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Does the WTO Government Procurement Agreement Deliver What It Promises?

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Abstract: We examine the impact of the World Trade Organization (WTO) Government Procurement Agreement (GPA) on government procurement practices in the European Union (EU). We analyse empirically whether the WTO GPA is effective in promoting non-discriminatory, open, transparent, competitive, and cost-effective government procurement. To study this question, we use a unique data set recently released by the EU, covering more than three million tenders conducted in the European Economic Area, Switzerland, and Macedonia during the years 2006–2016. We find that the WTO GPA promotes competition by increasing the probability of awarding a contract to a foreign firm. In addition, the WTO GPA significantly lowers corruption risk by decreasing the number of contracts with single bidders, and by decreasing total number of wins by a single firm. Finally, the WTO GPA fosters cost-effective public procurement by lowering the probability that the procurement price is higher than estimated cost.

1. Introduction

Countries wanting to create a sound public procurement system must balance several goals. Of these, competition, transparency, non-discrimination, and

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integrity are probably the most important. The economic literature emphasizes the importance of competition for achieving optimal allocation of resources. Competition leads to lower prices and higher-quality products for a given price. In public procurement, the main issues are preserving free entry and ensuring the absence of collusion. Competition can be promoted in procurement markets by prohibiting discrimination, adopting transparent procedures, standardizing procedures for awarding procurement contracts, opening procurement markets to international trade, and preventing collusion among alternative suppliers.

The concept of transparency in the context of procurement involves five main elements: (i) public disclosure of the rules that apply in the procurement process; (ii) publication of procurement opportunities; (iii) prior determination and publication of what is to be procured and how submissions are to be considered; (iv) procurement according to prescribed rules and procedures; and (v) the existence of a system to monitor that the rules are being followed. The major aim of transparency is to ensure that the rules are followed, and that non-compliance can be identified and addressed. The effect of transparency is a higher level of competition. Since contracting authorities must make procurements publicly known, more suppliers will be aware of opportunities. Furthermore, some suppliers will come up with proposals that are competitively superior to those of their opponents. Hence transparency helps ensure that the contracting authority will pick the best possible proposal.

The principles of equal treatment and transparency are closely related to the principle of non-discrimination. Equal treatment requires that comparable situations are all treated the same. Thus, a contracting authority must act fairly in the course of public procurement, and all competitors must have an equal opportunity to compete for the contract. Examples of discrimination against foreign firms in an international trade context include: price preferences, outright bans on foreign bidders, local-content-related restrictions such as offsets, and standards adopted in the procurement process that raise the costs of foreign firms. If the non-discrimination principle in public procurement is to be observed, these practices should be avoided.

Integrity in procurement involves avoidance of corruption and abuse, and that the personnel involved in procurement will act ethically and fairly in avoiding conflicts of interest. Corrupt practices involve different forms of collusion between governments and bidders, such as awarding contracts based on bribes; awarding contacts to firms in which one has a personal interest; awarding contracts to firms in which one's friends, family, or business acquaintances have an interest; and awarding contracts to political supporters. Such corruption, which can occur in executing as well as in awarding contracts, may prevent the government from achieving value for money in their acquisitions.

The revised World Trade Organization (WTO) Government Procurement Agreement (GPA), which came into force on 6 April 2014, stands outside the 'Single Undertaking', in that it is not binding for all WTO Members, but only for Signatory Parties. The WTO GPA provides the Signatory Parties with a

framework to ensure that procurements scheduled under the Appendix to the WTO GPA are conducted in a competitive, non-discriminatory, and transparent manner, satisfying the conditions with regard to integrity. The WTO GPA requires opening covered procurements to international competition. The provisions on contract awards, supplier qualifications, and conditions on the procurement process ensure the achievement of transparency and non-discriminatory conditions of competition between suppliers, resulting in cost savings to procuring governments. In addition, access to the WTO's dispute settlement mechanism helps enforce fair and non-discriminatory competition in public procurement. As a result, the WTO GPA is expected to bring about lower prices and efficiency gains, and to reduce corruption and rent-seeking tendencies.

In this paper, we analyse empirically whether the WTO GPA is effective in promoting non-discriminatory, open, transparent, competitive, and cost-effective government procurements. The paper is organized as follows: Section 2 provides an overview of the literature and Section 3 describes the data set. Section 4 analyses the effect of the WTO GPA on the openness of government procurement markets, and Section 5 investigates whether the WTO GPA promotes competition. While Section 6 examines corruption risk, Section 7 analyses the effect of WTO GPA on procurement cost effectiveness. Section 8 concludes.

2. Literature overview

There is a vast literature studying the effects of the WTO GPA. In this section, we restrict ourselves to a discussion of the more recent contributions by Shingal (2011, 2015), Rickard and Kono (2014), Fronk (2015), Kutlina-Dimitrova and Lakatos (2016), and Gourden and Messent (2017).

Shingal (2011) examines whether the WTO GPA has fulfilled its intended purpose of non-discrimination. Noting that governments frequently discriminate against foreign suppliers in favour of domestic ones, the author studies whether the WTO GPA has led to greater market access for foreign suppliers. His analysis reveals that the WTO GPA has not been effective in increasing, or even sustaining, market access for foreigners in the services procurement markets of Japan and Switzerland.[1]

Rickard and Kono (2014) – noting that home-biased government procurement is a pervasive phenomenon, and that measuring domestic bias is difficult since it is not directly observable – measure discrimination in government procurement by

1 In his study of the effects of WTO GPA, Shingal (2011) concentrates on public purchases of services for Japan and Switzerland derived from annual Japanese and Swiss submissions to the WTO's Committee on Government Procurement for the period 1997–2003. The author, considers 25 service sub-sectors in the case of Japan and 26 service sub-sectors in the case of Switzerland, and determines that there has been significant discrimination against foreign bidders in the government procurement services markets in Japan and Switzerland.

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estimating the impact of procurement spending on the imports of goods and services. According to the authors, an increase in procurement shifts spending from the private to the public sector. Empirical analysis indicates that the WTO GPA does not eliminate discrimination in public procurement.[2]

A different approach was adopted by Fronk (2015) who is concerned with the estimation of the impact of procurement disciplines in bilateral and multilateral agreements, which he calls national treatment agreements (NTA). He employs a theoretical model incorporating elements from political economy, international trade, and auction theory to derive his estimating equations. Then, he empirically analyses the effects of NTAs on procurement awards. Using a probit selection model, Fronk (2015) finds that signing national treatment agreements with the US increases countries' procurement awards, both in terms of contracts and in total value.[3]

Shingal (2015), using the dataset from the WTO's notifications on domestic and foreign purchases by Japanese and Swiss governments at the sector level over the period 1990–2003, undertakes econometric analysis of the determinants of procurement with a home bias using variables inspired by the political economy, trade-macroeconomic, and procurement literatures. The empirical results reveal that the coefficient on the WTO GPA is statistically insignificant, indicating that the disciplining mechanisms of the WTO GPA may not have led to greater foreign access to the governments' goods procurement market.[4]

Recently, using a multivariate logit model, Kutlina-Dimitrova and Lakatos (2016) analysed the impact of a set of selected explanatory variables on the probability of awarding public procurement contracts directly cross-border. The explanatory variables include contract value, number of offers, GDP per capita,

2 Rickard and Kono (2014) ask whether the WTO GPA reduces discrimination against foreign suppliers. The authors, using a gravity model of trade and making use of annual data for 74 countries for the period 1995–2013, regress the natural logarithm of imports between two country pairs on a number of explanatory variables. They show that the coefficient on procurement spending, which is one of the explanatory variables, is negatively signed and statistically significant. Hence, the authors conclude that the WTO GPA does not eliminate discrimination in public procurement.

