THE FINGERPRINTS OF FRAUD: EVIDENCE FROM MEXICO’S 1988 PRESIDENTIAL ELECTION*

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Abstract

This paper disentangles the opportunities for fraud in authoritarian settings by documenting the inflation of the vote returns during the 1988 presidential election in Mexico. In particular, I study how aggregation fraud was the result of an electoral reform that centralized the vote-counting process in the hands of district officials. Moreover, sub-national differences in the levels of this irregularity can be explained by the incentives of the governors to keep officials accountable for delivering the results they expected. Using an original image database of the vote-tally sheets for that election, and applying Convolutional Neural Networks (CNN) to analyze pictures, I find evidence of blatant alterations in almost thirty percent of the tallies in the country. An exploratory analysis on this classification suggests that altered tallies were more prevalent in the incumbent party-strongholds and where governors had both the electoral expertise and political motivations to engage in manipulation. This research has important implications for understanding the ways in which autocrats control elections as well as introducing a new methodology to audit the integrity of the vote tallies in contemporary elections.

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1 Introduction

The literature of comparative politics offers a wealth of hypotheses concerning the motivations of autocrats to hold and manipulate elections.¹ These works advance our understanding of how autocrats design biased institutions (Díaz-Cayeros and Magaloni, 2004; Levitsky and Way, 2010; Higashijima and Chang, 2015) and control election results through electoral fraud (Diamond, 2002; Schedler, 2006; Birch, 2012; Simpser, 2013; Little, 2015). The scholarly works on the topic have not only expanded our knowledge of the dynamics within authoritarian regimes, but they have also increased the analytical toolkit to explore the behavior of voters and political elites.

While all of these studies emphasize how elections help authoritarian regimes survive, it remains unclear the role of electoral institutions to accomplish it. Electoral rules in authoritarian settings decrease the uncertainty of power distribution both outside and inside the ruling elite (Lust-Okar, 2005; Brownlee, 2007; Blaydes, 2011; Boix and Svolik, 2013).² At the same time, dictators often engage in electoral manipulation, disregarding the institutions they established in the first place (Kalinin and Mebane, 2011; Enikolopov et al., 2013). This contradiction obscures our understanding of whether electoral institutions in autocracies are devices for intra-elite politics or a mere façade of a liberal procedure (Malesky and Schuler, 2011a; Pepinsky, 2013; Schedler, 2013; Boulianne Lagacé and Gandhi, 2015).

To determine the ways in which autocrats control elections, I use new data on the 1988 presidential contest in Mexico. In particular, I explore opportunities to manipulate vote returns after an electoral reform held prior to the 1988 election, which allowed district officials to recount and amend the results of the tallies they received from polling stations.

¹For the role of elections in dictatorships, see Magaloni (2006); Geddes (2006); Cox (2009); Gandhi and Lust-Okar (2009); Blaydes (2011); Schedler (2013), and Gehlbach and Simpser (2014).
²For similar arguments on the adoption of political parties and legislatures in autocracies see Magaloni and Kricheli (2010) and Schuler and Malesky (2014).
While this reform concentrated the opportunities for electoral manipulation to the district councils, the ultimate execution of fraud relied on dense networks of election officials activated and monitored by the governor of every state. To understand the patterns of fraud at sub-national level, I exploit the variation in governors’ resources and motivations to coordinate the electoral operation of district councils under their jurisdiction.

This paper presents a novel database with images of more than 50,000 vote tallies available for the election. Using Convolutional Neural Networks (CNN)—a computer-aided detection system used for image-recognition problems, I identify blatant alterations in about 30% of the vote tallies in the country. I complement this finding by exploring the factors determining aggregation fraud. The results suggest that this irregularity was more likely to occur in the strongholds of the incumbent party, in the polling stations where the opposition was absent, and under the jurisdiction of the governors with the expertise and motivation to lead the electoral operation.

This article seeks to make three main contributions. The first one sheds light on the formal and informal opportunities to manipulate vote totals during the aggregation process (Myagkov, Ordeshook and Shakin, 2009; Ofosu and Posner, 2015; Callen and Long, 2015). The findings provide evidence of the role of local officials in the execution of fraud (Ziblatt, 2009; Reuter and Robertson, 2012; Martinez Bravo, 2014; Mares, 2015). It also demonstrates that the overall prevalence of this irregularity at the subnational level depends on the opportunities to mobilize local agents, avoid exposure, and signal loyalty to the national government. The results suggest a way to overcome the collective action and coordination problems common to the decentralized execution of fraud (Rundlett and Svolik, 2016).

The second contribution is methodological. This paper assesses the integrity of the vote tallies by introducing a CNN model that can be extended to the analysis of any other election. The proposed approach complements recent developments trying to detect statistical anomalies in vote returns (Myagkov, Ordeshook and Shakin, 2009; Beber
and Scacco, 2012; Mebane, 2015; Rozenas, 2015). In particular, this work is most similar to the few works applying machine learning to identify electoral manipulation (Cantú and Saiegh, 2011; Montgomery et al., 2015; Levin, Pomares and Alvarez, 2016). However, I depart from the aforementioned literature by, rather than looking for statistical oddities in the vote returns, using the images of the tallies as the input to understand the data generating process behind those numbers.

The final contribution of this article is to document an overlooked electoral irregularity in one of the most alluded cases of authoritarian manipulation. The 1988 election in Mexico is often cited as the prototypical example of how authoritarian governments control electoral outcomes in a centralized manner (Chernykh and Svolik, 2015; Luo and Rozenas, 2016). In addition, its resultant fraud allegations and protests are regarded as the beginning of the country’s gradual democratization process, which concluded in the year 2000 with the defeat of the Institutional Revolutionary Party (PRI) for first time in 71 years (Eisenstadt, 2004; Magaloni, 2006; Greene, 2007). Nevertheless, to this date there is little evidence of the existence and scope of fraud in this election. This paper analyzes for the first time the results of all of the polling stations open on July 6, 1988 and shows that, against the conventional wisdom on this election, most of the electoral irregularities took place at the district councils.

The structure of the rest of the paper is as follows. Section 2 provides a brief contextual background for the 1988 election in Mexico, describing the structural and institutional conditions for this election, as well as describing the main irregularities documented in the literature. Section 3 defines the conditions in which aggregation fraud is more likely to occur, proposes the theoretical expectations, and provides qualitative evidence from the study case for this irregularity. Section 4 describes the methodology and presents the results of the classification of all the images in the database. Using this classification as the dependent variable, Section 5 explores the determinants of this fraud technology. Finally, Section 6 summarizes the contributions and provides suggestions for future research.
2 Mexico 1988

2.1 Contextual Background

For most of the twentieth century, Mexican elections embodied the aspiration of anyone wishing to rule perpetually and with consent (Przeworski et al., 2000, p. 26). Although multiparty elections were held uninterruptedly, a complex system of formal institutions and informal arrangements permitted the Institutional Revolutionary Party (PRI) to obtain all the victories for the Senate, Governor, and Presidential elections from 1929 to 1988 (Scott, 1964; Johnson, 1978; Langston, Forthcoming). The strength of the official party relied on the legitimacy gained by competing in elections and the uneven playing field for the opposition parties (Schedler, 2002a, p. 37; Levitsky and Way, 2010).

By the second half of the 1980s, however, the PRI’s invincibility started to shatter. The popularity of the official party gradually waned as a new generation of urban citizens, unfamiliar with the country’s economic boom thirty years earlier, reached the voting age (Craig and Cornelius, 1995). The erosion of the regime’s public support intensified with the financial crisis of the early 1980s, which withdrew the support of popular sectors and the entrepreneurial class (Bruhn, 1997; Haber et al., 2008). The discontent toward the government and the official party became evident during the 1985 legislative election, where the PRI’s vote share dropped to a previously unseen low of 64% (Molinar, 1991).

