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ARTICLE

Impact of Electronic Voting Machines on Blank Votes and Null Votes in Brazilian Elections in 1998*

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Electronic voting machines were used for the first time in general elections in Brazil in 1998; in that year, some cities used this new voting method, while others continued to vote using paper ballots. Few studies have demonstrated that the rate of invalid votes for federal deputy was significantly lower in cities that used electronic voting machines.

This article analyzes the frequency of null votes and blank votes for four posts—federal deputy, state deputy, the president and governor. Based on a comparison of the results from the 1998 elections with the results from previous elections (1994), the article demonstrates that electronic voting machines reduced the percentage of blank votes for federal deputy, state deputies, the president and governor. Meanwhile, null votes reduced the competition for the posts of federal deputy and state deputy; however, it increased the competition for posts with greater visibility in the Brazilian political system: the governor and president.

Keywords: voting machine; invalid votes; Brazilian elections.

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For replication, see bpsr.org.br/files/archives/Dataset_Nicolau.html.

Until the mid-1990s, Brazilians voted the way most of the world still continues to vote. Voters arrived at their polling stations, received an official printed ballot, went into a voting booth, wrote the names (or numbers) of their chosen candidates, and deposited their ballot into a ballot box. Despite a series of improvements that have been implemented over the years since 1985, such as voter re-enrollment in 1986 and the creation of a national list of voters, this method of voting was still associated with numerous instances of tampering with the voter's intentions. Though not generalized to encompass the whole country, fraud still occurred during the voting process, particularly during voting, counting or the tallying of votes. The solution that the Electoral Court proposed in order to do away with these fraudulent practices was to adopt a completely electronic voting system. Paper ballots, ballot boxes and the manual counting and tallying of votes were all replaced with electronic voting machines.

However, the creators of electronic voting machines did not imagine that the invention would have effects on other aspects of the voting system. Studies based on elections from 1996 and 1998, the elections in which some cities experimented with the use of electronic voting machines for the first time and others voted using traditional paper ballots, have revealed some of these effects. Electronic voting machines drastically reduced the total number of null and blank votes in the 1998 elections (FUJIWARA, 2014; HIDALGO, 2010; NICOLAU, 2002) and increased the number of party label votes in both the 1996 and 1998 elections (ZUCCO JR. and NICOLAU, 2015). The primary reason for the decline in null and blank votes is that the new voting method has facilitated the process of casting a vote, particularly among uneducated voters; for these citizens, it is easier to work with numbers than it is to write candidates' names on paper ballots. Furthermore, the keyboard on electronic voting machines has the same numerical format as telephones and bank terminals, thus ensuring familiarity for uneducated voters. The result of the shift to electronic voting meant the incorporation of millions of "new" voters into the electoral process. Three researchers have stated the following on this shift in the voting system:

> The data presented on the decrease in blank and null votes in the 1998 elections for Congress and State Legislature indicates that electronic voting likely encouraged more voters to vote (thus reducing

> blank votes) and made voting easier (thus reducing erroneous votes and consequent null votes)" (NICOLAU, 2002, p. 292).
>
> ...voting by paper ballot was difficult for a large fraction of Brazilian voters. The introduction of electronic voting reduced these difficulties, and consequently functioned as a de facto expansion of the suffrage(HIDALGO, 2010, p. 36).
>
> Estimates indicate that [electronic voting] reduced residual voting in state legislature elections by a magnitude larger than 10% of total turnout. Such effect implies that millions of citizens who would have their votes go uncounted when using a paper ballot were de facto enfranchised. Consistent with the hypothesis that these voters were more likely to be less educated, the effects are larger in municipalities with higher illiteracy rates (FUJIWARA, 2014. p.2).

The fact that studies on the effects of electronic voting machines have used the total number of invalid votes (the sum of blank votes and null votes) in the 1998 proportional elections—the first in which electronic voting machines were used for national offices—raises two questions: First, is there any difference when we consider null votes and blank votes separately? Second, to what extent did the decrease in observed invalid votes for federal deputy and state deputies occur in the case of executive posts (governor and president)? The purpose of this article is to answer these two questions.

