level of contract complexity



Notes: The figure considers confidence intervals at 95%. Standard errors are estimated by the delta method.

Table 5, which presents our findings on the cumulative change in renegotiated contract value, shows a similar pattern in the results (see the final specification in the table). The mean percent cumulative change in renegotiated contract value is 12.49, and the statistically significant, positive coefficient on discretion (3.53) suggests that a high level of discretion at the time of the contract award is associated with a larger (28% higher) cumulative increase in renegotiated contract value. Complexity is also a statistically significant and positive predictor of the cumulative change in renegotiated contract value, indicating that more complex contracts will be associated with larger overall changes in contract value. At the same time, as in the other

models, the interaction between discretion and complexity is negative and statistically significant, suggesting that contract complexity not only moderates the effect of discretion on the change in renegotiated contract value, but could even be associated with differing mechanisms, depending on the level of contract complexity (as discussed above).

Table 5 – Associations between discretion and contract complexity and renegotiation outcomes: Change in contract value (CAN-level, cumulative change) (H3a and H3b)

OLS regressions (CAN-level)	(1) No Controls	(2) Add moderation	(3) Controls	(4) FE
DV: ΔContractValue (cumulative, per CAN, %)				
Hypothesized relationships				
High-discretion	-0.3916 (0.5817)	2.2054 (0.0817)	2.1936 (0.0836)	3.5314 (0.0096)
Complexity index	-0.2889 (0.4614)	1.0023 (0.1245)	0.9405 (0.1496)	1.5606 (0.0338)
High-discretion * Complexity index		-2.0214 (0.0133)	-2.0256 (0.0131)	-2.9746 (0.0004)
Control variables				
COVID-related (proportion of CMNs per CAN)			-0.3916 (0.7732)	-3.0774 (0.0410)
Sustainability-related (proportion of CMNs per CAN)			3.7948 (0.0626)	2.1111 (0.3024)
Stringency Index			0.0345 (0.0037)	-0.0416 (0.1549)
Contract award value			-0.0000 (0.4164)	-0.0000 (0.3397)
SME (binary)			0.3236 (0.6425)	1.4074 (0.0553)
Country, contracting authority, CPV, CAN and CMN dates FE	N	N	N	Y
Constant	13.0387 (0.0000)	11.5077 (0.0000)	10.3469 (0.0000)	26.0375 (0.5362)
Observations	7,026	7,026	7,022	7,022
R-squared	0.0001	0.0010	0.0029	0.0838

Notes: The table presents OLS regression estimates explaining the renegotiation outcomes in terms of the ‘change in contract value’, proxied by the cumulative percentage change in each renegotiation (as detailed in the methodological section). This table considers the data at the CAN-level, and the cumulative percentage change corresponds to the value change from the initial award to the last renegotiation we have data available. Specifications 1 to 4 differ only by the set of regressors included (p-values in parentheses).

In all of the models we estimated to understand the relationship between discretion at the time of contract award and contract complexity and the orientation of the parties at renegotiation and renegotiation outcomes, the COVID indicator was consistently a negative and statistically significant predictor. That is, the COVID pandemic reduced the positive sentiment at the time of renegotiations, reduced the time to contract renegotiations, and reduced the spot percentage change and cumulative percentage change in renegotiated contract value. This implies that the pandemic likely brought about disruptions and generated inefficiencies in the contracting relationships and the execution of public procurement activities in the EU.

Robustness checks

To strengthen confidence in our main findings, we performed several robustness checks. First, we checked whether the presence of a specific country or different CPV-type might be driving our associations. To do so, we used the leave-one-out resampling method, in which the model is retested by dropping out one subsample (Efron, 1982). Simply put, we ran multiple rounds of estimations for our main specifications to generate regression results, each time excluding all the renegotiations of a particular country or 2-digit CPV. Our point estimates did not substantively change and are similar in every specification, no matter which country or CPV is excluded from the sample. It is possible to speculate that countries like Hungary, which have a high proportion of CMNs per CAN (as shown in Figure 2), could be influencing the results we have obtained. However, what's interesting is that our findings are only strengthened for each hypothesis when we exclude the Hungarian CMNs from our analysis.

Second, results are also maintained if we consider alternative measures or a different set of control variables. For instance, instead of CANs and CMNs dates fixed effects, we could use

time trends. Our estimates for the hypothesized and other control variables are remarkably similar when using linear and non-linear time trends instead. Our dependent variables are also robust to alternative specifications, such as when the polarity score (that measures sentiment at the time renegotiations) is reweighted by disregarding the influence on the renegotiation sentiment of specific words we use for identifying COVID- or sustainability-related renegotiations; the results are again similar. Analogously, we tested different specifications for our discretion and complexity measures. When considering the discretionary procedure and criteria separately, we find that the discretionary criteria is a stronger driver of the results, but both are statistically significant and predict renegotiation orientation and outcomes in the same direction. In terms of the complexity index, we used an alternative three-level (i.e., low, medium or high complexity) specification and found again that the results were maintained.