And yet, the most critical weakening factor for the regime sprang from within the PRI itself. In the early 1980s, a group of young party members with more technical skills than political experience began occupying top positions in the federal administration (Camp, 2014, p. 134-137). The gradual influence of this group within the party faced hostility from the traditional political bosses, who showed hostility towards the new pro-market policies promoted by the government (Langston, Forthcoming). The intra-party disagreements escalated in 1987, when a handful of prominent PRI members spoke out against the government’s orthodox measures to the economic crisis and the lack of democracy.
within the party. When the president and the party authorities showed themselves unsympathetic to these demands, the dissident group had no alternative but to leave the PRI, representing its most critical split since 1940 (Magaloni, 2006).

The adverse political outlook drove the government to reform the electoral code in 1987. The new electoral law pointed to concentrate the electoral process in the hands of the federal executive and safeguard the PRI’s legislative majority (Woldenberg, 2012, p. 52-53). One of the most partisan amendments to the code introduced a governability clause that gave the default legislative majority to the party obtaining plurality in the election (Molinar and Weldon, 2001, p. 451). Furthermore, the reformed code centralized the electoral administration in three ways. First, the federal executive was now in charge to appoint the council presidents of the Federal Electoral Commission (CFE) at the national and district level, as well as the poll workers in every polling station (Gómez-Tagle, 1993, p. 80). Second, government representatives had the default majority in every CFE council, with 19 out of the 31 seats available, securing that the PRI could override any objection from the opposition (Krieger, 1990; Valdés Zurita and Piekarewicz, 1990). Finally, the reform entitled district-level authorities to recount the votes of polling stations in their jurisdiction (Klesner, 1997, p. 44). Together, these provisions placed the vote-count process in the hands of the 300 CFE district-council presidents, who were directly assigned by the Minister of Internal Affairs in Mexico City (Gómez-Tagle, 1993, p. 80).

The public disapproval to the reform, and the threat of an electoral boycott, forced the government to include two marginal yet significant concessions to the opposition. First, the electoral code recognized for the first time the legal figure of the party representatives, whose expulsion of the polling station constituted a reason to nullify the votes of the polling booth (Barquín, 1987, p. 52). This addition to the electoral code addressed one of the most reported irregularities since 1940 (Simpser and Hernández Company, 2014), and it strengthened the role of opposition parties to monitor the process, witness the

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3For a detailed description of the electoral reforms in the 1980s see Molinar (1991), Klesner (1997), and Eisenstadt (2004, p. 42-44)
tabulation, and document the electoral outcome of the attended polling booths. Second, the law also established for the first time a figure to ratify the election from a judicial approach, the Tribunal of Electoral Disputes (TRICOEL). The scope of this judicial actor, however, was undefined in the electoral code, which did not specify the reasons to nullify results or guarantee that its decisions were bound (Gómez-Tagle, 1993).

2.2 Electoral process

The 1988 presidential race pitted PRI’s Carlos Salinas against two main opposition candidates campaigning on opposite sides of the ideological spectrum. A variety of leftist parties and civic organizations joined forces to form the Democratic National Front (FDN) and endorse Cuauhtémoc Cárdenas. Cárdenas, who lead the PRI’s splinter a year earlier, campaigned toward an eclectic electorate frustrated by declining living standards and governmental corruption (Smith, 1989; Bruhn, 1997). Meanwhile, the conservative National Action Party (PAN) nominated Manuel Clouthier, whose campaign targeted middle-class voters disappointed with the country’s economic policies (Shirk, 2001; Wuhs, 2014). Parrying unequal campaign resources and biased media coverage (Reding, 1988; Oppenheimer, 1996, p. 132; Lawson, 2002, p. 52, Greene, 2007), both opposition candidates focused on mobilizing the protest vote and emphasizing that a PRI defeat was the first step in democratizing the country (Domínguez and McCann, 1995).

As soon as the election started on July 6, 1988, opposition parties and news agencies gave account of the multiple irregularities prevailing throughout the country. The incidents included, for example, polling stations opening with an undue delay (The New York Times, July 7, 1988), stolen and stuffed ballot boxes (La Jornada, July 7, 1988), and

4Besides Cárdenas and Clouthier, there were other two presidential candidates on the ballot. Gumersindo Magaña from the Mexican Democratic Party and Rosario Ibarra from the Revolutionary Workers’ Party. Magaña stepped out of the race a month before the election day and endorsed Cárdenas’ candidacy. Their vote shares were 1% and 0.4% of the votes, respectively.
destroyed ballots marked for Cárdenas (Los Angeles Times, July 15, 1988). Later that day, opposition candidates signed a letter documenting these and other irregularities—such as absent election officials, inflated voter rolls, and voters casting multiple ballots—and asked election officials to “reestablish the legality of the electoral process” (Cárdenas, Clouthier and Ibarra, 1989).

However, the doubts about the legitimacy of the process escalated after electoral authorities suddenly stopped publishing the results. A few hours after polls closed, the first public reports showed adverse results for the PRI’s candidate, triggering the anxiety of government officials (Anaya, 2008). When the news of the preliminary results reached President Miguel De la Madrid, he urged Salinas to declare himself the winner of the election and instructed election officials to interrupt the public vote count (De la Madrid, 2004, p. 816). A few minutes later, the screens at the Ministry of Interior went blank, an event that electoral authorities justified as a technical problem derived from the saturation of telephone lines (Castañeda, 2000, p. 83). Skeptical about the official explanation, opposition representatives urged election officials to continue with the public vote count after finding a computer in the building’s basement that continued receiving electoral results (Valdés Zurita and Piekarewicz, 1990). The sudden interruption of public information and the refusal of electoral authorities to release further results lead to the “system crash” anecdote, suggesting that the interruption of the vote count allowed election officials in Mexico City to manipulate the final results (Domínguez and McCann, 1995; Castañeda, 2000; Preston and Dillon, 2004).

Electoral authorities resumed the public vote count three days later, on July 10, when the official vote tabulation took place in each of the country’s 300 district councils. Later that day, officials announced the victory of the PRI’s Carlos Salinas with 50.4% of the vote, followed by Cárdenas, with 31.1%, and Clouthier with 17.1%. These results sparked multiple protests from opposition parties and citizens across the country. The confrontation to the official results, however, gradually weakened with the divergent demands from
within the opposition (Gómez Tagle, 1990; Magaloni, 2010). These disagreements allowed
the ratification of Salinas’s victory by the Electoral College on September 11, 1988.

While prior research has focused on the after-effects of this election on the gradual
democratization process in the country (Bruhn, 1997; Eisenstadt, 2004; Magaloni, 2006;
Greene, 2007; Woldenberg, 2012), there are no accounts of the existence and prevalence of
the electoral irregularities themselves. This omission is not surprising, however, because
the ballots from that election were destroyed two years later, and electoral authorities
made public the results only at the district level. To overcome the lack of empirical ev-
idence for this election, this paper analyzes for the first time the tallies filled in every
polling station, as well as their corresponding vote returns.

3 Aggregation Fraud

This paper unfolds the alteration of the vote tallies by election officials when aggregating
the results from the polling stations. This irregularity, referred to in other works as ag-
gregation fraud (Callen and Long, 2015), is a prevalent problem in many contemporary
elections and represents a top concern to election observers and practitioners. In the case
of the 1988 election in Mexico, the existence of this irregularity implies that electoral au-
thorities inflated Salinas’s vote returns at the district councils, after receiving the results
from the polling stations and before reporting them to the Ministry of Interior in Mexico
City. The existence of aggregation fraud suggests an overlooked hypothesis for how elec-
toral manipulation was carried out in this election, and allows us to study the incentives
and opportunities for electoral authorities to carry out this fraud technology.

