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Policy Matters

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Abstract

This paper investigates the relationship between the quality of regulatory policies governing public procurement and participation in public tenders by small and medium enterprises (SMEs). Using a large dataset on European procurement contracts, we find that countries with better quality procurement regulation have higher SME participation and win ratios. Dividing contracts into smaller lots is associated with greater participation by SMEs, but only increases the probability of SMEs winning contracts for small value lots (€25,000 or less). Counterfactual simulations suggest that if governments want to enhance participation by SMEs in public procurement the focus should be on improving the overall quality of procurement processes.

Keywords

Public procurement; SME participation; good practice; regulation; lot size

JEL Codes: H57; O12

1. Introduction*

Small and medium-sized enterprises (SMEs) are the backbone of every economy. They account for more than half of total employment globally, play a vital role in improving and sustaining social cohesion and integration (OECD, 2018), and are drivers of economic growth in developing nations (Obi et al. 2018).¹ A substantial body of research has shown that many constraints faced by SMEs diminish their ability to grow. Such constraints range from access to finance to difficulties in complying with regulatory regimes (Beck and Demirguc-Kunt, 2006; Iacovone et al. 2014). Government policies affect the performance of firms, both indirectly by influencing the general business environment and directly through taxation and regulation of economic activities. Given the predominance of SMEs in most economies, many countries complement efforts to improve the general investment climate captured by the types of variables tracked in the World Bank's *Doing Business* and the *Worldwide Governance* databases with policies that specifically aim to support SMEs.

Public procurement (PP) is one instrument governments can use to this end. The PP market generally accounts for a significant share of GDP (Djankov et al. 2016) and is therefore a potentially important mechanism to increase the demand for the output of SMEs. "Demand shocks" have been argued to constitute a channel through which firms can be assisted to expand productive capacity (Geroski, 1990). As government procurement can represent a meaningful source of demand for firms, a PP contract may encourage firms to invest more, expand employment and increase productivity.²

Much of the literature analyzing PP tends to take a public sector governance perspective. Studies have shown that adoption of internationally accepted good practices in public procurement, such as transparency and use of design and award processes that reduce discretion and the scope for corruption, lowers prices and/or increases quality. Extensive empirical evidence shows that greater participation in PP processes (more competition for contracts) is a key mechanism to attain value for money public policy objectives. For example, Knack et al. (2019), using enterprise data for 88 countries, find that firms are more likely to participate in public procurement markets in countries with more transparent procurement systems that rely more on open competition. Taş (2019), focusing on public procurement in the European Economic Area, finds that better PP regulation significantly increases competition and lowers average contract prices.³

In this paper, we use detailed panel data to examine the impact of PP regulation on SME participation in public contracts in 32 European countries.⁴ We contribute to the literature studying factors influencing whether SMEs can contest and participate in public procurement and the impact of policy on SME participation in PP. We assess both the impact of generally applicable PP administrative policies and a type of policy used by many countries to increase SME participation in PP: reducing the size of contracts and subdividing lots. Our interest is to investigate whether PP policies affect participation in procurement processes by SMEs and the probability of success in winning contracts. In the process, we add to the literature by analyzing how changes in procurement policies can affect the incentives for SMEs to pursue PP opportunities.

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¹ The OECD defines SMEs as firms with less than 250 employees. This category of firms spans medium-sized firms that employ between 50 and 250 workers; small firms with between 10-49 employees; and micro firms that have fewer than 10 employees.

² See, e.g., Hebous and Zimmerman (2016), Ferraz et al. (2015), Edler and Georghiou (2007), Aschhoff et al. (2009), Fadic (2018), Edler and Yeow (2016), and Hoekman and Sanfilippo (2019).

³ See also Baldi et al. (2016) and Kenny and Crisman (2016).

⁴ The World Bank and Digiwhist do not calculate PP quality scores for Liechtenstein. As a result, instead of 33 countries available in the TED data set, we examine 32 European countries.

We find that the quality of PP regulation, as measured by indicators compiled by the World Bank and by Digiwhist – a European public sector accountability research initiative⁵ – has a statistically significant positive relationship with SME participation in PP tenders. We also find an associated positive probability that an SME wins a PP contract. SMEs are more likely to submit bids when government entities employ open procedures (first price auctions), and when contracts are of small size. Sub-dividing contracts into smaller lots is a distinct feature of recent EU PP reforms that aim at enhancing SME participation motivated by a presumption that dividing large tenders into smaller units makes these more manageable for SMEs. Threshold regression analysis reveals that conditional on contract size, dividing projects into smaller lots increases the probability that a SME wins the contract.

The plan of the paper is as follows. Section 2 discusses basic principles of public procurement policy and efforts to characterize the quality of PP regimes across countries. Section 3 describes the procurement data sources used. Section 4 reports the results of empirical analysis of the relationship between PP regulation and SME participation in procurement contests and the probability of success. Section 5 undertakes an illustrative empirical analysis of the potential effects of PP reforms in different regions, using the results obtained from the analysis of EU data. Section 6 concludes with some tentative policy recommendations.

2. Conceptualizing and benchmarking public procurement regulation

Most national PP systems seek to achieve value for money by ensuring procurement procedures award contracts to the lowest cost suppliers able to satisfy the technical specifications for a project. The basic features of good administrative practice in public procurement from a value-for-money perspective are well known.⁶ They include procuring authorities to conduct procurement in a transparent and impartial manner and utilizing open (competitive) tendering methods to award contracts above a minimum value threshold.⁷ Notices of intended or planned procurement should be published (including information on timeframe, treatment of tenders and contract awards, technical requirements, evaluation criteria used to determine the winning bid and payment terms). Implementing regulations should specify whether procuring entities may (or must) treat domestic bids more favorably than those from foreign companies or consortia, what such treatment comprises and the criteria that apply.⁸ Transparency is critical to make firms aware of opportunities. Publication of notices, ensuring sufficient time to prepare bids, and clearly specifying performance requirements is particularly important to SMEs as small firms have less capacity to be informed about procurement opportunities.

Evenett and Hoekman (2005) argue there are two important dimensions of procurement regulation. One relates to leveling the playing field by removing explicit discrimination against foreign firms. The other centers on transparency and related mechanisms that reduce discretion and the potential for corruption and collusion in the allocation of contracts. The first feature may reduce the prospects that SMEs can successfully contest procurement opportunities as leveling the playing field for large foreign firms will boost potential competition. Greater transparency and due process may be a positive or a negative for small firms. On the one hand it reduces fixed costs and there is a presumption that small firms will be less able to provide bribes or side-payments than larger firms. On the other hand, less

⁵ Digiwhist is an acronym for Digital Whistleblower, an EU-funded research project that includes an assessment of PP regulation and related processes for 34 countries and the European Commission. See <http://digiwhist.eu/>.

⁶ See, e.g., UNCITRAL (2014) and World Bank (2017).

⁷ Open tendering is any method that allows any supplier to bid, including international firms (also called international competitive bidding). Selective tendering is a method where only suppliers that satisfy specific criteria for participation may bid (usually prequalified suppliers). Limited tendering is non-competitive and usually involves a procuring entity approaching one or more potential suppliers of its choice.

⁸ See, e.g., <http://www.sigmaxweb.org/publications/key-public-procurement-publications.htm> for a set of policy briefs summarizing EU procurement rules and guidance as well as general good procurement practice.

discretionary procurement practices may encourage greater participation by firms that otherwise would refrain from bidding for contracts – or were simply excluded because they were not ‘connected’. Whether improving public procurement regulation can be expected to enhance participation by SMEs is therefore an empirical question.

Many jurisdictions have put in place procedures to encourage participation by SMEs in public contracts on the presumption that procurement regulation may be excessively burdensome for SMEs (Glover, 2008; Loader, 2011, 2015; Uyerra et al. 2018). Actions to this effect include reducing the average size of public procurement contracts; encouraging procuring entities to sub-divide contracts into smaller lots where this will not be detrimental to the realization of project objectives; implementing e-procurement systems; and ensuring timely payments. Such provisions seek to address specific characteristics of SMEs that may dissuade them from bidding for public contracts (OECD, 2018), including limited capacity to incur the cost of lengthy payment delays, satisfy bid security, minimum turnover or experience requirements, or difficulties in obtaining loans for the working capital needed to execute a contract on a timely basis. Both financial and human resource capacity constraints are likely to be more severe for SMEs than for large firms, with implications for the capability to incur the (opportunity) costs of dealing with the administrative requirements associated with bidding for public contracts.

Prevailing public procurement policy regimes

Djankov et al. (2017) characterize the quality of PP regulation for 142 countries in 2016. They assess three dimensions of the procurement process: (i) bid preparation; (ii) the content and management of the procedures used to award contracts; and (iii) payment of suppliers. The bid preparation score gauges the quality of the needs assessment associated with procurement projects and the call for tenders. The bid and contract management score considers the processes used for submission and evaluation of bids. The payment of suppliers score measures payment timeframes and the procedures for request of payment. The arithmetic mean of these scores is used to calculate an Overall Public Procurement Score. The data used to construct these scores come from surveys of more than 1,900 PP experts. Djankov et al. (2017) describe the questionnaire and the coding of the scores in detail.