The article is divided into three sections. The first section presents a history of the voting processes used in Brazil since 1945 and outlines how null votes and blank votes were considered when each of the different voting processes was in place. The second section offers a brief description of the blank and null votes for the posts of federal deputy, state deputy, governor and president in the 1998 elections, based on the voting system adopted (paper ballots versus electronic voting machines). The last section compares the results from 1998 with those from 1994 using the difference-in-differences (diff-in-diff) technique.

Voting processes in Brazil

Since the first general elections took place in Brazil in 1945, three voting processes have been used in the country: party ballots, Australian ballots and electronic voting machines[1].

[1] For a description of the voting processes used before 1945, see Nicolau (2012).

In the elections between 1945 and 1955, voters took completed ballots with them to the polling station. On election day, voters received an official envelope from poll station officials. Then, they went into a voting booth and inserted their ballots into the envelope. The legislation defines the rules of ballot design; the ballot needed to be rectangular in shape, white and have small enough dimensions to fit in the official envelope and to be printed or typed. They needed to have the office for which the election is held, the name of the party and the office and name of the candidate. Citizens could make their own ballots, but in practice, parties assumed the responsibility for printing and distributing ballots on a large scale.

During the counting process, votes were considered null when the ballots did not meet the design standards, or when the voter inserted ballots from different parties for the same office; for example, a vote would be null if the envelope contained two ballots for two congressman candidates from different parties. When the voter did not insert a ballot for a given post, the vote was considered to be "blank". The distinction between blank and null ballots has been a part of Brazilian election legislation since 1945. Though it seems trivial, the difference has been significant in races for proportional posts (state deputy, congressman and city councilman), since blank votes were distributed among the parties until 1996[2].

Following a decade of its implementation, party ballots became the target of much criticism: voters experienced coercion on the way to the polling station in an attempt to collect ballots from certain candidates; party leaders gathered groups of voters in some places (known as "voting corrals") to collect ballots and go to the polling station as a group. The primary target of criticism was the Social Democratic Party (PSD), which had a significant presence in numerous cities in Brazil and therefore benefited from ballot distribution[3].

In 1954, the Congress approved the adoption of Australian ballots, which would be produced and distributed by the Electoral Court. The new method caused a significant change in the voting process. Rather than taking ballots with them to

[2] As of 1997 (Brazilian Law Nº 9.504), blank votes are no longer counted toward any seats.
[3] A summary of this criticism appears in the debate within the Chamber of Deputies. See Lacerda (1982, pp. 77–111).

the polling station, voters received the official ballot at the polling station and went into the voting booth, where they filled the ballot. The design of the Australian ballots used different layouts for different offices. For majoritarian races (president, governor, senator and mayor), a complete list of candidates was presented, with small boxes in front of each name. Voters needed to tick the box next to their choice of candidate. Meanwhile, for proportional races (congressman, state deputy and city councilman), voters needed to write their chosen candidate's name or number. As an alternative, they could write a party number[4]. Since 1965, candidates for proportional offices began to be identified by a number as well[5].

Australian ballots were used for the first time in the elections for the offices of the president and vice-president in the 1955 elections. The ballots were slowly adopted for elections to other offices—first during the races for executive offices (governor, lieutenant governor, mayor and deputy mayor) and for the Senate (1958). For proportional elections, Australian ballots were adopted in stages: first in all cities in the state of São Paulo, in the former state of Guanabara, and in all state capitals (1962); then in cities with a population of over 100,000 (1966), and then in all cities throughout the country (1970)[6]. Between 1970 and 1994, Australian ballots were used in all cases for all offices and in all cities in the country.

In the new system, votes were considered blank when voters did not fill in their ballots. Votes were treated as null when voters deliberately erased their vote or made mistakes while voting. Examples of mistakes included illegible handwriting, votes casted for non-existent candidates, or votes casted for candidates running for different offices.

The most revolutionary change to the Brazilian voting process was the adoption of electronic voting machines in 1996. The Superior Electoral Court's primary reason for adopting the change was to end electoral fraud, particularly

[4] The 1982 ballot was unique in that voters wrote in the names of their chosen candidates for majoritarian offices (mayor, governor and senator). For an example, see Nicolau (2012), Figure 13 in the list of images.
[5] The new method was established by the Electoral Code of 1965 (Article 100).
[6] Only 24 cities began to use Australian ballots in 1966. The list is presented in the *Election Report (Boletim Eleitoral) from the Superior Electoral Court (TSE)*, September 1966, pg. 127.

that which occurred during the tallying process[7]. In the 1994 elections, cases of fraud in the state of Rio de Janeiro were so rampant that the State Superior Electoral Court (TRE-RJ) annulled the elections for federal deputy and state deputies and voters had to vote again for these posts when second votes were casted for the governor.

