

DISCUSSION

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Does Public Procurement Select (Real) Outsider Innovation? The Interplay Between Tender Design and Supplier Experience

Does public procurement select (real) outsider innovation? The interplay between tender design and supplier experience

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Abstract

Public organizations rely on open innovation to maintain and improve public service performance. Suppliers are a key source of such innovation. Public contracting authorities act as the interface between public organizations and supply markets, shaping whether supplier innovations are identified, rewarded, and selected. Combining representative firm-level data from the German Community Innovation Survey with official tender-level data from the Tenders Electronic Daily database, we construct firms' public procurement award histories between 2006 and 2023. We distinguish between four tender categories that differ by geographic scope (domestic versus international) and award mechanism (price-based versus criteria-based). We further differentiate between "real outsiders" and "pseudo-outsiders" based on experience supplying public markets. Using multivariate probit models, we examine how different degrees of innovation novelty are associated with supplier selection across tender categories and outsider status. Three findings emerge. i) Suppliers' category-specific procurement experience increases the likelihood of subsequent selection, indicating rigidity in public procurement markets. ii) Price-based tenders are associated with firm-level novelties, whereas criteria-based tenders are associated with market-specific novelties. iii) These innovation advantages are concentrated among "real outsiders" and largely disappear for "pseudo-outsiders", for whom prior category-specific procurement experience becomes the main predictor of subsequent selection.

Keywords Public procurement – open innovation – supply markets – tender design – competition
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1. Introduction

Public organizations are increasingly confronted with fiscal constraints, complex societal challenges and rising citizen expectations (OECD, 2025). Innovation is therefore a necessity for maintaining and enhancing public service performance, resilience, and legitimacy (Albury, 2005; European Commission, 2021; Figenschou *et al.*, 2024; OECD, 2017). Compared to private sector innovation, public sector innovation is typically less reliant on internal R&D and instead emerges from organizational processes and service delivery changes (Demircioglu, 2024; Hartley, 2005; Lagunes Marin and Rubalcaba Bermejo, 2015). This implies that the underlying solutions are predominantly developed by external suppliers (Edler and Yeow, 2016; Wesseling and Edquist, 2018; van Winden and Carvalho, 2019). This is reflected in the financial volume of public procurement, estimated at USD 9.5–11 trillion annually (Bosio and Djankov, 2020; World Bank, 2020), accounting for around 30% of government expenditure (OECD, 2021). Against this background, two implications emerge. First, public organizations assume an even more pronounced role than private firms as a beneficiary of open innovation (Bakici *et al.*, 2013; Berkhout *et al.*, 2026; Figenschou *et al.*, 2024; Gascó, 2017; Palumbo *et al.*, 2023). Second, open innovation sources are primarily suppliers (Dealroom.co, 2026; European Commission, 2023; Lagunes Marin and Rubalcaba Bermejo, 2015; Solaimani and van der Veen, 2021; World Intellectual Property Organization, 2024), which the state, acting both as a demand-side actor and as a beneficiary of a well-functioning innovation ecosystem, should strategically engage with (Aschhoff and Sofka, 2009; Berkhout *et al.*, 2026; Patrucco *et al.*, 2026; Plantinga *et al.*, 2020).

The combination of public procurement and innovation is thus not a novel topic (Aschhoff and Sofka, 2009; Edler and Georghiou, 2007; Pavitt and Walker, 1976). In a literature analysis, Obwegeser and Müller (2018) identify three distinct yet intercorrelated literature strands. *“Public procurement for innovation”* conceptualizes public procurement as an innovation policy instrument that leverages public demand to stimulate innovation at the macro level (Georghiou *et al.*, 2014). Prominent examples include the development and procurement of the internet (Mowery and Simcoe, 2002), GPS (Herring, 1996), and Estonia’s comprehensive e-government system (Kalvet, 2012). *“Public procurement of innovation”* emphasizes that this policy ambition has to be operationalized by public contracting authorities seeking to improve

public service delivery or internal processes through supplier innovations (e.g., strengthened resilience against external shocks such as natural disasters or cyberattacks) (Knutsson and Thomasson, 2014; Ruohonen, 2020; Selviaridis *et al.*, 2023). To do so, they conduct “*innovative public procurement*” (Kähkönen *et al.*, 2025), i.e., by using innovation-oriented procurement procedures (e.g., Directive 2014/24/EU, Art. 30 competitive dialogue; Art. 31 innovation partnership), supply market orientation (Art. 40), and functional requirements instead of overly technical specifications (Art. 42), as well as many other management instruments such as innovation intermediary support (Bangert *et al.*, 2026) and AI-based supplier scouting (Guida *et al.*, 2023).

Hence, public contracting authorities function as the “interface” between public organizations and supply markets (Holma *et al.*, 2022; Patrucco, Luzzini and Ronchi, 2017) and can either enable or constrain the realization of open innovation (Berkhout *et al.*, 2026; Krieger *et al.*, 2026; Schotanus, 2025; Solaimani and van der Veen, 2021). They can support the adoption of supplier innovations that are new to the procuring organization but already available in the market (Amann and Eßig, 2015; Johannessen *et al.*, 2001; OECD, 2005). They can also stimulate the development of supplier innovations that are new to the focal market or even to the world by actively inducing innovation through the procurement process itself (Adjei-Bamfo *et al.*, 2025; Belenzon and Cioaca, 2025; Kähkönen *et al.*, 2025). In both cases, innovative public procurement is essential (Knutsson and Thomasson, 2014; Uyarra *et al.*, 2014), which includes a strong supply market orientation (Foerstl *et al.*, 2020), active search for (Guida *et al.*, 2023; Werneth *et al.*, 2025) and early interaction with (potential) suppliers (Berkhout *et al.*, 2026), avoidance of overly prescriptive specifications (Röber, 2000), the use of appropriate tendering procedures (Rokkan and Haugland, 2021) and the use of contract award criteria that reward suppliers for their innovation capabilities (Krieger *et al.*, 2026).

However, suppliers currently participate in EU public procurement at historically low levels (European Court of Auditors, 2023; Tátrai *et al.*, 2024). Over the past decade, the average number of bids per procedure has roughly halved, while more than 40% of competitive procedures now attract a single bid (European Court of Auditors, 2023). Moreover, around 60% of EU-wide tenders are awarded solely based on the lowest price – an approach shown to hinder innovation (Krieger *et al.*, 2024). Due to prevailing procurement approaches (Flynn and

Davis, 2014; Trammell *et al.*, 2020), a relatively small subset of suppliers captures a disproportionately large share and value of public contracts (Decarolis and Srhoj, 2026; Kang and Miller, 2022; Pliatsidis, 2024). One potential contributing factor is that procurers tend to favor suppliers known from previous tenders (Tukiainen *et al.*, 2023). This is particularly problematic because innovation management research suggests that disruptive innovations are more likely to originate from new entrants than from established incumbents (Acemoglu and Cao, 2015).

Existing research has acknowledged the importance of both supplier characteristics and procurement tender design in shaping public procurement outcomes. However, these factors have largely been examined through separate empirical lenses, with studies focusing either on supplier-side perspectives and characteristics (Flynn and Davis, 2017; Loader, 2015; Saastamoinen *et al.*, 2020) or on procurement and tender-level characteristics derived from procurement data (Jääskeläinen *et al.*, 2026; Roumboutsos and Sciancalepore, 2014; Tátrai *et al.*, 2024). However, whether innovative firms participate, compete successfully, and ultimately are selected for public contracts depends on the interaction between supplier capabilities *and* procurement tender design, highlighting the need for a dyadic perspective. Emerging evidence supports this view. Blind *et al.* (2020) show that product innovation and engagement in standardization activities increase firms' chances of being selected for public contracts, while Krieger *et al.* (2026) find that innovation-related capabilities matter primarily when tenders are evaluated on award criteria beyond price. Together, these findings suggest that the value of supplier innovation is contingent on how competition is structured and assessed by public contracting authorities through tender design. Yet, little is known about how tender design interacts with suppliers' prior award history and innovation capabilities to shape selection outcomes.

Accordingly, our research objective is to examine the interplay between tender design and supplier experience in public procurement and its implications for the selection of innovative suppliers.

In doing so, we contribute to the literature in several ways. First, we strengthen the connection between firm-level evidence and the public procurement management literature (Decarolis and Srhoj, 2026). We combine firm-level data from the German Community Innovation Survey with the Tenders Electronic Daily database and construct firms' histories of being selected for

larger public tenders between 2006 and 2023. In total, we distinguish between four tender categories: domestic price-based tenders, international price-based tenders, domestic criteria-based tenders, and international criteria-based tenders. We estimate multivariate probit models that relate firms' introduction of firm, domestic market, and international market novelties to their likelihood of being selected.

Second, we strengthen the understanding of the active role of public procurement through tender design. We find that the type of innovation associated with supplier selection differs systematically across tender designs. Price-based tenders are primarily associated with firm-level novelties, whereas criteria-based tenders are associated with market-specific novelties that correspond to the geographic scope of the tender.

Third, we are the first to incorporate firms' prior category-specific procurement experience into the analysis. We show that firms with category-specific procurement experience are substantially more likely to be selected again within the same tender category, indicating considerable rigidity in public procurement markets.

Fourth, we open a discussion on the need for public procurement to attract more "new" suppliers – that is, firms that have not previously supplied public markets. We find that incumbent firms are not only more likely to secure subsequent contracts but also that, among these firms, the positive association between innovation and supplier selection observed for new entrants disappears. Instead, prior procurement experience within the relevant product category becomes the dominant predictor of future contract awards.

These findings suggest that public procurement is capable of selecting innovative suppliers, but that this selection mechanism is most pronounced when firms enter a tender category for the first time and becomes less innovation-oriented once firms have accumulated category-specific procurement experience. With our empirical analysis, we respond to the call by Berkhout et al. (2026) for further research on the interface between procurement and the supply market, particularly regarding "[...] procurement design, process, and evaluation." Furthermore, we address Chiappinelli *et al.*'s (2025) call for more public procurement of innovation evidence "[...] particularly on long-term effects at the firm level [...]." By linking tender design, supplier innovation, and accumulated procurement experience, our study

provides new evidence on the conditions under which innovative firms are selected in public procurement markets.

