

Women in Politics and Waste Management. Evidence from Italian Municipalities*

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Abstract

This paper analyses the issue, unexplored to date, dealing with the role of females politicians in the efficacy of the selective waste collection. The different attitude towards recycling between men and women may affect the amount of selective waste at the municipal level, therefore, an increase in women's political representation can be expected to improve the effectiveness of the waste management. We test for this consequence in Italy, exploiting an election law (Law 215/2012) whereby voters can express two preferences (instead of one) only if they are of different gender. We take Law 215 as an exogenous shock to the percentage of female municipal councilors. An instrumental variable analysis finds that a 10 p.p. increase in the percentage of female councilors increases the percentage in selective waste collection by 3.7% and the total tonnes in selective waste by 341.

JEL CLASSIFICATION:

KEYWORDS: Waste management, Gender quotas, Municipal elections.

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1 Introduction

In recent years, public administrations have significantly revised their environmental policies, in response to the worldwide debate about the climate change. One of the most important of those policies deals with the waste management. The growing amount of waste disposed in landfills is a great concern for public policy makers, and separating and recycling is considered the way to solve this problem (Kinnaman, 2006). So, the control of municipal waste management services plays an important role in public health and environmental protection (Guerrero et al., 2013, Romano and Molinos-Senante, 2020). As part of this analysis, external factors, as political, financial and sociodemographic, may influence efficiency, as this knowledge is considered essential to the design of efficient service management (Guerrini et al., 2017). In particular, an important factor to be considered is that men and women differ in their attitudes towards recycling (Ekere et al., 2009, Sidique et al., 2010). These gender differences might impact on the efficiency obtained by the service, affecting both the amount of selective waste collected and the approach taken to service management. Moreover, in this respect, the presence of women in municipal government may enhance councils' economic results (Hernández-Nicolás et al., 2018).

In this paper, we are the first to propose a causal analysis of an increase in women's political representation on the effectiveness of the waste management. Specifically, we show empirically that the increase in the share of female politicians in local governments leads to an improvement in waste management in terms of both an intensification in the amount of selective waste and a decrease in un-selective waste collected in Italian municipalities.

Waste is an inevitable bi-product of human life that, in large or small amounts, all produce. Indeed, improper waste management does not only result in litter everywhere, but it also affects the environment and results in air and sea pollution. The energy production, product consumption and irresponsible waste management contribute directly to climate change by adding carbon-based particles into the air, which are produced during the burning of petroleum products. The result is warmer air, creating a disastrous greenhouse effect.

In this regard, separating waste at the source is considered key by authors such as Lavee (2020) to increase recycling. Indeed studies have demonstrated that the waste management services is provided more efficiently by undertaking selective collection, i.e. distinguishing between different types of waste (paper/cardboard, glass, plastic, organic matter and batteries), rather than the traditional non-selective approach.

Various studies have found that the decision taken regarding public service provision may vary according to the gender of the municipal leader (Fox and Schuhmann, 1999, Hamidullah et al., 2015, José De La Higuera-Molina et al., 2020). In this respect, Funk and Philips (2019) recorded significant differences between male and female mayors in how government expenditure was allocated. Moreover, Hernández-Nicolás et al. (2018) argued that women tend to have more compassionate attitudes, while Wittenberg-Cox (2010) concluded that

female leaders were more concerned than their male counterparts for people’s welfare, and [Little et al. \(2001\)](#) reached similar conclusions with respect to the adoption of measures for environmental protection. Very recently, [Romano et al. \(2022\)](#) find that Italian provinces with a higher rate of female municipal administrators have higher separate collection rates than provinces with more males in the same role. Accordingly, we would expect the presence of a female in local political institutions be associated with greater efficacy in the waste management service, as this area has a direct impact on citizens’ quality of life.

Our empirical analysis estimates a panel data model of the percentage of female councilors on the number of tonnes in selected and un-selective waste collection in the Italian municipalities. Although the early literature suggests that female political representation matters for many policy choices, not always it cleanly identifies the causal link between female politicians and policymaking. Therefore, to overcome the endogeneity issue concerning the election of female politicians to unobserved municipality characteristics, we exploit the introduction of Law 215/2012 as a random assignment of women in city council. Law 215/2012 establishes that, in municipalities with population of over 5,000, voters can express one preference vote for a candidate of either gender but two for candidates of different genders. This gender quota law represents an exogenous variation in the gender composition of the municipal councils ([Baltrunaite et al., 2019](#)), and it is completely unrelated to waste management.

Therefore, to instrument the percentage of female councilors in the first stage of the two-stage-least-squares (2SLS) estimate, we use a dummy for the gender quota Law 215/2012 and take as treatment group the municipalities affected by the gender quota reform (those with population of 5,000 to 15,000 — we use the limit of 15,000 to operate under the same electoral rule, as we will explain later), and as control group municipalities with population of less than 5,000, which were unaffected by the reform.¹

Our main contribution is the strong evidence that a number of measures of the waste management are affected by the percentage of females in local political bodies. Specifically, a 10 percentage point (p.p.) increase in the percentage of female councilors increases the percentage in selective waste collection by 3,8% and the total tonnes in selected waste by 341. Similarly, the same 10 p.p. increase in the percentage of female councilors reduces the the total tonnes in un-selected waste collection by 347. We corroborates the validity of our results by 1) adopting two more measure of the efficacy of the waste management that purify from both the total waste selection amount and municipality dimension; 2) using as control group municipalities between 5,000 and 15,000 inhabitants belonging to special-statute regions unaffected by Law 215/2012. Moreover, every category of the selective waste collection (as organic, compostable organic, paper, glass, plastic, etc.) experienced the same increase due to the higher presence of female in city council. Finally, other robustness checks

¹In line with the previous research by [Baltrunaite et al. \(2019\)](#), our analysis shows that the enforcement of Law 215 resulted in a higher share of women in city councils.

are proposed for the validity of the results.

The mechanism we proposed is based on the literature highlighting that women have stronger environmental concerns than men and are more likely than men to adopt environmentally-friendly behaviors ([Eurobarometer, 2008](#), [Meyer, 2016](#), [Subiza-Pérez et al., 2020](#)).

This study contributes to a substantial field of literature documenting that larger share of women in political offices affect the quality of institutions. Although the most prominent theoretical contributions in the political economy literature suggests that personal characteristics of officeholders do not matter for policy choices that, instead, converge to the median voter preferences ([Downs, 1957](#)), the empirical evidence do not observe such economic policy convergence. Indeed, observational evidence shows that women legislators have a greater propensity to implement policies dealing with women’s issue ([Schwindt-Bayer, 2006](#), [Thomas, 1991](#)) such as abortion legislation ([Berkman and O’connor, 1993](#)), family assistance and child support laws ([Besley and Case, 2003](#)), maternity and childcare leave and education ([Kittilson, 2005](#), [Svaleryd, 2009](#), [Weeks, 2017](#)). The most rigorous quasi-experimental evidence widely documented that gender composition of the local government affects policy outcomes ([Clots-Figueras, 2011](#)): female leader provides more public goods ([Beaman et al., 2006](#)), invest more in education ([Clots-Figueras, 2012](#)) and public health infrastructure ([Bhalotra and Clots-Figueras, 2014](#)). This field of literature also concentrates on the effect of gender quotas on policy decision showing no-unanimous findings. On the one hand, some studies document no effect of an increase in the share of female in local politics due to the gender quota on the structure of public expenditure ([Bagues and Campa, 2021](#), [Baltrunaite et al., 2019](#), [Ferreira and Gyourko, 2014](#), [Geys and Sørensen, 2019](#)). On the other hand, other studies provide evidence for a significant effect of female political representation on policy choices in terms of child care provision ([Baskaran and Hessami, 2019](#)), child and health issues ([Lippmann, 2019](#)) and environment and social services ([Funk and Gathmann, 2015](#), [Hessami and da Fonseca, 2020](#)). Closer to our work, recently [Casarico et al. \(2022\)](#) find some evidence that female mayors devote a larger share of spending to the environment when there are more women in the municipal council. In this respect, we contribute to offer further empirical results that female in local institution may affect environmental policies by driving the waste management at municipal level.

The second important contribution of our paper deals with the literature on public management, with particular emphasis on the waste management efficacy in terms of selection for recycling. Studies concentrated on waste management costs and cost efficiency and its determinants ([Bel and Fageda, 2010](#), [Benito-López et al., 2011](#), [Perez-Lopez et al., 2023](#), [Simões and Marques, 2012](#)), as well as on the type of management structure adopted ([Simões and Marques, 2012](#)). Among the factors that contribute to the efficiency of the waste management service there can be the awareness that men and women differ in their attitudes towards recycling ([Ekere et al., 2009](#), [Sidique et al., 2010](#)). In our knowledge, the literature on waste management does not address the role of gender. This paper is the first to offer empirical

evidence on the causal effect of the presence of women in political institutions on the waste management service offering an interesting contribution to the debate on the importance of gender in public management.

The third contribution of the paper deals with the fact that, although women tend to display a higher sensitivity to environmental concerns and that women’s equal participation and leadership in political and public life are essential to achieving the Sustainable Development Goals by 2030, they are largely under-represented in the decision-making processes.² Therefore, the present paper shows how a policy aimed at enhancing women’s political representation makes females powerful agents of changes toward more responsible environmental policies and behaviour.

The rest of the paper is organized as follows. Section 2 describes the institutional framework. In Section 3 we present the variables of the analysis. Section 4 illustrates the empirical strategy and Section 5 presents the evidence of the effect of an exogenous increase of women in city council due to gender quota law on the number of measures of selective waste collection and it sets out some further evidence and robustness checks. Section 6 concludes.

2 Local political institutions in Italy and local waste management

Italy has three sub-national levels of government: regions, provinces and municipalities. The highest is the 20 regions, 15 ordinary-statute³ and 5 special-statute (*Regioni a Statuto Speciale*).⁴ The intermediate level of government consists of 107 provinces, the lowest of some 7.900 municipalities.⁵

²Very recent statistics have shown that as of 1 January 2023, there are 31 countries where 34 women serve as Heads of State and/or Government and women represent 22.8% of Cabinet members heading Ministries. There are only 13 countries in which women hold 50 percent or more of the positions of Cabinet Ministers leading policy areas. The five most commonly held portfolios by women Cabinet Ministers are Women and gender equality, followed by Family and children affairs, Social inclusion and development, Social protection and social security, and Indigenous and minority affairs. Looking at national parliaments, only 26.5% of parliamentarians in single or lower houses are women, up from 11% in 1995. Only six countries have 50 per cent or more women in parliament in single or lower houses; a further 23 countries have reached or surpassed 40%. Globally, there are 22 States in which women account for less than 10% of parliamentarians in single or lower houses, including one lower chamber with no women at all. Finally, for what that concern women in local government, data from 136 countries shows that women constitute nearly 3 million (34%) of elected members in local deliberative bodies. Only two countries have reached 50%, and an additional 20 countries have more than 40% women in local government. Source: UN WOMEN web page.

