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Measuring Productivity Dispersion: Lessons From Counting One-Hundred Million Ballots

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Measuring Productivity Dispersion: Lessons From Counting One-Hundred Million Ballots

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Abstract
We measure output per worker in nearly 8,000 municipalities in the Italian electoral process using ballot counting times in the 2013 general election and two referenda in 2016. We document large productivity dispersion across provinces in this very uniform and low-skill task that involves nearly no technology and requires limited physical capital. Using a development accounting framework, this measure explains up to half of the firm-level productivity dispersion across Italian provinces and more than half the north-south productivity gap in Italy. We explore potential drivers of our measure of labor efficiency and we find that its association with measures of work ethic and trust are particularly robust.

JEL classification: O47, E24, J24, Z10.

Keywords: Labor productivity, development accounting, work ethic, cultural economics.

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1 Introduction

Measuring output per worker is an important, yet challenging, task in economics. Workers' productivity is the main driver of income differences across countries, and its growth is the main proximate cause for economic growth over time (Caselli 2005). Yet measuring workers' output is less simple than it may seem at a first glance. While it is occasionally possible to observe workers' product directly in small scale settings, e.g. an individual production line, it is more difficult to isolate their value added from that of other factors in large scale settings, e.g. across an entire country. It isn't straightforward to separate workers' contribution from that of capital or other productive factors. Further, productivity in firms is often measured as revenue per worker, which may confound productivity with market power or other market imperfections (Syverson 2011)

In this paper, we measure the productivity of electoral workers who counted ballots in a general election and two referenda in Italy. We do so not out of a particular interest in vote-counting productivity itself, but rather because the task is particularly useful in isolating workers' productivity in naturally-occurring data spanning an entire 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. Each polling station had a fixed number of vote counters and polling stations were designed to minimize variation in eligible voters per station. Using observed turnout, we calculate the number of votes counted per person-hour: a direct, output-based, measure of workers' productivity. The task is managed at the national level and is uniform across the country, with identical guidelines in all polling stations, allowing a direct comparison of workers' productivity across municipalities. The task is simple, manual, and repetitive. There is virtually no physical capital or technology involved, and it would seem that only minimal education is required to count votes productively. Direct pecuniary incentives are identical for all volunteers and involve a lump-sum payment that is independent of performance or time-on-task.

There are a number of advantages to a measure of output per worker derived from this setting. First, the vote counting task is virtually identical in all polling stations across the country. This contrasts with workers' tasks in firms, which vary substantially even within industries and within a given firm. Second, the task is very labor intensive and uses essentially no other factors of production. Hence, the setting is a laboratory that isolates workers from the capital and technology that affects, but also confounds, their productivity in most settings. Third, the task is administered at the national level, thus controlling for (the direct effects of) regional institutional differences.

Fourth, workers' direct pecuniary incentives are identical in all polling stations and isn't linked to performance. (We discuss indirect pecuniary incentives in Section 4.) Any remaining productivity differences must therefore be due to workers' ability (human capital) or intrinsic motivation to perform the task. Fifth, the task is performed at thousands of polling stations in all parts of the country. Productivity has been studied in highly comparable tasks in smaller scale settings, such as an individual production line, but not at the national level, to our knowledge. Sixth, the non-market setting insulates our measurement from market power considerations that may hamper the direct measurement of productivity in firms.

One may not be interested in vote counting speed per se, but we believe that vote counting productivity provides some insights on productivity in other settings. For a number of reasons. First, our first finding is that the dispersion in Vote Counting Rates (VCR) across Italian provinces is slightly *greater* than the dispersion in output per average worker across firms in each province. Specifically, the variance in vote counting rates is greater then that of productivity in firms and the vote counting productivity gap between northern and southern Italy is 28%, compared to a 20% north-south labor productivity difference in firms. That a regional productivity divide exists even in an identical task in a setting with rudimentary technology, virtually no physical capital, and similar pecuniary and institutional incentives, suggests large productivity differences "embedded" in the workers themselves. Second, vote counting productivity is highly correlated with productivity in firms at the provincial level. Beyond documenting this correlation, we conduct a development accounting exercise, as in Caselli (2005) and Hsieh & Klenow (2010), while allowing assuming a common factor that affects both vote counting productivity and firm level productivity. In our preferred specification, factors of production (physical and human capital) explain less than a third of the productivity variation across Italian provinces. Once the our measure of labor-efficiency is incorporated in the development accounting exercise, we account for nearly 80% of the variation.

We then apply this framework to study the productivity gap between northern and southern Italy. Economists have long pondered this productivity gap, as it is remarkable that it has shown little sign of closing, more than a century after the country's unification. We estimate that if workers in the south were as efficient as a worker in the average province in the north according to our measure, the north-south gap in measured Total Factor Productivity (TFP) would decline by two thirds. Further, value added per worker in firms has a bimodal distribution across provinces, primarily reflecting north-south differences. However, when we equalize workers' efficiency based on our measure, the bimodal labor productivity distribution disappears. Quantitatively, the gap

between the 75th and the 25th percentile province in terms of value added per worker is 21%, but it is only 12% once our measure of labor efficiency is equalized. This suggests that a substantial portion of the geographical dispersion in productivity may be attributable to efficiency embedded in workers themselves.

These exercises suggest that much of the productivity dispersion in Italy can be accounted for by labor-specific components of productivity. This leaves open the question why it is that workers differ so greatly in their productivity. We conclude our study with some suggestive evidence in this regard. We show that Vote Counting Rates are correlated with cultural factors such as trust and "work ethic". Vote counting rates are correlated with absenteeism from the workplace, even exploiting only within-Region variation across municipalities. They also correlate with survey measures of self-reported trust. Exploring mechanisms, we find that the share of contested votes (when committee members disagreed on how to assign a vote) in a municipality reduces the vote counting rate substantially in southern Italy, but not at all in the north. Moreover, contested votes slow down the process in low-trust provinces far more than in high-trust ones. This is consistent with the notion that trust facilitates productivity in group tasks that involve conflict resolution.

We address a number of factors that might cause a spurious correlation between vote counting productivity and productivity in firms. First, while the vote counting task is identical across the country in principle, the complexity of the task might be very different in practice. To address this concern, we use rich electoral data to control for factors that might differentiate the task across municipalities (e.g. the number of invalid and contested ballots, how close the election was, dispersion of votes across parties). Second, there may be differential selection of volunteers into this task across municipalities. To address this, we polled all municipalities in Italy and obtained data on vote counters' characteristics. Our results are robust to controlling for workers' characteristics (education, employment status, age, experience). Third, vote counters may differ in their opportunity cost of time. Of greatest concern is that vote counters in more productive regions have higher wages and therefore have an incentive to complete the vote counting task more rapidly. In this case, VCR is merely an indirect measure of firm-level productivity, rather than a separate productivity measure. Given the specific setting, opportunity cost in its most explicit form is unlikely to be a driver of VCR. Less than 40% of vote counters are employed (a plurality is students), so that there is less of a direct link between the opportunity cost of time and firm-level productivity. In addition, 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-series 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. Although the improvement in labor market conditions differed greatly across provinces between 2013 and 2016, these changes had no bearing on vote counting productivity.

Our study relates to a literature that attempts to measure productivity in large scale settings. Measuring productivity on a national scale is challenging, as productivity is confounded with other factors, summarized in Syverson (2011). Firm-level data often measures revenues, but measures of physical output are less common. Revenue-based measures of productivity may confound demand factors and market power with physical productivity. This has led researchers to compare firm-level productivity in industries with very uniform products and/or where productivity based on physical output is observable (e.g. the Syverson 2004 study of the concrete industry). We complement this literature by studying workers' productivity in a uniform task. Our productivity measure is highly comparable across regions as we observe physical output (number of votes counted) and inputs (number of electoral workers) directly. We measure performance in a simple, uniform, repetitive task, in a non-market setting, where differences in technology are largely moot and demand-side factors are irrelevant. The large productivity dispersion in this setting and its strong geographical correlation with firm-level productivity suggests that workers' labor efficiency may contribute substantially to observed productivity dispersion.

Methodologically, we follow the development accounting literature, summarized in Caselli (2005). Conclusions from the development accounting are sensitive to assumptions, including the parametrization of the production function. However, the general consensus is that factors of production (physical and human capital) account for less than half the variation in output per worker across countries. Once we incorporate our measure of labor efficiency, factors of production and labor efficiency together account for nearly 80% of the variation in output per worker across Italian provinces, leaving only a small role for the residual.

Our study also relates to a literature in labor economics that attempts to measure and explain labor productivity across firms or regions. A major challenge is finding relatively comparable firms or tasks. Attempts to measure workers' productivity harks back at least to Taylor (1911). A modern literature in labor economics measures worker productivity in small-scale experimental and non-experimental settings (see Bandiera *et al.* 2011 and Bloom & Reenen 2011 for reviews of this

literature). Productivity is typically measured in a single plant and/or geographical location. In contrast, we construct a comparable measure of worker productivity in an essentially identical task in every municipality of a large economy. A central question in the microeconomic literature on labor productivity is whether workers respond primarily to monetary or non-monetary incentives. It is of note in this regard that compensation isn't tied to hours worked or productivity in our setting. Hence productivity differences are primarily due to differences in ability or in non-monetary incentives.

Given the that workers in our setting have similar extrinsic incentives to perform the task in a timely manner, our findings relate to the literature on intrinsic motivation in supplying work effort. Our research thus relates indirectly to the literature on shirking (Shapiro & Stiglitz 1984), on-the-job leisure (Paulson 2015 and Burda *et al.* 2016), and absenteeism from the workplace (e.g. Ichino & Riphahn 2005).

VCR is correlated with cultural measures of intrinsic work motivation (absenteeism) and performance in group tasks (trust). As such, our paper also relates to a literature on cultural causes for differences in income per worker (**?**). Much of this literature harks back to Banfield (1958) and Putnam *et al.* (1993), who evoke cultural factors such as trust and civicness to explain differences in regional development in Italy. More recently, Guiso *et al.* (2004, 2006, 2008a,b) have studied these factors empirically. We believe that our measure of vote counting productivity complements existing measures of intrinsic motivation in contributing to common efforts (e.g. blood donations) but has the advantage of being cardinal: It is measured in units of output per worker that relates directly to other quantities of interest to economic researchers. For example, our development accounting exercise requires a measure in productivity units and illustrates the value of having a cardinal measure of labor efficiency.

Italy is by now a canonical setting for the study of cross-regional differences in economic development. Although sharing common national institutions since unification in 1861, large economic and social differences persist across Italian regions. Income per capita is nearly twice as high in northern Italy than in the south. The north's employment rate was 70% in 2012, compared with 53% in the south.[1] Workers in the north are 20% more productive than their southern counterparts.[2] Even infant mortality–very low in Italy by international standards–is far higher in the south.[3] There is a ongoing debate on the reasons for the *Mezzogiorno* problem: the sluggish

[1] ISTAT: Noi Italia, 2013

[2] Authors' calculations: see Section 3

[3] ISTAT: Noi Italia, 2013. Infant mortality in Calabria and Basilicata in the south was nearly twice that of Piemonte

development of southern Italy. (See Eckaus 1961 and Zamagni 1997 for discussions.) We show that a substantial portion of the differences in output per worker may be attributable to workers themselves, rather than the lower capital stock, technology, or worse infrastructure in the south.

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 our data, including our measure of vote counting times, and provides some summary statistics. In section 4, we translate raw vote counting times into a measure of vote counting rates that is comparable across Italian municipalities. Section 5 provides a theoretical framework to relate vote counting productivity to firm-level productivity. In this section, we conduct a development accounting exercise to see how far our measure of labor efficiency can go in accounting for productivity differences across Italian provinces. In section 6, we study reasons for differences in vote counting rates. Finally, Section 7 concludes.

2 Institutional Setting: Vote Counting in Italy

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

2.1 The General Election of 2013

The nationwide general election of 2013 was held on Sunday and Monday, 24-25 of February, 2013. Modern Italian elections take place over two days. This helps 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*). Elections were held under an electoral system of proportional representation with majority bonus, regulated by law 270 of December 2005. 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 Lombardia in the north. The latter compare favorably with the best-performing countries in the world; the former are close to the bottom of the high-income country league tables.

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. However, 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%. 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. The important thing to note about the electoral system is that due to proportional representation, the results in any given polling station were of minimal consequence for the election as a whole.

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.

2.2 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.[4] 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".

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. 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.

Voters entering a polling station received a ballot and a pencil. They were required to mark

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

either "Yes" or "No". A sample of the ballot used in all polling stations in Italy is shown in Figure A.2 in the appendix.

2.3 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 referendum.

Voters entering a polling station received a ballot and a pencil. They were required to mark either "Yes" or "No". A sample of the ballot used in all polling stations in Italy is shown in Figure A.2 in the appendix.

2.4 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.[5]

Each polling station in the election had a 6-member committee: A president, 4 vote counters (*scrutatori*), and one secretary. In the referenda, each polling station had a 5-member committee, with 3 rather than 4 vote counters. In addition, political parties were entitled to appoint observers, who may report irregularities, but do not take part in counting process itself.

Participation in vote counting is voluntary. *Scrutatori* are selected by the municipal electoral commission (*commissione elettorale comunale*) from a list of volunteers. Prior to 2005, *scrutatori* were selected via lottery. In the polls studied here, municipalities differed in the degree of discretion given to the electoral commission, with lottery remaining the norm. *Scrutatori* must have completed eight or more years of education and must reside in the municipality where they wish

[5]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".

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.

Scrutatori 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 processes and did not depend on the number of hours devoted to counting votes. Thus, 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 *scrutatori* a day of paid leave to compensate for their electoral work on the actual polling days and the day following the elections (Sunday through Tuesday in the election of 2013, and Sunday and Monday in both referenda). In addition, *scrutatori* were eligible for one more 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 the task before midnight. In both referenda, polling stations closed at 11pm, so that the majority of polling stations completed the task after midnight. Hence, in the typical polling station in all three polls considered, employed *scrutatori* were paid by their employers for the Monday and Tuesday of the week following the election.

In the general election of 2013, polls closed at 3pm on Monday February 25th in all polling stations. 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. 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 the referenda, polls closed at 11pm in all polling stations. All polling stations were to follow the following procedure. First, preliminaries related to the voter registry are conducted. Second, votes for the referendum are counted.

In each election (Senate, Chamber of Deputies, both referenda), 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 that the vote was contested in the register. This procedure helps ensure that contested votes don't delay the

procedure.[6] When vote counting is complete for the given election, the president or municipal official 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 results are then brought physically to the municipality.

The task of vote counting is manual, routine, and uniform across the country. Figure A.3 in the appendix shows pictures from the vote counting procedure.[7] Ballots are removed from the box, unfolded, and counted one by one. This is a task that requires minimal skill and involves nearly no physical capital and no modern technology.