The literature on electoral manipulation provides multiple accounts on the ways and
consequences of aggregation fraud. Caro (1991, p. 391-395), for example, offers an as-
tonishing description of how the Democratic political machine in Southern Texas altered

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5See, for example: Democracy International (2011) and USAID (2015).
a tally in Jim Wells County to give Lyndon B. Johnson two hundred extra votes and flip the result of the 1948 Senate primary election. In a study for the 2003 presidential election in Nigeria, Beber and Scacco (2012) find a similar handwriting style across multiple tally sheets and demonstrate that the last-digit vote frequencies significantly deviate from the uniform distribution, a pattern suggesting the alteration of the electoral results. Myagkov, Ordeshook and Shakin (2009) detail a similar fraud technology in contemporary Russian elections and describe the incentives for local bosses to falsify the tallies under their jurisdiction. Leveraging the advantages of field experiments, Callen and Long (2015) photographed and compared a random sample of tallies at several stages of the 2010 parliamentary elections in Afghanistan, finding discrepancies on the tallies across electoral stages 78% of the time. Finally, Ofosu and Posner (2015) use a similar approach to study the extent of this problem in Malawi’s 2014 election. The authors show that the count disparities during the aggregation process benefitted one of the parties, and that those tallies were less likely to be posted outside the polling station.

The prevalence of aggregation fraud in contemporary elections suggests its appeal over other subtle alternatives. Compare this fraud technology with alternative irregularities occurring at other stages of the election, for instance. On one end of the process, incumbents can delegate the execution of fraud to an army of vote agents who are able to manipulate the results at the polling-station level. Scholarly work provides examples of electoral manipulation carried out by numerous agents—represented as party local bosses (Key, 1949), employers (Lehoucq and Molina, 2002; Mares, 2015), or vote brokers (Novaes, 2016)—with enough experience on the ground to deliver votes in an effective and concealed way. Although decentralized fraud relies on a crowd of election experts, this strategy is vulnerable to a couple of drawbacks. First, when local agents can determine the electoral destiny of the ruling elite, they can condition their performance in exchange for excessive material or political benefits from the party (Schattschneider, 1942, p. 162). Second, to assure the success of this fraud technology, agents must operate through
a dense and cohesive network that allows the incumbent to monitor their performance. In
the absence of such coordination structure, agents may either make electoral corruption
more noticeable or undersupply fraud when the incumbent needs it the most (Rundlett
and Svolik, 2016).

At the other end of the process, the incumbent can opt for centralized manipulation
and rig the final results just before their official announcement. In this case, electoral fraud
is carried out by a handful of top-level officials whose decisions are determinant on the
final outcome. Consider, for example, the case of Ukraine’s Central Electoral Commission
in 2004, whose decision of invalidating the votes in three districts flipped the outcome the
presidential election (Birch, 2012, p. 123-130). Although centralized manipulation gives
the incumbent greater control over the election outcome, the significance of this irregular-
ity correlates with its probability of being noticed by the opposition and other observers
(Simpser, 2013). The blatancy of this irregularity, therefore, carries “legitimacy costs” re-
lated to social unrest (Tucker, 2007; Davecker, 2012; Beaulieu, 2014) or penalties from the
international community (Hyde, 2011; Kelley, 2012). Therefore, centralized irregularities
at the end of the process should be considered only as a “last resort” for electoral manip-
ulation (Birch, 2012, p. 131).

In comparison with both extremes, aggregation fraud allows the political elite to rely
on a compact group of decentralized agents, each unable to change the overall result
by themselves but directly accountable to the incumbent to modify the outcome on the
aggregate. As Callen and Long (2015) describe, this type of fraud is performed by a
reduced number of middle-level officials with the expertise to carry out manipulation and
closed links to the benefitted candidates. Given the perpetrators’ skills and their selected
membership to the network, the ruling elite is able to benefit from electoral manipulation
in a more efficient way.
3.1 Theoretical Expectations

The overarching hypothesis in this paper is that the incentives for aggregation fraud depend on the opportunities set by electoral institutions and the resources available to local officials. This argument refines existing explanations about the motivations for electoral fraud in authoritarian elections. I distinguish these factors by considering the electoral strength of the incumbent, the physical resources of the opposition, and the characteristics of the network required to manipulate the results of the vote tallies.

The first expectation is that the most susceptible tallies to aggregation fraud come from those polling stations were opposition agents were absent. This conjecture builds on the existing works on the deterring and displacing effects of election monitoring at the polling stations (Hyde, 2007; Ichino and Schundeln, 2012; Enikolopov et al., 2013; Asunka et al., Forthcoming). These studies highlight how the costs of committing electoral fraud at the polls increase with the presence of opposition and independent agents, who can get first-hand evidence of the irregularities to publicize them or use them for legal action. As a result, perpetrators displace their fraud efforts to places with no opposition representatives or election observers.

I extend this logic to the case of aggregation fraud, and suggest that the deterring effects of opposition representatives persist across further stages of the electoral process. In particular, officials are less likely to modify the results of those tallies originally filled in the presence of opposition representatives, since they could register the results and, at least in the Mexican case, receive a carbon copy of the tally. Therefore, all other things being equal, election officials had the strongest incentives to amend the results of those tallies from polling stations where opposition party representatives were absent.

Next, I consider the relationship between the likelihood of aggregation fraud and the electoral strength of the incumbent. The literature of electoral manipulation in competitive elections suggests that irregularities are more common to appear in tight races because they yield the larger marginal returns for executing fraud (Lehoucq, 2003; Mares,
By contrast, the works on authoritarian elections explain the prevalence of fraud even when the incumbent party often controls most, if not all, of the constituencies as a way of demonstrating the strength of the incumbent and discourage the opposition (Magaloni, 2006; Simpser, 2013). Since most of these explanations focus on the aggregated results, they omit the logic for targeting specific constituencies in the country.

I refine this argument to the conjecture that aggregation fraud in authoritarian contexts is more prevalent in the incumbent-dominant areas, an expectation that rests in two observations. First, to win the election by wide margins, incumbents prioritize their overall sum of votes. Since the presidential results aggregate the votes from all constituencies, the safest way to inflate the votes is not by disrupting the marginal districts, but rather by modifying the vote totals in those places where the incumbent already has an overwhelming majority. Second, an additional way of intimidating the opposition is showing that, even with the existence of some competitive districts, its electoral strength is unable to overcome the incumbent’s strength in the rest of the country. Therefore, the probability of observing an altered tally increases with the electoral strength of the incumbent party.

The final conjecture has to do with the influence of the local power elites on the management of aggregation fraud. Similar to the cases of Russia (Myagkov, Ordeshook and Shakin, 2009; Reuter and Robertson, 2012; Simpser, 2013) or Indonesia (Martinez Bravo, 2014), subnational authorities have incentives to signal their loyalty to the central government by securing favorable electoral results for the party. These incentives, however, may not be equally distributed across local agents. To coordinate the efforts from sub-national elites, some of them may have more resources and expertise to mobilize party agents on election day. Others, meanwhile, may have greater personal and career-based incentives to deliver votes to the national party. Therefore, the execution of fraud will depend on the motivation of the local elites to deliver votes to the center and their resources for doing so in an effective way. I expect then to observe the larger rates of aggregation fraud in
districts within the jurisdiction of governors with electoral expertise and close ties to the presidential candidate.

