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Integrity Dividends

Procurement in the Water and Sanitation Sector in Latin America and the Caribbean

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Authors:

Isabelle Adam
Mihály Fazekas
Alfredo Hernandez Sanchez
Peter Horn
Nóra Regös

Editores:

Marcello Basani
Jacopo Gamba

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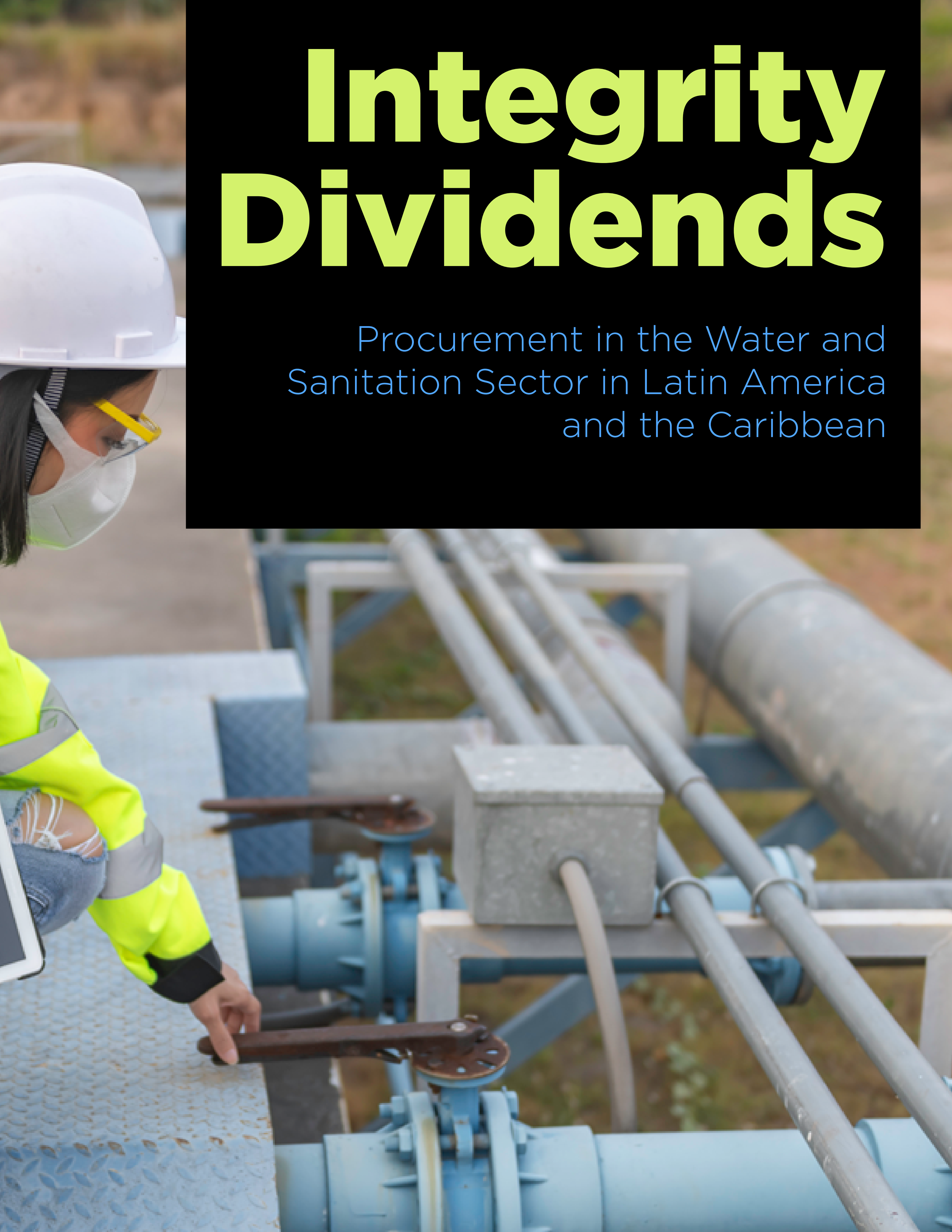

Integrity Dividends

Procurement in the Water and Sanitation Sector in Latin America and the Caribbean

Isabelle Adam (Government Transparency Institute)
Mihály Fazekas (Central European University and Government Transparency Institute) - corresponding author
Alfredo Hernandez Sanchez (Institut Barcelona d'Estudis Internacionals and Government Transparency Institute)
Peter Horn (Government Transparency Institute)
Nóra Regös (Government Transparency Institute)

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Executive Summary

Public procurement represents a large portion of government expenditure, more so in developing economies. Inefficiencies in public expenditures thus place a heavy burden on society. The Water and Sanitation (W&S) sector is especially vulnerable to public procurement inefficiencies due to the capital-intensive and complex nature of large-scale projects such as sewage, pipelines, and general maintenance. Recent studies have found that quality of corporate governance and transparency of water utilities as well as regulatory and supervisory agencies are key drivers of the sector's performance.

To support better policies in the W&S sector, this report conducts a sectoral measurement of public procurement integrity using government administrative data and identifies effective interventions for improving the performance of utilities. The following questions are explored:

- Which types of integrity risk carry the highest economic costs?
- What are effective policy solutions? Which address the most impactful risks effectively?
- What are the price savings and project-delay-reducing impacts of such solutions?

To this effect, the study analyzes data for six countries in the Latin American & Caribbean (LAC) region: Chile, Colombia, the Dominican Republic, Paraguay, Peru, and Uruguay. These cases were selected based on a) the scope and quality of data available, b) the coverage of water sector data in the country, and c) regional balance.

To measure W&S procurement integrity in the selected countries, the study collected data from publicly available sources such as national procurement portals. Several regression models were run to assess which indicators of integrity are good predictors of improved outcomes in terms of price (unit or relative) and quality (delays) of public purchases in the sector.

A total of 12 integrity indicators were considered and validity tested based on their availability within each country-level dataset. Each of them assumes a value between 0 and 100, where 0 represents risky behavior, 50 indicates medium integrity (where applicable) and 100 signals high integrity. Nine indicators were related to the tendering process, and three were based on information about organizations.

Based on pooled regression models in the procurement dataset, the study finds that several indicators of integrity predict a reduction in relative prices, unit prices and contract delays. Specific attributes of tenders such as multiple bidders and open procedure types are thus associated with better outcomes in W&S public procurement.

On this evidence, the report outlines seven policy recommendations and implementation strategies based on state-of-the-art research in the field of public procurement integrity to further improve these pricing and quality outcomes.

1 **Decrease the Share of Non-Open Procedures:** Policymakers should promote the use of open procedure types to increase competition in the sector.

2 **Foster Competition:** Policymakers should foster competition to further reduce the number of single bidder contracts.

3 **Reduce Buyers' Dependence on Select Suppliers:** Policymakers should encourage suppliers to diversify their bidding activity by competing for tenders posted by different contracting authorities.

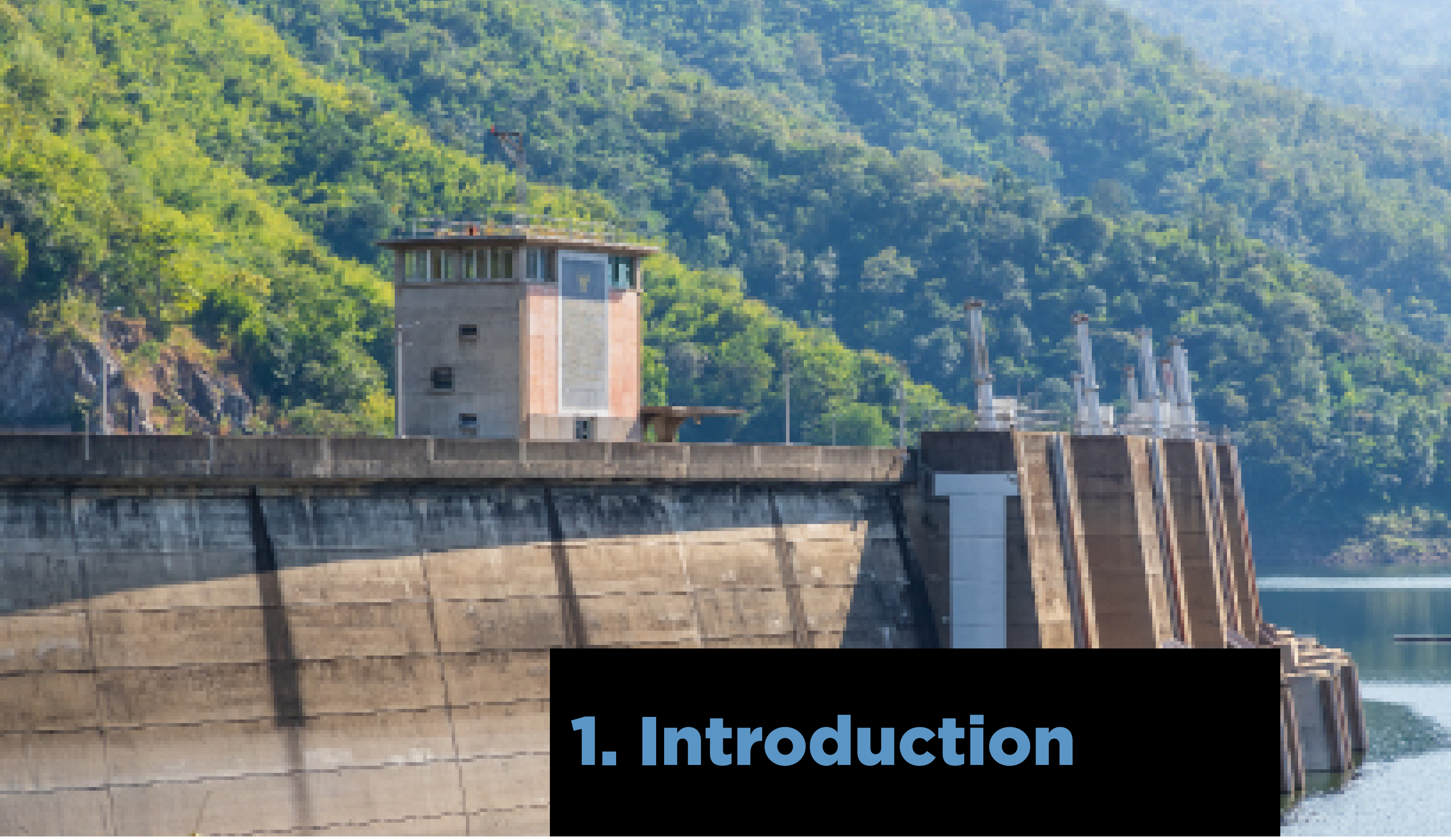
4 **Increase Transparency:** Policymakers should require publication of the most essential procurement documents from both contracting authorities and suppliers.

5 **Improve Tender Design:** Policymakers should advocate for longer submission periods so potential bidders have more time to submit their proposals of interest, and when needed, revise changes to legally mandated minimum periods.

6 **Increase Monitoring Effectiveness:** Increasing the efficiency and frequency of audits and monitoring visits may help curb integrity risks.

7 **Improve Data Reporting Standards:** Data accessibility could be improved by creating lot and contract level IDs to make merging different datasets more straightforward.

Although there is variation in the predicted effects these indicators have on savings and quality at the country level, there are some general guidelines and principles that can be extrapolated to the region as a whole. Based on the findings of the study, policymakers in the LAC region may prioritize encouraging competition in public procurement to decrease the share of single-bidder contracts as multi-bidding seems to be the most efficient way to further increase contract integrity in the W&S sector. Furthermore, promoting open procedures and improving tender design to reduce decision periods could also provide positive results as these tendering characteristics are associated with lower relative prices and fewer delays.



1. Introduction

Public procurement represents a large portion of government expenditure, averaging 29% for OECD countries, and even higher in developing nations. Globally, an estimated USD 11 trillion, approximately 15% of global output, is spent on public procurement. Thus, efficiency in public spending is essential. Implementing processes that support a more fair and transparent procurement system can lead to reduced costs and result in significant net savings in government spending. The Water and Sanitation (W&S) sector is especially vulnerable to public procurement inefficiencies due to the capital-intensive and complex nature of large-scale projects such as sewage, pipelines, and general maintenance.

There is growing evidence that the quality of corporate governance and transparency of water utilities as well as regulatory and supervisory agencies are key drivers of sectoral performance (Adam et al., 2020). These studies have found that the adoption of broad-based transparency policies and robust accountability mechanisms by regulators positively contributes to the sector's overall performance. Moreover, robust accountability mechanisms in the utility companies themselves are essential to improving their performance, including transparency and integrity of their public procurement processes (GWSP, 2021).

Thus, a closer look at indicators that measure integrity and the potential gains that stem from higher integrity is paramount. Such metrics are necessary to calculate the positive effects of good management practices and policies that can positively affect the full enjoyment of the human right to water and sanitation. Given the heterogeneity of available data, however, the report explicitly refrains from ranking countries on procurement integrity. Instead, it relies on pooled data to show the positive impacts higher procurement integrity could have in the W&S sectors of LAC countries.

1.1 Goals

This technical note develops a tailored measurement of W&S[1] public procurement integrity using government administrative data, estimates some key savings attributable to higher integrity, and identifies effective interventions for improving the performance of utilities. It proposes measurements for the scale, types, and impacts of public procurement integrity and sets out to answer the following questions:

- Which types of integrity risks carry the highest economic costs?
- What are effective policy solutions? Which address the most impactful risks effectively?
- What are the price savings and project-delay-reducing impacts of such solutions?

