Measuring Productivity Dispersion:

Lessons From Counting One-Hundred Million Ballots*

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This Draft: August 31, 2023

Abstract

We measure output per worker in nearly 8,000 municipalities using ballot counting times in the Italian general election of 2013 and two referenda in 2016. We document large productivity dispersion across provinces in this very uniform and simple task that involves no modern technology and little physical capital. Vote counting productivity has similar variance as–and is highly correlated with–labor productivity in the private sector. The correlation is larger with productivity in firms in labor-intensive and low-skill industries, consistent with a measure of (low-skilled-) labor-augmenting efficiency. Using a development accounting framework, this measure accounts for up to half of the firm-level productivity dispersion across Italian provinces and nearly two-thirds of the north-south productivity gap in Italy. We find evidence that a combination of lack of trust and contentious aspects of the job relates to low labor efficiency in this setting.

JEL Classification: E24, O11, Z10

Keywords: Productivity dispersion, development accounting, regional economic development, human capital, social capital.

*We thank Paola Menta and Salvatore Galatioto in the Ministrero dell'Interto–Dipartimento per gli Affari Interni e Territoriali for providing electoral data, Luigi Guiso for sharing additional data, and Sevim Kosem, Sara Moccia and Giuseppe Rossitti for outstanding research assistance. We also thank Alberto Alesina, Oriana Bandiera, Filipe Campante, Francesco Caselli, Francesco Drago, Alessandra Fogli, Nicola Gennaioli, Paola Giuliano, Andrea Ichino, Ethan Kaplan, Pete Klenow, Tatiana Komarova, Hamish Low, Nicola Limodio, Emi Nakamura, Tommaso Oliviero, Gerard Padro i Miquel, Marco Pagano, Torsten Persson, Annalisa Scognamiglio, Andrei Shleifer, Morten Ravn, Ricardo Reis, Federico Rossi, Guido Tabellini, John van Reenen, Hans-Joachim Voth, Eran Yashiv, Fabrizio Zilibotti and participants at several conferences and seminars. Research was supported by grants from the EIEF, STICERD and the Centre for Macroeconomics.

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1 Introduction

Output per worker differs enormously across countries and regions, and productivity is viewed the main driver of these differences (Caselli 2005). A large literature studies this variation but confronts difficulty even in measuring productivity. While it is occasionally possible to measure workers' productivity in small controlled settings, e.g. an individual production line, it is difficult to isolate their contribution to value added in larger scale settings, e.g. across an entire country. Further, productivity shows substantial dispersion even within narrow industries and the causes for this dispersion are not fully understood (Syverson 2011).

In this paper, we measure the productivity of electoral workers who counted ballots in a general election and two referenda in Italy. While our investigation isn't in a commercial setting, the task is useful in isolating labor efficiency in data spanning every municipality in a country. Using data on ballot counting times from the 2013 Italian general election and two referenda in 2016, we measure electoral volunteers' productivity in close to 8,000 municipalities. Combined, volunteers counted more than one-hundred million ballots. We calculate the number of votes counted per worker-hour: a direct, quantity-based, measure of labor productivity.

There are several advantages to measuring output per worker in this setting. First, the task is virtually identical in all polling stations across the country. This contrasts with tasks in the workforce, which vary substantially across firms within narrow industries and even within firms. Second, the task is simple, manual, and repetitive, making it highly labor intensive: essentially no physical capital or modern technology are involved.[1] This creates a quasi-laboratory setting that isolates labor efficiency from other inputs and technology that affect, but also confound, labor efficiency and human capital in most settings. Third, volunteers' direct pecuniary incentives are identical in all polling stations and involve a lump-sum payment that is independent of performance or time-on-task. (We discuss indirect pecuniary incentives in Section 6.) This isolates volunteers' ability and intrinsic motivation to contribute to the task. Fourth, the non-market setting insulates our measurement from considerations of market power, market frictions, and transportation costs that may confound productivity measurement in firms. Fifth, the task is administered at the national level, thus controlling for (the direct effects of) sub-national institutional differences. Finally, the task is performed at tens of thousands of polling stations, giving a nation-wide measure of productivity for a large economy.

[1] It would also seem that only minimal education is needed to count votes productively. We study the role of the educational component of human capital in Sections 5 to 7.

We document substantial dispersion in Vote Counting Rates (VCR) across Italy. The variance in VCR across provinces is slightly *greater* than that of output per worker in firms. Similarly, the Italian north-south productivity gap is greater in the vote counting task than it is in firms. Further, VCR is highly correlated with firms' productivity in the same location. These facts alone suggest substantial variation in the human component of labor productivity even for a uniform task that controls for most of the factors to which this variation is often attributed (north-south differences in infrastructure, for example).

We further corroborate VCR's relevance for other economic settings using firm level data. The regressions include two way (municipality and industry) fixed effects, using only municipality by industry variation in productivity. We show that the correlation between municipal-level VCR and workers' productivity in firms is greater in labor-intensive and low-skill firms. This is consistent with VCR capturing a labor-intensive and low-skill component of human capital.

We then use our measure to assess the importance of human capital in accounting for differences in output per worker across the country. We do so in a development accounting framework, as in Caselli (2005) and Hsieh & Klenow (2010). Given that our productivity appears to isolate the role of labor efficiency, we treat it as a proxy for labor-augmenting productivity. In our preferred specification, human capital accounts for nearly 50% of the productivity variation across Italian provinces. We estimate that if this resisdualized labor efficiency captured by VCR were equated across the country, the north-south gap in measured TFP would decline by two thirds and the gap between the 75th and the 25th percentile province in terms of value added per worker would decline by half.

We address a number of factors that might lead to mis-measurement of vote counting productivity or to a spurious correlation with productivity in firms. We use rich electoral data to control for task complexity; control for vote counter demographics; and explore the possibility that VCR was driven by the opportunity cost of time. On this last point, our setting makes the opportunity cost in its most obvious form an unlikely driver of VCR. Employers are obliged to give vote-counting volunteers paid time off on the day of, and the day following, the election, so that poll workers received wages on those days regardless of the time they devoted to vote counting. Nevertheless, we use the time dimension of our data to explore the importance of the opportunity cost of time. Using province-level unemployment and wages as proxies for the opportunity cost of time, we find no within-province correlation over time between VCR and these measures of opportunity cost.

We conclude with some correlations that shed some light on the the importance of social capital in explaining differences in labor productivity in vote counting. A survey measure of "trust" shows a particularly robust correlation with VCR and aspects of the vote-counting task shed light on the relationship between trust and productivity. The share of contested votes (when committee members disagreed on how to assign a vote) in a municipality reduces the vote counting rate substantially, but this is true only in low-trust provinces. This is consistent with a role for trust in facilitating productivity in group tasks involving conflict resolution.[2]

This paper relates to a large literature studying differences in output per worker across countries or regions (Mankiw *et al.* 1992, Hall & Jones 1999). Methodologically, we follow the development accounting literature (Klenow & Rodriguez-Clare 1997, Caselli 2005, Hsieh & Klenow 2010). Our setting usefully isolates the human component of productivity from technological, institutional, and infrastructure inputs to production. In a related and contribution, Hendricks & Schoellman 2018 show that immigrants' location of birth–and therefore their human capital–accounts for roughly half of the variation in their wage once employed in the US. Their setting has the advantage of observing the the same individual in two settings (countries), while we have to rely on municipal-level correlations. On the other hand, our setting has the advantage of a direct measure of productivity, rather than relying on wages, whose association with labor productivity depends on the labor markets' efficiency. Syverson (2004) studies productivity in concrete production, a highly uniform good. We complement this literature by studying productivity where workers face uniform tasks and incentives.

Labor productivity has been studied in smaller, controlled settings (Bandiera *et al.* 2011, Finan *et al.* 2015), but measuring productivity in a highly comparable task across an entire economy or across countries is rare. Similar in spirit to our study is Clark (1987, 2007), who compares labor costs in cotton mills in several countries in the early industrial period. He provides historical evidence that differences in technology, capital quality, transportation and raw material costs, and market frictions are insufficient to explain the large differences in labor costs. He concludes that human capital is the residual explanation. In our setting these confounding factors are mostly absent, allowing us a direct measure of labor efficiency and our data speaks to the role of social capital. Chong *et al.* (2014) send letters to non-existent addresses in every country in the world and measure the "return to sender" time. Their objective is to measure institutional efficiency as

[2] Anelli *et al.* (2021) have used our data to show that cheating in school exams is correlated with VCR, further corroborating the social capital component of VCR.

opposed to isolating labor efficiency as we do.

Our evidence on the role of social capital in the vote-counting process relates our study to a large literature on the importance trust and "civicness" in economic development, harking back to Banfield's (1958) and Putnam *et al.* 's (1993) studies of Italy. Guiso *et al.* (2004, 2006, 2008a,b) have studied the role of trust and civicness empirically.[3] Our labor efficiency measure complements existing measures of intrinsic motivation in contributing to common efforts (e.g. blood donations) with the advantage of being cardinal: It is measured in units of output per worker that relate directly to other quantities of interest to economic researchers. Our development accounting exercise in Section 6 is an example of analysis that requires a cardinal measure. Our finding that intrinsic motivation may play a role in the vote counting task relates to the work of Ichino & Maggi (2000) and Ichino & Riphahn (2005) work on shirking in and absenteeism from the workplace.

The remainder of the paper is organized as follows. Section 2 describes the institutional setting of the 2013 elections and the 2016 referenda, and the vote counting process. Section 3 describes the data. In Section 4, we translate raw vote counting times into vote counting rates. In Section 5 we present the firm-level analysis. Section 6 provides a development accounting framework that assesses the importance of labor efficiency in productivity differences across provinces, followed by several robustness checks. In Section 7 we discuss the role of social capital and its correlation with VCR. Finally, Section 8 concludes.

2 Institutional Setting: Vote Counting in Italy

Our main variable of interest is vote counting times in three separate polls: The Italian general election of 2013; the oil and natural gas drilling referendum of April 2016; and the constitutional referendum of December 2016. Full details on the polls can be found in Appendix B. Here, we briefly describe these polls and the broader administrative setting.

The 2013 general election determined 630 members of the Chamber of Deputies (*Camera dei Deputati*) and the 315 elective members of the Senate (*Senato della Repubblica*). The election was held on Sunday and Monday, February 24-25, with polling stations closing at 3pm on Monday. The April and December nationwide referenda related to oil-drilling licenses and constitutional changes, respectively. They were held on the Sundays of April 17 and December 4, 2016, respectively, with polling stations closing at 11pm.

[3]See Alesina & Giuliano (2015) for a review of the broader literature on culture and economic development.

In each of these polls, voters entering a polling station received a pencil and a ballot (or two in the election). They were required to mark one party on each election ballot or "Yes" or "No" in the referenda. Figure A.1. in the appendix shows sample Senatorial ballots from two Regions: Piemonte in the north and Sicily in the South. While there were slight differences due to the presence of Regional parties and in the ordering of coalitions, the ballots were similar in their design and complexity. Ballots for the Chamber of Deputies were even more uniform across Regions. Ballots in the referenda were identical across the country and are shown in Figure A.2 in the appendix.

Italy is divided into 20 administrative Regions, 110 provinces, and around 8000 municipalities (*comuni*). For electoral purposes, each municipality is divided into polling stations (*sezioni*). Clear rules regulate the number of registered voters per polling station, with a range of 500 to 1200 voters per polling station.[4] Each polling station in the election had a 6-member committee: A president, 4 poll workers (*scrutatori*), and one secretary. In the referenda, each polling station had a 5-member committee, with 3 rather than 4 poll workers. In addition, political parties are entitled to appoint observers, who may report irregularities, but do not take part in the counting process itself.

Poll work was voluntary and included supervising the entire voting process until polling station closing times, followed by the vote counting task studied here. Poll workers are selected by the municipal electoral commission (*commissione elettorale comunale*) from a list of volunteers. Prior to 2005, poll workers were selected via lottery. In the polls studied here, municipalities differed in the degree of discretion given to the electoral commission.[5] Poll workers must have completed eight or more years of education and must reside in the municipality where they wish to volunteer. The president of the committee is selected by the Regional court of appeals (*corte d'appello*) from a list of volunteers and must have completed 12 or more years of education. The secretary is appointed by the president and must have completed eight or more years of education.[6]

Poll workers and the secretary received financial compensation of €145 for their participation in the election and €104 in the referenda. Presidents received €187 in the election and €130 in the referenda. Importantly, this was a lump-sum reward for the entire one to two day process and

[4]Municipalities with more than 2,000 registered voters were divided into polling stations of 750 (for municipalities with 2,001 to 40,000 voters), 850 (for municipalities with 40,001 to 500,000 voters) or 900 (for larger municipalities) registered voters. Municipalities with 1,200 to 2,000 voters had two polling stations and smaller municipalities had one polling station. Source: MINISTERO DELL'INTERNO 2 aprile 1998, n. 117 - "regolamento recante i criteri per la ripartizione del corpo elettorale in sezioni".

[5]Our results are robust to restricting attention to municipalities where volunteers were randomly selected. We discuss volunteers' selection into the task in Section **??**.

[6]Poll worker absenteeism or tardiness isn't a concern for our measurement. Municipalities replace absent poll workers with others from the volunteer rolls. The vote counting task begins either at 11pm on the day or 3pm on the second day of the election, so that a replacement is obtained well before vote counting begins. Our data on poll workers contains the characteristics of those who actually served.

did not depend on the number of hours devoted to counting votes. There was no direct pecuniary incentive to prolong the vote counting task, nor any reward for completing it rapidly.

Employers were required by law to give poll workers a day of paid leave to compensate for their electoral work on the polling days and the day following the elections (Sunday through Tuesday in the election of 2013, and Sunday and Monday in both referenda). Poll workers were also eligible for an additional day of paid leave if vote counting extended beyond midnight. Given that polling stations closed at 3pm in the general elections, almost all polling stations completed work before midnight. In both referenda, polling stations closed at 11pm, so that the majority of polling stations completed work after midnight. Hence in the typical polling station in all polls considered, employed poll workers were paid by their employers for the Monday and Tuesday of the week following the election.[7]

All polling stations were required to follow the following procedures. These procedures are outlined in very precise detail in the polling station handbook provided to polling station presidents. First, a number of preliminaries are conducted related to the voter registry. Turnout is computed and the list of voters is sent to the municipality. Second, Senate votes are counted and reported. And third, Chamber of Deputies votes are counted and reported. (In the referenda, these two steps are replaced by a single vote-counting step). There are therefore two potential measures for vote counting time for the general election: the time Senate results were reported and the time Chamber of Deputies results were reported. In addition, there is a vote counting time from each of the two referenda.

During vote counting, the following procedures were to be followed. The committee counts and records one vote at a time. If a vote is contested (e.g. by a party observer), the president is authorized to assign the vote, but must record in the register that the vote was contested. This helps ensure that contested votes don't delay the process.[8] When vote counting is complete, the president reports unofficial results to the municipality. This is done by phone, fax, or in a small number of municipalities by PDA application. The municipality then communicates the unofficial result to the Ministry of Interior. Official hard copies are then transported to the municipality.

Further details on electoral institutions and the role of informal institutions (e.g. the Mafia) in Italian electoral politics can be found in Appendix B.

[7] We see no bunching in vote counting times around midnight, indicating the incentive to prolong vote counting past midnight had little effect on vote counters' behavior. Our results are robust to dropping the small portion of municipalities who reported their results past midnight in the election.

[8] We control for the number of contested votes in Section **??** and use the share of contested votes to study the causes for vote counting rate dispersion in Section 7.

3 Data

Vote Counting The Ministry of Interior provided data on reporting times of electoral results for each municipality in Italy. Municipalities reported *unofficial* results for each polling station and each election (Senate, Chamber of Deputies, referenda) in real time. The unofficial results were typically reported via phone, so they reflect vote counting times more accurately than official results, which require physical transportation of the hard copy results to Regional courts of appeals. For each municipality, we have two observations for the election and one for each referendum. Each observation is a time stamp indicating the reporting time of the municipality's last reporting polling station.[9] From the raw data we construct four vote counting times per municipality. A municipality's *Senate time* and *total time* are the times that Senatorial and Chamber of Deputy results, respectively, were reported, minus 3pm–polling station closing time.[10] A municipality's *referendum time* in either referendum is the time at which referendum results were reported minus 11pm.

Figure 1 shows the distribution of (total) vote counting times in the election (left-hand panel) and the December referendum (right-hand panel).[11] The distribution for the April referendum is reported in Figure A.3 and for the Senate elections in Figure A.4, both in the appendix. The average vote counting time was 5 hours and 16 minutes in the election, 1 hour and 31 minutes in the April referendum, and 1 hour and 54 minutes in the December referendum. This means that the average municipality completed the vote counting task at 8:16PM in the election, half past midnight in the April referendum, and nearly 1AM in the December referendum.[12]

[9] The Ministry kept records at the polling station level for municipalities in only 17 provinces and only in the most recent referendum, a point we revisit below.

[10] In principle, we could construct a third measure: *Chamber of Deputies* time, as the difference between *total time* and *Senate time*. But this measure is harder to interpret as the last polling station reporting Senate results may differ from the last polling station reporting Chamber of Deputies results in a given municipality. This might therefore reflect a vote counting time that did not occur at any polling station in the municipality. Our results are generally robust to using this third measure, with slightly weaker results as could be expected from a noisy measure.