3 Data

3.1 Vote Counting

The Ministry of Interior provided data on reporting times of electoral results at the municipal level. Municipalities reported *unofficial* results for each polling station and each election (Senate, Chamber of Deputies, referenda) in real time. As noted before, 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 of results to the ministry. For each municipality, we have two observations for the election and one for each referendum. Each observation is a time stamp indicating the time the unofficial result from the last polling station in the municipality was reported. From the raw data we construct four vote counting times per municipality. Municipality i's *Senate time* is the time that Senatorial election results from the last polling station in municipality i were reported, minus 3pm–polling station closing time. Municipality i's *total time* is the time that Chamber of Deputy election results from the last polling station in municipality i were reported, minus 3pm.[8] Municipality i's *referendum time* in either referendum is the time at which referendum results were reported minus 11pm.

Ideally we'd observe the counting time at the *average* polling station, rather than the *slowest*

[6] We control for the number of contested votes in Section 4 and find a positive association between counting time and the number of contested votes, as could be expected, but this correlation isn't statistically significant. We further use the share of contested votes in each municipality to study the causes for vote counting rate dispersion in Section 6

[7] These photos were taken from websites of a number of Italian municipalities. We cannot vouch for their authenticity, but communications with actual *scrutatori* confirm that they are representative of the nature of the task.

[8] 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 would 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.

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 that the slowest polling station in larger municipalities had longer counting times than in smaller municipalities. We address this challenge in the following section.

Figure 1 shows the distribution of (total) vote counting times in the election (left-hand panel) and the December referendum (right-hand panel).[9] The distribution for the April referendum is reported in Figure A.4 and for the Senate elections in Figure A.5, both in the appendix. The vote counting time for the average municipality 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 vote counting at 8:16 pm in the election, half past midnight in the April referendum, and nearly 1 am in the December referendum. We noted earlier that there was a potential incentive to complete the task after midnight, as this gave employed *scrutatori* 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 ending electoral activities. Indeed, we do see large masses of vote counting times at 7:30-8:00 and right before 9:00pm. An important 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.

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

3.2 Data on Vote Counters

We surveyed Italian municipalities to learn more about vote-counters' characteristics. Municipalities are required to keep a record of the identity of electoral volunteers, but aren't required to report these data to the Ministry of Interior. We sent an (unofficial) email to the relevant contact in each municipality in Italy. In the email, we explained that we were conducting research and wished to learn more about who volunteers for electoral service. 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 *scrutatori*) at each poling station, their age, gender, years of education, and employment status. In addition we asked whether the President had experience in previous elections.[10] Table 1 gives summary statistics of presidents, secretaries, and *scrutatori* in the 2013 election. *Scrutatori* and secretaries were in their mid-30s on average, and over 60% were women. Presidente were nearly a decade older on average and nearly 60% were men. *Scrutatori* had 12 years of education on average, secretaries 13, and presidents 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 39% of *scrutatori* were in full-time employment. Instead, 37% of *scrutatori* were students and nearly 9% 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. Only a small fraction of *scrutatori* were self-employed, but the self-employed comprised nearly 20% of all presidents.

3.3 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. We then calculate the average value added per worker across firms in each province from 2004-2013. We believe that the province is

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

the appropriate level of geographical aggregation to compare productivity in vote counting to productivity at firms. Vote counters must live in the municipality where they count votes, but might work in a different municipality. Similarly, the workers in our firm-level database might reside in a different municipality than the firm's location. In contrast, this problem is less likely to arise when aggregating to the province level. We average productivity over the decade preceding the election to smooth out any differential business cycle conditions across provinces. Italy was in recession during this period and the crisis had differential effects on Provinces. Averaging over a 10-year period smooths out such differential cyclical conditions.

In our preferred specification, we average value added per worker across 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 results are robust to using the former measure as well. Our results are also robust to controlling for the industrial composition of each province, thus restricting attention to within-industry productivity differences. We do so by regressing value added per worker on a set of province dummies and a set of NACE Rev. 2 four-digit dummies. Productivity in each province is then recalculated as it would have been if firms in that province had the average industrial composition of the country as a whole. This measure ensures that the productivity differences we measure are due to workers' productivity, not differences in value added per worker across industries.

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.

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 i as

$$VCR_{i,s} \equiv \frac{\tau_{i,s} v_{i,s}}{\sigma_i h_{i,s}}, \tag{1}$$

where $h_{i,s}$ is counting time for election s in municipality i in hours; $\tau_{i,s}$ is turnout as a share of total eligible voters at the municipal level; $v_{i,s}$ is the number of eligible voters in municipality i in election s; and σ_i is the number of polling stations in municipality s. Hence, $\tau_{i,s}v_{i,s}/\sigma_i$ is the number of votes to be counted per polling station in municipality i and election s. $VCR_{i,s}$ is then an approximation of the number of votes counted per polling station.[11]

A challenge with this measure is that we only observe the average number of ballots per polling station in a municipality. This measurement problem interacts with the fact that we observe the counting time $h_{i,s}$ for the *last* polling station in each municipality. Hence in equation (1) we are dividing the *average* number of votes per polling station in municipality i with the *largest* vote counting time in the municipality. We address this "last polling station" problem below.

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.4 and A.5 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.[12] Differences in vote counting rates across polls are far smaller than differences in vote counting times. This means that the majority of variation in vote counting times was due to differential turnout, rather than differential vote counting productivity.

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, with darker shades reflecting more productive provinces. 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. The correlation between VCR and firm level productivity is statistically significant. Figure A.6 shows the same information in a scatter plot of value added per worker against VCR.

[11] The number of workers is constant across polling stations, so that votes counted per worker is the same as this figure up to a constant.

[12] 134 in the Senate, 145 in the April referendum, and 254 in the December referendum, with standard deviations of 55, 63, and 100, respectively.

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. For example, the ballot may be more complex in some Regions and some municipalities may have a larger number of invalid votes, which require greater scrutiny by vote counters. To address this concern, we adjust the vote counting rate for information from the electoral rolls. Table 2 shows results from a regression of (log) VCR in the election, (*total time* in the left panel and *Senate time* on the right), on a number of factors that might affect the complexity of the task. (A similar table for the two referenda is shown in Table A.2 in the appendix.)

We first explore whether the share of challenged votes in a municipality affected the vote counting rate. As noted earlier, the polling station president is required to list every ballot that was contested and proceed without delay. Nevertheless, a contested ballot may lead to a discussion among the committee and may stall the vote counting process. As expected, municipalities with a higher share of contested votes had slower raw vote counting rates, but the relationship is statistically insignificant in most specifications.

Large numbers of invalid and blank ballots also appear to slow down the vote counting process. A one-percentage point increase in the share of blank or invalid votes lowers the vote counting rate by 7% in the election and more than 10% in the referenda. The committee may dwell on such ballots, wishing to ensure that they are truly invalid or blank before proceeding.

Columns 2 and 5 include additional controls for differences in the complexity of the task. Ballots with a larger number of parties may be harder to count. Hence we control for the number of parties in the lower house and the Senate. As expected, a larger number of parties did slow down vote counting, with an additional party causing vote counting rates to decline by 1%.

Counting votes may be easier where there is less dispersion in party affiliation. Where votes are cast for numerous parties, including large shares for smaller parties, each ballot may require more attention. Accordingly, we control for the dispersion of votes across parties in each of the elections (Senate and Chamber of Deputies) using a Herfindahl index. In practice, vote dispersion in votes didn't have a statistically significant effect on vote counting rates.[13]

Given proportional representation, the winners at the municipal level and even the Regional level are irrelevant for outcomes of the Chamber of Deputies. Referenda are determined at the national level as well. While senatorial elections are Regional, they are also based on propor-

[13]The number of parties and vote dispersion are irrelevant for the referenda and therefore excluded from the regression in Table A.2 in the appendix.

tional representation with more than one seat representing each Region,[14] making the result at any given polling station or municipality insignificant to the overall result. However, psychological factors may induce counters to scrutinize ballots more carefully where the stakes are perceived to be higher. We measure a close race by the difference between the vote shares of the two coalitions with the largest vote shares, in percentage points. However, the closeness of the election doesn't seem to have had an impact on vote counting rates.[15]

For completeness, columns 3 and 6 repeat the exercise for the sample of small municipalities with one or two polling stations. Results are essentially unchanged.

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.7 shows the distribution of Adjusted VCR in the election (left-hand panel) and the December referendum (right-hand panel). Similar figures for the April referendum and using Senate time can be found in Figures A.4 and A.5 in the appendix. VCR is adjusted using the more parsimonious specification from the first column of Table 2, but the distributions are similar when including the full set of controls.

The left-hand panel of Figure A.8 in the appendix shows that Adjusted VCR is very highly correlated with the original unadjusted measure, with a Spearman correlation of 0.98, so that the ranking of provinces is virtually the same by both measures. Further, Figure A.9 in the appendix shows that value added per worker at firms remains highly correlated with VCR after adjusting for the complexity of the task. All results that follow are also unchanged whether using the raw or adjusted measure, so we continue to use the unadjusted raw measure in our main specification.

Last vs. Average Polling Station As we have noted, we observe the vote counting time of the *last* rather than the *average* polling station in each municipality. This is of concern, because larger municipalities are statistically more likely to have an outlying polling station with an unusually large and unrepresentative vote counting time. We address this matter in two ways. First, figure A.10 in the appendix shows estimates from a non-parametric regression of log VCR (using the raw unadjusted measure) for each municipality on bins of the number of polling stations in each

[14] An exception is Val d'Aosta with one seat and a majority electoral system.

[15] Given the binary options in the referenda, the share of votes in favor of the proposition is perfectly correlated (positively or negatively) with the tightness of the referendum. We include the share of "YES" votes in each referendum as a control in Table A.2. The share of "YES" votes is statistically significant in the December referendum, but of incorrect sign, and this may be a spurious "over-control". Prime Minister Renzi happened to be particularly popular in high-productivity provinces. The referendum received the highest approval rates in South Tyrol, Tuscany, and Emilia Romagna, and these happen to be among the most productive regions in the country.

municipality. The regression is for the election using total time, but nearly identical results arise for the Senate and the referenda. There is some minor variation in VCR depending on the number of polling stations, but there is no clear relationship between the number of polling stations and VCR. Hence, there is no indication of an extreme value problem for municipalities with many polling stations. When we control for bins of the number of polling stations, the correlation between value added per worker in firms and VCR remains intact and all result that are reported below continue to hold.

Second, we restrict the sample to municipalities that had at most two polling stations, eliminating or diminishing the difference between last and average polling station. Unfortunately, we lose nearly half of all municipalities in this restricted sample and eight provinces with no such municipalities. Again, all results are robust to using this measure.

Given that the "last polling station problem" doesn't appear to affect any reported results qualitatively, we proceed with the raw VCR measure, but report robustness of our main results to the number of polling stations in the following section.

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, due to selection bias. To address this concern, we explore whether volunteers' characteristics are correlated with VCR and control our VCR measure for observables.

We surveyed all municipalities in Italy to obtain data on vote counters' characteristics in the 2013 election. We didn't make an official request for the data, so that response was voluntary. The response rate was nevertheless high at 20%. Summary statistics on vote counter characteristics can be found in Table 1. Table 3 then shows results of a regression of (log) VCR on these characteristics. As before, the two panels correspond to *total time* (on the left) and *Senate time* (on the right).[16] Results in the table are at the municipal level for the the nearly 1,000 municipalities that responded and provided complete information on vote-counters' characteristics.

We pooled the characteristics of all committee members (presidents, secretaries and *scrutatori*), but results were similar when we controlled separately for each category of polling station worker. Vote counters' age and gender had no substantial impact on vote counting productivity.

[16]We don't have information about vote counters' characteristics in the referenda so cannot conduct this exercise for the two referenda of 2016.

In contrast, measures of human capital did appear to have an important effect on vote counters' performance. An additional year of schooling for all vote counters in the municipality increased the pace of vote counting by 7%. Employment status also had an effect: a municipality with polling stations comprised entirely of employed vote counters was 27% more productive than a committee entirely comprised of volunteers who were not employed. Students were even more productive than employed vote counters.[17] Finally, experience matters. A municipality with a president with no previous experience counted votes 10% slower than one with a president with experience from previous elections. Finally, the regression includes controls for the vote counting process that were used to measure the adjusted vote counting rate described earlier.[18]

We label residuals from this regression as "Controlled" VCR, to reflect that it controls for vote counters' characteristics. Figure A.11 in the appendix shows a histogram of Controlled VCR. The right-hand panel of Figure A.8 in the appendix shows that this measure is correlated with Adjusted VCR, with a Spearman correlation of 0.6. The correlation coefficient is highly statically significant, but the correlation is imperfect. Provinces' vote counting productivity ranking is slightly altered when controlling for vote counter characteristics. Nevertheless, Controlled VCR remains correlated with value added per worker at firms, as shown in Figure A.9 in the appendix. In addition, we will show that our main results are robust to the use of this measure of VCR.

We caveat that this measure may involve over-controlling: the general population in high-productivity provinces is more educated and more likely to be employed than in low-productivity provinces. Hence, we might be inadvertently controlling for factors affecting labor productivity when controlling for vote counter characteristics, rather than merely correcting for selection on observables.

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. High opportunity cost of time may affect electoral workers' incentive to finish the vote counting task rapidly. Insofar as workers in high-productivity provinces earn higher wages, we might expect them to have a higher opportunity cost of time and count votes faster *because* they

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

[18] Column 2 (5 for the Senate) also includes the entire set of controls that appeared in Table 2 and column 3 (6 for the Senate) includes additional dummies of bins of the number of municipalities. Results are roughly the same in all three specifications.

are more productive in the workplace. If this is the case, our correlations don't reflect two separate measures of labor productivity.

We remind the reader that there are no direct pecuniary incentives to rapid completion of the vote-counting task. Payment is lump-sum and isn't tied to vote counting pace. Recall also that electoral volunteers' employers are required to compensate them during their absence, so opportunity cost is not reflected directly in forgone wages: employed vote counters' market income was unaffected by the amount of time devoted to vote counting. Nevertheless, if workers choose working hours and leisure optimally in the workplace, workers in high-wage municipalities may nevertheless face a higher opportunity cost due to a high value placed on scarce leisure. If VCR is higher because electoral workers with higher market wages have an incentive to complete the electoral task faster, then our measure is simply a consequence of market labor productivity, rather than an independent measure of productivity in a different setting.

To address this concern, we exploit the time series dimension of our data. We observe VCR in the 2013 election of and the referenda of 2016. If VCR captures intrinsic productivity, it 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 underlying economic conditions. There was much regional variation in pace of recovery from the recession (with a business cycle trough in 2012). If the opportunity cost of time is an important factor in incentivizing rapid vote counting, municipalities with stronger recoveries would have seen greater increases in VCR.