3.2 Aggregation Fraud in Mexico’s 1988 Presidential Election

Before presenting the evidence of this irregularity for the case study, it is important to understand its data-generating process. Beginning on 6 p.m. of Election Day, poll workers counted the ballots and recorded the polling station results in the presence of party representatives, who signed and got a carbon copy of the tally sheet. After finishing the vote-counting process, poll workers delivered the electoral material to one of the country’s 300 district councils, where election officials received the material and reported the preliminary results via telephone to the Ministry of Interior in Mexico City (Valdés Zu- rita and Piekarewicz, 1990). Despite the interruption of the national vote count, district councils continued receiving the tallies that were used three days later for the official vote tabulation, in which officials were allowed to amend the result of any tally and report the total vote sums for their district.

Even when the structure of the Mexican electoral administration was concentrated in the hands of the subnational electoral authorities and the Minister of Internal Affairs (Molinar, 1991; Simpser and Hernández Company, 2014), the 1987 electoral reform incentivized aggregation fraud in two ways. First, unlike in the case of the polling stations, the law provided the PRI with the absolute majority at the district councils, outnumbering those from the opposition by 19-to-12 seats. Second, the amended code allowed district officials to recount the votes of any polling station whenever the tallies did not correspond with those from the ballot boxes or when the tallies were missing. Both changes in the rules gave party officials the legal faculty to amend the vote tallies without the opposition’s approval (Gómez-Tagle, 1993).

The electoral operation in Mexico during the PRI’s hegemonic regime was performed by an informal chain of command leaded by the President, who relied on the Minister of
Interior to manage the election process and to hold accountable governors’ performance. Governors, in turn, were responsible for winning elections in their respective states, a goal that required them to coordinate local electoral authorities, not to mention to mobilize party officials and local brokers (Langston, Forthcoming, Chapter 3). The 1988 election, however, departs from this description in two ways. First, the gradual entitlement of technocrats within the PRI structure opened the opportunity for bureaucrats without political skills and electoral experience to become governors (Centeno, 2004). These inexperienced governors, however, lacked the means to mobilize local agents during Election Day and deliver the expected results (Anaya, 2008, p. 15). Second, the Minister of Interior, Manuel Bartlett, kept himself away from coordinating governors’ electoral efforts (Castañeda, 2000, p. 78-79). The bitterness of losing the presidential nomination led Bartlett to focus only on his formal task of administering the electoral process, while leaving inattentive his informal, yet critical, role of leading the electoral machine. Without the Ministry of Interior in the informal network, the control of the electoral results relied on a few governors with the expertise and motivation to deliver votes in an effective way.

Anecdotal evidence describes how election officials took part in altering the tallies during the tabulation of the votes. For example, Preston and Dillon (2004) describe the manipulation of the vote tallies in one of the district councils on July 10, 1988:

An official would page through the pile of precinct tallies one by one, calling out in a loud voice—in Spanish, cantando—the votes for each candidate as a secretary wrote the totals onto the district spreadsheet. (...) Each time Salinas’s votes from a precinct were read out loud, the PAN representative complained, the district committee secretary was adding a zero to Salinas’s total on the spreadsheet, changing 73 votes for Salinas to 730 votes, for instance. (p. 172)

The amendments to the tallies’ vote totals became evident when opposition representatives compared the results that they recorded at the polling stations during Election Day with the few official results published at the polling-station level. Consider the following
quote from a senator of the Socialist Populist Party describing the discrepancies in the results documented in the Eighth District of Puebla:

In the polling station number 2, the PRI obtained 232 votes, as it appears in the certified copy provided to the political parties. However, Mr. Carlos Olvera, the president of the Electoral Committee in the District, submitted an altered tally during the official vote count on Sunday 10, recording 1522 instead of 232 votes. (...) In the polling station number 3, the PRI got 184 votes, but the altered tally gives it 2488. The clean vote tally of the polling station number 4 shows 154 votes for the PRI, but the altered tally shows 720. Meanwhile, the Socialist Populist Party got 240 votes, but the altered tally gave it only 140. (Senado de la República, 1988, p. 115)

A close inspection of the vote tallies for that election confirms what suggested by the qualitative evidence. Figure 1 provides a few examples of vote tallies with alterations on their vote totals. The examples at the top present crossed out numbers as well as inconsistencies in the ink colors and handwritings. Meanwhile, the pictures at the bottom illustrate those altered tallies involving number insertions with irregular slant and pressure. The next section presents quantitative evidence for this irregularity and estimates the overall prevalence of the altered tallies in the election.

4 Analysis

This section introduces a methodology to identify alterations to the results reported in the vote tally sheets. To accomplish this task, I apply Convolutional Neural Networks (CNN), a computer algorithm able to learn visual patterns from the training data and classify new images accordingly (LeCun et al., 1990; Hastie, Tibshirani and Friedman, 2009). Emulating the learning capacity of the human brain, a CNN model gleans patterns from its interconnected units, or neurons, that activate when detecting a specific features
Figure 1: Examples of vote tallies with alteration in their numbers. Mexico, 1988
in an image. Applications of this method have now expanded to multiple fields, including object classification in photographs (Ciresan et al., 2011; Krizhevsky, Sutskever and Hinton, 2012), handwriting identification (LeCun et al., 1998), and human face recognition (LeCun, Kavukcuoglu and Farabet, 2010).

For the specific goal of this paper, a CNN classifier serves two purposes. First, it complements recent developments in electoral forensics by exploring the data generation process behind the statistical oddities in the turnout rates or vote shares. Second, this approach proposes an efficient and unbiased assessment for an issue as important as the integrity of an election. Computerized classification excels at the tedious exercise of classifying thousands of tallies—a labor that may yield to attention deficit and impatience from human coders (Hoque, el Kaliobly and Picard, 2009; Grimmer and King, 2011).

Notwithstanding its advantages, it is worth mentioning that the irregularities identified by the CNN are not exhaustive. Instead, the model distinguishes a specific type of fraud associated with the deliberate alteration of vote tallies. As such, this approach may overlook those irregularities originated from a different generation process, such as the manipulation of results before recording them in the tally or the replacement of an original tally with a new one. This approach, therefore, estimates a lower bound for the proportion of fraudulent tallies, and its results may complement alternative approaches for analyzing the data.

I describe below the classification of the vote tallies in four steps. First, I collected, organized, and pre-processed the tally images and their respective vote results. Second, I inspected a subset of images and identified those with potential alterations in their numbers. Third, I used the labeled images to train and fine-tune the CNN model. Finally, I

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6Consider, for example, the case of the results for the legislative election in Durango’s Second District, where the PRI won by unanimity in most of the polling stations. However, the results from one polling station give the PAN all votes for the deputy election but no even a single vote for the presidential nor senate election. In words of the PAN official, “(O)bviously, the person who marked the vote tallies got it wrong” (La Jornada, August 6, 1988b).
used the trained model to label the rest of the images in the database.

4.1 Data Collection

This paper presents new data from more than 53,000 polling stations opened on July 6, 1988, whose respective vote tally sheets are stored at the National Archive in Mexico City.\(^7\) The data collection and digitization process produced two databases. The first one contains the images of all the vote tallies from the 1988 election.\(^8\) With the help of two research assistants, I photographed, digitally edited, and organized by electoral district every vote tally available in the archive. To minimize the noise of the images during the classification stage, I manually cropped every picture to include only the area of the image that contains the vote returns, as the examples in Figure 1 illustrate.