2. Conceptualization

In the private sector, the procurement of supplier innovations is typically characterized by vertical integration, long-term exclusive partnerships, or broad managerial discretion (Aghion *et al.*, 2006; Arlbjørn and Freytag, 2012; Goldberg and Schiele, 2018; Handfield *et al.*, 1999; Larson, 2009; Patrucco *et al.*, 2026; Schiele, 2020). These approaches are not directly transferable to the public procurement context (Patrucco *et al.*, 2026). In particular, public procurement is characterized by an idiosyncratically proceduralized supplier selection process, in which the design of the tender predetermines – earlier and more rigidly than in private-sector procurement (Arlbjørn and Freytag, 2012) – whether the “best” and “most innovative” suppliers can be awarded contracts at all and are effectively rewarded for their innovation capabilities (Krieger *et al.*, 2024).

2.1. Unpacking the idiosyncratically proceduralized supplier selection in public procurement

Public contracting authorities are thereby legally obliged to follow the core principles of public procurement – “[...] equal treatment, non-discrimination, mutual recognition, proportionality and transparency” (directive 2014/24/EU) – along the entire public procurement process (Figure 1). This also applies if they are conducting innovative public procurement.

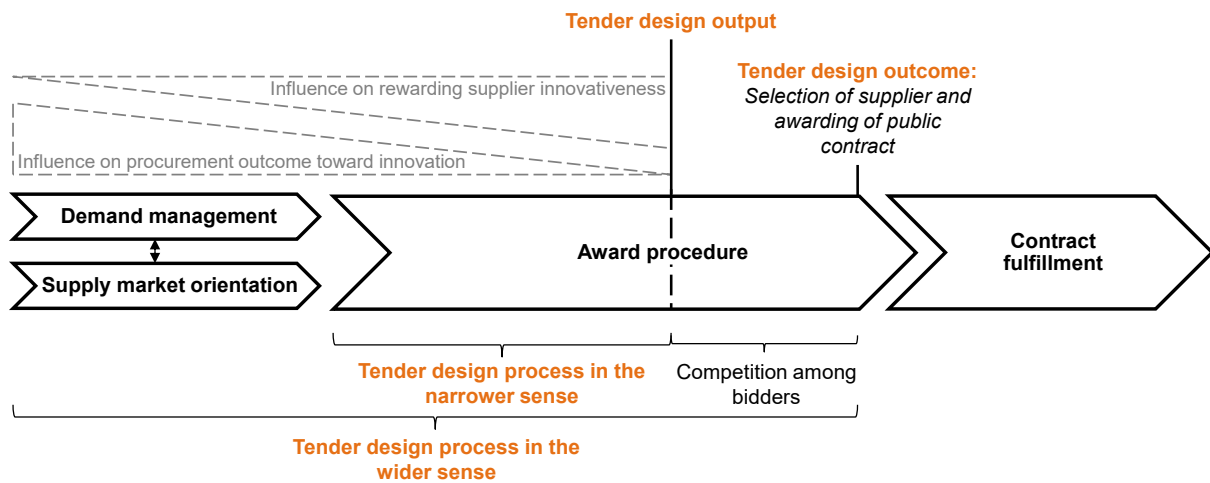


Figure 1: Public procurement process

Note: Figure 1 is based on Decarolis and Srhoj (2026); Patrucco et al. (2017) and Schaupp (2022)

Public procurement law thereby “[...] establishes rules on the procedures for procurement by contracting authorities [...]” (directive 2014/24/EU) and therefore primarily focuses on the procedural and legal design of tendering processes. Because each procurement project is treated as a distinct procedure subject to public procurement principles, less attention is paid to the cumulative effects of procurement decisions on market structures, and innovation trajectories.¹

2.1.1. Tender design process in the wider sense

The tender design process in the wider sense begins in the demand management phase. Through their contractual freedom to define the subject of the contract, public contracting authorities can largely determine whether and what should be procured (directive 2014/24/EU, recital 7). Especially if supplier innovations are aimed to be procured, the adoption of supply market orientation (identifying and interacting with innovative suppliers capable of addressing existing or future needs) is found to be beneficial (Berkhout *et al.*, 2026; Holma *et al.*, 2022). However, although preliminary market consultations under Article 40 of Directive 2014/24/EU provide a legal instrument for conducting supply market orientation, their use remains voluntary (Voda and Jobse, 2016). These provisions govern the pre-tender phase,

¹ The following sections use EU-level public procurement law as an illustrative example; however, comparable policy frameworks also exist in Australia, Brazil, China, Korea, the UK, and the USA (Lember *et al.*, 2014).

during which contracting authorities have the greatest scope to *influence procurement outcomes toward innovation* through their discretion in tender preparation and market engagement (Torvatn and de Boer, 2017; Voda and Jobse, 2016).

2.1.2. Tender design process in the narrower sense

The tender design process in the narrower sense refers to the activities and organizational processes through which a tender is developed and structured prior to publication. It encompasses the translation of procurement needs into a legally and economically specified procurement procedure (Holma *et al.*, 2020). Importantly, this is the phase in which the contracting authority predetermines (deliberately or not) which types of suppliers can participate and ultimately be awarded the contract, as well as how suppliers and different forms of supplier performance are rewarded (Bergman and Lundberg, 2013).

2.1.3. Tender design output

The formal tender documents constitute the tender design output and are published through procurement platforms such as Tenders Electronic Daily (TED) or national e-procurement systems (Articles 49 et seq. of directive 2014/24/EU). Depending on how contracting authorities employ the available legal instruments, tender design outputs can differ substantially in their structure, requirements, and competitive orientation:

Procedure type selection – While procurement law strongly regulates the award procedure, it still provides considerable flexibility for organizing innovation-oriented competition. Through the selection of procurement procedures such as negotiated procedures, competitive dialogues, or innovation partnerships, contracting authorities can create more interactive and collaborative forms of bidder rivalry (Articles 25 et seq. of directive 2014/24/EU).

Tender specification – To draw in more potential bidders, public contracting authorities can use functional specifications and the admission of variant bids to allow suppliers to differentiate themselves through alternative and innovative solutions instead of complying with rigid technical requirements (Article 42 of directive 2014/24/EU).

Selection criteria – Alternatively, in procurement situations with potentially too much quantitative competition, public contracting authorities could actively design the tender output to specifically attract the most innovative suppliers – for example, through strategically formulated specifications or selection criteria that trigger a form of self-selection (Blanc-Brude, 2013) among bidders (Article 58 of directive 2014/24/EU). Selection criteria operate as pass/fail requirements that determine whether a supplier is eligible to participate in the procurement procedure at all. They typically relate to a supplier’s economic and financial standing, technical and professional ability, *relevant experience*, qualifications, personnel, equipment, or other indicators of capability (Krieger *et al.*, 2026; Mardas and Triantafyllou, 1997).

Contract award criteria – Award criteria determine the dimensions along which suppliers compete and the basis on which bids are comparatively evaluated. While contracts may be awarded solely on the basis of the lowest price, Directive 2014/24/EU stipulates that “[...] contracting authorities shall base the award of public contracts on the most economically advantageous tender” (Article 67). In innovative contexts, price competition alone is indeed a limited selection mechanism (Arvanitis *et al.*, 2026; Globerman, 1980; Jovanovic and MacDonald, 1994). In this view, firms compete by anticipating and shaping demand, emphasizing “[...] quality competition as an anticipation of consumer demand.” (Copeland, 1934). For innovative public procurement, this implies that innovation should be explicitly defined as a demand-side preference and embedded in competitive procedures (Adjei-Bamfo *et al.*, 2025). Because award criteria directly determine how tenders are evaluated and ranked, they exert the strongest influence on *rewarding supplier innovativeness* (Krieger *et al.*, 2024).

2.1.4. Competition among bidders

Following publication of the tender documents, suppliers can participate in the procurement procedure. Here, public procurement is bound by its constitutive principle – competition (Fuchs, 2012; World Trade Organization, 2012, 2025). Competition is traditionally justified as a means of ensuring value for money and efficient public spending (Burgi, 2016) - including quality, innovation, and social and environmental aspects (directive 2014/24/EU, recital 47). Particularly above EU procurement thresholds, procurement regulation has been aligned with European market integration objectives, assuming that broad market opening and extensive

competition enhance efficiency, resource allocation, and innovation (Bungenberg, 2007; Holoubek and Fuchs, 2013; Martlreiter, 2011). Through tender design, contracting authorities can strategically shape bidder participation and the nature of competition using various legal instruments (Kähkönen *et al.*, 2025). The tender phase is particularly important because it influences not only how many suppliers compete but also which competitive attributes are rewarded (Krieger *et al.*, 2024; Tammi *et al.*, 2020). As firms can leverage product differentiation to strengthen their competitive position (Barney, 1986; Cattani *et al.*, 2017; Chamberlin, 1933), innovation competition depends on how bidder rivalry is structured and assessed. While moderate levels of competition may foster quality- and innovation-based differentiation, excessive bidder numbers can intensify price competition (Clark, 1940; De Scitovszky, 1941; Tammi *et al.*, 2020). Consequently, tender design output plays a critical role in promoting innovation-oriented competition rather than price rivalry alone (Krieger and Rainville, 2026; Tammi *et al.*, 2020).

Despite competition being a constitutive principle of public procurement, its relationship with innovation has received limited explicit attention in the literature (explorative literature analysis in Table A1 in the Appendix). Existing studies focus largely on quantitative measures of competition (such as the number of bids per tender), whereas innovation-oriented competition remains underexplored. The small body of research explicitly linking competition and innovation suggests indeed that competition is not simply a market condition but an outcome of tender design (Krieger *et al.*, 2024; Tammi *et al.*, 2020; Wan, 2014). For example, the participation (Di Mauro *et al.*, 2020) and selection of SMEs (Flynn and Davis, 2017) and young firms (Krieger *et al.*, 2026) benefit from criteria-based tender output.