We measure the improvement in business cycle conditions using the change in unemployment or alternatively the change in wages from 2013-15. Unfortunately, at the time of writing, unemployment and wage data were still unavailable for 2016. The correlation between the log change in unemployment and the log change in VCR is shown in a scatter plot in Figure 4. The figure also presents a similar figure comparing the change in wages and VCR. 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.

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 a decrease of more than 5 to an increase of nearly 10 percentage points. There were also changes in vote counting rates, but these largely reflect an upward shift that occurred to a similar extent in all provinces. The Spearman correlation between provinces' VCR in the election and the December referendum was 0.94, alone

suggesting that VCR is largely capturing a characteristic of the province, not of particular economic circumstances. It is therefore not surprising that regressing the change in VCR on the change in unemployment (or wages) gives a tightly estimated zero with an R-square of essentially zero. By this test, find no evidence that the opportunity cost of time was a factor in determining VCR. Our results are robust to using any of our VCR measures (adjusted, including population controls, or including municipalities with less than three polling stations). It is also robust to including area fixed effects.[19]

Another aspect of opportunity cost of time that might contaminate our measure is differences in dinner time.[20] Given that vote counting in the election began at 3pm and the several hours required to count votes, dinner time could have served as an incentive, or a coordinating device, to finish the at a specific time. We are reassured by the fact that all results in the paper are virtually identical when using data from the referendum alone. Vote counting in the referendum began at 11pm, so that dinner time would not affect the opportunity cost of time.

5 Vote Counting Rate as Labor Productivity

There is much dispersion in firms' productivity, even within narrow industries. This is true for the US and even more so among emerging markets (Hsieh & Klenow 2009). Syverson (2011) reports a 65% difference between the 90th and 10th percentile plant even within narrow industries in the US. We find similar dispersion of productivity across provinces in Italy, with a 50% difference between the 90th and 10th percentile provinces. There have been many suggestions as to the causes of this dispersion, including differences in production technology, the quality of labor or capital, and market structure.

Figure 5 shows the distribution of value added per worker across Italian provinces (in red). This distribution is based on the average worker in each province, regardless of industry. Further, it is a revenue-based measure of labor productivity rather than a quantity based one, with the associated confounding factors (Syverson 2011).

The figure also presents the dispersion in VCR (in black). The dispersion is no smaller, in fact slightly larger, than that of value added per worker. In contrast to value added per worker in firms, VCR is a quantity-based measure of productivity, from a non-market setting, in a uniform

[19] We include fixed effects for South-Center, North-East, and North-West.

[20] Dinner times may themselves be endogenous to labor productivity, but explaining dining habits is beyond the scope of this paper.

task that is directly comparable across the country. Given the nature of the task, differences in VCR cannot be due to physical capital, technology, or market power. The vote counting process is managed at the national level, so this measure also controls somewhat for (the direct effects of) regional institutional differences. It is therefore interesting that a similar degree of productivity variation exists in a task of this nature. Even when individuals are put in a uniform "industry", given a uniform task, given uniform compensation, and are sheltered from market forces, there are large spatial productivity differences. Further, we have shown a correlation between productivity differences in the polling station and in the workplace. This suggests a role for a productivity factor that affects performance both in the workplace and in the simple vote counting task.

We investigate this possibility further by treating VCR and value added per worker as two separate labor productivity measures and see how far a common factor might explain productivity dispersion across firms in Italy. The framework we propose is a development accounting type variance composition.[21] Beyond standard assumptions in development accounting, we make three additional assumptions that allow us to translate VCR into labor productivity in firms.

Assumption 1: Vote counters and workers within province i share a common labor efficiency factor e_i.

Assumption 2: The vote counting technology exhibits constant returns to scale in the number of worker-hours.

Assumption 3: Labor efficiency is an exogenous worker characteristic.

The first assumption is extreme, as the vote counting task is very different from the diverse set of tasks facing workers in firms. However, this assumption puts a larger burden on vote counting efficiency in accounting for labor efficiency in firms, as vote counting productivity is likely a noisy measure of productivity in the workplace. Vote counting may exhibit increasing (learning on the job) or decreasing (fatigue) returns to scale. Absent further guidance on returns to scale, we assume constant returns as our second assumption. Finally, the third assumption is for expositional simplicity.

We posit the following vote-counting production function

$$n_{i,s} = e_i h_{i,s} l_s, \tag{2}$$

where $n_{i,s}$ is the number of votes counted in municipality i in poll (election/referendum) s; $h_{i,s}$

[21] Our methodology follows Klenow & Rodriguez-Clare (1997) most closely. See Caselli (2005) and Hsieh & Klenow (2010) for reviews of the development accounting literature.

is the number of hours devoted to vote counting; l_s is the number of electoral workers per polling station in poll s, and e_i is the labor efficiency of workers in province i. The form of the production function follows directly from the three assumptions. With this production function, equation (1) implies that VCR is a direct measure of labor efficiency e_i.

Next, we posit a production function for firms in province i. We use a standard Cobb-Douglas production function:

$$Y_i = A_i K_i^{\alpha} \left(H_i e_i L_i\right)^{1-\alpha},$$

where Y_i is the physical output of firms in province i, K_i is physical capital, L_i is the number of workers, H_i is human capital per worker, α is the labor share, A_i is total factor productivity, and e_i is labor efficiency. In framing the production function in this manner, we are assuming that e_i is a productivity measure that goes beyond traditional measures of human capital (schooling). We have demonstrated that education does affect VCR in Section 4 and Table 3. However, with H_i absorbing variation in traditional measures of human capital, variance captured by e_i will be due to aspects of human productivity that go beyond these traditional measures. Moreover, our results are robust to using Controlled VCR as a measure of labor efficiency. Recall that measure controls for vote counters' years of schooling. Writing the production function in per capita terms gives

$$y_i = A_i k_i^{\alpha} \left(H_i e_i\right)^{1-\alpha}, \tag{3}$$

where y_i and k_i are output per worker and capital per worker, respectively.

Development accounting is a decomposition of the variance in output per worker into the variance associated with observable factors of production, while assigning the residual variation to unobserved TFP A_i. Conclusions are sensitive to the underlying production function (Caselli 2005). When using a simple production function as in (3), the general consensus in existing studies is that at least 50% of the variation in output per worker across countries remains residual variation in TFP.

In our baseline variance decomposition, we follow Klenow & Rodriguez-Clare (1997), who use the following measure.

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

where X_i is a vector of quantities of measured production inputs, y_i is output per worker, and

$f(.)$ is the posited production function. In words, the variation in output per worker explained by factors of production is given by the correlation between output per worker and its predicted value, based on the production function and observed inputs. The residual variation is given by one minus this measure.[22]

In order to conduct the variance decomposition, we require measures of capital per worker and of human capital. We measure capital per worker using the firm-level data discussed in Section 3. Human capital is typically measured as the predicted value added of a year of schooling using a Mincerian regression of the average years of schooling on wages using micro data.[23] In his compilation of international micro-level evidence on the returns to schooling, Caselli (2017) determines that the returns to a year of schooling in Italy has been 4.6% in recent years. These are meagre returns by international standards, so as robustness we repeat the exercise allowing for 9.5% and 15% returns, which are the average and on the higher end of the international range, respectively.

Formally, if ϕ is the return to a year of schooling and χ_i is the average number of years of schooling in province i, then human capital is given by

$$H_i = e^{\frac{\phi}{1-\alpha}\chi_i}.$$

Finally, we use average (log) VCR in the three polls as our measure of labor efficiency e_i.

Results of the variance decomposition are summarized in Table 4. The three rows correspond to three values of returns to schooling mentioned above. A production function including capital per worker alone, $y_i = A_i k_i^{\alpha}$, explains 22% of the of the variance in output per worker, with the remaining 78% attributed to TFP. When human capital is included as well, $y_i = A_i k_i^{\alpha} H_i^{1-\alpha}$, factors of production now explain 25% to 35% of the variance, depending on the assumed returns to schooling. In all cases, the majority of variation remains unexplained. However, when we add our measure of labor efficiency to the production function, we now explain 78% of the variance in the central scenario. With our measure of labor productivity, we can now explain well over half of the variation in labor productivity across firms. In fact, labor efficiency alone explains nearly half the variance.

[22] 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 alternate measure.

[23] Hanushek & Woessmann (2012) argue that quality of education needs to be taken into account alongside years of schooling. As a robustness check, we controlled for average PISA scores at the province level. 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 e_i.

In summary, a standard development accounting exercise suggests that a common productivity factor present in both the vote counting task and at the firm level may be important in capturing the variation in output per worker across Italian provinces.

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 as measured in firms is shown in Figure 6. As noted in the introduction, the distribution is bimodal, very much reflecting the north-south productivity gap. The figure also plots the distribution in terms of efficiency units of labor, given by $\frac{Y_i}{e_i L_i}$. This distribution is "better behaved": The bimodal nature of the distribution is eliminated. To put the compression of the labor productivity distribution in quantitative perspective, 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. Thus, our measure cuts the interquartile difference 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 from firm data. We wish to assess how far our measure of labor efficiency can go in accounting for this productivity gap. To answer this question we conduct the following counterfactual exercise. We assign the median labor efficiency of northern provinces to all southern provinces whose labor efficiency is below the northern median. Under this counterfactual, using our theoretical framework, the north-south gap in output per worker would decline to 7%, cutting the north-south labor productivity gap by more than half.

Robustness We conducted a series of robustness checks, summarized in Table 5. For each specification we report the results of our main three exercises. First, we calculate the IQR in value added per efficiency unit according to the associated measure. Second, we calculate the north-south difference in labor productivity, corrected for labor efficiency as described above. Third, we report the residual from the development accounting exercise, i.e. the remaining unexplained variation after capital, human capital, and labor efficiency are incorporated in the production function.

For sake of comparison, the first row reports results uncorrected for labor efficiency. As noted, the IQR of the distribution of value added per worker is 21% and the north-south labor productivity difference is 20%. In addition, recall that 69% of the variance of output per worker remains unexplained in a developing accounting exercise that includes physical and human capital (using

the middle scenario for returns to schooling). The second row repeats the results reported above from our baseline specification. In our preferred specification, accounting for labor efficiency cuts the IQR by half, the north-south productivity gap by nearly two thirds, and the development accounting residual by two thirds.

The remaining rows report results from robustness tests. Our main specification averages VCR from the three polls (total election time, April referendum and December referendum). We repeat the analysis for each poll separately. Results are strengthened substantially when restricting attention to the election or the December referendum. In particular, the development accounting exercise now explains nearly 100% of the variation in output per worker across provinces. Conversely, the April referendum gives slightly weaker results, but the message remains the same.[24]

We next report exercises that test robustness to the "last polling station problem". Results are robust to using a VCR measure that controls non-parameterically for the number of polling stations and a measure that includes only municipalities with less than three polling stations. (See Section 4.) Finally, results are robust to VCR measures adjusted for the complexity of the task and that control for vote-counter characteristics.

Assuming a common productivity factor that appears in both the vote counting task and in firms, we find that this factor accounts for much of the cross sectional variation in output per worker in Italian firms. What factors might drive this underlying productivity. We turn to possible determinants of vote counting productivity next.

6 What Drives Vote Counting Rates?

As a measure of labor efficiency, VCR shows large dispersion and geographical variation that is correlated with productivity in firms. With the simple theoretical framework we outlined in the previous section, labor efficiency was able to account for a significant share of the variation in output per worker. Development accounting exercises search for proximate causes for the variation in output per worker across countries or regions. In their seminal development accounting study, Hall & Jones (1999) go further in exploring correlates with the TFP residual in an investigation of root causes for productivity differentials across countries. They argue that productivity differences are driven by what they label "social infrastructure". In their words, social infrastructure is

> The institutions and government policies that determine the economic environment

[24] Results using the Senate election only perform even better than using total time in the election.

> within which individuals accumulate skills, and firms accumulate capital and produce output. A social infrastructure favorable to high levels of output per worker provides an environment that supports productive activities and encourages capital accumulation, skill acquisition, invention, and technology transfer. Such a social infrastructure gets the prices right.

We don't dispute the importance of social infrastructure, but the large dispersion in vote-counting productivity we have found refines what might explain productivity differentials in our setting. Incentives and "prices" in the vote counting task itself are equally right (or wrong) across the country in that volunteers were given no incentive to count votes rapidly. Whatever drove vote counters' ability or motivation to complete this task efficiently must have carried over from broader institutional and cultural factors driving labor efficiency.

What, then, drives labor efficiency in such a simple task as counting votes? We begin by recapitulating a number of hypotheses that we believe we can be rejected outright in this setting. We then explore some more plausible explanations. First, production technology and physical capital (private or public) are unlikely explanations for differences in VCR. The vote counting process requires a table, chairs, writing implements, and a building. While there might be minor regional variation in the quality of these work tools, it is hard to see how they would make an enormous impact on vote counting speed. Essentially no technology is involved. Literate workers from the pre-industrial era would have been able to complete this task with the technologies available to them at the time. Caselli (2017) suggests that some of the international difference in output per worker may be due to differences in production technology (e.g. capital or human capital intensity). However, in our setting, the production technology is essentially the same across the country.

Turning to incentives, the direct pecuniary incentive–financial compensation–is identical in all polling stations. Further, compensation is lump-sum and not linked to the amount of time spent counting votes. Vote counters may differ in the opportunity cost of their time. However, we showed in Section 4 that VCR wasn't correlated with measures of the opportunity cost of time.

More plausible explanations for regional differences relate to those that are worker-specific and would affect productivity in the workplace but also translate to other settings. These include cultural attitudes towards work, broader measures of culture that might affect work performance in group settings, and human capital. The nature of the task and the fact that we are using naturally occurring data makes it difficult to disentangle these factors. We nevertheless try to shed some light with suggestive correlations shown in Table 6. This table shows results from a panel regression of

(log) VCR (pooling the election and both referenda) on a number of variables may capture these underlying factors. All regressions include fixed effects for each of the referenda. Area fixed effects are also included, so that the regressions are based on within Area variation across municipalities rather than a comparison between say North and South Italy.

We first consider attitudes towards work, by looking at absenteeism from the workplace. We measure absenteeism using municipal level data on the number of sick leave days taken by public employees. We follow Ichino & Riphahn (2005) and others who have considered variations in sick leave as measuring shirking in the workplace. Table 6 reports a statistically significant and negative relationship between VCR and absenteeism. This regression is robust to including fixed effects for the 22 Italian Regions (not reported here). Municipalities with more workplace absenteeism also counted votes more slowly. 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 with 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. An alternative hypothesis fits more neatly with this correlation. Absenteeism and low efficiency in vote counting may reflect a high cost to exerting work effort or lower psychic costs to shirking: low "work ethic". Variation in work ethic would lead to a correlation between demand for off-the-job-leisure on one hand and shirking on the other. In this perspective, absenteeism is driven more by an aversion to being at work than by the attraction of being at home.