The second database includes the vote returns at the polling station level for every candidate. This information was entered by a team of professional data coders and double-supervised by the coding team manager and myself. The data-entry process proved impossible for a handful of images with faded writing or inadequate light. The total number of observations in the database, thus, is then 53,249. As Table A and Figure B in the Appendix show, these vote totals are very similar to the official total votes reported at the national and district level. The resemblance validates the information of my database and suggests that any electoral manipulation occurred before officials compiled the re-

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\(^7\)The closest analyses using this data are Barberán et al. (1988) and Báez Rodríguez (1994). The first one is a book by a group of scholars and leftist activists—Cuauhtémoc Cárdenas himself included—analyzing the results of a sample of 30,000 polling stations that election officials made available to opposition parties. However, it remains unclear whether the sample is representative of all the polling stations in the country and the data used for this work is unavailable after the one of the authors passed away (Personal communication with two of the authors. January, 2016.). The second one presents the results of a quantitative analysis that claims using the “computerized retrieval system” at the National Archive. Unfortunately, staff members at the Archive denied the existence of such information (Eisenstadt, 2004, p. xi-x), and the author declared having missed the database (Personal communication with the author. June, 2015.).

\(^8\)See Figure A in the Appendix for an example.
sults from the vote tallies. Table B in the Appendix provides descriptive statistics of the database.

4.2 Data splitting

After preprocessing the images, I divided the database into three parts: a training set, a validation set, and a test set. The first two sets came from a sample of 1,050 pictures that I inspected and labeled as either “with alterations” (WA) or “without alterations” (WOA), ending up with 525 images for each class. The training set contains 900 of these images, which I use as inputs to fit my CNN model. The remaining 150 images constitute the validation set, which helps me estimate the prediction error of my model. Finally, the test set contains the almost 52,300 unlabeled images in the database, and I use it to estimate the overall rate of aggregation fraud in the election.

To identify those tallies assigned to the WA class, I first used qualitative evidence from interviews and legislative debates to find those districts with testimonies of aggregation fraud. Then, I inspected the tallies from those districts and labeled as WA those images showing the alterations suggested by the primary sources, such as the crossing-outs or number insertions illustrated in Figure 1. The images labeled as WOA come from a random sample of tallies that did not present alterations in their numbers.

To verify the reliability of the labels using two different experiments. The first one used crowdsourcing to compare my image labels with labels provided by 200 respondents recruited through Amazon’s Mechanical Turk (MTurk) for an online survey fielded in February 2017. The survey presented respondents with a random sample of 10 images and asked them to identify those tallies that they perceived with alterations in their numbers.

---

Notes: Figure 3 illustrates the CNN structure applied to identify images of the vote tally sheets with alteration in their numbers. The inputs of the images consist of numerical arrays of $3 \times 227 \times 227$ (height) $\times$ 227 (width) pixel values. The network contains six convoluted layers of 36, 36, 64, 64, 128, and 256 filters, respectively. A fully description of the network is described in Table C in the Appendix.

63% of the respondents passed the attention check and the average completion time was 7.4 minutes. A second check recruited five undergraduate students at the University of Houston, who were asked to identify altered tallies from a random sample of 50 images. The average time for completing this task was 58 minutes. In both tests, subjects were never informed of the labels I had assigned to each of images. The overall results show a substantial agreement with the original labeling (Youden’s J statistic were 0.30 and 0.45, respectively).

### 4.3 Classifier Training

The learning phase consists in allowing the CNN model to absorb the information of the training images through thousands of iterations. Each iteration gradually calibrates the model’s inferences of those features that distinguish each class. Figure 2 illustrates the network architecture of the model, which is fully specified in Table C in the Appendix.
To train the network, every image is first transformed into a numerical array of pixel values. These inputs pass through a first convolutional layer, which contains 32 filters, or neurons. Each of these filters slides across every $3 \times 3$ pixel area of the image looking for basic features, such as a straight line, an edge, or a curvature. The 32 different image representations are then used as inputs for the second convolutional layer, which also contains 32 filters. These filters slide across each representation searching for more complex features, such as the combination of curvatures or straight lines, producing $32 \times 32 = 1024$ new image representations. This process repeats through four more convolutional layers, each of them gradually looking for higher level features of the pictures in larger regions of the pixel space.

The resulting image representations from the last convolutional layer are transformed into a uni-dimensional vector and sent to three fully connected layers that gradually “learn” those features more likely to correlate with each class. This learning process involves a procedure called backpropagation, which allows the model to gradually adjust the precision of its predictions. Every time a training image passes through the network, the model estimates the respective probabilities for the tally to belong to the WA and WOA classes, and it compares those probabilities with the image’s label assigned ex-ante. The difference between the predicted and the true label yields the loss value, or the cost function for the classification errors made by the network. The lower the loss value for the model, the better its classification accuracy. To decrease this function, the image passes back through the network, letting the model identify those features that contributed the most to the loss by calibrating its filters’ weights. Every time a new image passes back and forth within the network, the model assimilates those inputs that more clearly distinguish the classes.

I train the network for 250 epochs, wherein each epoch stands for a set of forward and backward passes for all images in the training set. After every epoch, I trace the accuracy rates of the model in the validation set and saved its weights when there was
an improvement in the loss value. The final model thus contains the model weights that reported the highest prediction accuracy in the validation set.

I address two potential issues for applying CNN to assess the integrity of vote tallies. The first one has to do with the risk of overfitting the model, a problem that occurs when the CNN “memorizes” image features that are not generalizable outside the training set. To minimize this problem, I use data augmentation to artificially increase the size of my training set. This technique produces new images derived from random shears, flips, rotations, and zooms of the original pictures (Chatfield et al., 2014). Furthermore, I include a set of dropout layers to block a random set of filters throughout my network. The inclusion of these layers during the training process forces the model to detract from considering specific filter activations and instead focusing on those features that can be generalizable to multiple images (Srivastava et al., 2014).

The second issue concerns the political sensitivity of producing two misclassifications types: labeling as WA those tallies with no clear patterns of manipulation (Error Type I) or labeling as WOA those tallies with potential altered features (Error Type II). Faced with this trade-off, I chose to minimize the first error type. In other words, the classifier would label a tally as altered only when its probability of belonging to the WA category is at least twice its probability of belonging to the WOA category. This conservative approach thus labels a tally as WOA when its estimated probabilities are too close to call, minimizing the number of false positives in the model.

To evaluate the accuracy of the model, I compare the predicted labels with the ones I assigned ex-ante for the images of the validation set using Monte Carlo cross-validation (Johansson and Ringnér, 2007). This test generates ten random splits of the labeled images into training and validation data. For each split, I fit the model into the training data and test its precision on the images from the validation set. The results on Table 1 show the average accuracy rate over the ten splits. The overall accuracy of the classifier is 89%, and its precision varies across classes; whereas 83% of the tallies with alterations are correctly
Table 1: Confusion Matrix for Classification

<table>
<thead>
<tr>
<th>True Label</th>
<th>Without alterations</th>
<th>With alterations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without alterations</td>
<td>0.94</td>
<td>0.06</td>
</tr>
<tr>
<td>With alterations</td>
<td>0.17</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Notes: Table 1 shows the mean accuracy rates of the classification model using 10 repeated random sub-samples of 150 images. The standard deviation for the accuracy rates on the clean and fraudulent images are 0.03 and 0.04, respectively. The overall accuracy rate is 0.89 with a mean loss value of 0.30.

classified, the accuracy rate for the tallies without alterations is 94%. The differences in the classification are due to the priority of minimizing the number of false positives at the cost of increasing the produced false negatives.

4.4 Classification

The final step uses the trained model to classify the almost 52,500 images in the test set. The results helped me estimate the overall rate of manipulated tallies in the election and provide descriptive statistics to assess the validity of the findings.

The results show that more than 29% of the observations exhibit patterns consistent with those belonging to the WA class. This finding suggests that there were alterations in about 15,000 vote tallies throughout the country. Moreover, a close inspection of the results suggests that the distribution of those tallies was uneven across the country. As Figure 3 shows, the state-level rates of altered tallies range from less than 2% in Mexico City to 69% in Puebla.