An alternative exercise with a similar goal but less comprehensive country coverage is the DigiWhist initiative, a EU Horizon 2020 public governance research project involving a consortium of six European research institutes. It covers the (then) 28 EU Member States, the European Commission, Armenia, Georgia, Iceland, Norway, Serbia, and Switzerland. One element of the project is to produce data measuring the transparency of public administration and the accountability of public officials based on both de jure and de facto practices pertaining to the scope, information availability, evaluation, open competition and institutional aspects of public procurement in European countries. The DigiWhist effort builds on indicators used in the World Bank Public Accountability Mechanisms (PAM) initiative. The resulting EuroPAM indicators score the quality of PP processes and regulation in the European countries considered. DigiWhist public procurement quality scores are available from 2012 to 2017. Accordingly, we consider the annual changes in procurement quality when we employ DigiWhist quality scores in the empirical analysis.

Table 1 reports summary statistics for PP quality indicators generated by these two sources for those European countries for which we have detailed data on procurement contract processes, participation by SMEs and outcomes (awards) from the EU Tenders Electronic Daily (TED) database. These data are discussed further in Section 4 below. The summary statistics for the two sources of policy information are comparable. Figure 1 plots country-specific scores and reveals there is some variation across the two sources in scores and associated rankings of the European countries included in the sample.

Table 1. World Bank and Digiwhist Public Procurement Indicators, selected European states

	Mean	Standard Dev.	Min.	Max
PP Overall Index	0.73	0.09	0.58	0.9
EuroPAM Country Score (Year 2016)	0.62	0.01	0.45	0.88
EuroPAM Country Score (Year 2017)	0.63	0.11	0.45	0.83

Notes: The World Bank Benchmarking Public Procurement (BPP) overall indicator ranges from 0 to 1, with higher scores denoting better quality regulation. EuroPam scores range between 0 and 100. The World Bank data span 31 European countries; DigiWhist covers one additional European country (Malta). EuroPam scores are divided by 100 to be on the same scale as BPP.

Figure 1 displays the overall PP quality scores for European countries.⁹ As can be seen, the overall PP indices vary significantly across countries, making it possible to assess how PP regulation quality affects levels of competition and cost-effectiveness using data on the outcomes of procurement processes from the TED database. These characterizations of the quality of PP regulation across countries do not include any measures capturing the extent to which policy seeks to earmark or provide explicit preferences to certain types of firms or to address specific constraints that may impede participation by small firms. The payment indicator is the only one that addresses a feature that is more likely to be of relatively greater importance to small firms, given the extensive evidence that such firms are more likely to be credit constrained than large companies. In the empirical analysis below we consider the association between these basic features of PP policy and participation by SMEs, and complement this with a focus on a specific measure that has been adopted by some countries to encourage SME engagement: dividing contracts into smaller lots.¹⁰

3. The Tenders Electronic Daily Database

In the analysis that follows, we use the World Bank and Digiwhist information on the quality of PP regulation and PP contract award data for 32 European countries. Contract award data are sourced from the TED database, which contains information on all tender opportunities as well as information on contract awards made by procuring entities in the European Economic Area (EU28, Iceland, Lichtenstein and Norway), Switzerland, and the Former Yugoslav Republic of Macedonia. In addition to acting as a platform for calls for tenders, TED is also a depository of information on PP outcomes, i.e., which firms win contracts.

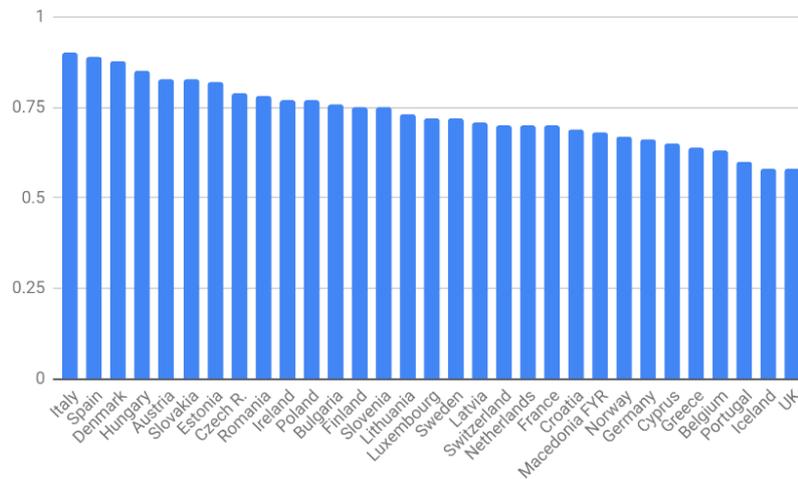
Data in TED pertain to the three main categories of PP distinguished in EU law – services, supplies (goods) and works (construction and infrastructure-related projects). Data are reported on the number and value of contracts issued by procuring entities for each of these three categories, as well as the procurement procedure that applies. These include open (competitive) bidding, restricted procedures and so-called competitive dialogue. The first two account for most procurement. Under open procedures, contracting authorities are required to publish procurement opportunities in the Official Journal of the EU, specify the technical criteria that bidders must satisfy and evaluate bids and allocate contracts on

⁹ These overall averages mask substantial variation in the different components that make up the composite index. For example, Slovakia has the highest bid preparation score of 0.9, while Iceland and Portugal have the lowest scores on this component (0.58). Scores for bid and contract management and for payment of suppliers also differ substantially across countries.

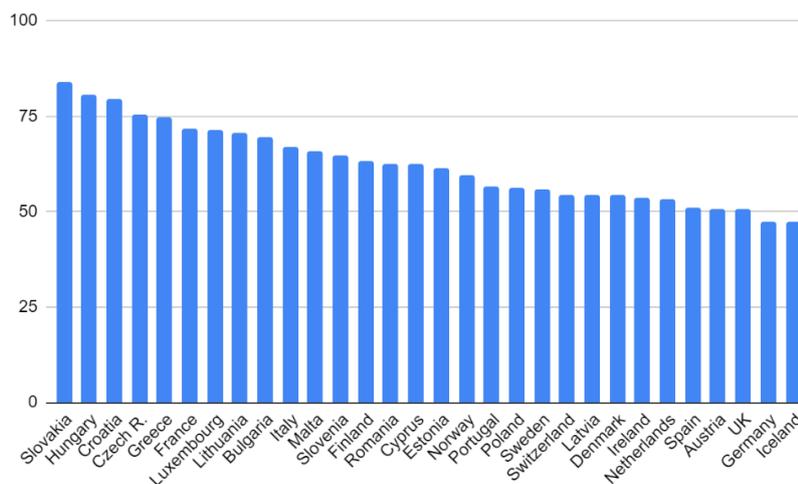
¹⁰ The 2014 EU directive on public procurement requires procuring entities to consider at the planning stage whether to divide a contract into lots and justify the reasons for decisions not to do so. Such sub-division into lots may not be used to circumvent thresholds established in EU legislation determining when competitive tendering procedures must be used. Japan, South Korea, New Zealand, Egypt and Albania have similar provisions in their procurement regulations (Nielsen, 2017; OECD 2018).

the basis only of the bids received. Restricted procedures, used for higher-value contracts, involve a process where contracts are awarded based on competition between pre-qualified suppliers that express interest in participating. Some 85 percent of PP contracts are allocated through open procedures in the European Economic Area, accounting for about three-fifths of total PP by value (Kutlina-Dimitrova and Lakatos, 2016).¹¹

Figure 1. Public Procurement Regulation Scores for EU Countries



World Bank Overall Benchmarking Public Procurement Index



Average DigiWhist EuroPam country scores¹²

¹¹ Negotiated procedures have the same transparency requirements as open and restricted tendering but permit the contracting entity to negotiate with potential bidders. The use of this procedure is circumscribed and in principle is limited to complex projects where there may be alternative technical solutions or procuring authority is unable to determine ex ante how best to attain its objectives or needs.

¹² The graph reports average of scores for 2016 and 2017 for each county. Annex Figure 1 presents DigiWhist scores separately for 2016 and 2017.

Public authorities are obliged to publish their tender invitations on TED for all contracts exceeding EU public procurement thresholds. For the period under analysis the thresholds were €135,000 for public sector supply and service contracts issued by central government entities (€209,000 for other authorities); €387,000 for utility supply and service contracts; €80,000 for small lots within a project above the services threshold; and €5,225,000 for public sector and utility works and services concession contracts. However, many contracts that fall below these thresholds are also reported in TED, as authorities often use TED to publicize tenders independent of contract values.

The TED data are available online in CSV format starting in 2006.¹³ The European Commission extracts the data from standard forms pertaining to the initial contract notice and final contract award notice that must be provided by each procuring authority.¹⁴ For each contract, the TED database includes fields for the estimated contract value (determined by the procuring entity), the actual contract (award) price, the sectoral Common Procurement Vocabulary (CPV) code that applies to the subject of procurement,¹⁵ the procurement method used, type(s) of contracting authority, and the names and locations of both the procuring agencies and the winning firms.