1 In a similar vein, Fazekas et al. (2021c) develop a Water Integrity Risk Index, which relies on a combination of similar procurement data along with survey data to assess integrity in the water and sanitation sector at the *city* level.

1.2. Country selection

The selection of countries included in the study was concluded following careful mapping and consideration of country characteristics as well as the different features of the data they publish. The three main selection criteria were the following:

1 **Data scope and quality:** Data scope is defined by the reporting thresholds and time period for which procurement data is available on the official government publication source (public procurement website). Therefore, if the observable period is too short or the available data does not cover a significant part of the procurement market (e.g., due to publication thresholds that are too high) the source becomes inadequate. Additionally, low data quality can also prevent the use of a specific data source for analysis. Low data quality is indicated by a large share of missing values or a complete lack of information on essential variables.

2 **Local water sector data coverage:** Specific variables are required to identify contracts related to the W&S sector. This includes the use of product codes and buyer names, item/contract names and contract descriptions to correctly identify contracts affiliated with the sector. The lack of all of these indicators would make the sectoral analysis unfeasible. In addition, an unrealistically low observation number in the sample can indicate inadequate data quality or W&S sector specific policies preventing the use of public data, both of which precludes an in-depth analysis.

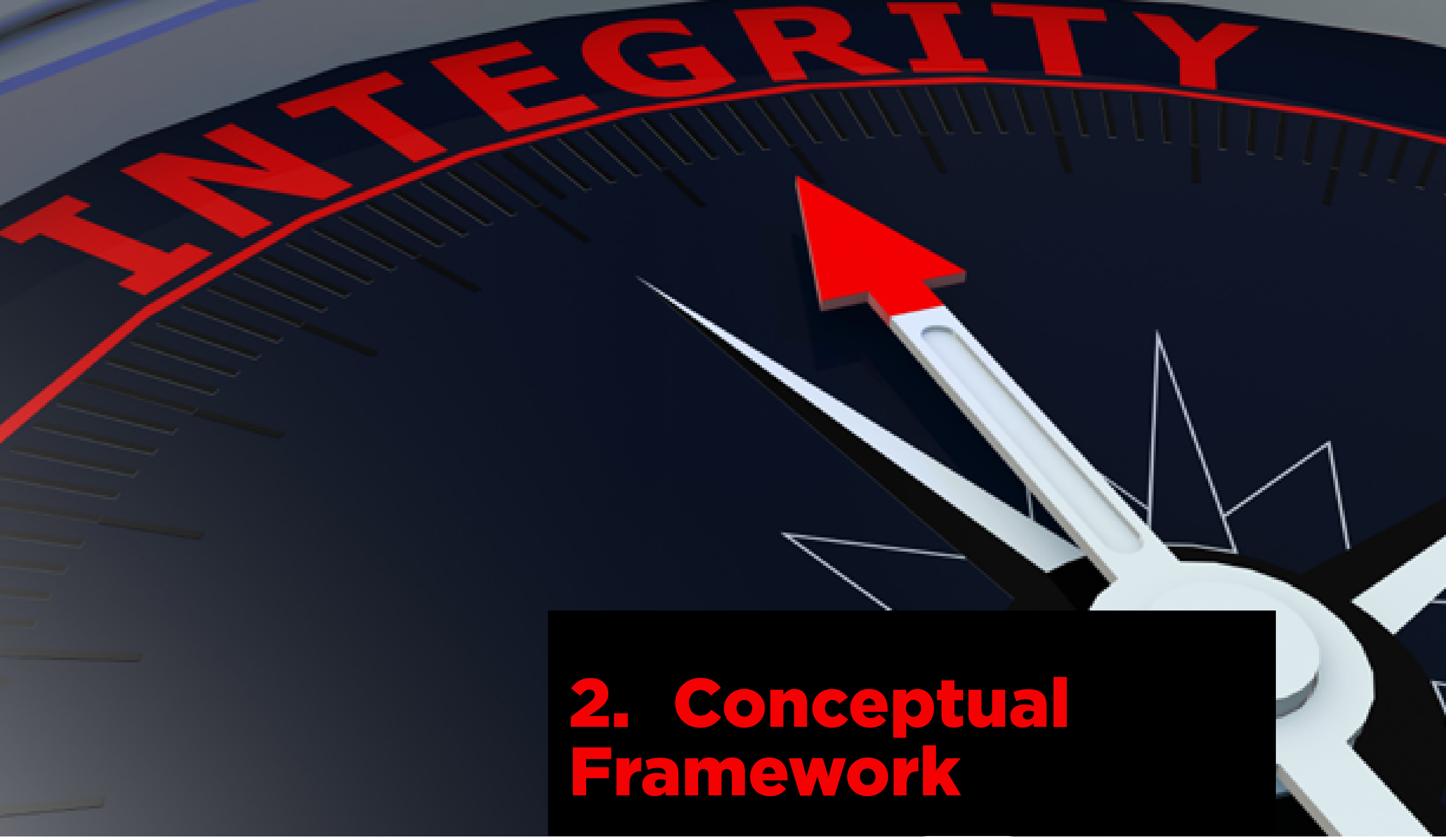
3 **Regional balance across LAC countries:** The final list of countries was selected to ensure that policy recommendations derived from our analysis are applicable to the wider Latin American region.

After screening a broad list of LAC countries, this report includes six countries from the region. The report focuses on LAC countries with high-quality procurement data, though considers sub-regional political and economic diversity. To this effect, the following countries were selected:

1. Chile
2. Colombia
3. The Dominican Republic
4. Paraguay
5. Peru
6. Uruguay

For Chile, Colombia, Paraguay, and Uruguay, we relied on the procurement dataset already available to the research team building on the Government Transparency Institute's global contracts database.[2] For the Dominican Republic and Peru, the research team mapped and collected new data from the countries' public procurement websites. Once all countries' datasets were collected, they were cleaned and validated in a standardized way to create a consolidated dataset that was used for our analysis. Relevant W&S contracts were identified by filtering for keywords, product codes, and procuring entities.

2 See: http://www.govtransparency.eu/gtis-global-government-contracts-database/.



2. Conceptual Framework

2.1 Definition of public procurement integrity

Integrity and the lack of it are notoriously hard to measure, partially because its definition is subject to debate (Michael, 1996). Many definitions are so broad or vague that they are not suitable for guiding measurement. For example, the OECD defines public integrity as “the consistent alignment of, and adherence to, shared ethical values, principles and norms for upholding and prioritizing the public interest over private interests in the public sector” (OECD, 2007). Yet such delineation demands a definition of public interest and shared ethical values. A clear and precise benchmark first needs to be set before any measurement exercise leading to actionable and comparable results.

Integrity[3] is defined in this study as the *open, fair, and impartial allocation of public resources to all citizens without favoring those with connections to the detriment of outsiders without such ties* (e.g., family, friendship or bribery-based) (Mungiu-Pippidi, 2006; North et al., 2009; Rothstein & Teorell, 2008). Although there are many other dimensions of accountability, this definition is not only conceptually sound and relevant for the scope of this study (i.e., sectoral public procurement) but it also resonates with commonplace understandings of the term. In addition, it supports a coherent and tractable measurement framework.[4]

When integrity is low, a range of corrupt activities can arise such as bribery, nepotism, theft, and other misappropriation of public resources (Bardhan, 1997; Nye, 1967; Lambsdorff, 1999; Mungiu-Pippidi & Hartmann, 2019; Shleifer & Vishny, 1993). Such corrupt acts may involve bribery and transfers of large cash amounts as kickbacks, but may also be conducted through broker firms, subcontracts, offshore companies, and bogus consultancy contracts. By implication, not everything designated as lacking integrity under this definition represents illegal activities as defined by the law in any given country (Fazekas et al., 2016; Fazekas & Kocsis, 2020).

Our definition of integrity focuses on open and impartial access to public resources, thus allowing for a clear-cut measurement framework (Mungiu-Pippidi, 2006; North et al., 2009). It concerns the access to, and distribution of, public resources given predefined policy goals, rather than the overall amount of such resources or the efficiency of the public sector to care for its citizens. Hence, though closely related to the level of economic development, lack of integrity is analytically distinct, thus enabling us to separate policymaking from policy implementation. Precisely differentiating integrity from efficiency of public spending also allows us to link the two and trace integrity on selected dimensions of spending efficiency, such as prices paid for a standard basket of goods.

3 This definition of integrity closely aligns with the scientific concept of ethical universalism as proposed by scholars in political science and institutional economics.
4 Throughout this report the lack of integrity and corruption are used interchangeably, even though some studies (Rose and Heywood, 2013) argue that integrity is a broader concept than just the impact of corruption.

2.2 The cost of low integrity

It is difficult to put an exact amount on the costs of low integrity in the W&S sector. While a best-case scenario might suggest that 10% is being siphoned off from the sector annually through corrupt practices, a worst-case scenario places the figure at 30% (Transparency International, 2008). Based on data from a diverse set of countries, estimates of quantifiable losses in the W&S sector associated with low integrity have been based on proxies. Davis (2004: p. 61), for example, finds that "it is not unreasonable to suspect that these institutions [public agencies and W&S service providers in South Asia] regularly spend 20–35% more on construction contracts than the value of the services rendered," thus diverting part of their resources in search of favors or providing free services or irregular connections to households. As a general figure, it is estimated that in developing countries, corruption can increase the cost of obtaining a connection to the water and sewerage network by 30% (Transparency International, 2008). Although reliable estimates of total losses are hard to calculate, the Water Integrity Network (2021) estimates that losses from several dimensions of corruption range 6–26% of overall costs in the water sector. By implication, corruption in this sector imposes a considerable social cost and constitutes a notable barrier to public health and economic development. Similarly, Adam et al. (2020) take a first step towards estimating the direct financial costs of low transparency on awarded contracts in the LAC W&S sector, as well as its costs on project delivery quality. Furthermore, W&S sector corruption corrodes public institutions and causes the loss of legitimacy and credibility of the government in the eyes of citizens. In addition, corruption threatens the achievement of Sustainable Development Goals (SDGs) and has a negative impact on attainment of humans' right to safe drinking water (Baillat, 2013; Davies & Fumega, 2014; Davis, 2004; Transparency International, 2008; Water Integrity Network, 2016).

Corruption and low integrity in the provision of W&S infrastructure can compromise public goals in at least three direct ways by: 1) distorting spending structure and project design; 2) inflating public procurement prices for a given quality; and 3) contributing to delayed and low-quality provision, and - in extreme cases - non-completion. Each of these is reviewed briefly to provide context for the subsequent empirical analysis.

1

First, low integrity in the W&S sector is likely to distort public spending structure, in particular, biasing public investment toward high-value, high-complexity investments in new infrastructure rather than spending on maintenance and operations. In high-value projects, even a small fraction of the investment value amounts to large corruption rents, making them particularly attractive to corrupt elites (Rose-Ackerman, 1999; Transparency International, 2008). This expected distortion is demonstrated by Tanzi & Davoodi (1997), who show that a higher level of perceived corruption in a country is associated with increased public investment, but with lower expenditures on operations and maintenance. Fazekas et al. (2015) point out that while the highest value and highest corruption risk procurement tenders are in infrastructure provision in Hungary, the average corruption risk of the sector is not particularly high. Given these considerations, the degree to which corruption biases W&S spending toward high-value projects in LAC should be investigated. Unfortunately, currently available datasets for countries included in this study are too limited to measure changes in spending structure.

2

Second, low integrity in the W&S sector is likely to increase procurement prices. A price increase can manifest itself in wages or material costs in the awarded contract or later during contract implementation. Duflo (2003) shows that overpricing is the key mechanism for extracting rents from public works on water irrigation systems in India. Flyvbjerg et al. (2004) also demonstrate that cost overruns are strongly affected by the type of accountability mechanism of the infrastructure project. Evidence from Italy contrasting data on cumulative investment into infrastructure and its available stock shows how regional level corruption in infrastructure positively correlates with the price of infrastructure, even after controlling for input costs, such as labor or construction material prices (Golden & Picci, 2005). While percentage price differences might appear small, given the high value of many W&S infrastructure projects, the absolute costs are high (Water Integrity Network, 2016).

3

Third, there seems to be a correlation between low integrity and increased delays and low-quality provision of W&S infrastructure and services. In this scenario, rents for the corrupt network are extracted by providing infrastructure or services of lower quality than contracted or delaying delivery. This connection between corruption and low quality and delivery delays in the W&S sector is indirectly established by Blancas et al. (2011), for example. To evaluate the effects of anti-corruption reform aiming to reduce delays in public works implementation in Brazil, they compare the procurement performance of the largest water and sewage utilities in São Paulo State (a reformer state) and Minas Gerais (a non-reformer state). The analysis finds that the reform is associated with a 24-day reduction in the duration of procurement processes for large projects. Interestingly, however, they find no evidence of an effect on prices paid (Blancas et al., 2011).

Flyvbjerg et al. (2004) point out that delayed provision and long implementation also create ideal conditions for inflating costs. Weak supervision and enforcement of the initial contract give rise to corruption risks, and while construction delays are easy to detect, assessing implementation quality is less straightforward (e.g., effects are only visible after years). Nevertheless, low quality and time overruns are not straightforward proxies of corruption, as complex projects can have unforeseen complications. The example of a report for the One WASH National Program in Ethiopia shows that most companies bidding for public contracts submitted bids without fully understanding the work or making a site visit, and bid a very low price to win contracts, leading to low quality and delays (Defere, 2015).