Electronic voting machines were employed experimentally in 57 cities (state capitals and cities with over 200,000 voters) in city-level elections in 1996. In the 1998 elections, the new system was used for the first time in election races for national and state-level seats. For logistical reasons, electronic voting machines were used in all elections in the states of Rio de Janeiro and Alagoas (states with high rates of electoral fraud in the 1994 elections), in two other states (Roraima and Amapá), and in the nation's capital (the Federal District). For the other 22 states, the TSE used the size of the registered electorate as the criterion: cities with fewer than 40,500 voters would continue to vote using paper ballots, while those above this threshold used electronic voting machines. Electronic voting machines were used in a total of 537 cities (9.8% of the 5,507 cities in the country). Fifty-eight percent of the country's total population at the time lived in these 537 cities.

In addition to the mechanical change to casting a vote—those who were writing a candidate's name or number with a pen would now type a candidate's number—electronic voting machines ushered in other changes as well. The first of these changes has been the required order in which offices would be voted upon, which was established by the TSE. The second change is the requirement to vote for a candidate for every office, that is, voters must vote for the first office before moving on to the second and so forth until the voting process is closed via an electronic alert. The third change has been that votes are no longer cast using party acronyms; candidates and parties are now identified by numbers. To vote for a given candidate or party, voters must type in a number. The fourth change has been the presence of photographs and party symbols for the first time in the history of elections in Brazil. Once voters type in their chosen candidate's number, a photo appears corresponding to the candidate whom they want to vote for, and

[7] See *Electronic Voting: Commemorative Edition (Voto eletrônico: edição comemorativa)*, TRE-RS, 2006.

voters must press the "CONFIRM" key[8]. In the case of party label votes, the party's symbol appears.

When the electronic voting machine was installed in 1996, a law was still in place in which blank votes were counted in the calculations to distribute seats for City Councils, State Assemblies and the Chamber of Deputies among the parties. For this reason, a special key was necessary to allow voters to cast blank votes. Curiously, however, even with the annulment of this law in 1997, the blank vote key was still added to new versions of the electronic voting machine. In the era of electronic voting machines, a blank vote became a more simple option for voters: all they had to do was push a special key in which "BLANK" was written. Meanwhile, to cast a null vote, voters must enter a non-existent candidate number (for example, a sequence of zeros) and confirm their votes.

Table 01 presents the percentage of null and blank votes in the race for federal deputy and president between 1945 and 2014; the sums of the two types are listed in the "invalid votes" column. During the democratic experience between 1945 and 1964, the total number of invalid votes for the two offices constantly grew[9]. The high percentage of blank votes in the 1962 elections is of particular interest. The use of Australian ballots for the first time in proportional elections may have been the cause for this rise. The requirement that ballots be filled in inside the voting booth likely contributed to the increase in voters casting blank votes or involuntarily casting null votes while trying to fill in the ballot, particularly among those with lower education levels (POWER and ROBERTS, 1995). Data from São Paulo and Guanabara, states in which all voters used Australian ballots in 1962, are consistent with this hypothesis[10]. In São Paulo, the total number of blank votes rose from 12% (1958) to 26% (1962); null votes

[8] In the first election in which electronic voting machines were used, I remember hearing the following comment from a voter with a low education level: "For the first time, I know I voted right, because I saw my candidate's face on the screen".

[9] For more on null and blank votes in Brazil in the 1946 election, see Lima Júnior (1983), Lavareda (1991), and Santos (2003).

[10] Gingerich (2013) compared cities that used party ballots and cities that used Australian ballots in 1962 and found an increase in invalid votes in the latter; however, the study did not distinguish between null votes and blank votes.

increased from 1.5% to 4.4%. In Guanabara, the total number of blank votes witnessed a rise from 4.9% to 10.4%[11].