³Abruzzo, Basilicata, Calabria, Campania, Emilia Romagna, Lazio, Liguria, Lombardy, Marche, Molise, Piedmont, Puglia, Tuscany, Umbria, and Veneto.

⁴They are: Friuli-Venezia Giulia, Sicily, Sardinia, Trentino-Alto Adige, and Valle d’Aosta. Article 116 of the Italian Constitution grants self-rule to the five special-statute regions (Valle d’Aosta, Friuli-Venezia Giulia, Sardinia, Sicily and Trentino-Alto Adige), with legislative, administrative and financial powers that varying depending on their specific statute. These regions can delegate their direct administrative powers to the municipalities, while ordinary-statute regions do not have direct administrative competence, which is instead recognized by the Constitution to the Municipalities.

⁵Data at the January 1, 2023.

Municipalities are headed by a mayor assisted by a legislative body – the municipal council (Consiglio Comunale) – and an executive body – the executive committee (Giunta Comunale) composed of aldermen.

The municipal council has legislative power at the local level and is composed by the mayor and a variable number of councilors depending on population size. In the full sample of the Italian municipalities (with population ranging from the minimum level of 29 to a max of 2873494). The number of councilors goes from a minimum of 6 to a max of 60; in the restricted sample of analysis of municipalities below 15,000 the max number of councilors is 36. The regular term for municipal elections is every five years and the term duration of councilors coincides with that of the mayor. Municipal governments cannot alter this schedule except under specific circumstances that may result in the unscheduled termination of the local government and early elections. Such circumstances include a permanent impediment, removal, lapse of appointment, or death that prevents the mayor or the majority of the council from performing their duties, violation of the Constitution or national law, and failure to pass the budget.

The mayor is assisted by the executive body. Aldermen are appointed by the mayor among members of the municipal council in municipalities below 15,000 residents. In municipalities above 15,000 residents, they can also be appointed from outside the municipal council. The number of aldermen ranges from a minimum 1 to a max of 17 in the full sample of Italian municipalities while the its max reduces to 9 in the restricted sample of municipalities below 15,000.

The local policy decisions about expenditures and revenues involve mayor, the municipal council and the executive committee: mayor and executive committee propose budgetary policy while the municipal council has to authorize the proposals. For our purpose, it is important to underline that the implementation of policies depends on the ability and room to build consensus within the council. If women and men have different policy priorities, a female (male) mayor may be able to implement the desired policy only if she (he) finds enough support, and this may be conditioned by the gender composition of the overall political body, in particular of the municipal council, which has to authorize the mayor's proposals. As women in political decision-making may care more than men about specific categories of public spending, such as environment and social services ([Funk and Gathmann, 2015](#), [Hessami and da Fonseca, 2020](#)), we expect this difference to appear in these categories.

Law 215/2012. Law 215/2012 contains provisions to foster gender balance in city councils (municipal council and executive body) and regional councils. It establishes that no gender can represent more than two-thirds of the total number of candidates on party lists for municipal councils in municipalities with more than 5,000 residents. This means that political parties must reserve at least a third of the total positions for female candidates. Additionally, for these municipalities it introduces double-preference voting conditioned on gender. This

allows voters to vote for a list and express one preference for a candidate of either gender or two preferences for candidates of different genders, or not to express a preference for any candidate. These provisions apply only to the election of city councilors, not the mayor. The first election under Law 215 took place in May 2013.

To select the sample for analysis correctly, it is critical to recall that the election rules differ according to town size, with a key threshold of 15,000 inhabitants. In municipalities below this cut-off, the mayor is elected by a single-ballot system, while in larger ones there is a run-off system. Therefore, to maintain consistency in electoral institutions, the focus of our analysis is on municipalities with fewer than 15,000 inhabitants. In these municipalities, each party or coalition presents a candidate for mayor within a list of candidates for the city council. Voters can cast a single vote for a mayoral candidate and the supporting list, or they can vote for a candidate for the city council, which automatically gives a vote to the mayor supported by that candidate's list. The candidate with the most votes is elected mayor; two thirds of the city council seats go to the winning list, the rest being distributed proportionally among the losing lists. The number of council seats ranges from 7 to 34 in our sample, depending on resident population.

Law 215/2012 does not apply to the four region with special statute regions of Friuli-Venezia Giulia, Sicily, Trentino-Alto Adige, and Valle d'Aosta; it applies, instead, to Sardinia.

The enforcement of Law 215/2012 allows to set our empirical design in terms of a quasi-experiment because it determines an exogenous increase in female councilors, as we will clarify in Section 4. Therefore, we take as treatment group the municipalities affected by the gender quota reform (those with population between 5,000 and 15,000 in the Italian regions voting under Law 215) and as control group the municipalities with under 5,000 inhabitants, unaffected by the reform (and in the same set of Italian regions).

In our sample 2010-2019 each electoral cycle lasts 2.9 years on average, the, after the enforcement of Law 215, we can detect at least one election.

Guidelines on Italian selective waste management. The Italian regulatory framework addressing the waste management issue was first formalized in the DPR 915/82; further amendments followed over time aimed at fulfilling the EEC Directives no. 75/442, 76/403, and 78/319. The regulation primarily involved the categorization of waste into three main types: urban, special, and toxic. In 1997, when the selective waste collection reached only 9% of the total waste, the "Decreto Ronchi" (LD 22/1997) provided an integrated discipline for waste collection and recycling, enhancing the collaboration among municipalities for a more efficient waste supply and disposal.

Today, Italian waste management is disciplined by Legislative Decree 152/2006, the Testo Unico Ambientale (TUA) which defines the national guidelines for selective waste collection. It states that regions have to formulate waste management plans to promote waste reduc-

tion, while municipalities are responsible for municipal waste collection and management. Moreover, it introduced a novel waste tariff system (which is proportionate to the quantity and quality of waste generated per unit of floor area) and penalties (as the "landfill tax") and incentives ("green certificates") to enhance energy recovery efforts.

Under the Italian waste management legislative framework, which targets selective waste collection to reach 35% in 2006, 45% in 2008, and 65% in 2012, municipalities have to manage the urban waste collection and to formulate local development plans.

In detail, municipalities' competencies concern: 1) the management of urban waste and related materials; 2) the regulations of the management of urban waste, including the Collection and transportation methods and the Procedures for the disposal of selective collection; 3) the Rules for the safe operation of the service and for environmental and health protection; 4) the Regulations for the management of hazardous urban waste; 5) the Criteria for the classification of non-hazardous special waste as urban waste.

Municipalities have to manage the selective waste collection to the light that it depends on the socio-economic characteristics of the area the municipality belongs to and on the increasing trend in selective waste.

Accordingly, municipal administration must promote and encourage separate waste collection, closely monitoring its comprehensive and adequate execution. This oversight should primarily deal with the adoption of effective contracts with the provider of the service, often involving penalties and incentive-based measures.

Referring to municipal council duties, they deal with the providers of the selective waste service through a complex process, that is generally composed of the following phases:

1. *Planning and Programming*: the municipality develops a *Waste Management Plan* (Piano Rifiuti) which sets out the objectives, strategies, and methods for waste management within the municipality.
2. *Determination of Collection Phases*: the municipality defines the type and frequency of separate waste collection (e.g., paper, plastic, glass) based on the 1) tendering procedure (involving a public tendering procedure, that includes publishing a tender notice, evaluating the submitted bids, and selecting the best provider); 2) evaluation of the bids (considering factors as the proposed price, the company's experience, the quality of the service, the financial capacity).
3. *Awarding of the Contract*: after the screening of the bids, the municipality offers a contract to provide the selective waste collection service.
4. *Monitoring and Oversight*: the municipality is responsible for monitoring the provided service in compliance with contractual obligations and environmental regulations.
5. *Contract Renewal or Modification*: the separate waste collection contract can be subject to renewal or modification based on the municipality's needs and the performance

of the service.

The municipal council can adopt a number of strategies and initiatives for encouraging citizens to actively participate in selective waste collection. They are: 1) campaigns to sensitize citizens about the benefits of selective waste collection; 2) school educational programs; 3) economic incentives for citizens who actively participate in selective waste collection (as reductions in waste disposal fees for those who produce less non-recyclable waste); 4) sanction measures for people do not complying with selective waste collection; 5) to set up well-located selective collection points within the municipal area; 6) ongoing communication with citizens, informing them about changes in collection services, separate collection dates, and other relevant information; 7) collaboration with local associations, volunteer groups, and other community organizations to promote citizen participation in selective waste collection; 8) reward programs; 9) open meetings to involve citizens in the definition of waste management policies and strategies; 10) the use of modern technologies, such as smartphone apps, to provide information on selective waste collection and schedules.

3 Data and variables

3.1 Dependent variables

We construct a rich dataset from a variety of sources. Data on waste come from the *Istituto Superiore per la Protezione e la Ricerca Ambientale* (ISPRA), an Italian institution under the supervision of the Italian “Ministro dell’ambiente e della sicurezza energetica”. We collect yearly data on waste at the municipal level in Italy from 2010 (the first available data) to 2019.

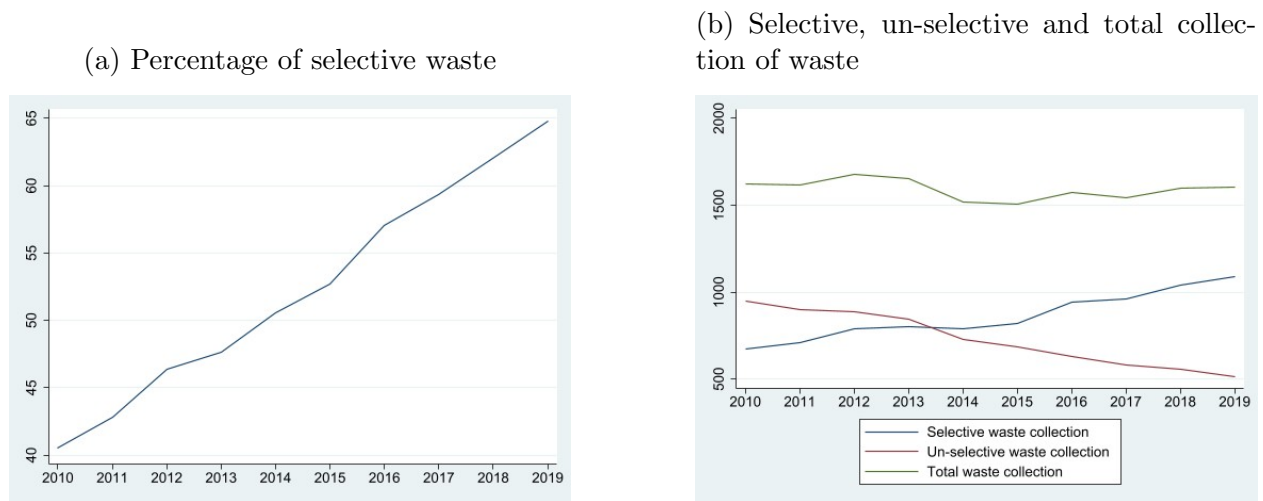
ISPRA also reports data on a number of types of selective waste: organic matter, compostable organic matter, paper/cardboard, glass, plastic, batteries/electrical equipment, wood, cloth, street cleaning, other.