2.2. Tender design outcome - introducing the concept of “pseudo-outsiders” and “real outsiders”

To gain a new perspective, we investigate whether innovation capabilities are equally relevant for entering a tender category and for being selected for further awards after prior category-specific procurement experience has been accumulated. Thus, the paper shifts the focus from whether public procurement can select innovative suppliers in general to whether innovation remains selection-relevant once firms have already entered public procurement markets. This question is particularly relevant because the literature has documented general barriers to

entry for firms seeking to participate in public procurement (Akenroye *et al.*, 2024; Amann and Eßig, 2015; Flynn, 2025; Kovacic, 1992; Mutangili, 2024; Uyarra *et al.*, 2014). Moreover, empirical evidence suggests that a relatively small number of firms receive a disproportionate share of public contracts by both number and value (Kang and Miller, 2022; Pliatsidis, 2024). To guide our research, we introduce a set of concepts describing different positions within public contracting authority–supplier relationships (visualized in Figure 2):

Insiders are public organizations that satisfy their demands by contracting external suppliers. They depend on supplier innovations as part of an open innovation approach (Lagunes Marin and Rubalcaba Bermejo, 2015; Solaimani and van der Veen, 2021).

The interface refers to public contracting authorities as the procurement function within public organizations. In the context of innovation, these actors conduct “innovative public procurement” along the procurement process. In Germany, for example, approximately 30,000 public contracting authorities exist (Karstedt-Meierrieks, 2013).

Pseudo-outsiders describe suppliers that are formally external to the state but whose distinction from the public sector becomes increasingly blurred. This embeddedness generates informational advantages (Caldwell *et al.*, 2005; Rokkan and Haugland, 2021) through selection and signaling effects (Carboni *et al.*, 2018; Schäfer *et al.*, 2024), fosters relational and repeated interactions between public contracting authorities and suppliers (Abdurakhmonov *et al.*, 2021; Carboni *et al.*, 2018; Schäfer *et al.*, 2024) and builds procedural knowledge in complex procurement and innovation processes (Cinar *et al.*, 2019; Flynn, 2025). Pseudo-outsiders are therefore conceptualized as firms with prior experience supplying public markets.

In contrast, *real outsiders* are firms without prior experience in supplying public markets. This group includes both young firms seeking their first customers (Krieger *et al.*, 2026) and established firms that have so far operated exclusively in private markets. As potential new entrants to public procurement, real outsiders represent an untapped source of innovation. This is particularly relevant because disruptive innovations frequently emerge from new entrants (Acemoglu and Cao, 2015).

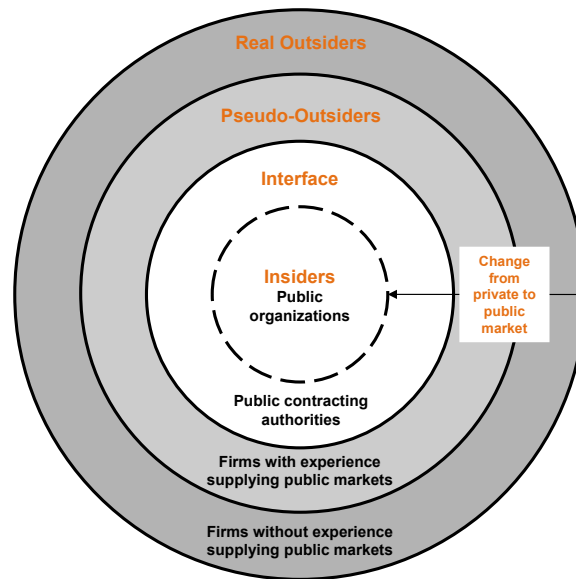


Figure 2: Conceptualization of public contracting authority-supplier relationships

Within this conceptualization, we empirically analyze the relationship between tender design output – that is, how a tender is ultimately specified and published – and tender design outcomes, reflected in the innovation capabilities of the suppliers selected through competitive bidding.

From the perspective of imperfect competition theory, firms compete not only through prices but also through differentiation advantages, such as innovation (Barney, 1986; Chamberlin, 1933). The extent to which such qualitative competition emerges depends on how demand preferences are articulated and translated into selection mechanisms (Copeland, 1934; Globerman, 1980). In public procurement, contract award criteria signal these preferences and determine the dimensions along which suppliers compete (Krieger *et al.*, 2024). Accordingly, we hypothesize that *i) tender design output influences whether suppliers' innovation capabilities are rewarded or deterred during competition among bidders*. Specifically, this hypothesis implies that award criteria should reflect the *depth of supply market orientation* (Figure 3). Greater depth entails looking beyond pseudo-outsiders to better understand the innovation potential of supply markets (including real outsiders) and using this knowledge to inform the tender design process in the narrower sense. Tender design outputs that place greater weight on quality- and innovation-related award criteria, rather than relying solely on the lowest price, are therefore expected to increase the likelihood that suppliers with stronger

innovation capabilities are selected. We operationalize this dimension by analyzing the contract award criteria.

Imperfect competition theory further highlights that entry barriers allow incumbent firms to preserve market positions and sustain excess profits over time (Bain, 1956). At the same time, the potential for competitive responses by pseudo-outsiders (Harrigan, 1981; Porter, 1989) and the erosion of temporary innovation rents (Futia, 1980) may be underplayed. Public procurement research has extensively documented general barriers that discourage firms from participating in tenders (Flynn, 2025; Loader, 2013). However, much less attention has been paid to the specific challenge of being selected for a first public contract and transitioning from a private-market supplier to a public-sector supplier. Accordingly, we hypothesize that *ii) tender design output influences the extent to which real outsiders are selected*. This relationship is particularly important for assessing whether contracting authorities can access the *breadth of supplier innovations* (Figure 3) needed to enhance public service delivery. This may not imply that real outsiders are always more innovative than pseudo-outsiders. Rather, if contracting authorities seek to access the *breadth of supplier innovations* available in the supply market, tender design outputs must enable innovative suppliers to participate, allowing the most suitable solution to emerge through competition. We operationalize this outcome by distinguishing between real outsiders and pseudo-outsiders among the selected suppliers.

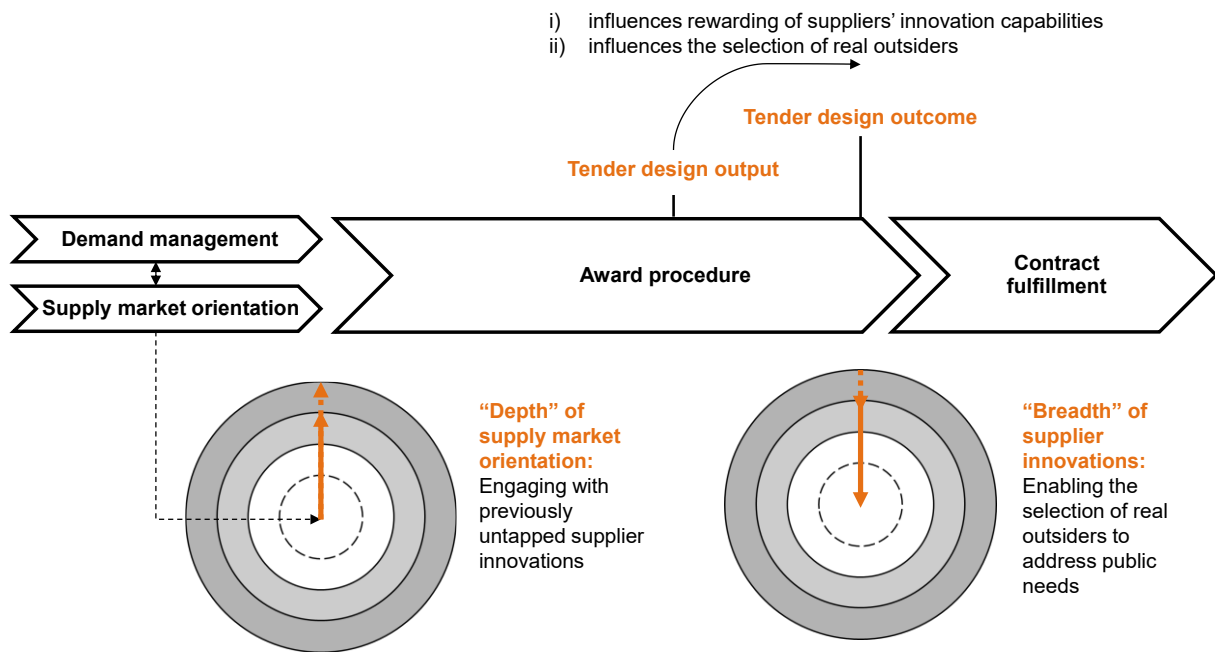


Figure 3: Central role of tender design outputs in public procurement of innovation

3. Data

3.1. Databases

To empirically examine the interplay between tender design and supplier experience, we construct a unique dataset by linking the German Community Innovation Survey to the Tenders Electronic Daily database.

The German Community Innovation Survey corresponds to a representative survey of firms in the German enterprise sector with more than 5 employees covering firms' innovation inputs and outputs, as well as firms' general characteristics. The survey started in 1992, whereas we focus on its reference years 2012, 2014, 2016, 2018, 2020, and 2022, as these not only cover information on firms' introduction of product innovations, which are new to the market of a firm or not, but further differentiate between product innovations new to the German and new to the international market. Whereas the survey is built as a rolling panel, focusing on every second year increases its unbalancedness, limiting our analyses to largely cross-sectional methods. The survey has been used to examine the link between public procurement and firms' innovation activities (Aschhoff and Sofka, 2009; Blind *et al.*, 2020; Czarnitzki *et al.*, 2020; Krieger *et al.*, 2024; Krieger and Zipperer, 2022).

The Tenders Electronic Daily database is administered by the European Commission and covers all public tender notices in the European Economic Area whose monetary value exceeds the legal thresholds for securing a transparent and competitive procurement process across borders starting in 2006. Most importantly, the database covers i) the name and addresses of the public contracting authorities, as well as the contracted suppliers, as well as ii) the inclusion or absence of additional award criteria next to the price within a tender. The Tenders Electronic Daily database is frequently used to investigate public procurement in Europe – representing the largest single database on public procurement in the European Economic Area – and has been combined with the German Community Innovation Survey previously (Czarnitzki *et al.*, 2020; Krieger *et al.*, 2024; Krieger and Zipperer, 2022).

3.2. Data matching

We combine the Tenders Electronic Daily databases and the German Community Innovation survey using the firm identifier from the Mannheim Enterprise Panel, which is the sample frame of the German Community Innovation Survey. The panel is based on data of all registered German firms since 2000 recorded by Creditreform, which is the largest credit rating agency in Germany. A detailed description of the Mannheim Enterprise Panel can be found in Vanhaverbeke *et al.* (2024).