While these different forms of direct corruption costs in the W&S sector may occur jointly or stand in for each other, they are likely to carry different social costs. If corruption only increases the price of services or infrastructure without impacting project design, quality, delivery time, or overall completion, total social cost would be close to the direct cost. However, if corruption's direct impact goes beyond prices, additional indirect costs are likely inflicted on society assuming the form of non-available W&S infrastructure or unreliable provision, which can pose serious risks to human health. These issues cannot be discussed in detail, as their measurement is beyond the scope of this study. Nevertheless, this short discussion aimed to clarify that the relationship between corruption and inefficiency is complex and depends not only on the amount, but also on the type of corruption occurring. Corruption causes larger and smaller inefficiencies, while broader inefficiencies may occur without corruption, such as through deficiencies in state capabilities.

2.3 Types of anti-corruption interventions and evidence of their impact

A wide variety of interventions aimed at strengthening integrity in public procurement has been attempted and documented in the last few decades. These follow different intervention logics, work under different circumstances and are feasible under varying political conditions. Among those which are based on well-articulated theories and have garnered rigorous scientific evidence, as recently reviewed by Fazekas and Blum (2021a), we focus on three groups of interventions: strengthening transparency, widening access to public contracts, and increasing the expected costs of wrongdoing.

2.3.1 Strengthening transparency by increasing the quality and scope of data reporting, as well as stakeholder capacity for using data

Due to extensive regulations, the economic rationale of market transparency and diverse stakeholder demands for accountability, public procurement has long been a data-rich area of public spending. With the increasing use of electronic and online procurement tools, this rich set of administrative records has become more readily and more extensively available. Real-time data analysis is enabled by datasets tracking individual actions such as bids submitted to a tender, evaluation scores assigned, or invoices paid. Additionally, the move from individual records to structured databases makes the evaluation of complex policy interventions possible (Fazekas & Blum, 2021a).

Still, there are challenges to be addressed to fully capitalize on the advantages of Big Data in public procurement. First, considerable investment is required to build integrated data systems, even if they only encompass information already collected. Efficient and capable data systems can only be built with significant IT expertise and the understanding of complex databases that are often lacking or scarce in many public administrations. While there is not much empirical evidence on the subject, a comparative study by Telgen et al. (2016) shows that the lack of capacity and

knowledge on the part of governmental employees is one of the main problems harming procurement outcomes. This review finds that the development of procurement courses consistently delivered positive results across 20 studies, rendering sufficiently trained staff at procuring entities one of the most important criteria for successful reform. Second, ongoing data aggregation projects have shed light on the deficiencies of reported data. Reporting requirements on public procurement are often grossly neglected, making even the most essential bits of data erroneous, missing, or incomprehensible. Civic pressure is essential to improve data quality and to make the scope of publicly available data larger and more accessible (Fazekas & Blum, 2021a).

Nonetheless, the potential gains from adopting these new technologies outweigh the costs. Big Data in public procurement gives rise to advanced indicators, which help diverse users make sense of the, often daunting, complexity of procurement tenders. Such new indicators of value for money and integrity can complement, or in some cases replace, traditional indicators of governance by providing actionable and more objective insights (Knack et al., 2003). Furthermore, as this report suggests (see section 4), even minor, easy-to-apply changes to current reporting standards in the LAC region could significantly increase the transparency and usability of public procurement datasets.

While there is a long way to go to be able to fully capitalize on the potential of Big Data in public procurement, there is a growing body of literature which develops, tests, and applies objective proxies of open access, corruption, and favoritism around the globe (Trapnell, 2015). These initial innovations attest to the increasing capacity of Big Data indicators and impact evaluations to inform policy decisions and the wider public (Fazekas & Blum, 2021a).

2.3.2 Widening access to public contracts to limit the impact of political connections

Without fair and open access to government contracts, no procurement system can function properly. In the context of public procurement, limited access to public resources, originally developed in institutional economics (North et al., 2009), "refers to the allocation and performance of public procurement contracts by bending prior explicit rules and principles of good public procurement in order to benefit a closed network while denying access to all others" (Fazekas & Blum, 2021a: p. 3).

One of the most effective solutions to the problem of limited access is the introduction of an e-procurement system and stakeholder promotion of its consistent use across all procurement activities. E-procurement refers to the use of electronic communications and transaction processing by public organizations when procuring public works, goods, and services, including any phase of the public procurement process (Buyse et al., 2015). All LAC countries in this report use e-procurement systems and publish key information on their e-procurement websites about buyers, suppliers, and the procurement process.[5] However, additional functionalities such as adequately implemented e-auctions and better reporting standards (discussed above), could further improve access to public contracts to limit the impact of political connections. E-auctions refer to the repetitive process for presentation of prices, typically revised downwards (reverse auction), making use of a structured electronic platform (Fazekas & Blum, 2021a).

E-auctions can increase the transparency and intensity of competition and hence contribute to social value growth as well as to more open access to public procurements (Soundry, 2004). E-auctions often require the publication of key bidding information, such as prices, at each stage of the process. This requirement limits any room for manipulation and intensifies competition due to higher transparency and more, and better quality, information about all submitted prices, which gives bidders a chance to lower their own prices for winning the contract. Nevertheless, e-auctions can also be manipulated by a sophisticated corrupt network spanning the public and private spheres that could make sure a corrupt company wins with the lowest price while also guaranteeing a watering down of contractual conditions during contract execution.

5 This was a prerequisite for inclusion in the report.

While there are not many high-quality studies about the effectiveness of e-auctions, there is some limited evidence on their positive effect on competition and lowering procurement prices (Yakovlev et al., 2014). A study by Pavel & Sičáková-Beblavá (2013) on Slovakian IT purchases suggests that the overall effect attributed to the use of e-auctions compared to standard open auctions is estimated to be a 2.4% price reduction compared to the originally estimated contract value. Similarly, a study by Yakovlev et al. (2014) on a large sample of Russian sugar purchases in 2011 finds a considerably larger effect correlated with e-auction use of 28.0%–28.7% additional increase in discounts.

2.3.3 Increasing the expected costs of wrongdoing by strengthening monitoring and sanctioning frameworks

Procurement audits and supervision are best carried out by public organizations that are independent from contracting bodies to decrease conflicts of interest in the supervision process. Inefficient organizational hierarchy leading to overlapping interests between the monitoring agency and the contracting authority can significantly increase corruption risks. Additionally, if audits and monitoring are uncertain and even rule-abiding bureaucrats can be found guilty, they can generate a culture of fear, which stifles innovation and creativity (Kelman, 1990).

Audits and monitoring by truly independent state bodies are expected to increase the likelihood of detecting misconduct and the threat of punishment. Increased risk of punishment, in turn, contributes to higher levels of compliance with rules and less corruption (Fazekas & Blum, 2021a). In a randomized controlled experiment on village road construction projects in Indonesia (2003-2004), Olken (2007) found that an increase in the probability of an audit (from 4–100%) led to an 8% reduction in missing infrastructure spending. Another study by Di Tella and Schargrodsky (2003) looked at the prices of homogenous hospital inputs such as ethyl alcohol as a proxy for corruption in Argentina in 1996–1997. The results of the study show that the introduction of full monitoring of some input prices led to a 14.6% decrease in input prices while a loosening of this regime lowered the positive impact to 11%. Fazekas and Tóth (2017) study the impact of the European Court of Justice's decisions striking down anti-competitive practices based on EU Public Procurement Directives between 2009 and 2014. Comparing procuring body behavior (e.g., use of exceptional procedures) as well as bidding outcomes (i.e., number of bidders) from before and after the decisions entered into force suggest that monitoring by EU courts decreases the incidence of corruption-related anticompetitive practices by 5%–30% depending on the country-group studied.

However, a study by Gerardino et al. (2017) highlights the disadvantages of monitoring practices that are overly strict. The study shows that the national procurement legislation in Chile tries to promote use of more transparent and competitive auctions rather than discretionary direct contracts for selection of suppliers. Nevertheless, auctions are significantly more complex, and the audit protocol mechanically leads to more scrutiny and a higher probability of investigation. Gerardino et al. (2017) exploits the variation imposed by the scoring rule of the National Comptroller Agency to show that more frequent audits lead to decreased use of auctions and a corresponding increased use of direct contracts. Hence, to mitigate the negative effects of frequent monitoring, it is important to implement targeted audits based on thorough risk analysis. This requires continuous maintenance of a high quality and comprehensive procurement dataset, as well as systematic training of stakeholders to use the data for monitoring purposes.

Overall, the most important condition for a well-functioning monitoring and sanctioning framework is an independent monitoring agency. While the frequency of audits can positively affect the integrity of the procurement market, their overuse could hinder the use of - bureaucratically often more complex - open procedures. Therefore, auditors must proceed with caution and should mainly focus on more risky tenders (i.e., negotiated procedures, direct/outright awards).

3. Methodology and Data

3.1 Methodology

To measure the integrity of the W&S sectors of selected countries, the research team collected unit or relative price and contract delay data from the publicly available datasets discussed in the next section. *Unit price* refers to the standardized price for a certain quantity of goods and is calculated as the ratio between the total contract value and quantity purchased (Borges de Oliveira et al., 2019). *Relative price* is defined as the final contract (or tender) value divided by the initially estimated price, which essentially captures the discounts companies offer compared to the reference price (Coviello & Mariniello, 2014). *Relative contract delay* is measured by dividing the actual number of days for contract completion by the originally planned number of days for contract completion. Depending on their availability in each country, one of these variables was used in the models.

However, it must be noted that neither of these variables is without its shortcomings, so the variables should ideally be used in conjunction. Unit prices are only reliable for standardized goods and services, not for unique products like most construction projects. They also remain susceptible to biases due to unobserved quality differences (e.g., electricity as a product is highly standardized, while the quality of electricity provision may vary greatly, for example, by service continuity guarantees or renewable production sources). Relative prices, while applicable to a broader range of products, may be biased by the variability in initial cost estimates, which can be manipulated or simply unreliable. Similarly, relative contract delay is strongly dependent on the ex-ante estimates, which can be misleading and subject to manipulation.

While a comprehensive identification of causal effects is beyond the scope of this report,[6] the analysis relies on strong theory as outlined above, data that is both detailed and comprehensive, and careful modeling to get a reasonable approximation of the savings caused by procurement integrity in the W&S sector in LAC. At a generic level, the following equation was estimated:

Integrity impact = B0 + B1*integrity score + B2*institutional and market controls + ε

Integrity impact refers to relative prices, unit prices and/or relative contract delay as defined above. The Integrity Score is a composite index of available integrity indicators shown in Table 1 (described in detail in Appendix B). The score is the simple arithmetic average of individual integrity indicators, falling between 0 and 100, with 100 representing the highest possible integrity and 0 the lowest (described in detail in Appendix B). Institutional and market controls also differ from country to country, but generally include year, market, contract value, and buyer characteristics such as type or location. Exact variable availability is shown in Table 2 and coefficient estimates are detailed in section 4. Regression tables are reported in Appendix C.

6 In particular, the simple linear regression approach used may be prone to endogeneity bias. For example, it may be the case that an unobserved factor, such as product specificity, simultaneously drives both high prices and a low incidence of integrity indicators.

3.1.1 Integrity indicators

A total of 12 integrity indicators could be calculated and validity tested based on their availability within each country-level dataset (see Table 2). Each indicator is validated on its country-level dataset based on its association with single bidding and with the supplier's or buyer's dependence indicators[7] (see technical details in Appendix B). A description of country-specific indicators can be found in Appendix Table B1. Each of them ranges between 0 and 100, where 0 represents risky behavior, 50 indicates medium integrity (where applicable) and 100 signals high integrity. Nine indicators were related to the tendering process, and three were based on information about organizations. Organization-level integrity indicators include the supplier's dependence on a buyer, the buyer's dependence on a supplier and the winning probability of the supplier. Supplier's dependence shows the winning supplier's contract share received from the same buyer in a given year, which is a continuous variable, where a higher value indicates lower contract share and thus higher integrity. In turn, buyer's dependence shows the contracting authority's dependence on the same supplier in a given year. Winning probability indicates the likelihood of a company to win when it bids in a public tender. An artificially high winning probability can indicate a favored bidder with good political connections and as such, it indicates greater risk of corruption (lower integrity).

The nine tendering integrity indicators are related to different aspects of the procurement process. First, all the different procedure types used in the LAC countries were classified into low, medium, and high integrity procedure types based on their openness to competition as indicated by the validity tests. While there is variation between national procedure types, in general, open, and often semi-open procedures are considered "high integrity," restricted and negotiated with publication type procedures are treated as "medium integrity" and completely closed and negotiated without publication types are thought of as "low integrity" procurements (see Table B1).

The length of the period specified for bid submission was also measured. Extremely short submission periods often signal corruption risk as companies that are not informed in advance about the upcoming procedure do not have time to submit a proper bid. This provides well-connected companies with a significant advantage.

7 For more details on the indicator validation process see: Fazekas, M. and Kocsis, G. (2015): Uncovering High-Level Corruption: Cross-National Corruption Proxies Using Government Contracting Data, Working Paper series: GTI-WP/2015:02, Budapest.

Medium integrity procurements refers to short, but not extremely short submission periods. High integrity procurements are those that have a sufficiently long submission period.

Likewise, the amount of time it takes for the procuring entity to announce a decision was also measured. This period is calculated in a similar manner to the submission period; however, it captures the inefficiencies in the decision-making process. A hasty decision can signal that the result was decided in advance, while sometimes an overly long period can also indicate a corrupted decision-making process. Therefore, procurements with too short, or – in some cases – an extremely long decision period have a low integrity. Medium integrity refers to periods that are short, but not extremely short. High integrity procurements are those that have an adequate lengthy decision period that is sufficient to make an appropriate decision.