TED includes information on SME participation for 2016 and 2017. A total of 1,018,794¹⁶ tenders were awarded in these two years. For 205,578 of these tenders, or 20 percent of the total, information is reported on the number of SMEs that participated in the tender process. We focus on this sub-sample of contracts in the empirical analysis.¹⁷ Information on whether an SME wins a tender is available for a larger set of contracts (531,164 in total), but data often is not reported on the number of SMEs participating in the PP tender process. Of the 531,164 contracts where information is reported whether an SME is awarded the contract, the SME win ratio is 53 percent. This ratio is higher in the subsample of 205,578 tenders for which we have information on the number of SME bidders per tender, i.e., participation rates are reported. In this sub-sample, which we use for the empirical analysis, 67 percent of tenders are won by an SME. The majority (185,682) of these contracts were awarded using open procedures (first price auctions).¹⁸

Almost 80 percent (163,265) of the contracts in our sub-sample involved division of a part of the project into smaller lots.¹⁹ Some 60 percent of our sample (123,842) had estimated contract values exceeding the legal thresholds that determine if EU procurement regulations apply, i.e., 40 percent of

¹³ We use the contract award notices csv files available at: <https://data.europa.eu/euodp/data/dataset/ted-csv>.

¹⁴ The standard forms of the EU are available at <http://simap.ted.europa.eu/web/simap/standard-forms-for-public-procurement>.

¹⁵ The CPV establishes a single classification system for public procurement aimed at standardizing the references used by contracting authorities and entities to describe the subject of procurement contracts. The economic sector that contracts are associated with is identified by the first two digits of the CPV code. The CPV distinguishes 45 major sectors. See <https://simap.ted.europa.eu/web/simap/cpv>.

¹⁶ 459,393 in 2016 and 559,401 in 2017.

¹⁷ No information is reported on SME participation in the remaining 813,216 contracts in 2016 and 2017. TED does not report information on SME participation for the pre 2016 period. Appendix Table A7 provides descriptive statistics for our sample of 205,578 tenders for which SME participation rates are reported. The last two columns of Appendix Table A7 report the share of total contracts per TED sector for both the sub-sample for which TED reports information on the number of SME participants in a tender and for the total sample, i.e., all contracts, for 2016-2017. This reveals that the sectoral distribution of contracts for the sub-sample is very similar to that for all contracts, suggesting that the analysis of the set of contracts where information is reported on the number of SME participants is not affected by selection bias.

¹⁸ This ratio is comparable to what is observed in the complete TED data set of 1,018,794 contracts, where 899,428 (88.4 percent) use the open procedure. Only 3,934 of these tenders reported the use of electronic procurement mechanisms. The low share of e-procurement may reflect slow take-up of such mechanisms in Europe. EU procurement regulation requiring that all communication and information with bidders, including tender submissions be performed using electronic means only came into effect on 18 October 2018.

¹⁹ This compares to 785,671 (77.1 percent) of all contracts in full sample of TED contracts for 2016-17 that are subdivided into smaller lots.

the contracts in our sample are below the thresholds established in EU regulation determining if PP rules must be implemented, i.e., publication of tenders and reporting information on winning bidders. This feature of the database is important for the empirical analysis as we are interested in low value contracts that are more likely to be won by SMEs. The ratio of below threshold to total contracts is somewhat higher to that observed in the complete TED database, where 716,571 (70.3 percent) of all contracts are above the value thresholds specified in EU PP regulation.

In the empirical analysis we use sector fixed effects to control for possible sector-specific dimensions of PP participation and outcomes.²⁰ Contracts in the subsample are weighted towards goods: 79.3 percent of contracts comprise procurement in goods sectors (including works); services account for 20.7 of awarded contracts. Participation and win rates for SMEs competing for goods and services contracts are very similar.

4. Empirical analysis

Our empirical analysis addresses three questions: (1) the relationship between PP regulation and SME participation in tenders, (2) whether higher quality PP processes is associated with a higher probability of an SME winning a contract; and (3) whether dividing larger projects (contracts) into smaller lots increases SME participation and their probability of success. The first two questions use both the World Bank and DigiWhist PP policy scores as a measure of the quality of the administrative processes prevailing in each country. To the best of our knowledge, the third question has not been the subject of empirical analysis to date.

4.1 SME Participation

We start with the economic factors that affect participation of SMEs in PP, using the ratio of SME bidders to total bidders for a contract c as the dependent variable.²¹ We estimate the following regression equation:

$$Ratio_c = \beta_1 PPQ_c^i + \beta_2 PM_c + \beta_3 above_c + \beta_4 divided_c + \sum_{z=1}^9 \beta_{z+4} PA_c^z + \sum_{s=1}^{44} \beta_{s+13} Sector_c^s + \varepsilon_c \quad (1)$$

where $Ratio_c$ is the ratio of bids by SMEs to the total number of bids submitted for each contract. PPQ_c^i is the public procurement quality score i , where i identifies whether the World Bank Overall Benchmarking Public Procurement score or the DigiWhist EuroPAM country scores are used.²² PM_c is a dummy variable for the use of open procurement methods and PA_c^z is a dummy variable denoting the type of public procurement authority that issued the call for tenders. $Sector_c^s$ denotes 44 sector fixed effects. In addition, we use dummy variables for whether estimated costs exceed the legal thresholds above which EU procurement law applies, $above_c$,²³ and whether the contract is divided into smaller lots, $divided_c$. All estimations use robust standard errors.

²⁰ Some types of PP contracts are likely to be less accessible to SMEs, e.g., tenders for products or services where economies of scale are large, making SMEs less competitive than large firms. In our sample, SME participation rates are similar across sectors. The main exceptions are PP tenders for water, petroleum products, public utilities and financial services – sectors with substantial scale economies or regulation. See Appendix Table A7.

²¹ We use the standard OECD/EU definition of SMEs as this is the basis for the data reported in the TED database.

²² World Bank (2017) do not have public procurement regulation scores for Liechtenstein and Malta. The TED data set contains only 311 contracts for Liechtenstein and 2,518 for Malta.

²³ For the period under analysis the main thresholds were €135,000 for public sector supply and service contracts issued by central government entities (€209,000 for other authorities); €387,000 for utility supply and service contracts; €80,000 for small lots within a project above the services threshold; €5,225,000 for public sector and utility works and services concession contracts.

The PP quality scores may be endogenous due to unobserved factors that affect both the number of bidders, the number of SME bidders and quality scores. In that case, the error term of the regression equation, ε_c , will contain these unobserved factors. The quality scores will be correlated with the error term and this endogeneity problem will distort the empirical results. We employ two alternative instrumental variable (IV) GMM methodologies to consider possible endogeneity of PP quality score variables. One is to use lagged GDP per capita as an IV. This is exogenous to PP processes and highly correlated with the quality of PP regulation insofar as richer countries tend to have better institutions as reflected in rule of law and public sector governance performance. Annex Table 1 presents the first-stage regressions. These show that lagged GDP per capita positively and significantly correlated with the BPP and DigiWhist scores. Given that countries with widely differing per capita GDP levels are similar in terms of the share of SMEs in the size distribution of firms, use of this instrument should not introduce an additional source of potential bias.

The second approach to control for possible endogeneity is to construct valid IVs using the Lewbel (2012) heteroscedasticity-based (HB) identification strategy to identify structural parameters when valid IVs do not exist. Lewbel (2012) constructs valid IVs that are independent of the error term using the heteroscedasticity structure of the error term. Additionally, we apply the approach of Conley et al. (2012) to obtain inferences when IVs are “plausibly exogenous,” i.e., when the correlation between the IVs and endogenous variables are near 0 but not exactly 0, to examine the validity of the IV-GMM estimation by constructing linear models such that the IV validity condition is not satisfied. This methodology allows us to use “instruments that are strong but may violate the exclusion restriction”. (Conley et al. 2012, p. 261).

Estimation results reported in Table 2 indicate that countries with better public procurement quality scores attract significantly more SME bidders and achieve higher levels of competition. Good procurement practices do not favour large firms disproportionately – to the contrary. The same holds for the use of open procedures to award contracts. The coefficient estimate for the dummy variable for use of ‘open procedures’ is statistically significant and positive in sign, implying that the ratio of SME to total bidders is higher when authorities use open (competitive) PP procedures. As expected, larger contracts are associated with lower participation of SMEs: contracts that are above the legal thresholds established in EU law are less likely to induce participation by SMEs.²⁴

As mentioned, in 79.5 percent of cases (163,265 of 205,469 contracts) contracts are divided into smaller lots.²⁵ In assessing the potential effect of such sub-division on SME participation, we specify a ‘Divided Lots’ dummy that equals one if a contract is divided into more than one lot and is zero otherwise. This variable is constructed using information from public notices and contract identification numbers – if there is more than one contract number assigned to a notice this indicates that the contract was sub-divided. When we also consider contracts where procuring entities divided an overall project in smaller lots, we find SME participation is greater. This suggests that smaller contracts attract greater participation by SMEs, consistent theoretical arguments (e.g., Timmermans and Zabala-Iturriagoitia, 2013) that dividing contracts into smaller lots promotes SME participation. In section 4.3 we estimate the critical value of the ‘smallness’ of contracts.