Discussions and Conclusion

This research draws from new, unexplored data from the EU and illustrates various contributions that can be made to different avenues of research. First, we show that there is a relationship between discretion in public procurement and renegotiation outputs, i.e., the sentiment toward and time to contract renegotiations, which contributes to the investigation of how we can improve public procurement performance (e.g., Bajari et al., 2009; Brunjes, 2020; Coviello et al., 2018; Decarolis et al., 2020). Joining with other scholars who have recognized the importance of contract complexity (e.g., Brown et al., 2010, 2016), we developed an original empirical measure of contract complexity and assessed how it interacts with discretion (or a relational approach to contracting) to affect both renegotiation outputs and outcomes. We find, as the literature predicts,

that complexity moderates the advantages of discretion in contracting, although it does not overwhelm them. We also add to the recent work of Decarolis et al. (2020) by linking both discretionary procedures and criteria (separately and in a combined measure) to the renegotiation orientation and renegotiated value. As such, our renegotiation output measures advance studies focusing on the *positive* guiding principles of renegotiations (Frydinger et al., 2019, 2021) and others focused on the renegotiated contract value (e.g., Brogaard et al., 2021; Ryan, 2020). In general, our study findings suggest that governments that are beholden to strict public procurement rules that discourage discretion at the contract award stage may be forgoing important benefits of procurement discretion that could improve contracting efficiencies and outcomes for the public.

This study also makes useful theoretical contributions in weaving together bodies of research at the intersection of economics and public administration and connecting studies that explore formal relational contracting (e.g., Frydinger et al., 2019, 2021) with complex public contracts (e.g., Brown et al., 2016). For example, we have illuminated reasons for renegotiations from these literatures and shown that future research should consider both the spot (temporal-specific) and successive or cumulative contract modifications when considering how relational elements in public contracting processes shape contract outcomes. Our preliminary evidence suggests that high-discretion procurement—often associated with relational approaches to contracting—may, on the one hand, be more exposed to future uncertainties (Williamson, 1985), but this may still allow it to improve the sentiment toward renegotiations and limit their frequency if, on the other hand, discretion allows the parties to informally work through smaller shocks to the contract execution (Brown et al., 2018; Frydinger et al., 2021; Kim & Brown,

2012). In addition, while our research confirms that contract complexity imposes challenges for collaboration in contracting, it also suggests that the typical response of layering on more formal procedures or rigidities to construct “guardrails” on renegotiations may undermine the benefits of discretion, which are not entirely forgone in the face of complexity.

It is also important to acknowledge some limitations of our study. First, the focus of this paper is on exploring the importance of discretionary procedures for complex, relational contracts rather than asserting causality. We do not have the data needed to ascertain causal identification, but our study encourages future research that could undertake a causal analysis of the factors that drive contract renegotiations and determine their outcomes. We also lack data on the end dates for contracts that were not renegotiated, which constrained our analysis to a sample of public procurement contracts that had been renegotiated at least once. And, of course, there may be other important features of the public procurement contracts that are not observable in our data, leaving our models subject to the potential criticism of omitted variable bias. In addition, our data are drawn from contracting in the EU, and having publicly available data outside of the EU to conduct similar or comparative research would be valuable for generalizing the findings to a broader, global context.

Future research that is qualitative in nature could also help to unpack how contracting authorities perceive these renegotiations, disentangling both what are potential relational benefits (if any) and/or challenges associated with opportunistic behavior and corruption concerns. For instance, Decarolis and Giorgiantonio (2022) highlight that, although public discretion may interplay with contract complexity, contracting authorities relying on discretionary criteria can navigate this by clearly defining objectives pursued and using “measurable” parameters that are

not as easily manipulated. Further research might also explore whether dictionaries used in constructing our measure of the sentiment of renegotiations can be reliably used in coding complex text and exploratory concepts (Nelson et al., 2021). We fully acknowledge that our analyses addressing public procurement discretion and contract complexity draw on concepts that are still unsettled in the literature. For example, future research efforts might enlist the help of legal experts in developing improved approaches to classifying renegotiations as cooperative vs. opportunistic or even generate additional categories. Another avenue for further investigation (contingent on available data) could investigate whether networks and prior relational ties between contracting partners influence renegotiation outcomes. This could again help us to better understand the benefits and challenges of a relational approach to contracting. For example, we are currently more deeply investigating a subsample of two countries for which we have more granular information (i.e., geolocalized contracting parties in the UK and France) for tracking their past contracting activities between 1990 and 2021.