We link the Tenders Electronic Daily database with the Mannheim Enterprise Panel. The matching process begins by extracting all German and international tenders from the Tenders Electronic Daily database between 2006 and 2023, for which German firms were awarded contracts. In total, we find 812,236 German tenders awarded to 325,987 German firms and 21,380 international tenders awarded to 13,918 German firms.² Next, we use a fuzzy string-matching algorithm for firm names and addresses to separately identify i) the awardees of German tenders, and ii) the awardees of international tenders in the Mannheimer Enterprise Panel. The matching procedure follows the approach described by Doherr (2023). It first semantically retrieves candidate matches between the Tenders Electronic Daily database and the Mannheim Enterprise Panel. Then, random samples of these candidate matches are

² In this case, firms refer to unique normalized name-address combinations of awardees within the Tenders Electronic Daily database (Doherr, 2023).

manually classified as true or false positives and used as training and test data for a supervised machine learning algorithm. The trained algorithm is subsequently applied to the full set of candidate matches.³

Tables A2 and A3 in the Appendix report the confusion matrices for the supervised machine-learning classification used to match German and international tenders to the Mannheim Enterprise Panel, respectively. They indicate high matching quality for both groups. For German tenders, the classification reaches an accuracy of 98.08 percent, with recall and precision for positive matches of 99.07 and 98.70 percent, respectively. For international tenders, accuracy amounts to 98.06 percent, while recall and precision for positive matches both equal 98.88 percent. The corresponding values for negative classifications are lower but remain high in both cases (≥ 92.13 percent). Thus, the procedure identifies valid matches with high reliability and distinguishes non-matches from valid matches with sufficient precision. Using the trained machine learning algorithm, we match 720,261 (88.68 percent) of German tenders and 286,196 (87.79 percent) of German tender awardees with the firm population of the Mannheim Enterprise Panel.⁴ Similarly, we link 19,160 (89.62 percent) international tenders and 12,362 (88.82 percent) international tender awardees. In comparison, Weichselbaumer (2024) matched 79.5 percent of public tenders from the Tenders Electronic Daily database awarded to German suppliers to ORBIS, which largely uses information provided by Creditreform, too (Breithaupt and Gottschalk, 2025). Finally, we identify the tenders awarded to firms within our investigated survey waves of the German Community Innovation survey by directly linking them to the Tenders Electronic Daily database via the generated joined firm identifier of the Mannheim Enterprise Panel.

3.3. Variable construction

The combination of the German Community Innovation Survey and the Tenders Electronic Daily database provides a firm-year-level dataset, which covers firms' characteristics in a

³ Before matching, multiple suppliers within one award line (e.g., due to bidding as a consortium) are disambiguated by splitting award-level records into supplier-specific award identifiers. This allows us to link suppliers within joint awards separately to the Mannheim Enterprise Panel.

⁴ It is important to note that we disambiguate multiple suppliers per award. This allows us to correctly identify different suppliers within one award.

given survey reference year, as well as firms' entire history of being awarded larger public procurement tenders between 2006 and 2023.

Public procurement awards – We construct two sets of four dichotomous variables based on firms' histories of being awarded large public procurement tenders. Within each set, the variables distinguish between four tender categories: (A) price-based tenders awarded by public contracting authorities located in Germany, (B) price-based tenders awarded by public contracting authorities located outside Germany, (C) criteria-based tenders awarded by public contracting authorities located in Germany, and (D) criteria-based tenders awarded by public contracting authorities located outside Germany.

In the first set, each variable equals one if a firm was awarded at least one tender in the respective category during the previous three years, and zero otherwise: (A) *German price-based awardee*, (B) *international price-based awardee*, (C) *German criteria-based awardee*, (D) *international criteria-based awardee*. This definition matches the three-year reference period of the innovation variables in the German Community Innovation Survey and captures a firm's contemporaneous success in securing public procurement awards (Krieger and Zipperer, 2022).

In the second set, each variable equals one from the year onward in which a firm is first awarded a tender in the respective category, and zero otherwise: (A) *post German price-based award*, (B) *post international price-based award*, (C) *post German criteria-based award*, (D) *post international price-based award*. These definitions capture firms' prior experience in securing public procurement tenders within a specific tender category. Thus, it indicates whether a firm represents a *real* or as a *pseudo-outsider* regarding the respective tender category.

Innovation capabilities – We measure firms' innovation capabilities using three dichotomous variables related to innovation outputs, namely the introduction of new or significantly improved products and services during the previous three years. The first variable equals one if a firm introduced new or significantly improved products or services during that period, and zero otherwise, regardless of its degree of market novelty. Thus, it does not differentiate between products and services new-to-the-firm which already existed on the market, and products and services new-to-the-market which did not yet exist in a market (*firm novelties*).

However, the second and third variables consider this differentiation. They distinguish whether such innovations were new to the local/German market (*German novelties*) or new to international – EU and/or beyond – market (*international novelties*). Additionally, we include firms' *innovation intensity* as a control variable related to innovation inputs. It is defined as annual innovation expenditures divided by annual revenues.

International capabilities – We measure firms' international capabilities using two dichotomous variables indicating whether a firm belongs to i) a national corporate group (*national group*) or ii) an international corporate group (*international group*). Each variable equals one if the firm is part of the respective group, and zero otherwise. In addition, we measure firms' *export intensity* as the share of firms' exports in their total revenues. Whereas group membership captures firms' structural organizational ties that may facilitate access to external markets and resources, export intensity captures firms' realized engagement in international markets.

Resource capabilities – We capture firms' resource capabilities using the share of employees with a higher education degree (*higher education*) and a set of size, age, and creditworthiness indicators. Together, these variables reflect firms' human capital endowment, organizational scale, accumulated experience, and financial strength. Firm size is measured by three dichotomous variables indicating whether a firm has i) fewer than 10 employees (*micro size*), ii) 10 to 49 employees (*small size*), or iii) 50 to 249 employees (*medium size*). Firm age is measured by indicators for being i) two years old or younger (*startup age*), ii) between three and five years old (*young age*), or iii) between six and ten years old (*medium age*). In addition, we include a dichotomous variable equal to one if a firm has a high credit rating, and zero otherwise (*high creditworthiness*).⁵

Market environment – We measure firms' market environment using industry, year, and competition indicators. Industry affiliation is captured by NACE Rev. 2 one-digit categories (*industry_X*), while year-specific effects are captured by a full set of dichotomous variables for

⁵ The credit score and age of a firm do not originate from the German Community Innovation Survey, but stem from the Mannheim Enterprise Panel. The credit score corresponds to a composite indicator constructed by Creditreform and takes into account various firm characteristics. It takes values between 100 (highest creditworthiness) and 600 (lowest creditworthiness). We follow the classification of Creditreform and classify firms with a score of 249 and lower as having a high creditworthiness.

the survey years (*year_X*). In addition, we include a dichotomous variable indicating strong competitive pressure (*competitive environment*). This variable equals one if a firm reports at least one of the following factors as being of high importance in their market environment: i) competitors' products or services are easily substitutable for those of the firm, ii) entry by new competitors poses a major threat to the firm's market position, or iii) the firm faces strong foreign competition, and zero otherwise. Each item is measured on a scale from 0 to 3, where 3 denotes high importance.

3.4. Sample description

The estimation sample includes firms from the German Community Innovation Survey with non-missing values for all constructed variables in the reference years 2012, 2014, 2016, 2018, 2020, and 2022. In total, it comprises 16,494 firms and 27,005 firm-year observations. Although the 2010 survey wave is the first to provide information on different types of market novelties, we exclude it to improve the reliability of our real and pseudo-outsider indicators. The construction of these indicators requires a sufficiently reliable identification of firms' first public procurement awards. However, the Tenders Electronic Daily database covers awards only from 2006 onward. To assess the resulting limitation, we examine the interval between tender awards for all firms in the German Community Innovation Survey that received awards in at least two different years between 2006 and 2023 (see Table A4 in the Appendix). In 95 percent of cases, the interval is shorter than five years. This suggests that firms with no observed tender award between 2006 and 2010 are unlikely to have won one before 2006. We therefore restrict the estimation sample to survey waves with reference years after 2010.

3.5. Sample statistics

Table 1 reports the descriptive statistics for the estimation sample. The distribution of the procurement variables shows that larger public procurement awards constitute relatively infrequent events in the sample. Considering the contemporaneous three-year award indicators, 4.2 percent of firm-year observations are associated with at least one German price-based award, while 3.4 percent are associated with at least one German criteria-based award. The corresponding shares for international awards are lower, amounting to 0.5 percent for price-based tenders and 0.4 percent for criteria-based tenders. Hence, procurement awardees

are more frequent in the domestic market. Moreover, within both the German and the international procurement market, price-based awards occur more often than criteria-based awards.

The pseudo-outsider indicators further show that the share of firms with prior procurement experience within a specific tender category naturally exceeds the share captured by the contemporaneous three-year award measures, while confirming the previously established tendencies: 7.0 percent of firm-year observations lie in periods after a first German price-based award, 6.1 percent after a first German criteria-based award, 1.2 percent after a first international price-based award, and 1.0 percent after a first international criteria-based award.

The descriptive statistics for the innovation variables indicate that innovation activity is common at the broad firm level, but less frequent when more demanding novelty thresholds are applied. Specifically, 41.3 percent of firm-year observations report the introduction of new or significantly improved products or services within the previous three years. By contrast, only 8.9 percent report product or service innovations that are new to the German market, and 9.6 percent report innovations that are new to international markets.⁶ Thus, a large share of observed innovation activity reflects innovations that are new to the firm, whereas market novelties at the national or international level are less prevalent. The mean innovation intensity amounts to 0.067, implying that firms spend, on average, 6.7 percent of their annual revenues on innovation activities.

The remaining variables capture firms' international orientation, resource endowments, and market environment and serve as controls in the empirical analysis. Since they are not at the center of our research question, we do not discuss them in greater detail here.

⁶ This difference reflects the design of the German Community Innovation Survey. After indicating that they introduced market novelties, firms are asked to report separately whether these novelties were new to i) the local/German market, ii) the European market, or iii) the world market. These categories are recorded as separate responses rather than as a hierarchically nested classification. This structure allows for a more detailed analysis of German versus international market novelties than a nested classification, as it distinguishes between three groups: i) firms with only German market novelties, ii) firms with only international market novelties, and iii) firms with both German and international market novelties. A nested classification would omit the second group.