[11] We trimmed the 1st and 99th percentiles of the distribution to eliminate outliers.

[12] We noted earlier that there was a potential incentive to complete the task after midnight, as this gave employed poll workers an additional day of unpaid leave. However, very few municipalities in the election completed counting after midnight. In contrast, in the referenda, the majority of municipalities completed vote counting after midnight. In all cases, we do not observe an excess mass (bunching) of vote counting times immediately after midnight, so that the incentive to extend voting beyond midnight does not seem to have affected vote counting rates in practice. Excluding the small number of municipalities that did report after midnight in the election or before midnight in the referenda does not alter our results. In the election, dinner time may have served as a focal point for completing electoral activities. Indeed, we do see an increase in vote counting times ending around 7:30-8:00 and right before 9:00PM. One concern is that vote counting times might be affected by regional differences in dinner times. However, we do not see any patterns (e.g. an unusual number of southern municipalities around 9PM) around these times. Moreover, results are robust when using only referendum results, where dinner time was not a factor.

Vote Counter Characteristics We surveyed Italian municipalities to learn more about vote-counters' characteristics. Municipalities are required to keep a record of electoral volunteers, but aren't required to report these data to the Ministry of Interior. We sent an email to the relevant contact in each municipality in Italy. We requested an anonymized list of volunteers' characteristics in the 2013 election. 19% of municipalities, covering 22% of polling stations in Italy, responded. They provided information about volunteers (presidents, secretaries, and poll workers) at each polling station, their age, gender, years of education, and employment status. In addition we asked whether the president had experience in previous elections.[13]

Table 1 gives summary statistics of presidents, secretaries, and poll workers in the 2013 election. Poll workers and secretaries were in their mid-30s on average, and over 60% were women. Presidents were nearly a decade older on average and nearly 55% were men. Poll workers had 12 years of education on average, secretaries 14, and presidents nearly 15. The average years of schooling in the general Italian adult population is 10.1, so that vote counters had above-average education. The vast majority of presidents participated in the vote counting process in previous elections. While the majority of presidents and secretaries were employed, only 42% of poll workers were in full-time employment. Instead, 31% of poll workers were students and nearly 13% were unemployed. The remainder were primarily stay-at-home spouses. At the time, the Italian unemployment rate was around 12%, so that the unemployed are under-represented in our sample, while students are greatly over-represented.

Labor Productivity in Firms We use the ORBIS database from Bureau van Dijk to measure labor productivity in firms. The dataset provides balance sheet information for 3.7 million Italian firms: more than half of all firms in Italy. The firms in our data employ 15.8 million workers, or more than 80% of all private sector employment. These firms create a total value added of €600 billion, nearly 40% of GDP. We measure labor productivity as value added per employee averaged from 2004-2013. We average productivity for each firm over the decade preceding the election to smooth out any differential business cycle conditions across the country. In studying industry-level variation, industries are defined by NACE Rev.2 at the three digit level. Data on labor intensity and skill intensity of each industry (for manufacturing industries only) are taken from the NBER-CES Manufacturing Industry Database (Bartelsman & Gray 1996). We use this external source because, while capital shares can be measured directly from our firm-level data,

[13]Table A.1 in the appendix compares municipalities that responded to our survey to the full population. The survey appears representative.

data on skill intensity is unavailable. When we aggregate value added per worker to the province level @@@, we weight firms using firm-level employment weights. This translates our measure from value added per worker in the average firm to the average value added of workers. Our province-level results are robust to using the former measure. Our province-level results are also robust to controlling for the industrial composition of each province, thus restricting attention to within (NACE Rev.2 four-digit) industry productivity differences.[14]

4 The Vote Counting Rate

We now translate vote counting times into a productivity measure. We define the vote counting rate (VCR) for election s in municipality m as

$$VCR_{ms} \equiv \frac{\tau_{ms} v_{ms}}{\sigma_m h_{ms}}, \quad (1)$$

where h_{ms} is counting time in hours; τ_{ms} is turnout as a share of total eligible voters; v_{ms} is the number of eligible voters; and σ_m is the number of polling stations. Hence $\tau_{ms} v_{ms} / \sigma_m$ is the number of votes to be counted per polling station. VCR_{ms} approximates of the number of votes counted per polling station per hour.[15]

A challenge with this measure is that we observe the counting time h_{ms} for the *last* polling station in each municipality. In contrast we observe the average number of ballots per polling station in a municipality. Hence in equation (1) we are dividing the *average* number of votes per polling station in municipality m with the *largest* vote counting time in the municipality. While we would ideally observe mean vote counting time, data from the few provinces for which we have the full distribution of polling station reporting times in the December referendum shows that this isn't a problem in practice. Regressing VCR calculated using times from the last polling station on VCR using times from the average polling station gives a nearly one-to-one mapping between the two measures, with an R^2 of 0.8. The primary problem with using "last" rather than "mean" time is that the former might relatively understate VCR for municipalities with a larger number

[14]One limitation of firm-level (as opposed to plant-level) data is the existence of multi-plant firms, with plants in several provinces. We code the firm's province based on its registered headquarters, but the firm may employ workers in plants located in other provinces as well. We therefore exclude the 10% largest firms in terms of value added when calculating average labor productivity, eliminating firms that are likely to have multiple plants. Our results are robust to including all firms or excluding the top 20% or top 50% of firms.

[15]The number of workers is constant across polling stations within an election, so that the cross-sectional variation in votes counted per worker is the same as the variation in this measure.

of polling stations, following the predictions of extreme value theory.[16] However, Table A.2 in the appendix shows that VCR measured with last polling station time isn't correlated with the number of polling stations nor with its interaction with average polling station time. The mapping between the two measures is the same regardless of the number of polling stations, so that the extreme value problem isn't distorting VCR comparisons along municipality size. Further we will show in Section 6 that our results are robust to restricting attention to municipalities with one or two polling stations where the difference between mean and max vote counting time is smaller or non-existent.

Figure 2 shows VCR in the election on the left-hand panel and in the December referendum on the right. (Similar figures for the April referendum and the Senate elections can be found in Figures A.3 and A.4 in the appendix.) The vote counting rate is largely in the 100-300 range and averages 190 in the election, with a standard deviation of 65.[17]

Correlation Between VCR and Firm-Level Productivity The stage is now set for an initial comparison between vote counting productivity with productivity in the workplace. The left panel of Figure 3 shows a map of Italy with average VCR at the province level for the elections. Shades reflect quartiles of the VCR distribution, with darker shades reflecting faster vote counting. This is compared with the right-hand panel, which shows the average value added per worker in each province, again shaded by quartiles. Vote counting was faster in the north of Italy than in the south, mirroring the north-south divide in labor productivity. But there is also significant within-area variation and within-area correlation between the two variables. For example, Emilia Romagna was among the fastest in vote counting and is among the most productive Regions in northern Italy.[18] The correlation between VCR and firm level productivity is statistically significant. Figure A.5 in the appendix shows the same information in a scatter plot.

Dispersion of VCR and Labor Productivity Figure 4 shows the distribution of (log) value added per worker across Italian provinces (in red). The dispersion is no smaller, in fact slightly larger, than that of value added per worker. The fact that a similar productivity distribution exists

[16]Imagine that vote counting times are drawn randomly from the same distribution in all municipalities, so that average VCR is the same in all municipalities. We'd nevertheless expect *last* vote counting times to increase and VCRs to decrease with the number of polling stations. Municipalities with more polling stations receive more draws from the distribution, increasing the probability that they obtain an extreme value.

[17]134 in the Senate, 145 in the April referendum, and 254 in the December referendum, with standard deviations of 55, 63, and 100, respectively.

[18]All regressions in the paper include Area fixed effects (South-Center, North-East, and North-West) and standard errors are clustered at the province level.

in the vote counting task as in firms is suggestive of the drivers of labor productivity. While different technologies, pecuniary incentives, transportation costs might affect productivity in firms, they are unlikely candidates to explain vote counting rates. Similarly, many of the measurement issues present in firm-level data–revenue based measures of productivity, confounding market power, different organizational structures and workers' tasks–are absent from the vote counting task. The high dispersion in VCR suggests a dispersion in labor efficiency itself, rather than the confounding factors present in firm-level data.

5 VCR and Labor Efficiency in Firms

In this section we show that labor efficiency in the vote counting task is correlated with workers productivity in firms, and particularly so in labor-intensive industries. This reaffirms that that we are capturing an externally-valid measure of productivity that might successfully isolate the efficiency of labor from that of other factors of production. We begin by providing a conceptual framework that helps link vote counting rates in polling stations with labor productivity in firms.

Conceptual Framework Let y_{fip} denote the (logarithm of) output per worker of firm f operating in industry i in province p. The firm operates a Cobb-Douglas production function:

$$y_{fip} = \alpha_i \left(m_{fip} + k_{fip} \right) + (1 - \alpha_i)\, h_{fip}, \tag{2}$$

where α_i gives the capital-intensity of production in industry i (assumed to be the same across provinces and firms), k_{fip} is capital per worker. h_{fip} and m_{fip} give labor- and capital-augmenting productivity, respectively: the former is often referred to as human capital.

We assume that human capital is (log-)linearly separable across industries and provinces, so that $h_{fip} = h_f + h_i + h_p$.[19] h_p gives the mean value of human capital in province p, h_i gives the relative average human capital of industry i, with a mean value of zero, and h_f is the added (residual) human capital of workers in firm f.

Let us now treat vote counting as an "industry" $i = v$ that is highly labor intensive as described in Section 2. At the extreme, assume that $\alpha_v = 0$, so that vote counting productivity in polling station f is given by

$$y_{fip} = h_f + h_i(i = v) + h_p,$$

[19] The implicit assumption here is that there is no province-by-industry variation in human capital.

where $h_i(i = v)$ is the average human capital of vote counters. VCR_p is the average vote counting rate in province p, and is given by $VCR_p = \bar{y}_{ip} = h_i(i = v) + h_p$.[20]

Using this last result, We can write for any firm f in *any* industry:

$$h_{fip} = h_f + h_i + VCR_p - h_i(i = v).$$

Using this result in equation (2) gives

$$y_{fip} = \delta_i + \delta_p + \alpha_i k_{fip} + (1 - \alpha_i)\, VCR_p + \varepsilon_{fip}. \tag{3}$$

δ_i is a set of industry fixed effects that give the difference between human capital in industry i and in the vote counting task, $h_i - h_i(i = v)$, in addition to any other industry-specific drivers of labor productivity. The separability of human capital into its three components is equivalent to assuming that there is no *differential* selection into vote counting across provinces, but industry fixed effects absorb any selection into vote counting that is common to all provinces. We discuss an important potential driver of differential selection–differences in the opportunity cost of time–in Section 6.

δ_p is a set of province fixed effects absorbing all province-specific drivers of productivity, including those that VCR itself measures. Remaining, however, is industry-by-province productivity variation captured by the term $(1 - \alpha_i)\, VCR_p$. In words: because VCR_p captures a particularly labor-biased component of productivity (human capital), we expect it to be more correlated with output per worker in industries that are more labor intensive.

While we aren't making a causal statement, it is worthwhile noting factors that might confound the correlation between $(1 - \alpha_i)\, VCR_p$ and output per worker. Given the industry and province fixed effects, confounding factors would have to be productivity differences across provinces that are increasing in the labor-intensity of the industry, that are correlated with vote counting rates, but not due to differences in human capital.

Analysis We analyze the role of labor efficiency or human capital in firms' productivity through a two-way fixed effects regression, based on (3). The regression augments the previous equation by interacting VCR not only with skill intensity. This provides a further test of the hypothesis that

[20] As we noted, we observe the vote counting rate of the slowest, not the average polling station. We discuss the implications in Section 3

VCR is more correlated with workers' productivity in low-skill sectors. The hypothesis is based on the fact that VCR measures workers' productivity in a task that is not only labor intensive, but also requires little formal education or skills. The specification is as follows: following regression

$$y_{ijp} = \delta_i + \delta_p + \beta_k \alpha_i k_{ijp} + \beta_h (1-\alpha_i)\,\gamma_i Edu_p + \beta_1 (1-\alpha_i)\, VCR_p + \beta_2 \gamma_i VCR_p + \varepsilon_{ijp}, \tag{4}$$

where Edu_p gives (the log of) average years of schooling in province p and γ_i is the skill intensity of industry i. The term $\gamma_i Edu_p$ residualizes output per worker not only from the capital input, but also from an existing measure of human capital at the province level: years of schooling.[21]

We obtain the capital share α_i and skill share γ_i of each industry using US data, giving a more exogenous classification of industries, but using Italian capital shares gives similar results (data on skill shares of Italian industries is unavailable).[22]

The results are shown in Table 2. Our main hypothesis is $\beta_1 > 0$, which holds if the correlation between measured TFP and VCR across provinces is greater for firms that are relatively more labor intensive. The coefficient is positive and statistically significant. The coefficient β_2 is also of interest, as it is positive if measured TFP is more correlated with VCR in more skill-intensive industries. We find a negative and statistically significant correlation, suggesting that VCR captures a low-skilled component of labor efficiency, as one might expect from the mechanical vote-counting task.

6 Labor Efficiency in Development Accounting

How important is labor efficiency in accounting for differences in output per worker across Italy? We now aggregate our data to the province level and use a development accounting variance decomposition to explore this question. We augment the production technology (3) with human capital h_p, so that output per worker is given by

$$y_p = A_p + \alpha k_p + (1-\alpha)\left(h_p + VCR_p\right). \tag{5}$$

[21] We don't observe schooling at the firm or industry level.

[22] We use the NBER-CES Manufacturing Industry Database, Bartelsman & Gray (1996). This restricts our sample to manufacturing industries only. α_i is measured as one minus the ratio of wage income to value added and γ_i by the ratio of wage income of non-production workers to total labor income.

A_p (log TFP) summarizes the contribution of all other factors, including capital efficiency, to output per worker in province p. We include two measures of human capital: h_p that derives from years of schooling and VCR, our measure of labor efficiency in the vote counting task.

We set $\alpha = \frac{1}{3}$ as is standard in the literature and follow the convention of predicting the value added of a year of schooling from micro-data Mincerian regressions of years of schooling on wages. Formally, if ϕ is the return to a year of schooling and Υ_p is the average number of years of schooling in province p, then the logarithm (of the educational component of) human capital is given by

$$h_p = \frac{\phi}{1-\alpha} \Upsilon_p.$$

Ciccone *et al.* (2006) estimate an average return to a year of schooling of 6% for Italy, but with some heterogeneity across different levels of educational attainment. As in Hall & Jones (1999), we allow for a piece-wise linear relationship between years of schooling and human capital, extending the simple linear relationship in (6).[23] [24]

We follow Klenow & Rodriguez-Clare's 1997 variance decomposition to obtain the share of the variance that can be attributed to factors of production:

$$\text{Accounted Variation} \left(X_p\right) = \frac{cov\left(f\left(X_p\right), y_p\right)}{var(y_p)},$$

where X_p is a vector of measured production inputs and $f(.)$ summarizes the role of factors of production (everything but A_p) in (5). Residual unexplained variation is attributed to TFP and given by one minus this measure.[25]

Results are summarized in Table 3. A production function including capital per worker alone ($f\left(X_p\right) = \alpha k_p$) accounts for 21% of the of the variance in output per worker. When human capital is included ($f\left(X_p\right) = \alpha k_p + \phi h_p$) factors of production account for 30% of the variance. These standard factors of production leave more than half of the variation unexplained and attribute it to TFP. When we add our measure of labor efficiency, measured by VCR, to the production function

[23] We allow a different returns on years of schooling up to 8 years, between 8 and 12 years, and above 12 years.

[24] Hanushek & Woessmann (2012) argue that quality of education needs to be taken into account alongside years of schooling. As a robustness check, we introduced the average PISA score to the Mincer regression. The quality-adjusted schooling measure of human capital increases the contribution of human capital in explaining the variance of output per worker across provinces by around 10 percentage points, but doesn't affect the contribution of labor efficiency as measured by VCR.

[25] Caselli (2005) proposes an alternative measure: Accounted Variation $(X_i) = \frac{var(f(X_i))}{var(y_i)}$. Our results are robust to the use of this approach. Weil (2007) builds on this but displays the full variance-covariance decomposition of output per worker. Appendix table A.7 shows a similar table in our setting. In this table, a production function corrected for VCR accounts for more than 100% of the variance in, i.e. over-explains, output per worker.

$(f\left(X_p\right) = \alpha k_p + \phi h_p + (1-\alpha)VCR_p)$ we now account for 77% of the variance in our baseline scenario. VCR alone accounts for nearly half the variance.

Our preferred specification measures VCR averaged across all elections and referenda, to reduce idiosyncratic factors and measurement error in any specific poll. VCR measured in the elections alone, VCR accounts for more (nearly all) of the variation in labor productivity, with referenda alone accounting for slightly less. The two measurements bound the role of labor efficiency between 39% and 63%.

The remainder of the table reports several robustness checks. These include controlling for possible differences in task complexity (e.g. the number of contested or invalid votes to be processed), vote counters' demographic characteristics, fixed effects for the number of polling stations in the municipality, and restricting the sample to municipalities with only one or two polling stations. Results vary slightly across specifications, but VCR accounts for at least 39% of the variation in labor productivity across provinces in all cases.

