PART II

TECHNOLOGY, INNOVATION, E-MARKET, E-PROCUREMENT AND E-GOVERNMENT

SMALL BUT NOT TOO MUCH! EVALUATING SMALL AND MEDIUM ENTERPRISES' PERFORMANCE IN THE ITALIAN GOVERNMENT'S E-MARKETPLACE

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ABSTRACT. E-procurement is widely advocated as an effective tool to promote the participation of small and medium enterprises (SMEs) as well as micro enterprises in the public procurement market. However, little evidence exists as to what factors may influence the allocation of contracts to differently sized suppliers in the same class of micro, small and medium firms.

We address this issue by analyzing a rather rich and unique data set, namely the "direct award" transactions - below the European threshold - that took place on the Italian e-marketplace during the period 2005-10. Although micro suppliers are the most represented group of firms in the e-marketplace, evidence suggests that medium-sized firms (the largest in the reference group) display the highest success rates in getting public contracts, especially when contract values are sufficiently high. Degree of loyalty with buyers and geographical location of both buyers and suppliers also emerge as relevant factors of success in the e-procurement market, proving, at least to some extent, that some features of "physical" procurement markets are mirrored in the "virtual" markets.

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INTRODUCTION

It has been long recognized that e-procurement has the ability to bring in significant improvements in public procurement accessibility, transparency and efficiency. According to a recent report by Deutsche Bank Research[2], a full switch to e-Procurement may save between 50 to 70 billion Euros on public procurement in the EU per year. In the current climate of fiscal consolidation, it becomes harder and harder to underestimate this potential. Although the ex-post evaluation of the EU Action Plan for e-procurement[3] shows that the technology is now mature and that many successful e-procurement platform are successfully operating in Member States, less than 5% of the overall procurement budgets in the leading Member States is spent through e-procurement. This generates increasing concerns especially in those countries with a high concentration of small and medium enterprises (SMEs) that are generally believed to benefit the most from a wide adoption of e-procurement solutions owing to the latter's ability to slash transaction and entry costs in the public procurement market.

However, even in those countries where public e-procurement solutions have been more intensely used, there is little evidence (and in many cases no evidence altogether) about the *nature* of the benefit, especially to SMEs: Which types of firms are getting more from e-procurement, very small firms or just medium-sized firms? In spite of e-procurement being potentially a tool to enlarge the potential set of suppliers, does a firm's *physical* location explain the likelihood that it is awarded a contract?

Gathering data from e-procurement transactions is necessary both for evaluating the appropriateness of high-level policies and the subsequent implementation as well as for taking possible corrective measures whenever observation is not in line expected results. Yet few data are available at national level, let alone at the EU level, especially when e-procurement solutions are

[2] See Meyer (2011)
[3] See DG Markt Services (2011)

implemented in order to facilitate low-value transactions (the so called below-the-threshold public procurement[4]). In Italy, for instance, the national Authority for the supervision of public contracts for works, services and supplies (AVCP, in the Italian acronym) estimates below-the-threshold public procurement at approximately €12.56 billion[5] in 2010, thus representing a potentially vast market for national SMEs.[6]

Since 2000 – when Consip S.p.A. (Consip henceforth) was mandated by the Italian Government to operate as a central procurement agency – Italy has been among the first-moving countries in the EU to take on the challenges of reaching higher level of demand aggregation in public procurement while finding effective ways to foster participation of SMEs in the procurement market. The Italian Government's e-procurement platform (MePA according to the Italian acronym), launched in 2003 and currently operating with a catalogue of more than one million items, is arguably one of leading e-procurement solutions designed in Europe. By exploiting the benefits of web-based/internet procurement, Consip took the role of a "market maker", by setting up an e-marketplace for acquisitions below the EU threshold as defined for supply and services. Originally conceived as a complementary market to the high-value (i.e., above the threshold) open-tender market , the MePA counted for a turnover

[4] To the 1st of January 2010, the European Regulation (CE) n. 1177/2009 – published on the Official Gazette of the 1st of January 2009 (L314/1964) – for goods sand services, the threshold is established at € 125,000 for the central PBs and € 193,000 for all the other entities operative under the European directive on public tenders. For special sectors, that is societies operating in gas, water, energy, transports and postal services, the threshold is € 387,000. For over – threshold transactions, the European legislation has to be applied. For under – threshold transactions, on the other hand, the dispositions of the art. 238 of the Legislative Decree 163/2006 (Code on Public Contracts), which provides less stringent indications on the award of public contracts and the selection mechanisms.

[5] AVCP 2011

[6] The Italian National Institute for Statistics (ISTAT) published in the Annual Report for the year 2010, the summary statistics referred to SMEs: enterprises with less than 20 employees are the 98,1% on the total number, occupying the 58,8% of the total workforce, realizing the 38,4% on the total revenue and the 44,1% of the added value.

of only € 700 million[7] in the years 2005 – 2010[8]. The volume of transactions is expected to increase, not only for the achieved familiarity of the PBs, but also for the role progressively attributed to the e-procurement[9].

The MePA is a trading platform – an "open market" hosting thousands of potential sellers/buyers other than those usually present in each geographical area - that allows thousands of central and local public bodies (PBs) distributed all over the country to interact with a large set of firms, mostly SMEs and micro enterprises. The e-marketplace guarantees an high degree of operational flexibility, allowing for direct purchases (DPs) from standardized catalogues by a simple "click and buy" procedure and for restricted e-auctions across a certain number of invited suppliers (request for quotations, RFQs).

DPs represent, among the two purchasing procedures, a unique opportunity to capture directly the revealed preferences of the PBs. That is, trade taking place by means of "direct award" does not suffer from the interference of strategic bidding that might arise were the contract to be awarded competitively. Thus, upon observing a trade link between one buyer and one seller, we face an event that might in principle be explained by a set of explanatory variables: value of the contract, physical proximity number of transactions realized in the past by the same trading parties, nature of the product/service. In looking at the tens of thousands of transactions, we borrow the suppliers' viewpoint in that *we aim at explaining the factors influencing the probability that one firm belonging to one of four subgroups (micro, small, medium and large) is awarded a procurement contract*. *To the best of our knowledge, our paper is the first contribution opening the "black box" of low-value transactions on a public e-platforms to explain the degree of success of differently sized firms within*

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[7] Of this, € 234 million of DPs, and € 465 million of RFQs, in the period 2005 – 2010.