In the baseline analysis, we use the percentage in selective waste (as the ratio between the total amount of tonnes in selective waste over the total amount of tonnes in total waste collection) as well as the total amount in selective and un-selective waste collection as the main dependent variables. In evaluating the efficacy of the waste management of a municipality, selective and un-selective waste collection are not the two faces of the same coin. Indeed, it could be the case of an increase in both the selective and un-selective waste which does not imply an improvement in the waste management because the total amount of waste has become bigger. Therefore, both the selective and un-selective waste collection are very good measures of the effectiveness of local waste management only under the condition of an almost constant amount of total waste.

Figure 1 shows the trend in the mean, over municipalities in the sample, of the percentage in selective waste collection (Graph 1a) and of tonnes in collection of waste, sorted by

selective, un-selective and total (Graph 1b). The increase in the percentage in selective waste collection is self-evident: it rises from 40% in 2010 to 65% in 2019. Graph 1b shows that, on average among municipalities in our sample, the total waste collection is a flat line during the sample-period, meaning that the average production of waste remains almost constant over year. It implies that reduction/growth in selective waste goes together with growth/reduction in un-selective waste. Indeed, Figure 1b remarks an upward trend in selective waste collection during the considered time span and a downward trend in un-selective collection, underlying a strong effort to significantly improve average environmental performance by municipalities. The two lines cross in 2013 — the first election under Law 215/2012 — when the selective waste collection overtakes the un-selective.

Figure 1: Percentage of selective, selective, un-selective and total collection of waste.



Note. The graphs report the mean, over municipalities, of the percentage in selective waste collection (Graph 1a) and of total, selective and un-selective tonnes in collection of waste (Graph 1b). The sample is restricted to municipalities with under 15,000 inhabitants. Years 2010-2019.

To sum up, we consider as main dependent variables in the empirical analysis 1) the percentage in selective waste collection (we take it in natural log because of easier interpretation in terms of elasticity), 2) the total amount of tonnes in selective waste collection, and 3) the total amount of tonnes in un-selective waste collection. We also consider two further dependent variables as 4) the ration between the total amount of tonnes in selective and un-selective waste collection (that purifies from any total waste amount issue) and 5) the total amount of tonnes in per-capita selective waste collection (that purifies from any municipality dimensional effect).⁶

Table A.1 shows the share of selective waste collection of municipalities within the sample in each Italian region (calculated dividing the total amount of tonnes of selective waste in each municipality in each region over the Italian total amount tonnes of selective waste).

⁶Figure B.1 in Appendix show the mean, over municipalities of the selective/un-selective waste ratio and of the per-capita selective waste collection.

The last column of the table, labeled *Total*, shows the share of the total amount of selective collection of waste (as the sum of each type of waste) in each Italian region. The three regions with the highest share of selective collection are the Lombardy, Veneto and Emilia Romagna, with the 24%, 14.2% and 10.4%, respectively. The Lombardy shows also the highest percentage of each type of selective waste. In general, in the North of Italy seems that the selective collection of waste be more effective with respect to the South.

Table A.2 shows the descriptive statistics of the total amount of tonnes in selective waste as well as the total amount of tonnes in each type of selective waste in the sample of analysis.

Selective waste collection in the treatment and control group. Figure B.2 displays the mean in selective (Graph B.2a) and un-selective (B.2b) collection of waste in treatment and control group of municipalities between 2010 and 2019. An overall look at Graph B.2a highlights that there has been a more conspicuous increase in the collection of selective waste in treated municipalities compared to untreated ones. At the same time, municipalities in the treatment group present a more pronounced reduction in un-selective waste collection during the time-span with respect to the control group.⁷

3.2 Regressors

Main regressor. The regressor of interest in the empirical analysis is the percentage of women in city councils. We collect data on the gender composition of Italian city councils provided by the Italian Ministry of the Interior. Figure B.4 shows the evolution of the (mean) percentage of the number of women councilors, in the Italian municipalities in the regions voting under Law 215/2012 and with population below 15,000 between 2010 and 2019.

A first look at this figure clearly shows the sharp increase in the share of females councilors in city councils starting in 2013, the first full year when Law 215/2012 was in force. In the empirical analysis, we consider, as the main regressor, female councilors, because the double preference voting conditioned on gender prescribed by Law 215/2012 refers only to the election of councilors. As Table A.3 in the Appendix shows, on average the percentage of female councilors in the sample period is about 26%.⁸

Figure B.5 shows the mean (over years) of the share of female councilors in Italian municipalities voting under the Law 215/2012 in the treatment and the control group. It reveals the important feature that there is a sharp change in the trend in the share of female councilors in the treatment group with respect to the control group. Indeed, before Law 215/2012, the average share of female city councilors in the treatment group was lower than

⁷Figure B.3 in Appendix B shows the total selective waste (selective and un-selective) in treatment and control group of municipalities. It displays a flat in both groups meaning an almost constant production of waste over time in both group of municipalities, corroborating the validity of the dependent variable we use.

⁸In a complementary analysis, we also examine the representation of female aldermen in the executive body. On average, women aldermen account for approximately 28% of the executive body's composition.

in the control group; starting from 2013 (with the first elections under Law 215) the share in treatment municipalities overtakes that in the control group, demonstrating the effectiveness of Law 215 in enhancing female political participation as in [Baltrunaite et al. \(2019\)](#).

The only previous work analysing the correlation between female municipal administrators and the separate collection at Italian province level by [Romano et al. \(2022\)](#) showed a positive sign, demonstrating a greater sensitivity of women than man administrators in reaching expected separate collection targets and in adopt environmentally-friendly behaviors.

Controls. In the empirical analysis we control for a number of variables. Firstly, municipality’s socioeconomic and demographic characteristics may affect the waste management service. We incorporate a control variable for the municipal population (denoted *Pop*) to account for the size-related effects of municipalities. This control variable helps address any potential influence of population size on the waste management and also controls for possible confounding policies on local election laws, such as the variation in the salary of the mayor at the cut-off of 5,000 inhabitants.⁹ In this respect [Gaeta et al. \(2017\)](#), analyzing municipalities in the Lombardy region, find a negatively correlation with the total recycled municipal waste.

The female population (hereafter *Female pop* as the share of female population) may also impact the waste management as women tend to be more concerned about the environment and are more willing to take action in this respect ([Brough et al., 2016](#)); moreover, men are reported to litter more than women ([Kallgren et al., 2000](#)) and to recycle less ([Zelezny et al., 2000](#)).

The standard of living, that we measure by the municipality per-capita GDP, also affects the waste management (hereafter *Per-capita GDP*). With respect to income, empirical results are inconclusive, since [Kinnaman \(2005\)](#), [Starr and Nicolson \(2015\)](#), [Romano et al. \(2019\)](#) and [Gaeta et al. \(2017\)](#) found a positive relationship with separate collection and recycling rates, while [Callan and Thomas \(2006\)](#), [Abbott et al. \(2011\)](#), [Lakhan \(2014\)](#) and [Hage et al. \(2018\)](#) found no significant relationship, and [Sidique et al. \(2010\)](#) found a negative link.

Moreover, we used the 1991, 2001, 2011, 2018 and 2019 Italian Census of Population to obtain data on average educational attainment at the municipality level (i.e., the population share of secondary education degree holders — hereafter *Municipal education*) and on the employment rate (hereafter *Municipal Employment*). About the average education level of residents, although the greatest part of studies found positive relationships with separate collection and recycling rates ([Callan and Thomas, 2006](#), [Gaeta et al., 2017](#), [Lakhan, 2014](#), [Romano et al., 2022](#), [Sidique et al., 2010](#), [Starr and Nicolson, 2015](#)), some other studies highlighted no significant link ([Hage et al., 2018](#), [Kinnaman, 2005](#)). The correlation between

⁹The change in the mayor’s salary at the 5,000 resident cut-off long antedates Law 215/2012.

the recycling and employment/unemployment rate of resident, population displays inconclusive results: [Starr and Nicolson \(2015\)](#) and [Romano et al. \(2022\)](#) showed a positive (but not sufficiently robust) link between the unemployment and the recycling rates, while [Hage et al. \(2018\)](#) found no significant relationships.

In Italy the great number of municipalities dependent on income from tourism seeks to present a good image of the municipality, by policies such as keeping the streets clean ([Guerrini et al., 2017](#)). We control for the level of tourism in a municipality by the number of tourist accommodation (hereafter *Tourism*).

An higher average age of municipal population may be associated with the waste management: evidences are not unanimous ([Callan and Thomas, 2006](#), [Gaeta et al., 2017](#)) (*Municipal age*).

We also control for politicians' characteristics, such as: 1) the average age of municipal council members (denoted *Council age*) in order to take account of the personal status of politicians linked to their age; 2) the average level of education in the city council (hereafter *Council education*)¹⁰, since the education level is a proxy for quality of politicians.

Finally, we control for the electoral cycle because some king of policies may be implemented/enhanced in proximity of the election date in order to increase the probability of re-election of incumbent politicians. We control for the electoral cycle via a set of dummy variables from the election years up to three years after,¹¹ for all municipalities in the sample. The four dummies are the following: *Electoral cycle_0* taking the value of 1 in election year and 0 in other years; *Electoral cycle_1* taking the value of 1 in the first year after the election year and 0 in other years; *Electoral cycle_2* taking the value of 1 in the second year after the election year and 0 in other years; *Electoral cycle_3* taking the value of 1 in the third year after the election year and 0 in other years.

Table [A.3](#) in Appendix A gives the descriptive statistics.

4 Empirical strategy

We analyze the impact of the female councilors in local political bodies on the number of tonnes of selective collection of waste. The panel structure of the dataset consists of yearly observations from 2010 to 2019 of the total number of tonnes collected by citizens in selective waste.

We firstly estimate the relationship of interest by the following model where subscript i

¹⁰We translate the qualitative information on the degrees attained by all city councilors into years of education. We also use the information on previous occupation of politicians to improve the criterion for attributing years of education. Specifically, we match the qualification and the previous occupation of each politician to attribute a more appropriate number of years of education. In this way, years of education range from 0 to 23.