These results are robust to using the World Bank or EuroPAM indicators and to considering potential endogeneity of PP quality scores. Estimates using the two IV-GMM approaches are similar in size and significance to the OLS results. Estimation results obtained using the Conley et al. (2012) methodology result in coefficient estimates of the BPP and Digiwhist quality scores that are similar to the GMM results presented in Table 2 (Annex Table 3), i.e., regulation quality scores are positively associated

²⁴ These results are not driven by the inclusion of below threshold contracts in our sample. If the regressions are run using only data on contracts that exceed the EU legal thresholds the results are similar (Annex Table 2).

²⁵ This is not a function of value of the tender: 72.6 percent (89,909) of 123,842 above threshold contracts are divided into smaller lots. As noted previously, sub-division is a common feature of PP contracts, being observed in 77 percent of the full sample of all contracts reported in TED for 2016-17.

with SME participation. Consequently, alternative IV methods of Lewbel (2012) and Conley et al. (2012) confirm the validity of the IV-GMM results.

Table 2. Public Procurement Regulation and SME Participation

Dependent Variable: Ratio of SME bidders to total number of bidders

	OLS	IV-GMM	HB-IV GMM
World Bank BPP Measure			
World Bank PP Score	0.16 (10.07)**	0.21 (5.74)**	0.11 (5.03)**
Open Procedure	0.07 (19.63)**	0.07 (19.46)**	0.07 (19.72)**
Above Threshold	-0.03 (16.76)**	-0.03 (15.60)**	-0.03 (17.03)**
Divided Lots	0.02 (7.07)**	0.02 (7.20)**	0.02 (6.98)**
Constant	0.57 (30.67)**	0.53 (17.45)**	0.60 (27.45)**
Observations	205,469	205,469	205,469
Digiwhist EuroPAM Public Procurement Score			
Country Score	0.08 (8.67)**	0.12 (5.73)**	0.07 (4.83)**
Open Procedure	0.067 (19.93)**	0.067 (19.88)**	0.067 (19.98)**
Above Threshold	-0.036 (18.41)**	-0.036 (18.41)**	-0.036 (18.40)**
Divided Lots	0.017 (6.62)**	0.017 (6.55)**	0.017 (6.60)**
Constant	0.629 (39.93)**	0.61 (32.17)**	0.634 (37.18)**
Observations	205,465	205,465	205,465

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses. IV-GMM employs lagged per capita GDP as an instrumental variable for the World Bank overall PP score and the Digiwhist country score. All models include authority, sector and year fixed effects. EuroPam scores are divided by 100 to be on the same scale as BPP.

4.2 Probability that an SME Wins a Contract

In this section, we examine only the contracts where an SME submitted a bid and investigate whether public procurement regulation quality affects the probability that an SME wins a contract.²⁶ We employ two alternative regression specifications. First, we estimate the following logit equation:

$$Prob(SME_Winner_c = 1|x) = F(x'_{it}\beta) \quad (2)$$

where SME_Winner_c is a dummy variable that equals 1 if an SME wins the public procurement contract and is 0 otherwise. $F(x'_{it}\beta)$ is a logit probability function of $x'_{it}\beta$, where x'_{it} contains the explanatory variables discussed previously. Second, we gauge the impact of PP regulation quality (PPQ_c^i) on the probability that an SME wins the contract. Given that quality scores may be endogenous, we again estimate a linear probability model using IV-GMM and lagged GDP per capita as an IV. Lewbel (2018) shows that a linear probability model can be estimated using heteroscedasticity-based (HB) instrumental

²⁶ As has been theorized and confirmed in empirical analysis of PP markets, entry by SMEs in procurement contests is strongly associated with win rates, i.e., SMEs participate in auctions they are more likely to win (Krasnokutskaya, et al. 2011; Li and Zheng, 2009).

variables in instances where the dependent variable is binary and an explanatory variable is potentially endogenous. Accordingly, we correct for possible endogeneity of the PPQ_c^i variables by implementing the IV GMM methodology of Lewbel (2012) to the following linear probability model in which use the same controls as in equation (1):

$$SME_Winner_c = \beta_1 PPQ_c^i + \beta_2 PM_c + \beta_3 above_c + \beta_4 divided_c + \sum_{z=1}^9 \beta_{z+4} PA_c^z + \sum_{s=1}^{44} \beta_{s+13} Sector_c^s + \varepsilon_c \quad (3)$$

Table 3 reports the results of estimating equations 2 and 3 using logit, IV and HB-IV GMM regression specifications. Annex Table 3 presents the Conley et al. (2012) “plausibly exogenous” estimation results. The coefficient estimates for the PP regulation quality scores are statistically significant and positive, suggesting that the likelihood that a SME will win a public procurement contract is higher when a country has better public procurement regulation quality. As is the case with the participation analysis in the previous section, above threshold contracts are associated with a lower likelihood that SMEs win contracts.²⁷ Noteworthy, however, is that the coefficient estimates for the use of open procedures and subdivision of lots are negative and statistically significant. These results suggest that good procurement practice encourages more SME participation that is rewarded with more contracts being awarded to SMEs (the result found in the previous section). But they also reveal that specific measures to ensure competition (use of open procedures) and increase the scope for SMEs to win contracts (subdivision of lots) may not do so.

That large firms are more likely to benefit from open procedures (open competition) is not surprising. That SMEs do not tend to benefit from decisions to subdivide lots is more surprising. In the next subsection we conduct threshold regression analysis to examine the impact of lot size on the probability that SMEs win contracts. Specifically, we hypothesize that dividing contracts into smaller lots increases the chances of an SME winning only when the lots are small enough.

4.3 Multiple Lot Procurement and Lot Size: Threshold Regression Analysis

We implement the following threshold regression specification:

$$SME_Winner_c = \beta_1 PPQ_c^i + \beta_2 PM_c + \beta_3 above_c + \sum_{j=0}^m 1_j(lotsize_j, \gamma) dividedlots \beta_{dl} + \sum_{z=1}^9 \beta_{z+4} PA_c^z + \sum_{s=1}^{44} \beta_{s+13} Sector_c^s + \varepsilon_c \quad (4)$$

where $1_j(lotsize_j, \gamma)$ takes the value 1 if the expression that $\gamma_j \leq lotsize_j \leq \gamma_{j+1}$ is true. Therefore, the coefficient of the *dividedlots* variable, β_{dl} , can differ across values of the threshold variable, lot size.

Table 4 reports the results of fitting a threshold model to equation 4. The threshold regression identifies the critical lot size threshold for small contracts as €23,469. When lot size is smaller than this, the coefficient estimate on the *dividedlots* variable is positive and statistically significant. Dividing procurements into smaller lots increases the probability that an SME wins the contract. For lots with larger contract values, SMEs are less competitive and less likely to win public procurement contests even if contracts are subdivided. The threshold contract value is very small in absolute magnitude raising an empirical (and practical) question how many such contracts are observed in a country in a given year. In the case of the sample used for the analysis, 40 percent (81,736) of contracts had a value below the estimated threshold, suggesting some scope for this policy to enhance SME participation.

²⁷ If the regressions are run using only data on contracts that exceed the EU legal thresholds the results are very similar (Annex Table 4).

Table 3. Public Procurement Regulation Quality and Probability of SME Winning a Contract

	Logit	Linear Probability Model		
		OLS	IV-GMM	HB-IV GMM
World Bank BPP Measure				
World Bank PP Score	3.47 (22.31)**	0.40 (22.77)**	0.61 (24.19)**	0.20 (7.90)**
Open Procedure	-0.15 (4.91)**	-0.02 (5.09)**	-0.02 (6.15)**	-0.01 (4.63)**
Above Threshold	-0.13 (8.03)**	-0.02 (8.58)**	-0.01 (4.76)**	-0.02 (10.54)**
Divided Lots	-0.13 (6.04)**	-0.02 (6.26)**	-0.01 (5.73)**	-0.02 (6.65)**
Constant	-0.29 (1.78)	0.61 (32.62)**	0.47 (20.27)**	0.75 (32.69)**
Observations	159,035	159,035	159,035	159,035
EuroPAM Public Procurement Score				
Country Score	1.23 (13.01)**	0.13 (13.62)**	0.33 (22.23)**	0.14 (9.01)**
Open Procedure	-0.12 (4.12)**	-0.014 (4.36)**	-0.016 (5.21)**	-0.014 (4.36)**
Above Threshold	-0.20 (12.47)**	-0.023 (12.80)**	-0.019 (10.91)**	-0.023 (12.80)**
Divided Lots	-0.16 (7.15)**	-0.018 (7.29)**	-0.018 (7.58)**	-0.018 (7.30)**
Constant	1.44 (10.48)**	0.819 (54.02)**	0.712 (42.82)**	0.816 (49.23)**
Observations	159,039	159,039	159,039	159,039

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses. IV for the World Bank overall PP score and the Digiwhist country score. All models include authority, sector and year fixed effects. EuroPam scores are divided by 100 to be on the same scale as BPP.