We next turn to broader cultural factors. A large literature studies the role of culture in affecting attitudes, economic policy, and economic outcomes. In the Italian context, Banfield (1958) suggested 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. More recently, Guiso *et al.* (2004) have shown that trust is an important factor in financial development and the development of trade relations and have studied the role of civic-mindedness on economic performance in Guiso *et al.* (2008a).[25] Turning first to civic duty, we use a commonly used measure of civic mindedness: blood donations.[26] One might expect a

[25]Aghion *et al.* (2010) have suggested 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.

[26]Number of blood bags per million inhabitants. The indicator ranges from 0 to 0.11. Source: Guiso *et al.* (2004). We

positive correlation between blood donations and VCR. The same cultural 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. As expected, blood donations are positively correlated with VCR. However, the association becomes weak and statistically insignificant when including additional controls.

Next, we measure "trust" using survey data collected for the World Value Survey.[27] VCR is correlated with trust with a statistically significant coefficient. A theoretical literature suggests that trust might affect performance in group tasks, particularly where workers' efforts are strategic complements.[28] The vote counting task features strong strategic complementarities. All vote counters are required to scrutinize each ballot and agree on assigning the vote. We will explore one mechanism, through which trust affects vote counting empirically below.

These regressions are robust using Adjusted VCR or Controlled VCR as the productivity measure. The latter controls for human capital as measured by employment status and education. However, human capital may affect vote counting productivity through a different channel, that of organizational capacity. We found some suggestive evidence that managerial capacity mattered in Table 3, as experienced presidents presided over faster vote counting. To explore this channel further, we use the management score from Bloom & Van Reenen (2007, 2010), but see an essentially zero correlation between VCR and management quality in firms.[29][30]

In summary, we find some suggestive evidence of the role of work ethic through a negative correlation between VCR and absenteeism. We also find a correlation between VCR and survey measures of trust. We now take a closer look at the role of trust in affecting VCR.

Trust and Labor Productivity in a Contentious Task We further investigate the mechanism through which trust affects VCR by looking closer at the vote counting process. As we saw in Table 2, the share of contested, blank, or invalid votes in a municipality slowed down the vote counting process. These factors likely affect VCR because they add to the complexity of the task and require

thank Luigi Guiso for sharing his data.

[27]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. We thank Luigi Guiso for sharing these data.

[28]However, much of the existing literature focuses on "vertical trust" between workers and supervisors or employers. See Wintrobe & Breton (1986) for a discussion.

[29]The management score is only available at the Regional level. With merely 20 observations on this variable, the regression may lack statistical power.

[30]For completeness, we show that results are robust when controlling for latitude, in an attempt to further control for factors that differ across north-south lines.

judgement calls. However, we assumed that the complexity of the task had similar effects across the country. We now investigate whether these factors had heterogeneous effects in the north and the south of Italy, in Table 7. This is pooled regression of (log) VCR on the these three factors in the election and the two referenda, interacted with broad area dummies (north and south-center). Challenged votes slowed down the vote counting rate in the south and center of Italy, but not in the north. The effect is statistically significant and large in the south: an increase in challenged votes by one percentage point slows down vote counting by nearly 25%. At the median southern VCR, this implies a reduction from counting 157 votes to only 120 votes per hour. In contrast, blank and invalid votes slow vote counting down by similar margins in both northern and southern Italy.

Why would contested votes have such a substantial effect on vote counting rates in the south but not in the north? We conjecture that trust plays a role in explaining this difference. Officially, the procedure for dealing with contested votes requires the President to assign the vote provisionally and indicate that the vote was contested in the register. In high trust environments, the committee may agree with this provisional assignment quickly. In low trust environments, each contested vote may lead to a debate on how to assign the provisional vote. We explore this possibility by interacting the number of contested votes with the survey measure of trust, in the third column of Table 7. Challenged votes slow down the vote counting process, and VCR is higher in high-trust provinces, as previously established. Specifically, the gap between the most- and least-trusting provinces is 0.3, so that trust may increase vote counting rates by up to 50%. However, when interacting the share of challenged votes with the measure of trust, we find that trust is particularly important where there are more challenged votes. Specifically, a one percent increase in challenged votes decreases vote counting rates by 35% in municipalities in the least trusting province, but this declines to merely 6% in the most trusting provinces.[31]. The contested task of adjudicating contested votes slows down the vote counting process substantially where trust is low, but only slightly where trust is high.

These findings provide suggestive evidence of the role of trust in labor productivity, directly from the vote counting task. Vote counting is a group task and the law requires consensus in assigning a vote to a particular party. Contested votes reflect a potentially conflictual component of the task and they may impede consensus. We find that trust, measured by a general social survey, may aide the group in reaching consensus.

[31] "Trust" ranges from 0.62 to 0.92

7 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 easily 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. We argue that 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. We conduct a simple development accounting exercise and find that our labor efficiency measure 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. Vote counting productivity is correlated with separate measures work ethic and trust. Exploring mechanisms, we find that trust is important in increasing productivity with aspects of the task that may be more conflictual.

We hope our measure will be of use to future empirical researchers. Our measure captures efficiency in a group task, is available for all Italian municipalities with three observations in two separate years. The task is measured in units of output per worker. Our development accounting exercise illustrates the utility of having a cardinal measure of what is potentially a cultural attribute. This exercise 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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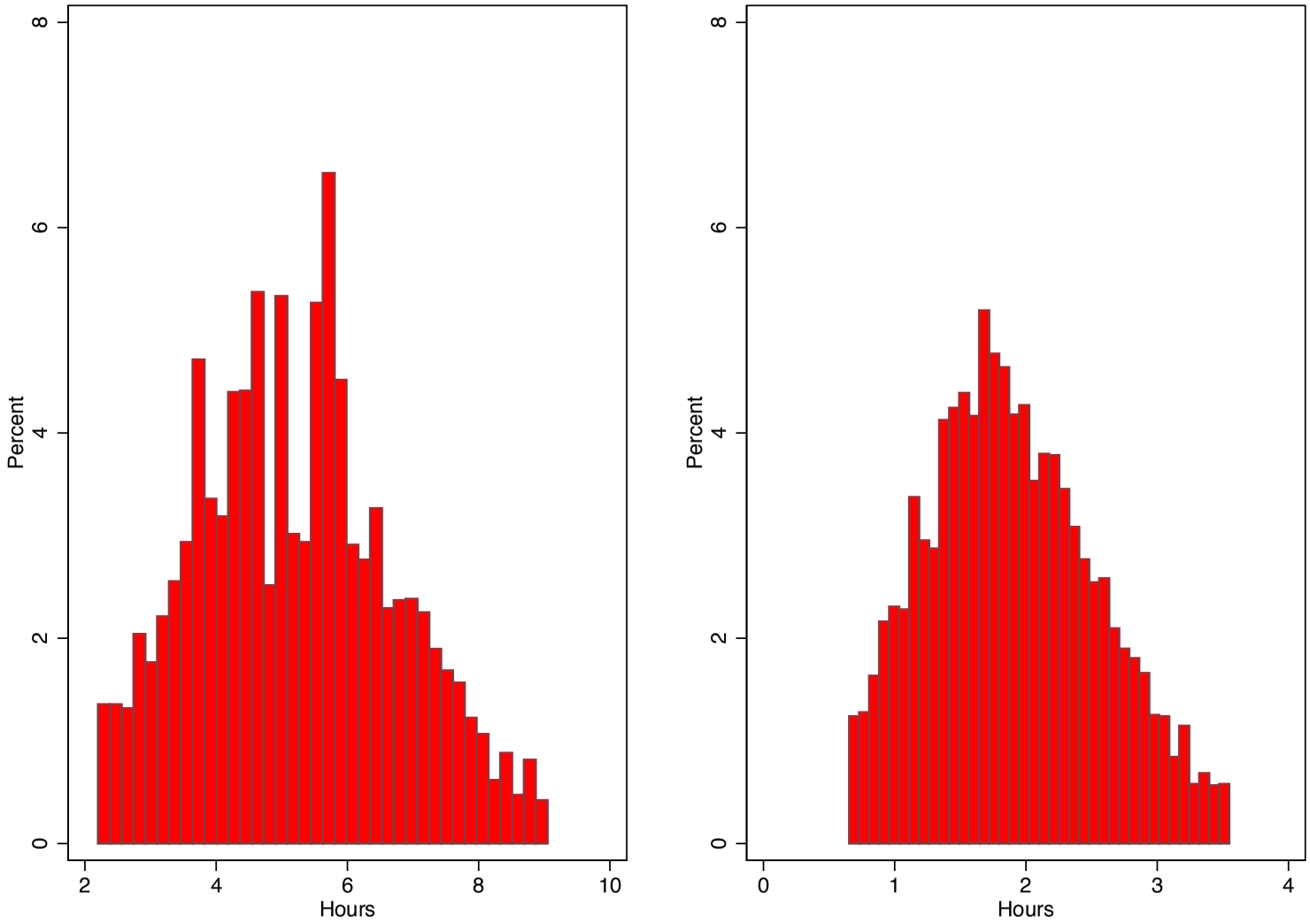
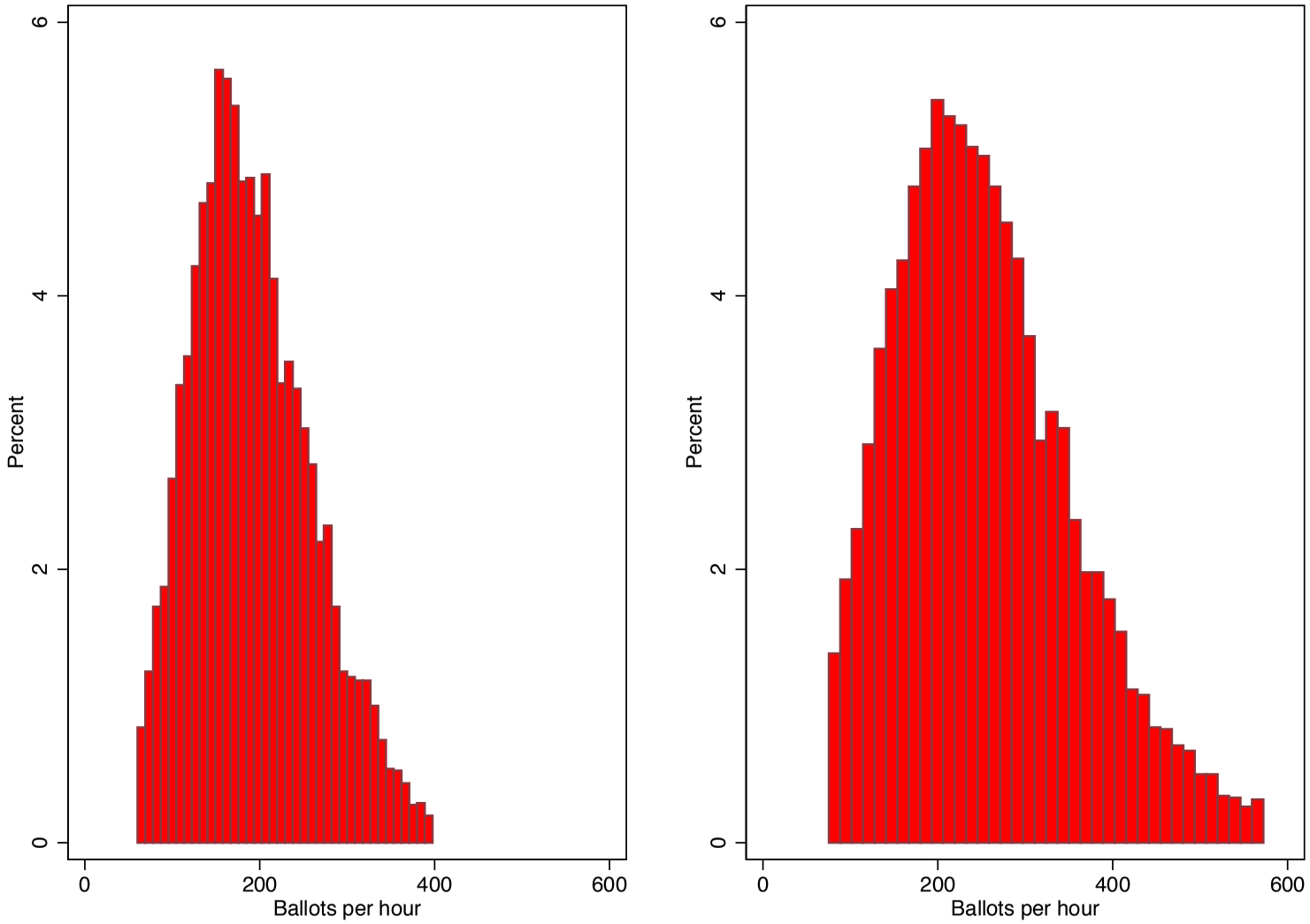
Figure 1: **Vote Counting Times**



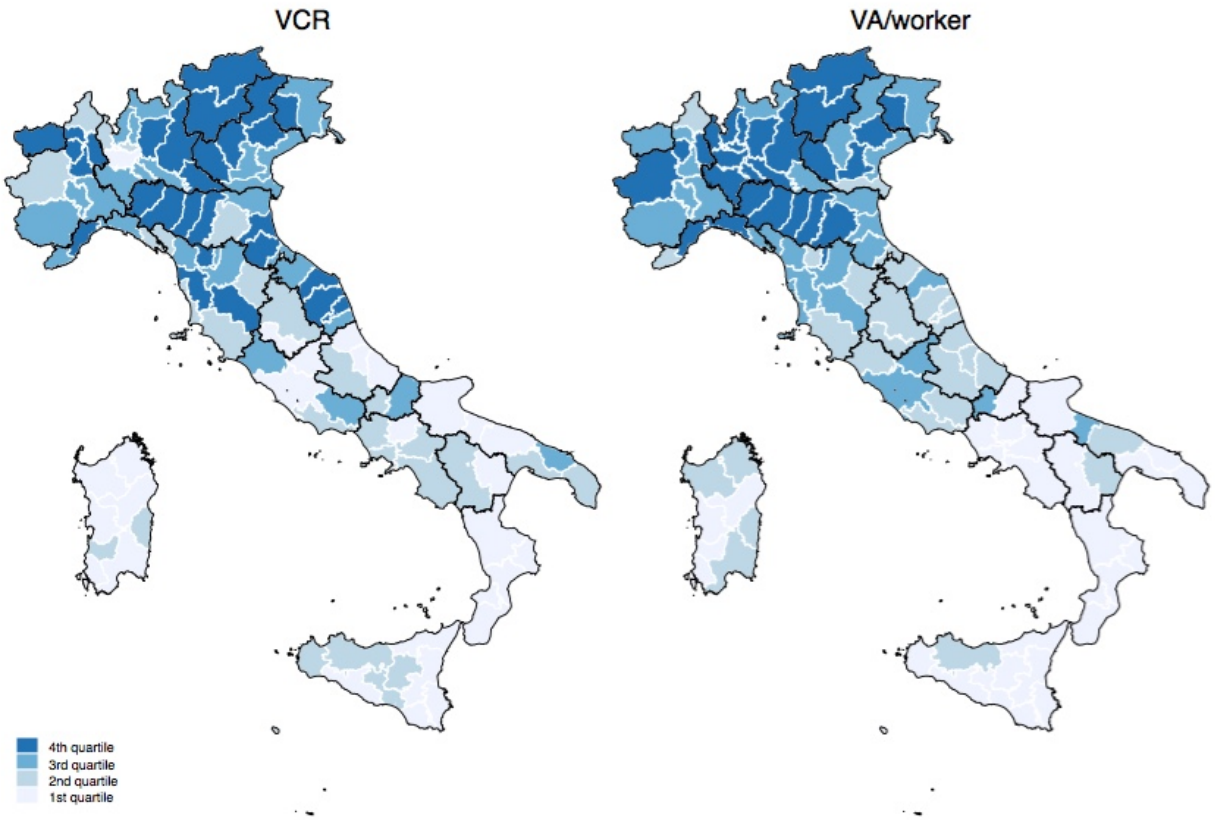
Note: The figure shows the distribution of (total) vote counting times in the election (left-hand panel) and the December referendum (right-hand panel).