3 Fronk (2015) concentrates on the case of the US and makes use of data obtained from the US Federal Procurement Data System. Using annual observations on federal contracts, he obtains a rich data set for the period 1996–2010, including information on contract value, place of performance, contract year, and nationality of the supplier for each procurement. Since thresholds vary widely among the USA's NTAs, he considers the minimum value of these thresholds and concentrates on those procurements above this minimum value. He notes that until 2007 foreign firms were awarded less than 1% of procurement contracts, and that it was only in the final few years that foreign firms began to increase their share.

4 When conducting the econometric analysis of home bias in government procurement, Shingal (2015) concentrates on public purchases of goods and services for Japan and Switzerland derived largely from annual Japanese and Swiss submissions to the WTO's Committee on Government Procurement for the period 1990–2003. The author, considers 26 goods sub-sectors in the cases of Japan and Switzerland, 24 services sub-sectors in the case of Japan, and 26 services sub-sectors in the case of Switzerland and determines that the disciplining mechanism of the WTO GPA has not led to greater foreign access to government procurement markets.

trade–GDP ratio, the scope of public enterprises, regulatory protection of incumbents, barriers to foreign direct investment (FDI), and the type of tender procedure.[5] Empirical results reveal that the value of a contract has a positive influence on the probability of a cross-border win, implying that high-value contracts are more likely to be awarded to a foreign company. In addition, the results point to the negative influence of the number of offers on the probability of a cross-border win.

Finally, Gourdon and Messent (2017), making use of Tenders Electronic Daily TED data for the period 2009–2014, study the impact of a set of selected explanatory variables on the probability of awarding public procurement contracts directly cross-border. The explanatory variables include gross domestic product (GDP), imports, distance, government procurement share in GDP, common border, common language, colony, and remoteness. In addition, to assess the efficiency of such agreements, the authors include dummies whenever the reporting and partner countries are both in the WTO GPA or have signed an agreement with procurement disciplines. The authors show that a country's membership of the WTO GPA increases the probability of their firms being awarded a procurement contract in the EU through the cross-border mode of supply. Thus, under WTO GPA membership, foreign suppliers are expected to win a greater share of available contracts. However the authors note that the procurement pie is not expanding. Noting that procurement will be discriminatory if foreign firms cannot contest the procurement market through foreign direct investment or if government entities differentiate among firms based on their nationality, the authors investigate the role of investment agreements. Using Rickard and Kono's basic (2014) framework, the authors show that FDI barriers reduce the effectiveness of the WTO GPA in increasing the chance of a cross-border award, and that to maximize gains from WTO GPA accession, a country should also undertake investment liberalization.[6]

To emphasize the added value of the present paper compared to the existing literature, we note that the paper uses TED micro-level data released recently by the EU, covering more than three million tenders conducted in the European Economic

5 The authors have obtained procurement related data from Tenders Electronic Daily (TED) based on contract award notices in EU Member states for the period 2008–2012. After removing from the dataset extreme values and a large number of reporting errors due to non-compliance, the authors ended up with approximately 1.2 million observations.

6 Gourdon and Messent (2017), when analysing the impact of international agreements on the elasticity of the import of goods to procurement spending, use a bilateral gravity model of imports. The data used in the analysis consist of annual bilateral import data from UN Comtrade covering the period 1995–2013. The sample comprises 74 countries – 44 of these countries have bilateral agreements with procurement disciplines with at least one other country in the sample, 32 countries have investment agreements, and 35 countries are WTO GPA signatories. Empirical analysis reveals that WTO GPA reduces home bias in general and even more when signatory countries have international investment disciplines.

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Area (EEA), Switzerland, and Macedonia for the period 2006–2016.[7] A very interesting feature of this data set is the variable B_GPA, which records whether the contract is covered by the WTO GPA. Using this data set, we examine the following research questions:

- Does the WTO GPA foster openness of government procurement markets by increasing the probability that a foreign firm will win a contract?
- Does the WTO GPA promote competition by increasing the number of offers submitted?
- Does the WTO GPA lower corruption risk in government procurement?
- Does the WTO GPA improve procurement cost-effectiveness by lowering the probability that the procurement price is higher than the estimated cost of the procuring authority?

The TED data set contains detailed information on public procurement contracts that allow us to examine the above research questions. Our empirical analysis provides the following results: First, using a multivariate logit model, we analyse the probability of a foreign firm winning government procurement contracts and show that the WTO GPA reduces barriers for foreign countries. Second, we find that the WTO GPA promotes competition. Third, we find that corruption risks, measured in two different ways, are lower in WTO GPA auctions: the first measure is the probability of a single-bid auction, and the second the number of recurrent wins by a single firm. Finally, we show that the WTO GPA improves procurement cost-effectiveness by lowering the probability of the procurement price being larger than the estimated cost.

3. Main features of the TED data set

The TED data set contains data on 3,562,829 government procurement contracts conducted in 33 countries for the period 2006–2016. As stated in TED (2016), the sources of the data are contracting authorities and entities across Europe. The data are extracted from the contract notice and contract award notice standard forms filled in by the authorities.[8] Public authorities are obliged to publish their tender invitations on TED for all contracts exceeding EU public procurement thresholds. However, as emphasized by Kulina-Dimitrova and Lakatos (2016), contract awards below the threshold are also reported on TED. Authorities are not prevented from announcing a tender on TED even if the tender's value is below the

7 The data set is open to the public and can be downloaded at https://data.europa.eu/euodp/en/data/dataset/ted-csv. Note that while Kutlina-Dimitrova and Lakatos (2016) use TED micro-level data covering the period 2008–2012 and Gourdon and Messent (2017) use TED micro-level data covering the period 2009–2014 – we examine extended TED data covering the period 2006–2016.

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

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threshold, and since tenders are often awarded to the most economically advantageous bidder, the final award value might be well below the threshold.

To conduct the empirical analysis, we employ the TED award notices data. Of these contracts, 1,936,456 are covered by the WTO GPA and 1,626,373 are non-WTO GPA contracts, indicating that 46% of the procurements in the TED data set are non-WTO GPA contracts. Note that the coverage schedules are a critical part of the WTO GPA.[9] The EU 'SIMAP'[10] form for public procurement contains question IV.1.8, which asks whether the procurement is covered by the WTO GPA. We use this information to examine the effects of WTO GPA on government procurement. Table 1 gives the distribution of the contracts across countries, and we present average contract values for each country in the Online Appendix.[11] We note that firms from 201 different countries have won at least one contract.[12,13] Also, while Armenia, Canada, EU member countries, Hong Kong, Israel, the Republic of Korea, New Zealand, Chinese Taipei, and the US are parties to the WTO GPA, some of the important trade partners of the EU, such as Australia, Egypt, India, Malaysia, Mexico, Pakistan, the Russian Federation, Thailand, and Turkey, are not.[14]

Each contract in the data set is identified by a unique contract ID number. The year of the contract, contracting authority name, contracting authority country, Common Procurement Vocabulary (CPV) sector code, winner firm name. and winner firm country are available for each contract. We use this information to examine the likelihood of a foreign firm winning a contract. We identify the

9 Article II of WTO GPA describes the scope and coverage of the agreement. For more details, see the Online Appendix.

10 Acronym for information system for public procurement (fr. système d'information pour les marchés publics).

11 Procurements conducted in France and Poland constitute a significant percent of the data set, 23% and 27% respectively. The TED documentation states that: 'Generally, the data consists of tenders above the procurement thresholds. However, publishing below threshold tenders in TED is considered good practice, and thus a non-negligible number of below threshold tenders is present as well.' Compared to other countries, French and Polish authorities regularly report contracts below the threshold value. We conduct the empirical analysis using the complete data set with all countries and also using a narrower data set excluding France and Poland. When we examine all countries, we use separate dummy variables for France and Poland to control for the asymmetric representation of these countries. Empirical results are similar with and without France and Poland and with and without these dummy variables. Tables OA.5, OA.10, and OA.12 in the Online Appendix present results without France and Poland and without dummy variables. Tables OA.7 and OA.8 in the Online Appendix display results with France and Poland dummy variables.