The mean absolute deviation (MAD) from Benford's Law was calculated for the contract values of each buyer in each year. Benford's Law suggests that in most real-life numerical data, the first digit of numbers tends to follow a particular distribution. On average, the probability of the leading digit being 1 is around 30%, while the probability of it being 9 is less than 5%. When reported contract values differ significantly from this well-established distribution, we suspect that some price manipulation may be at play. Evidence that contract values are artificially determined (i.e., deviate from Benford's Law) suggests lower procurement integrity.

For some countries, the length of the tender description was also relevant for integrity assessment. Excessively long descriptions can indicate that a tender was tailored to a pre-selected company, hence these are considered low integrity procedures. Similarly, where possible, the number of accompanying documents published was also counted, since a relatively small number of documents may indicate lower procurement integrity. Additionally, the location of the contracting authority and the supplier was also considered as some results suggest that organizations farther away could be less likely to engage in a particularistic relationship (see Tables C3 and C4).

Finally, calls for tender publication and multiple bidding were also employed as integrity indicators. The ex-ante publication of a contract notice can significantly increase procurement integrity, hence tenders with a published call for tenders are also considered higher integrity procedures. Single bidding (the opposite of multiple bidding) is the most widely used and most reliable corruption red-flag and as such is both included in the analysis and used as the dependent variable in the indicator validation.

Table 1: Integrity indicator description

Name	Description
Single Bidding integrity (multiple bidding)	Tenders/contracts receiving more than one bid
Supplier Dependence on Buyer	By winner-year-buyer: share of buyer in total annual winner contract value (lower implies higher integrity)
Buyer Dependence on Supplier	By winner-year-supplier: share of supplier in total annual awarded contract value (lower implies higher integrity)
Winning Probability	The likelihood of a company to win when it bids in a public tender
Submission Period	Period between call for tender publishing date and submission deadline
Call for Tender	Contract with call for tender
Decision Period	Period between call for tender submission deadline and award decision date
Procedure Type	Tender procedure type
Benford's Law	Contract/tender price deviation from the Benford's law
Disclosure of Procurement Documentation	Disclosure of procurement documentation (contracts, modifications, proposals)
Description Length	Length of procurement description (number of characters)
Buyer-Supplier Location	Different buyer-supplier location (county-level differences)

Each of the individual integrity indicators listed in Table 1 are assigned to categories that denote the level of integrity risk: low, medium, and high. The parameters of each risk category are calculated on a country basis through several rounds of validation regressions where the predictors include the indicator of interest plus relevant controls, and the response variables are commonly used proxies of procurement integrity: single bidding (binary) and market concentration (percentage). Depending on the availability of data by country (see Table 2), the individual components of the composite Integrity Score vary. Similarly, individual components that are not significant predictors of one of the two main response variables are omitted from the composite score in a given country (see Appendix B1).

3.2 Public procurement data

All the data used in this report comes from publicly available, official government procurement portals. For Chile, Colombia, Paraguay, and Uruguay, data had already been collected and cleaned by Adam et al. (2020), this data is made publicly available in the Government Transparency Institute's global contracts database[8]. For the Dominican Republic and Peru, the research team mapped and collected new data from the countries' public procurement websites[9]. Only data relevant for the W&S sector was considered. This includes all inputs purchased by utilities (e.g., office supplies or pipes) or W&S-related purchases by local and central public institutions (e.g., fresh water). The research team identified whether each country's public procurement data contained the relevant organizations belonging to the W&S sector or purchases related to the W&S sector based on keyword searches. As procurement rules and the ownership of water utilities differ by country (public vs. privatized utilities) the amount and coverage of data on the W&S sector differs considerably. The availability of variables needed for integrity indicators also varies on a country basis. The details of the available procurement data per country are provided in section 3.1.

Following these comprehensive data mapping and collection activities, our analysis is conducted on contract level datasets of public purchases in the six countries. However, even in this relatively narrow domain, the datasets of the six countries showed considerable variation in terms of scope, quality and key variables covered (Table 2). As a result of all these differences, *the report explicitly refrains from ranking countries on procurement integrity*. Instead, it relies on pooled data to show the positive impacts that higher procurement integrity could have in the W&S sectors of LAC countries. It must be noted that the selected countries do not necessarily represent the full set of LAC countries, especially as they were selected based on data availability, scope, and quality; however, the region's geographic and socio-economic pluralism was considered when selecting the cases.

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8 See: http://www.govtransparency.eu/gtis-global-government-contracts-database/.

9 Peru: https://bi.seace.gob.pe/pentaho/api/repos/%3Apublic%3Aportal%3Adatosabiertos.htmlcontent?userid=public&password=key#. Dominican Republic: https://www.dgcp.gob.do/datos-abiertos/.

Table 2: W&S sector database overview by country

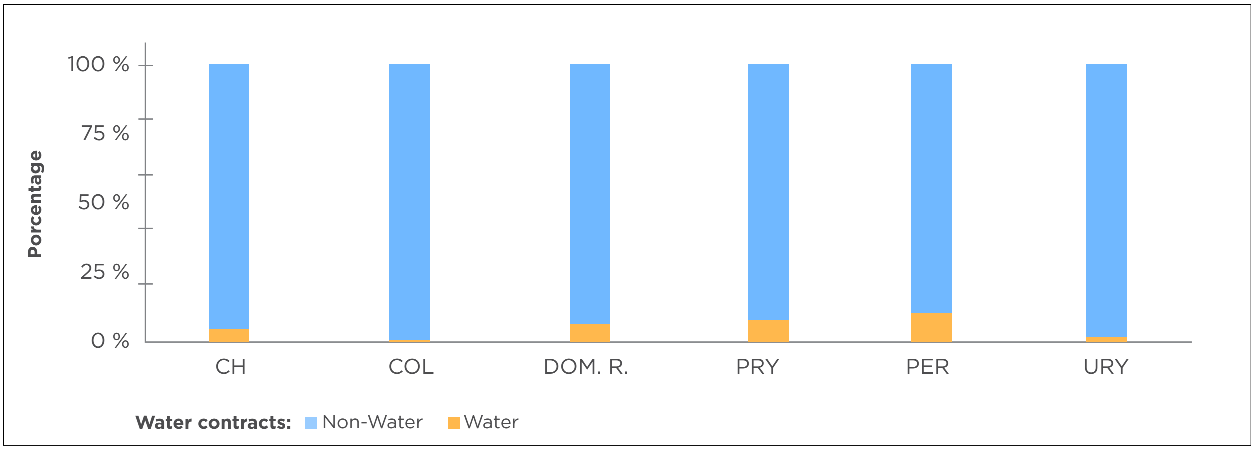
Category	Variable Name	Chile	Colombia	Dominican Republic	Paraguay	Peru	Uruguay
Integrity Impact (Dependent variables)	Relative Price	x		x	x	x	
	Unit Price						x
	Contract Delivery Delay		x				
Integrity Indicators (Explanatory variables	Single Bidding	x			x	x	x
	Supplier Dependence on Buyer		x		x	x	x
	Buyer Spending Concentration	x	x	x	x		x
	Submission Period			x	x	x	x
	Call for Tender		x	x	x	x	x
	Decision Period	x		x	x	x	x
	Procedure Type	x	x	x	x	x	x
	Disclosure of Procurement Documentation				x		
	Benford's Law	x	x	x			
	Buyer-Supplier Location		x				
	Description Length				x		
	Winning Probability				x		
Control Variables	Main Market	x	x	x	x		x
	Buyer Type	x	x	x	x	x	x
	Year	x	x	x	x	x	x
	Total Tender Value (log)	x				x	
	Contract Type		x				
	Supplier Legal Entity Form			x			
	Supplier Location	x		x		x	
	Supplier Gender			x			
	Supplier Age					x	
	Buyer Location					x	
	Contract Value (log)			x	x	x	x
	Contract Value		x	x		x	
	Source		x				
	Buyer Location	x	x			x	
General Information	Years Covered	2014–2020	2011–2020	2018–2021	2010–2020	2018–2021	2014–2020
	Observations[10]	35,899	77,249	12,235	14,055	21,630	43,275
	Unique Buyers	90	2651	15	73	294	5
	Integrity impacts tracked	Relative price	Relative delay	Relative price	Relative price	Relative price	Unit price

10 Observation numbers in regression models may differ due to missing red-flags and dependent variables.

3.3 Identifying W&S contracts

W&S contracts are identified by keywords in the tender title, tender description, and buyer name in national public procurement datasets. Keywords include references to water, sanitation, pipes, treatment, and sewage.[11] Bottled water for consumption is omitted. To find the most relevant utilities and products, buyer names and titles are harmonized (accents and whitespaces were removed, text was converted into lower case).

Figure 1: Share of W&S sector-related contracts by country



Source: GTI calculation based on country level procurement data

Procurement data for Chile (CL) was downloaded from the national portal ChileCompra.[12] Item-level data (9,836,152 observations) was made available from 2014 onwards in several spreadsheets that were subsequently merged into a single dataset.[13] The combined data was analyzed at the tender level, and indicators were also aggregated at the tender level. The combined dataset has a total of 1,090,239 observations including 2,475 procuring entities and 89,866 suppliers. Following W&S contract classification, 35,899 water-related observations, or approximately 3.3% of total tenders procured in the country for the period, were identified (Figure 1). These tenders can be associated with 90 utility companies and 2,941 suppliers (Table 2).

11 These keywords are references to water and sanitation in various grammatical forms. Prefixes include *acua, agua, alcanta, potable, saneamiento, drena, pipa, acue, and tuber*. Similarly, CPV codes related to W&S related products were also considered. For the complete list of keywords, see Appendix A, Table A1.

12 https://www.mercadopublico.cl/Home/BusquedaLicitacion.

13 Around 2.8 million direct (outright) awards are removed from the data due to two factors: procurements are unavailable before 2019, making the dataset uneven across years, and they lack essential information, which would distort the results of the analysis.

The public procurement dataset for Colombia (CO) was collected from the national procurement system, SECOP.[14] State entities are required to publish their public contracting activities in SECOP, ensuring procuring bodies' accountability. Therefore, data focus on contract details, including purchases by both centralized and decentralized government bodies at national, regional, and local levels. The full procurement dataset contains 2.9 million observations. The number of W&S contracts identified amounts to 77,249, or approximately 2.5% of total items procured in the country for the period (Figure 1).

Procurement data for the Dominican Republic (DR) was downloaded from the national portal DGCP.[15] Item-level data was made available from 2018 to 2021 in several spreadsheets that were subsequently merged into a single dataset and aggregated to the contract level (239,913 observations). The complete dataset provides information on public procurements by 353 contracting authorities and 16,794 suppliers. The research team classified 12,235 water-related observations, or approximately 5.1% of total items procured in the country for the period (Figure 1). The contracts can be associated with 14 utility companies and 597 suppliers.

The Paraguayan (PY) dataset consists of a combination of three sources: a) Open Contracting Data Standards (OCDS) publications, b) yearly publications on the public procurement portal, and c) bidder data downloaded from the website of the national procurement agency.[16] The combined dataset contains 733,098 observations defined on the level of bids submitted for the years 2010–2021, which translates to 177,745 unique contracts. This dataset contains purchases by federal, state, and municipal governments, federal and local bodies, national funds and banks, and other independent entities. Overall, 14,055 W&S sector related contracts were identified, or approximately 7.9% of the total items procured in the country for the period (Figure 1).

Peruvian (PE) data was downloaded from the national portal CONOSCE.[17] Item-level data (203,597 observations) was made available from 2018 onwards in several spreadsheets that were subsequently merged into a single dataset. The complete dataset has 3,003

14 The system's structure and the scope of published data changed over the analyzed period (2011–2021). SECOP I was launched in 2011 and operated until 2018. It contained most of the variables relevant for indicator calculation. SECOP II was launched in 2015 and was active until 2018. After 2018, these data sources were combined into SECOP Integrado. Data from Tienda Virtual was not collected for this analysis.

15 https://www.dgcp.gob.do/datos-abiertos/.

16 https://contrataciones.gov.py/.

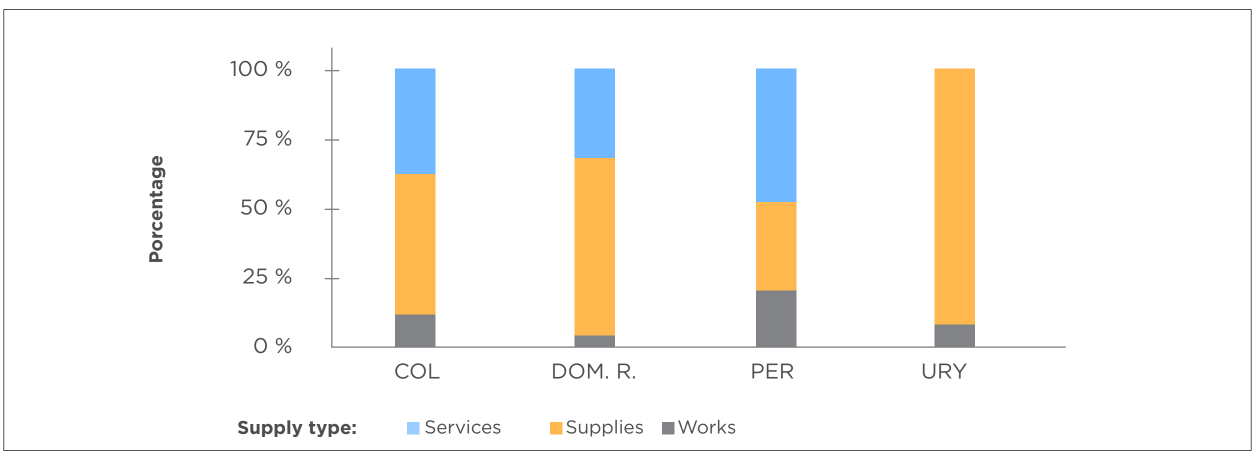
17 https://portal.osce.gob.pe/osce/conosce/.

procuring entities, 76,522 suppliers and an average bidder number of 4.6 at the contract level. The research team identified 21,630 water-related observations, or approximately 10.6% of total items procured in the country between 2018 and 2021 (Figure 1). The contracts can be associated with 294 utility companies and 8,443 suppliers (Table 2).