Figure 2: **Vote Counting Rates**



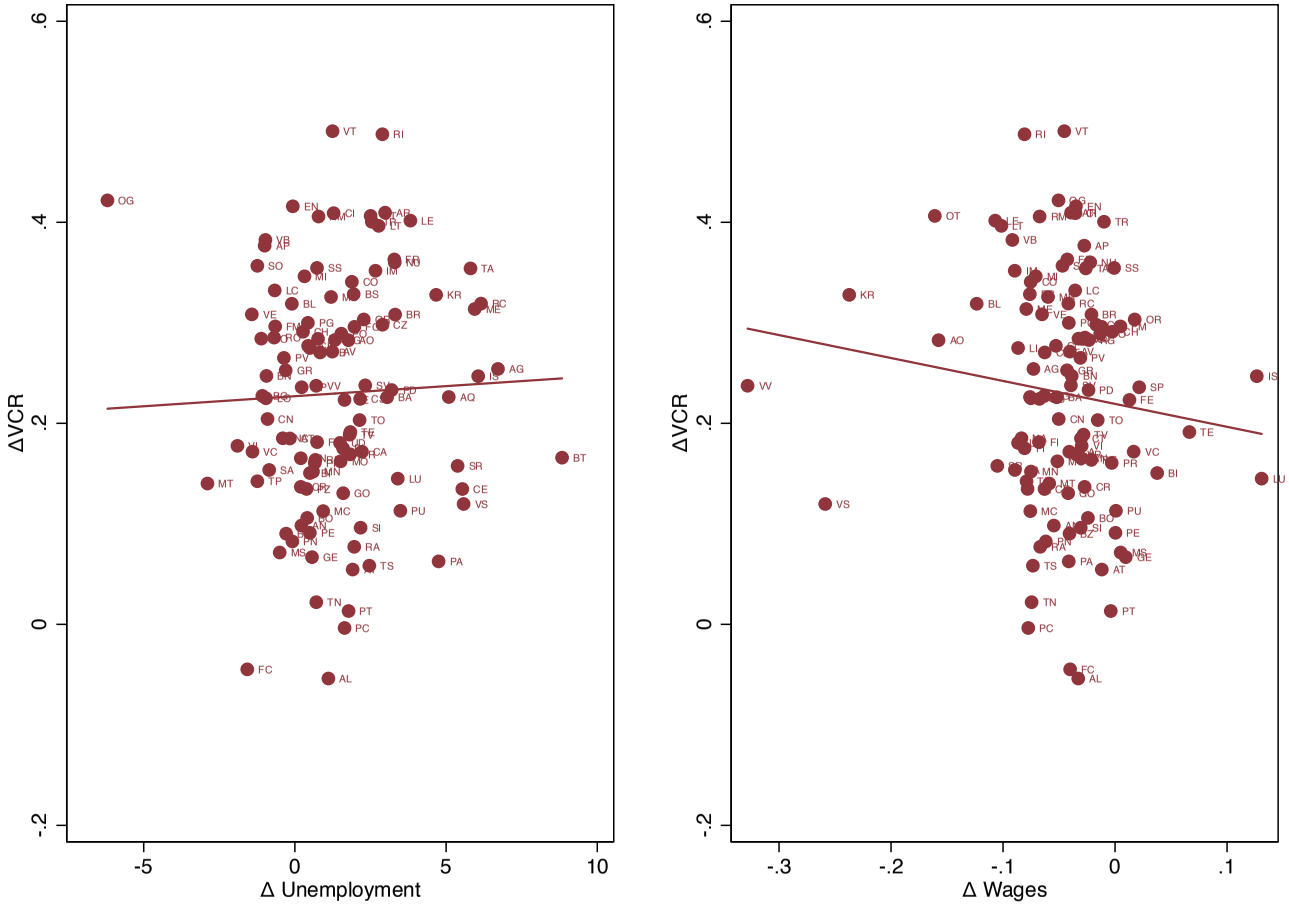
Note: The figure shows the distribution of vote counting rates (VCR) in the election (left-hand panel) based on total counting times and in the December referendum (right-hand panel).

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



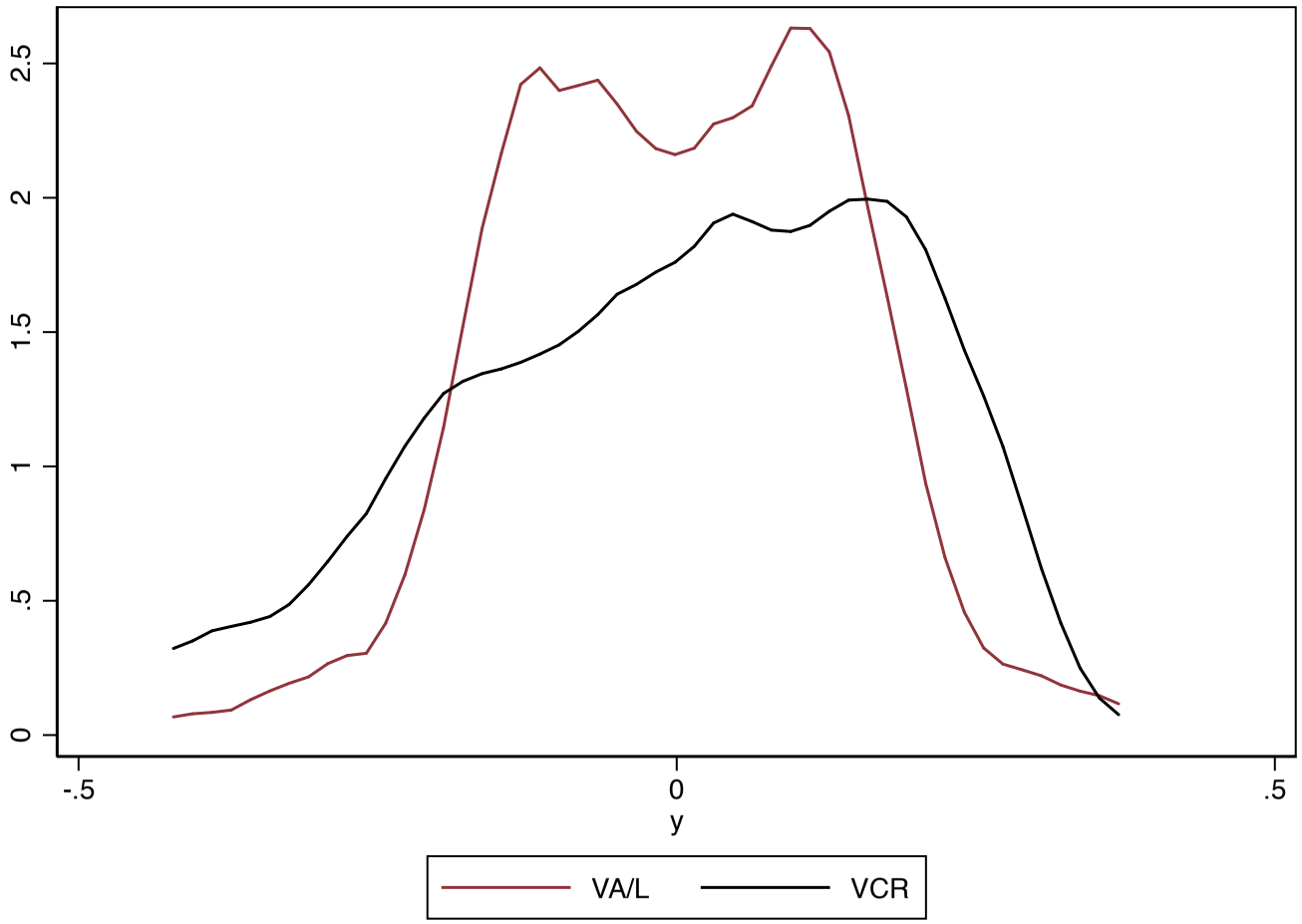
Note: The left panel shows a map of Italy with vote counting rates (VCR) averaged at the province level for the elections. Shades reflect quartiles of the VCR distribution, with darker shades reflecting faster vote counting. The right panel shows value added per worker, shaded by quartiles, with darker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

Figure 4: **Changes in VCR (2013-16) and Unemployment/Wages (2012-15)**



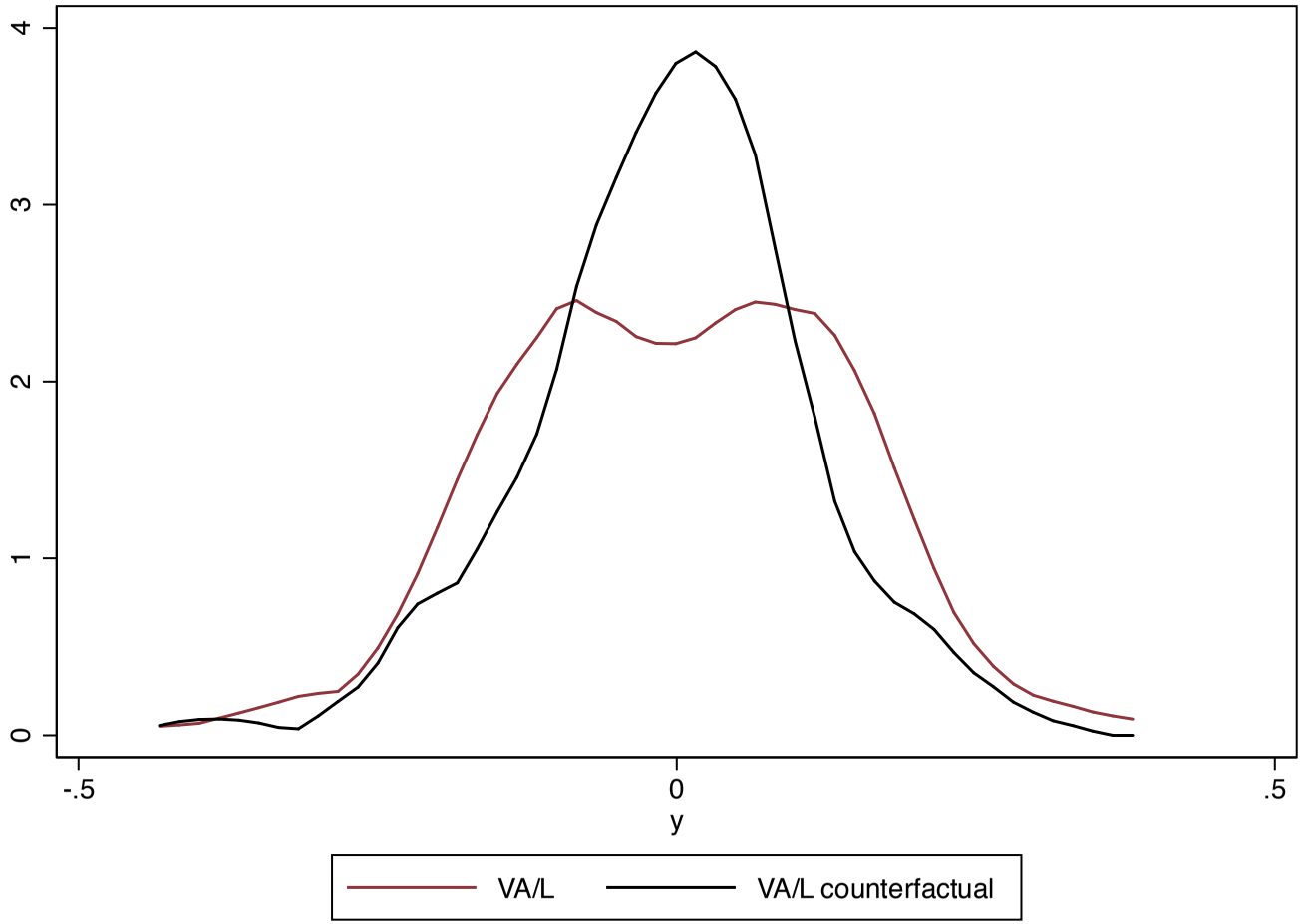
Note: The figure compares the change in unemployment (left panel) or wages (right panel) from 2013 to 2015 with the change in vote counting rates from the election of 2013 to the referendum of December 2016. The correlation isn't statistically significant and slightly positive for unemployment and negative for wages. This suggests that opportunity cost of time was not an important incentive in driving vote counting times.