Table 1: Descriptive statistics of estimation sample

Variables	Mean	Sd	Min	Max
<i>Public procurement awards</i>				
German price-based awardee (0/1)	0.042	0.201	0	1
International price-based awardee (0/1)	0.005	0.071	0	1
German criteria-based awardee (0/1)	0.034	0.181	0	1
International criteria-based awardee (0/1)	0.004	0.067	0	1
<i>Pseudo-outsider tender category</i>				
Post German price-based award (0/1)	0.070	0.255	0	1
Post international price-based award (0/1)	0.012	0.110	0	1
Post German criteria-based award (0/1)	0.061	0.240	0	1
Post international criteria-based award (0/1)	0.010	0.098	0	1
<i>Innovation capabilities</i>				
Firm novelties (0/1)	0.413	0.492	0	1
German novelties (0/1)	0.089	0.284	0	1
International novelties (0/1)	0.096	0.294	0	1
Innovation intensity	0.067	0.784	0	75
<i>International capabilities</i>				
National group (0/1)	0.247	0.431	0	1
International group (0/1)	0.546	0.498	0	1
Export intensity (0-1)	0.135	0.240	0	1
<i>Resource capabilities</i>				
Higher education (0-1)	0.249	0.287	0	1
Micro size (0/1)	0.254	0.435	0	1
Small size (0/1)	0.415	0.493	0	1
Medium size (0/1)	0.234	0.424	0	1
Startup age (0/1)	0.024	0.152	0	1
Young age (0/1)	0.040	0.196	0	1
Medium age (0/1)	0.086	0.280	0	1
High credit rating (0/1)	0.722	0.448	0	1
<i>Market environment</i>				
Competitive environment (0/1)	0.288	0.453	0	1

Note: 27,005 observations.

Table 2 provides additional descriptive evidence on the rigidity of public procurement markets in our estimation sample. More specifically, it reports, for each group of pseudo-outsiders, the share of firm-year observations that is associated with at least one award in each of the four tender categories during the previous three years. The four categories again distinguish between German and international tenders as well as between price-based and criteria-based tenders. Since firms may receive awards in more than one tender category within the same three-year period, the reported shares do not sum to one within columns.

Two patterns emerge. First, firm-year observations belonging to firms with prior award experience are more frequently associated with recent procurement awards than the average firm-year observation reported in Table 1. This indicates that firms having secured procurement awards in the past are more likely to secure further awards than firms without such prior experience. Second, this pattern is strongest within the same tender category. For each group of market-specific pseudo-outsiders, the highest share is located on the diagonal of Table 2, that is, in the tender category corresponding to the category in which the firm has already secured an award. For example, 51.7 percent of firm-year observations in the group with a prior German price-based award are again associated with a German price-based award. The corresponding diagonal shares amount to 31.9 percent for international price-based pseudo-outsiders, 48.2 percent for German criteria-based pseudo-outsiders, and 37.3 percent for international criteria-based pseudo-outsiders. Taken together, these descriptive patterns point to a degree of rigidity in public procurement markets. Firms that have already secured awards are more likely to secure further awards, and this tendency is strongest within the same tender category. This is consistent with the view that the four tender categories are not fully interchangeable and separated by barriers to successful entry.

Table 2: Firms' awardee status of German vs international and price-based vs criteria-based awards by pseudo-outsider category

		Pseudo-outsider category			
		(A) Post-German price-based award	(B) Post-int. price-based award	(C) Post-German criteria-based award	(D) Post-int. criteria- based award
Awardee status	(A) German price-based awardee	0.517	0.286	0.351	0.254
	(B) International price-based awardee	0.032	0.319	0.028	0.192
	(C) German criteria-based awardee	0.267	0.237	0.482	0.300
	(D) International criteria-based awardee	0.033	0.164	0.033	0.373
Observations		1,885	329	1,659	260

4. Empirical strategy

We investigate the relationship between a firm's introduction of new or significantly improved products and services with different degrees of novelty in year t and the likelihood of becoming a public tender awardee in year $t + 1$. Moreover, we differentiate between tender categories j , where j refers to the previously introduced four categories of public tenders. In addition, we allow the relationship between firms' introduction of new or significantly improved products and services and becoming a public tender awardee to differ between pseudo-outsiders and real outsiders in a given tender category. More formally, we estimate the following multivariate probit model:

$$A_{ji,t+1}^* = \alpha_j + \beta_j Pseudo_{i,t}^{(j)} + \gamma_j' Novelty_{i,t} + \delta_j' (Novelty_{i,t} \times Pseudo_{i,t}^{(j)}) + \theta_j' X_{i,t} + \varepsilon_{ji,t},$$

- $j =$ (A) price – based tenders awarded by public authorities located in Germany,
(B) price – based tenders awarded by public authorities located outside Germany,
(C) criteria – based tenders awarded by public authorities located in Germany,
(D) criteria – based tenders awarded by public authorities located outside Germany.

$A_{ji,t+1}^*$ denotes the latent propensity⁷ of firm i to become an awardee in tender category j in year $t + 1$, $Pseudo_{i,t}^{(j)}$ indicates whether the firm is a pseudo-outsider in tender category j in year t , $Novelty_{i,t}$ captures a firm's introduction of firm, German market, or international market novelties in year t . $X_{i,t}$ is a vector of controls in year t , including all further constructed variables on firms' innovation, international, or resource capabilities, as well as their market environment. $\varepsilon_{ji,t}$ are the error terms. Unlike separate probit models, the multivariate probit model allows error terms to be correlated across tender categories. This accounts for unobserved factors that affect becoming an awardee in multiple categories simultaneously.⁸

As stated above, the estimates of interest, γ_j and δ_j , are interpreted on the latent probit scale. For a binary novelty indicator, γ_j measures the conditional difference in latent propensity to become an awardee in tender category j between real outsiders with and without the respective novelty. The interaction estimate δ_j measures how this difference changes for pseudo-outsiders. Hence, $\gamma_j + \delta_j$ gives the corresponding conditional difference for pseudo-outsiders. Even though these estimates are conditional on various controls – likely beyond the information used by a public procurer for its awardee selection (e.g., Krieger and Rainville, 2026) – they should be interpreted as conditional correlations, not causal effects.

Across all results, we report the estimated coefficients directly, not average marginal effects. The main interest of the analysis lies in the sign, significance, and cross-equation pattern of the associations. Average marginal effects are useful for probability interpretations, but in nonlinear multivariate models they also depend on baseline probabilities and covariate distributions (e.g., Hoetker, 2007; Mullahy, 2017). Therefore, they are less transparent for comparing the underlying structure of associations across tender categories, because differences in marginal effects may reflect differences in outcome prevalence rather than

⁷ Latent propensity refers to an unobserved continuous index capturing a firm's underlying tendency to become an awardee in a given tender category. In the multivariate probit model, the observed binary outcome indicates whether this latent index exceeds a threshold. The estimated coefficients therefore refer to conditional differences in this latent index rather than to direct probability changes (e.g., Cappellari and Jenkins, 2003).

⁸ Relative to separate probit models, the multivariate probit model is preferable in our setting because it not only increases efficiency when unobserved determinants of becoming an awardee are correlated across tender categories, but also explicitly models this cross-category dependence. This is important in our empirical setting, as the four tender categories are differentiated, but not fully separated, such that unobserved firm characteristics may jointly affect becoming an awardee across several categories.

differences in the estimated latent associations.

In addition, as robustness test, we re-estimate the model using an alternative pseudo-outsider definition based on a first award in any of the other three tender categories. This complements our baseline specification, which – motivated by the rigidity shown in Table 2 – implicitly treats prior procurement experience within the same tender category as the more relevant form of prior experience. Similar results across both specifications would suggest that the estimated relationships reflect prior procurement experience more generally. Heterogeneous results would indicate that prior experience within the same tender category is empirically distinct from experience accumulated in other categories.

Finally, we assess whether the baseline results are driven by specific tender characteristics following (Krieger *et al.*, 2024). We conduct two leave-one-out analyses based on classifications available in the Tenders Electronic Daily database. First, we re-estimate the baseline model 44 times, each time excluding one product and service category based on the two-digit Common Procurement Vocabulary. Second, we re-estimate the model ten times, each time excluding one of ten procurer types provided in the Tenders Electronic Daily database. For both analyses, we examine the distribution of all coefficients of interest across re-estimations, covering the pseudo-outsider coefficients, the innovation coefficients, and their interaction terms. We report the mean, 25th percentile, 75th percentile, standard deviation, minimum, and maximum of these coefficients. This allows us to assess whether the baseline patterns are sensitive to specific product and service classes or procurer types.

5. Results

5.1. Baseline results

Table 3 reports the baseline estimates from the multivariate probit model. Since the coefficients are estimated on the latent probit scale, the discussion focuses on their sign, statistical significance, and relative pattern across tender categories and outsider status.

The first result concerns the pseudo-outsider indicator. Across all four tender categories, the coefficient on pseudo-outsider status is positive and highly statistically significant. Thus, conditional on the full set of controls, firms that have previously become awardees within a

given tender category are more likely to become awardees again in that same category than real outsiders. This pattern is consistent with the descriptive evidence in Table 1 and points to a pronounced role of category-specific prior procurement experience.

Turning to the novelty variables, the results indicate that the relevance of innovation differs across tender categories and outsider status. For German price-based tenders, firm novelties are positively associated with becoming an awardee for real outsiders. At the same time, the interaction between firm novelties and pseudo-outsider status is negative and statistically significant. Hence, the positive association of firm novelties with becoming an awardee is weaker for pseudo-outsiders. For international price-based tenders, firm novelties are again positively associated with becoming an awardee, although only weakly statistically significant. The interaction with pseudo-outsider status is again negative, but not statistically significant ($p = 0.538$). Thus, the point estimates are consistent with the pattern found for the previous price-based tender category and novelty measures, but the comparatively small number of international price-based awardees likely limits statistical precision.

For criteria-based tenders, the pattern shifts from broad firm-level novelty to market-specific novelty. In the case of German criteria-based tenders, German novelties are positively and statistically significantly associated with becoming an awardee for real outsiders. The corresponding interaction term is negative and highly statistically significant, implying that this positive relationship is weaker for pseudo-outsiders. For international criteria-based tenders, the same pattern appears for international novelties. International novelties are positively and statistically significantly associated with becoming an awardee for real outsiders, while the interaction with pseudo-outsider status is negative and statistically significant. By contrast, we do not find systematic evidence that German novelties matter for international criteria-based tenders or that international novelties matter for German criteria-based tenders.