More broadly, the value of this research to practitioners is to show how discretionary procedures and criteria are associated with collaboration, renegotiation, and the outcomes of public procurement renegotiations relative to contracts subject to more rigid contracting procedures. Our findings suggest that discretion may be underutilized in the EU, particularly in the context of turbulent times that inherently require adaptation (e.g., COVID-19, refugee crises, and the war in Ukraine).

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Appendix: A simple model of public procurement and renegotiation considering public discretion and contract complexity

Baseline definitions and sequence of decisions

We consider a public procurement setting with two actors: a public procurer (contracting authority) and the private provider (winning bidder). The baseline contract award value is given by a and the cost of service is c , such that $a > c > 0$. The procurer and the provider can negotiate (and further renegotiate) the contract value beyond this initial baseline value by r . This (re)negotiated value r is aligned with discretionary procedures and criteria, such as the use of “most economically advantageous tender” instead of “lowest price” criteria, following EU public procurement directives.

Suppose the negotiated value r can assume negative values (i.e., discounts in the contract value) or positive values (i.e., increase in the contract value), as long as $1.5a > a + r > c$. In other words, there is an upper bound $1.5a$, given that the public procurer is wealth-constrained and their willingness to pay (WTP) is $0 < v < 1.5a$, and providers would not trade if $a + r < c$. As we further detail next, we also assume that $\frac{1}{2}v > c$, that is, the procurer’s WTP is high enough to generate gains from trade (even though their WTP is lower than the regular posted price). The upper bound $1.5a$ is aligned with EU public procurement renegotiation directives, as contract modifications should not increase the contract value by more than 50% of the original award value.

For the sake of simplicity, we consider only two periods of potential interaction – the first negotiation round and an eventual renegotiation. This again follows the pattern of contract award and modification notices in the Official Journal of the European Union: the large majority of contracts are not renegotiated, and focusing on the renegotiated sample, about 37 percent are renegotiated/modified only once.

With respect to private providers, we assume there are two types. First, an opportunistic provider (type $\theta = 0$), which considers only the outcomes of the current negotiation (i.e., short-sighted), and second, a relational-oriented provider (type $\theta = 1$), which also considers the outcomes of future renegotiations (i.e., far-sighted). For the sake of simplicity, we assume the interest rate to discount future periods is zero. Importantly, θ is unknown to the procurer (asymmetric information).

The provider likely incurs costs to build relational capital with the public procurer and vice-versa (e.g., time and effort invested in negotiating and developing trust). Building a relationship costs $t > 0$, which is a sunk investment. After incurring in these costs, in each negotiation period the procurer will get $v - (a + r)$, while the provider receives a commission $0 < \beta < 1$ applied to the (re)negotiated value. The provider thus gets $\beta(a + r)$. Both actors maximize expected payoffs, and the reservation utilities of the procurer and provider are both zero (i.e., for the sake of simplicity, we assume no opportunity costs are involved).

Given these basic definitions, the sequence of decisions is as follows. Nature moves first and defines the provider type θ . Thus, contracting actors have to decide whether to invest in the relationship. The provider starts by choosing to spend t , a sunk cost, so it does not affect the subsequent negotiations. In the first negotiation period, the procurer and provider then negotiate the contract “additional” value r (or “discount”, if $r < 0$). Nature moves again and determines if the contract will need adaptations/modifications, such that the procurer and provider will renegotiate in the second period. The probability that this will happen is $0 < \alpha < 1$.

In the second negotiation period, if the procurer purchased the service/product in the first period, then the procurer would have switching costs (λ) to switch to another provider. These costs are a function of the contract complexity (Δ), assumed to be an increasing function (i.e., $d\lambda/d\Delta > 0$). Simply put, switching costs increase as contracts get more complex. This follows prior literature considering complex contracts are composed of elaborate clauses addressing higher risks and uncertainties that are likely specific to the current contract and contracting partners. For the reasons further detailed next, we suppose that $\lambda(\Delta)$ is high enough such that $\lambda(\Delta) > (1 + \alpha)\beta v$. Simply put, such switching costs would ensure procurers would not have incentives to negotiate with opportunistic providers.

Finally, if the provider acts cooperatively and does not push for increases in the contract value (i.e., accepts $r \leq 0$), the provider reaps a relational (reputational) gain of $g > 0$ in future transactions beyond those two periods (with the current or other procurers). Notice that by definition, the opportunistic provider (short-sighted) will not consider this future gain.