¹¹Considering that the whole electoral cycle normally lasts five years, we include four dummies to avoid the dummy variable trap.

refers to municipalities and t to time:

$$Y_{i,t} = \beta_0 + \beta_1 W_{i,t} + \beta_2 X_{i,t} + \delta_i + \delta_t + \varepsilon_{i,t} \quad (1)$$

where $Y_{i,t}$ is the total number of tonnes of selected waste in municipality i in year t and $W_{i,t}$ is the percentage of female councilors in the local government i in year t . As noted above, we consider only female councilors, given that the double preference conditioned on gender prescribed by Law 215/2012 refers only to city council elections. $X_{i,t}$ is the set of controls for characteristics of municipality (and politicians in municipality) i at time t (listed above); δ_i forms a vector of municipal fixed effects that control for heterogeneity in the cross-section dimension and account for unobserved time-invariant factors that could engender omitted-variable bias; δ_t are year fixed effects that account for unobserved year-specific events that affect all municipalities; $\varepsilon_{i,t}$ is the idiosyncratic error term. β_1 in eq. 1 is the parameter of interest, which measures the impact of a variation in the percentage of female councilors on the total number of tonnes of selected waste.

A regression as in eq. 1 would not address endogeneity issues in terms of unobservable municipality characteristic that can be correlated both with the gender of the members of the council and with the number of tonnes of selected waste. Therefore, this empirical challenge of endogeneity can be solved by a random assignment of women to political positions as the gender quota reform at municipal elections in 2012 does. The gender quota law, as described in Section 2, creates an exogenous source of variation in the gender composition of the municipal council (between municipalities and over time) that correlates with the gender of the elected politicians (Baltrunaite et al., 2019), but should not correlate with our outcomes of interest.

The effectiveness of Law 215/2012 in enhancing the presence of females in city council has been well documented in Baltrunaite et al. (2019). One concern about the validity of the instrument could be that a municipality might arranged the election schedule in order to vote either under or not under the gender quota law. Local elections take place every 5 years, and municipalities cannot change their scheduled time. In specific circumstances, the legislature ends before the natural term and early elections are held; from then on, the elections (always after 5 years) will be mismatched with the normal election year in the other municipalities. Therefore, we maintain the validity of the instrument.

Accordingly, the quasi-experimental setting exploiting Law 215 as determining a sharp increase in female councilors allows to take as treatment group the municipalities affected by the gender quota reform (those with population between 5,000 and 15,000) and as control group the municipalities with under 5,000 inhabitants, unaffected by the reform.

Thus, we address the endogeneity of the share of women in municipal councils by a 2SLS estimation approach for panel data with two-way fixed effects, where eq.1 is the second stage equation, and in the first stage the potential endogenous variable is a function of all

the assumed exogenous explanatory variables and the instrument

$$W_{i,t} = \alpha_0 + \alpha_1 Law215_{i,t} + \alpha_2 X_{i,t} + \delta_i + \delta_t + u_{i,t} \quad (2)$$

where *Law215* is a dummy taking the value of 1 for all the local governments elected after 2012 in municipalities with resident population between 5,000 and 15,000 and 0 otherwise (that is, for all the local governments elected prior to the first election under Law 215 in municipalities with more than 5,000 and all governments in municipalities with under 5,000 for the entire period 2010-2019).

5 Results

5.1 Endogeneity and instrumental variable estimates

In this Section, we present the first empirical evidence on the causal link between a variation in the presence of women in local political bodies and the amount of waste collected in municipalities, by estimating an panel FE model where the dependent variables are the (natural log of the) percentage of selective waste, the total tonnes in selective and un-selective waste collection and the main regressor is the percentage of females in city council. As said above, we restrict the sample to municipalities voting under Law 215/2012 (that is, all municipalities within the regions with ordinary status and within Sardinia) and with the same electoral rule (that is, municipalities below 15,000 resident population). In all regressions, standard errors are clustered at the municipal level and robust to heteroscedasticity.

To deal with the endogeneity issues, we now perform 2SLS estimates. Table 1 reports the results of panel fixed-effect 2SLS with the first stage eq. 2 is followed by the second stage eq. 1. In Table 1, the first two columns refer to the (log of the) percentage in selective waste, Columns 3 and 4 refer to the total tonnes in selective waste collection and the last two refer to the total tonnes in un-selective collection, as dependent variables.

In line with the work of [Baltrunaite et al. \(2019\)](#), in the first stage the coefficient of *Law215* along all the estimates is positive and highly significant everywhere, meaning that Law 215 produced a larger percentage of women city councilors. The last rows of the upper part of Table 1 display a set of tests for the validity of the instrument for all the specifications. The F-test of weak identification assures that the instrument is very powerful indeed. The Kleibergen–Paap test rejects the null hypothesis of under-identification. Therefore, the tests show no sign of a weak instrument problem. Finally, the endogeneity test rejects the null hypothesis that the endogenous regressor specified, *Female councilors*, can actually be treated as exogenous, meaning that 2SLS corrects the estimates for probable endogeneity bias.

The second stage estimates are reported in the lower part of Table 1. An overall look

at the table shows that female councilors affect positively the selective waste and negatively the un-selective waste collection. There is strong evidence that the percentage of selective waste increases with the percentage of women in city council. Indeed, a 10 p.p. increase in the percentage of female councilors increases the selective waste collection by almost 3% (Column 1*a*) that correspond to an increase in the amount of total tonnes in selective waste by 304 (Column 3*a*); and considering complete models, as in Column 2*a* and 4*a*, the increase in the percentage of selective waste, derived by a 10 p.p. increase in female councilors, amount to 3.8% and 341.7 total tonnes of selective waste. In this more complete model all the control variables (but the municipal share of female population) are significantly different from zero. Here we observe a positive sign for the average age of the council, the per-capita GDP, the mean age of population and the rate of tourism. Instead, the average level of education of the council and all the dummies for electoral cycle have a negative sign. The municipal population, the average rate of schooling and the municipal employment rate of municipal population have discordant signs.

Column 5*a* says that a 10 p.p. increase in the percentage of female councilors decreases the amount of total tonnes in un-selective waste by 301.5 while the most complete model in Column 6*a* displays an increase by 347.6 tonnes.

Table 1: Panel FE - 2SLS estimates

First stage						
Dep. Var.: Female councilors	(1)	(2)	(3)	(4)	(5)	(6)
Law215	15.521*** (0.379)	13.868*** (0.400)	15.519*** (0.379)	13.867*** (0.400)	15.519*** (0.379)	13.87*** (0.399)
No.Observations	59,130	49,405	59,133	49,408	59,417	49,628
No. Municipalities	6,346	5,845	6,346	5,845	6,349	5,855
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
F-test	1674.22	1202.24	1673.90	1201.98	1675.24	1204.48
Chi ² Kleibergen-Paap test	905.40	781.61	781.49	994.94	904.86	781.95
Endogeneity test (p-value)	0.00	0.00	0.00	0.00	0.00	0.00
Second stage						
Dep. Var.:	% Selective (1a)	% Selective (2a)	Tonnes in selective (3a)	Tonnes in selective (4a)	Tonnes in un-selective (5a)	Tonnes in un-selective (6a)
Female councilors	0.296*** (0.105)	0.378*** (0.127)	30.40*** (1.611)	34.17*** (2.114)	-30.15*** (1.645)	-34.76*** (2.106)
Pop		-0.00893*** (0.00112)		0.312*** (0.0109)		0.0781*** (0.0120)
Council age		0.561*** (0.149)		13.16*** (1.774)		-14.09*** (1.791)
Council education		-0.855* (0.483)		-34.19*** (7.640)		32.96*** (7.161)
Per-capita GDP		0.00364*** (0.000598)		0.00934 (0.00771)		0.00132 (0.00708)
Female pop		4.602 (15.13)		-30.86 (112.9)		116.9 (129.8)
Municipal education		56.18*** (18.44)		-310.2*** (96.50)		450.6*** (154.6)
Municipal Employment		-48.84*** (16.60)		246.5* (128.8)		-517.7*** (178.2)
Municipal age		1.746* (0.975)		11.56 (8.940)		8.638 (7.956)
Tourism		-0.000687 (0.00420)		0.377** (0.170)		-0.296* (0.178)
Electoral cycle_0		-2.530** (1.116)		-210.7*** (13.75)		217.3*** (14.25)
Electoral cycle_1		-2.898** (1.162)		-177.0*** (18.11)		191.4*** (15.31)
Electoral cycle_2		-4.295*** (1.059)		-123.4*** (11.91)		125.0*** (11.67)
Electoral cycle_3		-3.974*** (0.863)		-66.10*** (9.924)		60.18*** (9.024)
Observations	59,130	49,405	59,133	49,408	59,417	49,628
N. Municipalities	6,346	5,845	6,346	5,845	6,349	5,855
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes

Note. Panel fixed-effect 2SLS estimates. The dependent variables are the percentage in selective waste (Columns (1a) and (2a)), the total tonnes in selective waste collection (Columns (3a) and (4a)) and the total tonnes in un-selective waste collection (Columns (5a) and (6a)). All regressions include municipality FEs; coefficients are not reported. Robust standard errors, clustered at municipal level, are in brackets. Period: 2010-2019. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

5.1.1 Further specifications of the dependent variables

For robustness, we consider two more dependent variables as the ratio between the total amount of tonnes in selective and un-selective waste collection and the total amount of tonnes in selective waste collection per-capita. The first one, i.e. the ratio between the total amount of tonnes in selective and un-selective waste collection, is a measure of the virtuousness of a municipality because it considers contemporaneously the variation in selective and un-selective waste collection, purifying from any effect linked to the total level of waste. Estimation results are in Columns (1) and (2) of Table 2.¹² The coefficients for female councilors in all the model specifications show a positive sign meaning that, referring to Column (2), a 10 p.p. increase in the percentage of female councilors generates an increase in the ration between selective and un-selective waste by 0.22.

Table 2: Panel FE - 2SLS estimates

Dep. var.:	Selective/Un-selective		Per-capita tonnes in selective waste	
	(1)	(2)	(3)	(4)
Female councilors	0.0184*** (0.00246)	0.0220*** (0.00312)	0.00105*** (0.000406)	0.00145** (0.000583)
Observations	59,145	49,429	59,145	49,429
N. Municipalities	6,348	5,847	6,348	5,847
Municipality FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes

Note. Panel FE - 2SLS estimates. The dependent variable is the ratio between the total amount of tonnes in selective and un-selective waste collection in Columns (1) and (2) and the total amount of tonnes in selective waste collection per-capita in Columns (3) and (4). All regressions include municipality FEs; coefficients are not reported. Coefficients of year FE are not reported. Controls are: *Pop*, *Council age*, *Council education*, *Per-capita GDP*, *Female pop*, *Municipal education*, *Municipal employment*, *Municipal age*, *Tourism* and dummies of electoral cycle. Robust standard errors, clustered at municipal level, are in brackets. Period: 2010-2019. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

Another informative measure of the impact of an increase in women politicians on the amount of selective waste is the per-capita total tonnes, obtained dividing the total tonnes of selective waste by the municipality resident population. It purify from any dimensional effect of the phenomenon. Results about this alternative measure are reported in Columns 3 and 4 of Table 2. The increase of 10 p.p. in the percentage of female councilors increase the per-capita amount of selective waste from 1.05 Kg to 1.45 Kg adding all controls.

This further analysis corroborate both the validity of the main dependent variable we used and effectiveness of the role of female in city council in the municipal waste management.