Table 3: Firms' introduction of product innovations with different degrees of novelty and becoming an awardee of public tenders across tender categories and outsider status

	(A) German price-based awardee	(B) Int. price-based awardee	(C) German criteria-based awardee	(D) Int. criteria-based awardee
Pseudo-outsider	2.477*** (0.060)	2.355*** (0.187)	2.353*** (0.071)	2.657*** (0.235)
Firm novelties	0.135** (0.065)	0.229* (0.136)	0.113 (0.077)	0.113 (0.159)
Firm novelties × pseudo-outsider	-0.194** (0.095)	-0.122 (0.198)	0.017 (0.103)	0.211 (0.249)
German novelties	0.078 (0.111)	0.017 (0.195)	0.283*** (0.102)	-0.085 (0.188)
German novelties × pseudo-outsider	-0.063 (0.166)	0.209 (0.306)	-0.464*** (0.161)	-0.045 (0.340)
International novelties	-0.172 (0.121)	0.014 (0.189)	-0.159 (0.113)	0.357** (0.169)
International novelties × pseudo-outsider	0.179 (0.173)	-0.192 (0.280)	0.213 (0.167)	-0.512** (0.250)

Note: All estimations are based on a multivariate probit model and include all constructed control variables related to firms' capabilities and market environment. The number of observations equals 27,005 observations. Standard errors are clustered at the firm-level and displayed in parentheses. The full table is presented as Table A5 in the Appendix. p-values correspond to * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Taken together, these results indicate that the relevance of novelty is aligned with tender type. In the two price-based categories, the clearest positive relationship is found for firm novelties. In the two criteria-based categories, the relevant novelty measure corresponds more closely to the geographic scope of the procuring authority, that is, German novelties for German criteria-based tenders and international novelties for international criteria-based tenders. At the same time, these relationships are strongest for real outsiders. For pseudo-outsiders, the relevance of novelty is absent and the positive association visible for real outsiders disappears in the point estimates. This pattern is consistent with the view that novelty is more relevant for becoming an awardee when firms enter a tender category for the first time, whereas prior category-specific procurement experience becomes the more relevant factor once firms have already entered that category.

5.2. Robustness tests

Table 4 reports the robustness test based on the alternative pseudo-outsider definition, according to which a firm is treated as a pseudo-outsider in category j once it has previously become an awardee in any of the other three tender categories. The corresponding pseudo-outsider coefficient remains positive and highly statistically significant in all four equations. Thus, prior procurement experience outside the focal tender category is also positively associated with becoming an awardee. However, the magnitude of these coefficients is markedly smaller than in Table 3. This indicates that prior procurement experience in other tender categories is relevant, but less than prior experience within the same category.

The results for the novelty variables are weaker under this alternative definition. Most coefficients and interaction terms are no longer statistically significant. The only exception is a weakly significant positive relationship between firm novelties and becoming an awardee in international price-based tenders. Hence, the baseline interaction patterns do not carry over when pseudo-outsider status is defined through prior awards in other categories rather than within the same category.

These heterogeneous results across specifications indicate that prior procurement experience within the same tender category is empirically distinct from prior procurement experience accumulated in other categories. They suggest that the baseline results do not merely capture general procurement experience but are more closely related to prior award experience in the focal tender category. This is consistent with the descriptive evidence on rigidity in Table 2 and supports the view that the four tender categories are linked, but not interchangeable, because barriers to becoming an awardee remain at least partly category specific. Moreover, the absence of comparable novelty patterns in Table 4 suggests that the baseline specification in Table 3 is better aligned with the underlying process of becoming an awardee. More specifically, defining pseudo-outsider status within the focal tender category appears to recover a relationship between novelty and becoming an awardee that is masked when prior procurement experience is defined more broadly across categories.

Table 4: Firms' introduction of product innovations with different degrees of novelty and becoming an awardee of public tenders across tender categories and an alternative outsider status definition

	(A) German price-based awardee	(B) Int. price-based awardee	(C) German criteria-based awardee	(D) Int. criteria-based awardee
Alt. pseudo-outsider	1.484*** (0.060)	0.916*** (0.142)	1.408*** (0.064)	0.745*** (0.165)
Firm novelties	-0.021 (0.049)	0.230* (0.119)	0.055 (0.055)	0.102 (0.139)
Firm novelties × alt. pseudo-outsider	0.007 (0.086)	-0.062 (0.169)	0.038 (0.093)	0.226 (0.202)
German novelties	0.064 (0.079)	-0.108 (0.176)	0.141 (0.089)	-0.188 (0.208)
German novelties × alt. pseudo-outsider	-0.145 (0.142)	0.370 (0.239)	-0.131 (0.150)	0.132 (0.255)
International novelties	-0.036 (0.086)	0.057 (0.150)	-0.132 (0.102)	0.038 (0.175)
International novelties × alt. pseudo-outsider	0.068 (0.149)	-0.081 (0.227)	0.133 (0.171)	0.221 (0.237)

Note: All estimations are based on a multivariate probit model and include all constructed control variables related to firms' capabilities and market environment. The number of observations equals 27,005 observations. Standard errors are clustered at the firm-level and displayed in parentheses. The full table is presented as Table A6 in the Appendix. p-values correspond to * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Tables 5 and 6 report the results of the two leave-one-out analyses for the coefficients of interest. Table 5 shows that the baseline results do not appear to be driven by awardees in a specific product or service category. Across the 44 CPV-based re-estimations, the mean and quartile values of the coefficients are very close to the baseline coefficients. The pseudo-outsider coefficients remain positive in all four tender categories. Moreover, the relevant novelty coefficients remain positive, while the corresponding interaction terms remain negative in almost all cases. The only exception is the interaction between firm novelties and pseudo-outsider status for international price-based awardees, where the maximum coefficient becomes slightly positive. However, the corresponding baseline interaction term is not statistically significant. Overall, the CPV leave-one-out analysis therefore indicates that the baseline patterns are not driven by a single product or service category. Table 6 provides the corresponding leave-one-out analysis by contracting authority type. Across the ten CAE-based re-estimations, the mean and quartile values of the coefficients generally remain close to the baseline coefficients, although the distributions are somewhat more dispersed than in Table 5. This is expected given that the analysis is based on only ten CAE-type exclusions and therefore on a smaller descriptive distribution. Nevertheless, the main patterns remain stable.

**Table 5: Leave-one-out analysis for the coefficients of interest
by product and service category**

	Coeff.	Mean	P25	P50	P75	SD	Min	Max
(A) German price-based awardees								
Pseudo-outsider	2.477	2.467	2.469	2.473	2.477	0.030	2.283	2.490
Firm novelties	0.135	0.137	0.131	0.137	0.141	0.011	0.103	0.172
Firm novelties × pseudo-outsider	-0.194	-0.197	-0.204	-0.199	-0.191	0.012	-0.223	-0.162
(B) International price-based awardees								
Pseudo-outsider	2.355	2.344	2.334	2.345	2.357	0.035	2.230	2.448
Firm novelties	0.229	0.229	0.224	0.229	0.234	0.032	0.148	0.326
Firm novelties × pseudo-outsider	-0.122	-0.116	-0.131	-0.119	-0.106	0.043	-0.254	0.021
(C) German criteria-based awardees								
Pseudo-outsider	2.353	2.346	2.342	2.347	2.351	0.013	2.317	2.398
German novelties	0.283	0.281	0.277	0.283	0.287	0.018	0.212	0.324
German novelties × pseudo-outsider	-0.464	-0.470	-0.486	-0.472	-0.460	0.035	-0.556	-0.324
(D) International criteria-based awardees								
Pseudo-outsider	2.657	2.652	2.606	2.644	2.671	0.069	2.558	2.922
International novelties	0.357	0.378	0.368	0.377	0.390	0.052	0.148	0.547
International novelties × pseudo-outsider	-0.512	-0.470	-0.503	-0.473	-0.444	0.056	-0.667	-0.319

Note: To assess whether our results are driven by public procurement awardees in specific product and service categories, we conduct a leave-one-out CPV analysis. Specifically, we exclude observations referring to firms that were awarded a tender in a given product or service category, defined by two-digit CPV codes, within the last three years, and then re-estimate our baseline model. This procedure yields 44 estimations. Based on these estimations, we calculate the mean, 25th percentile, median, 75th percentile, and standard deviation of the coefficients of interest. These values allow us to compare the distribution of leave-one-out estimates with the coefficients from the baseline estimation.

**Table 6: Leave-one-out analysis for the coefficients of interest
by contracting authority type**

	Coeff.	Mean	P25	P50	P75	SD	Min	Max
(A) German price-based awardees								
Pseudo-outsider	2.477	2.411	2.405	2.451	2.467	0.109	2.115	2.475
Firm novelties	0.135	0.139	0.133	0.137	0.142	0.033	0.068	0.190
Firm novelties × pseudo-outsider	-0.194	-0.193	-0.212	-0.198	-0.193	0.044	-0.238	-0.074
(B) International price-based awardees								
Pseudo-outsider	2.355	2.354	2.334	2.358	2.386	0.038	2.270	2.402
Firm novelties	0.229	0.237	0.192	0.229	0.276	0.061	0.160	0.366
Firm novelties × pseudo-outsider	-0.122	-0.145	-0.183	-0.150	-0.104	0.091	-0.304	0.041
(C) German criteria-based awardees								
Pseudo-outsider	2.353	2.304	2.304	2.339	2.350	0.076	2.122	2.355
German novelties	0.283	0.271	0.256	0.280	0.282	0.059	0.147	0.379
German novelties × pseudo-outsider	-0.464	-0.474	-0.494	-0.470	-0.457	0.080	-0.656	-0.329
(D) International criteria-based awardees								
Pseudo-outsider	2.657	2.718	2.611	2.664	2.821	0.133	2.598	2.985
International novelties	0.357	0.353	0.339	0.358	0.378	0.102	0.144	0.520
International novelties × pseudo-outsider	-0.512	-0.437	-0.569	-0.444	-0.284	0.165	-0.672	-0.155

Note: To assess whether our results are driven by public procurement awardees associated with specific contracting authority types, we conduct a leave-one-out contracting authority type analysis. Specifically, we exclude observations referring to firms that were awarded a tender by a given contracting authority type, defined by CAE types, within the last three years, and then re-estimate our baseline model. This procedure yields 10 estimations. Based on these estimations, we calculate the mean, 25th percentile, median, 75th percentile, and standard deviation of the coefficients of interest. These values allow us to compare the distribution of leave-one-out estimates with the coefficients from the baseline estimation.