[8] As mentioned above, although being started in 2003, we analyse the data starting from the year 2005, when the implementation of the instrument reached its maturity phase.

[9] A number of regulatory interventions (most recently, the 2008 Financial Law) established the mandatory use of the MEPA by the public central bodies. Thus, since July 2007, the diffusion and use of the instrument was significantly stimulated.

the same group of micro, small, medium (and large) economic operators.

Considering the dataset of the 188.447 DPs from January 2005 until September 2010, we find that, despite the significant and substantial role played by the SMEs, only few firms occupy a relevant share of the electronic market: small enterprises (not more than 9 employees) have met approximately 60% of DPs - for a total transaction value of approximately € 126 million -, while micro enterprises, despite their presence in the market, represent the minority share with respect to the value of awarded contracts. To investigate the performance of the supplier side, in spite of revealing also the preferences of the demand side, we conduct an econometric analysis to investigate the performance of the supply side, controlling for structural and geographical characteristics. In spite of the large participation of micro firms, but consistently with a limited-capacity explanation, as the contract value increases micro firms are less and less likely while medium and large firms are more and more likely to be awarded a contract by central and local public authorities. This evidence is particularly striking for non-ICT goods and services and when public buyers are not located in the Centre of Italy.

The rest of the paper is organized as follows. After a brief survey of the economic literature on e-procurement and e-platforms, Section 3 describes the MePA's institutional/legal framework and stated goals, its evolution and performance in the period 2005-2010, with focus on the dynamics of transactions and volumes. In Section 4, we look in more detail at the supply side, in terms of number, size and performance of suppliers. After a brief description of the estimation methodologies, we present the results on the determinants of estimated probabilities of suppliers' performance. Section 5 concludes.

LITERATURE REVIEW

E-procurement, be it public or private, has spurred the interest of researchers from very different backgrounds: computer and management science, law, theory of organizations, law and economics. It would then be almost impossible to provide a fully fletched picture of the main research papers written during the last two decades. Being the main subject of the current paper the possible explanations of the dynamics occurring on the Italian e-

marketplace, it seems then a sensible choice to limit our attention to those lines of research focusing on the operations of e-procurement platforms.

The emergence of internet platforms, such as eBay and Amazon, has progressively provided data to economists and IT experts to conceptualise and analyse aspects such as the necessary information structure to implement an e-marketplace, the nature of forces affecting price formation, the main performance dimensions, namely the degree of participation from both sides of the market and the level of competition.

From a theoretical perspective, Gaudeul and Jullien (2001), Rochet and Tirole (2004), Jullien (2005) and Armstrong (2006), analyze the pricing decision of monopolistic and competitive (profit maximizing) platforms that have to get aboard both sides of the market for transactions to take place, and the dynamics that incur in the strategic behaviour of different players operating in a two – sided market (that is, a competitive platform which respond to both the sides of the market, supply and demand).

In spite of the potentially sizeable benefits to both sizes of the market from interacting through a common platform, the theoretical literature does not provide any clear solution to the *"chicken and egg problem"*, which appears when the market is private and not held by a public agent. This states the *dilemma* on identifying which of the two market sides should bear the initial cost of the market start – up. The same problem arises when analysing the introduction of an efficient pricing system, considering a entry or transaction fee and its the effects on the published catalogues. With respect to the degree of participation, Galbreth *et al.* (2004) show that it increases if and only if the expected volume of transactions is greater than the participation costs, both depending on the investments of the market counterpart[10].

On the public procurement side, such investments to implement a B2G[11] scheme or a *public e – procurement marketplace* are

[10] In the specified model, the growth (participation) in equilibrium involves the demand and supply side, and the value (profitability) of the participation for buyers and suppliers increases with the investment in the market of the respective counterpart.

[11] With the term B2G (*Business – to - Government*) we mean the market of the public sector, which includes the selling and purchasing activities

made by public authorities, mainly concerned on the public expenditures rationalization. Neef (2001), Subramaniam and Shaw (2003), Somasundaram (2004) and Moon (2005) emphasize the relation between *e – procurement* and demand aggregation in terms of efficiency, process standardization, relevant impact on the contractual power of the participants and on the necessity of monitoring each performance[12]. Empirically, aside from the papers on B2B[13] (Bajari and Hortacsu, 2004; Jullien, 2006; Dellarocas, 2007), the only reference is Mithas and Jones (2007): the results confirm that an electronic marketplace stimulates the economic competition, giving an increase in the surplus of the purchasing party (increase of direct and process share of savings).

Mainly related to our paper is the controversial issue regarding the SMEs performance in a centralized *e-procurement* scheme. On one hand, Lucking-Reiley and Spulber (2001) emphasize the centrality of *e-commerce*, describing the potential benefits in terms of productivity, market competition and the expected consequences on the organization of industrial districts and within the firms itself. In Great Britain, for instance, where small

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of goods and services to furnish different government levels (central and local) generally performed through web – based procedures. B2G networks provide the platforms through which economic transactions are performed as a result of direct negotiation or competitive procedures (for instance, electronic auctions).

[12] Beside the economic literature, institutional sources were interested to the topic. The European Commission, through the EU directive 2004/18/EC of the 31st March 2004 on the coordination of procedures for the award of public works contracts , public supply contracts and public service contracts, emphasizes the importance of providing national e – procurement platforms in order to increase competition and create new opportunities for the European enterprises. On the other side, it is specified how the adoption of ICT solutions in the procurement process may bring to a higher degree of savings and, in general, through the reduction of the costs, to an improvement of the efficiency in purchasing procedures and to the removal of the main commercial barriers.

[13] Generally speaking, with the term B2B (*Business – to - Business*), we refer to a marketplace where the transactions are exclusively between different enterprises (more precisely, between producers and wholesalers and wholesalers and retailers). On the other hand, the Business – to – consumers (B2C) is a marketplace between enterprises (retailers) and consumers.

and medium firms are fundamental to the national economy, central government allocates extensive economic resources to finance IT services and the development of e – commerce (Simpson and Docherty, 2004). On the other hand, Somasundaram and Dansgaard (2005) point out that a centralized *e-procurement* platform may undermine SMEs due to their lack of competitiveness with respect to the large sized counterparts. Moreover, providing standardized catalogues may be quite energy demanding, shifting a competitive advantage to larger firms.