Table 01. Percentage of blank votes, null votes, and invalid (total) votes for federal deputy and the presidency in Brazil (1945–2014)

	Null Vote for Congressman	Blank Vote for Congressman	Invalid Vote for Congressman	Null Vote for President	Blank Vote for President	Invalid Vote for President
1945	1.9	1.3	3.2	4.2	1.1	5.3
1950	2.7	4.6	7.3	1.8	2.6	4.4
1954	1.9	4.7	6.6			
1955				3.4	1.8	5.2
1958	1.6	7.5	9.1			
1960				3.8	3.4	7.2
1962	3.2	14.6	17.8			
1966	6.8	14.2	21.0			
1970	9.4	20.9	30.3			
1974	7.1	14.2	21.3			
1978	7.3	13.4	20.7			
1982	4.2	10.9	15.1			
1986	6.2	21.9	28.1			
1989				4.8	1.6	6.4
1990	13.7	30.0	43.7			
1994	25.2	16.5	41.7	9.6	9.2	19.8
1998	9.8	10.2	20.0	10.7	8.0	18.7
2002	2.9	4.7	7.6	7.4	3.0	10.4
2006	4.8	6.3	11.1	5.7	2.7	8.4
2010	6.0	3.4	9.4	5.5	3.1	8.6
2014	8.8	6.9	16.7	5.8	3.8	9.6

Source: Brazilian Superior Electoral Court.

In the five elections that were held under the military dictatorship (1966–1982), one fact that draws particular attention is the high number (30%) of invalid votes in 1970. In that election, opposition factions led the largest null vote campaign in the nation's history. If the results from 1970 are excluded, the results from the other years are close to those from the last election that were held before the 1964 coup d'état. Another hypothesis for the increase in invalid votes in 1970 was the fact that, for the first time, voters in cities with fewer than 100,000 voters

[11] Data from 1962 on the new state of Guanabara was compared with data from 1958 on the former Federal District.

used Australian ballots in proportional elections, which may have increased null votes due to voter mistakes while filling out the ballots[12].

The first three elections after the end of the military dictatorship were marked by a high rate of invalid votes. In the 1986 elections for constituent representatives, 28% of voters cast null or blank votes. The increase in the number of parties contesting (which went from five to twenty-eight) plus the use of a much more complex ballot than any used thus far were likely complicating factors for voters, particularly for the large percentage of people who were voting for the first time[13]. In the two following races, invalid votes for the Chamber of Deputies reached an extremely high level: 43.7% (1990) and 41.7% (1994). These values are high, and not just by Brazilian standards: in a review of data from all of the elections held between 1945 and 2001, I found only one case in Peru from 1995 in which 44.4% of votes for the Chamber of Deputies were invalid. This was the only case in which the amount of invalid votes surpassed the ones in the two Brazilian elections held in the early 1990s (PINTOR and GRATSCHEW, 2002).

In 1998, the total number of invalid votes in the races for the Chamber of Deputies witnessed a substantial decline. A series of studies have produced consistent evidence that this decline was associated with the introduction of electronic voting machines (FUJIWARA, 2014; HIDALGO, 2010; NICOLAU, 2002). The drop in invalid votes was the result of two factors. The first factor was that, for voters (particularly those with low education levels), it became easier to vote by typing numbers on a keyboard that was similar to those used on telephones and at bank terminals than it was to write a candidate's name or number on a ballot. The second factor is a question of how voting came to take place. The fact that votes for proportional offices appeared first and that voters were required to make a choice (to press a key to cast a blank vote, or to press a number for a candidate or for a party, or to cast a null vote by entering a non-existent number) in order to move on to majoritarian offices had a considerable effect on the choice for federal deputy (ZUCCO JR. and NICOLAU, 2015).

[12] As far as I know, this hypothesis has not been explored in any empirical study on the 1970 Brazilian elections.

[13] The 1986 elections were the first elections to be held after voter re-enrollment. Another important factor is that illiterate voters voted in general elections for the first time since the proclamation of the Republic.

In the three elections that followed (2002, 2006 and 2010), invalid votes for the Chamber of Deputies remained at relatively low levels for a specific period and increased substantially in 2014. Meanwhile, in the series of eleven presidential races in the country, it is interesting to note that the total number of invalid votes from 1998 was not significantly lower than that of 1994. The drop occurred in 2000 and has remained relatively stable since then. Is it possible that, in 1998, electronic voting machines did not have the same effect as the one observed in the congressman race? This topic will be discussed in the following section.