The findings are consistent with the anecdotal and indirect evidence available about the election. As the map in Figure 3 illustrates, most of the tallies with alterations are placed in the south of the country, a region distinguished by its legacy of subnational authoritarian enclaves that survived the federal democratization process during the last decade of the twentieth century (Cornelius, 1999; Gibson, 2013). The results are also con-
Figure 3: Rates of tallies classified as altered by state.

Notes: This figure shows the proportion of tallies in every state classified by the CNN as altered. The left plot relates these proportions with the vote share of Salinas in a given state. The gray dot represents the result at the national level.
sistent with previous estimations of electoral manipulation at the sub-national level. For example, Simpser (2012) compares the PRI’s vote shares before and after the electoral reforms during the 1990s, identifying Jalisco, Chihuahua, State of Mexico, and Baja California among the states with the lowest levels of manipulation. By contrast, the states associated with the largest rates of manipulation include Tlaxcala, San Luis Potosí, and Querétaro.

The results at the state level also suggest an explanation for the career paths of many governors during the Salinas administration. Governors who were promoted to top-level positions in the PRI or the federal government—such as Genaro Borrego in Zacatecas, Beatriz Paredes in Tlaxcala, and Fernando Gutiérrez Barrios in Veracruz—represented states with the largest rates of aggregation fraud during the 1988 election. By contrast, during his first year in office, President Salinas removed three governors—Xicoténcatl Leyva Morera in Baja California, Luis Martínez Villicaña in Michoacán, and Mario Ramón Beteta in the State of Mexico—as a response to a “perceived lack of loyalty” to the president and the party (Ward and Rodríguez, 1999, p. 676). As Figure 3 shows, these governors come from states with the lowest rates of altered tallies.

As an additional check for the validation of the labels, I used the database of electoral results at the polling-station level, described in subsection 4.1, to determine whether the vote returns between the clean and altered tallies differ. The top, middle, and bottom plots of Figure 4 show the vote share distributions for Salinas, Cárdenas, and Clouthier, respectively, with the solid and dashed lines representing the densities of the clean and fraudulent tallies. The top plot shows the vote share distributions for PRI’s Salinas, whose vote shares among the tallies classified as clean show a unimodal distribution with a mean of 0.47. In the case of the opposition candidates, the clean tallies show bimodal distributions of their vote share, with a mode close to 0 and a second mode close to 0.50 for Cárdenas and 0.15 for Clouthier.

The long and wide-right tail for the distribution of clean tallies suggests the existence
Figure 4: Distribution of vote shares for each of the candidates. Mexico, 1988.

Notes: The plots show the density distribution of the vote shares for the three main candidates of the 1988 election. Each line type corresponds to the classification of the vote tally sheet using the CNN classifier.
of other manipulation technologies that are overlooked by the methodology described above. Out of every ten tallies classified as clean and showing vote shares for Salinas above 90%, only three have a signature of at least one party representative from the opposition. Furthermore, many of these observations come from four states: Durango, Veracruz, Chiapas, and Guerrero. In the last two cases, the tallies without significant alterations that report vote shares for Salinas above 90% represent 17% and 28% of all the tallies in each state.

Besides the potential effects of electoral manipulation, the fact that many unaltered tallies show very low vote returns for the opposition is consistent with previous works suggesting the territorial concentration of the electoral support of the opposition candidates (Domínguez and McCann, 1996; Greene, 2007). The largest rates of clean tallies showing vote shares below 10% for Cárdenas are in the northern region of the country—specifically in Sinaloa (42%), Nuevo León (45%), and Chihuahua (65%)—where the PAN was more likely to obtain the support from voters against the regime. Similarly, Clouthier received his lowest vote shares among the unaltered tallies in Cárdenas strongholds, such as Veracruz (44%), Michoacán (64%) and Hidalgo (71%).

If the methodology identifies random alterations or something else than aggregation fraud, the two tally classes would show similar vote share distributions. However, Salinas’s vote shares among altered tallies mirrors its counterpart, with a mean value of 0.66 and a mode closer to 1. This comparison suggests not only that the altered tallies present larger vote shares than those tallies without alterations, but also that many of them gave Salinas almost unanimous support. For Cárdenas, the vote shares are considerably lower among the tallies classified as fraudulent (averaging about 0.11) than among those classified as clean (averaging about 0.33). Moreover, while the vote shares for the clean tallies follow a bimodal distribution, with a higher mode close to 0.5, the vote share distribution of the fraudulent tallies has a unique mode close to 0. Similarly, Clouthier’s vote shares averaged about 0.13 in the clean ballots and only 0.04 among those classified as
In sum, the application of the CNN technique to the 1988 election in Mexico provides additional evidence of a fraudulent technology by looking at the vote returns. The findings support the anecdotal evidence of aggregation fraud and the role of local election officials in this irregularity.

5 The Correlates of Aggregation Fraud

The last section of the paper uses the results from the tally classification to explore the determinants of aggregation fraud. To accomplish this task, I test the hypotheses developed in Section 3.2 regarding the informal opportunities and motivations for this fraud technology in authoritarian elections. In particular, I conjecture that aggregation fraud is more likely to affect those tallies from the incumbent’s strongholds, where opposition agents are not present, and the local elites can hold fraud perpetrators accountable.

To explore the effects of the incumbent’s electoral strength, the opposition presence, and the local elites on the incidence of aggregation fraud, I describe below the set of variables used for this analysis and discuss the results. The dependent variable is then the classification of altered tallies described in Section 4.

5.1 Independent Variables

I first account for the presence of the opposition party agents. As the theoretical expectations describe, election officials were more likely to modify the vote returns of those tallies which results were not recorded at the polling station by the opposition. Therefore, the deterrent effect of the opposition agents should have a negative relationship with the incidence of aggregation fraud (Opposition party agents). This is an indicator variable with the value of 1 if the tally contains the signature of at least one representative of an opposition party and 0 otherwise.
I also consider the prevalence of fraud in the incumbent-dominant areas. From the discussion in Section 3.2, I expect that aggregation fraud is more prevalent in the incumbent-dominant areas of the country, where it is easier to add votes on the aggregate while changing the district’s vote shares on the margin. I operationalize this variable using PRI’s district vote share for the 1985 legislative elections (PRI 1985). An additional model considers the curvilinear relationship of the PRI’s strength by including the quadratic value of the same variable. A potential caveat with this variable lies on the possibility that the 1985 results were distorted in a similar way, biasing the estimation of the electoral preferences in the district. Therefore, I check the robustness of the results by replacing this variable for the proportion of survey respondents in every state who identified with the PRI three weeks prior the Election Day (PRI’s Poll Support). The data from this variable comes from a survey of 4,414 respondents fielded during June 6-17, 1988, and published by La Jornada newspaper a day before the election.

Finally, I test for the characteristics of the local elites. Section 3 sustains that, when the Minister of Interior shirked his responsibility of coordinating the electoral operation, the ultimate fraud execution ended up in the hands of the governors, whose effectiveness depended on the resources and motivation to deliver votes to the presidential candidate. I build two variables regarding the electoral experience and political ties of the governors. The first one (Governor’s Experience) indicates whether the governor has previously held an elected public office. Politicians that had competed in other elections demonstrated their loyalty to the party and learned the ways to deliver votes in an efficient way. The information for this variable comes from the Dictionary of Mexican Political Biographies (Camp, 2011), and I coded as 1 those tallies in states where governors were previously elected as Mayor, Deputy, or Senator, and 0 otherwise.