GENERAL FRAMEWORK ON THE MEPA

3.1 Why the MePA?

Over the past two decades, sizeable financial resources have been poured in Europe as well as in other continents in setting up public e-procurement platforms[14]. Italy was one of the first EU countries to adopt an e-procurement regulation. In 2002, the Italian Government introduced the use of digital procedures in public procurement, under the supervision of the Ministry of Economy and Finance (MEF), allowing the Italian public sector to perform acquisitions below the EU threshold through the MePA in order to streamline purchasing processes. More generally, the main objective was to modernize the culture and the practice of public purchasing management. At its core, the MePA was conceived as a complementary tool to the set of national frame contracts that Consip[15] had started awarding only a couple of

[14] Beside the large diffusion in EU, computerised procedures of public procurement are implemented also in the US. Is relevant to emphasize the modernisation of many Latin America countries, which are realizing modern electronic platform, in order to ensure transparency in most of the different stages of the awarding of purchasing public contracts. South Korea still represent the most established reality of electronic public procurement, since it was one of the first country to introduce it.

[15] After having concentrated its main activities on the electronic management of the public authorities' financial accountability (Legislative Decree 414/1997), with particular focus on the management and development of the IT activities connected to the Ministry of Finance (Ministry Decree of the 22nd of December 1997 and of the 17th of June 1998), Consip core activities moved to the

years earlier on behalf of PBs for acquisitions above the EU threshold, thus optimising the purchasing process for below-the-threshold values through the implementation of the electronic platform. Indeed it had become evident that Italian SMEs found it virtually impossible to compete for high-value contracts. Although national frame contracts could be split in (geographical) lots and/or smaller firms could in principle form temporary joint ventures, participation pattern confirmed that SMEs remained out of high-value contests. The MePA was designed precisely to facilitate the access of SMEs to low-value public procurement market whose value, according to the Italian Authority for Public Contracts, was approximately €13 billion in 2010[16].

3.2 How the MePA works

The MePA is designed to maximize suppliers' access to the below-the-threshold public procurement market. Registration is free of any charge both for suppliers and PBs. Operational costs for running the platform are funded by the Ministry of Economy and Finance's (MEF) transfers to Consip, that operates as a "market maker". Transactions are entirely digitalized and its legal conformity and complete transparency is guaranteed by the use of digital signatures.

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rationalization on the purchasing activities of the public authorities, as specified in the 2000 Italian Financial Law. In conclusion, with the Ministry Decree of the 24th February 2000, Consip dedicated its effort to regulate and implement the public procurement platform.

[16] This estimated value was drawn by the 2010 Annual Report of the Monitoring Authority on Public Contracts for goods, services and supplies (in the Italian acronym, VCPA).

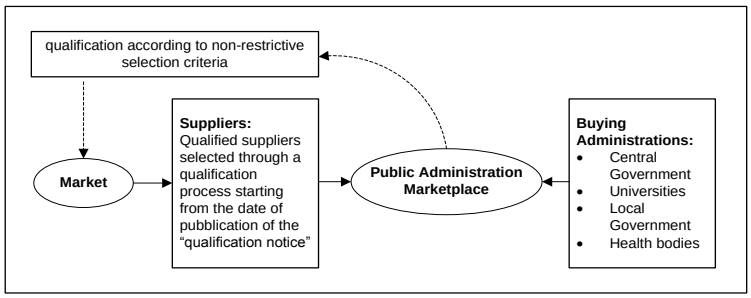


Figure 1: MePA, the conceptual scheme

The e-marketplace is structured as an "open" platform. Qualified suppliers[17] can public their catalogues (that is, a list of goods and services together with financial conditions) on the MePA's web page. Catalogues are structured in order to guarantee a high degree of comparability of the different set of offers. Qualifies firms can also decide to limit their willingness to respond to any request from public buyers within a limited area (say, one or more regions or a few provinces).

Registered public buyers can purchase by using two different tools:

- Request for Quotation (RFQ);
- Direct Purchase (DP).

The RFQ is a (simplified) competitive selection procedure through which the PB solicits all qualified (or a certain group of) suppliers to submit an offer. Responding suppliers provide both a price quotation and the details of technical/quality improvements when required. The contract is awarded to the most preferred price-quality combination *without* necessarily using an explicit – that is, publicly announced – scoring rule. Thus PBs have some discretionary power in awarding RFQs. Because PBs seek to maximize *value for money* contracts may be awarded to a supplier that did not submit the lowest price. A RFQ is then conceived as a

[17] Qualification requirements are quite loose, consisting mainly in not having been convicted for major criminal offences.

way to introduce further degrees of competition in the acquisition of relatively more valued contracts that normally require firms to better tailor their product/services to a PB's specific needs.

A DP allows any registered buyer to "click and buy" any object/service on the catalogues at the posted technical and financial conditions. Whenever a PB finds the object that meets its quality and price requirements, it may buy it directly from the e-catalogue at a pre-fixed (i.e., posted) price. This tool is characterized by a very fast and low-effort design, though not leaving any space for further renegotiations of contractual conditions between involved partied. Thus, it is usually adopted to purchase very low-value items or when the PB needs to satisfy urgent needs thus avoiding delays generated by a competitive procedure.

Due to its "click-and-buy" nature, the DPs are more frequently used with respect to RFQs (roughly the 81% of the total number of transactions), whereas they display a lower mean *value* per transaction (corresponding to € 1,242). Since RFQs are normally used for designing a procurement that better suits the buyer's needs, they are generally more time-demanding and require a major degree of skill to be correctly implemented. Unsurprisingly, RFQs are fewer in number (19% of the total number of transactions) but greater in relation to their total value (roughly € 466 million on € 700 million) and to the mean value per transaction (€ 10,791).

In this paper we focus our analysis only on the DPs since they represent the great majority of the market and since its nature allows, beside the study of the performance of the suppliers, to infer directly the preferences of the PBs.

3.3 Analysis on the expenditure patterns

The MePA was launched in 2003. However, we only consider transactions that took place throughout the period 2005-2010. The simple reason being a series of measurement errors that we encountered for the years 2003 – 2004 and that are probably due to the lack of experience of the users of the platform itself. Consequently, the data considered in our analysis include 188,447 DPs for an overall turnover of roughly € 230

million (Table 1), related to all the categories of goods and services available on the MePA, from January 2005 until September 2010. In most cases, the orders refer to the supply of ICT goods or services and office equipment, followed by electrical equipment and medical supplies.