12 Tables OA.3 and OA.14 in the Online Appendix display the distribution of winner countries.

13 We manually processed the countries with an unlikely number of winner firms. For example, Afghanistan has 203 contracts. Although the total amount of exports from Afghanistan to the EU is 417 million Euros for the 2006–2015 time period, it might be excessive that 203 firms from Afghanistan won an EU public procurement contract. The TED data set also contains the names and addresses of the firms. We matched the names and corrected winner country information. These modifications do not change the results as they make up only 0.0001% of the data set.

14 We present the number of successful firms in EU tenders from selected countries in the Online Appendix Table OA.3.

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Table 1. Authority Country conducting the procurement

	GPA covered		Not covered by GPA	
Country	Frequency	Percent	Frequency	Percent
Austria	10,790	0.56	20,550	1.26
Belgium	37,794	1.95	13,722	0.84
Bulgaria	365	0.02	61,590	3.79
Croatia	75	0	20,595	1.27
Cyprus	7,342	0.38	297	0.02
Czech Republic	41,361	2.14	29,198	1.8
Denmark	31,771	1.64	10,275	0.63
Estonia	9,381	0.48	9,126	0.56
Finland	12,031	0.62	5,269	0.32
France	680,057	35.12	106,971	6.58
Germany	163,076	8.42	122,217	7.51
Greece	29,385	1.52	3,751	0.23
Hungary	39,737	2.05	18,740	1.15
Iceland	658	0.03	303	0.02
Ireland	21,088	1.23	3,789	0.23
Italy	43,411	2.24	72,025	4.43
Latvia	89,254	4.61	1,821	0.11
Lithuania	85,555	4.42	3,748	0.23
Luxembourg	3,105	0.16	1,156	0.07
Macedonia	146	0.01	2,236	0.14
Malta	1,208	0.06	116	0.01
Netherlands	50,199	2.59	13,198	0.81
Norway	29,620	1.53	1,956	0.12
Poland	172,037	8.88	784,022	48.21
Portugal	1,455	0.08	8,535	0.52
Romania	74,058	3.82	112,044	6.89
Slovakia	11,120	0.57	14,352	0.88
Slovenia	523	0.03	47,246	2.90
Spain	41,164	2.13	43,251	2.66
Sweden	39,063	2.02	7,756	0.48
Switzerland	16,457	0.85	3,393	0.21
United Kingdom	190,782	9.85	83,123	5.11
Total	1,936,456	100	1,626,373	100

sector of procurement using the first two digits of the CPV code, noting that there are 72 major sectors.[15]

Government institutions implement different procurement procedures. The most common procedure is 'open tender' with 1,405,288 WTO GPA covered and 1,234,645 non-WTO GPA contracts awarded using the open procedure. Additionally, authorities implement negotiation, restricted auction, and competitive

15 Detailed summary statistics for each sector are provided in the Online Appendix Table OA.13.

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dialogue procedures.[16] The TED data set also provides information about procurement results, namely procurement price, estimated cost determined by the procuring authority, and number of offers received.

We identify firms by their names and base countries. One of the unique features of the TED data set is the availability of firm names and the countries in which they are located. We use this information to calculate the total number of wins by a single firm. There are 414,917 unique firms that have won at least one contract. Ninety percent of the firms have won ten or fewer contracts.[17,18] When we consider only the WTO GPA covered procurements, we note that 258,647 unique firms have won on average 7.48 contracts. In comparison, when we consider non-WTO GPA contracts the average number of wins is 8.38 by 193,981 firms.

4. Effect of the WTO GPA on the openness of government procurement markets

To analyse the effects of the WTO GPA on the openness of government procurement markets, we consider three cases. First, we call a firm foreign whenever the country of the procuring authority is different from the country of the firm, and we examine whether the WTO GPA reduces barriers for foreign firms. Next, we consider a different definition of foreign firm, and define a firm as foreign whenever the procuring authority is in an EU Member state and the country of the firm is a non-EU state. We then examine whether the WTO GPA promotes non-EU firms.[19] Finally, the third case investigates whether the WTO GPA encourages competitive tendering procedures.

4.1 Effect of WTO GPA on the probability that a foreign firm will win a contract

Using the following logit regression specification, we examine whether the WTO GPA reduces barriers for foreign firms which are attempting to win government procurement contracts:

$$\text{Prob}(C_{irt} = 1|\text{x}) = F(x'_{irt}\beta) \tag{1}$$

16 We provide detailed information about procedure types in the Online Appendix Tables OA.1 and OA.2.

17 One of the irregularities that we observe is about the total number of wins by each firm. Twenty firms out of 414,917 have won more than 10,000 contracts in the TED data set and one, from Latvia, has apparently won 53,085. These firms all operate in multiple sectors.

18 For 2,813 contracts, there is no information on the winner's name or country, and for 37,512 contracts, information is missing on the CPV code. We do not examine these contracts and remove them from the data set.

19 EU directives regulate intra-EU procurement, but if the EU does not have an FTA with procurement market access commitments with a country that is a party to the GPA – US, Japan, Armenia – then the access to EU markets by these firms under GPA schedules will likely affect intra-EU procurement due to more bids, competitive pressures etc.

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where C_{irt} is a dummy variable, that is 1 if a procurement contract is awarded to a firm when the country of the procuring authority is different from the country of the firm, and 0 otherwise. $F(x_{irt}'\beta)$ is the logit probability function of $x_{irt}'\beta$ and x_{irt}' contains the explanatory variables GPA_{irt} and control variables, X'. GPA_{irt} is the dummy variable, which is 1 if the procurement is covered by a WTO GPA and 0 otherwise. The coefficient of GPA_{irt} indicates the impact of the WTO GPA on the probability that a foreign firm wins a government procurement contract in EU countries.[20] X' contains dummy variables for the procurement method (type), and dummy variables for the type of contracting authority. Additionally, X' includes country-specific factors, such as the ratio of trade-to-GDP and GDP per capita.[21] The fixed-effect of the dummy variables for the years 2007–2016 and sector dummy variables, identified by the first two digits of the CPV codes, are also given. Note that foreign firms have been awarded 61,889 contracts: 37,516 covered by the WTO GPA and 24,373 non-GPA contracts.[22]

Using a multivariate logit regression and instrumental variable (IV) GMM linear probability model estimation enables us to examine the effect of WTO GPA on the probability that a foreign firm wins a contract (see Table 2). As presented in Table 1, 44% of WTO GPA and 54.79% of non-WTO GPA contracts are conducted in France and Poland. The over-representation of these countries might alter the results. Accordingly, to assess the robustness of the results, we conduct the empirical analysis using the complete data set but excluding France and Poland. In the second column, we focus on the contracts with estimated contract values above the thresholds determined by the EU, namely 1,413,379 contracts. Specifically, we eliminate contracts where the estimated contract values are not known or the contract values are below EU threshold levels.