The second variable accounts for the political ties of the governors with the presidential candidate. During the hegemonic party period, the career of a politician was defined by his affiliation to a political clique, or camarilla, which bonded the loyalty of its mem-
bers toward a specific leader in exchange of patronage jobs (Smith, 1979, p. 50-51; Camp, 2014, 128-139). To identify those governors within Salinas’s camarilla, I use the classification of presidential clouts by Centeno (2004), who identifies forty top-level officials in the Salinas’s camarilla, out of which seven of them were governors during the 1988 election day.  

5.2 Control Variables

I consider alternative explanations on the way fraud was carried out by including a battery of control variables. First, I account for the possibility that the alteration of the tallies was not accomplished at the district councils but rather at the polling stations by the incumbent party’s manpower. To consider this possibility, I identify those districts where the PRI nominated a union leader as a legislative candidate. The territorial base of the party relied on its affiliated unions, which displayed their workforce and resources during the election day in exchange of political power within the PRI (Murillo, 2001; Langston, Forthcoming). However, given their resource constraints, unions allocated their workers only in those districts where the party endorsed one of their members (Langston and Morgenstern, 2009). If aggregation fraud occurred at the polling station level, it would be more likely to affect the tallies from those polling stations where the PRI had enough human resources to perform it, making the presence of union candidates to correlate with the extent of fraud.

Next, it could also be the case that aggregation fraud was performed by election officials with the most loyal ties to the federal executive. To test for this possibility, and following similar approached by Reuter and Robertson (2012) and Martinez Bravo (2014), I identify those districts that had any reappointments of all district election officials during the year prior to the election. Since district election officials were directly appointed by the Minister of Internal Affairs, any reappointment prior to the election would suggest

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10See Centeno (2004, p. 166) for more details on the classification of this variable.
the nomination of an agent closer to the Federal Executive. The information from this variable comes from reviewing all the issues of the *Diario Oficial de la Federación*, Mexico’s equivalent to the U.S. Federal Registry or Canada’s *Gazette*, from July 7, 1987 to July 5, 1988.

I also consider two additional factors that may affect the extent of fraud in a district. To control for the existence of fabricated, rather than altered, tallies, I identify those images with no signatures of the poll workers. Since it was a requirement to sign the tally, images with no signatures are likely to be replaced with a new tally during the official count in the district tallies. A final factor that may explain electoral fraud is whether it occurred in a rural place. As the literature on Mexican politics suggests, ballot stuffing was more difficult in urban areas than its rural counterparts, where the opposition had fewer resources to monitor the polling stations and brokers got greater control of the voters (Molinar, 1991). To account for this possibility, I include the proportion of citizens in the district living in communities with fewer than 50,000 inhabitants. The information for this variable comes from the 1990 census at the municipal level.\(^{11}\)

### 5.3 Results

Since my dependent variable is binary, I use a logistic model to examine the relationship of the three factors explained above—the presence of the opposition, the electoral strength of the incumbent party, and the characteristics of the local political elites—and the incidence of observing altered vote tallies. To control for unobserved district-specific characteristics, I include random effects at the district level. Table 2 presents the main results. Model 1 shows the estimates from the benchmark model, Model 2 replicates the analysis excluding the control variables, and Model 3-5 test the robustness of the results under three alternative variable specifications.

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\(^{11}\)Given the multiple sample problems that the 1980 census had, I preferred using the 1990 census data as a proxy of the rural population in 1988 rather than interpolating the data between the two data sources.
Table 2: Explaining the Characteristics of the Altered Vote Tallies. Mexico, 1988.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable: Altered Vote Tally</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Opposition Representative</td>
<td>0.388***</td>
<td>0.381***</td>
<td>0.389***</td>
<td>0.388***</td>
<td>0.388***</td>
</tr>
<tr>
<td></td>
<td>(0.0259)</td>
<td>(0.0255)</td>
<td>(0.0259)</td>
<td>(0.0258)</td>
<td>(0.0259)</td>
</tr>
<tr>
<td>PRI 1985 vote share</td>
<td>2.173***</td>
<td>3.249***</td>
<td>9.687**</td>
<td>2.213***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.619)</td>
<td>(0.434)</td>
<td>(3.583)</td>
<td>(0.619)</td>
<td></td>
</tr>
<tr>
<td>Governor’s Experience</td>
<td>1.007***</td>
<td>1.008***</td>
<td>0.962***</td>
<td>0.933***</td>
<td>1.078***</td>
</tr>
<tr>
<td></td>
<td>(0.154)</td>
<td>(0.155)</td>
<td>(0.154)</td>
<td>(0.151)</td>
<td>(0.169)</td>
</tr>
<tr>
<td>Governor’s Camarilla</td>
<td>0.547**</td>
<td>0.642***</td>
<td>0.508**</td>
<td>0.594***</td>
<td>0.662**</td>
</tr>
<tr>
<td></td>
<td>(0.181)</td>
<td>(0.178)</td>
<td>(0.181)</td>
<td>(0.177)</td>
<td>(0.213)</td>
</tr>
<tr>
<td>No Poll Workers’ Signature</td>
<td>-0.109</td>
<td>-0.110</td>
<td>-0.109</td>
<td>-0.109</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0644)</td>
<td>(0.0643)</td>
<td>(0.0644)</td>
<td>(0.0644)</td>
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</tr>
<tr>
<td>Reappointment</td>
<td>0.105</td>
<td>0.138</td>
<td>0.167</td>
<td>0.0913</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.176)</td>
<td>(0.176)</td>
<td>(0.173)</td>
<td>(0.176)</td>
<td></td>
</tr>
<tr>
<td>Union membership</td>
<td>0.0939</td>
<td>0.0886</td>
<td>0.139</td>
<td>0.0866</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.141)</td>
<td>(0.140)</td>
<td>(0.138)</td>
<td>(0.141)</td>
<td></td>
</tr>
<tr>
<td>Percent Rural</td>
<td>0.587*</td>
<td>0.528*</td>
<td>1.028***</td>
<td>0.564*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.238)</td>
<td>(0.237)</td>
<td>(0.165)</td>
<td>(0.238)</td>
<td></td>
</tr>
<tr>
<td>PRI 1985 Vote Share Squared</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.634)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRI’s State Support from Polls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.288***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.634)</td>
</tr>
<tr>
<td>Governor’s Experience × Governor’s Camarilla</td>
<td>-0.379</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-3.732***</td>
<td>-4.065***</td>
<td>-6.016***</td>
<td>-4.055***</td>
<td>-3.768***</td>
</tr>
<tr>
<td></td>
<td>(0.324)</td>
<td>(0.269)</td>
<td>(1.122)</td>
<td>(0.294)</td>
<td>(0.326)</td>
</tr>
</tbody>
</table>

σ_d

<table>
<thead>
<tr>
<th>σ_d</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.067</td>
</tr>
</tbody>
</table>

Observations: 53288 53288 53288 53288 53288
Districts: 300 300 300 300 300
Log Likelihood: -25438 -25443 -25436 -25431 -25437
χ²: 436.1 422.6 443.5 458.6 437.6

Notes:
Entries are logistic regression coefficients and standard errors. All models include district random effects. The dependent variable is a binary indicator for the classified integrity of a vote tally. *** is significant at the 0.1% level; ** is significant at the 1% level; and * is significant at the 5% level.
The results for *No Opposition Representative* are positive and statistically significant, suggesting that the tallies from those polling stations with no signatures from any opposition party agent are more likely to present alterations in their vote returns. As Model 1 indicates, a 0.39 coefficient in the logit model translates to a probability increase for a tally being altered of about 0.06.