¹²We show only the results of the second stage estimates. All the tests for the weak instrument issues are passed.

5.1.2 Municipalities with population between 5,000 and 15,000

In the IV approach in Subsection 5.1 we used as control group for the first stage estimates municipalities below 5,000 inhabitants for the regions voting under Law 215. One concern might be that municipalities below and above 5,000 are subject to different laws. For example, up to 2013 municipalities below 5,000 residents were exempt from the Domestic Stability Pact (DSP), a set of constraints on spending imposed by national government that can affect the dependent variable. Moreover, Law 148/2011 prescribes that the budgets of municipalities above 5,000 inhabitants are reviewed by more experienced accountants.¹³

In order to face these issues, we consider as control group municipalities above 5,000 inhabitants (and always below 15,000 residents) belonging to the four autonomous regions not interested by Law 215, i.e., Sicily, Valle d'Aosta, Friuli-Venezia Giulia and Trentino-Alto Adige. We replicate the baseline estimation for the four dependent variables previously specified. Results when the dependent variables are the percentage in selective waste collection, the total tonnes in selective waste collection, the ratio between selective and un-selective waste and the per capita-tonnes in selective waste, in Columns (1), (2), (4) and (5) respectively of Table 3, are unchanged in sign and significance of the *Female councilors*. As Column 1 shows, an increase of 10 p.p. in the percentage of female councilors generate an increase by 27.4% in the percentage of selective waste collection, by 162.4 tonnes in selective waste, by 0.30 in the selective/un-selective ratio and by 17.3 Kg in the per-capita tonnes in selective waste. The tonnes in un-selective waste collection loses significance.

Table 3: Panel FE 2SLS estimates - Pop 5,000 — 15,000

Dep. Var.	% Selective (1)	Selective (2)	Un-selective (3)	Selective/un-selective (4)	Per-capita selective (5)
Female councilors	2.747*** (0.633)	16.24** (7.190)	19.90 (13.12)	0.0300*** (0.00762)	0.00173** (0.000752)
Observations	14,837	14,837	14,844	14,837	14,837
R-squared	0.016	0.111	0.086	0.333	0.115
N. Municipalities	1,654	1,654	1,654	1,654	1,654
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Note. Panel FE - 2SLS Estimates. The dependent variable is: in Column (1) the percentage in selective waste collection; in column (2) total tonnes in selective waste; in Column (3) the total tonnes in un-selective waste; in Column (4) the selective/un-selective ratio; in Column (5) the per-capita tonnes in selective waste. All regressions include municipality FEs; coefficients are not reported. Coefficients of year FE are not reported. Controls are: *Pop*, *Council age*, *Council education*, *Per-capita GDP*, *Female pop*, *Municipal education*, *Municipal employment*, *Municipal age*, *Tourism* and dummies of electoral cycle. Robust standard errors, clustered at municipal level, are in brackets. Period: 2010-2019. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

5.1.3 Different types of selective waste

In Section... we described in detail how the municipal legislation on selective waste prescribes the collection for easy recycling of waste. The main categories of selective waste are: organic,

¹³While this could potentially affect the outcomes of interest in this study, [Vannutelli \(2022\)](#) has causally shown that this policy does not have significant effects on a range of municipal public finance outcomes.

compostable organic, paper, glass, wood, metal, plastic, electric and cloth. Here we want to analyse how female in city council impact such different kinds of selective waste. Table 4 gives the answer. In Column 1 a 10 p.p. increase in the percentage of female councilors determine an increase in the organic waste by 89 tonnes. The second-highest increase is that in plastic waste, equal to about 39.7 tonnes. Compostable organic follows with 28.6 tonnes; then paper with 19.3 tonnes, glass with 18.7 tonnes, wood with 17.9 tonnes. Metal, electric and cloth are under the 1.8 tonnes.

Table 4: Panel FE 2SLS estimates - Types of selective waste

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. Var.:	Organic	Comp. organic	Paper	Glass	Wood	Metal	Plastic	Electric	Cloth
Female councilors	8.992*** (0.788)	2.861*** (0.624)	1.936*** (0.430)	1.869*** (0.281)	1.793*** (0.258)	0.342*** (0.0718)	3.977*** (0.245)	0.182*** (0.0450)	0.337*** (0.0382)
Observations	35,056	31,226	48,138	47,942	32,873	43,574	47,306	42,357	31,989
N. Municipalities	4,777	4,222	5,749	5,767	4,547	5,535	5,737	5,410	4,576
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. The dependent variable is the total tonnes in selective waste. All regressions include municipality FEs; coefficients are not reported. Coefficients of year FE are not reported. Controls are: *Pop*, *Council age*, *Council education*, *Per-capita GDP*, *Female pop*, *Municipal education*, *Municipal employment*, *Municipal age*, *Tourism* and dummies of electoral cycle. Robust standard errors, clustered at municipal level, are in brackets. Period: 2010-2019. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

The emerging evidence is that, whatever the kind of waste we consider, a greater portion of female in city council gives a non negligible push in the selective waste collection.

5.2 The mechanism

In this section, we investigate the role of female in city council in determining the increase in the amount of selective waste.

It is linked to the greater “green” attitudes of women in their personal choices. Given that citizen-level research suggests that women express more concern about the environment and are more likely to act pro-environmentally than men (Clements, 2012, McCright, 2010, McCright and Xiao, 2014, Mohai, 2014, Tranter, 2011, Zelezny et al., 2000), do male and female policy-makers differ in their attitudes and actions when it comes to environmental issues?

5.2.1 The environmental gender gap

Research on environmental issues reveals consistent gender differences in the perception of environmental problems (McCright, 2010, Shapiro and Mahajan, 1986): women express higher levels of concern about environmental issues than men and they tend to behave toward (Zelezny et al., 2000). The environmental gender gap persists in both the general concern for the environment as well as the risk perception regarding environmental degradation (Honda et al., 2014, Norgaard and York, 2005). According to this different perception about environmental problems, women are more likely to adopt pro-environmental action than

men, in terms of daily life behaviour and in political participation (Luchs and Mooradian, 2012, Stolle et al., 2005).

The environmental gender gap can be explained according two lines: the *gender socialization* and the *social role* arguments

The *gender socialization* hypothesis grounds on the exposure to different cultural norms during childhood: the compassionate, cooperative, and caring norms for women and competition and independence for men (Gilligan, 1993). Accordingly, women are more altruistic and care more about safety concerns and risk perceptions (Gilligan 1982) toward both family and community members behaving accordingly also to environmental concern (Blocker and Eckberg, 1997, Davidson and Freudenburg, 1996, Freudenburg and Davidson, 2007).

the *social role* hypothesis focuses on the impact of social roles that men and women perform differently in society that shape the perceptions of the environment (Greenbaum, 1995).

Researches confirm that we can expect this gender gap at citizens level be confirmed at political level. Female representatives are more likely to support pro-environmental legislation than their male colleagues. Indeed the research by McEvoy (2016) and Dittmar et al. (2018) state that female representatives that act on behalf of women and take women's concerns into account. Vega and Firestone (1995), Swers (1998), Poggione (2004) and Jenkins (2012) confirm that congresswomen are more likely to support women's issues as gender equality, education, and childcare than their male colleagues. Further evidence on the environmental gender gap at the political level is given in the research on representatives' behaviour in Argentina (Jones, 1997), Canada (Tremblay, 1998), Sweden (Wängnerud, 2000), and Italy (Papavero et al., 2009). Sundström and McCright (2014) find that women policy-making report greater environmental concern than men in municipal councils and regionally elected assemblies. Similarly, Fraune (2016) concluded that female delegates care more than men about environmental degradation, putting more emphasis on environmental issues in their electoral campaigns. Ramstetter and Habersack (2019) in their analysis on European Parliament find that women are significantly more likely to support environmental legislation than men. Looking at the Italian scenario, Casarico et al. (2022) find that female mayors devote a larger share of spending to the environment when there are more women in the municipal council.

5.2.2 Suggestive evidences

A first suggestive evidence about the effective role of female councilors in driving the selective waste is to verify if, in municipalities with zero female councilors, there is a significant difference in the selective waste between municipalities voting under Law 215 and municipalities not affected by the Law. We perform a t-test on the mean of both the percentage in selective waste and the per-capita tonnes in selective waste between municipalities with

resident population below 5,000 (not affected by the Law 215) and municipalities with resident population between 5,000 and 15,000 (affected by the Law 215). The t-test, revealing a p-value of 0.50 and 0.55 respectively, shows that there is not a significant difference in the percentage of selective waste as well as in the amount of per-capita selective waste in municipalities with zero female councilors, enforcing our conjecture that the results can be reasonably ascribed to the presence of female in city council. The result of the mean test is confirmed when we consider municipalities with population between 5,000 and 15,000 voting under Law 215 (municipalities within regions with Ordinary Statute and Sardinia) and the same municipalities not affected by the Law (Municipalities belonging to the four region with Special Statute, as Sicily, Valle d'Aosta, Friuli-Venezia Giulia and Trentino-Alto Adige). Indeed, in this case, when we consider the percentage in selective waste, the p-value of the t-test reveals a value of 0.42 while, when taking into account the per-capita selective waste, the p-value is equal to 0.88.

5.2.3 Women in relevant positions

Often women hold informal role within institutions, that is, they are marginalized across a wide range of formal and informal political institutions (Barnes, 2016, Bjarnegård, 2013, Michelle Heath et al., 2005) implying that when they enter politics, they typically lack ties to established political networks (Escobar-Lemmon and Taylor-Robinson, 2009, Sundström and Wängnerud, 2016). Given their marginalized status, when women enter political institutions, citizens and other political elites may perceive them as lacking access to the kind of informal networks within the institution that male politicians enjoy. Because of political outsiders do not come to power through established political party networks (Barr, 2009, Morgan, 2011), women are less likely to be incorporated into the networks that are necessary for engaging in political decision-making processes.

According to this strand of the literature, the mechanism that we propose (i.e., a greater percentage of women in politics enhance waste management activity) holds if an increase of female in politics reduces also their marginalization. Instead, if gender quotas enlarges women's presence into political body without modifying their marginal role, women cannot be considered as a sort of "law enforcement" in the selective waste management, thus, they cannot be the cause of the resulted increase in collective waste, as our mechanism prescribes.

In order to face this issue, we restrict our analysis to female aldermen that constitute the executive body of the city council. Indeed aldermen have the task of supervising particular sectors of the administration or specific projects or services, giving impetus to the activity of the municipal offices according to the guidelines established by the bodies of the municipality and supervising the correct exercise of the administrative and management activity. In other words, the appointment as alderman is likely to gives a non-marginal role into the political body.

Figure B.6 shows the yearly pattern of the (mean of the) percentage of female aldermen in treatment and control group of municipalities. The remarks just made for Figure B.5 hold here too: Law 215/2012 affected the share of female aldermen in a visible way. This is the first suggestive evidence of a reduction of women marginalization due to the double preference related to the gender.