The third column considers that the WTO GPA covered variable might be endogenous. There might be unobserved factors that authorities use to determine whether tenders are covered by the WTO GPA. These unobserved factors might also be related with the probability that a foreign (or non-EU firm) wins a contract. In that case, the WTO GPA covered variable will be correlated with the error term and this endogeneity problem will affect the results. We employ an instrumental variable generalized method of moments (GMM) methodology to consider possible endogeneity of the WTO GPA covered variable. Lewbel (2018) shows that a linear probability model can be estimated using the heteroscedasticity based instrumental

20 We also estimate alternative regression specifications with additional control variables such as number of offers and contract value. We display the estimation results in the online appendix Table OA.5.

21 We display the regression results with the trade–GDP ratio and GDP per capita in the online appendix Table OA.5. We obtain these variables from the World Development Indicator database of the World Bank.

22 We display the total number of wins by foreign firms for each country in the Online Appendix Tables OA.3 and OA.14.

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Table 2. Effect of WTO GPA on the probability of a foreign firm winning a contract

	Excluding France and Poland			All countries		
	Logit regression		IV-GMM	Logit regression		IV-GMM
	(1)	(2)	(3)	(4)	(5)	(6)
GPA covered	0.17	0.18	0.004	0.08	0.09	0.01
	(17.84)**	(17.02)**	(15.96)**	(9.65)**	(9.81)**	(17.20)**
accelerated negotiated	0.36	0.27	0.01	0.31	0.22	0.01
	(5.37)**	(3.83)**	(5.78)**	(4.96)**	(3.33)**	(4.83)**
accelerated restricted	0.16	0.21	0.00	0.17	0.23	0.00
	(3.82)**	(4.61)**	(3.77)**	(4.11)**	(5.50)**	(2.70)**
award without publication	−0.18	−0.18	−0.01	−0.39	−0.39	−0.01
	(4.96)**	(4.59)**	(5.91)**	(12.80)**	(11.84)**	(16.93)**
competitive dialogue	0.87	0.88	0.04	0.74	0.78	0.03
	(13.12)**	(13.20)**	(15.54)**	(13.43)**	(13.89)**	(17.10)**
negotiated with competition			0.97	1.40	1.40	0.09
			(8.36)**	(1.77)	(1.76)	(2.49)*
negotiated without comp.	0.08	0.07	0.01	0.05	0.03	0.01
	(4.00)**	(3.58)**	(9.99)**	(2.99)**	(1.48)	(13.31)**
restricted	−0.29	−0.25	−0.01	−0.39	−0.33	−0.01
	(22.95)**	(18.71)**	(22.56)**	(33.96)**	(27.42)**	(36.57)**
Central government	0.92	1.00	0.02	0.80	0.88	0.01
	(51.48)**	(52.49)**	(40.66)**	(52.98)**	(54.83)**	(45.99)**
Water, energy, transport	1.39	1.42	0.04	1.13	1.19	0.03
	(69.63)**	(67.44)**	(67.96)**	(66.95)**	(66.21)**	(64.76)**
EU institution	4.66	4.66	0.57	4.52	4.49	0.56
	(188.10)**	(174.04)**	(377.65)**	(198.80)**	(182.29)**	(437.40)**
other international org.	2.61	2.65	0.16	2.43	2.41	0.14
	(20.04)**	(17.17)**	(20.03)**	(19.21)**	(16.18)**	(22.19)**

Table 2. (*Cont.*)

	Excluding France and Poland			All countries		
	Logit regression		IV-GMM	Logit regression		IV-GMM
	(1)	(2)	(3)	(4)	(5)	(6)
governed by public law	0.98	0.96	0.02	0.84	0.82	0.02
	(59.73)**	(54.48)**	(51.11)**	(63.99)**	(57.52)**	(63.45)**
Other	0.86	0.91	0.01	0.72	0.77	0.01
	(46.85)**	(45.94)**	(36.28)**	(50.80)**	(49.72)**	(51.11)**
National agency	0.95	1.01	0.02	0.85	0.93	0.01
	(32.78)**	(32.57)**	(21.77)**	(31.99)**	(32.40)**	(21.63)**
Regional or local agency	0.30	0.38	0.00	0.26	0.37	0.00
	(7.33)**	(8.65)**	(4.27)**	(7.32)**	(9.67)**	(6.88)**
Not specified	1.07	1.13	0.02	0.72	0.71	0.01
	(16.83)**	(16.16)**	(11.13)**	(30.00)**	(27.20)**	(26.76)**
France				−0.24	−0.31	−0.01
				(21.38)**	(25.98)**	(29.43)**
Poland				−0.75	−0.68	−0.01
				(60.21)**	(39.90)**	(35.54)**
Constant	−3.22	−3.41	0.07	−2.91	−3.10	0.07
	(12.97)**	(12.64)**	(6.20)**	(11.75)**	(11.47)**	(7.16)**
Observations	1,793,712	1,413,379	1,793,764	3,523,919	2,443,603	3,524,060
Pseudo R^2	0.16	0.15	0.10	0.14	0.09	0.07
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$

variables (IV) of Lewbel (2012) when the dependent variable is binary and an explanatory variable is potentially endogenous. Accordingly, we correct for possible endogeneity of the WTO GPA covered variable using the IV GMM methodology of Lewbel (2012):[23]

$$C_{irt} = \beta_0 + \beta_1 GPA_{irt} + X'\theta + \varepsilon_{irt} \quad (2)$$

where C_{irt} is a dummy variable as described in equation (1). In equation (2), β_1 measures the effect of WTO GPA on the probability that a foreign firm wins a contract. X' contains the control variables as described above.

Columns 4–6 in Table 2 provide the results for the 3,524,060 contracts for all countries. Column 5 focuses on the estimated contract values above the EU thresholds. Finally, column 6 implements the IV GMM methodology to all contracts.[24]

The coefficient of the WTO GPA-covered variable is significant, with a positive sign for all regression specifications. Accordingly, we conclude that foreign firms are more likely to win government procurement contracts when the contract is covered by the WTO GPA. This result indicates that the WTO GPA is successful in lowering the barriers for foreign firms to win government procurement contracts in EU Member states and affiliated countries.

4.2 *Effect of the WTO GPA on the probability that a non-EU firm will win a contract*

We now consider a different definition of 'foreign firm' and examine whether the WTO GPA promotes non-EU firms. We note that during the years 2006–2016, 13,591 non-EU firms won 29,045 government procurement contracts in the EU. We conduct a multivariate logit regression and an IV-GMM linear probability model estimation to examine the effect of the WTO GPA on the probability that

23 Lewbel (2012) constructs valid instrumental variables that are independent of the error term using the heteroscedasticity structure of the error term. Previously, Rigobon and Sack (2003) used a similar identification technique to assess the reaction of monetary policy to the stock market. Lewbel (2012) generalizes this identification technique. Accordingly, it can be applied to data sets with different structures like the TED data set. The method developed by Lewbel (2012) identifies structural parameters by constructing instruments as functions of the model's data when valid instrumental variables do not exist. This approach provides an unbiased and consistent estimate of parameters when the regression model contains endogenous or mismeasured regressors, or when the model suffers from the omitted-variable bias. The Monte Carlo results and numerous empirical applications presented in Lewbel (2012) show that the estimator works very well compared to the two-stage least squares method and to GMM when good instrumental variables are not available. The methodology uses the heteroscedasticity of the errors to construct valid IVs, and consistent and unbiased parameters of the empirical model can be estimated by employing these IVs in an IV-GMM setting.