Counterfactual Exercises using VCR as Labor Efficiency This framework allows us to conduct a number of counterfactual "experiments", to which we now turn. The provincial distribution of output per worker y_p as measured in firms is shown (in red) in Figure 5. The distribution is bimodal, reflecting the north-south productivity gap. The figure also plots (in black) the distribution in terms of efficiency units of labor, given by $\frac{Y_p}{e_p L_p}$. This distribution is "better behaved", with a single peak and lower variance. Quantitatively, the 75%-25% interquartile gap (IQR) in output per worker is 21%, but it is only 12% in value added per efficiency units of labor, cutting the IQR by nearly half.

Thinking along north-south lines, we conduct the following counterfactual exercise. Value added per worker is 20% higher in northern Italy than in the south, measured in firm data. As a counterfactual, we assign the median labor efficiency of northern provinces to all southern provinces whose labor efficiency is below the northern median. Under this counterfactual, the north-south gap in output per worker would decline to 7%, cutting the north-south labor productivity gap by nearly two thirds.

6.1 Robustness

Adjusting for Task Complexity While the vote counting task is very uniform across the country, there are some factors that may make the task more challenging in some municipalities than in others. To address this, we adjust the vote counting rate for information from the electoral rolls. Tables A.3 and A.4 in the appendix show results from a regression of (log) VCR on a number of factors that might affect the complexity of the task. These include the number of challenged, blank, and invalid votes; the closeness of the election, the dispersion of votes across parties; and the number of parties. Having controlled for the complexity of the task, we use residuals from these regressions as "Adjusted VCR", reflecting a measure of vote counting productivity that is adjusted for the complexity of the task. Figure A.6 in the appendix shows a strong correlation between the adjusted and raw VCR measures. Figure A.7 in the appendix shows its correlation with value added per worker in firms remains strong. Not surprisingly, the fifth row of Table 3 shows that our results are robust to adjusting VCR for these factors.

Controlling for Volunteer Characteristics (Selection on Observables) Vote counting is voluntary and volunteers' characteristics may differ across the country. Of particular concern is that volunteers in low-productivity provinces are negatively selected, creating a spurious correlation between vote counting rates and firm-level productivity. To address this, we control for observables based on our survey of vote counter characteristics. Table A.5 in the appendix shows results of a regression of (log) VCR on vote counters' characteristics. Results in the table are at the municipal level for the nearly 1,000 municipalities that responded and provided complete information on vote-counters' characteristics.[26] We control separately for the characteristics of polling station presidents and other polling station workers.[27]

Vote counters' age and gender had no consistent impact on vote counting productivity. In contrast, measures of human capital did appear to have an effect. Interestingly, it is the team's human capital, rather than the president's that appears to have impacted vote counting productivity. Employment status also had an effect: a municipality comprised entirely of employed team members was 24-26% more productive than a committee entirely comprised of volunteers who were not employed. Students were even more productive than employed vote counters.[28] Finally, experienced presidents presided over more productive polling stations.[29]

[26]In case a volunteer was replaced, we observe the characteristics of the volunteer that participated, not the absent volunteer.

[27]Results are robust to controlling for all three categories of workers separately or pooling the characteristics of all types of electoral volunteers.

[28]This is initial suggestive evidence that the opportunity cost of time was not central in determining vote counting rates. Presumably workers have a higher opportunity cost of time than do students, yet students counted votes more rapidly.

[29]Past experience of other electoral volunteers was not available.

We label residuals from this regression as "Controlled VCR". The right-hand panel of Figure A.6 in the appendix shows that this measure is strongly correlated with Adjusted VCR, with a statistically significant Spearman correlation of 0.7. Figure A.7 in the appendix shows its correlation with value added per worker in firms. All results are robust to the use of this measure of VCR.[30] In particular, the sixth row of Table 3 shows that our main results hold up when controlling for observable characteristics.

Last vs. Average Polling Station Ideally we'd observe the counting time at the *average* polling station, rather than the *slowest* polling station in each municipality. To understand the challenge that our measure poses, imagine that counting times at each polling station in Italy were drawn randomly from the same distribution. We'd expect the average counting time in each municipality to have the mean of this distribution and our expected outcome would be the same in all municipalities. However, larger municipalities obtain a larger number of draws from this distribution and there is a higher likelihood that they draw an unusually large value from this distribution. Thus, even if average counting times were the same in all municipalities, we'd expect to find a negative correlation between VCR and municipality size. We have seen that this concern didn't hold in practice in Section 4 and Table A.2, where the number of polling stations didn't affect the mapping between the average and last polling station in the sample of municipalities where both measures were available.

We nevertheless show that our results are robust to this measurement concern in two ways. First, Figure A.8 in the appendix shows estimates from a non-parametric regression of log VCR on bins of the number of polling stations in each municipality in the election (similar results were found in the other polls). There is no clear relationship between the number of polling stations and VCR and thus no indication of an extreme value problem for municipalities with many polling stations. We report results of a VCR measure where we control for non-parametrically for the number of polling stations in each municipality. The seventh row of Table 3 shows that our results are robust to controlling for the number of polling stations.

Second, we restrict the sample to municipalities that had at most two polling stations, eliminat-

[30]Results are also robust to controlling for *differential* selection on observables between the north and south of Italy. Results of this regression, which includes interactions between poll workers' characteristics and North and South dummies are shown in Table A.6 in the appendix. No clear North-South pattern emerges from this regression. This regression also controls for whether poll workers were randomly selected. Vote counting was similarly slower where poll workers were randomly selected in both the north and the south of Italy, suggesting no differential selection between the two areas due to differences in appointment methods. This also suggests that non-randomly-selected vote counters weren't negatively selected in either part of the country.

ing or diminishing the difference between last and average polling station. All results are robust to using this measure, but we lose nearly half of all municipalities in this restricted sample and eight provinces that have no small municipalities. Nevertheless, the eighth row of Table 3 shows that our results are virtually identical in this subsample.

Opportunity Cost of Time The correlation between VCR and labor productivity in firms is not meant to represent a causal relationship. Rather, these are two separate measures of output per worker in two different settings. One causal concern nevertheless arises, relating to the opportunity cost of time. The opportunity cost of time is correlated with wages and may affect electoral workers' incentive to complete the vote counting task rapidly. If this incentive drives vote counting rates, VCR is simply an indirect measure of labor productivity in firms. Although employers were required to compensate volunteers during their absence, so that opportunity cost is not reflected directly in forgone wages, workers in high-wage municipalities may nevertheless face a higher opportunity cost due to a high value placed on scarce leisure. (This would arise if workers choose working hours and leisure optimally in the workplace).

To address this concern, we exploit the time series dimension of our data. We observe VCR in the 2013 election and the 2016 referenda. If VCR captures a deeper measure of human capital, its cross-sectional distribution is unlikely to have changed dramatically within 3 years. If, on the other hand, VCR merely captures the opportunity cost of time then it should change with incentives reflected in underlying economic conditions. We measure the improvement in business cycle conditions using the change in unemployment or alternatively the change in wages from 2013-15. The correlation between the log change in unemployment and the log change in VCR is shown in a scatter plot in Figure 6. A similar figure compares changes in wages and VCR.[31]

There was much variability in the economic recovery from 2013 to 2015. In fact, provinces were as almost as likely to experience an increase in unemployment as they were to experience a decrease. Changes in unemployment varied widely from -5 to +10 percentage points. There were also changes in vote counting rates, but these are largely an upward shift reflecting faster vote counting rates in the referendum across all provinces. Regressing the change in VCR on the change in unemployment (or wages) gives a tightly estimated zero with an R-square of essentially zero.[32] By this test, we find no evidence that the opportunity cost of time was a factor in determining VCR.

[31] The figure shows the change in VCR from the election to the referendum of December 2016, but results are similar when using the April referendum or the average VCR of both referenda.

[32] The Spearman correlation between provinces' VCR in the election and the December referendum was 0.94, alone suggesting that VCR largely captures a province characteristic.

7 Human Capital and Social Capital

We have found a large dispersion in labor efficiency across Italian provinces and our analysis suggests that human capital is an important proximate cause for differences in output per worker across Italy. Our setting does not provide direct evidence on the drivers of labor efficiency dispersion. Like other development accounting exercises, ours explores the proximate causes for the variation in output per worker across countries or regions. We study productivity in a group task where complementarity across workers may be particularly important. The task requires coordination, cooperation, and consensus among five to six volunteers. These all suggest a potential role for social, alongside (or as a potentially important component of) human, capital.

Table 4 shows correlations between VCR on a number of measures of human and social capital. The first column narrows in on three measures of social capital. The first variable is absenteeism from the workplace. This measure is available at the municipal level and has been suggested as a measure of (poor) work ethic by Ichino & Maggi (2000) and Ichino & Riphahn (2005).[33] We find a statistically significant and negative relationship between VCR and absenteeism. This correlation provides some possible insights on the forces affecting both absenteeism and VCR. High rates of absenteeism are often seen as driven by high value placed on off-the-job leisure. For example, people have a greater incentive to be absent from work in cultures that place a higher value on time with family. The correlation between absenteeism and VCR casts absenteeism in a different light. Absenteeism is greater where votes are counted more slowly, thus where vote counters forewent *more* off-the-job leisure while engaged in the electoral task. This correlation is thus inconsistent with absenteeism and VCR driven solely by valuing off-the-job leisure. The correlation is more consistent with a high cost to exerting work effort or lower psychic costs to shirking: low "work ethic".

We next consider civic duty, using a commonly used measure of civic mindedness: blood donations.[34] The same civic attitudes that drive citizens to donate blood might encourage them to devote a greater effort in a voluntary group task, particularly one that is related to the democratic process. Guiso *et al.* (2008a) have studied the role of civic-mindedness on economic performance. However, we don't find a statistically significant correlation between VCR and blood donations.

[33]The measure captures absenteeism among public employees and may confound some aspects of institutional quality. We view absenteeism as largely reflecting an aspect of social capital, although it admittedly may also reflect human capital, for example a disutility of providing work effort.

[34]Number of blood bags per million inhabitants. The indicator ranges from 0 to 0.11. Source: Guiso *et al.* (2004). We thank Luigi Guiso for sharing his data.

We next turn to the role of trust. A large literature studies the importance of trust in affecting productivity in group settings. A theoretical literature suggests that trust might affect performance in group tasks, particularly where workers' efforts are strategic complements, as is likely the case in the vote counting task, with all vote counters required to scrutinize each ballot.[35] In the Italian context, Banfield (1958) highlighted lack of trust outside of the family circle–termed amoral familialism–as an impediment to the economic development of the Italian south. Putnam *et al.* (1993) studies the historical role of lack of trust or civicness in Italian regional development. More recently, Guiso *et al.* (2004) have shown that trust is an important factor in financial development and the development of trade relations.[36] In line with this literature, we find a robust correlation between labor efficiency in vote counting and a survey measure of trust. We use survey data collected for the World Value Survey at the provincial level asking citizens how much they trust other citizens.[37] The correlation is statistically significant and continues to hold in the following columns, when controlling for human capital and institutional variables.

The second column of Table 4 turns to variables related to human capital. Human capital is most commonly measured through educational quantity and quality. Educational quality, in turn, is commonly assessed through standardized, PISA, test scores. We also look at VCR's correlation with the quality of management, as measured through the management score from Bloom & Van Reenen (2007, 2010). VCR is correlated with educational quality, but has an essentially zero correlation with management quality. Turning to column 3 of the table, we see that once we control for social capital variables, both human capital variables become statistically insignificant and both have the incorrect sign. In contrast, the social capital variables remain statistically significant.[38] In the last column of the table we see that the correlations with social capital remain intact even after controlling for measures of institutional quality (mafia presence and corruption), which themselves are uncorrelated with VCR after including social and human capital controls.[39]

[35] However, much of the existing literature focuses on "vertical trust" between workers and supervisors or employers. See Wintrobe & Breton (1986) for a theoretical exposition and Ashraf & Bandiera (2018) for a recent discussion on horizontal trust.

[36] Aghion *et al.* (2010) argue that lack of trust could lead to over-regulation (which in turn makes it harder for trust to develop). See also discussion in Tabellini (2008, 2010) on the interaction between trust and institutions.

[37] The survey was conducted across 2,000 Italian households in the 1990s. Respondents were asked how much they trusted other Italians in general. Responses were on a scale of 1 to 5, with 5 indicating that they trust them completely and 1 indicating that they do not trust them at all. The measure is then normalized to range from zero to one. The data contains one observation per province, more granular than publicly available data. We don't use the time series component of the WVS data. We thank Luigi Guiso for sharing these data.

[38] Both the management score and PISA test scores are available only at the Regional level, which may affect their statistical power. The social capital variables are available at the municipal or provincial level.

[39] Note that Fisman & Miguel (2007) conclude that corruption is both an institutional and a cultural trait.

Column 4 of Table 4 replaces the human capital measures taken from external sources with our own measures of the human capital of the poll workers themselves. This has the advantage of a direct measure of the human capital that contributed to the vote counting task, but limits the sample size, as we have these measures for a sample of municipalities for the election only. We allow for separate measures for the human capital (education and occupation) of poll workers and presidents. As we had previously seen in Table A.5, VCR is correlated with measures of human capital taken from our data. More educated poll workers counted votes 4 percent faster per year of education, and students counted votes at a 14 percent faster rate. In contrast, the educational attainment of presidents is uncorrelated with VCR and student-presidents lead to a 24% decline in vote counting rates. However, even after controlling for vote counters' characteristics, the correlation between VCR and measures of social capital, particularly trust, remain intact.[40]

Trust and Labor Productivity in Contentious Tasks We investigate the role of trust in affecting productivity in this task further. We hypothesise that trust is particularly important in more contentious group tasks. The share of contested votes is a direct measure of the degree of conflict or disagreement in the vote-counting team. We now look at the role of trust in this conflictual component of the task in Table 5. Not surprisingly, we find that vote counting was slower where the share of challenged votes were higher. The coefficient is large: an increase of one-hundredth of a percent in the share of contested votes in a municipality is associated with a one percent productivity decline.[41] Consistent with Table 4, we also find that provinces with a higher degree of self-reported trust were more productive in counting votes. Moving from a province with the median trust score to one with the top trust score is associated with a productivity increase of almost a third. Our focus, however, is on the interaction between challenged votes and trust. The interaction term is positive, large, and statistically significant. Where trust is high, challenged votes slow down the process by far less than in low-trust provinces. Quantitatively, moving from the least- to the most-trusting province eliminates half the productivity loss due to challenged votes.[42]

Our setting doesn't provide a "smoking gun" for the root causes of labor efficiency dispersion. In addition, the role of trust in resolving the conflict of challenged votes cannot be the full expla-

[40] Absenteeism is no longer statistically significant in this regression because of the restricted sample. That is, absenteeism is insignificant in this sub-sample even if we do not control for vote counter characteristics.

[41] The median municipality had no contested votes. The median share of contested votes for municipalities that had at least one contested vote was one hundredth of a percent.

[42] The regression controls for the number of blank and invalid votes. Result are robust to controlling for their interaction with "trust" as well.

nation for differences in labor efficiency: The majority of municipalities had no contested votes. However, the heterogeneity patterns shown here are indicative that trust may play an important role in facilitating productivity in a contentious group task.

8 Conclusions

We measure output per worker in the vote counting process of the Italian election of 2013 and two referenda in 2016. The vote counting task is simple, uniform, and readily comparable across municipalities. The task involved no physical capital or modern technology and minimal skills. The process was governed at the national level and provided workers with identical incentives. This measure captures labor-specific efficiency that is clean from many of the confounding factors when measuring output per worker using firm level data. We nevertheless find that this measure shows similar geographical dispersion as does labor productivity in firms and the two measures are correlated. Vote counting productivity was particularly correlated with firm level productivity in labor intensive industries, further suggesting that our measure captures labor-specific productivity. A development accounting exercise estimates that labor efficiency accounts for nearly half of the variation in output per worker across provinces. Equalizing labor efficiency would substantially compress the provincial dispersion in labor productivity and would halve the north-south productivity divide. We find that measures of both social and human capital are correlated with labor efficiency. Exploring one particular mechanism, we find that trust is important in increasing productivity with more conflictual aspects of the task.

We hope our newly collected data will be of use to future empirical researchers. Our measure captures labor efficiency, measured in units of output per worker, is available for all Italian municipalities with three observations in two separate years. This study should be replicable in other countries where the vote counting process is similarly uniform across the country and we hope that future research will find use for the methodology proposed here in other settings.