The Uruguayan (UY) dataset contains data published by the national procurement agency (Agencia de Compras y Contrataciones del Estado, ACCE) on its website listing details for tenders and contract awards from 2014-2021. The ACCE database used in the report includes 553,000 observations that cover awarded, active or completed tenders from the period of 2014–2021. Contracts related to the W&S sector consist of 43,275 water-related observations, or approximately 7.8% of total items procured in the country for the period (Figure 1). The contracts can be associated with five utility companies (88% of the contracts were awarded by the Administración de las Obras Sanitarias del Estado, OSE).

Figure 2 shows the distribution of W&S contracts by supply type, in each country where such data was available. The bulk of these contracts were for supplies (34,026) followed by services (25,065) and works (9,075). Nevertheless, approximately 46% of total W&S contracts had a missing supply type classification, mainly because Chilean and Peruvian public procurement systems do not disclose this information.[18]

Figure 2: Supply type of awarded contracts in the W&S sector by country (if supply type variable was available)



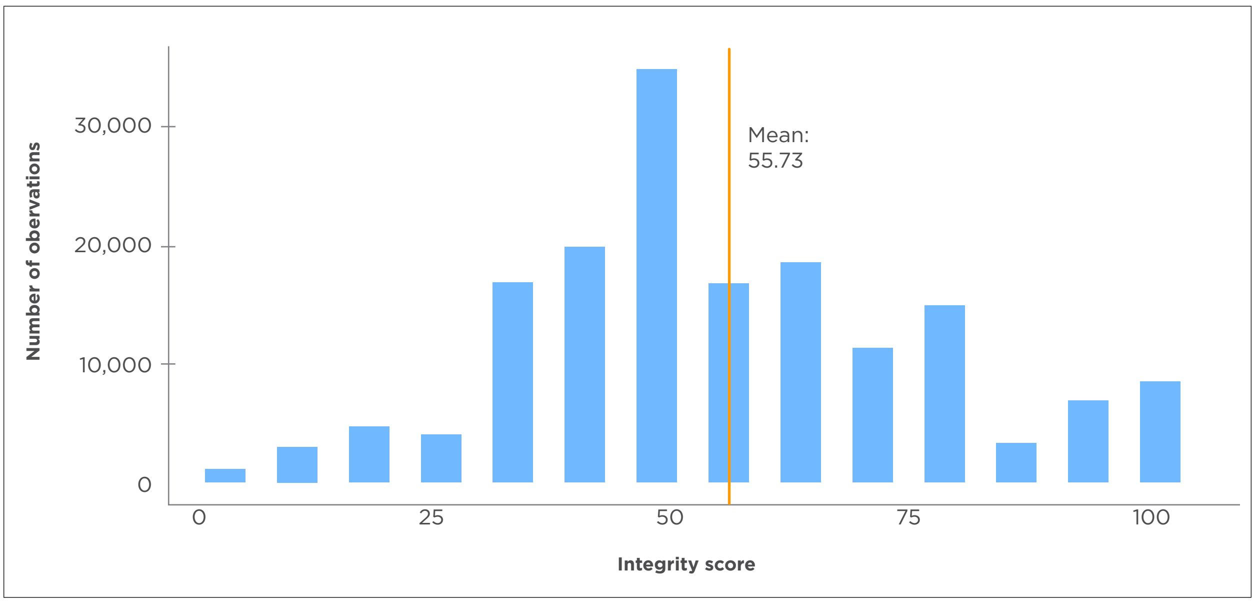
Source: GTI calculation based on country level procurement data.

18 For Uruguay, only unit prices for supplies and works were considered, services were excluded (see Table 2).

3.4 Regional integrity overview

The integrity score is calculated as a simple arithmetic average of the previously described integrity indicators. The composite index is computed at the contract-level, meaning that for each contract, the available integrity indicators were aggregated, thus measuring the overall integrity of each procurement process. Figure 3 shows the distribution of the integrity score across all W&S contracts in the selected LAC countries. It illustrates that an average contract had an integrity score of 55.7 on the 0–100 scale, implying that the water and sanitation sector in the observed LAC countries had medium integrity during the observed period.[19] Notably, there is an approximately normal distribution of pooled integrity scores.

Figure 3: Distribution of integrity scores in the LAC region W&S sector (2010-2021)



Source: GTI calculation based on country level procurement data.

19 Each indicator is calculated on a country-by-country basis and risk-levels are determined by their predictive power on well-established metrics of low procurement integrity such as single bidding and market concentration.

4. Results: Positive Effects of Integrity

This section presents the main results of the regression analysis. First, we analyzed the effect of integrity indicators and composite integrity score on the dependent variables (relative price, log unit price and contract delay). Then we estimated the potential savings that could be achieved from higher integrity.

4.1 Explaining prices and delays

The effects of integrity indicators and composite integrity scores on relative contract prices, the logarithm of item unit prices and contract delays, were separately tested using OLS regression models. *Relative prices* are calculated as the normalized fraction of the final contract value and the estimated contract value initially assigned by the contracting authority.[20] Consequently, the relative

20 (Final contract value/Estimated contract value) * 100.

price increases as the final contract value positively diverges from the estimated value. The relative price is below 100 whenever the contract value is below the estimated value, indicating a discount compared to the reference price. Rather infrequently, the relative price is above 100, which would suggest that the winning bid was above the initial estimate. Log unit prices are the logarithms of the price for a unit of product within a given contract. As work and service type procedures tend to have less standardized quality, they are not included in this model. This report assumes that supply type procedures have standardized units that are mostly comparable across different procedures. *Relative contract delay* is measured by dividing the actual number of days for contract completion by the originally planned number of days for contract completion.

For each model, country-level datasets were combined based on the availability of the dependent variable.[21] In addition to the available integrity indicators (details on indicator calculations in Appendix B), the models also include year, market, and – if applicable – country fixed effects and a set of control variables. The report estimates the effect of both the composite integrity score and the individual integrity indicators separately to demonstrate the likely effects from comprehensive as well as targeted integrity improvements. The detailed coefficient estimates, and the list of controls are shown in Tables C2-C4 in Appendix C. Figure 4 highlights the integrity indicator effect magnitude by dependent variable.[22] For each indicator, the predicted coefficient represents the largest effect size (e.g., if an indicator has two integrity categories – medium and high – it only shows the predicted value for the highest category). The base category of each indicator is the riskiest, except for winner and buyer dependence, which are continuous variables. For these, the predicted effects can be interpreted as a change in the dependent variable due to a one percentage point improvement in the winner's/buyer's dependence, everything else being equal.

In the case of the relative price model, each available integrity indicator is significantly negative, suggesting that high integrity categories have significantly lower relative prices compared to the lowest integrity category. For example, multi bid contracts, on average, have 5.4% lower relative prices compared to single bid contracts, and procedures that publish calls for tenders have 2.8% lower relative prices. This indicates that LAC countries could significantly reduce relative prices, therefore lowering total

21 The log unit price and contract delay dependent variables could only be calculated for one country each. For details on which dependent variables were available in each country, see Table 2.
22 The figure only shows significant integrity effects; all coefficient estimates can be seen in Tables C2–C4 in Appendix C.

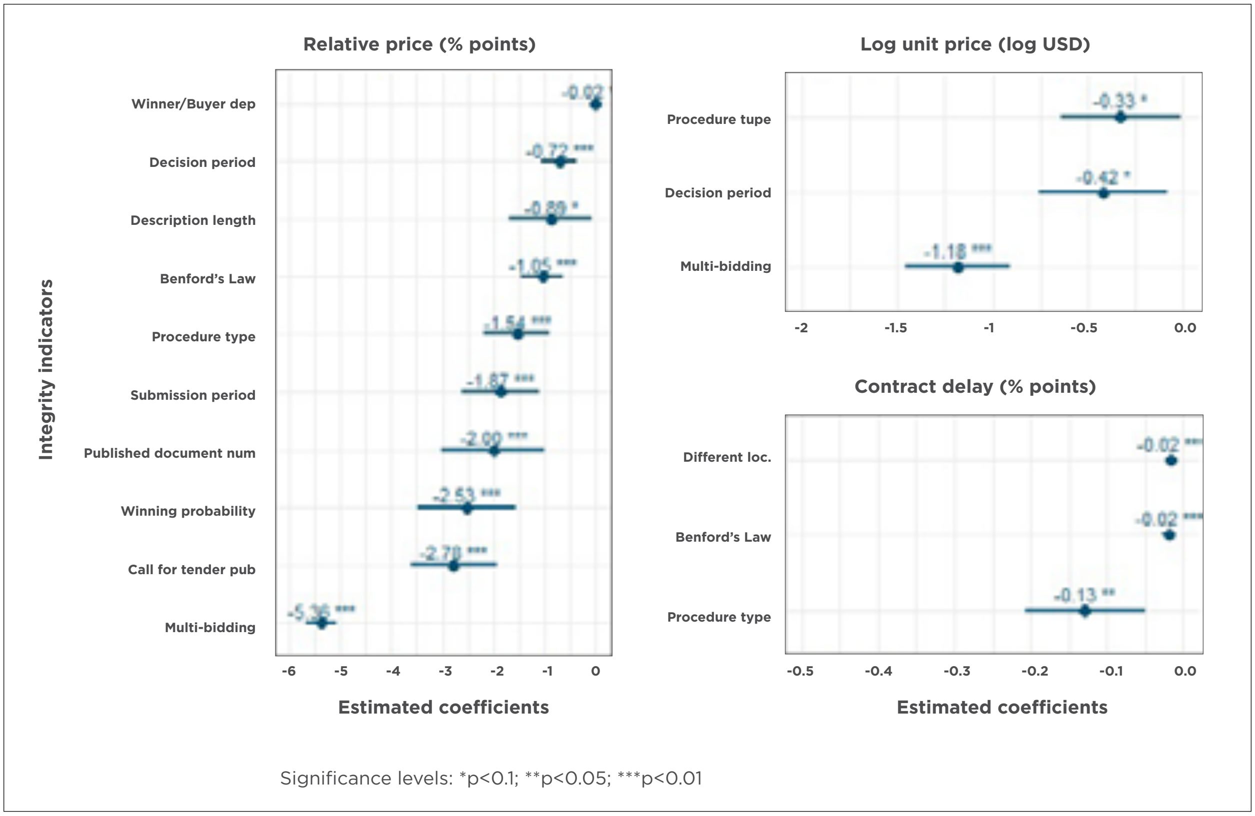
costs by increasing integrity in the W&S sector. (See Appendix Table B1 for the exact – country specific – definitions of integrity indicators. See Appendix B to understand how the thresholds are calculated.)

The log unit price model illustrates a similar, albeit less robust picture. From the six available integrity integrators, three, namely multi-bidding, high integrity decision period, and high integrity procedure type, indicate significant savings potential. Much like the relative price model, multi bidding has more than twice the effect size on log unit price decrease than the second most impactful integrity indicator, which is the decision period. This diversity of effects may be indicating that the product-level fixed effects are not sufficiently detailed.

Finally, while bidding information was not available for the contract delay model, like the two other models, it suggests that increasing the share of open procedures is a promising way to increase contract integrity. That implies moving an average tender from a high to a low-risk procedure type category lowers contract delay by 0.13%. Furthermore, the results imply that compliance with Benford's Law and the different registered locations of the contracting authority and supplier could also statistically significantly reduce relative contract delay.

Given scarce resources, policymakers in the LAC region may prioritize encouraging competition in public procurement to decrease the share of single-bidder contracts as multi-bidding seems the most efficient way to further increase contract integrity in the W&S sector. Additionally, promoting open procedures and improving tender design to reduce decision periods could also provide positive results as these indicators have a statistically significant impact in at least two out of the three models.

Figure 4.1: Integrity indicator effect sizes in the LAC W&S sectors by dependent variable[23]



Source: GTI calculation based on country level procurement data.

23 Coefficients represent the largest effect sizes on the dependent variable. Winner/buyer dependence is non-binary.

Figure 5 shows the effect of the composite integrity score on the W&S sector. The composite index is the arithmetic average of the available integrity indicators shown in Figure 4.1. It can measure the compounded effects of individual integrity indicators. The result suggests that improving overall sectoral integrity can lead to procurement market efficiency gains, such as reduced procurement prices and less contract delay.