4.4 E-procurement

A total of 3,927 contracts report use of electronic procurement mechanisms. As mentioned above, the low share of e-procurement may reflect slow implementation by EU member states of e-procurement-related legislation, but as e-procurement is generally regarded as a way to reduce participation costs for smaller firms, we report the results of estimating equations (1) – (3) including a dummy variable for use of e-procurement in Appendix Tables A1 (for the whole sample) and A2 (for tenders in which at least one SME participated). Perhaps counterintuitively the results suggest that e-procurement is associated with less participation by SMEs in the set of contracts for which we have data. This finding calls for additional analysis.

4.5 Timeliness of payments

Timely payment of suppliers is important for SMEs as payment delays by a procuring entity will have a negative impact on cash flows of the firms executing a contract and their ability to cover running costs and pay financial liabilities. Djankov et al. (2017) construct an indicator to examine several aspects related to payment of suppliers including how burdensome the procedures are to request payments, the average time taken for processing of invoices and disbursement of payments by agencies, and the procedures that apply in instances where payments are delayed. We use this indicator (the payment score) to assess its salience for both SME participation and the probability of SMEs winning contracts.

using regression specifications in section 4.1 and 4.2.²⁸ Appendix Tables A3 and A4 display the empirical results for payment quality. The results reported in Table A3 show that payment score is positively associated with SME participation. Similarly, results reported in Table A4 indicate a positive and significant relationship between payment score and the probability that an SME wins a contract. All regression specifications in Appendix Tables A3 and A4 provide similar results.

Table 4. Procurement Regulation Quality and Probability of SMEs Winning a Contract

	LOTSIZE < EURO 23,468.55 (N= 91,907)	
Divided Lots	0.009 (3.31)**	0.009 (3.09)**
	23,468.55 ≤ LOTSIZE < 250,000 (N=27,694)	
Divided Lots	-0.03 (9.39)**	-0.03 (10.22)**
	LOTSIZE ≥ 250,000 (N=21,119)	
Divided Lots	-0.13 (26.26)**	-0.14 (28.62)**
WB PP Score	0.32 (20.32)**	
Country Score		0.001 (8.19)**
Open Procedure	-0.019 (5.42)**	-0.017 (4.89)**
Above Threshold	-0.008 (3.90)**	-0.013 (6.67)**
Authority FE	Yes	Yes
Sector FE	Yes	Yes
Year Fe	Yes	Yes

Notes: Threshold regression of linear probability model. Only tenders in which an SME submitted a bid are examined, i.e., number of SME offers > 0. * $p < 0.05$; ** $p < 0.01$.

4.6 Sample Selection

Our sample spans the years 2016 and 2017. In 2016, 31,145 contracts were awarded for which information is reported on SME participation, whereas this information is reported for 176,097 contracts awarded in 2017. This creates a potential source of sample selection bias. Results from conducting the empirical analysis using only data for contracts awarded in 2016 reported in Appendix Tables A5 and A6 are very similar to the main results presented in Tables 2 and 3 that use the whole sample. As noted previously, the sectoral distribution of contracts in our sub-sample of contracts for which TED reports SME participation numbers is very similar to that observed in the full sample of contracts (see Appendix Table A7). Accordingly, the main results are robust to sample selection.

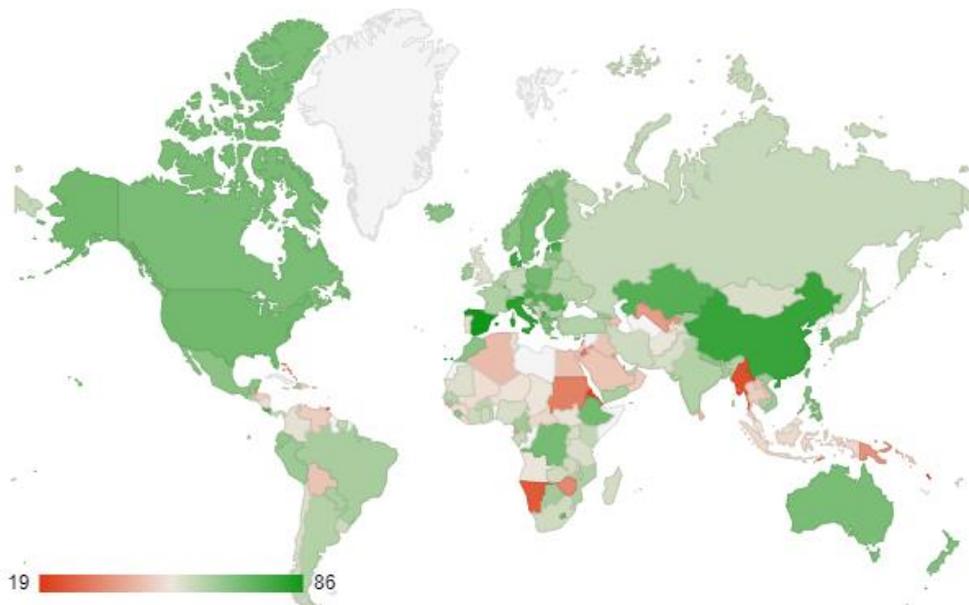
5. Potential Policy Implications for Developing Countries

In this section, we examine the potential impact of public procurement reforms in other countries on participation by SMEs in public procurement opportunities, using the results from the analysis based on

²⁸ This indicator ranges between 0.5 and 1, with a mean of 0.69 and standard deviation of 0.14.

the European data. Table 5 shows that PP regulation in developing countries, both in terms of the mean and overall distribution of scores, is substantially weaker than in the European countries that were the basis of the empirical analysis.²⁹ Figure 2 plots PP scores for all 142 countries included in World Bank (2017). Most countries (93%) have public procurement quality scores that are lower than the European countries' average.

Figure 2. World Bank Public Procurement Scores



Note: Higher numbers (darker green) denote higher quality PP regimes.

Source: World Bank (2017).

Table 5. World Bank BPP Scores: Summary Statistics for Country Groups

	Mean	Standard Dev.	Min.	Max
EU	0.73	0.09	0.58	0.9
East Asia and Pacific	0.55	0.17	0.24	0.8
Latin America & Caribbean	0.55	0.12	0.25	0.77
Middle East and North Africa	0.48	0.11	0.27	0.67
South Asia	0.58	0.08	0.44	0.66
Sub-Saharan Africa	0.55	0.1	0.26	0.72

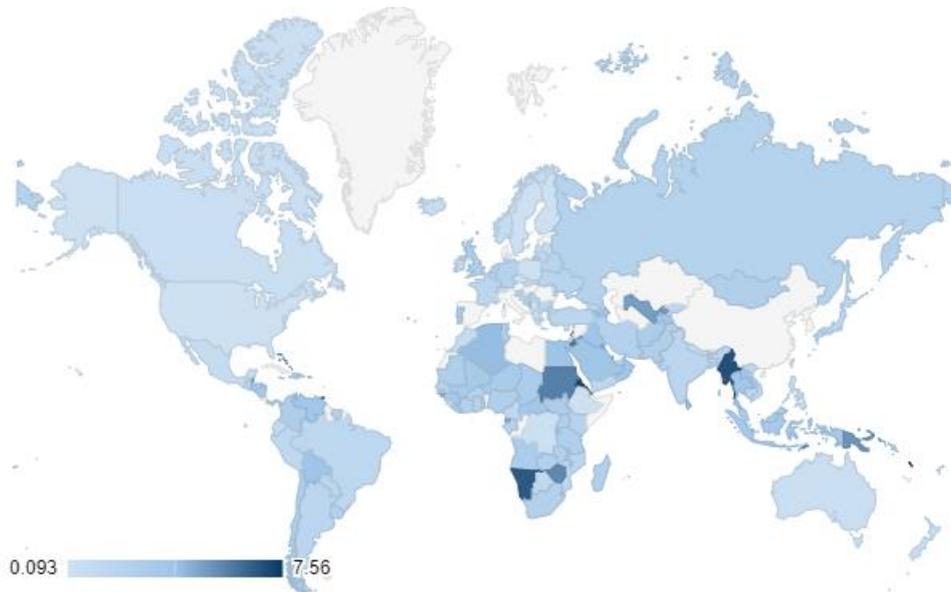
Source: World Bank (2017).

Figures 3 and 4 report the results of a counterfactual analysis of the potential effects on SME participation in PP and the probability of winning a contract if national PP regimes were reformed to achieve the European average quality score. We do so by taking the difference between national PP quality scores and the EU average, 0.73 and then calculate the counterfactual values using the estimated OLS coefficients in Tables 2 and 3, i.e., assuming each country achieves a PP regulation score of 0.73. Annex Tables 5-9 report the counterfactual values for each country group. While a purely illustrative exercise, it illustrates the potential to increase both SME participation in public procurement and SME win probabilities associated with measures to improve general PP practices, independent of

²⁹ Countries are grouped following the World Bank definition.