Equilibrium and main proposition

Having described the negotiation setting and the corresponding payoff functions, we can begin to solve the model for the perfect Bayesian equilibrium (PBE). A standard backward induction approach is applied. In the second negotiation period, if we consider an opportunistic provider, the procurer will accept any value such that $v - (a + r) \geq -\lambda(\Delta)$, thus appropriating $v - (a + r) + \lambda(\Delta)$. The provider appropriates $\beta(a + r)$. Hence, the Nash bargaining solution considering equal appropriation is:

$$v - (a + r) + \lambda(\Delta) = \beta(a + r)$$

or

$$r = \frac{v + \lambda(\Delta)}{1 + \beta} - a,$$

conditional on the restriction that $a + r > c$, that is, $\frac{v+\lambda(\Delta)}{1+\beta} > c$. This restriction will always be binding if $\frac{v}{2} > c$ (that is, even if there are no switching costs and the provider receives full commission). Considering equal appropriation, the provider gets $\frac{\beta(v+\lambda(\Delta))}{1+\beta}$, but then the procurer would incur the switching costs and would get $\frac{\beta v - \lambda(\Delta)}{1+\beta}$. The provider does not benefit from the reputational gains.

If, instead, we consider a relational-oriented provider, being “aggressive” by taking into account the switching cost $\lambda(\Delta)$ in her negotiation with the procurer (such as the opportunistic provider) implies that the renegotiated value will fall relative to the first period (e.g., it is a form of hold-up). In this case, the provider will not reap the reputational gain g . Therefore, if the provider is aggressive, not acting cooperatively, its appropriation is given by $\frac{\beta(v+\lambda(\Delta))}{1+\beta}$. If, instead, the provider is not aggressive and acts cooperatively, the appropriation would be $\frac{\beta v}{1+\beta} + g$. For the sake of simplicity, we suppose that $\frac{\beta \lambda(\Delta)}{1+\beta} < g$, that is, the provider’s reputational gain is high enough to not “opportunistically” raise the renegotiated value. Therefore, the procurer gets $\frac{\beta v}{1+\beta}$ and the provider $\frac{\beta v}{1+\beta} + g$.

In the first negotiation period, assuming again the opportunistic provider, the negotiation would be analogous, except for the fact that there are no switching costs in the first period. Therefore, the procurer analogously gets $\frac{\beta v}{1+\beta}$, and also the provider $\frac{\beta v}{1+\beta}$. In sum, for the two periods, if the provider is opportunistic, the procurer gets:

$$\frac{\beta v}{1+\beta} + \alpha \frac{\beta v - \lambda}{1+\beta} = \frac{(1+\alpha)\beta v}{1+\beta} - \frac{\alpha \lambda}{1+\beta}.$$

If λ is high enough, it is not worthwhile for the procurer to exchange with the opportunistic provider. This will happen when:

$$\frac{(1+\alpha)\beta v}{1+\beta} - \frac{\lambda(\Delta)}{1+\beta} < 0, \text{ or}$$

$$\lambda(\Delta) > (1 + \alpha)\beta v.$$

Instead, for the two periods, if the provider is relational-oriented, the procurer gets:

$$\frac{\beta v}{1+\beta} + \alpha \frac{\beta v}{1+\beta} = \frac{(1+\alpha)\beta v}{1+\beta},$$

which, given our assumptions, is always greater than zero. Meanwhile, the provider gets $\frac{(1+\alpha)\beta v}{1+\beta} + g$.

Finally, in the initial period (investment in the relationship), the opportunistic provider will only consider the first negotiation period as a potential gain to compensate for the cost t . Therefore, for the opportunistic provider to share investments with the procurer in building the relationship, it must be the case that:

$$t \leq \frac{\beta v}{1+\beta}.$$

The relational-oriented provider, in contrast, will invest in building the relationship if:

$$t \leq \frac{(1+\alpha)\beta v}{1+\beta} + g.$$

Therefore, if

$$\frac{\beta v}{1+\beta} < t \leq \frac{(1+\alpha)\beta v}{1+\beta} + g,$$

only the relational-oriented provider will have incentives to invest in the relationship.

In this case, if the procurer sees that the provider is investing $t > \frac{\beta v}{1+\beta}$, then (by Bayes' theorem) the procurer should infer that the provider is relational-oriented ($\theta = 1$). More formally,

$$Prob\left(\theta = 0 \mid t > \frac{\beta v}{1+\beta}\right) = \frac{Prob\left(t > \frac{\beta v}{1+\beta} \mid \theta = 0\right) Prob(\theta=0)}{Prob\left(t > \frac{\beta v}{1+\beta}\right)},$$

which is equal to zero since $Prob\left(t > \frac{\beta v}{1+\beta} \mid \theta = 0\right) = 0$.