Figure 5: The effect of integrity score on LAC W&S sectors by dependent variable

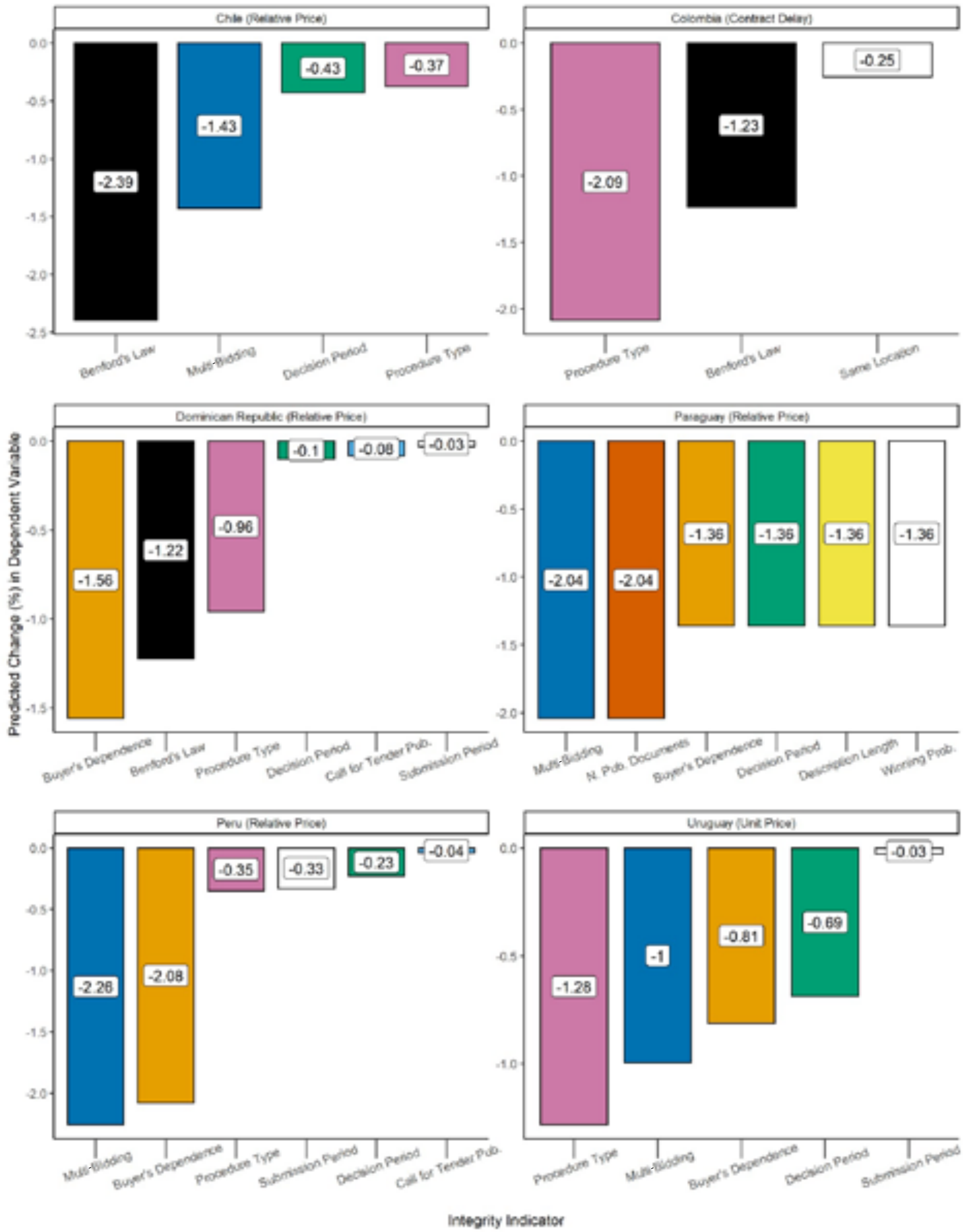
Source: GTI calculation based on country level procurement data.

4.2 Estimating savings from higher integrity

Once the predictive models have been built, it is possible to estimate the impact of alternative integrity improvement scenarios. Figure 6 shows the potential efficiency gains for each country by hypothetically raising each indicators' integrity level to the highest level. In practice, each bar in Figure 6 represents the percentage change in the outcome variable that results from moving the integrity value from the observed amount to the hypothetical best. Therefore, the percentage differences show how much value (money or time, depending on the indicator) could be saved if the specific integrity indicator was high integrity[24]. Finally, the study also predicts the combined savings effects of all indicators by simultaneously setting all of them to the highest integrity. The percentage and USD denominated saving sizes are described below. While achieving full integrity for any of these indicators is challenging, these maximum savings scenarios highlight the potential benefits of pro-integrity improvements in the W&S sector.

24 Note that for different countries, different integrity indicators could be calculated and validated. Therefore, horizontal axes of Figure 6 represent different values.

Figure 6: Integrity and savings scenarios



Source: GTI calculation based on country level procurement data.

Although there is a lot of variation in the savings potential of individual integrity indicators, measures such as elimination of single bidding and closed procedure types predict relative savings and delays of around 2%, a substantial dollar amount given the capital-intense nature of W&S contracts. The results indicate that for the Chilean W&S sector, the greatest marginal gain is related to correcting price manipulations, as even a very small deviation in tender prices from Benford's Law can significantly affect price savings. Completely eliminating these could potentially lead to a 2.4% price savings (around USD 280 million)[25]. Additionally, eliminating single bidding contracts may result in an additional 1.5% price savings (around USD 167 million). Overall, setting the four integrity indicators that have proven to have a significant effect on relative prices to the best category (i.e., highest integrity) can decrease average tender prices in the W&S sector by 4.6% (around USD 541 million).

In the Dominican Republic's W&S sector, the largest price savings – 1.6 % (around USD 10 million) – can be achieved by reducing the contracting authorities' dependence on any specific supplier. As average buyer's dependence is already low, the few contracting authorities with high dependence could be located efficiently. Fully eliminating contract price manipulations – illustrated by the price deviation from Benford's Law – and limiting non-open procedure types could also increase savings by around 1–1.2% (around USD 6–8 million). Overall, our models predict that 3.9% in savings (around USD 26 million) could be achieved by awarding only high integrity contracts.

In Paraguay, the largest price savings can be achieved by reducing single bidding for government contracts and increasing the number of accompanying documents (approximately 2% each, around USD 6.4 million). In addition, decreasing winning probability by encouraging new suppliers to enter the market, reducing all contracting authorities' dependence on any specific supplier to the minimum, and providing adequate amounts of time for public officials to evaluate bids could also increase savings by approximately 1.4% (around USD 4.25 million) for each indicator. Overall, optimal contracting conditions result in a model predicted savings of 7.5%.

25 USD savings estimates for relative price regressions is the predicted contract value difference between the unchanged model and the artificially modified models: (predicted relative price x initially estimated contract price) - (predicted relative price (modified model) x initially estimated contract price).

The results for the W&S sector in Peru suggest that the largest savings can be achieved by curbing single bidding and buyer dependence rates. Reducing all suppliers' dependence on any specific contracting authorities to the country-minimum is predicted to result in relative prices around 2% lower (around USD 150 million savings), with a similar effect when single bidding is eliminated (around USD 163 million). Additionally, eliminating non-open procedure types could also decrease relative price by approximately 0.3% (around USD 25 million). Overall, a theoretical 5.2% savings (around USD 382 million) could be achieved by only awarding optimal integrity contracts.

In the case of Uruguay, the largest price savings (item unit price decrease) can be achieved by transitioning all contracts to open procedures. This can lead to 1.3% decrease in unit prices (on average around USD 30/item). Additionally, eliminating single bidding may lead to a 1% decrease in unit prices (on average around USD 23.3/item). Overall, a theoretical 3.8% (on average around USD 89/item) reduction in prices could be achieved by only awarding optimal integrity contracts.

Finally, the savings scenario results for the Colombian W&S sector indicate that the most efficient way to reduce delivery delays can be achieved by fully transitioning to open procedure types, resulting in a predicted 2.1% decrease in relative delays. Similarly, partially eliminating contract price manipulations – as illustrated by the price deviation from Benford's Law – could also decrease relative delays by around 1.2%. Overall, contracts issued under optimal integrity settings may result in an approximately 3.7% increase in efficiency.

5. Policy Recommendations

Empirical results show that a continued increase in several integrity metrics could lead to a substantial savings in public contracting in the W&S sectors of the LAC region. This section outlines seven such metrics and proposes recommendations and implementation strategies based on state-of-the-art research in the field of public procurement integrity.

These recommendations are based on the findings described in the previous section regarding the positive power of integrity in maximizing value-for-money and efficiency in W&S sector public procurement. The study also draws on successful regional initiatives that may serve as a general blueprint towards strengthening integrity in the region's W&S procurement market.

5.1 Decreasing the share of non-open procedures

Problem: Closed procedures such as direct awards and exceptional procedures, compared to open procedures significantly increase relative and unit prices and relative contract delay. While this report finds a consistent, positive effect across the region, there is a notable cross-country variation that may reflect country-specific regulatory differences and the different prevalence of non-open procedures (see Figure 4).

Recommendation: Policymakers should promote the use of open procedure types to increase competition in the sector.

Implementation: Policymakers can directly influence the number of non-open procedures by modifying legislation to make use of these procedure types harder; i.e., by decreasing the value threshold below which procedures can be awarded as outright awards. Governments can also indirectly influence the number of non-open procedures by educating contracting authorities on the importance of transparency and accountability.

Furthermore, aggregating related, small-volume purchases across multiple government offices, municipalities or schools could decrease the number of low-value, low-integrity tenders, thus resulting in overall savings for governments. According to Fazekas and Blum (2021a) there is empirical evidence that the use of centralized procurement could lead to price reductions. In this framework, a central purchasing unit makes bulk purchases directly from suppliers; then individual procuring entities can purchase from the central unit under specific conditions, typically using a central framework agreement (OECD, 2011).

For example, the prevalence of Minitenders – a tender competition between at least two predetermined suppliers – can be decreased by demand aggregation. In the Dominican Republic, more than 2.7% of all Minitenders are for low performance – electric, water, centrifugal – pump purchases, more than 1% are refrigerator acquisitions and more than 0.6% of all procedures can be connected to air conditioner purchases in the W&S sector[26].

26 Calculated using UNSPSC codes.

As shown in Figure 4, high-integrity (open) procedures are associated with up to a 1.5% decrease in relative price across the region even after controlling for product market specificities. Furthermore, a hypothetical elimination of all non-open procedures would predict a 2% reduction in contract delays in the case of Colombia and a 1.3% decrease in unit prices in the case of Uruguay (see Figure 6).

5.2 Fostering competition

Problem: Multi-bidding is the strongest predictor of reduced prices. Although there is a modest reduction of regional level single bidding percentages over time, this bidding type still significantly affects procurement market integrity as the complete lack of competition could reduce the bargaining power of contracting authorities, thus significantly lowering their price savings potential.

Recommendation: Policymakers should foster competition to further reduce the number of single bidding contracts. Competition can be promoted by breaking down market entry barriers and reducing the transaction costs of competing.

Implementation: In addition to the greater use of open procedures noted above, Borges et al. (2019) point out that more open (less restrictive) technical and financial conditions in tenders can lead to stronger competition, and thus greater savings. The risk of failed contracts due to looser conditions should be balanced against the need for wider access, however. Furthermore, matching tender sizes to market capacity and median bidder size can also successfully increase the number of bidders. For example, breaking large tenders into smaller chunks can help smaller enterprises (SMEs) compete. Furthermore, Fazekas and Kocsis (2020) show that bid evaluation criteria, which are more concrete and objective, encourage more bidding and lower corruption risks in the EU.

As shown in Figure 4, multi-bidding in a tender predicts a relative price reduction of 5.3% and a unit price reduction of 1.2% when compared to single bidding at the regional level. As shown in Figure 6, moving completely towards multi-bidding may result in a reduction of relative prices of more than 2% in the cases of Peru and Paraguay.

5.3 Reducing buyers' dependence on select suppliers

Problem: While contracting authorities' dependence on specific suppliers is relatively low in the region, decreasing it even further could lead to significant savings in several of the studied LAC countries. This implies that there are still a few contracting authorities in the W&S sectors with high dependence on one or a few large suppliers, even though on average, this type of dependence is low.

Recommendation: Preference for frequently used suppliers should be reduced. Policymakers should encourage suppliers to diversify their bidding activity by competing for tenders posted by different contracting authorities. Meanwhile, contracting authorities should be incentivized to search for alternative suppliers wherever feasible.

Implementation: The group of competitors can be diversified by aiding smaller enterprises, which often lack the necessary human resources to enter the procurement market. Better distribution of information on tendering opportunities can increase the willingness of smaller businesses to diversify their bidding portfolio. Additionally, reducing the time spent and the human resources required for competing for tenders can also decrease supplier dependence.

For example, the US Small Business Act enables SMEs in public procurement through:

i. Set-asides for SMEs, i.e., reserving contracts to be awarded solely to them, with a target of 23% of direct contracts and 40% of subcontracts to SMEs;
ii. Conducting training sessions and workshops for SMEs;
iii. Making documentation or guidance that focuses on SMEs available online;
iv. Simplifying administrative procedures.

Our data shows that a 10% decrease in supplier dependence is associated with a 2.1% decrease in relative prices, other things being equal (see Appendix C, Table C2). Reducing buyers' dependence to its theoretical minimum (i.e., perfect competition with close to zero market share per provider) could lead to a 2.1% relative price savings in Peru, a 1.6% relative savings in the Dominican Republic, a 1.4% relative price savings in Paraguay, and a 0.8% unit price savings in Uruguay (Figure 6).

5.4 Increasing transparency

Problem: The transparency of a procurement system can be measured by the quantity, quality, and depth of information publicly available about procurement contracts. The number of documents published on the e-procurement website can significantly affect price savings. The lack of sufficiently detailed and reliable information about contracts remains an important issue in the region.

Recommendation: Policymakers should require publication of the most essential procurement documents from both contracting authorities (e.g., technical requirements and product details) and suppliers (e.g., proof of company registration and relevant prior experience). Furthermore, they should encourage the publication of additional documents, which while not essential can further increase transparency.