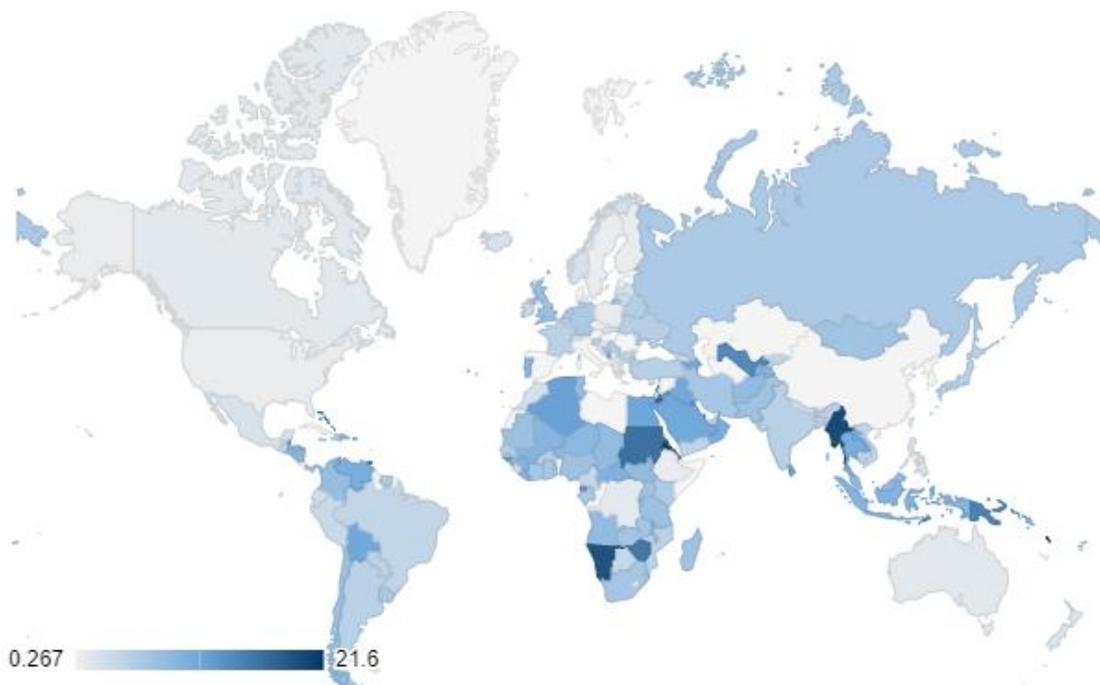
complementary specific policy measures that aim at increasing the share of total government procurement contracts awarded to SMEs.

Figure 3. Potential Benefits of PP Reforms on Change in SME participation ratio (% points)



Note: Countries with BPP scores above the EU average and countries without BPP scores are white.

Figure 4. Potential Benefits of PP Reforms on Change in SME win probability (% points)



Note: Countries with BPP scores above the EU average and countries without BPP scores are white.

6. Conclusion

Public procurement constitutes a major source of economic activity in virtually all countries. The processes used to define needs, design projects, and allocate contracts to maximize value for money are important. The basic elements of what is generally accepted as constituting good practice in this area of public administration are well established. They involve mechanisms to ensure transparency, limit discretion, and constrain rent-seeking and corrupt practices. Competition is a key feature of good public procurement regulation.

Many governments are concerned that open, competitive procurement mechanisms may bias participation in procurement contests away from smaller companies towards large firms and/or benefit international bidders over domestic ones. In this paper we use a large dataset of procurement contracts issued by European countries that includes information on whether SME participated in bidding and on their success in obtaining contracts. We find that good procurement practice is good for SMEs: countries with higher PP regulation quality scores are associated with a larger ratio of SME participation and higher probability that SMEs win contracts. However, controlling for PP regulation quality, the use of open competitive tendering methods tends to benefit large firms more than SMEs, with larger contracts more likely to be awarded to large firms.

This finding may help to explain why many governments are interested in adopting measures that help SMEs participate in public procurement. Such measures may involve earmarking a share of procurement for small firms or other forms of preferences that target small firms. The EU, Japan, South Korea and several other countries have implemented a policy that encourages subdivision of contracts into smaller lots as a way of encouraging greater participation by SMEs. This paper offers the first evidence on the potential effects of such a policy. We find that it is associated with greater participation by SMEs but not an increase the probability of SMEs winning contracts. Threshold regression analysis suggests the absolute value of lot sizes matters. If lots are small enough – below €25,000 – the likelihood that SMEs win procurement contracts increases. Our counterfactual simulations suggest that insofar as governments are interested in enhancing participation by SMEs in public procurement auctions the focus should be on improving the quality of PP regulation. Although outside the purview of our empirical analysis, improving PP regulation is also likely to be a precondition for effectively implementing policies such as subdivision of procurement contracts.

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Appendix

Table A1: Effect of Public Procurement Regulation Quality on SME Participation

Dependent Variable: Ratio=number of SME bidders/Total number of bidders
Regressions with Electronic Procurement Explanatory Variable

	OLS	IV-GMM	HB-IV GMM
	World Bank BPP Measure		
World Bank PP Score	0.16 (10.41)**	0.22 (5.96)**	0.11 (5.03)**
Open Procedure	0.07 (19.98)**	0.07 (19.81)**	0.07 (19.72)**
Electronic Procurement	-0.05 (7.58)**	-0.05 (7.48)**	-0.03 (17.03)**
Above Threshold	-0.03 (16.64)**	-0.03 (15.44)**	0.02 (6.98)**
Divided Lots	0.02 (7.19)**	0.02 (7.32)**	0.11 (5.03)**
Observations	205,469	205,469	205,469
Authority FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
	EuroPAM Public Procurement Score		
Country Score	0.001 (9.16)**	0.001 (5.96)**	0.0004 (2.19)*
Open Procedure	0.068 (20.27)**	0.068 (20.24)**	0.071 (20.96)**
Electronic Procurement	-0.048 (7.46)**	-0.049 (7.57)**	-0.046 (7.19)**
Above Threshold	-0.036 (18.33)**	-0.036 (18.33)**	-0.040 (19.48)**
Divided Lots	0.017 (6.72)**	0.017 (6.65)**	0.016 (6.41)**
Observations	205,465	205,465	205,465
Authority FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses. IV-GMM employs lagged GDP per capita as an instrumental variable.

Table A2: Public Procurement Regulation Quality and Probability of SME Winning a Contract

Only Tenders that an SME has submitted a bid are examined. Number of SME offers >0
Regressions with Electronic Procurement Explanatory Variable

	Logit	Linear Probability Model		
		OLS	IV-GMM	HB-IV GMM
World Bank BPP Measure				
World Bank PP	3.51 (22.61)**	0.40 (22.94)**	0.62 (24.30)**	0.20 (7.77)**
Open Procedure	-0.14 (4.47)**	-0.01 (4.64)**	-0.02 (5.74)**	-0.01 (4.17)**
E-Procurement	-0.52 (10.39)**	-0.06 (8.78)**	-0.06 (8.71)**	-0.06 (8.60)**
Above Threshold	-0.13 (7.93)**	-0.02 (8.43)**	-0.01 (4.63)**	-0.02 (10.47)**
Divided Lots	-0.13 (5.87)**	-0.01 (6.06)**	-0.01 (5.54)**	-0.02 (6.47)**
Observations	159,035	159,035	159,035	159,035
Authority FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
EuroPAM Public Procurement Score				
Country Score	0.013 (13.38)**	0.001 (13.83)**	0.003 (22.36)**	0.001 (8.80)**
Open Procedure	-0.110 (3.68)**	-0.012 (3.91)**	-0.015 (4.79)**	-0.012 (3.91)**
E-Procurement	-0.504 (10.15)**	-0.062 (8.66)**	-0.063 (8.77)**	-0.062 (8.66)**
Above Threshold	-0.203 (12.43)**	-0.022 (12.68)**	-0.019 (10.80)**	-0.022 (12.68)**
Divided Lots	-0.155 (7.01)**	-0.017 (7.11)**	-0.018 (7.40)**	-0.017 (7.10)**
Observations	159,039	159,039	159,039	159,039
Authority FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses. IV-GMM employs lagged GDP per capita as an instrumental variable.

Table A3: Payment of Suppliers Quality Score and SME Participation

	OLS	IV-GMM	HB-IV GMM
	World Bank BPP Measure		
Payment Quality Score	0.05 (4.94)**	0.45 (5.72)**	0.03 (2.09)*
Open Procedure	0.07 (19.94)**	0.07 (19.03)**	0.07 (19.97)**
Above Threshold	-0.03 (17.56)**	-0.02 (8.29)**	-0.04 (17.80)**
Divided Lots	0.02 (7.09)**	0.03 (8.66)**	0.02 (6.92)**
Observations	205,469	205,469	205,469
Authority FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses. IV-GMM employs lagged GDP per capita as an instrumental variable.

Table A4: Payment of Suppliers Quality Score and Probability of SME Winning a Contract

	Linear Probability Model			
	Logit	OLS	IV-GMM	HB-IV GMM
Payment Quality	1.87 (19.69)**	0.21 (20.01)**	0.96 (29.60)**	0.05 (3.80)**
Open Procedure	-0.13 (4.25)**	-0.01 (4.40)**	-0.02 (5.41)**	-0.01 (4.22)**
Above Threshold	-0.15 (9.05)**	-0.02 (9.52)**	0.01 (2.63)**	-0.02 (11.93)**
Divided Lots	-0.11 (5.16)**	-0.01 (5.45)**	0.00 (0.06)	-0.02 (6.62)**
Observations	159,039	159,039	159,039	159,039
Authority FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses. IV-GMM employs lagged GDP per capita as an instrumental variable.