Table 1 – MEPA: Annual distribution for volumes and transactions (2005-2010) – *(*data until September 2010)*

DPs					
Year	N.	Percent	cum.	mean (€)	total (000 €)
2005	8422	4.47%	4.47%	1474.24	€ 12,400
2006	9865	5.23%	9.70%	1180.47	€ 11,600
2007	23387	12.41%	22.11%	1298.32	€ 30,400
2008	50798	26.96%	49.07%	1144.43	€ 58,100
2009	58593	31.09%	80.16%	1288.86	€ 75,500
2010*	37382	19.84%	100.00%	1228.63	€ 45,900
Total	188447	100.00%		1241.77	€ 234,000

A first look at Table 1 reveals a sudden increase of all the economic indicators after the year 2007[18], that is mostly explained by a legislative *structural break*: the 2007 financial bill (act 926/2006) imposes to central PBs the use of the MEPA for below-the-threshold purchases. The mandatory use of the MePA for central government, while contributing to the overall increase of the value of transactions (+600% throughout the reference period), may also have contributed to a decrease in the *mean value* of transactions (-17%).

3.4 Summary statistics of the MePA

Table 2 summarizes the distribution of suppliers according to the firm's size (that is, the number of employees)[19]. The supply side of

[18] The number of DPs from 2006 and 2007 rose roughly by 2,4 times, while in the same period.

[19] Since there is a lack of reliable data concerning the turnover of the firms involved in the MEPA, we classified the size of the firms relating it to the number of employees as depicted in the EUROSTAT scheme:

the MePA is mostly populated by very small firms (up to nine employees), roughly covering 60% of the suppliers. As to the overall value of transactions, micro suppliers are awarded 54% of DPs. However, a closer look at summary statistics reveals a clear pattern concerning the relation between the value of the awarded contract and firm size. Micro firms are awarded a much larger share of the contracts (both in terms of number[20] and overall value[21]), but with a lower mean value. Two effects are at play. First, micro firms are by far the mostly represented class of firms, so *ex ante* they are more likely to get a contract. At the same time, however, they are less likely to be able to serve a higher-value and more customized contract.

Table 2 - MEPA: distribution of volumes and transactions for size of the firms.

DPs					
Size of the firm	**N.**	**percent**	**cum.**	**Mean contract value (€)**	**total (000 €)**
micro (0-9)	112288	59.59%	59.59%	1,121.83	€ 126,000
small (10-49)	61931	32.86%	92.45%	1,310,19	€ 81,100
medium (50-249)	11170	5.93%	98.38%	1,785,22	€ 19,900
big (>=250)	2711	1.44%	99.82%	1,508.4	€ 4,000
n.a.	347	0.18%	100.00 %	8,264.91	€ 3,000
Total	188447	100.00 %		1,241.77	€ 234,000

Firms location is described in Table 3 (a). All the dimensional classes are represented in the North and the Centre of the country (roughly 70% on the total number of participants). This data is in line with the general distribution of the Italian industrial

micro enterprises [0-9 employees], small [10-49 employees], medium [50-249 employees] and large [≥ 250 employees].

[20] Indeed, the data depicts that smaller firms subscribe about 40 times more contracts.

[21] Data show that the cumulated value of the contracts subscribed by small firms is 30 times higher.

districts, which are concentrated in the northern and central part of Italy, especially for medium- and big-size firms. On the other hand, purchasing authorities (Table 3, b) are distributed quite uniformly, with a higher density in the central part of the country (due to the presence of the central bodies mainly located in Rome).

DPs show a more profitable distribution for suppliers located in the Centre, in the South and in the Islands. Taking into account the exception of the central regions, where the higher demand due to the presence of the central bodies may result to a general rise in prices, it is useful to emphasize the presence of a territorial pattern that seems to advantage the SMEs in the less advantaged areas of the country. No straightforward intuition helps us understand the concentration of DPs in the southern part of Italy. Plausible hypotheses, although far from being directly tested, may include a lower generalized skill on the use of the platform by purchasing authorities, the lower degree of competition in certain markets, lower efficiency levels of local administrations (due to political interferences and clientelism).

Table 3 - MePA: geographical distribution of firms and PBs with volumes of transactions

(a) DPs – supply side					
Geo of firms	**N.**	**percent**	**cum.**	**mean (€)**	**total (k €)**
North - East	29808	15,82%	15,82%	1014,93	€ 30.300
North - West	47013	24,95%	40,77%	1117,83	€ 52.600
Centre	60258	31,98%	72,74%	1484,68	€ 89.500
South	29771	15,80%	88,54%	1167,28	€ 34.800
Islands	17682	9,38%	97,93%	1314,48	€ 23.200
Abroad	3906	2,07%	100,00%	950,48	€ 3.597
n.a.	1	0,00%	100,00%	2700	€ 3
Total	188439	100,00%		1241,67	€ 234.000

(b) DPs – demand side					
Geo of PBs	**N.**	**percent**	**cum.**	**mean (€)**	**total (k €)**
North - East	35922	19,06%	19,06%	944,79	€ 33.950

North - West	40834	21,67%	40,73%	977,86	€ 39.900
Centre	50838	26,98%	67,71%	1785,78	€ 90.850
South	37620	19,96%	87,67%	1100,57	€ 41.400
Islands	23233	12,33%	100,00%	1203,02	€ 27.900
Total	188447	100,00%		1241,77	€ 234.000

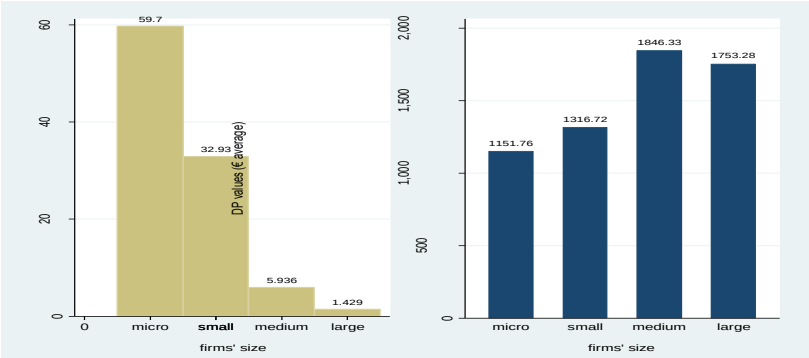
Descriptive statistics seem to confirm, at least to some extent, that the major objective pursued has been achieved: the creation of an *e-marketplace* allows a growing number of small and medium enterprises to participate in the public procurement market. Descriptive statistics also force us to make some caveats. For instance, the uneven distribution of the contract values deserves our attention. While representing the main actors of the national industrial system, SMEs get on average lower-value contracts than bigger firms. Data clearly show that the lowest-value contracts are concentrated in the less developed areas of the country, where smaller size firms are located.