Data accessibility could be further improved by allowing for bulk procurement data downloads or creating an application programming interface (API) for public access when these are not already in place. Lot-level information should be supplemented with contract level estimated prices, procurement category type, product code, call for tender publication and most importantly, the number of bids received.

Implementation: The amount of tender documentation can be increased by developing an adequate e-attestation system. This refers to the electronic submission and storage of qualification documents such as proof of company registration or prior experience (Fazekas & Blum, 2021a). Such a system should be developed in a way that requires contracting authorities and suppliers to upload specific documents to publish the call for tenders or submit their bids. Contract documentation can be further improved by creating guidelines and easy-to-fill forms to reduce the transaction costs of providing information.

Procurement authorities may allocate funds for the improvement of their e-procurement websites and facilities for large-scale data downloads. Additionally, policymakers should rely more on the resources and capabilities of nonprofit organizations such as watchdog portals and anti-corruption agencies that can offer additional functionalities to the websites developed by government agencies. These organizations can provide novel indicators which help make sense of diverse and often hard-to-interpret data (Fazekas & Blum 2021a).

As shown in Figure 6, moving towards better documented procedures is associated with a 2% increase in price savings in Paraguay.

5.5 Improving tender design

Problem: Short submission periods can lead to a lower level of competition and suboptimal tender performance, especially when they include holidays and weekends. Additionally, the lack of correlation between contract value and decision period suggests an inadequate decision period length for high-value procedures.

Recommendation: Policymakers should advocate for longer submission periods so that potential bidders have more time to submit their proposals of interest, and when needed, revise legally mandated minimum periods. The decision-making quality of high-value procedures could also be further improved.

Implementation: Policymakers should directly influence submission periods by setting minimum required lengths, commensurate with the complexity of the tender. Both submission and decision periods can be indirectly influenced by training contracting authorities on the importance of high-quality tender designs. Furthermore, guidance for suppliers on efficient tender documentation preparation can help smaller companies compete.

As shown in Figure 4, improved decision-making processes can lead to 0.7% reduction in relative prices and a 0.4% reduction in unit prices in LAC overall. Additionally, longer submission periods could lead to a 1.8% relative price reduction in the region.

5.6 Increasing monitoring effectiveness

Problem: The significant deviation of contract prices from Benford's Law can stem from mostly harmless price adjustments but may also suggest that price setting is influenced by favoritism or collusion.

Recommendation: Increasing the efficiency and frequency of audits and monitoring visits may help curb integrity risks. Similarly, contracting agencies should improve their budget estimation transparency.

Implementation: According to Fazekas and Blum (2021a), an increased probability of punishment contributes to higher levels of compliance with rules and higher integrity. Increasing the probability of procurement audits and introducing full monitoring of some input prices by an independent government body can effectively decrease procurement prices. However, it is important not to disincentivize the use of open procedures that often have significantly more complex publishing requirements, and hence a higher risk for error. Gerardino et al. (2017) show that more complex open auctions lead to an increased probability of audit. In turn, audits lead to a decrease in the use of auctions and a corresponding increase in the use of direct contracts. Therefore, it is important to implement targeted audits based on thorough risk analysis. This requires three separate conditions to be met:

i. The development and maintenance of appropriate, publicly available procurement datasets;

ii. The development of efficient risk models (e.g., "red-flag" identification),

iii. The regular training of the monitoring agencies' staff, with potential NGO support.

As shown in Figure 4, a 1.1% relative price reduction could be achieved by eliminating any potential price manipulations.

5.7 Improving data reporting standards

Problem: Although there have been considerable improvements in the provision of data in recent years, the reporting quality could be further enhanced. The main issues to consider are a) data quality and interoperability and b) data access (Fazekas et al. 2021b).

Recommendation: Data accessibility could be improved by creating lot and contract level IDs to make the merging of different datasets more straightforward. Furthermore, information should be reported on the appropriate level (i.e., bidder number at the contract level) and the number of low-quality observations (i.e., incomplete data) should be minimized.

Implementation: Policymakers should require contracting authorities to upload all essential information (such as the bidding deadline) onto the e-procurement website and draw on the expertise of nonprofit organizations such as watchdog portals and anti-corruption agencies to monitor data quality. The transparency of the public procurement system can be further improved by following the recommendations provided in section 2.

Below are some general guidelines. These can ensure that:

i. There is a bulk-download option for the procurement data and that different datasets can be merged when the information is spread across multiple datasets.
ii. The number of bidders is available at the contract level. Single bidding is one of the most important integrity indicators, therefore, its absence can severely limit the usability of the data.
iii. Data is complete (e.g., a low rate of missing values) and accurate. For example, making sure that information entered by contracting authorities and suppliers is reviewed and, if necessary, corrected.

In sum, we find that strengthening indicators of procurement integrity in the W&S sector can lead to measurable increases in savings and quality. Although there is variation in the predicted effects these indicators have on savings and quality at the country level, there are some general guidelines and principles that can be extrapolated to the region overall. It is therefore important to take domestic political factors into consideration when considering these policy recommendations for the overall LAC region. Nevertheless, our findings and the accompanying recommendations are derived from the analysis of a combined dataset of economically and geographically diverse countries in the region, as well as state-of-the-art research on procurement integrity.

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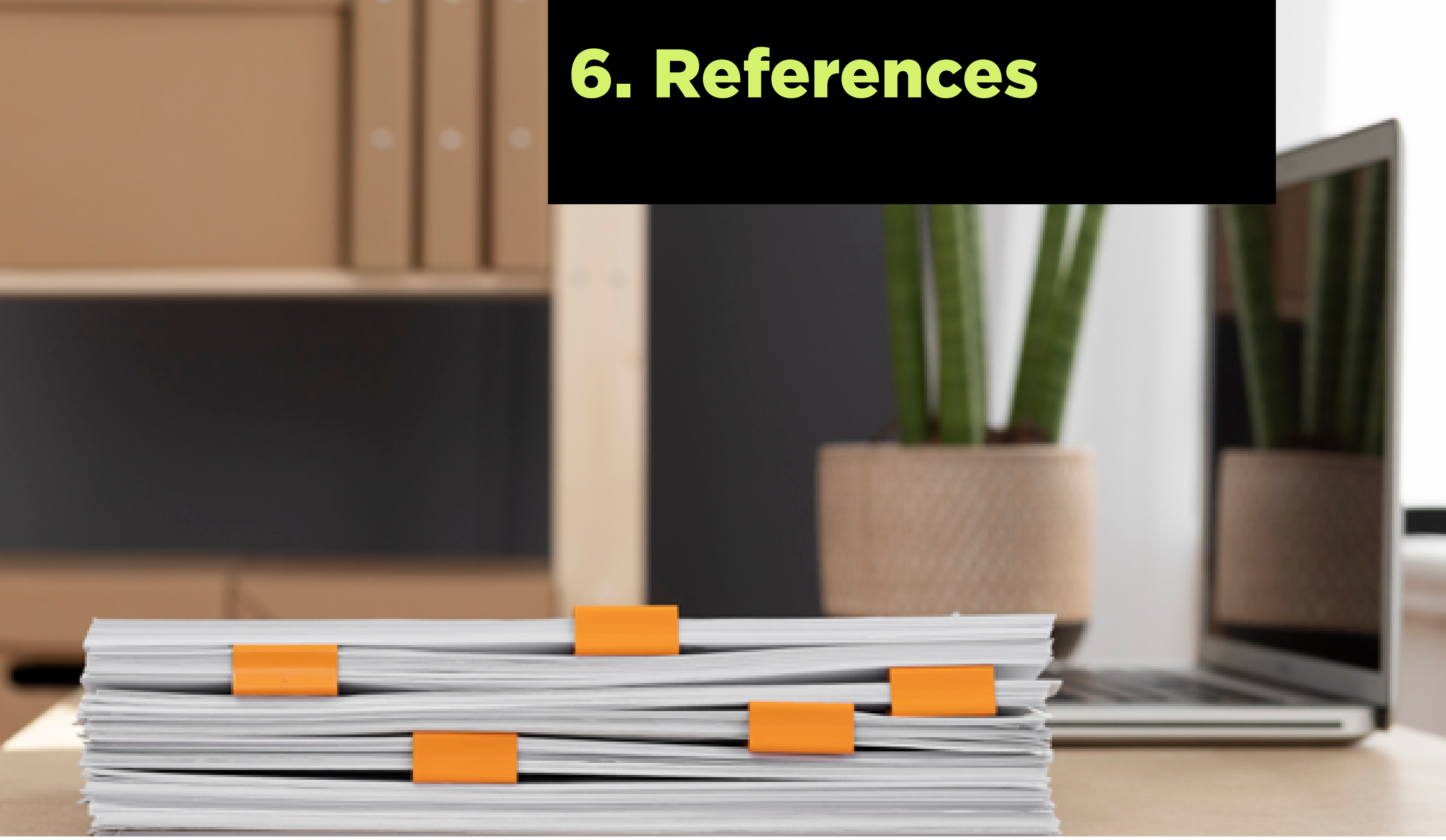

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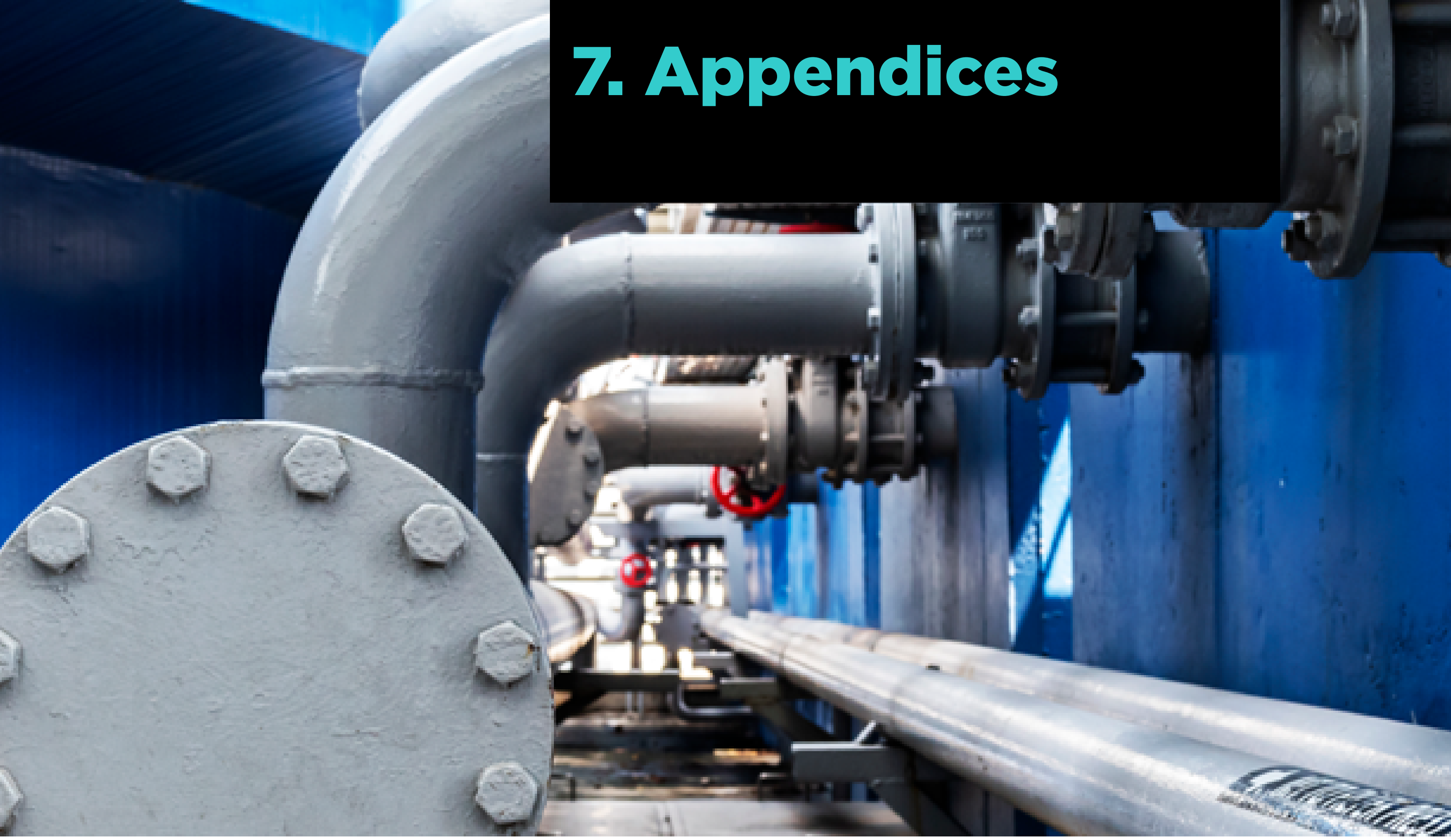
7. Appendices



1. Appendix A: Keywords used to filter for W&S contracts

Contracts related to the W&S sector were marked in two ways.

This was done by first matching buyer names to the list of W&S utility companies provided by the International Benchmarking Network for Water and Sanitation Utilities (IBNet) and then searching for the names using keywords related to the W&S to identify local utilities not included on the IBNet list. These keywords capture the various dimensions of the W&S sector, such as drainage, sewerage, and water systems. The information was then marked in the procurement dataset.

Secondly, a range of keywords was used to search product descriptions in the procurement dataset to mark those contracts that are also related to the W&S sector. The product descriptions were then harmonized (accents and whitespaces were removed, and all text was converted into lower case) to find the most relevant utilities and products.