Therefore, we reach our final proposition:

Proposition. If $\frac{\beta v}{1+\beta} < t \leq \frac{(1+\alpha)\beta v}{1+\beta} + g$, there is a separating PBE equilibrium where the relational-oriented provider invests in relationship building with the procurer at an initial period, and the procurer purchases the product/service at lower negotiated values (and they possibly negotiate again in a subsequent period with probability α).

Testable implications

This formal model leads us to testable implications that are mirrored in the paper by our hypotheses. Below, we detail each of these connections.

First, the relationship-building costs we model should be sufficient high to avoid the scenario in which the opportunistic provider will incur this cost to imitate a relational-oriented provider, such that $\frac{\beta v}{1+\beta} < t$. Public procurement procedures that allow the governments greater discretion will contribute to the selection of relational-oriented providers, which, in turn, should lead to a reduced degree of deceptive or opportunistic contract renegotiations. In our empirical setting, we measure the sentiment of renegotiation and expect high-discretion contracts to be more relational-oriented, and therefore, to go through more positive/cooperative renegotiations (as predicted by hypothesis 1).

Second, this relationship-building mechanism depends on switching costs that are not too high. Contract complexity, however, increases the switching costs. If complexity, and consequently

switching costs, increase to the point that $\frac{\beta\lambda(\Delta)}{1+\beta} > g$, then the relational gains would not surpass the benefits of acting opportunistically. This is mirrored in our empirical setting by hypothesis 2, as a higher level of contract complexity (and consequently higher switching costs) will reduce the positive effect of discretion on the parties' positive/cooperative orientation toward renegotiations.

Third, in our manuscript we have detailed alternative hypotheses for the role of discretionary (relational) approaches in the contract value changes (i.e., nondirectional expectations). Importantly, however, our formal model detailed in this Appendix supports a reduced value change r as a consequence of high discretion and a more relational approach (aligned with the predictions of H3a). This follows as straightforward from our main proposition detailed above. Nevertheless, different but other reasonable specifications in the formal model could lead to alternative expectations that are, in turn, aligned with the predictions of H3b, as we discuss next.

Supplementary specifications of the public procurer WTP and provider costs: alternative implications

In the previous model specification, we have considered both the procurer WTP (v) and provider costs (c) as given. Therefore, they are not directly associated with the level of contract value r negotiated between the partners. It would be also reasonable to assume v and c as functions of the contract final value ($a + r$); e.g., $v=v(a + r)$ and $c=c(a + r)$. In that case, one could expect the value for the procurer to increase when involved in more expensive (and potentially high-quality) contracts, as well as the costs for the providers. We would not have, however, similarly straightforward propositions. The decision-making of both procurer and provider would depend on the functional forms of v and c . Importantly, $v - a - r$ determines the value captured by the public procurer, while $a + r - c$ is the value captured by the provider.

On the one hand, if c increases more than proportionally than v as r increases (simply put, $dc/dr > dv/dr$), our initial predictions would be likely maintained when considering a few more technical assumptions (for instance, regarding strictly concave functions for v and c with respect to r). Intuitively, providers would not have additional incentives to increase r , as it would be costly and would not favor as much the procurer. Hence, the reputational gains (g) associated with cooperative behavior and maintaining unexpensive contracts would still suffice for maintaining our PBE.

On the other hand, if v increases more than proportionally than c as r increases (simply put, $dv/dr > dc/dr$), our initial predictions could not hold. Providers would have incentives to increase r in order to deliver contracts that would be *perceived* by public procurers as higher-quality. Analogously, there are incentives for higher r in the second negotiation round if these are associated with costly but meaningful renegotiations. Other more complex models could also consider g as a function of the perceived value of the contract by the public procurer. This would represent additional mechanisms and incentives for providers in favor of more costly

but relational-oriented and meaningful (re)negotiations (as stated in H3b in the main manuscript).

Ultimately, this is why we have non-directional hypotheses 3a and 3b. In the former scenario, or if we simply assume v and c as given (following our main model), this would imply predictions aligned with H3a. Conversely, in the latter scenario, depending on the extent to which r substantially increases v instead of c , a more sophisticated model would point to H3b. Importantly, the rationale behind cooperative approaches, which is the center of our modeling and the focus of H1, is maintained for both cases, and the same is true for hypothesis 2 on the moderating influence of complexity.