Null and blank votes in the 1998 elections

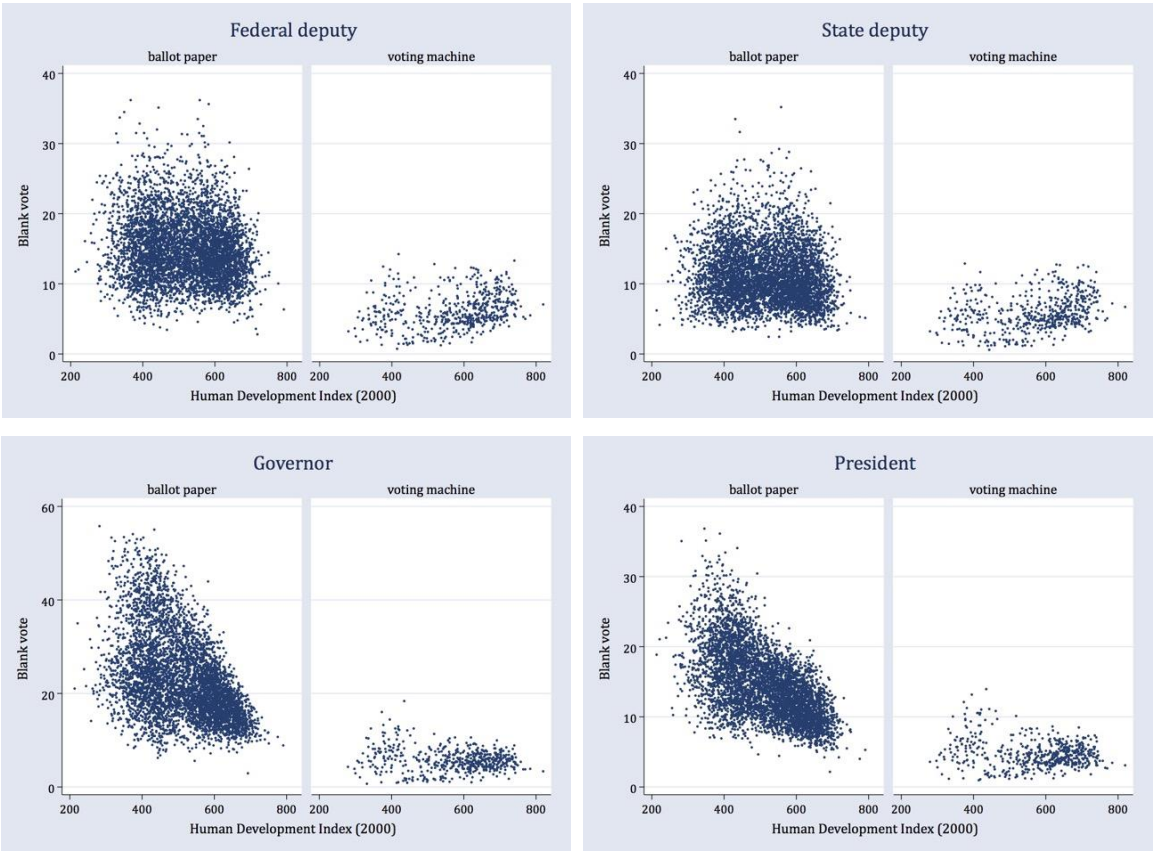
In the 1998 elections, residents in cities that used the old voting model received two ballots when they arrived at the polling station. The first was a yellow ballot with the names of the candidates for president, governor and senator with small boxes in front of each name. The second was a white ballot on which voters had to write the name (or number) of their chosen candidate or party (if they chose to cast a party label vote). Votes were cast in the voting booth and were then deposited in a ballot box. Meanwhile, voters who used electronic voting machines (many of whom were using them for the first time), needed to follow a specific voting order. In 1998, the order of the offices used was congressman, state deputy, senator, governor and finally president[14].