24 We also estimate different regression specifications with different sets of explanatory variables to assess the robustness of our results. These results are available in Table OA.5 in the Online Appendix.

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a non-EU firm wins a contract. We estimate the following logit regression specification and linear probability model:

$$\text{Prob}(NEU_{irt} = 1|\text{x}) = F(x'_{irt}\beta) \tag{3}$$

$$NEU_{irt} = \beta_0 + \beta_1 GPA_{irt} + X'\theta + \varepsilon_{irt} \tag{4}$$

where NEU_{irt} is a dummy variable that is 1 if procurement is awarded to a non-EU foreign firm or 0 otherwise. $F(x'_{irt}\beta)$ is the logit probability function of $x'_{irt}\beta$. x'_{irt} and X′ contains the explanatory variables described in section 4.2. The coefficient of GPA_{irt} shows the impact of the WTO GPA on the probability that a non-EU firm wins a government procurement contract in the EU Member state and affiliated countries.[25]

Table 3 displays the results of the multivariate logit regression estimation of equation (3) and IV-GMM linear probability model estimation using Lewbel (2018) methodology as in equation (4). As in Table 2, the second and fifth columns focus on estimated contract values above the EU thresholds. The coefficient of the WTO GPA covered variable is significant with a positive sign for all regression specifications. Accordingly, we conclude that non-EU firms are more likely to win government procurement contracts when the contract is covered by the WTO GPA. The WTO GPA opens the EU government procurement market to non-EU firms.

4.3 Effect of the WTO GPA on procurement method: multinomial logit regression analysis

The WTO GPA encourages competitive tendering procedures. Procurements must be carried out in a transparent and impartial manner, avoiding conflict of interest and preventing corrupt practices by using methods such as open tendering, where any supplier may respond to a published call for tenders, or selective tendering, where bids are restricted to prequalified suppliers who have demonstrated that they meet technical competence norms. Limited tendering, under which potential suppliers are directly solicited to bid by the procuring entity, is non-competitive and may be used in only the following circumstances: situations in which no tenders had been submitted; none of the tenders conformed to the essential requirements of tender documentation; none of the suppliers satisfied the conditions for participation; or collusion had been involved in the tenders submitted. In this section, we investigate the effect of the WTO GPA on methods of procurement. We study whether the WTO GPA promotes competitive tendering procedures by affecting the choice of procurement types.

25 We also estimate alternative regression specifications with additional control variables such as number of offers and contract value. We display the estimation results in Table OA.5 in the online appendix.

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Table 3. Effect of WTO GPA on probability of a non-EU firm winning a contract

	Excluding France and Poland			All countries		
	Logit regression		IV-GMM	Logit regression		IV-GMM
	(1)	(2)	(3)	(4)	(5)	(6)
GPA covered	0.09	0.19	0.001	0.08	0.12	0.001
	(4.94)**	(9.31)**	(7.78)**	(5.59)**	(7.13)**	(6.00)**
accelerated negotiated	0.21	0.19	0.01	0.04	0.02	0.003
	(1.79)	(1.57)	(5.61)**	(0.35)	(0.20)	(2.79)**
accelerated restricted	−0.36	−0.29	−0.00	−0.33	−0.24	−0.002
	(4.25)**	(3.35)**	(3.20)**	(4.00)**	(2.82)**	(4.07)**
award without publication	−0.12	−0.20	0.00	−0.62	−0.65	−0.002
	(1.90)	(2.94)**	(6.37)**	(11.85)**	(11.64)**	(6.65)**
competitive dialogue	0.75	0.70	0.01	0.54	0.53	0.012
	(6.99)**	(6.47)**	(8.35)**	(6.39)**	(6.18)**	(10.41)**
negotiated with competition			0.98	2.65	2.54	0.122
			(15.98)**	(3.30)**	(3.18)**	(5.64)**
negotiated without comp.	−0.16	−0.14	0.00	−0.27	−0.30	−0.001
	(4.20)**	(3.64)**	(3.04)**	(8.43)**	(8.99)**	(2.54)*
restricted	−0.45	−0.49	−0.00	−0.48	−0.48	−0.002
	(20.34)**	(20.66)**	(3.23)**	(25.09)**	(23.25)**	(8.70)**
Central government	0.50	0.55	0.00	0.41	0.45	0.004
	(15.37)**	(15.57)**	(19.33)**	(16.53)**	(16.98)**	(21.34)**
Water, energy, transport	0.77	0.72	0.01	0.48	0.49	0.005
	(20.12)**	(17.63)**	(22.99)**	(16.04)**	(15.47)**	(22.39)**
EU institution	1.84	1.73	0.03	1.66	1.55	0.029
	(31.93)**	(27.43)**	(36.73)**	(30.57)**	(25.80)**	(36.31)**
other international org.	1.81	1.93	0.03	1.59	1.62	0.022
	(6.78)**	(6.71)**	(6.43)**	(6.02)**	(5.68)**	(5.94)**

Table 3. (*Cont.*)

	Excluding France and Poland			All countries		
	Logit regression		IV-GMM	Logit regression		IV-GMM
	(1)	(2)	(3)	(4)	(5)	(6)
governed by public law	0.92	0.79	0.01	0.62	0.56	0.005
	(33.63)**	(26.58)**	(28.25)**	(31.45)**	(25.76)**	(32.83)**
Other	0.67	0.68	0.01	0.32	0.36	0.004
	(21.04)**	(19.66)**	(25.13)**	(15.17)**	(15.23)**	(25.78)**
National agency	0.56	0.56	0.00	0.40	0.43	0.002
	(9.92)**	(9.24)**	(7.33)**	(7.85)**	(7.96)**	(6.07)**
Regional or local agency	−0.01	0.20	0.00	−0.02	0.17	0.001
	(0.11)	(2.64)**	(0.58)	(0.34)	(2.76)**	(2.42)*
Not specified	0.45	0.58	0.00	0.95	0.83	0.009
	(2.90)**	(3.62)**	(2.25)*	(30.82)**	(25.05)**	(32.47)**
France				0.48	0.46	0.015
				(29.39)**	(26.17)**	(21.08)**
Poland				−0.17	−0.03	0.003
				(5.68)**	(0.77)	(13.16)**
Constant	−4.12	−4.09	0.02	−3.78	−3.72	0.027
	(10.67)**	(10.57)**	(4.11)**	(9.81)**	(9.65)**	(4.70)**
Observations	1,792,419	1,412,292	1,793,764	3,520,835	2,441,237	3,524,060
Pseudo R^2	0.06	0.05	0.01	0.06	0.05	0.01
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$

We implement a multinomial logit regression analysis. We take 'award without prior publication of a contract notice' and 'negotiated without a call for competition' as the base outcomes. Accordingly, we investigate the effect of the WTO GPA on the probability of competitive and open procedures compared to procedures without competition.[26] We find that the WTO GPA significantly increases the probability that authorities implement open and competitive procedures. The coefficients of WTO GPA procedures for open competitive dialogue are all significant and positive.