Table A5: World Bank Public Procurement Quality Score and SME Participation

Analysis with Contracts in 2016

	OLS	IV-GMM	HB-IV GMM
	World Bank BPP Measure		
World Bank PP Score	0.11 (3.46)**	0.64 (9.38)**	-0.20 (3.09)**
Open Procedure	0.09 (11.38)**	0.08 (10.30)**	0.09 (11.20)**
Above Threshold	-0.08 (14.75)**	-0.07 (12.09)**	-0.09 (15.82)**
Divided Lots	0.01 (2.28)*	0.01 (1.65)	0.00 (0.20)
Constant	0.62 (19.69)**	0.37 (6.40)**	0.96 (17.22)**
Observations	31,165	31,165	31,165
Authority FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses. IV-GMM employs lagged GDP per capita as an instrumental variable.

Table A6: World Bank Public Procurement Quality Score and SME Contract Winning Probability

Analysis with Contracts in 2016

	Logit	Linear Probability Model		
		OLS	IV-GMM	HB-IV GMM
World Bank PP	1.49 (4.82)**	0.20 (5.13)**	0.45 (8.36)**	0.16 (2.41)*
Open Procedure	-0.22 (3.37)**	-0.03 (3.52)**	-0.03 (3.64)**	-0.03 (4.23)**
Above Threshold	-0.56 (11.59)**	-0.06 (12.28)**	-0.05 (10.62)**	-0.05 (9.07)**
Divided Lots	-0.25 (5.01)**	-0.03 (5.09)**	-0.03 (4.93)**	-0.03 (4.33)**
Constant	1.70 (4.81)**	0.83 (18.74)**	0.64 (12.34)**	0.93 (14.96)**
Observations	22,775	22,775	22,775	22,775
Authority FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses. IV-GMM employs lagged GDP per capita as an instrumental variable.

Table A7. Sectoral Distribution of Tenders, SME Participation and Win Ratio

CPV	Sector	Total Number of Contracts	Average Number of Offers	Average Number of SME Offers	Total Number of Contracts Won by SMEs	SME Win Ratio	Percentage of Contracts (with SME Information)	Percentage of Contracts (all contracts)
3	Agriculture	922	2.79	2.30	721	0.78	0.45	0.48
9	Petroleum Products	4601	3.03	1.15	1699	0.37	2.24	1.92
14	Mining	492	6.77	5.94	395	0.80	0.24	0.22
15	Food	31521	2.67	1.96	22887	0.73	15.33	5.51
16	Agricultural Machinery	348	2.39	2.10	290	0.83	0.17	0.13
18	Clothing	1239	2.91	2.23	955	0.77	0.60	0.61
19	Leather and Textile	209	3.69	2.97	168	0.80	0.10	0.13
22	Printed Matter	1151	13.47	12.52	787	0.68	0.56	0.53
24	Chemical Products	1050	3.85	3.14	787	0.75	0.51	0.63
30	Office and Computing Machinery	5714	5.45	4.59	4543	0.80	2.78	2.04
31	Electrical Machinery	1490	3.12	2.20	1009	0.68	0.72	0.77
32	Communication Equipment	1214	2.62	1.85	844	0.70	0.59	0.65
33	Medical Equipment	63079	3.70	2.13	37309	0.59	30.7	33.4
34	Transport Equipment	6586	2.95	1.99	4600	0.70	3.20	3.07
35	Security Equipment	876	2.18	1.68	671	0.77	0.43	0.50
37	Musical Instruments and Sports Goods	336	6.96	6.27	279	0.83	0.16	0.18
38	Laboratory Equipment	2761	4.86	2.87	2137	0.77	1.34	1.08
39	Furniture	3437	4.16	3.33	2901	0.84	1.67	1.71
41	Water	114	1.26	0.31	28	0.25	0.06	0.02
42	Industrial machinery	1430	2.65	2.07	1133	0.79	0.70	0.75
43	Construction Equipment	631	4.39	3.35	492	0.78	0.31	0.34
44	Construction Materials	2691	3.11	2.26	1822	0.68	1.31	1.39
45	Construction Work	11960	5.50	3.81	8618	0.72	5.82	8.48

SME Participation in Public Purchasing: Procurement Policy Matters

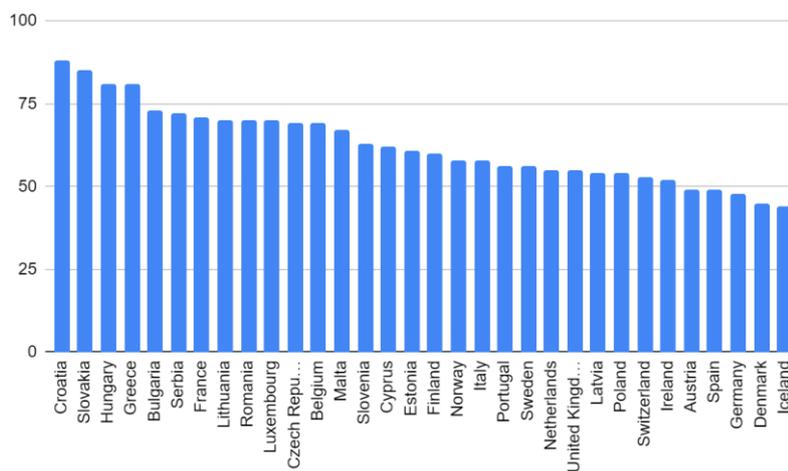
48	Software	1753	3.53	2.73	1252	0.71	0.85	0.78
50	Repair and Maintenance	5813	3.01	2.07	3980	0.68	2.83	3.31
51	Installation	175	2.79	2.12	133	0.76	0.09	0.09
55	Hotel and Restaurant	1350	3.30	2.47	898	0.67	0.66	0.76
60	Transportation services	5285	15.07	12.66	3820	0.72	2.57	3.08
63	Travel agency services	421	7.70	5.80	297	0.71	0.20	0.23
64	Postal and telecommunication	1449	2.00	0.86	562	0.39	0.70	0.71
65	Public Utilities	313	2.42	0.61	72	0.23	0.15	0.19
66	Financial and Insurance	2153	2.86	0.71	476	0.22	1.05	1.96
70	Real Estate services	390	14.62	6.17	270	0.69	0.19	0.22
71	Architectural and engineering	8652	4.96	3.96	6835	0.79	4.21	4.83
72	IT Services	3089	3.37	1.92	1994	0.65	1.50	1.70
73	Research and Development	508	4.64	1.55	259	0.51	0.25	0.29
75	Administration	453	3.75	2.71	325	0.72	0.22	0.26
76	Oil and gas	55	2.87	1.69	30	0.55	0.03	0.05
77	Forestry	8035	10.66	9.34	6874	0.86	3.91	2.49
79	Business Services	6083	6.36	4.54	4194	0.69	2.96	4.02
80	Education and training	3257	3.62	2.81	2518	0.77	1.58	1.91
85	Health and Social Work	2660	10.00	6.31	1578	0.59	1.29	3.36
90	Sewage & environmental services	8601	4.02	2.51	5958	0.69	4.18	4.38
92	Recreational and sporting	495	5.86	4.61	377	0.76	0.24	0.40
98	Other Community services	736	3.25	2.63	537	0.73	0.36	0.42

Source: TED Database.

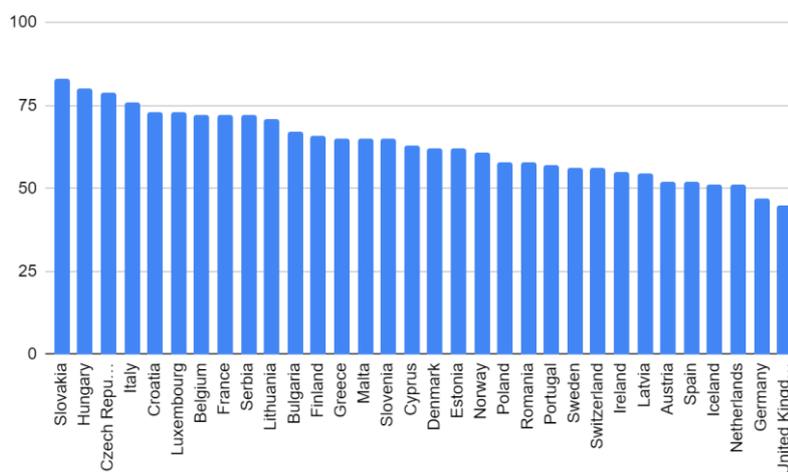
Annex

Additional Figures and Tables

Annex Figure 1. DigiWhist Public Procurement Regulation Scores for EU Countries



2016 DigiWhist EuroPam country scores



2017 DigiWhist EuroPam country scores

Annex Table 1. First Stage Regressions of IV GMM

Dependent Variable	Coefficient	t-Statistic
World Bank PP Score	0.032	415.27***
DigiWhist Country Score	5.73	520.46***