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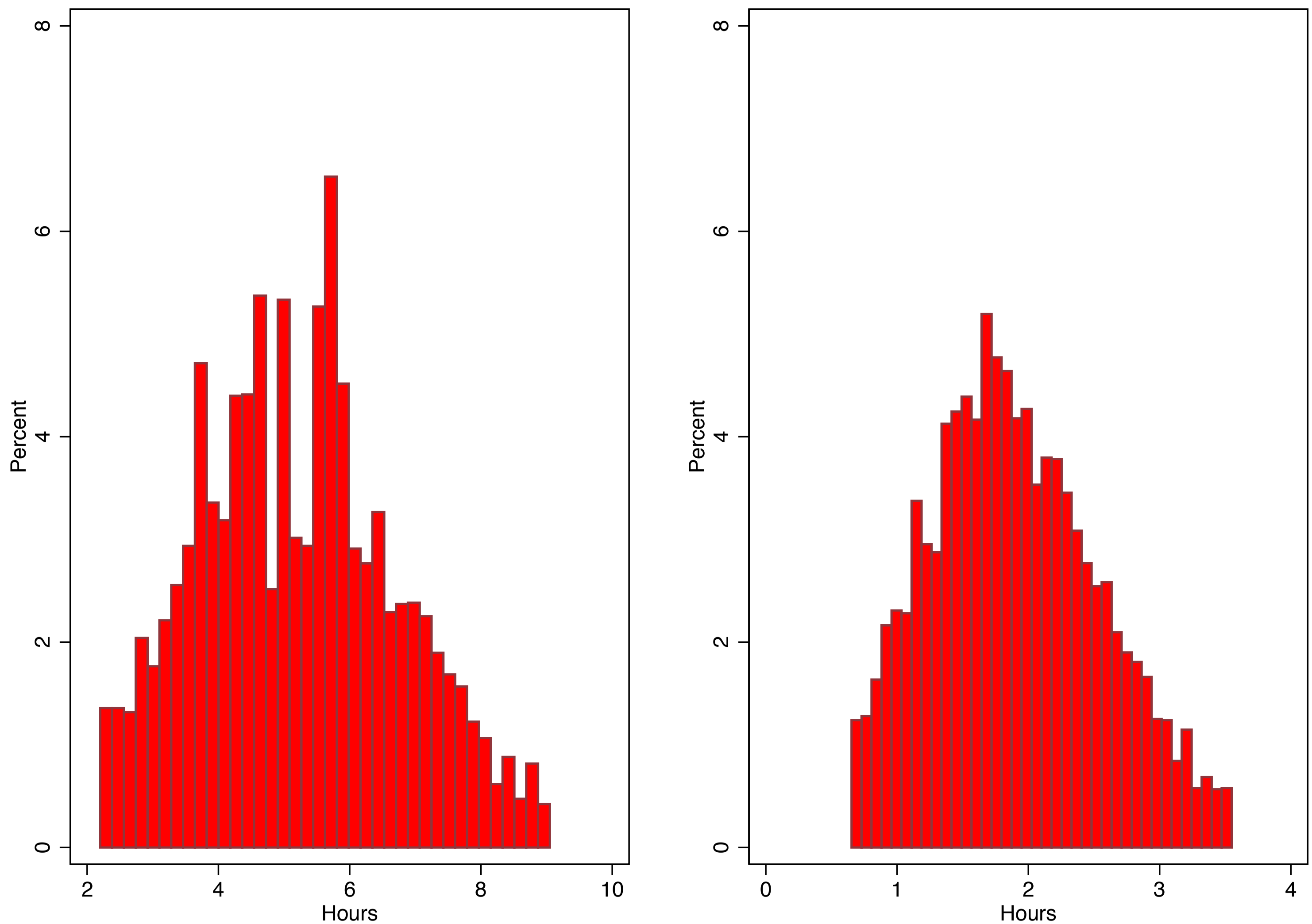
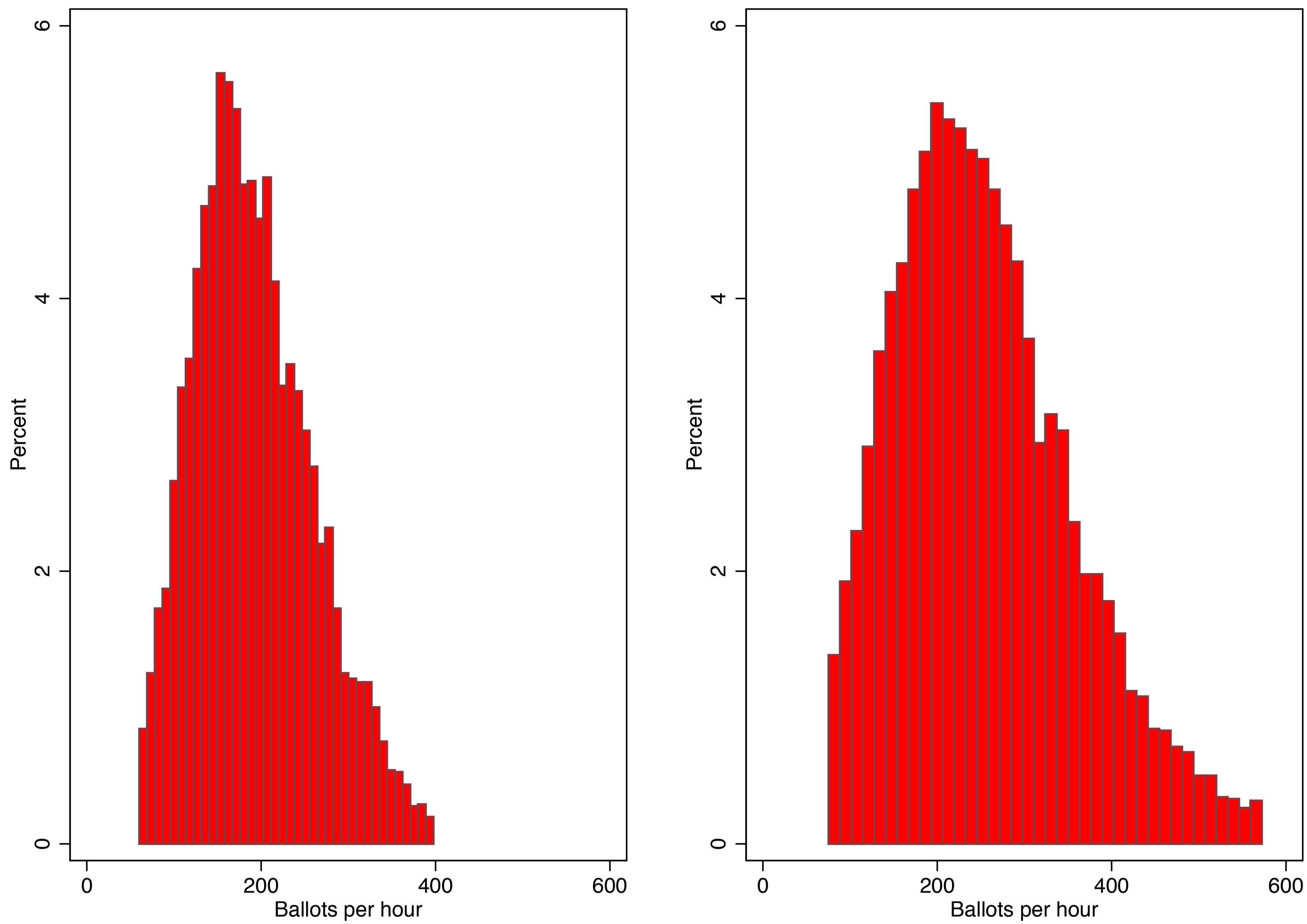
Figure 1: **Vote Counting Times**



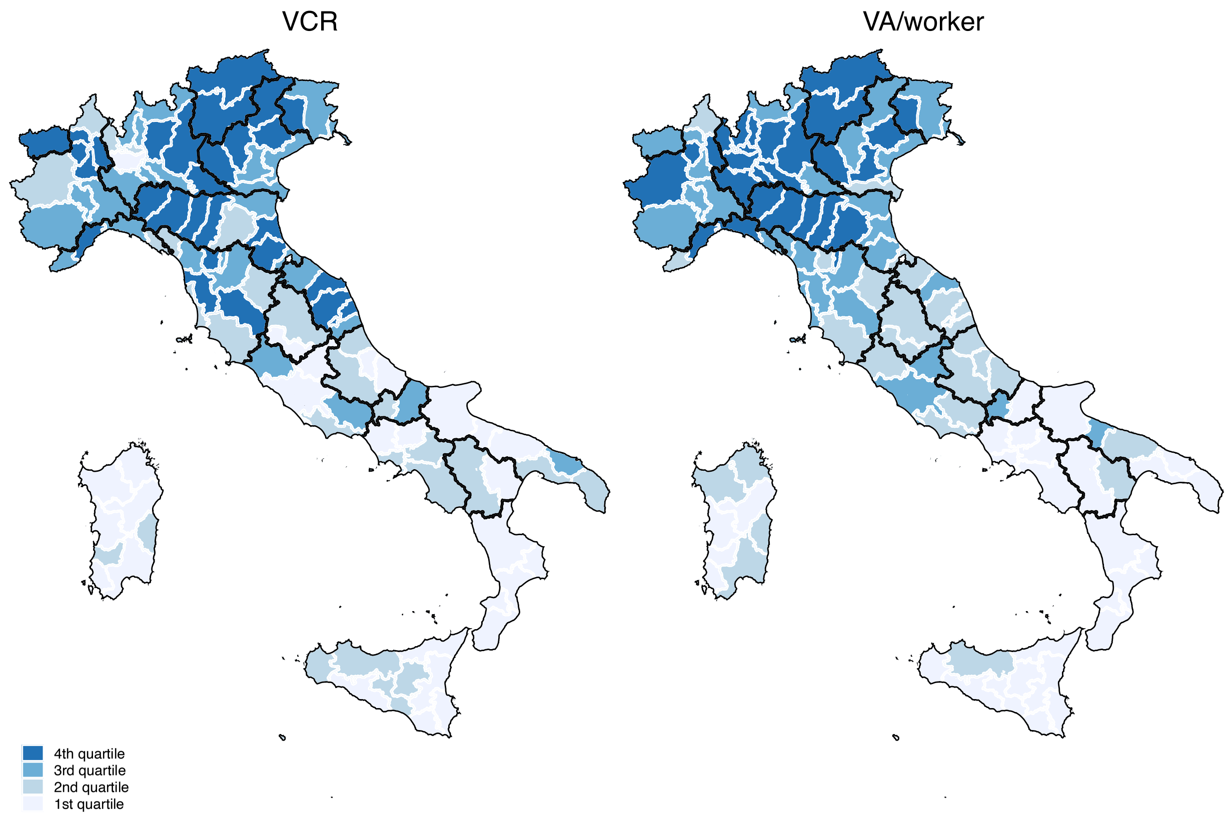
Note: The figure shows the distribution of (total) vote counting times in the election (left panel) and the December referendum (right panel).

Figure 2: **Vote Counting Rates**



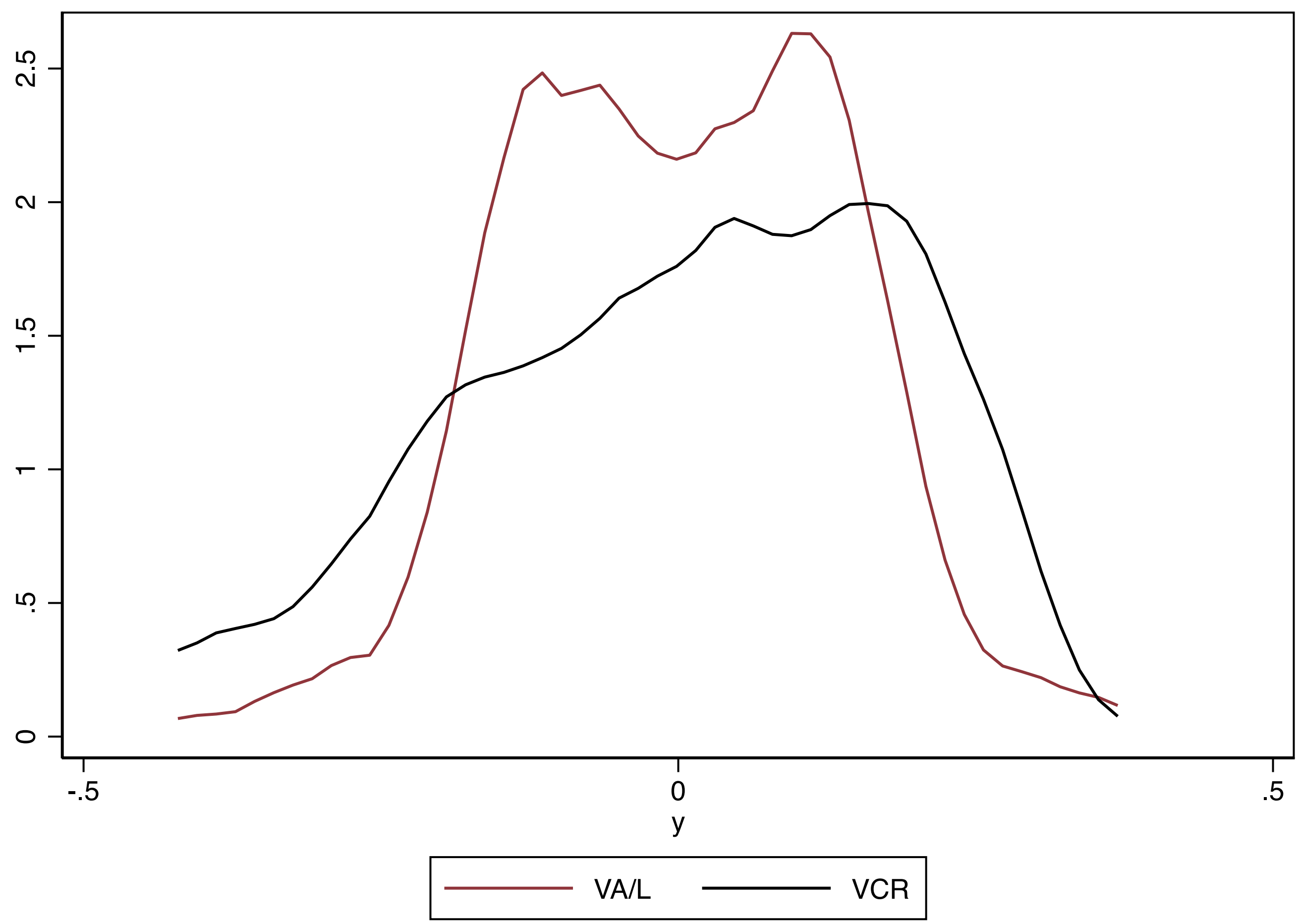
Note: The figure shows the distribution of vote counting rates (VCR) in the election (left panel) based on total counting times and in the December referendum (right panel).

Figure 3: **Vote Counting Rates and Value Added Per Worker across Italian Provinces**



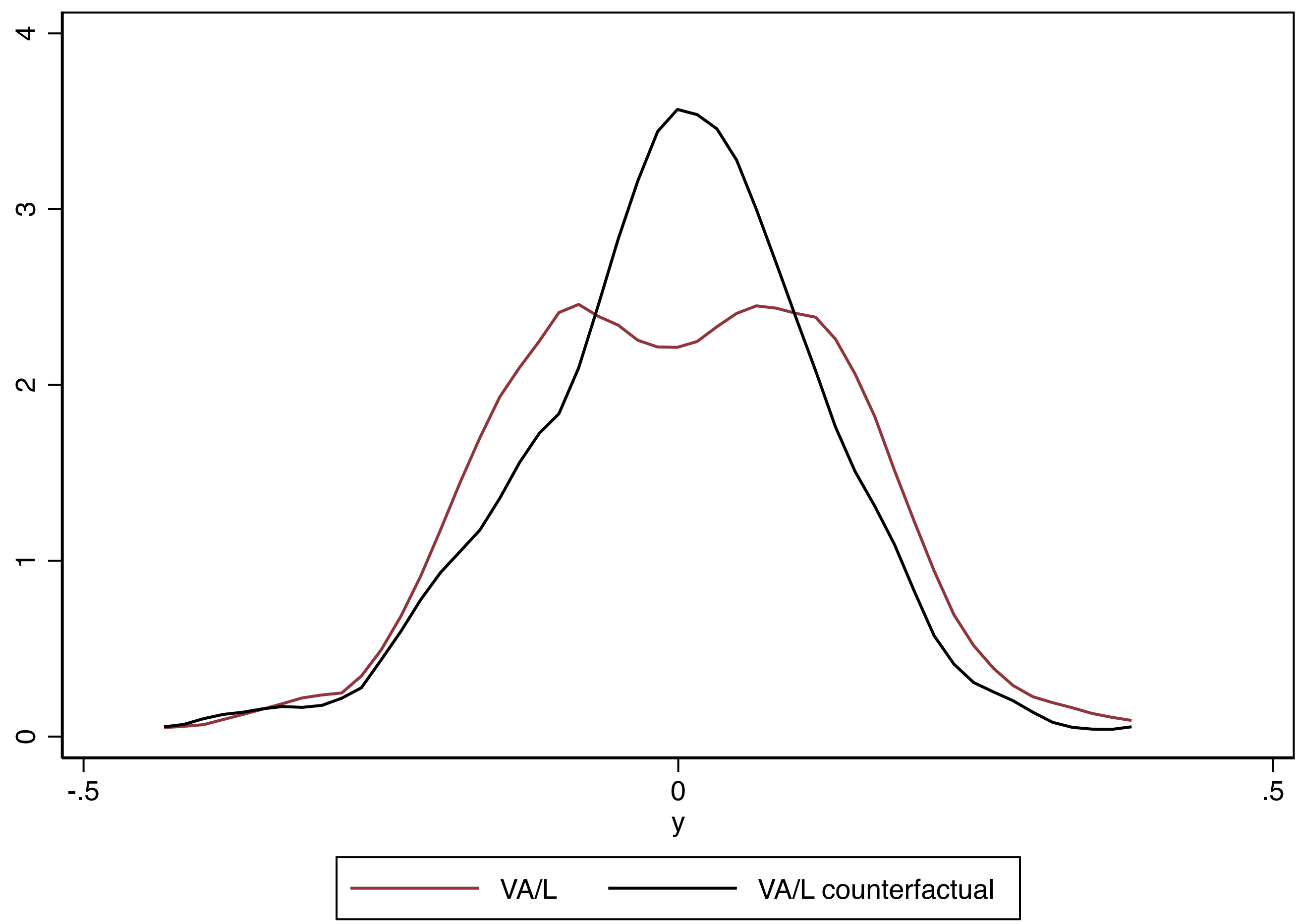
Note: The left panel shows a map of Italy with vote counting rates (VCR) averaged at the province level for the elections. Shades reflect quartiles of the VCR distribution, with darker shades reflecting faster vote counting. The right panel shows value added per worker, shaded by quartiles, with darker shades reflecting more productive provinces.