5. Effect of the WTO GPA on competitive environment

In this section, we examine whether the WTO GPA improves the competitive environment by increasing the number of offers submitted for a contract. We implement a negative-binomial regression methodology, as suggested by Bajari and Hortacsu (2003), to assess the determinants of the number of bidders. Specifically, we examine the following regression equation

$$N_{irt} = \alpha + \rho GPA_{irt} + \theta C_{rt} + \beta X_{irt} + \delta FE + \varepsilon_{irt} \quad (5)$$

where N_{irt} is the number of bids submitted for each contract.[27] We exclude France and Poland and examine contracts from the remaining EU countries. We present the empirical results for this sample in Table 4 and for all countries in Table OA.7 of the Online Appendix.[28] Table 4 (second column, consisting of 1,283,658 contracts) studies tenders with estimated contract values above EU thresholds. The coefficient of the WTO GPA-covered variable is significant, with a positive sign for all regression specifications. This result indicates that significantly more firms submit offers to WTO GPA-covered procurements. Hence, we conclude that the WTO GPA improves the level of competition in government procurement auctions.

6. Corruption risk in government procurement and the WTO GPA

Cost-effective government procurement requires a competitive and transparent procurement system. Corruption limits competition and artificially increases procurement prices above a competitive level. Therefore, to be able to improve procurement cost-effectiveness, authorities should conduct appropriate competition policy actions to deter collusion in public procurement. Hence, collusion prevention is one of the goals of the WTO GPA. In this section, we investigate whether the WTO GPA manages to limit collusion.

26 We display multinomial logit regression results in Table OA.6 in the Online Appendix.

27 Of the contracts we examine, 4,919 had no information about the number of offers, so we do not include them in our calculations.

28 We also estimate alternative regression specifications with additional control variables. We display these estimation results in Table OA.7 in the Online Appendix.

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Table 4. Effect of WTO GPA on level of competition and corruption measures excluding France and Poland

	Dependent variable			
	Number of bidders		Probability of single bidder procurement	
	(1)	(2)	(3)	(4)
GPA covered	0.27	0.22	−0.27	−0.23
	(142.13)**	(102.20)**	(62.17)**	(42.92)**
accelerated negotiated	−0.32	−0.35	0.09	0.11
	(18.42)**	(19.26)**	(2.52)*	(2.93)**
accelerated restricted	0.40	−0.11	−0.47	−0.45
	(40.72)**	(10.74)**	(20.71)**	(17.59)**
award without publication	−0.06	0.02	−0.27	−0.08
	(7.23)**	(1.91)	(18.64)**	(4.90)**
competitive dialogue	−0.29	−0.31	−1.08	−1.02
	(13.69)**	(14.67)**	(19.08)**	(16.89)**
negotiated with competition	−1.00	−1.09		
	(1.18)	(1.30)		
negotiated without comp.	−0.09	−0.12	−0.86	−0.83
	(16.16)**	(21.80)**	(71.41)**	(63.29)**
restricted	0.03	0.02	−0.61	−0.60
	(10.77)**	(6.44)**	(103.04)**	(87.90)**
Central government	−0.20	−0.18	0.46	0.47
	(62.63)**	(52.52)**	(65.83)**	(56.97)**
Water, energy, transport	−0.27	−0.31	0.43	0.54
	(57.77)**	(62.03)**	(42.49)**	(48.14)**
European Union institution	−0.84	−0.91	0.46	0.58
	(74.17)**	(74.56)**	(19.42)**	(22.00)**
other international org.	−0.54	−0.70	0.15	0.05
	(8.51)**	(9.68)**	(1.18)	(0.26)
governed by public law	−0.01	−0.04	0.09	0.10
	(3.97)**	(14.96)**	(13.55)**	(13.53)**
Other	0.03	−0.07	0.17	0.22
	(9.63)**	(20.27)**	(23.99)**	(25.34)**
National or federal agency	0.19	0.20	−0.01	0.05
	(32.69)**	(30.14)**	(0.98)	(2.71)**
Regional or local agency	−0.44	−0.44	0.31	0.28
	(72.22)**	(62.69)**	(21.88)**	(16.23)**
Not specified	−0.21	−0.32	−0.15	−0.04
	(14.38)**	(19.32)**	(4.10)**	(0.90)
Constant	0.17	0.15	−1.31	−1.43
	(162.58)**	(122.67)**	(6.38)**	(6.71)**
Observations	1,651,327	1,283,658	1,791,463	1,411,433
Pseudo R^2	0.07	0.04	0.05	0.05
Sector fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$

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We first construct collusion measures to gauge collusive risk in government procurement in the EU. Fazekas *et al.* (2014) calculate a proxy indicator of corruption by using signs of limited competition, such as a single bid received or the same company winning recurrent contracts. Ishii (2009) provides details about the operational structure of bidding rings that manipulate public procurement auctions. Bidding rings determine the winning firm by considering the previous intentional losses of a bid member. Accordingly, ring members that do not win a contract for a certain period of time are more likely to win the next rigged auction. Ishii (2009) argues that bidding ring members tend to win a higher number of contracts compared to non-ring members. We employ the arguments stated by Ishii (2009) and use the total number of contracts by a firm as a potential indicator of collusion. We examine the impact of the WTO GPA on corruption by assessing how the WTO GPA affects two red flags of limited competition: contracts with a single bid and firm win ratios.

6.1 *Contracts with single bids*

Of all procurements in the time period we study, 762,813 (21%) contracts were conducted when there was only one offer. Of this total, 21%, namely 285,905 contracts, were WTO GPA covered and 476,908 were not. We estimate a multivariate logit regression:

$$\text{Prob}(SB_{irt} = 1|\text{x}) = F(x_{irt}^{'}\beta) \tag{6}$$

where SB_{irt} is the single-offer procurement dummy variable and equals 1 if procurement was conducted with only one offer or 0 otherwise. $x_{irt}^{'}$ contains the explanatory variables GPA_{irt}, C_{rt}, P_{irt}, and FE, as described above in Section 4.

The last two columns of Table 4 display the regression results using all contracts and using contracts with estimated values above EU thresholds. The table shows that the probability of a one-offer procurement is significantly lower for WTO GPA-covered procurements. The coefficient of the WTO GPA-covered dummy variable is negative and significant at the 1% significance level. In other words, it is more likely that WTO GPA-covered procurements attract more than one offer. Accordingly, we conclude that the WTO GPA helps governments promote a competitive procurement environment that is less susceptible to collusive behavior. Table OA.8 in the Online Appendix estimates equation (6) using the complete data set with all EU countries and employs additional control variables. The WTO GPA covered variable is significant with a negative coefficient. The magnitude of the coefficient is lower (–0.16 compared to –0.27 in Table 4) when we examine all EU countries.

6.2 *Firms' winning ratios*

The second measure that Fazekas *et al.* (2014) use to gauge corruption risk is the number of recurrent wins by a single firm. To evaluate recurrent wins, we calculate

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the percentage of a firm's total number of wins in a specific sector and country. For example, if the percentage value of a firm is 50, then that firm has won half of the contracts in a sector and country. A higher percentage value is likely to indicate that a small number of firms win a higher percent of all contracts. Fazekas *et al.* (2014) argues that this limited competitive environment signals higher corruption risk.