6. Discussion

The results provide three main insights into the relationship between tender design outputs (the actual tender documents) and procurement outcomes (the suppliers ultimately selected). First, current tender design outputs show a strong tendency to select suppliers with prior public procurement experience (pseudo-outsiders), particularly within the same tender category. This indicates rigidity in public procurement markets and suggests that contracting authorities face difficulties in selecting suppliers across differing tender designs, even when suppliers possess relevant category-specific experience. Second, the extent to which tender design outputs reward innovation capabilities differs across tender types. In price-based tenders, public contracting authorities are more likely to select suppliers with broad firm-level novelties, whereas in criteria-based tenders the relevant innovation dimension aligns more closely with the geographic scope of the procuring authority: Domestic novelties in domestic criteria-based tenders and international novelties in international criteria-based tenders. Third, these innovation-related selection effects are concentrated exclusively among real outsiders. For pseudo-outsiders, innovation capabilities are not rewarded through tender design output, indicating that prior procurement experience dominates tender design outcomes. The robustness tests support this interpretation by showing that the observed patterns are linked to prior experience within the focal tender category and are not driven by specific product or service categories or contracting authority types.

6.1. Implications for public procurement – procurers and policy

Regarding hypothesis i), which suggests that tender design outputs influence whether suppliers' innovation capabilities are rewarded during competition among bidders, several implications emerge.

Formulating innovation policy objectives aimed at fostering innovation through public procurement at the macro level (*public procurement for innovation*) is insufficient to ensure that innovation is actually procured (Amann and Eßig, 2015; Chiappinelli *et al.*, 2025). Innovation capabilities remain largely unrelated to selection outcomes among pseudo-outsiders, even where tender design outputs include award criteria beyond the lowest price.

This suggests that improvements in tender design outputs are a necessary but not sufficient condition for achieving *public procurement of innovation*.

Instead, *innovative public procurement* at the micro level requires strengthening the tender design process in the wider sense, particularly by increasing the *depth of supply market orientation*. As illustrated in Figure 3, a greater depth of supply market orientation reflects the extent to which contracting authorities systematically engage with previously untapped open innovation potential before tender documents are drafted. Rather than relying predominantly on pseudo-outsiders and existing solutions, deeper supply market orientation enables contracting authorities to identify innovation capabilities that remain outside their current knowledge base (Berkhout *et al.*, 2026).

Hypothesis ii) further suggests that tender design outputs influence the extent to which real outsiders are selected. Consequently, attracting a greater number of real outsiders may be essential for accessing the *breadth of available supplier innovation* for improved public services (compare Figure 3). Without efforts in the tender design process in the wider sense, real outsiders face two structural disadvantages. They may be indirectly excluded where tender design outputs are not informed by their alternative solutions, particularly when selection criteria (Mardas and Triantafyllou, 1997), technical specifications (Edquist and Zabala-Iturriagoitia, 2020; Röber, 2000), and award criteria (Krieger *et al.*, 2026) may fail to accommodate or reward innovative approaches. Tenders may also not be actively communicated toward these real outsiders (Coviello and Mariniello, 2014; Knack *et al.*, 2019). As a result, suppliers with superior innovation capabilities may not become part of the competitive process (Butler *et al.*, 2020).

More generally, reducing supplier transaction costs associated with tender design outputs appears essential for innovation-oriented competition (Carboni *et al.*, 2018; Rokkan and Haugland, 2021; Roumboutsos and Sciancalepore, 2014). This requires public contracting authorities to make greater strategic use of the legal instruments available to them, including market consultations, the choice of procurement procedure, selection criteria, functional and performance-based specifications, and award criteria. The central challenge for public procurement of innovation may therefore not be how to select the most innovative supplier

from among existing bidders, but rather how to ensure that “new” (and thus potentially more innovative) suppliers enter the competitive process in the first place.

6.2. Implications for firms aiming to be selected for public contracts

For firms aiming to supply public markets, the results suggest that innovation capabilities are particularly relevant at the point of entry into a tender category. Novel products or services are positively associated with award success among real outsiders, while this association is absent among firms with prior category-specific procurement experience. This indicates that novelty functions mainly as an entry-related advantage, rather than as a consistently rewarded capability after entry. For pseudo-outsiders, procurement experience appears more relevant than innovation. Established suppliers therefore do not appear to depend on continued innovation to remain successful in the same tender category. Instead, they are likely to face stronger incentives to allocate resources toward exploiting their category-specific procurement experience than toward developing additional novelties for public markets. For real outsiders, this further increases the importance of becoming visible prior to the tender design output – and even before the tender design process in the narrower sense begins. This highlights the role of signaling their innovation capabilities towards public contracting authorities during their supply market orientation (Pemer and Skjølsvik, 2019; Vinayavekhin *et al.*, 2026).

7. Conclusion

The findings primarily show that prior category-specific public procurement experience substantially increases the likelihood of a supplier being selected again, indicating a tendency toward rigidity and path dependency in public procurement markets. Second, the role of innovation capabilities differs across tender types. In price-based tenders, contracting authorities appear to reward broad firm-level novelties, whereas in criteria-based tenders they appear to reward market-specific novelties that correspond to the geographic scope and contextual needs of the procuring authority. However, these innovation-related effects are concentrated among real outsiders. For pseudo-outsiders, innovation capabilities are no longer associated with being selected, suggesting that innovation mainly functions as an entry-related advantage, while established suppliers benefit predominantly from prior procurement experience. This is particularly critical because pseudo-outsiders account for a

disproportionately large share of awarded contracts and procurement expenditure (Kang and Miller, 2022; Pliatsidis, 2024), potentially limiting the public sector's access to the *breadth of supplier innovations*.

7.1. Limitations

The empirical analysis is subject to four main limitations. First, the Tenders Electronic Daily database covers only larger public procurement tenders mandatorily. Hence, our results refer to firms becoming awardees in larger, formally reported procurement procedures and do not necessarily extend to smaller contracts below these reporting thresholds (Delegated Regulation (EU) 2025/2152). Second, we observe public procurement awards, but not firms' bids. As a result, the analysis cannot fully distinguish between firms' propensity to apply for public tenders and public procurers' propensity to select them as awardees. The estimated relationships may therefore reflect both supply-side selection into tender participation and demand-side selection by public contracting authorities (Di Mauro *et al.*, 2020; Krieger *et al.*, 2026). Third, the results should be interpreted as conditional correlations rather than causal effects. Although the multivariate probit model controls for a broad set of firm capabilities and market environment characteristics and accounts for correlations across tender categories, a causal interpretation would require a conditional independence assumption. More specifically, it would require that, conditional on the included controls, no unobserved factors jointly affect firms' innovation capabilities, prior procurement experience, and their likelihood of being selected. This assumption cannot be tested directly. Fourth, our empirical setting focuses on German firms. Although we distinguish between German and international public tenders, the analysis does not include suppliers from other countries. Accordingly, the findings should be interpreted primarily in the German context – the largest reporting country in the TED dataset – and may not be directly generalizable to countries with different procurement systems, supply markets, or innovation ecosystems.

7.2. Future research

These limitations should be considered when interpreting the results, but they also reflect the empirical constraints of linking public procurement records to representative firm-level innovation data at scale. Future research could extend the analysis to firms from other

European countries to assess the external validity of these relationships, once comparable and sufficiently recent innovation survey data become available.

Future research could also examine the characteristics and strategic behavior of pseudo-outsiders, particularly firms that operate predominantly within public procurement markets (Abdurakhmonov *et al.*, 2021; Miller and Lehoux, 2020) and may adapt their business models to public contracting authorities (Eßig and Batran, 2005). The *depth of supply market orientation* and screening mechanisms across the tender design process in the wider sense warrants further attention. In particular, more evidence is needed regarding how public contracting authorities identify, communicate with, and become aware of real outsiders prior to tender design outputs (Berkhout *et al.*, 2026; Lorentz *et al.*, 2020). Further research should investigate how tender design elements beyond award criteria – such as functional specifications, negotiation procedures, and selection requirements – shape innovation competition, supplier participation, and the attraction of real outsiders. Access to more detailed procurement data would further enable competition intensity analyses (Tátrai *et al.*, 2024) not only of which supplier was ultimately selected, but also of how many firms submitted bids and how innovative unsuccessful bidders were (Fountoukidis *et al.*, 2023). Finally, given the limited conceptual and theoretical work in public procurement research (Obwegeser and Müller, 2018), the proposed outsider-logic offers a foundation for further theory development on competition, innovation, and supplier selection processes (Schotanus, 2025). In particular, future research should further refine the concept of real outsiders introduced in this paper. While substantial evidence exists on the role of startups, young firms, and SMEs in public procurement (Flynn, 2025; Krieger *et al.*, 2026), these groups likely represent only a subset of real outsiders. The concept also encompasses established firms operating solely in private markets.