In this section we present IV estimates where the regressor of interest is the percentage of female aldermen in city council. Table A.4 presents the second stage estimates of the percentage of female aldermen (hereafter *Female aldermen*) on the five dependent variables specified above.¹⁴ The coefficient of *Female aldermen* is highly significant for all the dependent variables. More in detail, a 10 p.p. increase in the percentage of female aldermen increase the percentage of selective waste by 3.57% (Column 1); the total tonnes in selective waste by 309.8 tonnes (Column 2); the same increase in the percentage of female aldermen decreases the total amount in un-selective waste by 317.1 tonnes (Column 3); it increases by 0.19 (Column 4) and by 12.7 Kg (Column 5) the ratio selective/un-selective waste and the per-capita amount in selective waste, respectively.

5.3 Further evidences and robustness

5.3.1 Regional differences

From Table A.1 we can notice regional differences in selective waste between regions in the Center-North and South of Italy. In particular, in the regions of the so called “Mezzogiorno”¹⁵ the collection of selective waste seems on/below the mean while the green shades in the rest of Italy is more pronounced. These two tranches of Italy are characterized by well-known socio-cultural-economic differences. Indeed, the “Mezzogiorno” has been always characterized by a lower economic growth, by greater unemployment and by backward industrial sector.

In this respect, in this section we want to analyse if the impact of a greater female presence in city council after Law 215 has been different in the two main tranches of Italy: “Mezzogiorno” and Center-North. Accordingly, we perform the baseline estimations into the two sample of municipalities belonging to the Center-North and the “Mezzogiorno”, respectively.¹⁶

Results are in Tables A.5 and A.6.¹⁷ The coefficients of the female councilor variable say that the Center-North of Italy makes more selective waste with respect to the “Mezzogiorno”. More in detail, a 10 p.p. increase in the percentage of female councilors increases the

¹⁴The first stage estimates as well as all the test on the instrument are available request and fulfill all the requirement of validity.

¹⁵The Italian “Mezzogiorno” is made of the regions of Abruzzo, Basilicata, Calabria, Campania, Molise, Apulia, Sardinia and Sicily.

¹⁶In line with the rest of the analysis, we consider in the Mezzogiorno only the 7 regions with ordinary statute voting under Law 215/2012, that is, Abruzzo, Basilicata, Calabria, Campania, Molise, Apulia and Sardinia. As before, the Center-North of Italy comprises only the ordinary regions voting under Law 215.

¹⁷All the tests confirms the validity of our instruments.

percentage in selective waste by 5.6% in the Center-North of Italy while in the “Mezzogiorno” it loses significance. (Columns (3) in Tables A.5 and A.6). A 10 p.p. increase in the percentage of female councilors increases the amount of selective waste by 425.5 tonnes in the Center-North of Italy while in the “Mezzogiorno” this increase is by 219.4 tonnes. Similarly, a 10 p.p. increase in the percentage of female councilors increases the selective/un-selective ratio by 0.42 in the Center-North of Italy while in the “Mezzogiorno” this increase is by 0.046. Finally, a 10 p.p. increase in the percentage of female councilors increases the per-capita selection of waste by 2.1 Kg in the Center-North of Italy while in the “Mezzogiorno” this increase is by 0.8Kg.

Looking instead at the tonnes in un-selective waste, a 10 p.p. increase in the percentage of female councilors decreases the amount of un-selective waste by 411.5 tonnes in the Center-North of Italy while in the “Mezzogiorno” this decrease is by 251.6 tonnes.

5.3.2 Dynamic

In this Section we look at the dynamic pattern of Law 215/2012 on the selective waste management with an event-study approach. We estimate a fully dynamic (event-study) model as the following (subscript i for municipalities, t for years):

$$Y_{it} = \sum_{t=0}^{+n} \nu_t \cdot D_{it} + \alpha_i + \delta_t + X_{it} + \epsilon_{it} \quad (3)$$

where Y_{it} is the outcome variable in municipality i at year t . D_t is the set of event-time dummies, which take the value of 1 only for municipalities above 5,000 inhabitants if year t is k periods after the election under Law 215. The ν_t coefficients measure the difference in the dependent variable in the period after the application of Law 215 (t_0) compared to the control group of municipalities below 5,000 population. In all the estimations we control for municipality fixed effects (α_i), time fixed effects (δ_t) and apply all the controls specified above. ϵ_{it} is the idiosyncratic error term. We estimate the maximum number of event-study dummies (6) after the enforcement of Law 215.

Figure B.7 depicts the estimation result of eq. 3. Starting from the year of the first election under Law 215 (t_0), we can observe a remarkable increasing path in both the total tonnes in selective waste (Graph B.7b) and in the selective/un-selective ratio (Graph B.7d) in the treated municipalities compared to the untreated. Also remarkable is the decreasing path of the total tonnes in un-selective waste (Graph B.7c) in the treated group of municipalities than in the control group. The increase in the per-capita tonnes in selective waste (Graph B.7e), although less pronounced, is also visible comparing the two groups of municipalities in the sample.

5.4 Dropping Sardinia

In the main analysis we consider all the municipalities within regions where Law 215/2012 enforces. We recall that Law 215 applies to all the regions of Ordinary Statute and to Sardinia (among regions of Special Statute). In order to take into account the Special Statute of Sardinia with respect to the other ordinary regions, we drop it from the sample and we conduct the analysis over municipalities within region with Ordinary Statute with population below 15,000 inhabitants. Estimations in Table A.7 confirm the baseline results.

5.5 Political parties affiliation of women

It is known that women tend to be more leftist than men (Wängnerud, 2000). Therefore, the environmental gender gap can be also due to the location of green issues on the left of the political spectrum. Some studies already document the independence of the green attitude of women from political colors. As an example, Ramstetter and Habersack (2019) women are more likely to support environmental legislation than men even after controlling for political ideology. Vega and Firestone (1995), Swers (1998), Poggione (2004) and Jenkins (2012) confirm their findings about the support, by congresswomen, of gender equality, education, and childcare policies irrespective of party affiliation.

However, here we control for this aspect through dummies for political orientation of the local government. At local level, only in the largest municipalities do elections involve national parties with a well-defined political orientation. In most municipalities, instead, the competition is between civic lists, often with no clear political orientation. Therefore, we divide the parties in local government into three categories: parties and civic lists of right and center-right (i.e., all those whose names contain words clearly ascribable to a rightist political group - *Center-right*), parties and civic lists of left and center-left (i.e., those with names containing words clearly ascribable to a leftist political group - *Center-left*), and parties and civic lists with no definite political orientation (*Civic lists*). In our sample, almost the 87% of local government are held by civic lists; the remaining 7.5% and 6% are held by center-right and center-left parties, respectively.

In the 2SLS estimations we control for the dummies *Center-right*, *Center-left* and *Civic list*. The results in Table A.8 are consistent with the baseline, and they indicate that the mayor's political orientation does not affect the outcome variable.

6 Conclusions

Municipal council plays a fundamental role in the waste management, at the core of the climate change issue. Enhancing representation of women's voices in public consultations regarding environment-sensitive projects, may improve also their management. Indeed, a

gender lens needs to be applied to broad-ranging environmental issues because it is fully recognized the link between gender and climate change.

More generally, giving women greater access to leadership positions in both the public and private sectors and at all levels of decision-making can help focus priorities on environmental goals (Ben-Amar et al., 2017, Bonewit and Shreeves, 2015, Hossain et al., 2017). Where they are able to reach such positions, women are likely to integrate sustainability considerations into their organisation's vision and strategy (Homsy and Lambright, 2021). Hence, environmentally centred policy efforts together with a well-structured approach to gender equality can have a positive net effect on measures aimed at protecting the planet.

Our study documents that an increase in female representation in Italian city council enhances the selective waste collection by citizens.

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APPENDIX

A Tables

Table A.1: Share of selective collection of waste by regions and type

Region	Organic	Compostable organic	Paper	Glass	Wood	Metal	Plastic	Electric	Cloth	Total
Abruzzo	0.036	0.007	0.027	0.028	0.01	0.011	0.018	0.02	0.031	0.024
Basilicata	0.008	0	0.01	0.009	0.004	0.009	0.009	0.011	0.025	0.007
Calabria	0.024	0.003	0.027	0.019	0.004	0.011	0.015	0.012	0.026	0.019
Campania	0.131	0.007	0.047	0.073	0.015	0.054	0.08	0.051	0.079	0.069
Emilia Romagna	0.061	0.189	0.106	0.076	0.177	0.081	0.099	0.09	0.069	0.104
Friuli Venezia Giulia	0.032	0.049	0.038	0.037	0.038	0.042	0.04	0.045	0.013	0.037
Lazio	0.033	0.009	0.024	0.034	0.014	0.023	0.031	0.03	0.033	0.026
Liguria	0.023	0.025	0.033	0.035	0.045	0.031	0.029	0.035	0.027	0.03
Lombardy	0.17	0.331	0.221	0.245	0.312	0.259	0.21	0.235	0.241	0.24
Marche	0.039	0.029	0.036	0.027	0.029	0.019	0.03	0.03	0.038	0.032
Molise	0.005	0	0.003	0.005	0	0.002	0.004	0.004	0.002	0.003
Piedmont	0.059	0.076	0.09	0.084	0.092	0.063	0.106	0.081	0.086	0.079
Puglia	0.029	0.005	0.033	0.032	0.016	0.017	0.039	0.03	0.046	0.027
Sardinia	0.057	0.01	0.028	0.038	0.004	0.03	0.034	0.045	0.021	0.032
Sicily	0.04	0.006	0.028	0.024	0.012	0.011	0.026	0.026	0.022	0.025
Tuscany	0.061	0.035	0.063	0.042	0.053	0.065	0.046	0.062	0.062	0.052
Trentino Alto Adige	0.034	0.027	0.043	0.036	0.04	0.065	0.037	0.043	0.045	0.036
Umbria	0.014	0.005	0.011	0.009	0.006	0.01	0.011	0.011	0.011	0.01
Valle D'Aosta	0.001	0.005	0.006	0.006	0.015	0.009	0.007	0.007	0.003	0.005
Veneto	0.143	0.182	0.127	0.139	0.112	0.19	0.128	0.132	0.121	0.142

Note. The table displays the fraction of selective collection of waste by Italian region (over the total selective collection in Italy), also sorted by types of selective collection. The last column *Total* contains the total amount of selective collection that does not coincide with the sum of displayed types in the table because there are other “minor” types of selective waste that are not reported. The overall data for Italy and for each region is obtained by summing the tonnes of selective collection in each municipality and in each municipality in the same region, respectively. We restrict the sample to municipalities with population below 15,000.