Figure 4: **Distribution of Value Added Per Worker and Vote Counting Rates**



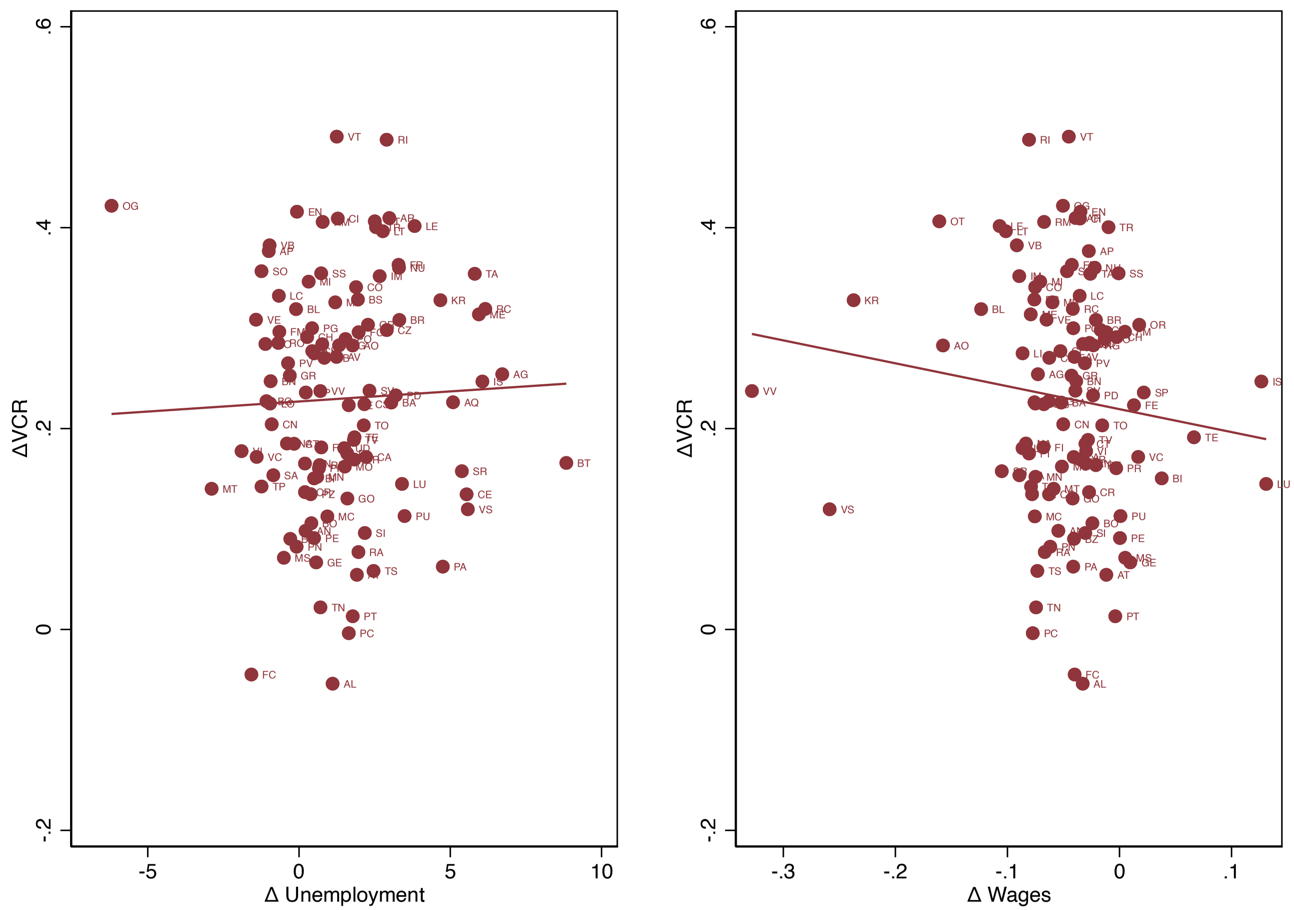
Note: The figure plots the provincial distribution of (log) output per worker as measured in firms (red line) with the distribution of (log) Vote Counting Rates (black line). Both measures are normalized around zero. The two productivity measures show similar geographical dispersion.

Figure 5: **Distributions of Value Added per Worker and Value Added per Efficiency Unit**



Note: The figure plots the provincial distribution of (log) output per worker as measured in firms (red line) and under the counterfactual that all provinces had the same labor efficiency (black line). Both measures are normalized around zero.

Figure 6: **Changes in VCR (2013-16) and Unemployment/Wages (2012-15)**



Note: The figure compares the change in (log) unemployment (left panel) or wages (right panel) from 2013 to 2015 with the change in (log) vote counting rates from the election of 2013 to the referendum of December 2016. This suggests that opportunity cost of time was not an important incentive in driving vote counting times. The correlations have the "wrong signs", are statistically significant, with R^2 close to zero.

Table 1: **Vote Counter Characteristics**

	Presidents	Secretaries	Poll Workers
Age	43.46	35.32	32.89
% Male	.54	.36	.35
Years of Education	14.73	14.04	12.16
% With Experience	.89		
% Not Working	.08	.27	.44
% Students	.04	.2	.31
% Unemployed	.04	.08	.13
% Working	.88	.66	.42

Note: This table reports vote counters' characteristics in the 2013 elections as per our survey of all municipalities in Italy. The response rate was 19%. Each column gives statistics for one category of electoral volunteer. *With Experience* gives the share of polling station presidents who presided in a previous election.

Table 2: **The Importance of VCR in Labor- and Skill-Intensive Sectors**

	(1)	(2)	(3)
Capital Intensity × ln (Capital)	0.66***	0.67***	0.67***
	(0.01)	(0.01)	(0.01)
Labor Intensity × ln (Yrs. Schooling)	0.94***	0.97***	0.97***
	(0.17)	(0.17)	(0.17)
Labor Intensity × ln (VCR)		0.37***	0.43***
		(0.10)	(0.10)
Skill Intensity × Labor Intensity × ln (VCR)			-0.19**
			(0.09)
Adjusted R^2	0.24	0.24	0.24
Municipality FE	YES	YES	YES
Industry FE	YES	YES	YES
Observations	77,448	77,448	77,448

Note: The dependent variable is value added per worker at the firm level. All regressions include municipality and industry fixed effects. Capital intensity and skill intensity are industry-level variables calculated from the NBER-CES database. Capital intensity is measured as on one minus the ratio of the cost of employees to value added. Labor intensity is measured as the ratio of production workers' compensation to total employee compensation. ln(Capital) is the log of capital per worker at the firm level. ln(Yrs. Schooling) is the log of years of schooling at the province level. The first two rows residualize value added per worker from the contributions of factors of production–physical and human capital. The third row shows that value added per worker is more correlated with VCR in labor intensive sectors, as could be expected from a measure of labor efficiency. The fourth row shows that value added per worker is less correlated with VCR in skill-intensive sectors, as could be expected from labor efficiency as measured in the low-skilled vote counting task. The standard errors reported in parentheses are clustered at the industry level. Similar results hold when clustering at the provincial level. Statistical significance is denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: **Variance Decomposition of Output per Worker**

	k	k ,h	k, h ,VCR	A	IQR	% Decline in IQR
Standard Production Function	0.21	0.30	-	0.70	21.5%	-
Baseline	0.21	0.30	0.77	0.23	14.8%	31%
Election 2013	0.21	0.30	0.93	0.07	12.3%	43%
Referenda	0.21	0.30	0.69	0.31	16.1%	25%
VCR Adjusted for task complexity	0.21	0.30	0.73	0.27	13.2%	39%
Controlling for Volunteer Characteristics	0.21	0.30	0.69	0.32	18.9%	15%
# Polling Stations FE	0.21	0.32	0.81	0.19	15.3%	29%
Municipalities w/ 1-2 Polling Stations	0.21	0.32	0.74	0.26	18.5%	14%

Note: This table gives results from a development accounting exercise that decomposes output per worker into variance that can be captured with factors of production (physical capital K, human capital as measured by years of schooling$h$), labor efficiency as measured by the vote counting rate (VCR), and residual variation (TFP, A). It then gives the difference in TFP between provinces at the 25^{th} and 75^{th} of the TFP distribution. Finally, the last column gives the reduction in the IQR resulting from TFP being further residualized from labor efficiency as captured by VCR, relative to a production function without VCR. The production function is given by (2). The first row uses a production function without VCR. The remaining rows use different measures of VCR. *Baseline* averages vCR across all elections and all polls for each municipality. *Election 2013* uses only the election, *Referenda* uses only the referenda. The next two rows use VCR in the elections, and control for variation in vote counting complexity and vote-counter characteristics as outlined in Section 6.1. The 7^{th} row uses VCR after controlling for fixed effects for the number of polling stations. The final row uses VCR averaged only across municipalities with one or two polling stations. These last two rows allay concerns that results are driven by extreme values in municipalities with many polling stations as discussed in Section 6.1.

Table 4: **Vote Counting Rate and Human- and Social-Capital**

	(1)	(2)	(3)	(4)	(5)
Absenteeism	-0.01***		-0.01***	-0.00	-0.01***
	(0.00)		(0.00)	(0.01)	(0.00)
Blood Donations	0.11		0.51	0.09	0.36
	(0.88)		(0.91)	(1.13)	(0.88)
Trust	1.64***		1.48***	1.58***	1.46***
	(0.22)		(0.27)	(0.33)	(0.27)
PISA test score		2.19***	-0.41		-0.39
		(0.44)	(0.59)		(0.57)
Management Quality		-0.03	-0.06		-0.06
		(0.04)	(0.04)		(0.04)
Education (years, president)				0.01	
				(0.01)	
Education (years,poll workers)				0.04***	
				(0.01)	
Students (%, president)				-0.24**	
				(0.09)	
Students (%, poll workers)				0.14***	
				(0.05)	
Unemployed (%, president)				-0.12	
				(0.08)	
Unemployed (%, poll workers)				-0.02	
				(0.07)	
Mafia					0.02
					(0.04)
Corruption					-0.01
					(0.01)
Area FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.28	0.12	0.22	0.30	0.22
Province	93	102	88	91	88
Observations	5588	6905	5243	767	5243

Note: The dependent variable is Vote Counting Rates at the municipal level, with data pooled from the election and both referenda. *Absenteeism* gives number of annual sick days taken by public employees in the municipality. We use this as a measure of "work ethic". *Blood Donations* measures the number of blood bags per million inhabitants in each province (ranging from 0 to .11). It is used to measure "civic duty". *Trust* is the average trust score based on the World Value Survey for Italy between 1990 and 1999. *Management Quality* is the average quality of management in the Region, from the World Management Survey. *PISA Test Score* is the PISA test score in the Region, measuring human capital as captured by standardized test scores. *Mafia* gives the average (2005-13) annual number of penal actions taken due to mafia-type association in the province per 100,000 inhabitants. *Corruption* gives the average (2005-10) annual number of crimes and prosecutions for corruption in the province per 100,000 inhabitants. The remaining variables give average years of schooling, the share of students, and the share of unemployed among poll workers and presidents using survey data for surveyed municipalities. All regressions include fixed effects for the two referenda and for broad geographical Areas. The standard errors reported in parentheses are clustered at the provincial level. Statistical significance is denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: **The Role of Trust in a Contentious Task**

	(1)	(2)	(3)
Challenged	-135.52***	-135.54***	-118.58***
	(43.64)	(43.65)	(43.96)
Trust	1.76***	1.75***	1.49***
	(0.19)	(0.22)	(0.21)
Challenged × Trust	153.98***	153.99***	134.35**
	(52.68)	(52.69)	(53.17)
Blank			-5.21***
			(0.82)
Invalid			-5.22***
			(0.63)
Area FE	No	Yes	Yes
Adjusted R^2	0.34	0.34	0.37
Provinces	99	99	99
Observations	21445	21445	21445

Note: The dependent variable is the Vote Counting Rate at the municipal level, with data pooled from the election and both referenda. *Challenged*, *blank*, and *invalid* are the percent of challenged, blank, and invalid votes in the municipality, respectively. *Trust* is the average trust score based on the World Value Survey for Italy between 1990 and 1999. The original survey asked "how much [do] you trust other Italians in general?" with responses ranging from (1) "Do not trust them at all" to (5) "Trust them completely". The measure is then normalized to be between zero and one. Regressions include fixed effects for both referenda. VCR is negatively correlated with challenged votes and positively correlated with Trust. Challenged votes have a smaller impact on productivity where trust is high. The standard errors reported in parentheses are clustered at the provincial level. Statistical significance is denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix (For Online Publication)

A Appendix: Supplementary Figures & Tables

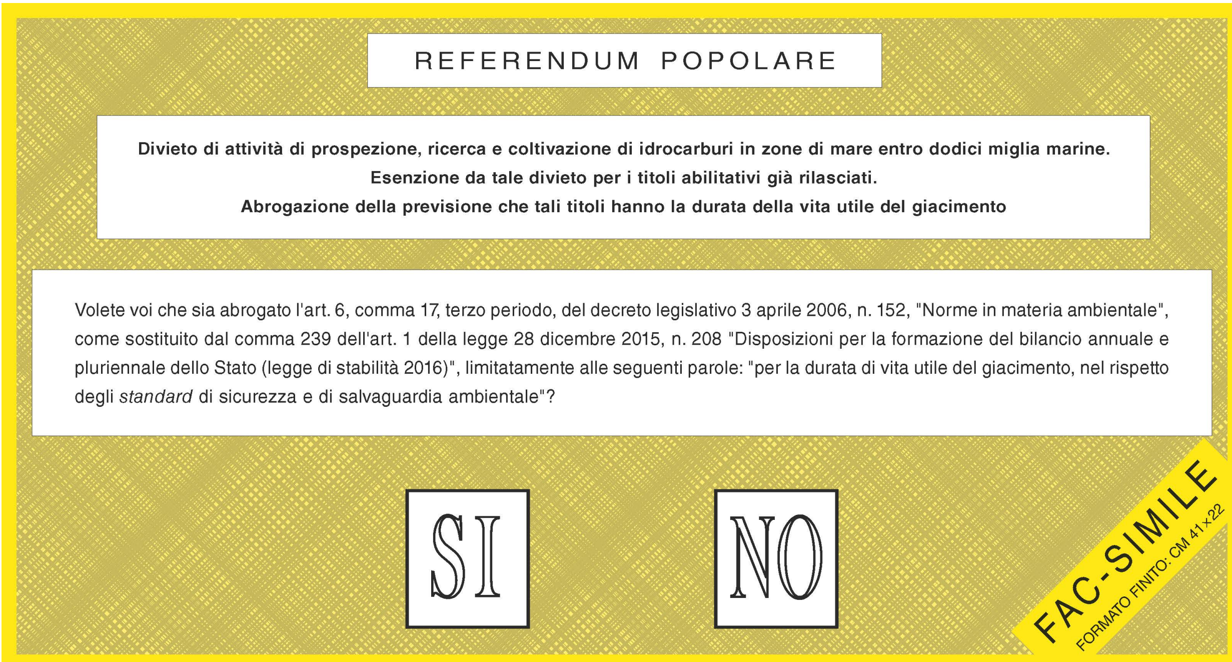
Figure A.1: **Sample Ballots: Election 2013**