Conflicts of interest – *anonymized for peer review*

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During the preparation of this work the author(s) used ChatGPT v.5.5 in order to improve English language readability and clarity. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

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Appendix A

Table A1: Explorative literature analysis on competition in public procurement

Reference	Quantitative competition	Qualitative competition			Barriers	Theoretical foundation
		Price	Quality	Innovation		
(Goldberg, 1977)	(X)	X	X	-	(X)	Information economics
(Erridge and Nondi, 1994)	X	-	X	-	-	-
(Vagstad, 1995)	(X)	-	X	-	(X)	Competition theory; Auction theory
(Albæk <i>et al.</i> , 1997)	X	X	-	-	(X)	Competition theory
(Kim, 1998)	X	-	X	-	(X)	-
(Møllgaard and Overgaard, 2001)	X	X	-	-	(X)	Competition theory
(Heijboer and Telgen, 2002)	X	X	(X)	-	X	-
(Caldwell <i>et al.</i> , 2005)	(X)	-	-	(X)	X	-
(Telgen and Schotanus, 2010)	-	-	X	-	(X)	-
(Spagnolo, 2012)	X	(X)	X	-	X	-
(Rouboutsos and Sciancalepore, 2014)	X	X	-	-	X	-
(Wan, 2014)	X	-	-	X	X	-
(Sanchez-Graells, 2016)	-	X	-	(X)	X	-
(Borowiec, 2017)	X	X	-	-	X	-
(Flynn and Davis, 2017)	(X)	(X)	X	(X)	X	Capability-based view of public sector tendering
(Detkova <i>et al.</i> , 2018)	X	X	-	-	(X)	-
(Flammer, 2018)	X	(X)	X	-	(X)	Signaling Theory
(Knack <i>et al.</i> , 2019)	X	X	(X)	-	X	-
(Di Mauro <i>et al.</i> , 2020)	(X)	X	X	(X)	X	Transaction cost economics and resource-based view
(Nemec <i>et al.</i> , 2020)	X	X	-	-	-	-
(Tammi <i>et al.</i> , 2020)	X	-	-	X	(X)	“Competition and innovation: the inverted U-shape relationship”
(Tas, 2020)	X	X	-	-	-	-

Reference	Quantitative competition	Qualitative competition			Barriers	Theoretical foundation
		Price	Quality	Innovation		
(Abdurakhmonov <i>et al.</i> , 2021)	(X)	-	-	(X)	X	Resource dependence theory and resource orchestration
(Kang and Miller, 2022)	X	X	-	-	X	-
(Bhagat and Jha, 2023)	-	-	-	-	X	-
(Fountoukidis <i>et al.</i> , 2023)	X	(X)	-	-	X	-
(Tukiainen <i>et al.</i> , 2023)	(X)	X	(X)	(X)	(X)	-
(Krieger <i>et al.</i> , 2024)	-	-	-	X	-	-
(Tátrai <i>et al.</i> , 2024)	X	-	-	-	(X)	-
(Drake and Xu, 2025)	X	-	-	-	X	-
(Gorgun <i>et al.</i> , 2025)	X	-	-	-	(X)	-
(Kähkönen <i>et al.</i> , 2025)	(X)	X	-	(X)	-	Dynamic capabilities
(Koh and Lee, 2025)	(X)	X	-	-	(X)	-
(Schotanus, 2025)	X	(X)	(X)	-	(X)	-
(Krieger <i>et al.</i> , 2026)	X	X	X	X	X	-
(Krieger and Rainville, 2026)	(X)	(X)	X	X	X	Innovation trajectories
Total - 36	22	17	11	5	17	11

Note: An established literature strand rooted primarily in auction theory and economic approaches (e.g., (Bajari and Ye, 2003; Camboni *et al.*, 2025; Che, 1993; Coviello and Mariniello, 2014)) was excluded from the analysis, since its primary focus lies on “optimal bid levels of competing firms” (Gilley and Karels, 1981), auction efficiency, and auction design. Here, explicit conceptualizations or operationalizations of innovation-oriented competition in public procurement are absent.

Table A2: German tenders confusion matrix

ACC 98.08	True	False
Classified positive	532	7
Classified negative	82	5
Recall	99.07	92.13
Precision	98.70	94.25

Table A3: International tenders confusion matrix

ACC 98.06	True	False
Classified positive	353	4
Classified negative	51	4
Recall	98.88	92.73
Precision	98.88	92.73

Table A4: Distribution of the annual intervals between firms' tender awards

	Percent	Cum.
1	65.47	65.47
2	15.50	80.98
3	7.44	88.41
4	4.53	92.94
5	2.33	95.27
6	1.37	96.64
7	0.98	97.62
8	0.74	98.36
9	0.54	98.90
10	0.40	99.30
11	0.25	99.55
12	0.20	99.75
13	0.10	99.85
14	0.07	99.92
15	0.04	99.97
16	0.03	99.99
17	0.01	100.00
Total	100.00	100.00

Note: This table shows the percentage distribution of firms across the annual intervals between tender awards. All firms in the German Community Innovation Survey are included that become an awardee in at least two years within the period from 2006 to 2023.

Table A5: Firms' introduction of product innovations with different degrees of novelty and becoming an awardee of public tenders across tender categories and outsider status (FULL TABLE)

	(A) German price-based awardee	(B) Int. price-based awardee	(C) German criteria-based awardee	(D) Int. criteria-based awardee
Pseudo-outsider	2.477*** (0.060)	2.355*** (0.187)	2.353*** (0.071)	2.657*** (0.235)
Firm novelties	0.135** (0.065)	0.229* (0.136)	0.113 (0.077)	0.113 (0.159)
Firm novelties × pseudo-outsider	-0.194** (0.095)	-0.122 (0.198)	0.017 (0.103)	0.211 (0.249)
German novelties	0.078 (0.111)	0.017 (0.195)	0.283*** (0.102)	-0.085 (0.188)
German novelties × pseudo-outsider	-0.063 (0.166)	0.209 (0.306)	-0.464*** (0.161)	-0.045 (0.340)
International novelties	-0.172 (0.121)	0.014 (0.189)	-0.159 (0.113)	0.357** (0.169)
International novelties × pseudo-outsider	0.179 (0.173)	-0.192 (0.280)	0.213 (0.167)	-0.512** (0.250)
Innovation intensity	-0.004 (0.019)	0.009 (0.009)	-0.049 (0.084)	-0.004 (0.047)
National group	0.021 (0.070)	0.153 (0.163)	-0.042 (0.076)	0.028 (0.165)
International group	-0.026 (0.088)	0.043 (0.189)	0.011 (0.104)	0.140 (0.213)
Export intensity	-0.361*** (0.120)	0.539*** (0.169)	-0.230* (0.129)	0.043 (0.204)
Higher education	0.265*** (0.101)	0.616*** (0.223)	0.561*** (0.106)	0.824*** (0.213)
Micro size	-0.736*** (0.093)	-0.568*** (0.192)	-0.917*** (0.107)	-0.495* (0.273)
Small size	-0.357*** (0.071)	-0.410*** (0.151)	-0.501*** (0.081)	-0.192 (0.180)
Medium size	-0.226*** (0.067)	-0.087 (0.137)	-0.195** (0.078)	0.216 (0.165)
Startup age	0.200* (0.119)	-4.924*** (0.346)	0.184 (0.169)	0.421* (0.247)
Young age	0.244** (0.101)	-0.038 (0.203)	0.127 (0.131)	0.189 (0.274)
Medium age	0.020 (0.083)	0.086 (0.196)	0.145 (0.091)	0.021 (0.209)
High credit rating	0.062 (0.057)	0.267* (0.158)	0.050 (0.065)	-0.068 (0.153)
Competitive environment	0.023 (0.048)	-0.198* (0.112)	-0.055 (0.058)	0.017 (0.109)

Note: All estimations are based on a multivariate probit model and include all constructed control variables related to firms' capabilities and market environment. The number of observations equals 27,005 observations. Standard errors are clustered at the firm-level and displayed in parentheses. p-values correspond to * p < 0.10, ** p < 0.05, *** p < 0.01.

Table A6: Firms' introduction of product innovations with different degrees of novelty and becoming an awardee of public tenders across tender categories and an alternative outsider status definition (FULL TABLE)

	(A) German price-based awardee	(B) Int. price-based awardee	(C) German criteria-based awardee	(D) Int. criteria-based awardee
Alt. Pseudo-outsider	1.484^{***}	0.916^{***}	1.408^{***}	0.745^{***}
	(0.060)	(0.142)	(0.064)	(0.165)
Firm novelties	-0.021	0.230*	0.055	0.102
	(0.049)	(0.119)	(0.055)	(0.139)
Firm novelties × alt. pseudo-outsider	0.007	-0.062	0.038	0.226
	(0.086)	(0.169)	(0.093)	(0.202)
German novelties	0.064	-0.108	0.141	-0.188
	(0.079)	(0.176)	(0.089)	(0.208)
German novelties × alt. pseudo-outsider	-0.145	0.370	-0.131	0.132
	(0.142)	(0.239)	(0.150)	(0.255)
International novelties	-0.036	0.057	-0.132	0.038
	(0.086)	(0.150)	(0.102)	(0.175)
International novelties × alt. pseudo-outsider	0.068	-0.081	0.133	0.221
	(0.149)	(0.227)	(0.171)	(0.237)
Innovation intensity	-0.003	0.009	-0.192	-0.117
	(0.030)	(0.010)	(0.158)	(0.124)
National group	0.022	0.056	-0.076	-0.046
	(0.054)	(0.118)	(0.063)	(0.122)
Int. group	0.000	0.117	0.060	0.341*
	(0.071)	(0.149)	(0.081)	(0.174)
Export intensity	-0.784 ^{***}	1.102 ^{***}	-0.542 ^{***}	0.681 ^{***}
	(0.105)	(0.124)	(0.109)	(0.131)
Higher education	0.257 ^{***}	0.495 ^{**}	0.869 ^{***}	0.926 ^{***}
	(0.083)	(0.199)	(0.085)	(0.199)
Micro size	-0.874 ^{***}	-0.529 ^{***}	-1.213 ^{***}	-0.543 ^{**}
	(0.080)	(0.192)	(0.095)	(0.215)
Small size	-0.423 ^{***}	-0.444 ^{***}	-0.644 ^{***}	-0.324 ^{**}
	(0.058)	(0.127)	(0.067)	(0.142)
Medium size	-0.219 ^{***}	-0.137	-0.260 ^{***}	-0.058
	(0.056)	(0.117)	(0.066)	(0.125)
Startup age	0.064	-4.320 ^{***}	0.055	0.361
	(0.126)	(0.279)	(0.160)	(0.239)
Young age	0.110	0.248	-0.164	0.098
	(0.097)	(0.196)	(0.123)	(0.219)
Medium age	-0.057	0.083	0.041	0.006
	(0.073)	(0.165)	(0.076)	(0.160)
High credit rating	0.062	0.303 ^{**}	0.060	0.033
	(0.050)	(0.133)	(0.052)	(0.106)
Competitive environment	0.020	-0.154*	-0.057	0.005
	(0.039)	(0.092)	(0.047)	(0.089)

Note: All estimations are based on a multivariate probit model and include all constructed control variables related to firms' capabilities and market environment. The number of observations equals 27,005 observations. Standard errors are clustered at the firm-level and displayed in parentheses. p-values correspond to * p < 0.10, ** p < 0.05, *** p < 0.01.



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