Table A.2: Descriptive statistics of dependent variables

	Obs	Mean	Std.Dev.	Min	Max
% selective waste	59218	52.242	23.642	0	99.683
Total tonnes in selective waste	59218	873.051	1245.598	0	68563.469
Total tonnes in un-selective waste	59498	703.683	1058.583	.183	63253.922
Selective/un-selective ratio	59218	1.814	2.29	0	314.486
Selective waste/Pop	59218	0.231	0.52	0	98.685
Organic	42623	318.216	412.547	0	19517.84
Compostable organic	38116	216.656	369.36	0	10296.09
Paper	57677	167.703	250.27	0	15233.1
Glass	57476	122.78	156.908	0	7528.56
Wood	39277	67.546	114.99	0	3314.32
Metal	52198	24.399	35.37	0	983.818
Plastic	56771	72.294	109.487	0	6975.06
Electric	50751	17.751	24.626	0	2050.76
Cloth	38468	10.884	14.853	0	499.765

Notes. Descriptive statistics of all the dependent variable in the analysis. Period: 2010-2019. Sample of municipalities in the regions voting under Law 215/2012 and with resident population below 15,000.

Table A.3: Descriptive statistics of regressors

	Obs	Mean	Std.Dev.	Min	Max
Female councilors	61962	26.374	14.054	0	100
Female aldermen	61969	28.354	24.588	0	100
Pop	61975	3361.106	3342.606	29	14998
Council age	61974	44.828	4.598	19.011	76.926
Council education	61974	13.332	1.652	5	21
Per-capita GDP	61665	16681.535	3539.78	5417.283	51403.207
Female pop	61723	0.531	0.606	0.013	42.689
Municipal education	60234	0.313	0.371	0.006	26.869
Municipal employment	60234	0.4	0.509	0.009	34.639
Municipal age	59725	45.556	3.66	32.912	67.089
Tourism	54031	16.054	193.446	0	15235

Descriptive statistics of all the regressors in the analysis. Period: 2010-2019. Sample of municipalities in the regions voting under Law 215/2012 and with resident population below 15,000.

Table A.4: Panel FE 2SLS estimates - Female aldermen

Dep. Var.:	% Selective (1)	Selective (2)	Un-selective (3)	Selective/un-selective (4)	Per-capita selective (5)
Female aldermen	0.357*** (0.115)	30.98*** (2.190)	-31.71*** (2.168)	0.0199*** (0.00289)	0.00127** (0.000532)
Observations	49,433	49,436	49,656	49,436	49,436
N. Municipalities	5,847	5,847	5,857	5,847	5,847
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Note. Panel FE - 2SLS Estimates. The dependent variable is: in Column (1) the percentage in selective waste collection; in column (2) total tonnes in selective waste; in Column (3) the total tonnes in un-selective waste; in Column (4) the selective/un-selective ratio; in Column (5) the per-capita tonnes in selective waste. All regressions include municipality FEs; coefficients are not reported. Coefficients of year FE are not reported. Controls are: *Pop*, *Council age*, *Council education*, *Per-capita GDP*, *Female pop*, *Municipal education*, *Municipal employment*, *Municipal age*, *Tourism* and dummies of electoral cycle. Robust standard errors, clustered at municipal level, are in brackets. Period: 2010-2019. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

Table A.5: Panel FE 2SLS estimates - Center-North

Dep. Var.:	% Selective (1)	Selective (2)	Un-selective (3)	Selective/un-selective (4)	Per-capita selective (5)
Female councilors	0.561*** (0.156)	42.55*** (3.519)	-41.15*** (3.336)	0.0424*** (0.00471)	0.00212* (0.00113)
Observations	34,252	34,254	34,315	34,254	34,254
N. Municipalities	4,062	4,062	4,065	4,062	4,062
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Note. Panel FE - 2SLS Estimates. The dependent variable is: in Column (1) the percentage in selective waste collection; in column (2) total tonnes in selective waste; in Column (3) the total tonnes in un-selective waste; in Column (4) the selective/un-selective ratio; in Column (5) the per-capita tonnes in selective waste. All regressions include municipality FEs; coefficients are not reported. Coefficients of year FE are not reported. Controls are: *Pop*, *Council age*, *Council education*, *Per-capita GDP*, *Female pop*, *Municipal education*, *Municipal employment*, *Municipal age*, *Tourism* and dummies of electoral cycle. Robust standard errors, clustered at municipal level, are in brackets. Period: 2010-2019. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

Table A.6: Panel FE 2SLS estimates - “Mezzogiorno”

Dep. Var.:	% Selective (1)	Selective (2)	Un-selective (3)	Selective/un-selective (4)	Per-capita selective (5)
Female councilors	-0.113 (0.190)	21.94*** (1.693)	-25.16*** (2.234)	-0.00465 (0.00324)	0.000834*** (0.000226)
Observations	15,173	15,174	15,333	15,174	15,174
N. Municipalities	1,788	1,788	1,795	1,788	1,788
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Note. Panel FE - 2SLS Estimates. The dependent variable is: in Column (1) the percentage in selective waste collection; in column (2) total tonnes in selective waste; in Column (3) the total tonnes in un-selective waste; in Column (4) the selective/un-selective ratio; in Column (5) the per-capita tonnes in selective waste. All regressions include municipality FEs; coefficients are not reported. Coefficients of year FE are not reported. Controls are: *Pop*, *Council age*, *Council education*, *Per-capita GDP*, *Female pop*, *Municipal education*, *Municipal employment*, *Municipal age*, *Tourism* and dummies of electoral cycle. Robust standard errors, clustered at municipal level, are in brackets. Period: 2010-2019. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

Table A.7: Panel FE 2SLS estimates - Dropping Sardinia

Dep. Var.:	% Selective (1)	Selective (2)	Un-selective (3)	Selective/un-selective (4)	Per-capita selective (5)
Female councilors	0.476*** (0.131)	33.98*** (2.160)	-34.60*** (2.151)	0.0234*** (0.00319)	0.00134** (0.000598)
Observations	47,612	47,615	47,834	47,615	47,615
N. Municipalities	5,630	5,630	5,640	5,630	5,630
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Note. Panel FE - 2SLS Estimates. We drop Sardinia from the sample. The dependent variable is: in Column (1) the percentage in selective waste collection; in column (2) total tonnes in selective waste; in Column (3) the total tonnes in un-selective waste; in Column (4) the selective/un-selective ratio; in Column (5) the per-capita tonnes in selective waste. All regressions include municipality FEs; coefficients are not reported. Coefficients of year FE are not reported. Controls are: *Pop*, *Council age*, *Council education*, *Per-capita GDP*, *Female pop*, *Municipal education*, *Municipal employment*, *Municipal age*, *Tourism* and dummies of electoral cycle. Robust standard errors, clustered at municipal level, are in brackets. Period: 2010-2019. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

Table A.8: Panel FE 2SLS estimates - Controlling for political parties

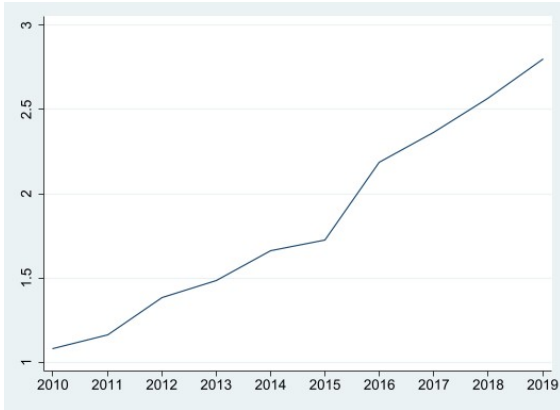
Dep. Var.:	% Selective (1)	Selective (2)	Un-selective (3)	Selective/un-selective (4)	Per-capita selective (5)
Female councilors	0.284** (0.129)	33.30*** (2.232)	-35.02*** (2.186)	0.0204*** (0.00314)	0.00138** (0.000591)
Center-right	-17.26*** (2.097)	-68.14** (31.18)	-37.80 (30.58)	-0.157*** (0.0563)	-0.0279 (0.0255)
Center-left	-6.521** (2.650)	-191.2*** (32.69)	191.1*** (33.32)	-0.117* (0.0681)	-0.0315 (0.0252)
Civic lists	-4.222*** (1.513)	-18.36 (18.52)	16.66 (16.79)	-0.00578 (0.0270)	-0.0206 (0.0253)
Observations	49,426	49,429	49,649	49,429	49,429
N. Municipalities	5,847	5,847	5,857	5,847	5,847
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Note. Panel FE - 2SLS Estimates. The dependent variable is: in Column (1) the percentage in selective waste collection; in column (2) total tonnes in selective waste; in Column (3) the total tonnes in un-selective waste; in Column (4) the selective/un-selective ratio; in Column (5) the per-capita tonnes in selective waste. All regressions include municipality FEs; coefficients are not reported. Coefficients of year FE are not reported. Controls are: *Pop*, *Council age*, *Council education*, *Per-capita GDP*, *Female pop*, *Municipal education*, *Municipal employment*, *Municipal age*, *Tourism* and dummies of electoral cycle. Robust standard errors, clustered at municipal level, are in brackets. Period: 2010-2019. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

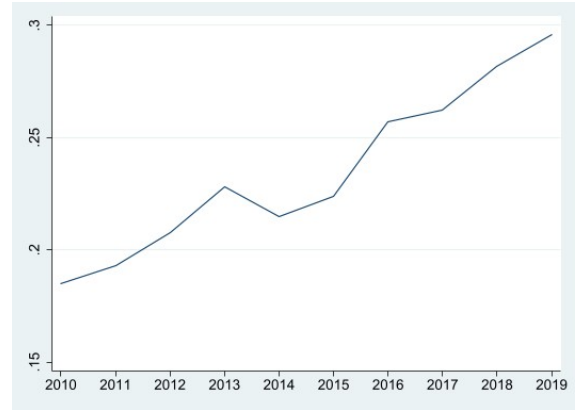
B Figures

Figure B.1: Selective/Un-selective ratio and selective collection/population

(a) Selective/Un-selective ratio



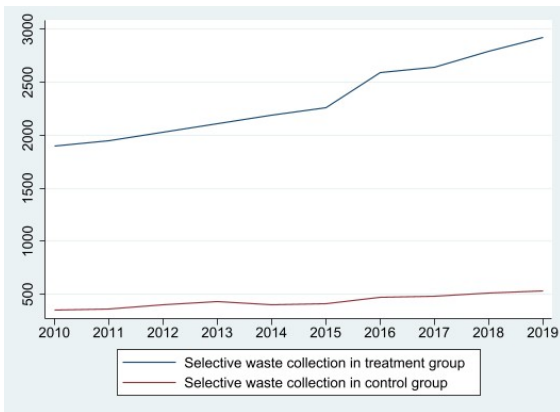
(b) Selective collection/population



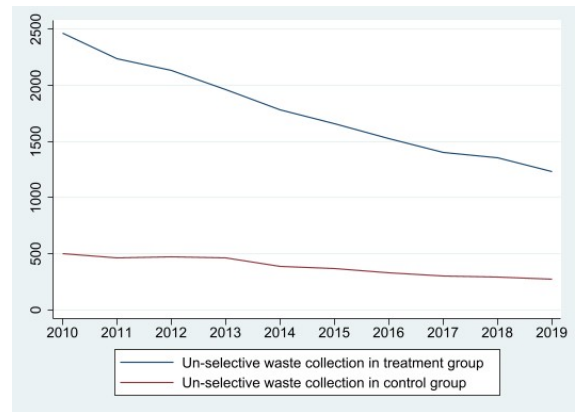
Note. The graphs report the mean, over municipalities, of the selective/un-selective ratio (B.1a) and of the selective waste/population (B.1b). Period: 2010-2019.