We present the summary statistics of the total number of wins by each firm in Table OA.9 in the Online Appendix. The maximum value is 100 percent, and the table shows that in some countries all contracts are won by a single firm in a sector. WTO GPA-covered procurements are won by firms with a slightly lower average number of total wins: 0.65 compared to 0.67. The difference between WTO GPA-covered and non-covered procurements is statistically significant, with a p-value of 0.002.

The above considerations reveal that corruption risks, measured first by the probability of being a single-bid auction and second by recurrent wins by a single firm, are lower in WTO GPA auctions.

7. Does the WTO GPA improve procurement cost-effectiveness?

Finally, we examine the impact of the WTO GPA on the cost-effectiveness of government procurement. We measure cost-effectiveness by assessing whether the procurement price is lower than the authority's estimated cost.[29] We can use only 1,116,249 observations since the estimated value is missing for a substantial number of contracts. Additionally, we have eliminated the outliers by implementing Billor *et al.*'s (2000) BACON methodology (blocked adaptive computationally efficient outlier nominators) to identify the outliers. Although both the contract price and the estimated cost should have been entered in Euros, some observations have been entered in local currencies. Additionally, the contract price may be for one unit; however, the estimated cost may represent the total amount, which causes the ratio to be unrealistically small.[30] We identify these entries as outliers and eliminate them.[31] We display the ratio's summary statistics in the Online

29 As stated by Conley and Decarolis (2016: 6), the estimated cost 'is the maximum (the public authority) is willing to pay'. Conley and Decarolis analyse auctions held between 2000 and 2010 by Italian public administrations to procure contracts for simple roadworks in Northern Italy. They find that on average the contract price (winning bid) is 13.4% lower than the estimated cost. Similarly, Ishii (2009) shows that the ratio of winning bid to estimated cost is between 0.80 and 0.95 in Okinawa Prefecture road construction auctions in Japan. Onur *et al.* (2012) find similar results for Turkish public procurement auctions. Winning firms provide significant discounts compared to the estimated cost. Cost-ineffective procurement has significantly higher ratios compared to the average ratio of 0.89 in TED procurement. We display this statistic in Table OA.11 in the online Appendix. The minimum ratio is 0.25 and maximum is 1.87 for EU public procurement in the TED data set.

30 For example, the procurement price might be entered as 10,000 Euros for one car, but the estimated cost might be 1,000,000 Euros for a fleet of 100 cars. Therefore, a ratio of 10,000/1,000,000 will be unrealistically small.

31 We removed 145,465 observations that were identified as outliers by the BACON methodology.

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Appendix Table OA.11. On average, the ratio is equal to 0.89, indicating that the contract price is 89% of the estimated cost.[32]

We follow the description of OECD (2012) to identify cost-ineffective procurements. As stated by OECD (2012) 'value for money' can be assessed by comparing the procurement price and estimated costs. Specifically, procurement prices that are higher than the engineering cost estimates are not cost-effective. OECD (2012) suggests that public authorities should investigate these procurements. We identify the tenders with procurement prices higher than estimated costs (ratio of price and estimate is larger than one). We determine 225,837 (17.45%) procurements that are not cost-effective since their procurement prices are higher than their estimated costs.

We conduct several regression analyses to investigate whether WTO GPA lowers the probability that a tender is cost-ineffective (the ratio of price and estimate is larger than one). We also examine the impact of collusive behaviour on procurement cost-effectiveness by analysing the effects of single-offer procurements. Specifically, we estimate the following regression specification:

$$\text{Prob}(cost - ineffective_{irt} = 1|\text{x}) = F(x_{irt}^{'}\beta) \tag{7}$$

where $cost–ineffective_{irt}$ is a dummy variable that is 1 if the procurement price is larger than the estimated cost and 0 otherwise. $F(x_{irt}^{'}\beta)$ is a logit probability function of $x_{irt}^{'}\beta$. $x_{irt}^{'}$ and X' contains the explanatory variables described in Section 4.

We consider the endogeneity of the number of bidders and of the GPA dummy variable when conducting the regression analysis.[33] As stated by Estache and Iimi (2010) and Onur *et al.* (2012), there exist factors that might simultaneously influence bidders' participation decisions and the winning bid might cause the OLS estimates to be inconsistent. Ohashi (2009) argues that unobserved attributes of the procurement process are represented in the error term, and that bidders' participation decisions are likely to be correlated with these unobserved procurement attributes. Accordingly, the potential correlation between the error term and number of bidders might cause an endogeneity problem. Unobserved attributes that affect the number of bidders and the WTO GPA dummy variables are represented in the error term. If the empirical model of equation (7) does not incorporate these attributes then both the number of bidders and the WTO GPA dummy variables might be endogenous. We consider potential endogeneity of the number of

32 Table OA.11 in the Online Appendix presents the summary statistics with and without outliers. The ratio of procurement price and estimated cost has very unrealistic values like 2.5e+15 compared to 1.87 when we eliminate outliers. Table OA.10 presents the regression results with outliers. The extreme values are most likely caused by data error and should be discarded.

33 One might argue that the exclusion process might cause an endogeneity problem. Accordingly, we treat both the number of bidders and the GPA variables as potentially endogenous when conducting the regression analysis. An alternative regression specification of ordinary least squares, where we treat the GPA dummy variable as exogenous, rendered similar results. Table OA.12 in the Online Appendix displays the ordinary least squares results.

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bidders and the WTO GPA dummy variables and estimate the IV-GMM linear probability model estimation using Lewbel's (2018) methodology as in equation (8).

$$cost - ineffective_{irt} = \beta_0 + \beta_1 GPA_{irt} + X'\theta + \varepsilon_{irt} \tag{8}$$

Table 5 displays the results of the multivariate logit regression estimation of equation (7) and IV-GMM linear probability model estimation of equation (8). Columns 1–4 in Table 5 give the estimation results excluding France and Poland. Columns 5–8 analyse all EU countries. Columns 2, 4, 6, and 8 additionally contain the single bidder dummy variable as an explanatory variable to investigate the impact of potential corruption (single bidder procurement) on cost-effectiveness.

All regression specifications in Table 5 show that the WTO GPA-covered dummy variable is significant with a negative coefficient. The WTO GPA lowers the probability that the procurement price is larger than estimated cost. Accordingly, WTO GPA covered tenders are significantly more likely to be cost-effective.

In addition to the impact of the WTO GPA on procurement cost-effectiveness, Table 5 provides consequential results about the effect of competition and potential corruption. We find that competition plays a consequential role for improving procurement cost-effectiveness. The coefficient of the number of offers is negative and significant in all regression specifications. An increase in the number of bidders significantly lowers the probability that the procurement price is higher than the estimated cost.

Columns 2, 4, 6, and 8 of Table 5 examine the impact of potential corruption on procurement cost-effectiveness. We examine the effect of the proxy for potential corruption, namely single-bidder procurement as described in section 6.1. The single-bidder dummy variables in columns 2, 4, 6, and 8 have significant positive coefficients. Hence, single-bidder contracts are more likely to have procurement prices higher than their estimated costs. Accordingly, potential corruption proxied by single bidder procurement significantly lowers the cost-effectiveness of government procurement.[34] These results display the importance of competition as well as the importance of eliminating corruption in achieving government procurement cost-effectiveness.