Figure 5: **Distribution of Value Added Per Worker and Vote Counting Rates**



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

Figure 6: **Distributions of Value Added per Worker and Value Added per Efficiency Unit**



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

Table 1: **Vote Counter Characteristics**

	Presidents	Secretaries	*Scrutatori*
Age	43.85	36.31	34.42
% Male	0.57	0.38	0.39
Years of education	14.57	13.47	11.96
% With Experience	0.89		
% Not Working	0.23	0.39	0.61
% Students	0.11	0.26	0.37
% Unemployed	0.03	0.06	0.09
% Working	0.77	0.61	0.39
% Salaried Workers	0.59	0.50	0.34
% Self Employed	0.18	0.11	0.05

Note: This figure gives vote counters' characteristics of in the elections of 2013 as per our survey of all municipalities in Italy. The response rate was 20%. 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: **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
Province	110	110	102	110	110	103
Observations	7589	7589	3318	7589	7589	3332

Note: The dependent variable is the log of Vote Counting Rates ($VCR_{i,s}$) for election s and municipality i as defined in equation (1). 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 municipality i 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 municipality i 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 3: **Vote Counting Rates and Vote Counter Characteristics**

	Election 2013 - Total			Election 2013 - Senate		
	(1)	(2)	(3)	(4)	(5)	(6)
% male	-0.05	-0.04	-0.02	-0.18*	-0.17*	-0.12
	(0.09)	(0.09)	(0.09)	(0.10)	(0.09)	(0.09)
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)
Education (years)	0.07***	0.07***	0.07***	0.09***	0.09***	0.09***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
% students	0.48***	0.44***	0.45***	0.41***	0.37***	0.41***
	(0.08)	(0.07)	(0.08)	(0.11)	(0.11)	(0.11)
% employed	0.27***	0.25***	0.25***	0.13	0.08	0.09
	(0.07)	(0.08)	(0.08)	(0.10)	(0.10)	(0.10)
% previous experience	0.09**	0.08*	0.08	0.18***	0.16***	0.15**
	(0.04)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Challenged	-71.97	-68.24	-61.60	-92.92	-107.59	-107.55
	(70.15)	(70.33)	(64.75)	(83.06)	(88.51)	(88.45)
Blank	-6.78***	-7.14***	-7.30***	-4.28***	-5.38***	-6.07***
	(1.11)	(1.19)	(1.19)	(1.46)	(1.64)	(1.66)
Invalid	-4.54***	-4.77***	-4.87***	-3.65**	-3.59**	-4.04***
	(1.28)	(1.25)	(1.26)	(1.51)	(1.47)	(1.47)
Other controls	No	Yes	Yes	No	Yes	Yes
Adjusted R^2	0.23	0.24	0.24	0.13	0.14	0.16
Province	104	104	104	104	104	104
Observations	920	920	920	917	917	917

Note: The dependent variable is the log of Vote Counting Rates ($VCR_{i,s}$) for election s and municipality i as defined in equation (1). 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 municipality i 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 municipality i were reported, minus 3pm. Columns 2 and 5 include the full set of controls from Table 2. Columns 3 and 6 include additional dummies for the number of polling stations in each municipality. Vote counter characteristics pool all types of electoral volunteers in the 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. *Challenged*, *blank*, and *invalid* are the share of challenged, blank, and invalid votes, respectively. 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 4: **Variance Decomposition of Output per Worker**

	K	H ,K	H, K ,e	A
Human Capital $\phi = 0.035$	0.21	0.25	0.72	0.28
Human Capital $\phi = 0.095$	0.21	0.31	0.78	0.22
Human Capital $\phi = 0.15$	0.21	0.37	0.83	0.17

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 or labor efficiency. The first column gives the share of variance that is captured with a production function including physical capital only. The second column gives the share of variance that is captured with a production function including physical and human capital. The third column gives the share of variance that is captured with a production function including physical and human capital and labor efficiency. Labor efficiency is captured with vote counting rates, as described in Section 5. A gives residual variation. The three rows reflect three different assumptions on the returns to schooling.

Table 5: **Robustness**

	IQR (%)	North-South (%)	Dev. Accounting Resid. (%)
Value Added per Worker	0.21	0.20	0.69
Baseline	0.12	0.07	0.22
Election 2013	0.11	0.04	0.06
Referendum April	0.13	0.09	0.42
Referendum December	0.11	0.07	0.19
Controls for # Polling Stations	0.12	0.10	0.25
1-2 Polling stations	0.12	0.08	0.18
Adjusted VCR	0.13	0.08	0.26
Controlled VCR	0.14	0.08	0.39

Note: This table shows robustness of our main results to a variety of specifications. The three columns correspond to three main results. The first column gives the difference in output per unit of labor efficiency between the 75 percentile and the 25 percentile province. The second gives the difference in output per worker in the north and south of Italy, if all Provinces in southern Italy had the labor efficiency of the median northern Province. The third gives the share of the variance in output per worker that remains unexplained using a production function using physical and human capital, and labor efficiency. The first row gives result when labor efficiency is assumed equal in all provinces. The second gives our benchmark results, where labor efficiency is measured using vote counting rates, averaged across the election (using total time) and the two referenda. Rows 3 to 5 give results when labor efficiency is measured separately from each of the three polls. The sixth row pools all three polls once again and controls non-parameterically for the number of polling stations, as in Figure A.10. The seventh row restricts attention to municipalities with no more than two polling stations. The eighth row uses the Adjusted VCR measure that controls for the complexity of the vote counting task, as described in Table 2. The ninth row uses the Controlled VCR measure that control for the complexity of the task and for vote counters' characteristics in the election, as described in Table 3.

Table 6: **Correlates with Vote Counting Rates**

	(1)	(2)	(3)	(4)	(5)
Absenteeism	-0.02***	-0.02***	-0.02***	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Blood Donations		2.63*	2.34*	0.44	0.45
		(1.45)	(1.40)	(1.20)	(1.20)
Management Quality			-0.06	-0.06	-0.06
			(0.05)	(0.05)	(0.05)
Trust				1.28***	1.24***
				(0.22)	(0.27)
Latitude					0.00
					(0.01)
Referendum Apr16	-0.30***	-0.31***	-0.31***	-0.31***	-0.31***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Referendum Dec16	0.27***	0.26***	0.26***	0.26***	0.26***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Area FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.38	0.39	0.38	0.40	0.40
Province	103	93	88	88	88
Observations	23671	22286	20947	20947	20947

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". *Management Quality* is the average quality of management in the Region, from the World Management Survey. *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. *Latitude* gives the municipality's latitude in degrees. All regressions include fixed effects for the two referenda and for five 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 7: **The Role of Trust in a Contentious Task**

	(1)	(2)	(3)
South-Center × Challenged	-24.05***	-23.39***	
	(7.43)	(7.33)	
North × Challenged	0.59	1.11	
	(3.20)	(2.84)	
South-Center × Blank		-4.96***	-4.21***
		(0.85)	(0.96)
North × Blank		-7.86***	-7.64***
		(0.76)	(0.93)
South-Center × Invalid		-6.09***	-4.96***
		(0.82)	(0.89)
North × Invalid		-6.47***	-5.57***
		(0.74)	(0.73)
Trust			1.50***
			(0.21)
Challenged			-125.56***
			(42.83)
Challenged × Trust			143.10***
			(51.99)
North	0.20***	0.21***	0.05
	(0.04)	(0.04)	(0.04)
Referendum Apr16	-0.33***	-0.52***	-0.49***
	(0.02)	(0.02)	(0.02)
Referendum Dec16	0.27***	0.04**	0.07***
	(0.01)	(0.02)	(0.02)
Adjusted R^2	0.29	0.34	0.37
Province	110	110	99
Observations	22763	22763	21445

Note: The dependent variable is Vote Counting Rates at the municipal level, with data pooled from the election and both referenda. *North* and *South-Center* are dummy variables for municipalities in the north and south or center of Italy, respectively. *Challenged*, *blank*, and *invalid* are the percent of challenged, blank, and invalid votes in the municipality, respectively. Trust is a survey measure of trust, normalized on a scale from zero to one as described in the footnote to Table 6. Regressions include fixed effects for both referenda. The first two columns show that challenged votes slow down the vote counting process in the south of Italy but not the north. The third column shows that challenged votes slow down the vote counting process more where trust is low. The standard errors reported in parentheses are clustered at the provincial level. Statistical significance is denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Web Appendix (Not For Publication)

A Appendix: Supplementary Figures & Tables

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

Panel A: Piemonte

Panel B: Sicily

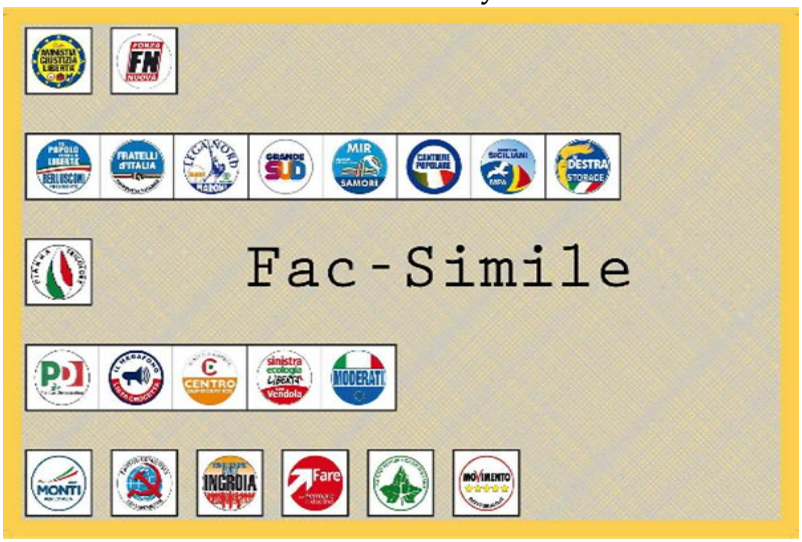
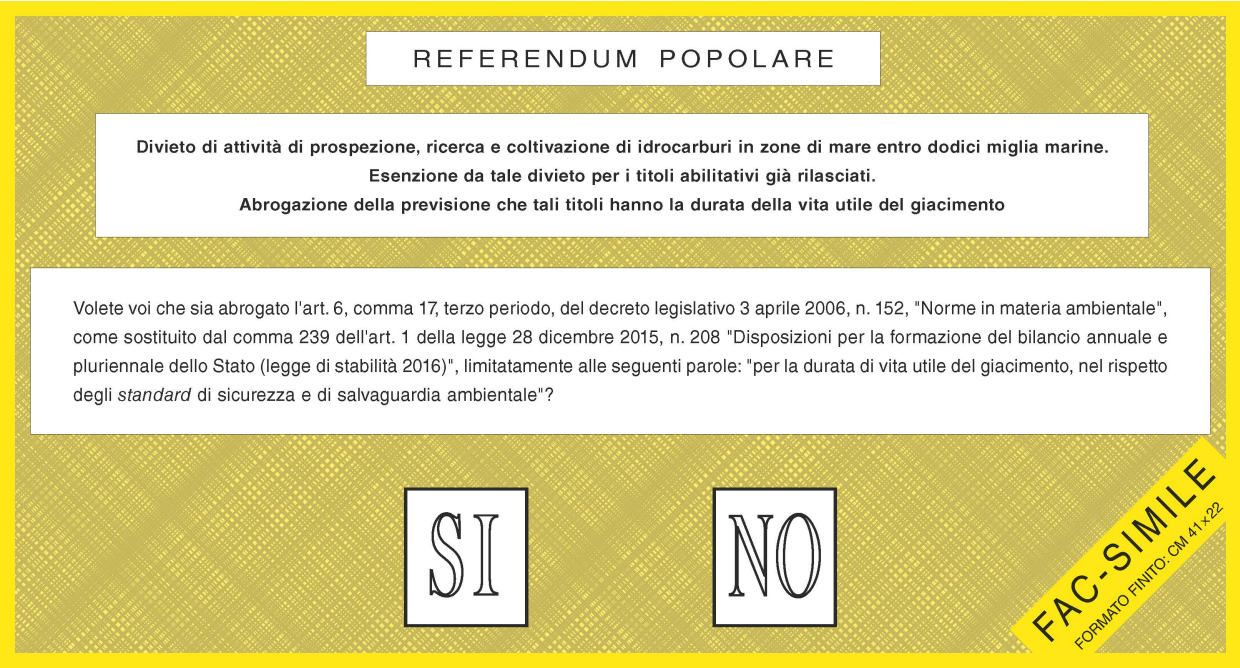


