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DOES THE ARRIVAL OF FAST INTERNET IN AFRICA AFFECT VOTING BEHAVIOR? EVIDENCE FROM KENYA

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Abstract

Does the arrival of fast Internet in Africa have an impact on the level of political information of voters and thus on voting behavior? Using a difference-in-differences approach, this paper examines the effects of the introduction of high-speed Internet in Kenya in 2009 on electoral outcomes. The results show that voter turnout in the subsequent parliamentary election increased by almost 3 percentage points due to treatment, suggesting a higher level of political information. There is some evidence for a positive effect on the vote share of the incumbent party and no evidence for an effect on the share of invalid votes.

Keywords: Development Economics, Elections, Difference-in-Differences, Internet, Political Outcomes.

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1 Introduction

Access to political information is a basic prerequisite for the functioning of a democracy. The more access to information voters have, the better they are able to evaluate policy options and government performance, hold politicians accountable and defend their own political interests. Although the literature often focuses on Western democracies, the same is true for developing countries, where information can increase political participation and accountability, reduce vote-buying, and increase electoral competition, thus strengthening developing democracies. The media are crucial in this regard in providing political information. However, the role of the Internet as a source of information and its impact on electoral outcomes, particularly in developing countries, has not been sufficiently studied in the empirical literature, and the results are conflicting. Therefore, this paper aims to answer the question of whether the arrival of fast Internet in Africa plays a role in providing political information in democracies. This is measured by its impact on election outcomes, namely the voter turnout, the vote share of the incumbent party and the share of invalid votes, as those outcomes can be related back to the level of political information. To this end, constituency-level data on the parliamentary elections in Kenya are combined with data on the locations of the national Internet backbone network. Causal effects are identified using a difference-in-differences approach, with the treatment being the arrival of a submarine cable in Kenya that brought fast Internet for those constituencies connected to the national Internet network. The results of a regression with fixed effects estimate an increase in turnout of nearly three percentage points in the 2013 elections as a result of the treatment. The findings also suggest a possible increase in the incumbent party's vote share but present no evidence of effects on the share of invalid votes. The results are not fully robust, but the results of the placebo regressions and the presence of parallel pre-treatment trends support the interpretation that the arrival of fast Internet in Kenya increased the level of political information.

The remainder of this paper is organised as follows. Section 2 reviews the literature on the relationship between information via the media and political outcomes. Section 3 provides background information about the Internet transmission in African countries and the political system in Kenya. Section 4 states the data sources and the empirical strategy. The main findings of this paper are presented in Section 5. Section 6 interprets the results and Section 7 concludes.

2 Literature Review

Why should information have an impact on people's voting decisions? The underlying model of human decision-making is the concept of rationality. Downs et al. (1957) developed the theory of the "rational voter" who chooses the party or the candidate that maximizes the voter's utility. Cheaper information allows the rational voter to estimate more easily the differences between political parties or candidates, in order to defend their political interests by voting. A different or more comprehensive set of information may thus change voting behavior. Numerous empirical studies have tested the validity of this theory in real-world applications and experiments (for an overview see Cebula and Tullock 2005). Moreover, the likelihood that a person will go to the polling station increases as the level of information increases, because confidence in the voting decision and the expected benefits grows (Matsusaka 1995). Information is also crucial for people to hold politicians accountable. Accountability of politicians is an essential ingredient of a well-functioning democracy. This is based upon voters having access to the information that enables them to monitor and evaluate the performance of politicians, such that the threat of not being reelected is sufficient to force incumbents to act in the best interest of voters (Manin, Przeworski, and Stokes 2006; Besley 2005). The (mass) media provide voters with access to political information and enable them to hold politicians accountable. Therefore, politicians are forced to target users of the mass media if they want to be re-elected (Strömberg 2004).

When analyzing election outcomes, there are a variety of measures that can be interpreted. This paper will focus on voter turnout, the vote share of the incumbent party and the share of invalid votes, as those outcomes can be related back to the level of political information. The link of media and thus the Internet to the vote share of the incumbents has been explained by the literature on information and accountability. As for the voter turnout and the share of invalid votes, it will be shown later in this Section that information and the media affect these outcomes. In general, one can robustly say that voter turnout is lower in poor countries, and it is higher in small countries and during closely contested elections (Blais 2006). In Sub-Saharan Africa, turnout is negatively affected by perceived violence, fear of violence and voter intimidation (Mac-Ikemenjima 2017), and increases with concurrency of the presidential and legislative elections (Kuenzi and Lambright 2007). A high share of invalid votes can be interpreted as the expression of dissatisfaction with the government's performance and policy offerings (Moral

2016; Driscoll and Nelson 2014; Cohen 2018). This is of relevance for this paper as this is based on having access to information, similar to accountability. Further drivers of a high share of invalid votes are a low urbanization, low levels of income inequality, political violence, low literacy rates (Power and Garand 2007) and a high ethnic fragmentation (Martinez i Coma and Werner 2019).