Annex Table 2. Public Procurement Regulation and SME Participation

(Above Threshold Contracts)

Dependent Variable: Ratio of SME bidders to total number of bidders

	OLS	IV-GMM	HB-IV GMM
	World Bank BPP Measure		
World Bank PP Score	0.13 (7.18)**	0.16 (5.45)**	0.15 (5.71)**
Open Procedure	0.06 (16.61)**	0.06 (16.70)**	0.06 (16.57)**
Divided Lots	0.02 (6.56)**	0.02 (6.81)**	0.02 (6.60)**
Constant	0.53 (25.46)**	0.51 (18.98)**	0.52 (21.47)**
Observations	123,778	123,778	123,778
Authority FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Digiwhist EuroPAM Public Procurement Score			
Country Score	0.001 (9.50)**	0.001 (7.51)**	0.001 (5.00)**
Open Procedure	0.063 (16.62)**	0.063 (16.62)**	0.064 (16.70)**
Divided Lots	0.018 (6.07)**	0.016 (5.58)**	0.018 (6.10)**
Constant	0.557 (30.85)**	0.567 (31.20)**	0.575 (30.04)**
Observations	123,781	123,781	123,781
Authority FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year Fe	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses. IV-GMM employs lagged per capita GDP as an instrumental variable.

Annex Table 3. Validity of Instrumental Variable

Plausibly Exogenous Instrumental Variable (Conley et al., 2012)

Dependent Variable	Coefficient of World Bank BPP Measure	Coefficient of EuroPAM Public Procurement Score
Ratio of SME bidders (Table 2)	0.34**	0.002**
Ratio of SME Winners (Table 3)	0.31**	0.002**

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses.

**Annex Table 4. Public Procurement Regulation and Probability of SME Winning a Contract
(Above Threshold Contracts)**

	Logit	Linear Probability Model		
		OLS	IV-GMM	HB-IV GMM
World Bank BPP Measure				
World Bank PP Score	2.91 (16.78)**	0.35 (17.13)**	0.76 (24.71)**	0.23 (7.91)**
Open Procedure	-0.16 (4.72)**	-0.02 (4.77)**	-0.02 (6.23)**	-0.02 (4.51)**
Divided Lots	-0.14 (5.81)**	-0.02 (6.07)**	-0.02 (5.15)**	-0.02 (6.42)**
Constant	-0.16 (0.88)	0.62 (28.53)**	0.35 (12.95)**	0.70 (26.99)**
Observations	95,242	95,242	95,242	95,242
Authority FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Year Fe	Yes	Yes	Yes	Yes
EuroPAM Public Procurement Score				
Country Score	0.02 (15.81)**	0.002 (16.20)**	0.005 (23.92)**	0.001 (7.87)**
Open Procedure	-0.15 (4.44)**	-0.017 (4.56)**	-0.022 (5.86)**	-0.016 (4.39)**
Divided Lots	-0.17 (7.06)**	-0.021 (7.26)**	-0.023 (7.78)**	-0.021 (7.22)**
Constant	0.85 (5.71)**	0.746 (42.41)**	0.603 (30.52)**	0.781 (41.49)**
Observations	95,247	95,247	95,247	95,247
Authority FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Year Fe	Yes	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$. Robust z-statistics in parentheses.

Annex Table 5. Potential Benefits of PP Reforms for MENA Countries*Counterfactual Results for Attaining EU Average Procurement Score*

Country	PP quality score	Change in SME participation ratio (% points)	Change in SME win probability (% points)
Algeria	0.48	4	10
Bahrain	0.55	3	7
Djibouti	0.30	6	17
Egypt	0.59	2	6
Iran	0.60	2	5
Iraq	0.51	3	9
Jordan	0.37	5	14
Kuwait	0.44	4	11
Lebanon	0.47	4	10
Mauritania	0.46	4	11
Morocco	0.67	1	2
Oman	0.49	3	10
Qatar	0.35	5	15
Saudi Arabia	0.48	4	10
Sudan	0.27	7	18
Tunisia	0.58	2	6
UAE	0.55	3	7

Annex Table 6. Potential Benefits of PP Reforms for East Asia and Pacific Countries*Counterfactual Results for Attaining EU Average Procurement Score*

Country	PP quality score	Change in SME participation ratio (% points)	Change in SME win probability (% points)
Cambodia	0.62	1.49	4.27
China	0.8	-0.98	-2.8
Indonesia	0.5	3.22	9.2
Korea, Rep.	0.72	0.14	0.4
Lao PDR	0.46	3.78	10.8
Malaysia	0.53	2.8	8
Mongolia	0.56	2.38	6.8
Myanmar	0.24	6.91	19.73
Papua New Guinea	0.37	5.09	14.53
Philippines	0.69	0.61	1.73
Singapore	0.77	-0.56	-1.6
Thailand	0.48	3.5	10
Timor-Leste	0.34	5.46	15.6
Vietnam	0.64	1.31	3.73

Annex Table 7. Potential Benefits of PP Reforms for Latin American & Caribbean Countries*Counterfactual Results for Attaining EU Average Procurement Score*

Country	PP quality score	Change in SME participation ratio (% points)	Change in SME win probability (% points)
Antigua and Barbuda	0.32	5.69	16.27
Argentina	0.61	1.63	4.67
Belize	0.34	5.46	15.6
Bolivia	0.46	3.78	10.8
Brazil	0.63	1.4	4
Chile	0.55	2.52	7.2
Colombia	0.54	2.66	7.6
Costa Rica	0.77	-0.51	-1.47
Dominica	0.71	0.28	0.8
Dominican Republic	0.49	3.31	9.47
Ecuador	0.66	0.98	2.8
El Salvador	0.57	2.24	6.4
Grenada	0.55	2.52	7.2
Guatemala	0.63	1.45	4.13
Haiti	0.61	1.63	4.67
Honduras	0.49	3.36	9.6
Jamaica	0.56	2.43	6.93
Mexico	0.67	0.79	2.27
Nicaragua	0.52	2.99	8.53
Panama	0.56	2.33	6.67
Paraguay	0.62	1.54	4.4
Peru	0.64	1.21	3.47
St. Kitts and Nevis	0.43	4.2	12
St. Lucia	0.42	4.34	12.4
Suriname	0.59	1.96	5.6
Trinidad and Tobago	0.25	6.77	19.33
Venezuela, RB	0.48	3.5	10

Annex Table 8. Potential Benefits of PP Reforms for South Asia Countries*Counterfactual Results for Attaining EU Average Procurement Score*

Country	PP quality score	Change in SME participation ratio (% points)	Change in SME win probability (% points)
Afghanistan	0.53	2.8	8
Bangladesh	0.63	1.45	4.13
Bhutan	0.64	1.26	3.6
India	0.61	1.63	4.67
Nepal	0.66	0.93	2.67
Pakistan	0.56	2.38	6.8
Sri Lanka	0.44	4.01	11.47

Annex Table 9. Potential Benefits of PP Reforms for Sub-Saharan African Countries*Counterfactual Results for Attaining EU Average Procurement Score*

Country	PP quality score	Change in SME participation ratio (% points)	Change in SME win probability (% points)
Angola	0.53	2.80	8.00
Botswana	0.64	1.31	3.73
Burkina Faso	0.60	1.82	5.20
Burundi	0.55	2.52	7.20
Cabo Verde	0.72	0.14	0.40
Cameroon	0.64	1.26	3.60
Central African Republic	0.50	3.27	9.33
Chad	0.53	2.80	8.00
Comoros	0.59	1.96	5.60
Congo, Dem. Rep.	0.70	0.37	1.07
Cote d'Ivoire	0.58	2.15	6.13
Equatorial Guinea	0.41	4.43	12.67
Eritrea	0.21	7.28	20.80
Ethiopia	0.71	0.28	0.80
Gabon	0.58	2.05	5.87
Gambia, The	0.58	2.15	6.13
Ghana	0.57	2.19	6.27
Guinea	0.51	3.13	8.93
Guinea-Bissau	0.41	4.48	12.80
Kenya	0.59	1.96	5.60
Liberia	0.50	3.17	9.07
Madagascar	0.56	2.33	6.67
Malawi	0.48	3.50	10.00
Mali	0.51	3.08	8.80
Mauritania	0.55	2.52	7.20
Mauritius	0.58	2.15	6.13
Mozambique	0.62	1.59	4.53
Namibia	0.26	6.63	18.93
Niger	0.52	2.94	8.40
Nigeria	0.56	2.43	6.93
Rwanda	0.53	2.80	8.00
Senegal	0.60	1.87	5.33
Seychelles	0.58	2.05	5.87
Sierra Leone	0.66	0.98	2.80
South Africa	0.57	2.24	6.40
South Sudan	0.53	2.75	7.87
Sudan	0.33	5.65	16.13
Tanzania	0.55	2.47	7.07
Togo	0.58	2.15	6.13
Uganda	0.56	2.38	6.80
Zambia	0.57	2.24	6.40
Zimbabwe	10.35	5.37	15.33

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