EMPIRICAL EVIDENCE

4.1 The econometric modelAs descriptive statistics indicate, micro firms play a central role in the government e-marketplace. While, on the one hand, the degree of participation (the number of times a purchase has involved a firm) decreases as firms' size increases – with smaller suppliers amounting to almost 60% of orders and the largest ones getting barely to 1.5% of cases –, on the other hand, the larger suppliers the higher contract values are. These patterns truly reflect the distribution of suppliers by dimensional classes (according to the Eurostat classification based on the number of employees) in the Italian industrial district. Figure 2 shows straightforwardly the frequency (in percentage) of firms and the mean values of made contracts by size classes.

Figure 2 - MePA: distribution of the number of DPs (%) and their mean values (€) per firms' size

A different and more complex approach of our analysis is based on the particular nature of available data[22]; information on the size classes of suppliers for each order can be effectively used for the econometric estimation of non-linear models. We investigate the potential effects of a set of explanatory variables on the performance in probabilistic terms of the supplier's belonging to a given dimensional class. Regressions belonging to the family of *ordered logistic models (OLM)* have been estimated[23]: relaxing progressively those assumptions on the strong proportionality of estimated coefficients of the classical model, some *generalized*



[22] We excluded, from the data depicted in the descriptive statistics, 347 transactions that did not include the dimension of the suppliers and 130 transactions where the value per contract was negligible (less to 1€).

[23] As for usual binary models, the OLM is a non-linear model where the estimated coefficients affect the estimated probability that a certain phenomenon happens as a result of the level of all the independent variables included in the model.

ordered logit models (GLM) – with *non-parallel-lines* (*NPL*) and *partial-parallel-lines* (*PPL*) assumptions assumed – have been estimated (William, R., 2006)[24].

Basically, our dependent variable – the firms' size class – is a categorical one (i.e. the order of categories, is meaningful but the distance between them are arbitrary), where micro firms stand for y=1, small firms stand for y=2, medium and large ones are, respectively, y=3 and y=4, or, alternatively, medium and large suppliers are grouped together in y=3. Hence, in this general ordered logit model there is an observed ordinal variable, *Y*, which is in turn a function of another variable, *Y**, a continuous latent variable not explicitly measured but referable to various thresholds, seemingly our dimensional classes. Exactly, we estimate the following model:

[24] One of the assumptions underlying ordinal logistic regression is that the relationship between each pair of outcome groups is the same. In other words, ordinal logistic regression assumes that the coefficients that describe the relationship between the lowest versus all higher categories of the response variable are the same as those that describe the relationship between the next lowest category and all higher categories. This is the proportional odds assumption or the parallel regression assumption. Because the relationship between all pairs of groups is the same, there is only one set of coefficient or, which is the same, only one model (UCLA: Academic Technology Services, Statistical Consulting Group from http://www.ats.ucla.edu). In our analysis, the tests on the proportional odds assumptions suggest their violation. "Hence, we fit models that are less restrictive than the parallel-lines models fitted by means of the classical *ordered logit* model, but more parsimonious and interpretable than those fitted by a non-ordinal method" (William, R., 2006). The partial proportional odds model fits the data with a higher final model specification, with respect to the cases of assumed parallel-lines – which require the estimation of the *ordered logit model* – and that of assumed non-parallel lines, which goes too far in the other direction, estimating far more parameters than is really necessary. The partial proportional odds model, we applied in our estimation, lets some of beta coefficients can be the same for all values of *i*, while others can differ. Overall the model, the statistical significance tests suggest the good performance of the model.

$$P(Y_i > j) = \mathrm{F}\left(X\beta_j\right) = \frac{\exp\left(\alpha_j + X_i\beta_j\right)}{1 + \left\{\exp\left(\alpha_j + X_i\beta_j\right)\right\}}, \quad j = 1,\ 2,\ M-1$$

and

$$P(Y_i = 1) = 1 - F(X_i\beta_1)$$

$$\begin{aligned} P(Y_i > j) = F\left(X\beta_j\right) \\ = F\big(\alpha_j + \beta E_{isb} + \beta X_{ig} + \beta X_{ib} + \beta X_{im} \\ + \delta G_{is} + \delta T_i + \varepsilon_i\big), \end{aligned}$$

$$P(Y_i = 2) = F(X_i\beta_1) - F(X_i\beta_2)$$

$$P(Y_i = M = 3) = F(X_i\beta_2),$$

where *M* indicates the firms' size classes (1 = micro, 2 = small and 3 = medium+large), and *Y* - the dependent variable - represents the probability of each of the three possible events (1, 2 or 3) relative to all others for the *i-th* direct purchase in our dataset. On the right-hand side of the model, *X* represents the vector of explanatory variables while the *betas* are the estimated coefficients. For the sake of simplicity, the model can be reduced as follows:

where the independent variables *(X)* have been arranged in sub-vectors: E_{isb}, is the vector of those indicators which can be considered as proxies for the degree of experience in using the electronic platform reached by the *s*-th supplier or the *b*-th public buyer at the time *t* when the *i-th* contract is signed; X_{ig} comprises some features of purchases, such as contract value and the nature of purchased goods or services; X_{ib} is a vector including the

nature of the public buyer (say, whether central or local government) and the latter's geographical location; X_{im} gathers other possibly relevant information such some of demand's and supply's features in each class of product and other macroeconomic indicators such regional per-capita GDP; G_{is} includes some of the fixed effects related to suppliers' geographical location – North-East, North-West, Centre, South, Islands, and outside of Italy; finally, T_i is the time vector for year dummies, while ε_i is the residuals term.

Table 4 reports the results of the estimated models. The main findings are as follows.

- *DP_value (IPCA/k)* is the contract value (in thousand), harmonized by the inflation rate (with reference base 2005=100). The odds ratio[25] estimated for the value of DPs confirms the evidence arising descriptive statistics: the contract value is positively related to the firm's size in that the higher the value of the contract the higher the probability that the supplier is a larger one.