Figure A.2: **Sample Ballots: Referenda**

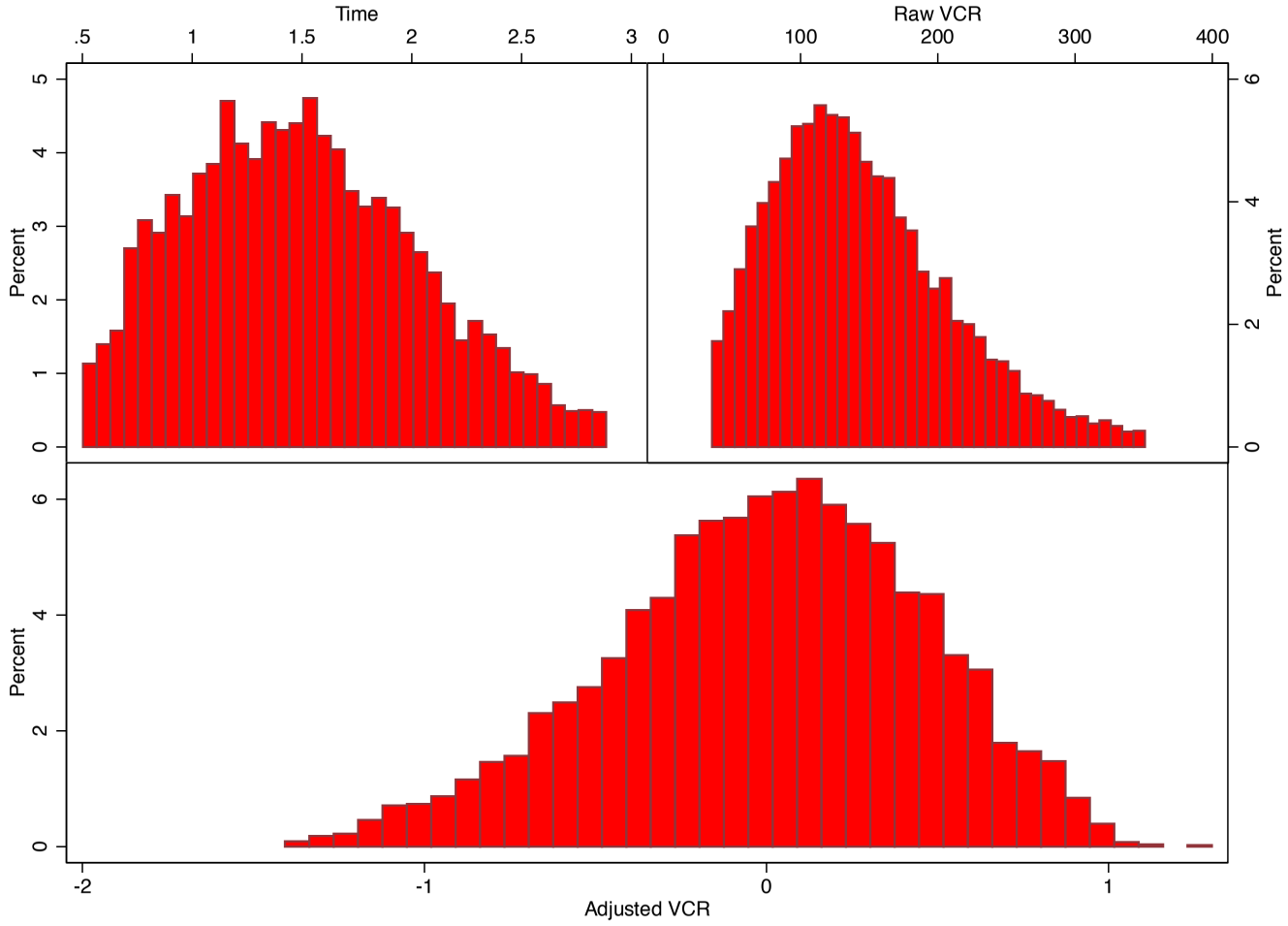
Panel A: April 2016



Panel B: December 2016

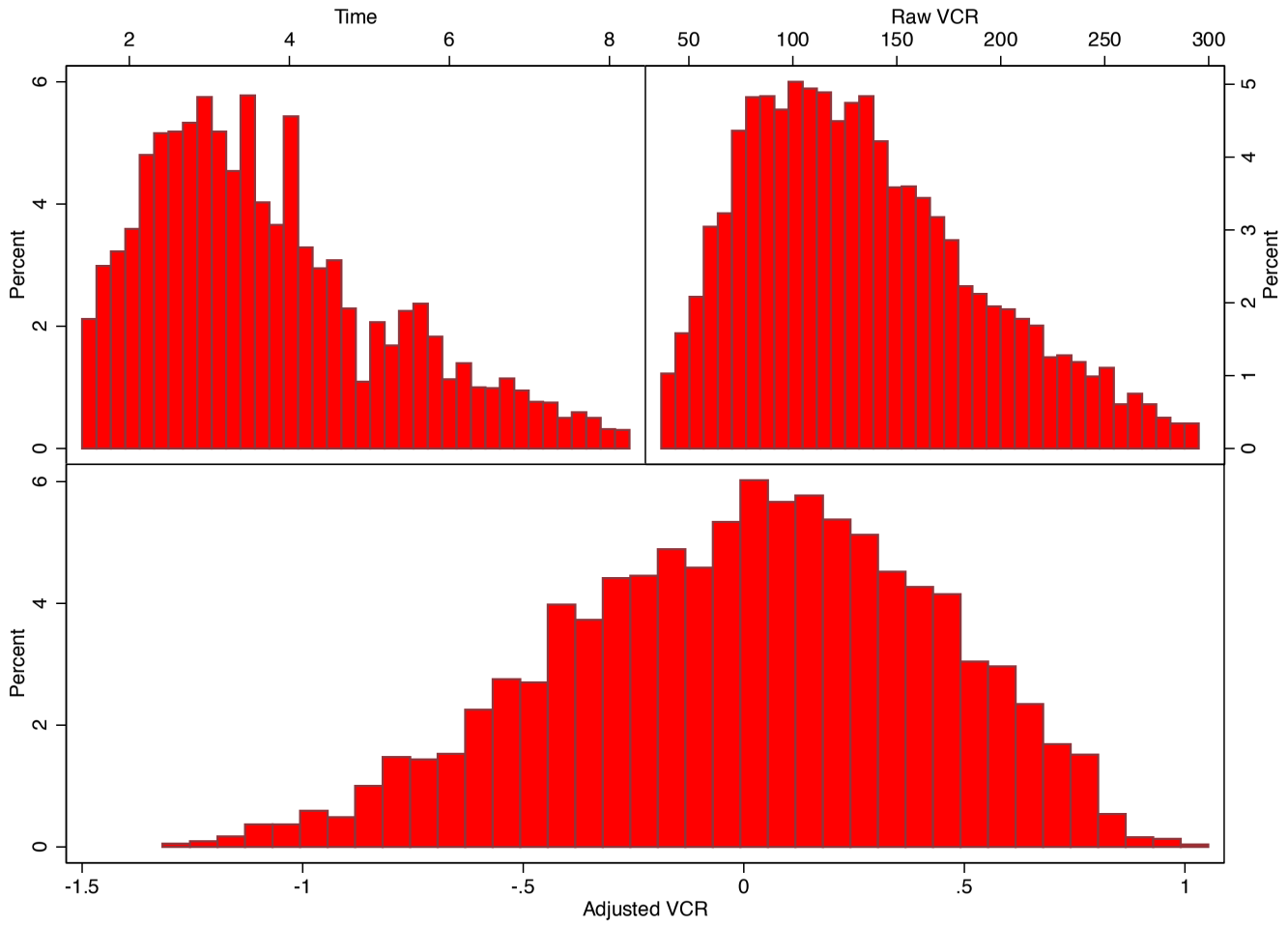
Figure A.3: **Vote Counting**

Figure A.4: **Vote Counting Time and Rates in the April 2016 Referendum**



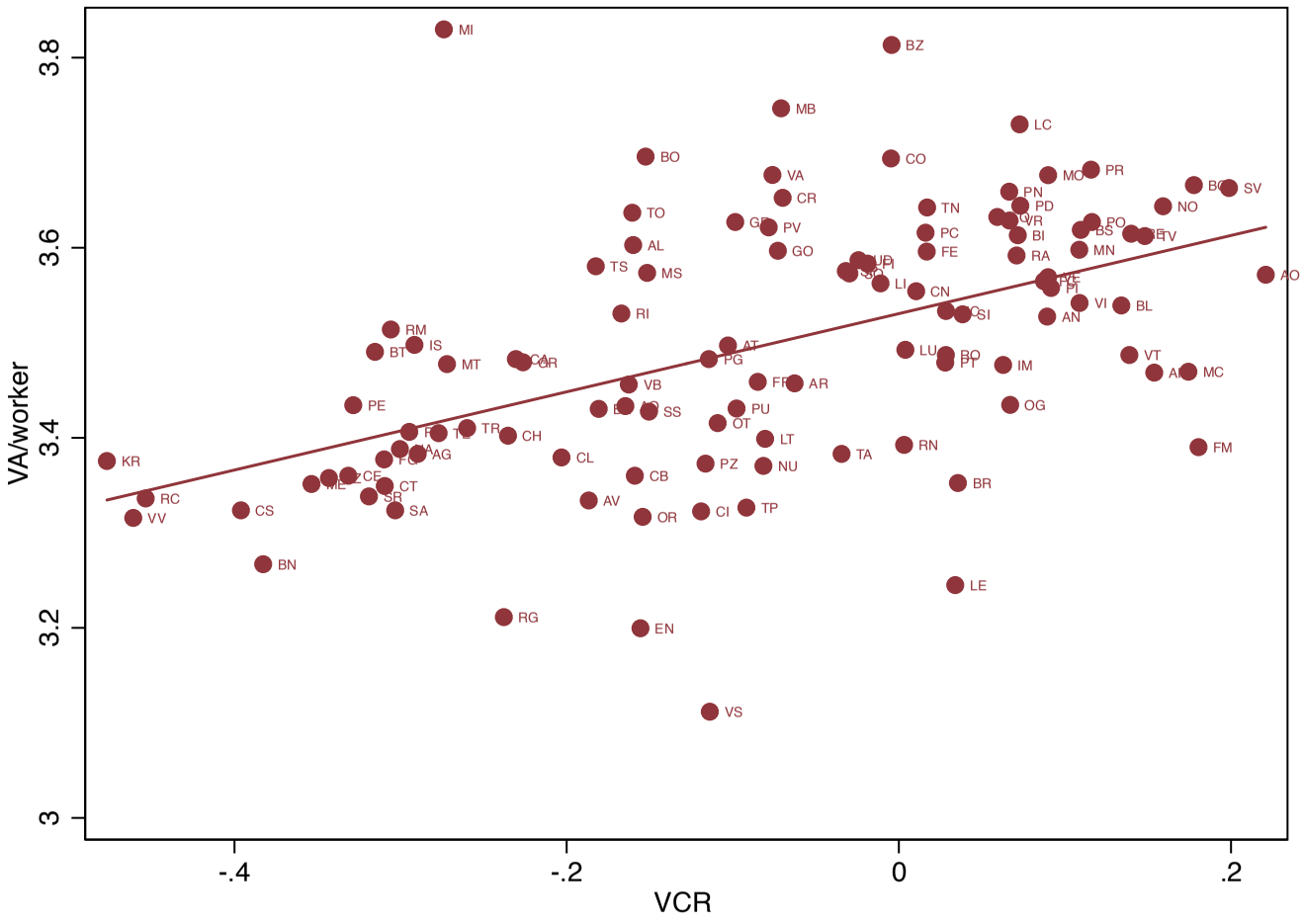
Note: The figure plots the distributions of vote counting times (top left), vote counting rates (top right) and Adjusted Vote Counting Rates (bottom) in the referendum of April 2016. The adjusted vote counting rate adjusts for the complexity of the vote counting task, reported in Table 2.

Figure A.5: **Vote Counting Time and Rates in the Senate Election 2013**



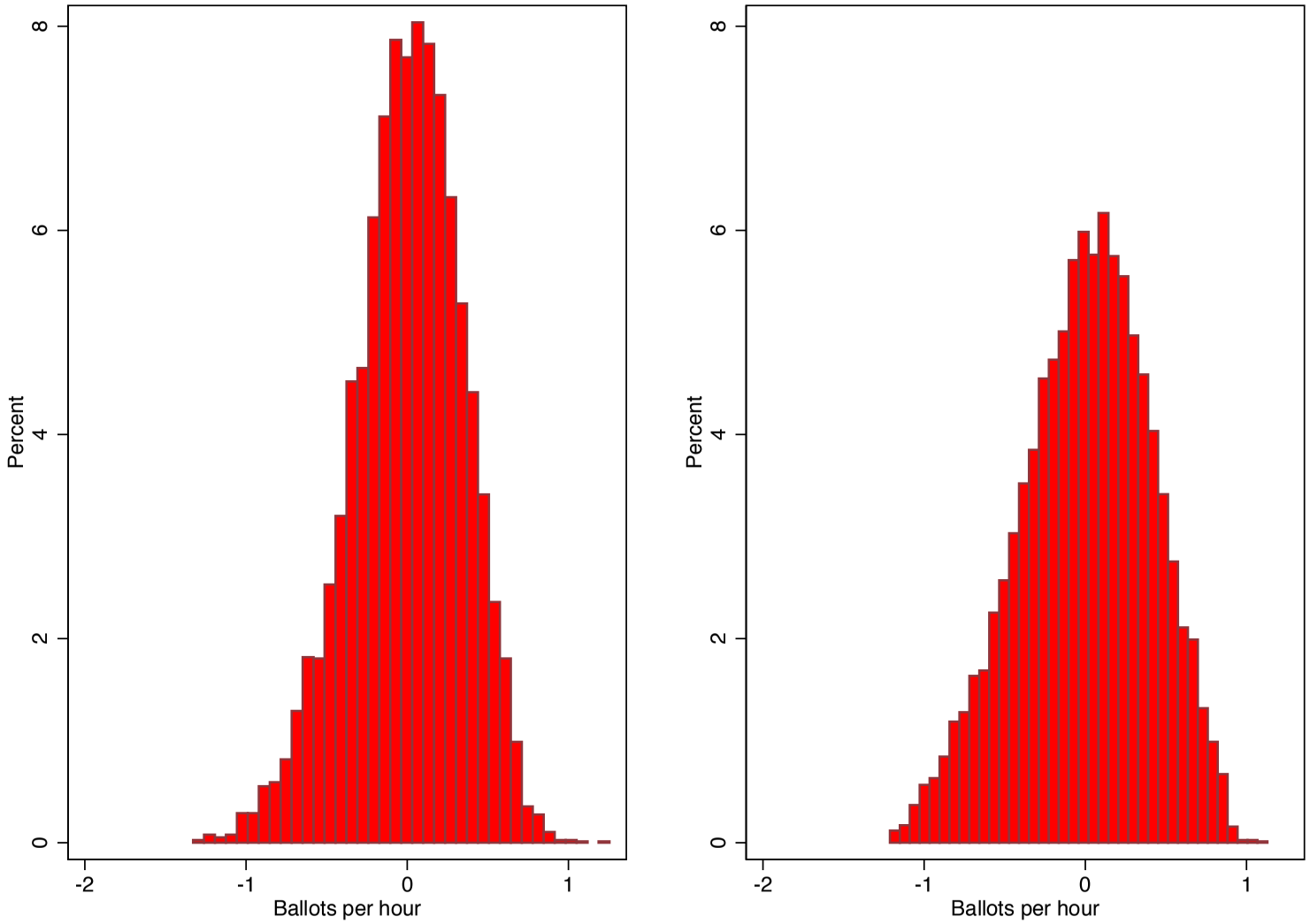
Note: The figure plots the distributions of vote counting times (top left), vote counting rates (top right) and Adjusted vote counting rates (bottom) in the election of 2013, using vote counting times in the senate. The adjusted vote counting rate adjusts for the complexity of the vote counting task, reported in Table 2.

Figure A.6: **Vote Counting Rates and Value Added Per Worker across Italian Provinces**



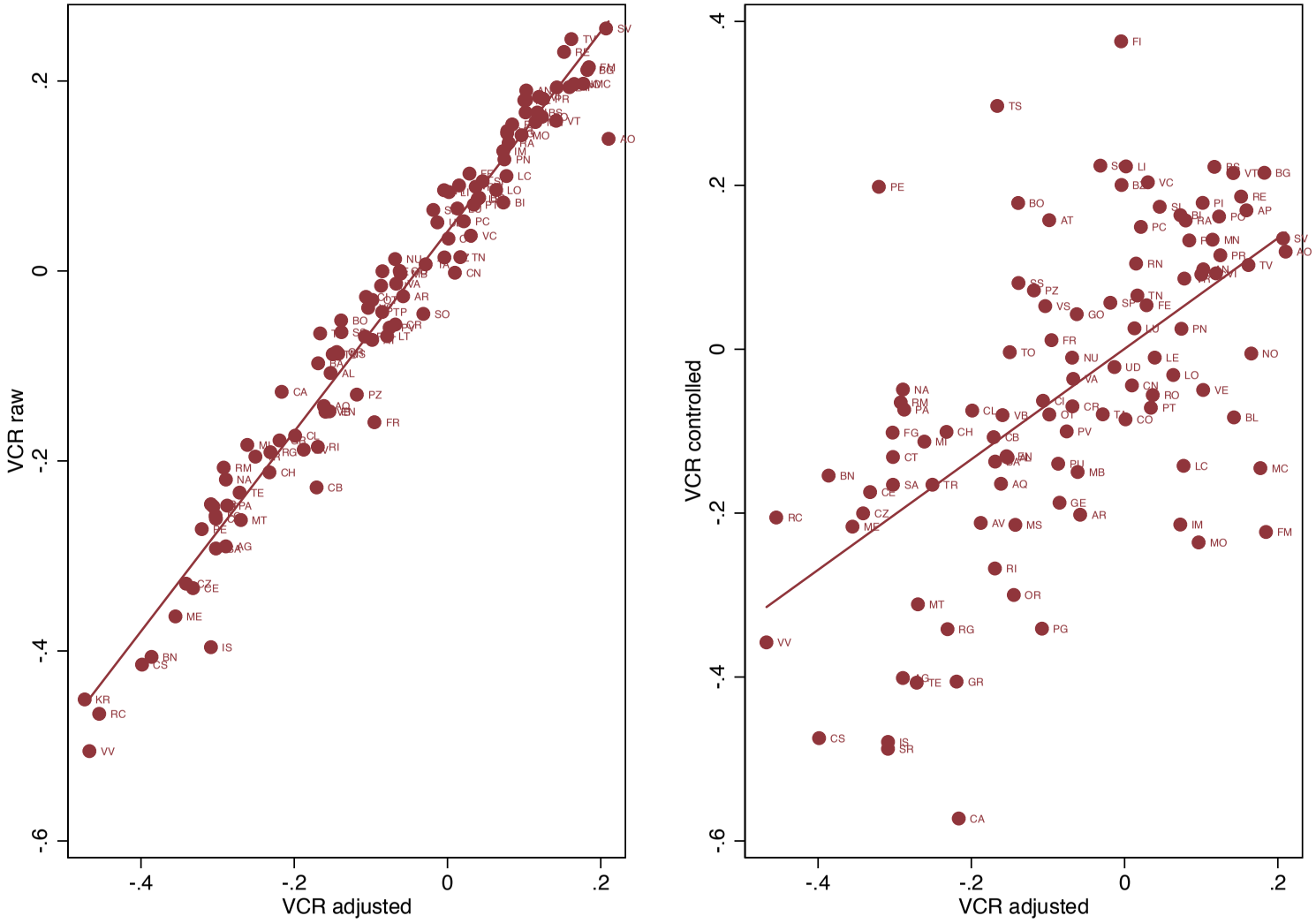
Note: The figure compares vote counting rates in the election of 2013 with value added per worker in Italian provinces.