Panel A: Piemonte

Panel B: Sicily

Figure A.2: **Sample Ballots: Referenda**

Panel A: April 2016



Panel B: December 2016

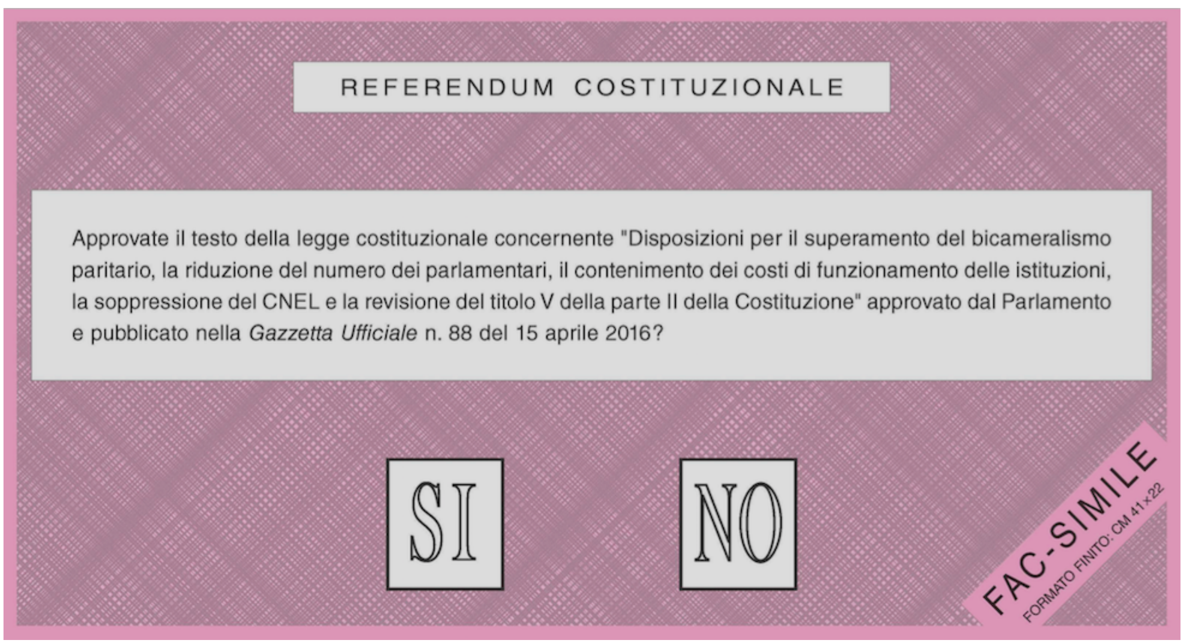
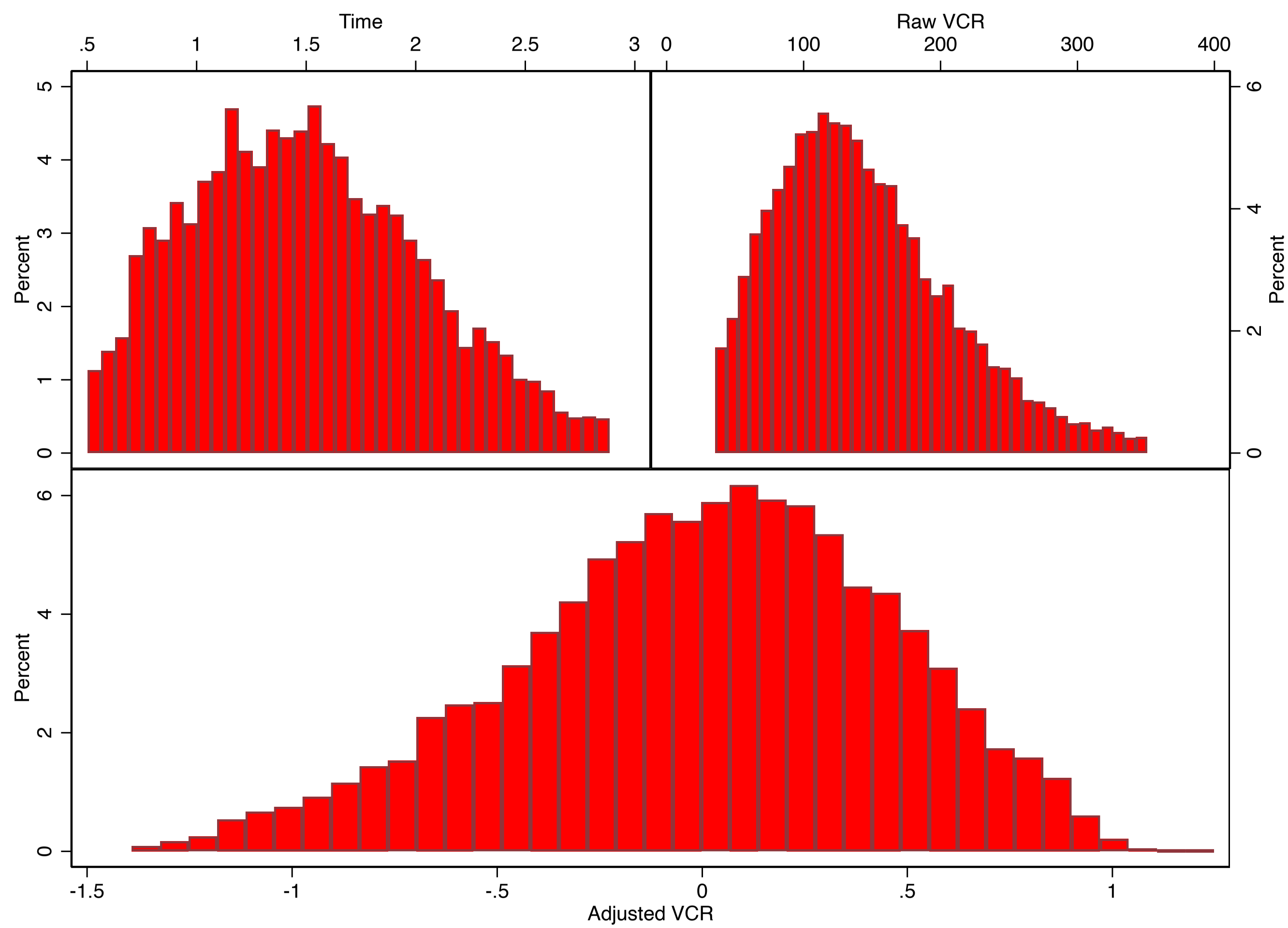
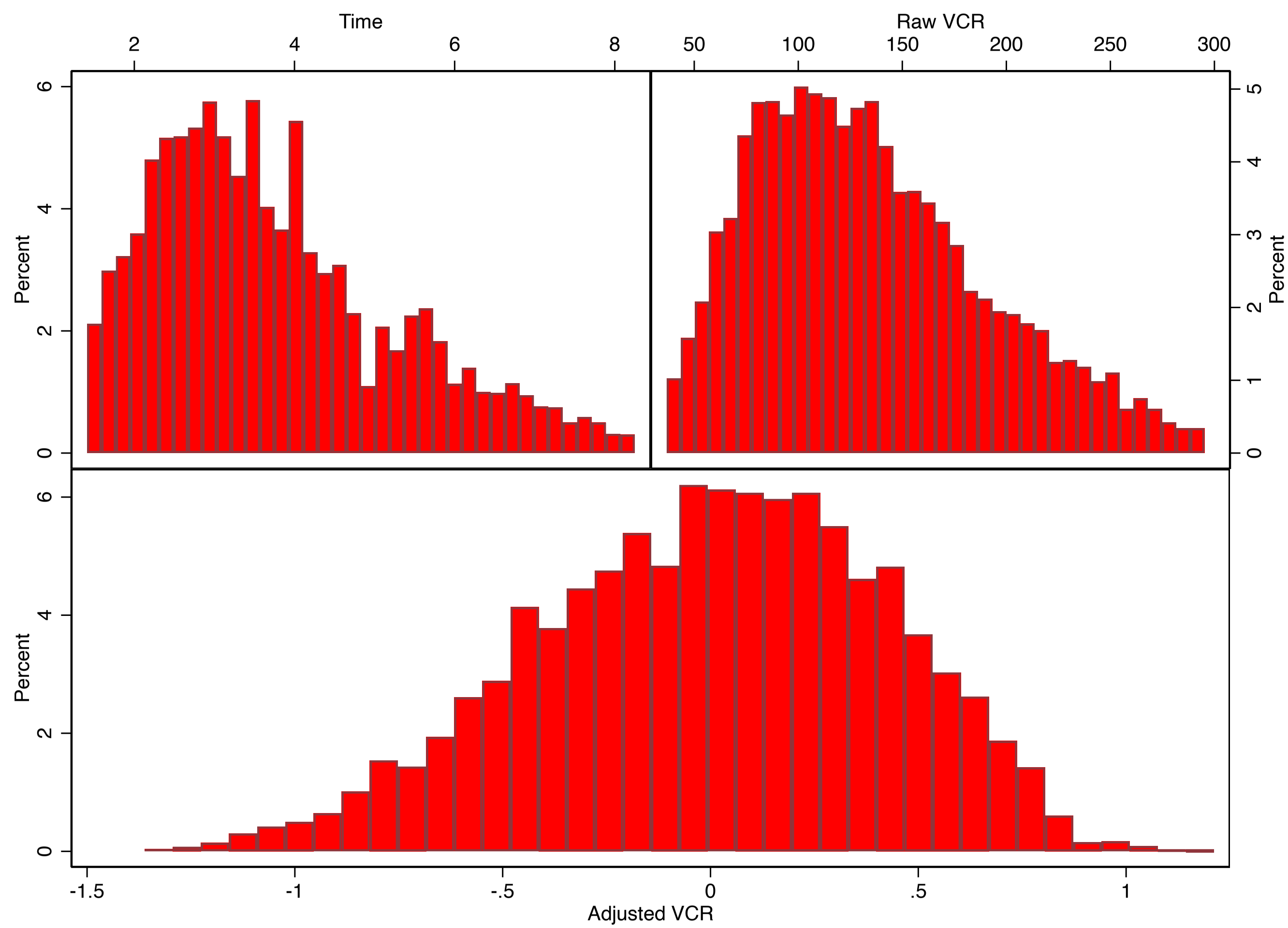


Figure A.3: **Vote Counting Time and Rates in the April 2016 Referendum**



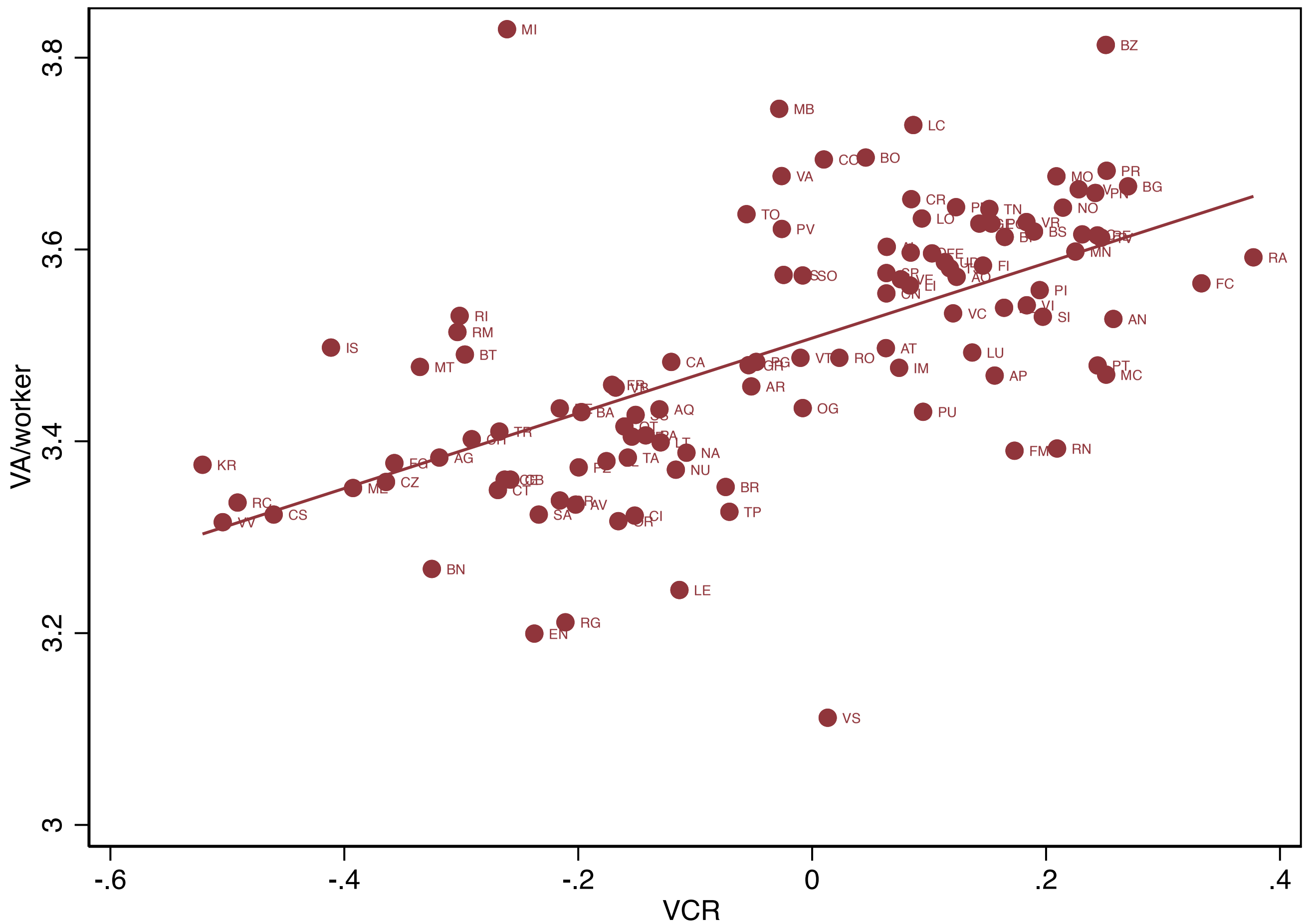
Note: The figure plots the distributions of vote counting times (top left), vote counting rates (top right) and Adjusted Vote Counting Rates (bottom) in the referendum of April 2016. The adjusted vote counting rate adjusts for the complexity of the vote counting task, as reported in Table A.3.

Figure A.4: **Vote Counting Time and Rates in the Senate Election 2013**



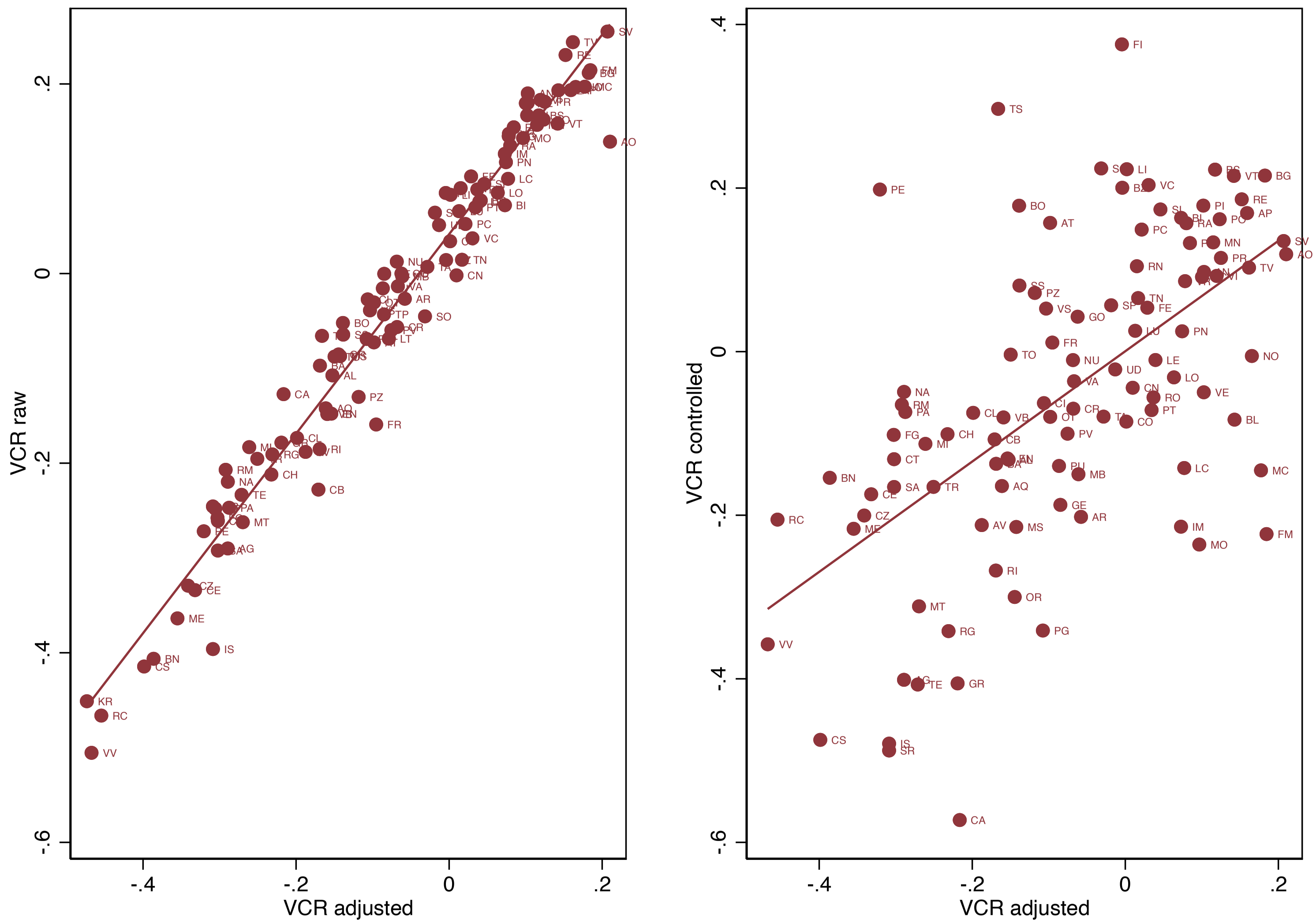
Note: The figure plots the distributions of vote counting times (top left), vote counting rates (top right) and Adjusted vote counting rates (bottom) in the election of 2013, using vote counting times in the senate. The adjusted vote counting rate adjusts for the complexity of the vote counting task, as reported in Table A.3.