- *N_DP_supplier* is the cumulative number of contracts each supplier has been awarded up to the date of the transaction. Such a measure of experience, although statistically significant, does have a substantial effect on the probability that one specific size class is selected. The direction of the relation suggests, however, that larger firms profit from experience more than smaller firms. Also *N_DP_public_buyer*, which measures the cumulative number of direct purchases made by public bodies up to date of the transaction, is statistically significant with its magnitude resulting substantially irrelevant, but the direction of effects is more favourable to smaller suppliers.

[25] The odds ratio indicates the ratio between the probability that the higher event happens (p) on the probability it does not happen (1-p), i.e. the lower event or the reference base to which the effects of explanatory variables are evaluated. If p/1-p <1, the probability that lower event happens is higher, vice versa p/1-p >1 suggests a higher probability the higher event happens.

- As for the cumulative number of DPs, the cumulative value of contracts – progressively satisfied and/or made, respectively by supplier *s* and/or public buyer *b*, up to time *t-1* (where *t* is the time of the *i-th* transaction) – *DP_value_supplier* and *DP_value_public_buyer* are statistically significant but, again, characterized by a very weak effect.

- *N_notices* shows the effect of the number of catalogues (or class of products) for which each supplier *s* is qualified at the time *t* of the transaction. This variable is meant to represent the degree of suppliers' experience in terms of variety of catalogues. Consistently with intuition such a degree of experience affects positively the likelihood that bigger firms get a contract.

- *N_operating_suppliers* and *N_operating_buyers* indicate, respectively, the number of suppliers/public buyers that received/issued at least one purchasing order for the same product catalogue (or notice) in the previous year. These variables can be seen as *proxies* for the size of the market's supply/demand side, as well as for the level of competition level in the marketplace. On the one hand, as the size of the demand side increases the probability that firms belonging to smaller classes (micro and small) are selected rises; on the other hand, the higher the supply size the higher public buyers' preference for small firms, relative to micro and medium-large competitors.

- The *Distance* variable is built by calculating the kilometric distance between purchasing bodies and suppliers' registered headquarters. Intuitively, in a government e-marketplace we expect public buyers to be concerned only with the value for money (the most economically advantageous offer or the lowest-price offer), whereas the distance should not be statistically relevant in the analysis of purchasing patterns given that posted prices already include delivery. Our results suggest a different story. Low-value contracts are awarded to firms regardless of the seller-buyer

distance, whereas only physically closer suppliers get higher-value contracts. Smaller firms (micro and small) - that are, in principle, in a position to serve mostly low-value contracts given their limited production capacity, seem to be systematically preferred as distance increases. This evidence is compatible a moral-hazard feature of e-marketplace. When the stakes of the contract - as measured by its value - are quite limited then the buyer's moral hazard concerns - that is, the risk of interacting with an anonymous and opportunistic supplier - are sufficiently low so as to induce the buyer not to consider the *physical distance* as a discriminatory dimension, where distance may well be a proxy for the likelihood that the buyer and the seller *knew* each other before trading. Consequently, as the contract value goes up distance plays a crucial role, in that physically closer suppliers are much more likely to be awarded the public contract. Trade on an e-platform may then be driven by "anonymous" economic considerations (the most advantageous contractual conditions) as well as by patterns of trade that existed well before the establishment of the e-marketplace. In this sense we might also state that an internet based procurement system inherits, at least to some extent, some of the features of the traditional - that is, physical - procurement market.

- The estimated betas for *Public Sector dummy* variables (i.e., Central Bodies – the reference dummy –, Local Authorities and other public bodies such Universities and the National Health Service) show there exists a strongly positive relation between local authorities and other public buyers with the firms' size: these PBs seem, in fact, to prefer larger suppliers, whereas central bodies tend to buy from smaller firms.

- The estimated coefficients for *Notice Type dummies* (i.e., ICT – the reference dummy –, furniture, stationary, electric materials, health products and miscellaneous products) suggest different purchasing patterns between the ICT and non-ICT purchases. The latter seem to be strongly associated with micro suppliers, whilst the other catalogues – among which the electric one has the highest effect – explain a more

robust relation with all other larger suppliers. In section 4.2 we will further speculate on this ICT/non-ICT patterns.

- *Dummies for the geographical location of PBs* (i.e., the Centre of Italy – the reference dummy –, the North-East, the North-West, the South and Islands, which are equal 1 if a PB is placed in a specific macro-area and 0 otherwise) show that buyers placed in the North-West and the South mostly purchase from smaller suppliers while PBs located in the Centre of the Country select larger enterprises. Anyway, a more in-depth analysis on estimated probabilities will highlight further effects related to the type of catalogue (see paragraph 4.2). The North-East and Islands dummies are not steadily statistically significant.

- *Dummies for the geographical location of Suppliers* (i.e., the Centre of Italy – the reference dummy –, the North-East, the North-West, the South, Islands and foreign suppliers, which are equal 1 if a supplier is placed in a specific macro-area and 0 otherwise) highlight that the purchases of e-marketplace follow the analogous geographical pattern of the Italian industrial sector: the probabilities that PBs purchase from Northern suppliers increase with the firms' size, while purchases from Southern and Island suppliers experiment an opposite trend.

- Finally, *year dummies* allow to control for fixed effects related to each year, from 2005 to 2010, observed in the dataset. There is evidence that micro firms strengthen their participation in the marketplace along the considered time period.

Table 4 – Coefficients, odds ratios and gammas estimated by different logistic regression models

	Ordered Logit	Generalized Ordered Logit (NPL) §	Generalized Ordered Logit (PPL) #
Independent variables	*firms' size (categorical variable)*	*firms' size (categorical variable)*	*firms' size (categorical variable)*

		micro=1, small=2, medium=3, large=4			*micro=1, small=2, medium+large=3*				*micro=1, small=2, medium+large=3*			
					micro=1 vs. small=2 and medium-large=3		*micro=1 and small=2 vs. medium-large=3*		*micro=1 vs. small=2 and medium-large=3*		*micro=1 and small=2 vs. medium-large=3*	
		Beta	**Odds ratio**		**Odds ratio**		**Odds ratio**		**Beta**		**Gamma**	
Value	DP_value (IPCA/k)	0.0220	1.0223	***	1.0196	***	1.0236	***	0.2101 0	***	=	
Experience	N_DP_supplier (progr.)	0.0002	1.0002	***	0.9999	***	1.0003	***	-0.0005	***	0.0023	***
	N_DP_supplier (progr.)^2	-3.96E-09	1	***	-		-		-		-	
	N_DP_public_buyer (progr.)	-0.0001	0.9999	***	1	***	0.9997	***	-0.0007	***	-0.0010	***
	DP_value_supplier (progr. t-1)	4.66E-08	1	***	1	***	1	***	6.06E-07	***	-1.22E-06	***
	DP_value_supplier (progr. t-1)^2	-1.26E-14	1	***	-		-		-		-	
	DP_value_public_buyer (t-1)	-2.11E-07	1	***	1	***	1	***	-2.60E-07	***	2.77E-07	***
	N_RFQ_supplier (progr.)	-0.0016	0.9984	***	-		-		-		-	
	RFQ_value_supplier (progr.)	6.43E-07	1	***	-		-		-		-	
Supply and demand proxy	N_notices (supplier)	2.45E-02	1.0248	***	1.0003		1.2286	***	0.0025 0		0.2670 9	***
	N_operating_buyers	-3.08E-04	0.9997	***	0.9999	***	0.9998	***	-0.0014	***	-0.0019	***