Research has shown that information is an important factor for election outcomes in developing countries. Banerjee et al. (2011) conduct a field experiment where they increase citizens' information about incumbent politicians via newspapers. They find an increased turnout, which was stronger when incumbent's performance was worse, and reductions in the incidence of cash-based vote-buying. They also observe electoral gains for better performing incumbents. Fujiwara and Wantchekon (2013) state that the arrival of information and deliberation by information-based election campaigns has an effect in reducing the vote share of the dominant candidate. Moreover, there is evidence that the access to information also impacts other political outcomes: Manacorda and Tesei (2020) find that mobile phones enhance the information-level of individuals, which leads to increased protest participation during economic downturns in African countries. Aker, Collier, and Vicente (2017) conduct a field experiment in Mozambique and find that the distribution of a free newspaper as well as the distribution of information about the election via SMS increased electoral participation. Similar effects are found for increased radio exposure (Kuenzi and Lambright 2007). Ferraz and Finan (2008) show the value of information and media in fostering political accountability. The authors find that the likelihood of re-election of incumbent politicians in Brazil decreased when information about their corruption was disclosed. This effect was even stronger in municipalities with local radio stations. Using a Randomized Control Trial, Sandholtz (2019) shows that in Liberia, the incumbent party's vote share reacted to the effects of a policy that directly affected the voters. This demonstrates that voters hold politicians accountable when they have the opportunity to do so, underlining the importance of mass media to convey political information that voters themselves cannot perceive directly.

Beyond that, the literature has shown that the various types of media differ in their role of providing information and in their effect on election outcomes, and one can therefore not directly conclude general effects of the introduction of the Internet. Similar to Manacorda and

Tesei (2020), Christensen and Garfias (2018) find that cell phone coverage globally increases the probability of protest. Gentzkow, Shapiro, and Sinkinson (2011) investigate the impact of the entry and exit of newspapers on political participation and vote shares of incumbents. They find that newspapers increase political participation in both presidential and parliamentary elections. No systematical effect of newspapers is found on election results of incumbents. Strömberg (2004) focuses on the expansion period of the radio in the US. Areas with a larger share of radios received more funds. This suggests that a targeting of voters who use mass media took place. Moreover, the increase in radio coverage increased voter turnout. Gentzkow (2006) finds a contrary result for the introduction of the television in the US: The expansion of the TV significantly reduced voter turnout, possibly by crowding out other media like newspapers and radio. The results suggest that television substituted news consumption by entertainment consumption and thus reduced citizens political information level. DellaVigna and Kaplan (2007) show that the entry of Fox News significantly increased the Republican vote share in the 2000 US elections. This is presumably due to the political bias of Fox News. Fox News also significantly increased voter turnout, seemingly due to the mobilization of conservative voters. Snyder Jr and Strömberg (2010) demonstrate the overall key role of the media in the dissemination of political information. In US districts where the press coverage of politics is reduced, the citizens have lesser knowledge about the performance of their representative, and the representatives do less work for their constituencies. Similar to Strömberg (2004), their findings suggest that governmental spending is lower for areas with less press coverage. There is also a small decreasing effect on turnout when press coverage is decreased.

There has not been as much research on the role of the Internet as a source of information and its effect on election results and the results are contradictory. Miner (2015) explores the effect of Internet growth on election results in Malaysia. He finds that the increased access to Internet contributed to the 2008 election result where the ruling party, which was in power for 40 years, lost its two-thirds majority in parliament. He therefore argues that the access to Internet can play a role in the transition towards a multiparty system by facilitating the access to information. On the other hand, Falck, Gold, and Heblich (2014) analyze the effects on voting behavior of information disseminated over the Internet and find no evidence that the Internet systematically benefits specific parties. They suggest that information consumption is

based on individual ideological preferences. The authors further find that Internet availability lowered voter turnout. They argue that television consumption is crowded out by an increased entertainment consumption of the Internet, an effect similar to that shown by Gentzkow (2006) on television adoption. The opposite result is found by Tolbert and McNeal (2003): Their findings suggest that citizens with access to the Internet were significantly more likely to vote in the 1996 and 2000 presidential elections in the US. One possible explanation is that the Internet offers many different sources of information and provides a faster and more flexible way of obtaining information. Czernich (2012) also discovers an increase of political participation in Germany as broadband access expands, whereas Campante, Durante, and Sobbrio (2018) initially find a negative effect of the introduction of high-speed Internet on turnout in the Italian parliamentary elections, but this effect reverses in subsequent elections. In South Africa, high-speed mobile Internet access did not significantly affect voter turnout. However, the vote share of the dominant party decreased while the main opponent benefited (Donati 2019). A different approach is offered by Minard and Landriault (2015). The authors demonstrate that the effects of Internet use on voting behavior in Asia vary by regime type. Internet reduces turnout in democracies and mature anocracies, while it increases turnout in immature anocracies. An immature anocracy is defined as a hybrid regime of democratic and autocratic characteristics, that experienced an abrupt polity change during the twenty years preceding the assessment. Since Kenya is a hybrid regime that returned to a multi-party-system in 1991 (see Section 3.2), Kenya can be considered an immature anocracy and should therefore be expected to see an increased turnout.