Figure A.5: **Vote Counting Rates and Value Added Per Worker across Italian Provinces**



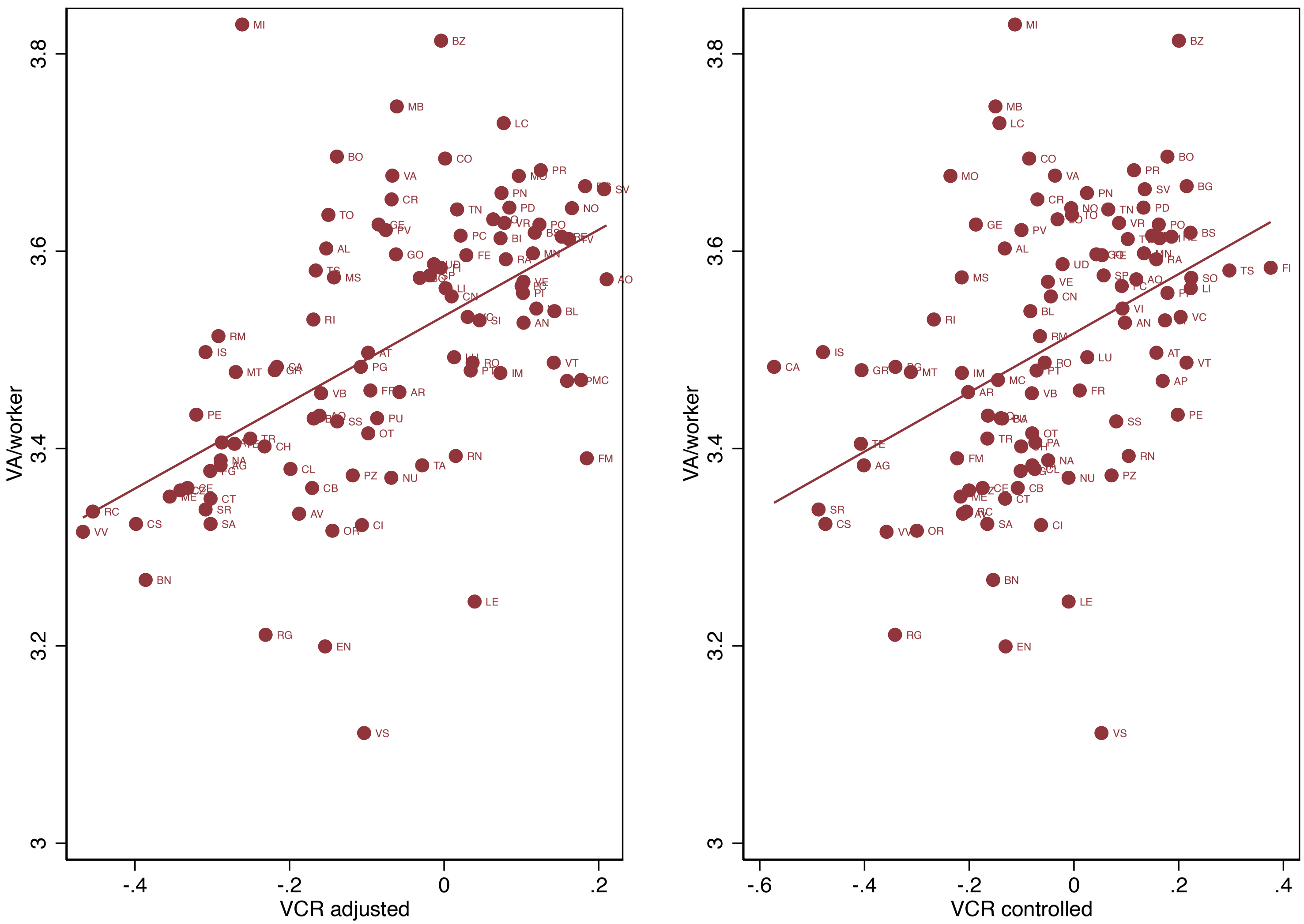
Note: The figure compares (log) vote counting rates in the election of 2013 with value added per worker in Italian provinces. VCR is normalized around zero.

Figure A.6: **VCR, Adjusted VCR, and Controlled VCR**



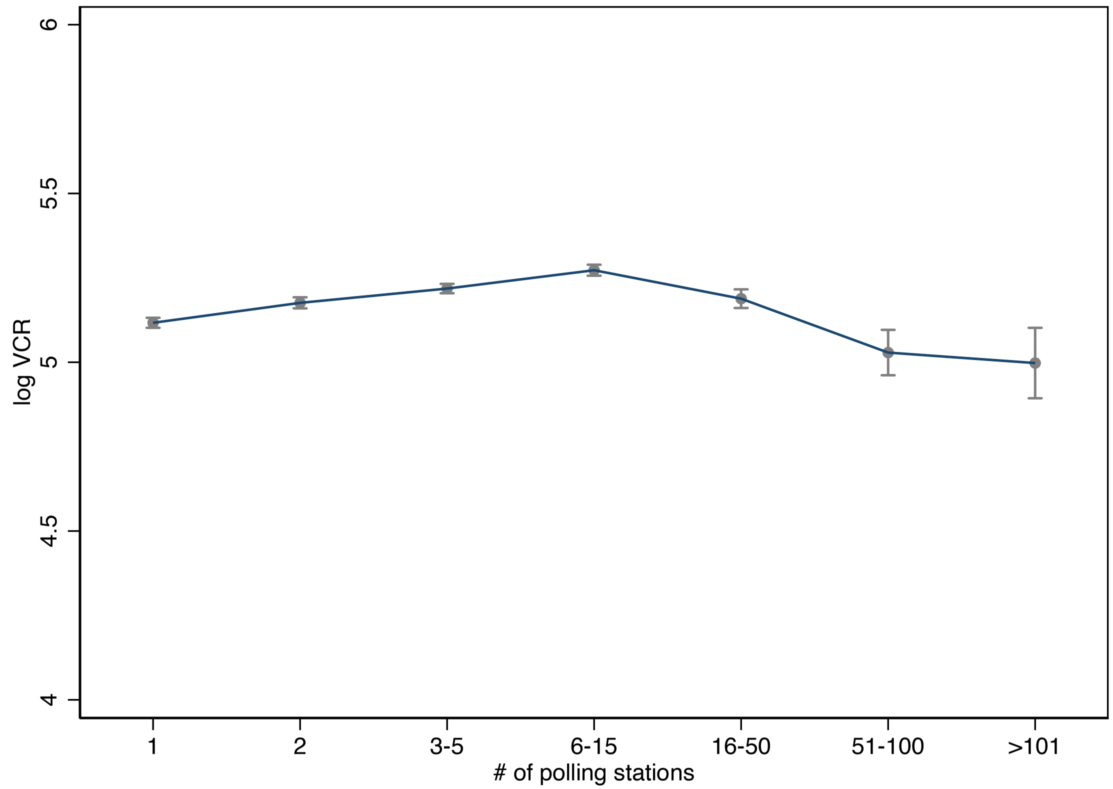
Note: The figure compares three measures of vote counting rates. The left panel compares (log raw) VCR with Adjusted VCR, which controls for the complexity of the vote counting task. Raw VCR is normalized around zero and Adjusted VCR is centered around zero by construction. The Spearman correlation coefficient is 0.98. The right panel compares Controlled VCR and Adjusted VCR, where the former controls also for vote-counter characteristics. The Spearman correlation coefficient is 0.70.

Figure A.7: **Adjusted/Controlled VCR and Value Added per Worker**



Note: The figure compares VCR with value added per worker. The left panel uses Adjusted VCR, which controls for the complexity of the vote counting task. The right panel uses Controlled VCR, which also controls for vote-counter characteristics.

Figure A.8: **Number of Polling Stations and Vote Counting Rate**



Note: The figure plots the parameters from a regression of vote counting rates on bins of number of polling stations, with standard errors shown with whiskers. Vote counting rates don't appear to be associated with the number of polling stations in a municipality.

Table A.1: **Representativeness of Survey Sample of Vote Counter Characteristics**

		Surveyed Municipalities				All Municipalities			
		Mean	SD	Min	Max	Mean	SD	Min	Max
North West	VCR	218.5	68.5	61.5	396.6	202.0	68.3	60.3	397.5
	# Polling Stations	6.3	31.8	1	653	5.1	31.8	1	1248
North East	VCR	238.4	67.6	83.5	397.6	234.0	66.3	63.0	397.5
	# Polling Stations	7.2	15.9	1	187	8.5	23.7	1	445
Center	VCR	213.9	65.9	82.1	365.4	193.2	61.6	60.6	379.2
	# Polling Stations	8.6	14.8	1	103	12.4	90.0	1	2600
South and Islands	VCR	151.1	47.6	61.1	318.3	153.7	46.4	60.5	370.8
	# Polling Stations	5.8	8.5	1	71	8.9	28.7	1	886

Note: The table compares vote counting rates and the number of polling stations in municipalities that responded to our survey on vote counter characteristics with those in all municipalities. The four rows correspond to four macro areas of the country. The sample appears representative in terms of municipality size and vote counting productivity.

Table A.2: VCR Using Counting Times from the Last and Mean Polling Stations

	(1)
VCR (mean)	0.866***
	(0.018)
# of polling stations	-0.005
	(0.005)
VCR (mean) $\times$ # of polling stations	0.001
	(0.001)
Adjusted R^2	0.803
Observations	619

Note: The dependent variable is the Vote Counting Rate calculated using the vote counting time of the last polling station in the municipality. VCR (mean) is the Vote Counting Rate calculated using the vote counting time of the average polling station in the municipality. There is nearly a one-to-one mapping between the two VCR measures. "Last" VCR isn't correlated with the number of polling stations and the number of polling stations doesn't affect the mapping between "mean" and "last" VCR.

Table A.3: **Vote Counting Rates and Complexity of Vote Counting Task**

	Election 2013 - Total			Election 2013 - Senate		
	(1)	(2)	(3)	(4)	(5)	(6)
Challenged	-11.03	-10.45	-8.02	-18.35	-16.49	-29.59***
	(8.64)	(9.16)	(12.10)	(12.23)	(11.85)	(10.63)
Blank	-7.37***	-7.04***	-5.47***	-4.64***	-4.39***	-3.97***
	(1.16)	(1.10)	(0.94)	(1.03)	(0.81)	(0.79)
Invalid	-4.88***	-5.07***	-2.97***	-4.13***	-4.34***	-3.02***
	(0.83)	(0.72)	(0.51)	(0.83)	(0.68)	(0.64)
Close Chamber		-0.19	-0.30			
		(0.33)	(0.35)			
Close Senate		0.22*	0.12		0.19	-0.12
		(0.12)	(0.13)		(0.14)	(0.15)
HHI Chamber		-0.36	-0.28			
		(0.43)	(0.56)			
HHI Senate		0.06	0.29		-0.22	0.37
		(0.39)	(0.43)		(0.29)	(0.34)
# parties (Chamber)		0.01	0.03***			
		(0.00)	(0.01)			
# parties (Senate)		-0.01***	-0.01***		-0.01***	-0.00
		(0.00)	(0.00)		(0.00)	(0.00)
Adjusted R^2	0.13	0.15	0.13	0.06	0.08	0.05
Provinces	110	110	102	110	110	103
Observations	7589	7589	3318	7589	7589	3332

Note: The dependent variable is the log of Vote Counting Rates. In the first three columns VCR is measured for the general election of 2013 using *total time*: the time that Chamber of Deputy election results from the last polling station in the municipality were reported, minus 3pm. In the last three columns, VCR is measured for the general election of 2013 using *Senate time*: the time that Senatorial election results from the last polling station in the municipality were reported, minus 3pm. Columns three and six include only municipalities with no more than two polling stations. *Challenged* is the percentage of challenged votes. *Blank* is the percentage of ballots that were left blank. *Invalid* is the percentage of ballots that were deemed incompatible with the voting procedure. # *parties* is the number of parties on the ballot in municipality i. *HHI* is the Herfindahl-Hirschman index of the distribution of votes across parties in the elections. *Close* is the percentage point difference between the first two coalitions with the highest vote shares. # *parties*, *HHI* and *close* are computed separately for the Chamber of Deputies (*Chamber*) and Senatorial (*Senate*) elections. The standard errors reported in parentheses are clustered at the provincial level. Statistical significance is denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4: **Vote Counting Rates and Complexity of the Vote Counting Task: Referenda**

	Referendum - April 2016			Referendum - December 2016		
	(1)	(2)	(3)	(4)	(5)	(6)
Challenged	3.47	3.67	4.57	-18.07	-21.59	-19.07
	(2.89)	(2.80)	(3.35)	(19.14)	(18.72)	(20.86)
Blank	-6.91***	-6.55***	-4.62***	-13.30***	-17.76***	-12.61***
	(1.10)	(1.06)	(1.09)	(2.94)	(2.24)	(2.03)
Invalid	-9.13***	-8.89***	-6.87***	-5.76***	-5.81***	-5.27***
	(0.90)	(0.95)	(0.78)	(0.78)	(0.73)	(0.76)
Yes vote share		0.21	0.79***		0.72***	0.20
		(0.26)	(0.23)		(0.11)	(0.14)
Adjusted R^2	0.07	0.07	0.07	0.03	0.05	0.03
Provinces	110	110	103	110	110	103
Observations	7589	7589	3331	7585	7585	3321

Note: The dependent variable is the log of Vote Counting Rates. In the first three columns, VCR is measured for the Referendum of April 2016 . In the last three columns VCR is measured for the Referendum of December 2016. Columns three and six include only municipalities with no more than two polling stations. *Challenged* is the share of challenged ballots. *Blank* is the share of ballots that were left blank. *Invalid* is the share of ballots that were deemed incompatible with the voting procedure. *Yes vote share* is the percentage of votes in favour of "YES". The standard errors reported in parentheses are clustered at the provincial level. Statistical significance is denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5: **Vote Counting Rates and Vote Counter Characteristics**

		Election 2013 - Total			Election 2013 - Senate		
		(1)	(2)	(3)	(4)	(5)	(6)
Age	President	0.00	0.00	0.00	0.00*	0.00*	0.00*
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Team	-0.00	-0.00	-0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% male	President	0.08**	0.08**	0.08**	0.07	0.07	0.08*
		(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
	Team	-0.13*	-0.12	-0.11	-0.26***	-0.25***	-0.21**
		(0.08)	(0.08)	(0.08)	(0.09)	(0.09)	(0.09)
Education	President	0.01	0.01	0.00	0.01	0.01	0.01
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
	Team	0.06***	0.06***	0.06***	0.07***	0.07***	0.07***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
% students	President	-0.12	-0.14	-0.14	-0.15	-0.17	-0.14
		(0.11)	(0.11)	(0.11)	(0.16)	(0.16)	(0.16)
	Team	0.42***	0.40***	0.40***	0.35***	0.31***	0.34***
		(0.08)	(0.08)	(0.08)	(0.10)	(0.10)	(0.10)
% employed	President	-0.03	-0.04	-0.05	-0.00	-0.02	-0.02
		(0.05)	(0.05)	(0.05)	(0.08)	(0.07)	(0.07)
	Team	0.26***	0.24***	0.24***	0.12	0.07	0.09
		(0.07)	(0.07)	(0.07)	(0.09)	(0.09)	(0.08)
% previous experience	President	0.07	0.05	0.05	0.12**	0.11*	0.10*
		(0.04)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Other controls		Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2		0.24	0.25	0.25	0.15	0.15	0.18
Provinces		104	104	104	104	104	104
Observations		919	919	919	916	916	916

Note: The dependent variable is the log of Vote Counting Rates (VCR). In the first three columns VCR is measured for the general election of 2013 using *total time*. In the last three columns VCR is measured for the general election of 2013 using *Senate time*. Columns 1 and 4 include controls from the first column of Table A.3. Columns 2 and 5 include the full set of controls from Table A.3. Columns 3 and 6 include additional dummies for the number of polling stations in each municipality. Rows indicated with "President", control for characteristics of polling station Presidents in the municipality. Rows indicated with "Team" control for characteristics of non-managerial polling station workers (poll workers and secretaries) in each municipality. *% male* is the percent of male vote counters. *Age* is their average age. *Education* represents years of schooling. *% students* is the share of vote counters who listed their occupation as "student". *% employed* is the share of vote counters who were employed. *% previous experience* is the percent of Presidents who had pervious experience as polling-station president. The standard errors reported in parentheses are clustered at the provincial level. Statistical significance is denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.6: **VCR and Vote Counter Characteristics: Additional controls and interactions.**

	Election 2013 - Total			Election 2013 - Senate		
	(1)	(2)	(3)	(4)	(5)	(6)
South-Center × Age	0.00	0.00	0.00	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
North × Age	0.00	0.00	0.00	0.01	0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
South-Center × % male	-0.32*	-0.33**	-0.30*	-0.30	-0.29	-0.25
	(0.16)	(0.16)	(0.16)	(0.22)	(0.21)	(0.21)
North × % male	0.01	0.04	0.06	-0.10	-0.09	-0.06
	(0.11)	(0.10)	(0.10)	(0.12)	(0.11)	(0.11)
South-Center × Education	0.06***	0.05***	0.05***	0.07***	0.07***	0.07***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
North × Education	0.06***	0.06***	0.06***	0.08***	0.09***	0.08***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
South-Center × % students	0.14	0.13	0.14	0.16	0.14	0.18
	(0.15)	(0.15)	(0.15)	(0.23)	(0.22)	(0.23)
North × % students	0.34***	0.26***	0.27***	0.17	0.14	0.17
	(0.09)	(0.08)	(0.08)	(0.13)	(0.12)	(0.12)
South-Center × % employed	0.22*	0.22*	0.22*	0.11	0.05	0.08
	(0.12)	(0.12)	(0.12)	(0.16)	(0.15)	(0.14)
North × % employed	0.04	-0.04	-0.04	-0.16	-0.21	-0.19
	(0.09)	(0.10)	(0.10)	(0.13)	(0.13)	(0.13)
South-Center × % experience	0.07	0.10	0.11	0.05	0.05	0.05
	(0.08)	(0.07)	(0.07)	(0.11)	(0.11)	(0.11)
North × % experience	0.14***	0.10*	0.09	0.26***	0.23***	0.22***
	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
South-Center × random	-0.08*	-0.09*	-0.09**	-0.07	-0.06	-0.06
	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
North × random	-0.09**	-0.08*	-0.08*	-0.08**	-0.09**	-0.09**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Adjusted R^2	0.28	0.30	0.31	0.15	0.16	0.18
Province	104	104	104	104	104	104
Observations	870	870	870	869	869	869