	N_operating_suppliers	3.08E-05	1		1.0001	***	0.9999	***	0.00011	***	-0.00029	***
	Distance	3.51E-08	1	*	1	***	1	***	-4.95E-08	**	-1.30E-07	***
	Public_buyer_age	4.01E-06	1		1		1	***	-3.51E-06		=	
Public Sector dummies	d_Local_Authorities	0.0817	1.0851	***	1.1268	***	1.2349	***	0.08535	***	0.3003	***
	d_other_Public_Bodies	0.0998	1.1050	***	1.1694	***	1.2246	***	0.14388	***	0.1503	***
Notice type dummies	d_varoius	0.6673	1.9490	***	1.7426	***	1.2985	***	0.61742	***	-0.41366	***
	d_furniture	-0.0260	0.9743		1.1101	***	0.3433	***	0.14496	***	-1.18505	***
	d_stationery	0.3764	1.4571	***	1.3403	***	0.7339	***	0.28979	***	-0.40762	***
	d_electric	1.6325	5.1168	***	6.0573	***	4.7641	***	1.82650	***	-0.26621	***
	d_health	0.5596	1.7500	***	1.5423	***	0.3057	***	0.46267	***	-1.58409	***
Public bodies macro-area dummies	NE_public_buyer	-0.0461	0.9550	***	0.9883		0.7072	***	0.01128		-0.42503	***
	NW_public_buyer	-0.3793	0.6843	***	0.6305	***	0.7589	***	-0.43755	***	0.08076	***
	S_public_buyer	-0.2954	0.7442	***	0.7916	***	0.8186	***	-0.2281	***	0.11644	***

									3			
	I_public_buyer	-0.2101	0.8105	***	0.9682	*	0.9004	***	-0.02210		=	
Supplier location macro-area dummies	NE_supplier	0.8148	2.2588	***	1.6827	***	1.2943	***	0.4375 3	***	0.1424 0	***
	NW_supplier	1.3785	3.9691	***	3.0912	***	4.4839	***	1.0139 7	***	0.8562	***
	S_supplier	-0.8694	0.4192	***	0.5898	***	0.0342	***	-0.5800 4	***	-2.7285 4	***
	I_supplier	-0.2481	0.7803	***	0.8655	***	0.1976	***	-0.1803 0	***	-1.2314 2	***
	Foreign_supplier	1.0799	2.9444	***	6.0575	***	3.22E-09		1.1664 4	***	=	
Year dummies	y2006	-0.3106	0.7330	***	0.7442	***	1.0111		-0.3200 4	***	0.4774 0	***
	y2007	-0.4402	0.6439	***	0.5958	***	0.8902	*	-0.5565 3	***	0.6341 7	***
	y2008	-0.0004	0.9996		0.6783	***	0.8282	***	-0.4415 8	***	0.5330 1	***
	y2009	-0.0875	0.9162		0.6261	***	0.9797		-0.5229 3	***	0.8375 9	***
	y2010	-0.0157	0.9845		0.6176	***	0.9563		-0.5465 9	***	0.9105 3	***
	d_compulsory	-0.2216	0.8012	***	-		-		-		-	
GDP	GDP_regional_pc (buyer)	-8.98E-06	1	***	-		-		-		-	

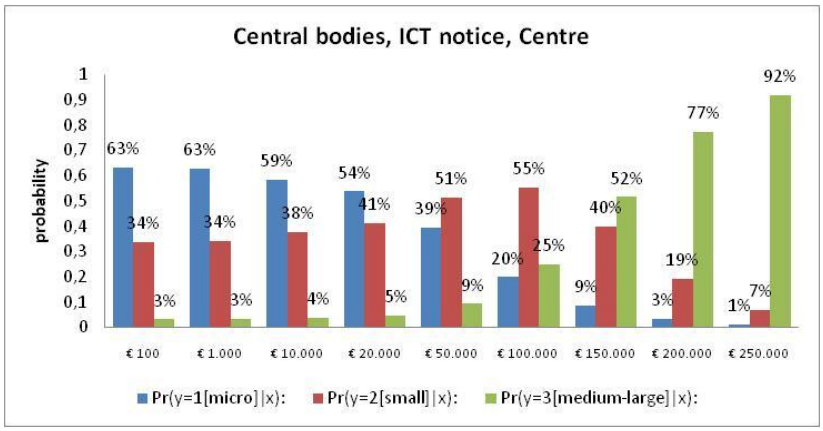
	GDP_regional_pc (supplier)	-4.13E-05	1	***	-		-		-		-	
	/cut1	-0.5957			-				Alpha_cons_1	-0.4553	***	
	/cut2	2.0213			-				Alpha_cons_2	-3.8651	***	
	/cut3	3.8973			-							
	N. obs.	187970			183190				183190			
	LR Chi2 (NPL)/Wald Chi2(PPL)	46572.17			56160.09				54146.62			
	Prob>Chi2	0.0000			0.0000				0.0000			
	Pseudo R2	0.1373			0.1768				0.1633			

Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***. (§) The generalized ordered logit model has been estimated on the sub-sample of direct purchases amounting above 50 euros. NPL being for non-parallel-lines assumption assumed, that is the case under the assumption of parallel-lines model overall violated. (#) The generalized ordered logit model has been estimated on the sub-sample of direct purchases amounting above 50 euros. PPL being for partial-parallel-lines assumption assumed, that is the case under the assumption of parallel-lines only partially violated overall the model.