The keywords used for buyer names and product descriptions in each dataset are summarized in the table below:

Table A1. Keywords used to filter W&S contracts

Country	Variable used	Keywords
Chile	Contract title	"acua," "acue," "potable," "saneamiento," "drena," "pipa," "tuber," "alcanta"
	Buyer name	"acua", "alcanta", "potable", "saneamiento", "agua", "drena", "pipa", "tuber"
Colombia	Item classification description, tender description, tender title	"acueducto" & "agua", "saneamiento" & "conexiones", "sistema de agua", "saneamiento", "cuenca" & "agua", "alcantarillado", "drenaje", "fontaneria" & "agua", "sistemas de abastecimiento" & "agua", "pozos" & "agua", "canal" & "agua", "constr" & "agua"
	Buyer name	"aguas de" & "vallecaucana," "valle del cauca - empresas publicas municipales de cartago," "aguazul espa s.a. e.s.p.," "aguas y aseo, saneamiento basico, emcoaguas, aguas&s.a. e.s.p. ," "aguas claras," "acueducto," "alcantarillado," "sanitaria," "de aseo," "acuasan"
Dominican Republic	Contract title	"acua," "acue," "potable," "saneamiento," "drena," "pipa," "tuber", "alcanta"
	Buyer name	"acua," "alcanta," "potable," "saneamiento," "agua", "drena," "pipa," "tuber"
Paraguay	Tender title	"sistema" & "agua," "saneamiento" & "agua," "cuenca" & "agua," "alcantarillado" & "agua," "drenaje" & "agua"
	Buyer name	"servicios sanitarios," "erssan"
Peru	Contract title	"acua," "acue," "potable," "saneamiento," "drena," "pipa," "tuber," "alcanta"
	Buyer name	"acua," "alcanta," "potable," "saneamiento," "agua," "drena," "pipa," "tuber"
Uruguay	Item classification description, item description, tender title	"sistema de agua," "servicio red" & "agua", "saneamiento" & "conexiones," "constr" & "agua," "cuenca," "alcantarillado," "tuberias" & "agua," "canal," "sistemas de abastecimiento" & "agua," "sanitarias," "abastecimiento," "canalizac," "residual" & "agua"
	Buyer name	"obras sanitarias," "agua"

2. Appendix B: Technical description of integrity indicator calculation

Integrity indicators are selected based on thorough qualitative and quantitative research on the initial assumption that certain quantifiable features of public procurements are able to predict their corruption risk level. Some features are equipped to measure corruption risks in the procurement planning and advertisement phase (e.g., procedure type, call for tender publications, submission period) while others are equipped to measure them in the submission and selection phase (e.g., decision period, single bidding).

However, before their use in empirical research, each potential indicator must be tested using national procurement datasets. Since one of the most robust and empirically tested indicators is single bidding – which shows whether a contract had one (low integrity) or more (high integrity) bidders – it is often used to validate every other available integrity indicator. Practically, each indicator is validated on its country-level dataset based on its association with single bidding and/or with the supplier's or buyer's dependence indicators. The general validity model is as follows:

Single bidding = B0 + B1*integrity indicator + B2*institutional and market controls + ε

While we use a larger pool of initially available[27] indicators for each country, we only keep those that have a positively significant association with single bidding (and supplier's or buyer's dependence). This also suggests that a different set of indicators might be used for different countries. Nonetheless, most of the widely used indicators are robust enough to be used for almost all countries' procurement systems.

27 The availability of required features is used to calculate the specific indicator. For example, to calculate the decision period, the procurement data source must contain the submission deadline (date) and the contract award decision date.

Additionally, the raw values of several integrity features are non-binary. Ordinal (such as procedure type) and continuous (such as submission period, decision period) features are sorted into high-, medium- and low-integrity categories based on their association with single bidding. Therefore, as Table B1 illustrates, the definition of each indicator can differ slightly by country. However, the logic behind each of these indicators remains the same; for example, in each country, relatively short decision and submission periods are considered risky, and non-open procedure types are also associated with low integrity. In practice, each indicator is either a binary (0 - low integrity, 100 - high integrity) or ordinal (0 - low integrity, 50 - medium integrity, 100 - high integrity) variable. This generalization makes possible the cross-country analysis performed in the report.

Finally, the validated integrity indicators are combined into a single Integrity Score, which is the simple arithmetic average of the individual integrity indicators, falling between 0 and 100, with 100 representing the highest possible integrity and 0 the lowest. The score is capable of measuring the compounding effects of the separate indicators.

For a more in-depth guide to indicator creation and validation see: Fazekas et al. (2015), Fazekas et al. (2016a), Fazekas et al. (2016b), and Fazekas et al. (2021a).

Table B1: Integrity indicator definitions by country

Integrity indicator	High integrity	Medium integrity	Low integrity
		Chile	
Procedure type	Open (all types except public bidding under 100 UTM)	-	Closed (all types of private bidding), Low value open (public bidding under 100 UTM)
Decision period	65–183 days	1–64 days	Missing
Single bidding	1+ bidders	-	1 bidder
Benford's Law	<= 0.0028 MAD	-	> 0.0028 MAD
Buyer's dependence	Continuous, higher value indicates lower share, thus higher integrity		

Integrity indicator	High integrity	Medium integrity	Low integrity
Colombia			
Procedure type	Open restricted	Other	Negotiated without publication
Call for tender publication	Published	-	Not published
Benford's Law	0.0045-0.0119 MAD	0.012-0.0149 MAD	0.015-0.119 MAD
Same location	Buyer and bidder location (department level) is not identical	-	Local supplier (buyer and bidder operate in the same department)
Tax haven	Supplier is not located in tax haven	-	Supplier is located in tax haven
Winner's contract share	Continuous, higher value indicates lower share, thus higher integrity		
Dominican Republic			
Procedure type	Open, Other, Approaching bidders, Restricted	-	Mini-tender, Sole source
Submission period	4–200 days	-	1–3 days
Decision period	11–362 days	-	1–10 days, missing
Benford's Law	<=0.010 MAD	-	>0.010 MAD
Call for tender publication	Published	-	Not published
Buyer's dependence	Continuous, higher value indicates lower share, thus higher integrity		
Paraguay			
Single bid	More than 1 bid received	-	1 bid received
Procedure type	Open, Limited	Open within threshold	Outright award, Other
Submission period	32-365 days	13–31 days	1–12 days
Call for tender publication	Published	-	Not published

Integrity indicator	High integrity	Medium integrity	Low integrity
Decision period	63-189 days	28–62 OR 190–365 days	0–27 days
Number of documents published	22-1626	-	0–21
Description length	0–167 char	-	168–278653 char
Winning probability	0.42–29.1%	29.2–60%	60.3–100%
Winner's contract share	Continuous, higher value indicates lower share, thus higher integrity		
		Peru	
Procedure type	Open	Negotiated, Outright award, Restricted	Selection of Individual Contractors
Submission period	12+ days	2–12 days	0–1 day
Decision period	6+ days	2–6 days	0–1 day
Single bidding	1+ bidders	-	1 bidder
Call for tender publication	Published	-	Not published
Supplier's dependence	Continuous, higher value indicates lower share, thus higher integrity		
		Uruguay	
Single bid	More than 1 bid received	-	1 bid received
Procedure type	Open, Other	Restricted	Outright award
Submission period	6–162 days	4–5 days	0–3 days
Call for tender publication	Published	-	Not published
Decision period	29–183 days	7–28 days	1–6 days
Winner's contract share	Continuous, higher value indicates lower share, thus higher integrity		

3. Appendix C: Detailed regression estimates

To measure W&S procurement integrity in the selected countries, the study collected data from publicly available sources such as national procurement portals. Several regression models were run to assess which indicators of integrity are good predictors of improved outcomes in terms of price (unit or relative) and quality (delays) of public purchases in the sector. Table C1 shows the distribution of the three dependent variables used across the different models (for more details on data availability by country see Table B1). The effects of integrity indicators and composite integrity scores on relative contract prices (Table C2), the logarithm of item-unit prices (Table C3) and contract delays (Table C4), were tested using the OLS regression models shown below.

Table C1: Dependent variable descriptions

Dependent variable	Mean	Std.	Min.	Max.	N (non-missing)
Relative price	91.40	12.86	50.03	149.94	54,556
Log unit price	9.91	3.84	-8.11	19.05	27,604
Relative contract delay	1.15	0.24	1.001	3	59,751

Table C2: Relative price regression results in the W&S sector

	Relative price regressions											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Procedure type												
Baseline: High risk	0 (.)										0 (.)	
Medium risk	-0.053 (0.371)										0.628* (0.382)	
No risk	-3.201*** (0.319)										-1.545*** (0.327)	
Call for tender publication												
Baseline: High risk		0 (.)									0 (.)	
No risk		-5.747*** (0.201)									-2.777*** (0.431)	
Description length												
Baseline: High risk			0 (.)								0 (.)	
No risk			-0.193 (0.409)								-0.888** (0.407)	
Submission period												
Baseline: High risk				0 (.)							0 (.)	
No risk				-4.666*** (0.181)							-1.873*** (0.384)	

	Relative price regressions											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Single bidding												
Baseline: High risk					0						0	
					(.)						(.)	
No risk					-5.552***						-5.359***	
					(0.140)						(0.148)	
Number of published documents												
Baseline: High risk						0					0	
						(.)					(.)	
No risk						-3.017***					-2.003***	
						(0.511)					(0.515)	
Decision period												
Baseline: High risk							0				0	
							(.)				(.)	
Medium risk							-2.448***				-0.725***	
							(0.198)				(0.208)	
No risk							-3.393***				-0.725***	
							(0.156)				(0.171)	
Supplier's/buyer's contract share with the same buyer/supplier (depending on the country)												
Supplier's/ buyer's dependence (0–100)								-0.041***			-0.021***	
								(0.002)			(0.002)	
Supplier's winning probability												
Baseline: High risk									0		0	
									(.)		(.)	
No risk									-4.108***		-2.530***	
									(0.493)		(0.490)	

Relative price regressions												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Benford's Law												
Baseline: High risk										0 (.)	0 (.)	
No risk										-1.366*** (0.210)	-1.050*** (0.206)	
Integrity Score												
(0–100)												-0.129*** (0.004)
Obs.	45,393	46,932	46,932	46,932	46,932	46,932	46,932	46,932	46,932	46,932	45,393	46,932
Adj. R-squared	0.185	0.208	0.192	0.182	0.196	0.182	0.190	0.182	0.193	0.185	0.231	0.198

Note: Some countries have different integrity indicators and control variables.

All regression models in the table above include the following control variables: country fixed effects, market fixed effects (available for four countries), year fixed effects (four countries), log contract values (four countries), winner location (two countries), contract award type (two countries), buyer type (two countries), winner type (one country), buyer sector (one country), buyer location (one country), buyer-supplier same location binary variable (one country), supplier CEO gender (one country).

Table C3: Log unit price regression results in the W&S sector

	Log Unit Price 1	Log Unit Price 2	Log Unit Price 3	Log Unit Price 4	Log Unit Price 5	Log Unit Price 6	Log Unit Price 7	Log Unit Price 8
Single bidding								
Baseline: High risk	0 (.)						0 (.)	
No risk	-1.445*** (0.130)						-1.184*** (0.139)	
Decision period								
Baseline: High risk		0 (.)					0 (.)	
Medium risk		-0.431** (0.159)					-0.273* (0.159)	
No risk		-0.872*** (0.155)					-0.420** (0.172)	
Call for tender								
Baseline: High risk			0 (.)				0 (.)	
No risk			0.087 (0.096)				1.132 (0.127)	
Submission period								
Baseline: High risk				0 (.)			0 (.)	
No risk				-0.292* (0.157)			-0.002 (0.159)	
Procedure type								
Baseline: High risk					0 (.)		0 (.)	
No risk					-0.869*** (0.132)		-0.327** (0.159)	
Winning supplier's contract share with the same contracting authority								
Supplier's contract share (0–100)						-0.004 (0.004)	-0.004 (0.004)	
Integrity Score								
(0–1100)								-0.031*** (0.003)
Control variables								
CA. type	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market id.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log contract value	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333
Adj. R-squared	0.631	0.620	0.620	0.640	0.631	0.620	0.643	0.631

Table C4: Relative delay regression results in the W&S sector

	Relative delay 1	Relative delay 2	Relative delay 3	Relative delay 4	Relative delay 5	Relative delay 6
Benford's law						
Baseline: High risk	0 (.)				0 (.)	
Medium risk	0.017** (0.005)				0.017*** (0.005)	
No risk	-0.018*** (0.004)				-0.019*** (0.004)	
Buyer-supplier location						
Baseline: High risk		0 (.)			0 (.)	
No risk		-0.017*** (0.003)			-0.016*** (0.003)	
Procedure type						
Baseline: High risk			0 (.)		0 (.)	
Medium risk			-0.130*** (0.040)		-0.129*** (0.040)	
No risk			0.021*** (0.003)		0.021*** (0.003)	
Winning supplier's contract share with the same contracting authority						
Supplier's contract share (0–100)				0.0003*** (0.000)	0.0003*** (0.000)	
Integrity Score						
(0–100)						-0.001*** (0.000)
Control variables						
Buyer type	Yes	Yes	Yes	Yes	Yes	Yes
Buyer location	Yes	Yes	Yes	Yes	Yes	Yes
CA. type	Yes	Yes	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	Yes	Yes	Yes	Yes
Market id.	Yes	Yes	Yes	Yes	Yes	Yes
Log contract value	Yes	Yes	Yes	Yes	Yes	Yes
Observations	57,574	57,574	57,574	57,550	57,550	57,574
Adj. R-squared	0.019	0.018	0.018	0.018	0.020	0.021

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