Note: See notes to Table A.5. The dependent variable is the log VCR. This regression interacts vote counter characteristics with dummies for the north of Italy or the South-Center. *random* is a dummy equalling one if vote counters were randomly selected among the list of volunteers in the municipality and zero otherwise. The standard errors reported in parentheses are clustered at the provincial level. Statistical significance is denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.7: **Decomposition of Output Per Worker Including all Variances and Covariances**

Production Function:	Conventional	with VCR
var($ln(y)$)	.02	.02
var($\alpha ln(k))/var(ln(y))$	.36	.36
var($(1-\alpha)ln(h))/var(ln(y))$	.02	.02
var($ln(A))/var(ln(y))$	.83	.76
cov($\alpha ln(k), (1-\alpha)ln(h))/var(ln(y))$	.03	.03
cov($ln(A), \alpha ln(k))/var(ln(y))$	-.17	-.19
cov($ln(A), (1-\alpha)ln(h))/var(ln(y))$	.04	.02
var($(1-\alpha)ln(VCR))/var(ln(y))$	.	.79
cov($\alpha ln(k), (1-\alpha)ln(VCR))/var(ln(y))$	.	.02
cov($(1-\alpha)ln(h), (1-\alpha)ln(VCR))/var(ln(y))$	.	.02
cov($ln(A), (1-\alpha)ln(VCR))/var(ln(y))$	.	-.36
Fraction of variance in $ln(y)$ attributable to productivity	.57	-.29
Proportional reduction in variance of $ln(y)$ from VCR gaps	.	.15

Note: Variance decomposition of output per worker with full variances and covariances, following Weil (2007). The left hand column uses a production function $y_p = \alpha k_p + (1-\alpha)h_p$, where p is the province, y is output per worker, k is physical capital per worker, and h is human capital, all in logs. The right hand column gives a production function that includes labor efficiency, measured by the vote counting rate VCR: $y_p = \alpha k_p + (1-\alpha)(h_p + VCR_p)$

B Institutional Setting: Further Details on Vote Counting in Italy

Our main variable of interest is vote counting times in three separate polls: The Italian general election of 2013; the oil and natural gas drilling referendum of April 2016; and the constitutional referendum of December 2016. We first describe each of these polls and then discuss the vote counting process and the broader administrative setting, which were similar in all three polls.

B.1 The General Election of 2013

The general election of 2013 was held on Sunday and Monday, 24-25 of February, 2013. Modern Italian elections take place over two days to avoid congestion and delays towards polling station closing times. In the 2013 elections, polls closed at 3pm on Monday, following a full election day on Sunday.

The elections determined 630 members of the Chamber of Deputies (*Camera dei Deputati*) and the 315 elective members of the Senate (*Senato della Repubblica*). Constituencies for the Senate correspond to the 20 Italian Regions (plus 6 Senators representing Italians living abroad). For the Chamber of Deputies, the country is divided into 26 constituencies, corresponding to the 20 Regions, with most Regions containing one constituency and with six multi-constituency Regions. Political parties may organize in coalitions (e.g. left and right). Representation for parties and coalitions is proportional: at the national level for the Chamber of Deputies and at the Regional level for the Senate.[43] More than 40 parties participated in the election, but all viable ones were in one of four coalitions. Turnout in the election was 75% at 35 million.

Voters entering a polling station received ballots for the two elections and a pencil. They were required to mark one party on each ballot, fold the ballots, and insert them into a ballot box. Figure A.1 in the appendix shows sample Senatorial ballots from two Regions: Piemonte in the north and Sicily in the South. While there were slight differences due to the presence of Regional parties and in the ordering of coalitions, the ballots were similar in their design and complexity. Ballots for the Chamber of Deputies were even more uniform across Regions.

B.2 The Oil-Drilling Referendum of April 2016

A nationwide referendum on oil and natural gas drilling was held in Italy on Sunday, April 17, 2016, with polling stations closing at 11pm. The referendum was called by nine Regional councils in response to a law passed by the national government that allowed existing offshore drilling facilities to remain in operation until they are fully depleted.[44] The referendum asked whether the government should stop renewing offshore drilling licenses within 12 nautical miles of the coast. The ballot contained two options: “Yes” and “No”.[45]

[43] In addition, the largest party or coalition receives a bonus that increases its representation to 55% of the seats, with the remaining parties and coalitions represented proportionally within the remaining 45%.

[44] The nine Regions were Basilicata, Calabria, Campania, Liguria, Marche, Molise, Puglia, Sardegna, and Veneto.

[45] According to Italian electoral law, a turnout of at least 50% is required if a referendum is to alter existing laws. In this case, restrictions on offshore drilling would have been adopted only if 50% of eligible voters participated and in addition the majority of participating voters voted “Yes”. Due to the turnout requirement, Prime Minister Matteo Renzi–who was opposed to the referendum–called on voters to abstain from voting. Proponents of the proposition encouraged voters to participate and vote “Yes”. While 85% of participants voted “Yes”, turnout (at nearly 16 million) was only 31%, so that the proposition was rejected.

B.3 The Constitutional Referendum of December 2016

A nationwide constitutional referendum was held in Italy on Sunday, December 4, 2016, with polling stations closing at 11 pm. The referendum bundled together a number of constitutional changes relating to the size of parliament, the division of powers between the legislative bodies and between national and regional institutions, and additional reforms. The ballot contained two options: "Yes" and "No", with a "Yes" vote affirming all proposed reforms. Turnout in this referendum was 65%, with 59% of votes rejecting the constitutional reforms.

In both referenda, voters entering a polling station received a ballot and a pencil. They were required to mark either "Yes" or "No". Sample ballots used in all polling stations in Italy in each of the referenda is shown in Figure A.2 in the appendix.

B.4 The Vote Counting Process

Italy is divided into 20 administrative Regions, 110 provinces, and around 8000 municipalities (*comuni*). For electoral purposes, each municipality is divided into polling stations (*sezioni*). Clear rules regulate the number of registered voters per polling station, with a range of 500 to 1200 voters per polling station.[46] Each polling station in the election had a 6-member committee: A president, 4 poll workers, and one secretary. In the referenda, each polling station had a 5-member committee, with 3 rather than poll workers. In addition, political parties are entitled to appoint observers, who may report irregularities, but do not take part in the counting process itself.

Participation in vote counting is voluntary. Poll workers are selected by the municipal electoral commission (*commissione elettorale comunale*) from a list of volunteers. Prior to 2005, poll workers were selected via lottery. In the polls studied here, municipalities differed in the degree of discretion given to the electoral commission. Poll workers must have completed eight or more years of education and must reside in the municipality where they wish to volunteer. The president of the committee is selected by the Regional court of appeals (*corte d'appello*) from a list of volunteers and must have completed 12 or more years of education. The secretary is appointed by the president and must have completed eight or more years of education.

Poll workers and the secretary received financial compensation of €145 for their participation in the election and €104 in the referenda. Presidents received €187 in the election and €130 in the referenda. Importantly, this was a lump-sum reward for the entire one to two day process and did not depend on the number of hours devoted to counting votes. There was no direct pecuniary incentive to prolong the vote counting task, nor any reward for completing it rapidly. Employers were required by law to give poll workers a day of paid leave to compensate for their electoral work on the polling days and the day following the elections (Sunday through Tuesday in the election of 2013, and Sunday and Monday in both referenda). Poll workers were also eligible for an additional day of paid leave if vote counting extended beyond midnight. Given that polling stations closed at 3pm in the general elections, almost all polling stations completed work before midnight. In both referenda, polling stations closed at 11pm, so that the majority of polling stations completed work after midnight. Hence in the typical polling station in all polls considered, employed Poll workers were paid by their employers for the Monday and Tuesday of the week following the election.

[46] Municipalities with more than 2,000 registered voters were divided into polling stations of 750 (for municipalities with 2,001 to 40,000 voters), 850 (for municipalities with 40,001 to 500,000 voters) or 900 (for larger municipalities) registered voters. Municipalities with 1,200 to 2,000 voters had two polling stations and smaller municipalities had one polling station. Source: MINISTERO DELL'INTERNO 2 aprile 1998, n. 117 - "regolamento recante i criteri per la ripartizione del corpo elettorale in sezioni".

All polling stations were required to follow the following procedure. First, a number of preliminaries related to the voter registry are conducted. Turnout is computed and the list of voters is sent to the municipality. Second, Senate votes are counted and reported. And third, Chamber of Deputies votes are counted and reported. (In the referenda, these two steps are replaced by a single vote-counting step). We therefore have two measures for vote counting time for the general election: the time Senate results were reported and the time Chamber of Deputies results were reported. In addition, we have two vote counting measures in each referendum.

During vote counting, the following procedures were to be followed. The committee counts and records one vote at a time. If a vote is contested (e.g. by a party observer), the president is authorized to assign the vote, but must record in the register that the vote was contested. This helps ensure that contested votes don't delay the process.[47] When vote counting is complete, the president reports unofficial results to the municipality. This is done by phone, fax, or in a small number of municipalities by PDA application. The municipality then communicates the unofficial result to the Ministry of Interior. Official hard copies are then transported to the municipality.

B.5 Electoral Institutions, Local Institutions, and the Mafia

The Central Directorate for Electoral Services (*Direzione Centrale dei Servizi Elettorali*) is the main body responsible for managing and overseeing elections for the entire country. It is responsible for ensuring that polling stations are properly equipped and for providing formal polling station guidelines for all polling stations in Italy. It also tabulates the unofficial results, used in our study, that determine initial seat allocations. The Directorate is within the Italian Ministry of Interior, so that electoral institutions ensuring that electoral results are reported in a timely manner are national rather than local. Polling stations are staffed by volunteers who are typically not public employees (a plurality is students), so that vote counters' productivity isn't directly confounded with the quality of local institutions. Local governments are involved in selecting volunteers: Poll workers are selected by the municipality (in most cases randomly) and Presidents by the Regional Court of Appeals. We control for observable characteristics of both presidents and poll workers in Section **??**, in part to address differential selection of Presidents in this process.

The mafia's role in Italian society and politics is well documented (Gambetta 1996). One might be concerned that variation in mafia presence might confound measurement of vote counting productivity. However, there are several indications that the mafia had no direct effect on vote counting rates.

First, there is no indication of electoral fraud or mafia intervention in the elections and referenda studied here. Following a comprehensive study of the process, the Organization for Security and Co-operation in Europe (OSCE) expressed confidence in the integrity of the 2013 elections in Italy. OSCE reports from the last three elections in Italy (since 2006) don't mention the mafia.[48]

Second, while the mafia was historically involved in electoral fraud, the techniques used by the mafia didn't include attempts to affect vote counting itself. Hess (1973) reports a number of methods used by the mafia to influence electoral outcomes including assassination or intimidation of opponents, voting on behalf of the dead or infirm, and voter bribery and intimidation. But even in the heyday of mafia influence, it didn't attempt to affect vote counts directly. In addition, by the 1970s, such election-day mafia interventions "have been progressively stopped. Pressure

[47] We control for the number of contested votes in Section **??** and use the share of contested votes to study the causes for vote counting rate dispersion in Section 7.

[48] OSCE/ODIHR Needs Assessment Mission Report, "The Italian Republic, Early Parliamentary Elections, 24 and 25 February, 2013", 7-10 January 2013.

on the voters has become more diffuse. [Instead, a]ttempts are made to create a general atmosphere of fear and then identifying a candidate with mafioso power, so that people will not dare vote against him." (Hess 1973). Eurorpol also notes that the mafia uses threats and favors to control large amounts of votes but does not report attempts to directly affect election day proceedings in polling stations.[49]

Finally, while the mafia may have had some stake in the results of the 2013 election, it is less likely that the mafia would have been involved in the referenda, which had low stakes for the mafia's interest in local political control. Our results in the referenda are very similar to those in the election.

[49] Europol, "Threat Assessment: Italian Organized Crime," June 2013.

C Data Appendix

C.1 Vote counting data

Vote counting data, obtained from the Ministry of Interior, are described in the main text.

C.2 Value Added Per Worker in Firms

The data spans the period 2006-2013 and was downloaded from ORBIS database of Bureau van Dijk. We construct the average across these years for 110 Italian provinces. The variables are measured in thousand EUR at 2010 prices. The Italian CPI index was obtained from EUROSTAT.

Value added per worker We measure value added as the sum of average cost of employee and profit per employee. We drop observations with negative values.

Capital per worker Following Gopinath et al (2015), we construct the capital stock as the sum of tangible fixed assets and intangible fixed assets. We drop observations with negative values for intangible fixed assets and observations with negative or zero values for tangible fixed assets.[50] We delete firm-year observations where the ratio of tangible fixed assets to total assets is greater than one. We then divide the firm's capital stock with its number of employees.

Winsorization and trimming We Winsorize at the 1st and 99th percentile the variables average cost of employee, profit per employee, tangible fixed assets and intangible fixed assets. We also drop capital per worker values that are above the 99th percentile. We trimmed the sample with respect to turnover (last available year) to control for distribution of firms across provinces. We exclude the firms that are in the top decline and conduct robustness for an untrimmed sample and samples trimming the top 20 or 50 percentiles. We restrict attention to the subset of firms for which both Capital per worker and VA per worker can be calculated. Per year around 20% of the firm observations are dropped due to lack of matched data.

Weighting We weigh each firm in the province by its employment share. Results are robust to using an un-weighted sample.

Industry Control In order to control for the differences that could arise from industry decomposition across provinces, we run the following regression:

$$y_{ijp} = \beta_0 + \delta_i + \delta_p + \varepsilon_{ijp},$$

where y_{ijp} is the value added of the firm, and δ_i and δ_p are industry and province fixed effects. Province fixed effects give output per worker controlled for industry composition.

[50] For 2006 total assets were unavailable, so we didn't drop observations based on this criterion.

C.3 Factor Intensities

Factor intensities were calculated using manufacturing industry data base retrieved from the NBER-CES database based on 1997 NAICS codes. (Bartelsman & Gray 1996).[51]. Industry classifications in ORBIS were based on NACE codes. We matched NACE to NAICS codes. Where no one-to-one match was available, we took the median factor intensities for the broader NAICS industry for the corresponding NACE one.

The capital share of an industry α_i was calculated as one minus the ratio of total cost of employees to value added. The skill intensity of an industry γ_i was taken as the income share of high-skilled workers, calculated as the ratio of non-production worker wages to total wages.

C.4 Survey on Vote Counter Characteristics

Data on vote counters (*presidenti*, *segretari* and poll workers were collected directly from individual municipalities for the Italian general election on 24-25 February 2013.

First e-mail data request

We obtained a list of the e-mail addresses of 7,533 municipalities from the National Association of Italian Comuni (ANCI). Between April 18, 2016 and April 22, 2016, we contacted every address in the list using an automated e-mail. We asked them to indicate, for every individual involved in the counting process:

1. Role (*presidente*, *segretario* and *scrutatore*);
2. Birthplace;
3. Birthdate;
4. Gender;
5. Highest degree earned;
6. Occupation;
7. For Presidents: whether they had served as polling station president in the past..

Residence is known as vote counters can only be appointed in their town of residence. Finally, we also asked the municipality to indicate whether the vote counters were drawn randomly or selected by the electoral committee. We received a low initial response. This may partially be due to outdated addresses in the contact list. In many cases municipalities refused our request, directed us to a higher official, or requested further information.

Second e-mail data request

In the hope of increasing the response rate, we decided to rewrite the content of the e-mail (asking for the same set of data) and run a second round from the April 27 to April 29 , sending 7,157 emails to all those that had not yet replied. The response rate was higher, possibly by increasing the salience of the first request. In total, we were able to collect data on 1,456 of the 8,093 Italian municipalities that existed in 2013. A total of 179 municipalities refused to share data

[51] http://www.nber.org/data/nberces5809.html

because of administrative cost, privacy concerns, or data unavailability. An additional 188 municipalities replied expressing willingness to share the data but have shared the data to date

We computed the age at the time of the election using date of birth. Information on the highest degree earned was used to calculate years of schooling. Occupational data was used to determine whether vote counters were employed, self-employed, students, unemployed or out of the labor force. Given the large number of students in the sample, we employed two additional definitions of *student*, to ensure that this category was not misused. In the first we restrict students to be younger than 29; in the second we exclude individuals older than 29 or, alternately, that did not complete upper-secondary school. We used the resulting individual level variables to compute municipal and provincial average characteristics of the poll workers.