8. Conclusion

This paper uses a unique data set provided by the EU, covering more than three million tenders conducted in the EEA, Switzerland, and Macedonia between 2006 and 2016. It analyses empirically whether the WTO GPA is effective in

34 As stated by Fazekas *et al.* (2014), a single bidder contract signals lack of competition and is a likely outcome of the corruption process. An alternative explanation for single bidder contracts is miscalculation of the estimated cost by the government authority. If the authority determines an unrealistically low estimated cost, then the most efficient firm or a firm that miscalculates its costs will be able to submit a bid.

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Table 5. Effect of the WTO GPA and Corruption on procurement cost-effectiveness

	Excluding France and Poland				All countries			
	Logit		IV-GMM		Logit		IV-GMM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GPA covered	−0.22	−0.21	−0.02	−0.02	−0.18	−0.18	−0.02	−0.02
	(23.46)**	(23.20)**	(24.48)**	(23.89)**	(30.57)**	(30.53)**	(30.27)**	(29.89)**
Single bidder		0.12		0.03		0.21		0.05
		(9.68)**		(21.40)**		(31.22)**		(61.52)**
No. of offers	−0.14	−0.13	−0.01	−0.01	−0.16	−0.12	−0.01	−0.01
	(75.06)**	(58.77)**	(76.55)**	(57.29)**	(111.30)**	(72.90)**	(98.57)**	(57.17)**
accelerated negotiated	0.51	0.52	0.06	0.06	−0.12	−0.12	−0.01	−0.01
	(6.19)**	(6.30)**	(5.96)**	(6.16)**	(1.88)	(1.91)	(1.59)	(1.69)
accelerated restricted	−0.28	−0.26	−0.03	−0.03	−0.15	−0.13	−0.02	−0.01
	(5.59)**	(5.21)**	(6.15)**	(5.15)**	(4.29)**	(3.55)**	(4.40)**	(2.46)*
award without publication	−0.06	−0.06	0.00	0.00	−0.23	−0.23	−0.01	−0.01
	(1.42)	(1.44)	(0.38)	(0.49)	(8.14)**	(8.22)**	(4.01)**	(3.97)**
competitive dialogue	0.36	0.39	0.04	0.05	0.57	0.62	0.08	0.09
	(3.18)**	(3.47)**	(2.99)**	(3.57)**	(6.92)**	(7.52)**	(6.22)**	(7.45)**
negotiated with competition			−0.14	−0.13			−0.11	−0.09
			(0.61)	(0.56)			(0.41)	(0.34)
negotiated without comp.	0.19	0.22	0.02	0.02	0.12	0.15	0.01	0.02
	(7.56)**	(8.36)**	(6.55)**	(8.38)**	(5.57)**	(6.91)**	(3.04)**	(6.23)**
restricted	−0.12	−0.11	−0.02	−0.01	0.01	0.04	−0.00	0.01
	(8.57)**	(7.21)**	(10.40)**	(7.28)**	(1.19)	(3.83)**	(1.37)	(5.23)**
Central government	0.05	0.05	0.01	0.00	0.06	0.05	0.01	0.01
	(3.01)**	(2.87)**	(3.19)**	(2.65)**	(4.52)**	(4.42)**	(4.91)**	(4.50)**
Water, energy, transport	−0.02	−0.01	−0.00	−0.00	0.22	0.23	0.03	0.03
	(0.80)	(0.71)	(0.77)	(0.71)	(16.36)**	(17.00)**	(16.03)**	(17.34)**
EU institution	0.02	0.03	0.01	0.01	−0.13	−0.12	0.00	0.01

Table 5. (*Cont.*)

	Excluding France and Poland				All countries			
	Logit		IV-GMM		Logit		IV-GMM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(0.39)	(0.48)	(2.14)*	(2.40)*	(2.39)*	(2.23)*	(0.89)	(1.37)
other international org.	0.50	0.49	0.05	0.05	0.08	0.09	0.01	0.01
	(2.12)*	(2.10)*	(2.06)*	(2.02)*	(0.36)	(0.38)	(0.25)	(0.25)
governed by public law	0.59	0.59	0.07	0.07	0.28	0.28	0.04	0.03
	(43.54)**	(43.55)**	(47.19)**	(47.06)**	(28.46)**	(28.34)**	(27.71)**	(27.51)**
Other	−0.18	−0.18	−0.01	−0.01	0.10	0.10	0.01	0.01
	(11.32)**	(11.26)**	(9.75)**	(9.74)**	(9.75)**	(9.66)**	(8.51)**	(8.21)**
National agency	0.09	0.10	0.02	0.02	−0.04	−0.04	0.00	0.00
	(3.00)**	(3.08)**	(6.03)**	(6.00)**	(1.45)	(1.45)	(1.60)	(1.51)
Regional or local agency	−0.03	−0.03	−0.00	−0.00	−0.02	−0.01	−0.00	−0.00
	(1.16)	(1.05)	(1.25)	(1.05)	(0.74)	(0.31)	(1.97)*	(1.07)
Not specified	0.30	0.30	0.03	0.03	0.33	0.34	0.05	0.05
	(4.00)**	(4.04)**	(3.74)**	(3.86)**	(10.76)**	(11.03)**	(9.97)**	(10.39)**
France					0.31	0.33	0.04	0.04
					(21.03)**	(22.23)**	(18.81)**	(21.00)**
Poland					0.45	0.44	0.06	0.06
					(67.69)**	(66.90)**	(73.64)**	(69.54)**
Constant	−0.62	−0.70	0.37	0.35	−0.22	−0.39	0.41	0.38
	(2.92)**	(3.31)**	(11.01)**	(10.52)**	(1.06)	(1.87)	(10.67)**	(9.82)**
R^2	0.06	0.06	0.04	0.04	0.05	0.05	0.04	0.04
Observations	474,034	474,034	474,060	474,060	1,170,232	1,170,232	1,170,234	1,170,234
Sectoral	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: * $p < 0.05$; ** $p < 0.01$

promoting non-discriminatory, open, transparent, competitive, and cost-effective government procurements. The main results of the paper are summarized below:

- The WTO GPA significantly increases the probability that a foreign firm will win a government procurement contract in EU Member and affiliated states.
- The WTO GPA promotes a competitive environment by increasing the number of offers.
- The WTO GPA significantly lowers corruption risk by decreasing the number of contracts with a single bidder, and by decreasing firms' winning ratios.
- The WTO GPA promotes cost-effective public procurement by lowering the probability that the procurement price is higher than the estimated cost of the procuring authority.
- The level of competition in the procurement environment is a significant determinant of government procurement cost-effectiveness. An increase in the number of offers decreases the probability that the procurement price is higher than the estimated cost.
- Single-offer procurements have significantly lower cost-effectiveness; the probability that the procurement price is higher than estimated cost for these contracts is higher than for procurements conducted with multiple offers.

The empirical results displayed above have many policy implications. Non-WTO GPA countries could use the results to convince their constituents to accede to the WTO GPA. The empirical analysis presented in the paper shows that the WTO GPA promotes competition and increases the probability that foreign firms will win procurement contracts. Higher levels of competition significantly lower procurement prices. Finally, the paper shows that public authorities should closely monitor single-bid procurements since these contracts have significantly higher procurement costs.

Supplementary Material

To view supplementary material for this article, please visit https://doi.org/10.1017/S1474745618000290

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