Figure 01 presents the percentage of blank votes for federal deputy, state deputies, governor and president in Brazilian cities in 1998. The four dispersion graphs indicate the human development index (HDI; 2002 data) on the *x* axis and blank votes on the *y* axis, segmented by the use of paper ballots or electronic voting machines. Each graph presents a line of best fit (LOESS). In the four graphs, the rate of blank votes is, on an average, lower in cities that used electronic voting machines. This fact is particularly interesting, because electronic voting machines have a key specifically for voters to cast blank votes. The graphs for the elections of the governor and president show surprising data: in cities that used paper ballots, the percentage of blank votes tended to decrease as the cities' HDIs increased. In

[14] Votes for senator were excluded from this study, since one of the goals of the work was to compare 1998 data to 1994 data. The fact that senators were elected in 1998 and not in the previous election did not allow for an ideal comparison between the invalid votes in the two elections.

summary, the data from the four graphs indicates that when compared to paper ballots, electronic voting machines had a positive effect on the decline of blank votes.

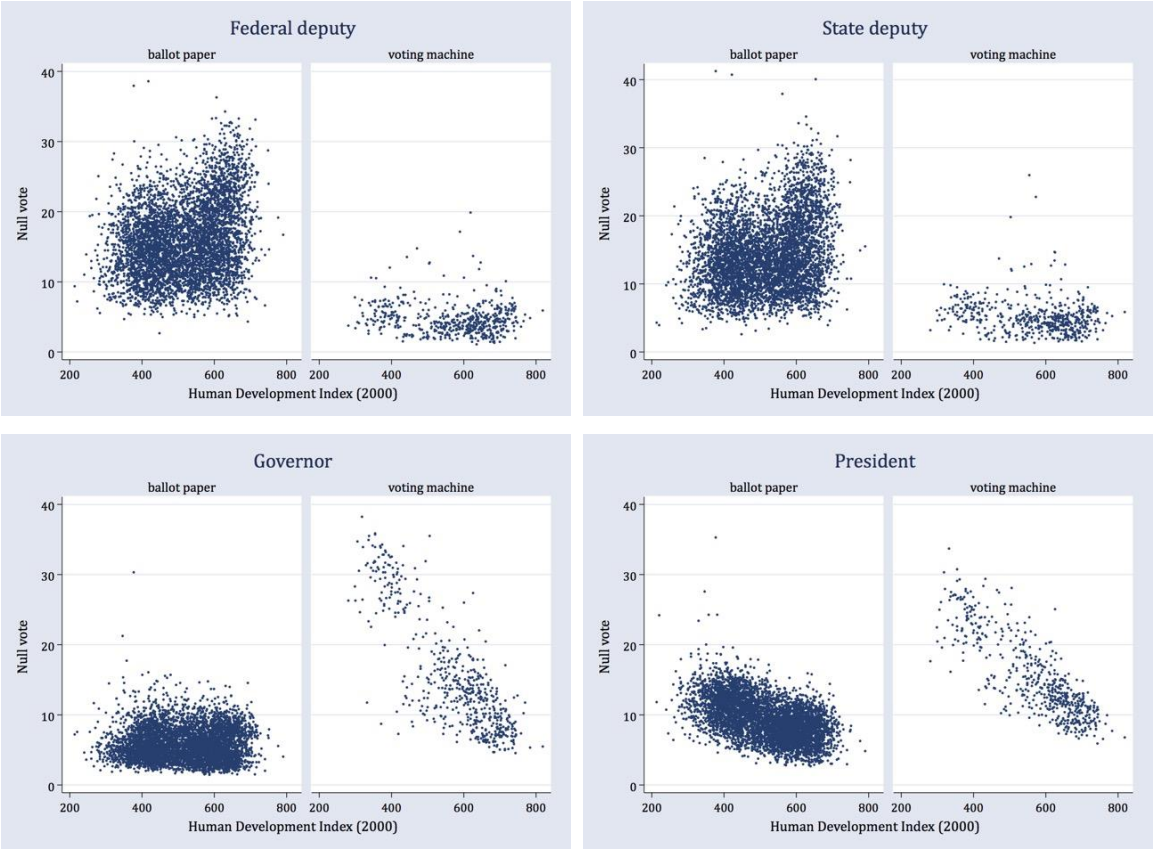
Figure 01. Percentage of blank votes in the 1998 elections



Source: Brazilian Superior Electoral Court and United Nations Program for Development.
Note: The four graphs present a scatterplot with the percentage of blank votes and the human development index (2000), divided on the basis of the voting process (paper ballots or electronic voting machines).