4.2 Estimated probabilities

To describe the performance of smaller suppliers with respect to their larger competitors in the MePA, we focus on the preferences of the PBs as revealed by their "click-and-buy" behavior for increasing values of purchases. To this end, we aggregate both the product dimensions ad the geographical location by using two binary variables: ICT and non-ICT notice (product dimension); Centre and the rest of Italy (geographical dimension). We consider study how the estimated probabilities vary across different scenarios with respect to nature of the public buyer (central PBs and other PBs).

Figure 2 shows the first scenario. A clear pattern arises. Regardless of the nature of the public buyer, as the value of the contract goes up it is increasingly unlikely that the contract is awarded to a micro firm and increasingly likely that the contract is awarded to a medium-large firm. The micro enterprises, however, dominate, in terms of absolute probabilities, for many classes of values of DPs. A threshold contract value appears clearly at €50,000: above the threshold the PBs prefer buying from either a small or a medium-large firm.



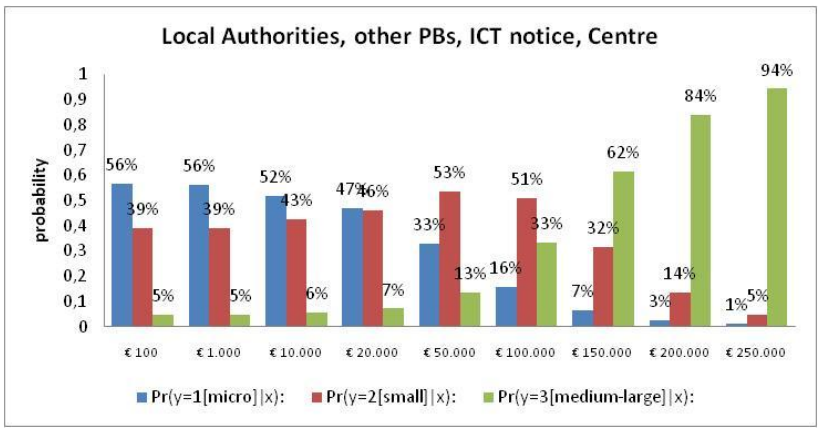
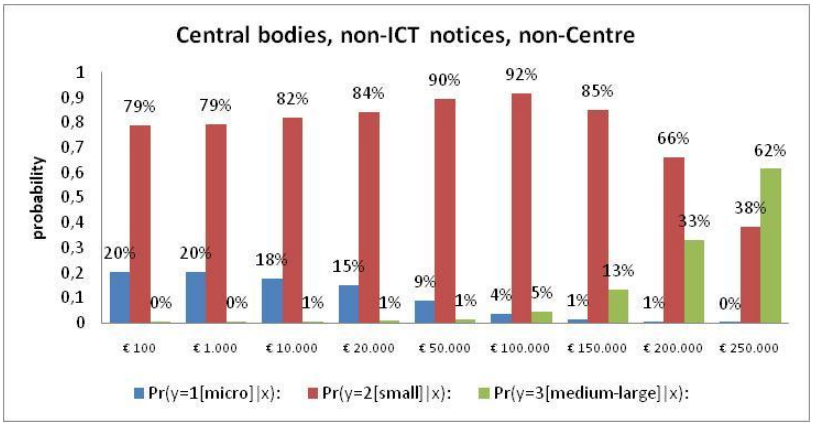


Figure 2 – Probabilities of DPs from classes of suppliers for ICT and the Centre

Figure 3 illustrates the second scenario which shares a similar feature with the previous one in that the probability of a micro firm being awarded a contract is inversely correlated with the value of the contract. However, the absolute magnitude of probabilities, both for micro and medium-large firms, are quite lower than the ones estimated in the first scenario. The striking fact is that PBs of all kinds seem to have a marked preference for buying from small enterprises, with the estimated probabilities decreasing only for contracts above €150,000.



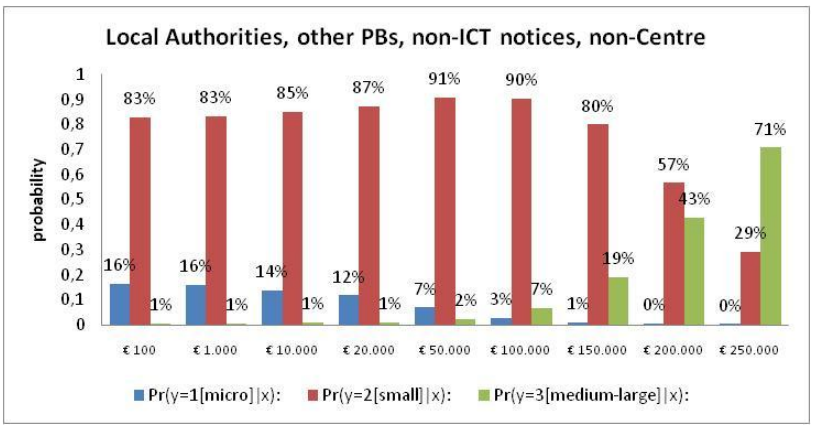


Figure 3 – Probabilities of DPs from classes of suppliers for non-ICT and all the geographical locations except for the Centre

The exercise just carried out sheds some light on the presence of heterogeneous patterns of trade on the Italian public e-marketplace. In particular, while small firms get sizeable market shares of non-ICT contracts (up to contract values of €200,000), micro firms appear more successful in ICT contracts of low values, whereas medium-large firms get the lion's share of more valuable contracts. This multifaceted picture may provide insights as to the possible strategies to favor the entry of *small* firms in the public procurement market, that is, to multiply the variety of non-ICT notices.

CONCLUSIONS

In this paper, we analyze the main features of the Italian public procurement e-marketplace (MePA). Created as a tool for facilitating low-value (that is under the EU threshold) purchases, data from the MePA show how a centralized e-procurement platform could rationalize the expenditures of the public bodies while fostering the access of smaller firms to the public procurement market.

By exploiting a data set of more than 180,000 direct ("click-and-buy") purchases from 2005 until 2010, we constructed an econometric strategy to better understand which kind of firms - within the broader set of micro and small and medium enterprises - benefits most from a public e-Bay-like marketplace. The importance of the geographical distance between the contracting parties, the type of product catalogue as well as the nature of the public buyer suggest, at least to some extent, that a seemingly anonymous e-marketplace mirrors the purchasing patterns of a more traditional - that is, paper-based - procurement market. E-procurement solutions does not seem to start from *tabula rasa*, but are likely to inherit some of the features of the preexisting procurement system.

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