Figure A.7: **Vote Counting Rates (Adjusted)**



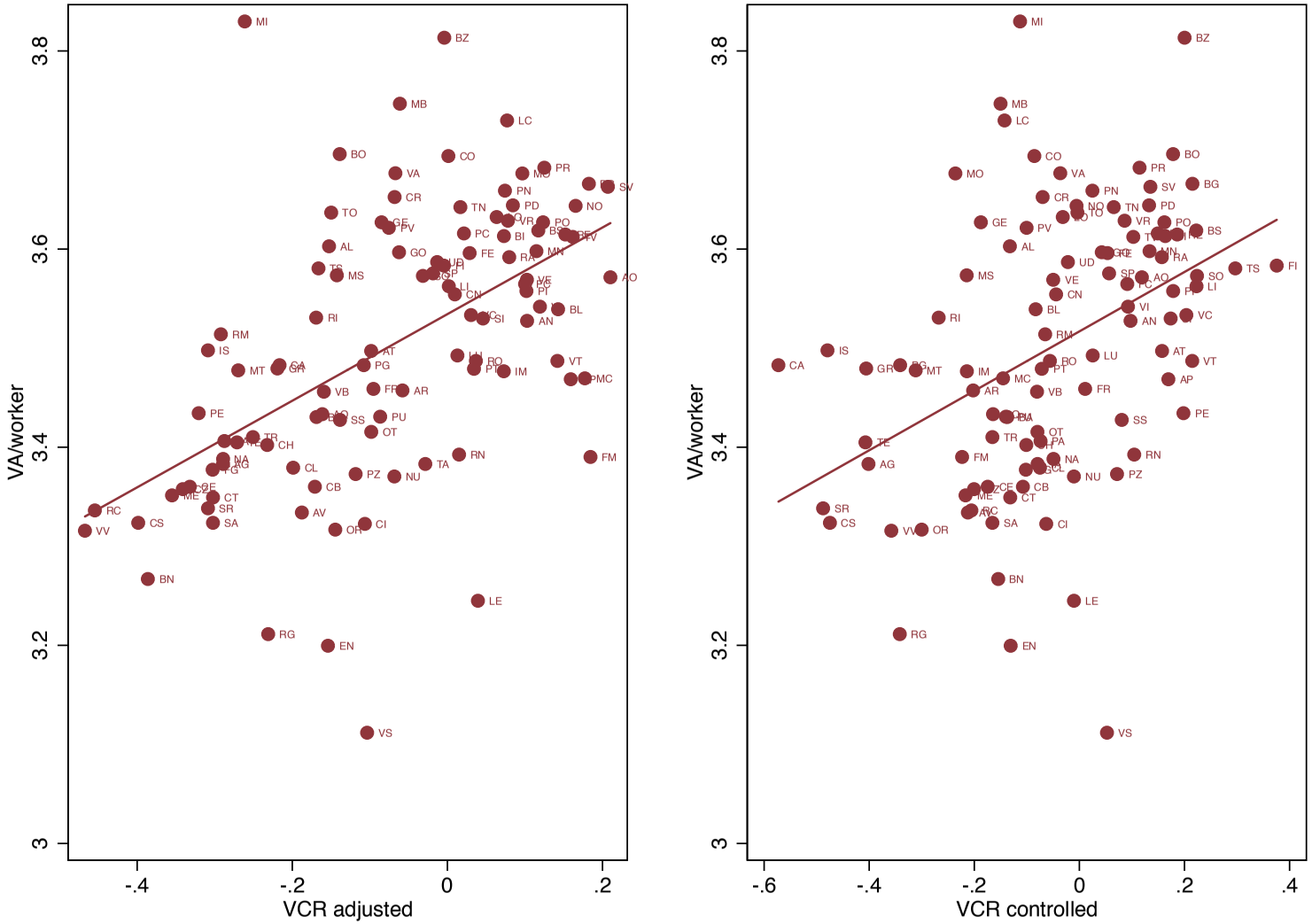
Note: The figure shows the distribution of Adjusted vote counting rates (adjusted for the complexity of the vote counting task) in the election (left-hand panel) and the December referendum (right-hand panel).

Figure A.8: **VCR, Adjusted VCR, and Controlled VCR**



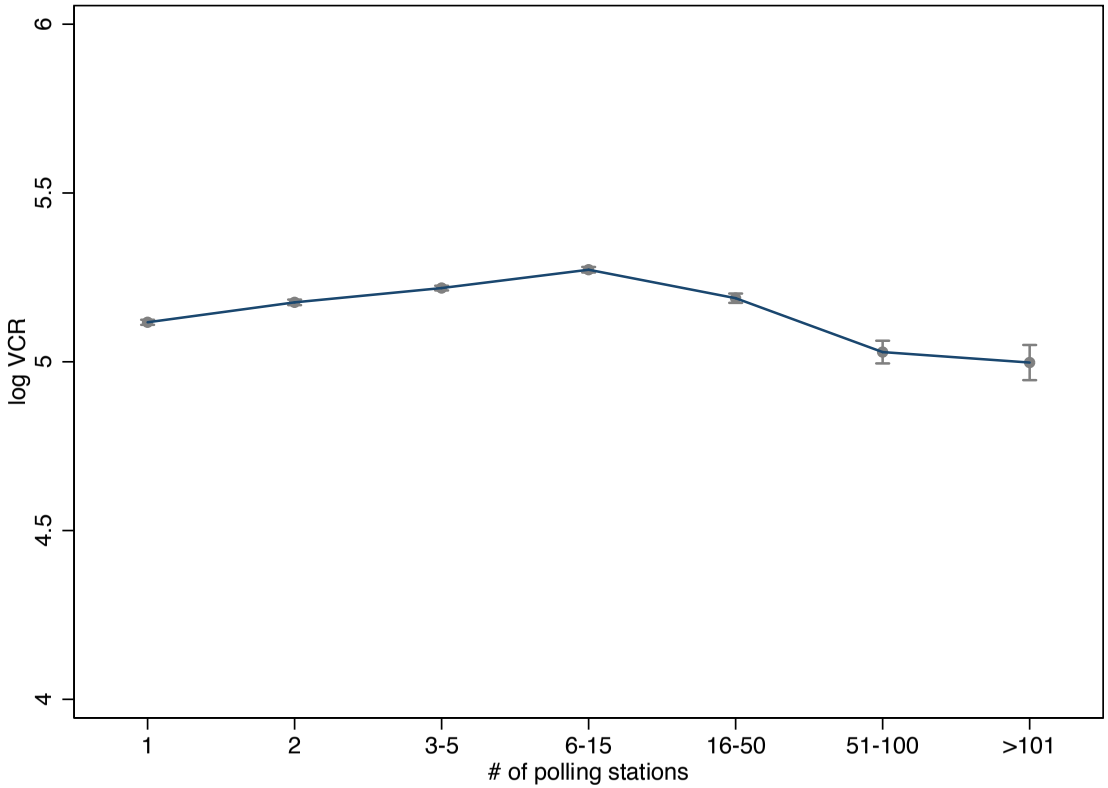
Note: The figure compares three measures of vote counting rates. The left-hand panel compares (raw) VCR with Adjusted VCR, which controls for the complexity of the vote counting task. The Spearman correlation coefficient is 0.98. The right-hand panel compares Controlled VCR and Adjusted VCR, where the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

Figure A.9: **Adjusted/Controlled VCR and Value Added per Worker**



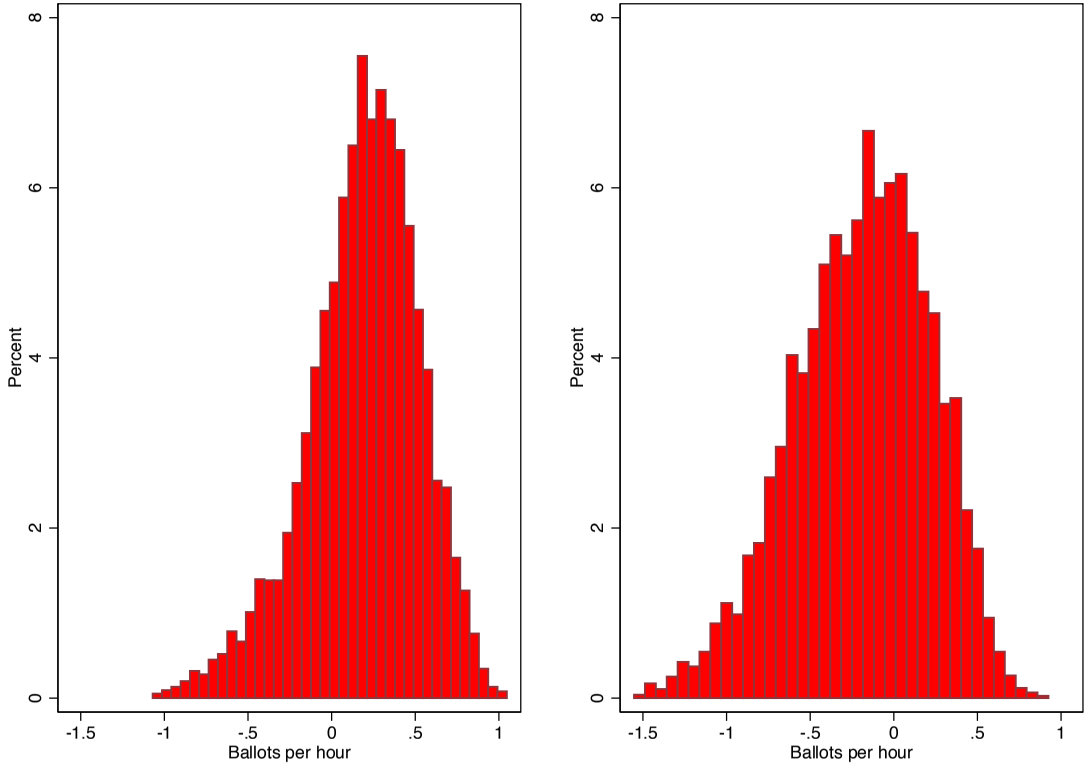
Note: The figure compares VCR with value added per worker. The left-hand panel uses Adjusted VCR, which controls for the complexity of the vote counting task. The right-hand panel uses Controlled VCR, which also controls for vote-counter characteristics.

Figure A.10: **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.

Figure A.11: **Controlled VCR**



Note: The figure plots vote counting rates using total time (left-hand panel) and Senate time (right-hand panel) in the 2013 election, after controlling for the complexity of the vote counting task and vote counters' characteristics.

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 and 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: **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
Province	110	110	103	110	110	103
Observations	7589	7589	3331	7585	7585	3321

Note: The dependent variable is the log of Vote Counting Rates ($VCR_{i,s}$) for election s and municipality i as defined in equation (1). 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: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B Data Appendix

B.1 Vote counting data

Vote counting data and the vote counting process are described in the main text. They were obtained from the Ministry of Interior.

B.2 Value Added Per Worker in Firms

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

Value added per worker

Our value added measure is the sum of average cost of employee[32] and profit per employee. We drop the observations with negative values.

Capital per worker

Following Gopinath, Kalemli-Ozcan, Karabarbounis and Villegas-Sanchez (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.[33] We also delete firm-year observations where the ratio of tangible fixed assets to total assets is greater than one. We then divide the capital stock of the firm with number of employees.

Winsorization

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.

[32] Average cost of employee and profit per employee are under *Global ratios/industrial companies/per employee ratios* in the database.

[33] For 2006 total assets were unavaialble, so we didn't drop observations with tangible assets that are larger than total assets. Tangible and intangible capital values are under *Global standard format/industrial companies/balance sheet* in the database.

From Output per Worker in the Average Firm to Average Output per Worker

We also compute a weighted average measure, where weight of each firm in the province is its employment share in that province[34].

Industry Control

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

$$ValueAdded_f = \beta_0 + \beta_{1i} Industry_i + \beta_{2j} Province_j + \varepsilon_f$$

where $ValueAdded_f$ is the value added of the firm, and Industry and Province are dummy variables to capture the fixed effects. Then, value added for each province is the sum of intercept, province fixed effect and industry fixed effect adjusted with its frequency in Italy:

$$ValueAdded_f^c = \beta_0 + \sum \beta_{1i} f_i + \beta_{2j} Province_j$$

Trimmed Sample

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 10, 20 and 50 percentiles. We use the first of these in our main specification, but results are robust to using the other two and the untrimmed sample.

Consistent Sample

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.

[34]Number of employees are under *Key financials&employees* in the database

B.3 Survey on Vote Counter Characteristics

The data on vote counters (*presidenti*, *segretari* and *scrutatori*), consists of a cross-section with a single observation per individual involved in the vote counting process during the Italian general election on 24-25 February 2013. It was collected directly from inidividual municipalities.

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 know 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.
The initial response was underwhelming. It is impossible to quantify how many of the addresses in our list were outdated and in how many cases the e-mail was just ignored. 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 second e-mail was more successful. We believe this effect is partially due to 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. It is worth noting that since some municipalities have been aggregated into larger entities since then, in a few cases a single reply provided data on more than one municipality. A total of 179 municipalities refused to share data 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

Age variables

We computed the exact age at the time of the election using date of birth.

Education variables

The information on the highest degree earned was used to calculate years of schooling.

Employment status variables

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 *scrutatori*.