A general overview of the null votes is presented in Figure 02. The two graphs above clearly show that, for proportional offices (federal deputy and state deputies), the percentage of null votes tended to be much lower in cities that used electronic voting machines. Whether because of the significance accorded to votes for proportional offices, or whether because it is much easier to type on the keyboard of an electronic voting machine than it is to write out candidates' names, we found that null votes truly were lower for these two offices.

Figure 02. Percentage of null votes in the 1998 elections



Source: Brazilian Superior Electoral Court and United Nations Program for Development.
Note: The four graphs present a scatterplot with the percentage of null votes and the human development index (2000), divided on the basis of the voting process (paper ballots or electronic voting machines).

Meanwhile, for the executive offices (president and governor), the result was surprising: the number of null votes tended to be higher in cities that used electronic voting machines, though with a negative correlation: the higher the HDI of the city, the lower the number of null votes. The two graphs indicate that the high rates of null votes tend to be concentrated in the upper area, where cities with lower HDIs are displayed. The following question persists: in cities that used electronic voting machines, why were null votes so much higher for offices that have greater importance in the Brazilian representative system (governor and president)?

One hypothesis is that the order in which candidates are presented on the screens of electronic voting machines during the voting process may have contributed to voter confusion (KINZO, 2004). Because of the importance of elections for the Executive branch, voters expected the vote for president and

governor to be the first to be presented. Thus, voters who were unfamiliar with electronic voting machines may have begun voting by typing the numbers of their chosen presidential candidate. By voting for the presidential candidate in this way, voters would have cast party label votes for federal deputy. In the next vote, upon entering the numbers for their chosen governor candidate, voters would have cast party label votes for state deputies. Null votes increased precisely at the point when voters would have needed to enter three numbers for senators and five numbers for federal deputy and state deputies[15].

Comparing 1998 election results with those from 1994

The criteria used by the TSE to select which cities would use electronic voting machines and which would continue to vote using paper ballots were not random: (1) total adoption of electronic voting machines in five states and (2) adoption of electronic voting machines in cities with fewer than 40,500 voters in the other states. Because smaller cities have, on an average, lower social indicators than large cities, it is crucial to know to what extent the differences found in blank and null vote rates can be explained by social factors and not by the effects of the voting process. A simple way to "isolate" the effects of cities' socioeconomic levels is to compare the average amount of null and blank votes from 1998 to those from the same cities in the previous elections (1994), a technique known as difference-in-differences, or diff-in-diff (ANGRIST and PISCHKE, 2009; 2014). The fact that the intervals between the two elections were only four years aids the comparison, since it is to be expected that the socioeconomic attributes of the cities changed little during this period.

Table 02 presents the differences in the average percentages of null, blank and invalid votes in the 1994 and 1998 elections. The idea is to determine whether differences present before the introduction of electronic voting machines could have influenced 1998 percentages. For example, is it possible that cities that used electronic voting machines in 1998, which were larger and had higher average incomes, would not have had very different rates of null and blank votes in the 1994 elections? The two first columns present the differences between the 1998

[15] Zucco Jr. and Nicolau (2015) showed that the amount of party label votes for federal deputy was much higher in cities that used electronic voting machines.

and 1994 elections, focusing on the cities that used electronic voting machines in 1998. We observed a small difference in percentage points between the two types of cities. This difference followed the same pattern for all four offices: in cities that adopted electronic voting machines, the rate of blank votes was higher and the rate of null votes was lower.

Table 02. Difference-in-differences of blank votes and null votes in the 1994 and 1998 elections for federal deputy, state deputies, governors and the president

	1994 (paper ballots) A	1994 (ballot boxes) B	Difference (B-A)	1998 (paper ballots) C	1998 (ballot boxes) D	Difference (D-C)	Difference -in - Differences
Blank votes for federal deputy	20.04	17.47	-2.57	14.88	6.13	- 8.75	- 6.18
Blank votes for state deputies	17.96	14.45	-3.51	11.17	5.89	-5.29	- 1.78
Blank votes for governors	23.94	19.99	-3.94	22.80	5.69	-17.11	- 13.16
Blank votes for president	13.47	9.97	-3.51	14.42	4.68	-9.74	- 6.24
Null votes for federal deputy	21.40	24.83	3.43	15.86	4.56	-11.30	- 14.73
Null votes for state deputies	17.45	19.84	2.40	14.17	5.06	-9.10	- 11.50
Null votes for governors	6.75	8.29	1.54	5.80	15.19	9.39	7.85
Null votes for president	10.11	10.64	0.53	9.34	15.06	5.72	5.19

Source: Brazilian Superior Electoral Court.
Note: The table presents the average percentage of null votes and blank votes in Brazilian cities and the differences between them based on the voting method used. Though electronic voting machines were still not in use in 1994, the idea is to retrospectively observe possible differences between the two methods over time.