Figure B.2: Selective/Un-selective waste collection in treatment and control group

(a) Selective waste collection

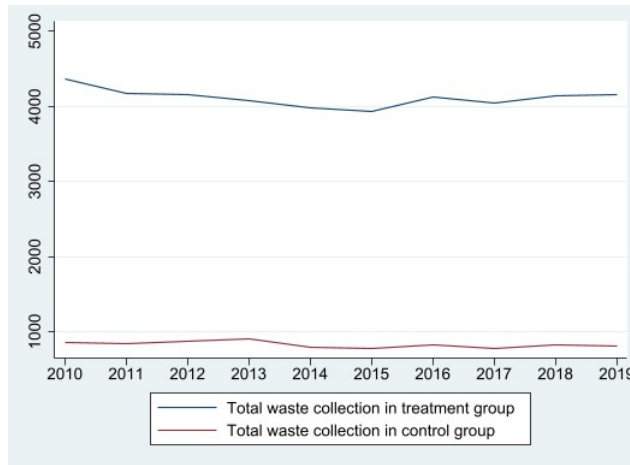


(b) Un-selective waste collection



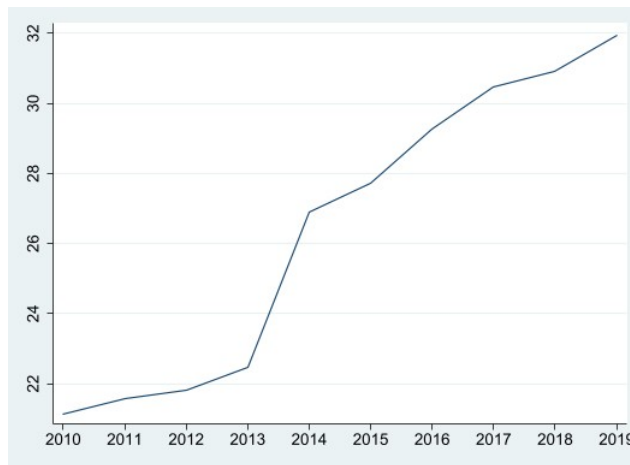
Note. The graphs report the yearly mean, over municipalities, of the total tonnes in selective and un-selective waste collection in treatment and control group of municipalities, respectively graph B.2a and B.2b. Belong to the treatment group municipalities voting under Law 215/2012 with resident population between 5,000 and 15,000; belong to the control group municipalities not affected by Law 215/2012 with resident population below 5,000. Period: 2010-2019.

Figure B.3: Total waste collection in treatment and control group



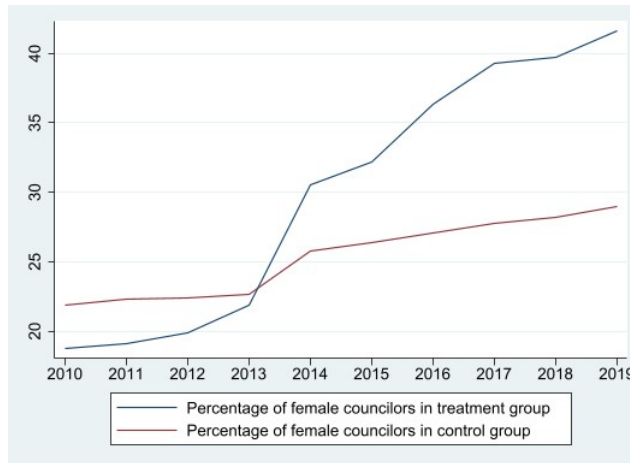
Notes. The graph report the total tonnes in total waste collection in treatment and control group of municipalities. Belong to the treatment group municipalities voting under Law 215/2012 with resident population between 5,000 and 15,000; belong to the control group municipalities not affected by Law 215/2012 with resident population below 5,000. Period: 2010-2019.

Figure B.4: Females councilors. 2010-2019



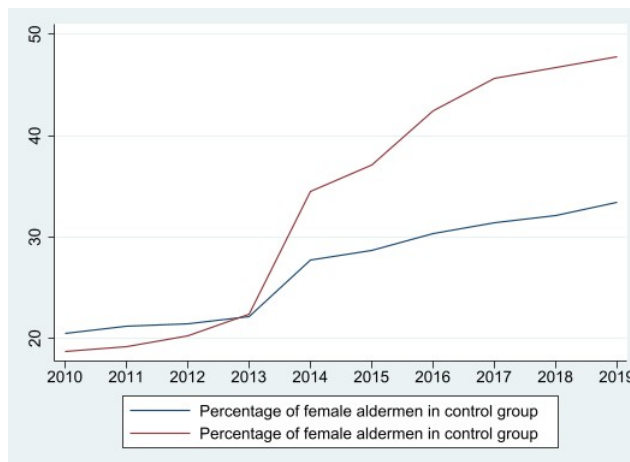
Notes. The Figure shows the percentage of women councilors for each year in 2010-2019. The sample is restricted to municipalities with under 15,000 inhabitants and to the regions voting under the Law 215/2012.

Figure B.5: Percentage of female councilors in city council in treatment and control groups



Notes. The graph reports the share of female city councilors in the treatment and control groups of municipalities between 2010 and 2019. We take all the municipalities in regions voting under Law 215/2012 and with population below 15,000 inhabitants. The treatment group is municipalities with population of 5,000 to 15,000; the control group, municipalities with population below the 5,000.

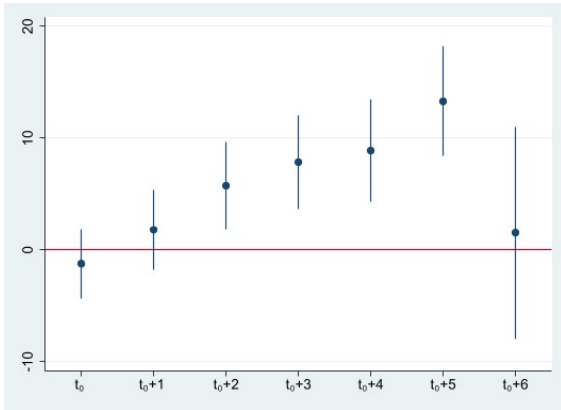
Figure B.6: Percentage of female aldermen in city council in treatment and control group



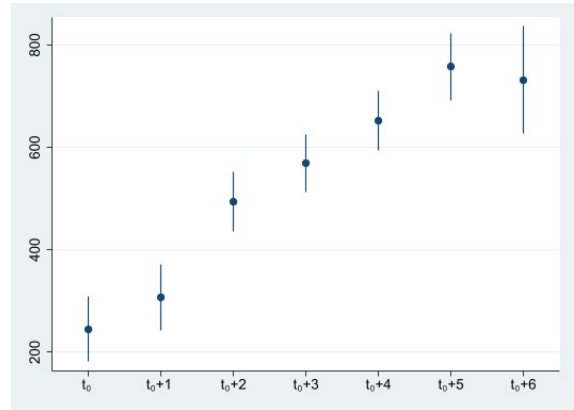
Notes. The graph reports the share of female aldermen in city council in the treatment and control group of municipalities between 2010 and 2019. We take all the municipalities in regions voting under Law 215/2012 and with population below 15,000 inhabitants.

Figure B.7: Dynamic

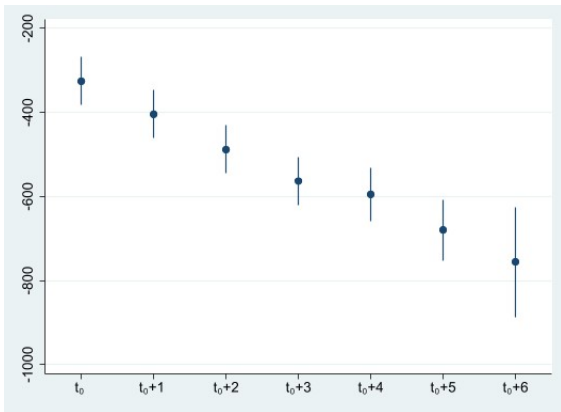
(a) Percentage in selective waste



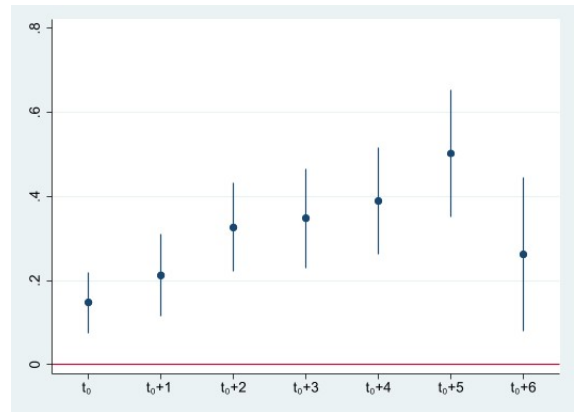
(b) Total tonnes in selective waste



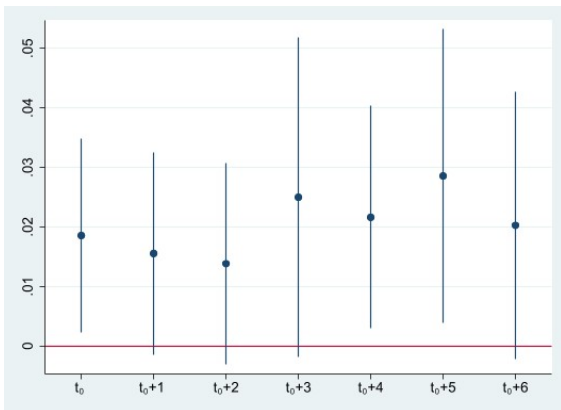
(c) Total tonnes in un-selective waste



(d) Selective/un-selective ratio



(e) Total tonnes in per-capita selective waste



Notes. The graph reports coefficients and confidence intervals estimated according to eq. 3. The dependent variable is: in Graph B.7a the (log of the) percentage in selective waste; in Graph B.7b the total tonnes in selective waste; in Graph B.7c the total tonnes in un-selective waste; in Graph B.7d the selective/un-selective ratio; in Graph B.7e the per-capita tonnes in selective waste. Standard errors are clustered at municipal level. Dots refer to point estimates, spikes to 95% confidence intervals. We include event-time dummy variables for 6 years after the election under Law 215/2012. Regression includes municipality FEs, year FEs and controls as: *Pop*, *Council age*, *Council education*, *Per-capita GDP*, *Female pop*, *Municipal education*, *Municipal employment*, *Municipal age*, *Tourism* and dummies of electoral cycle. Period: 2010-2019.