Regarding the PRI’s electoral strength, the results suggest that altered tallies were more frequent in those districts with the largest vote shares. In those districts with a PRI’s vote share above 88% (the top decile), the probability of observing an altered tally is 0.36. In contrast, among those tallies from districts where the PRI obtained less than 41% percent of the vote (the bottom decile), the probability is just 0.20. As Models 3 and 4 show, this relationship holds under two alternative specifications. First, the quadratic term suggests the existence of a curvilinear relationship between PRI’s vote share and the dependent variable, yet the predicted incidence of aggregation fraud peaks at 92%, showing a small decline for those districts where the vote share was close to unanimity. Second, the claimed relationship also holds when measuring PRI’s electoral strength with the proportion of survey respondents that identified with the official party a month prior the Election Day.

The results also provide evidence that the characteristics of the governors leading the electoral operation affected the likelihood of observing an altered tally in the district. The coefficients for *Governor’s experience* and *Salinas’s Camarilla* are both positive and statistically significant. Among those tallies under the jurisdiction of governors with previous electoral experience, their probability of presenting alterations is about 0.15 larger than in those tallies from states with electorally unexperienced governors. Similarly, the probability for a tally to show alterations is about 0.08 larger in those states governed by a member of Salinas’s political clique. As Model 5 shows, both effects work independently and are not substitutes, as the interaction of both variables is statistically insignificant.

Regarding the control variables, the only variable statistically different from zero is
Rural, which shows positive and statistically significant estimates in all the specifications. This finding confirms the evidence from previous work showing the prevalence of electoral corruption in rural areas (Molinar, 1991; Fox, 1994; Simpser, 2012). The sign of No poll workers’ signature is consistently negative, between \(-0.109\) and \(-0.110\), yet is not statistically different from zero. One potential explanation is the relatively small share of tallies with this characteristic, about 3 percent of the observations, which makes this effect insufficient to reliably estimate its effect. Similarly, the coefficients for Union present no statistically significant, providing no evidence that aggregation fraud was more likely to occur in those districts where unions provided manpower during the Election Day. Finally, Reappointments show estimates not statistically different from zero. Suggesting that the officials reappointed during the six months prior to the election had an effect on the alteration of the tallies.

The results above are suggestive of the ways that aggregation fraud was carried out. In order to inflate the results in an effective way, the alterations of the tallies were more likely to occur in the PRI-strongholds and where the opposition was unable to cross-check the results. Moreover, this irregularity was more prevalent in those states with a governor with the experience to lead and coordinate the operation or who have a political connection to the presidential candidate. These findings provide evidence of the opportunities for perpetrators to use this fraud technology.

6 Conclusion

In his memoirs, President Carlos Salinas (2002) defends the legality of his victory in the 1988 election based on two facts. First, the official results resemble those recorded in the vote tallies, which were filled out in the presence of opposition party representatives in 72% of the polling stations. Second, the results of the polling stations are publicly available for corroboration. In the words of Salinas, “[t]he actas (vote tallies) stored in the
National Archives confirm that the 1988 presidential elections are fully documented” and validate his triumph in an election with “the major mobilization to monitor the election that the opposition had in fact achieved” (p. 942-943).

This paper verifies both claims for the first time. Using the almost 53,500 tallies available in the National Archive, the results reported in those document are very similar to those announced on July 9, 1988. Nevertheless, this paper takes a further step by looking for amendments to the vote returns reported on the tallies. Applying developments in deep learning and image analysis, the methodology finds deliberate alterations in almost a third of the tallies. Moreover, these alterations correlate with the unusually high vote shares for Salinas.

I conclude by discussing three contributions of this project to policy practitioners and scholars. First, the results report the institutional opportunities for aggregation fraud. These opportunities appeared after an electoral reform that, while allowing the presence of opposition party agents in the polling stations, centralized and disclosed the vote aggregation process to the officials at the district councils. This finding suggests that while election monitoring is a necessary input for electoral integrity, its role is limited when it is only focused on a particular stage of the process. Furthermore, the results illustrate the dynamics of electoral institutions in autocracies, which develop from the tension between the demand of opposition parties to guarantee democratic uncertainty and the desire of autocrats to retain control over electoral outcomes (Schedler, 2002b, p. 109).

Second, this paper provides a novel approach to identify potential amendments to the electoral results. The methodology complements recent works looking for statistical anomalies in the recorded vote counts by analyzing the data-generating process behind those numbers. Policy practitioners and scholars are welcome to repurpose the model to the analysis of the tallies from a different election. However, it is worth emphasizing that this approach must not been taken as an endpoint on the topic. Perhaps one of the most exciting advantages of the trained network I propose is that it can be tuned-up as
it gathers more images from other elections and cumulates the input from experts on the topic. This method, therefore, should be seen as a steppingstone to identify electoral fraud in a more accurate way.

Finally, the database with electoral results extends the information available on Mexican elections to a period before the beginning of its long and gradual democratization, helping experts understand the dynamics between voters and rulers in authoritarian settings. According to scholars on hegemonic party regimes in Mexico (Magaloni, 2006; Langston, Forthcoming) and elsewhere (Blaydes, 2011; Malesky and Schuler, 2011b), the main goal of electoral manipulation (apart from legitimacy) is to acquire the party’s information about the performance of the candidates and government officials. The data for this paper available can help us verifying this hypothesis in one of the most prototypical cases of electoral authoritarianism. Furthermore, the data available is open to identifying other types of electoral manipulation for this election, where despite the rulers’ effort to enclose the irregularities, the perpetrators, as this paper shows, left their fingerprints on the available evidence.
References


Key, V.O. 1949. Southern politics in state and nation. The University of Tennessee Press.


A Supplementary Tables
### Table A: Vote Results

<table>
<thead>
<tr>
<th></th>
<th>Salinas</th>
<th>Cárdenas</th>
<th>Clouthier</th>
<th>Total Votes</th>
<th>Polling Stations</th>
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<td>(0.292)</td>
<td>(0.179)</td>
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<td><strong>Official Data</strong></td>
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<td>5,956,988</td>
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<tr>
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<td>(0.503)</td>
<td>(0.311)</td>
<td>(0.171)</td>
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*Notes:* This table compares the vote total and vote shares of the three main candidates using the official results and the information from the tally sheets. Vote shares are in parenthesis.
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<thead>
<tr>
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<td>Ibarra (PRT)</td>
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<td>Castillo (PDM)</td>
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Notes: This table reports summary statistics for the information obtained from the vote tally sheets. The unit of observation is the polling station. The information of party agents and poll workers’ signatures are dummy variables that equal 1 for each observation where the individual signed the tally sheet.
B Experiment Description

The survey experiment discussed in Section 4.2 used Qualtrics survey technology with two population samples. The respondents for the first sample were recruited through Amazon’s Mechanical Turk via a HIT advertised as a “Find altered tallies. A 15 minute survey” Respondents were restricted to those in the United States with HIT approval rates greater than or equal to 95% with the number of HITs approved greater than or equal to 1,000. Respondents were provided $1.70 compensation for taking the survey. Survey data was collected on February 14, 2017. The survey collected a total of 200 responses with an average response time of 8 minutes. Each respondent was presented with 10 random images from the Training Set and were asked to identify those files that present alterations in their numbers.

The second sample used five undergraduate students at the University of Houston. Students’ responses were collected during March, 2017. Each respondent got a sample of 50 random images from the Training Set and were asked to identify those files that present alterations in their numbers. The average response time was 54 minutes. Neither Amazon Turk respondents nor undergraduate students were informed about the label that the images were originally assigned.
C Network Structure
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D Supplementary Figures
Figure A: Example of a Digitized Vote Tally Sheet. Mexico, 1988
Figure B: Number of votes for at the district level in the official data and the vote tallies. Mexico, 1988.

Notes: This figure shows the total number of votes for the three main presidential candidates in 1988 at the district level. The information comes from the official results and the vote tally sheets at the district level. The correlation between both data sources for the candidates’ votes at the district level is 0.98.