The most important information in Table 02 is the difference-in-differences demonstrated in the last column. We observed a decline in votes for all four offices relative to the data from 1994; in terms of percentage points, the differences found were −6.2 for the federal deputy, −1.8 for state deputies, −13.2 for governors, and −6.24 for the president. In other words, there is no doubt that electronic voting

machines contributed to the decline in blank votes. Null votes for proportional offices also decreased substantially in cities that used electronic voting machines; they decreased to an average of 14.7 percentage points in the case of federal deputy and 11.5 percentage points in the case of state deputies. The same results did not occur for majoritarian offices, for which the null votes increased relative to 1994: 7.9 percentage points for governors and 5.2 percentage points for the president.

Conclusions

The 1998 Brazilian elections were an ideal opportunity to determine the effects of the voting process on the votes cast. A series of studies have indicated that the introduction of electronic voting machines in the country reduced the amount of invalid votes, which therefore enfranchised many voters: millions of voters who had already or who would have otherwise cast blank votes or null votes because of mistakes while filling in ballots were now having their votes counted. The fact that these studies analyzed only the total number of invalid votes, without distinguishing between null votes and blank votes, along with their focus on the results of elections for the Chamber of Deputies, both raise the questions that have guided this article: First, is there any difference when we consider null votes and blank votes separately? Second, to what extent did the observed decline in invalid votes for federal deputy and state deputies occur in the case of executive posts (governor and president)?

Observing the difference between blank votes and null votes may appear an instance of preciosity, but the difference resulting from the legislation on the two types of votes and the special blank vote key on electronic voting machines are valid reasons for these two options to be considered individually. The data indicates that the introduction of electronic voting machines did, in fact, reduce the total number of blank votes in the four offices analyzed in this article. The voters had more incentive to vote for a candidate (or to cast a null vote) in an electronic voting machine than on a paper ballot. The introduction of a new voting method had a consequence that many Brazilian analysts have overlooked. Paper ballots without symbols or images required voters to make up to six choices at once. This

system was not adequate for a country with such a high level of undereducated voters.

Electronic voting machines also contributed to the decrease in null votes for federal deputy and state deputies. In the 1994 elections, which preceded the adoption of the new voting model, the total rate of null votes in the country reached 25%. Though the rate of null votes decreased in 1998, the drop was greater in cities that experimented with electronic voting machines (a rate of 05%) than in cities that continued to use paper ballots (a rate of 15%). For the offices of governor and president, however, the reverse trend was observed: the rate of null votes was higher in cities that used electronic voting machines. A comparison of the null votes in these cities indicated that they increased substantially. These findings are surprising, particularly if we consider the effect that presidential and gubernatorial elections have on the Brazilian political system.

One hypothesis is that the voting order established in electronic voting machines may have contributed to the high rate of null votes when these machines were used. In an attempt to encourage voting for the legislature, the law established that voting would begin with proportional offices. The fear was that, if the vote for president came first, many voters would choose not to vote for the other offices. Based on the format adopted, voters would have to vote for all other offices before they could vote for the president.

The problem is that the order adopted is counter-intuitive. With no experience with the new voting method, voters expected to vote for the president first. An unfortunate coincidence causes the presidential candidate's campaign number to be the same as the party number in proportional races; consequently, a vote cast for the president is counted as a party label vote for the party with which the president is affiliated. This initial error results in confusion and increases the probability that greater errors occur specifically with regard to casting votes in the elections for the last two offices.

As other studies on the 1998 elections have indicated, electronic voting machines make a difference. In addition to separately analyzing blank votes and null votes, the main contribution of this study may be to show that, despite an overall drop in blank and null votes for federal deputy, electronic voting machines have increased null votes for offices that have more visibility in Brazilian politics.

In addition to the differences that are traditionally referenced in comparisons between paper ballots and electronic voting machines, which is a seemingly simple choice, the order in which candidates appear in the voting process may have had a significant effect on the results of the 1998 elections.

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