The theoretical and empirical literature has shown that the emergence of new information channels affects voting behavior. However, one cannot conclude directly about the arrival of the Internet, given that it can both increase and decrease political information, depending on the way of usage. Information consumption could be increased because of the faster and more flexible access offered by the Internet, or it could be crowded out by entertainment consumption. It could also depend on whether the voters use many different sources of information or only consult those sources that are in line with their own ideological preferences. The literature predicts an increase in turnout with an increase in the level of political information. Moreover, depending on the perception of the government's performance, a change in the level of informa-

tion would affect the election result of the incumbent party and the share of invalid votes. Only little empirical evidence exists on how the Internet affects voter information and behavior, and the results are conflicting. The effect of Internet on voting behavior is thus still left unknown. Furthermore, empirical papers focused rather on democracies in Western Europe and the US and there is little evidence in the context of developing countries and democracies. Further research is therefore needed. This paper seeks to contribute new evidence on the impact of the introduction of fast Internet on electoral outcomes in Kenya and to draw conclusions regarding the important question of whether the Internet, like other media, can play a key role in providing political information in democracies.

3 Background

3.1 Internet Transmission in African Countries

The Internet arrived in Sub-Saharan Africa in the early 1990s and came to Kenya in 1993. Internet connectivity began with existing analog telephone lines in most countries (ITU 2013). In 2000, Africa as a whole had less Internet bandwidth than Luxembourg (ITU 2002). In 2013, 13 percent of African citizens used the Internet, compared to 36 percent globally (Hjort and Poulsen 2019), and more than half of urban African consumers owned Internet-capable devices (McKinsey 2013). The number of Internet users in Kenya increased from over four million in 2008 to 17.38 million in 2011 (Mueni and Ndavula 2014). In 2020, 29.5 percent of individuals in Africa used the Internet, compared to 84.9 percent in Europe and 78.8 percent in the Americas (ITU 2021).

Internet is transmitted through a national backbone network in most African countries. From there, it reaches the users via the "last mile" infrastructure (Hjort and Poulsen 2019). In 2009, only 12 percent of terrestrial infrastructure in the region was fibre-optic cable – which are preferable for higher traffic volumes – with the remainder being microwave networks which carry low traffic volumes. As of 2009, about a third of the terrestrial backbone in sub-Saharan Africa was owned by fixed operators, including (formerly) state-owned incumbents and new entrants, with the other two-thirds owned by mobile operators. Fixed operators account for most high-capacity fibre networks, whereas mobile operators have a very low fibre share. Fibre-optic networks have

been rolled out primarily in and between major urban areas and on international routes. When building their backbone networks, new entrants have focused on areas with existing networks of incumbent operators (Williams 2009). In the 2000s, undersea Internet cables from Europe reached Kenya and other African countries. These cables brought much faster Internet to the locations that are connected to the fibre-optic backbone network (Hjort and Poulsen 2019). The submarine cables were built by consortia made up of private investors, African governments and partly multilateral organizations (OECD 2014). This paper focuses on the fibre-optic backbone network, as only this is capable of transmitting the high-speed Internet carried by the undersea cables. For the access to this network, the locations of the network-nodes and not the transmission links are the decisive factor. Masaki, Ochoa, and Rodrıguez-Castelán (2020) compare the backbone networks to motorways (the transmission links) that have junctions (the nodes): Even if a household is located near the motorway, the distance to the nearest junction is critical. Clearly, the availability of a nearby node does not guarantee the access to Internet. This still depends on whether a "last mile" infrastructure is in place and if a household can afford the access to Internet. However, the absence of a nearby fibre-optic node is a binding constraint.

3.2 Kenya's Political System

Kenya is categorized as a hybrid regime between democracy and authoritarianism (The Economist 2007). The country is organized as a presidential system with a directly elected president who is limited to two terms. Since the 2010 constitution, the legislature consists of two chambers: The National Assembly and the Senate. Kenya has a multi-party system in which alliances frequently form and dissolve due to the rivalry for power (Kanyinga 2014).

The then ruling party Kenya African National Union (KANU) banned the opposition in 1969 and turned Kenya into a one-party state in 1982. In 1991, Kenya became a multi-party state again (Kanyinga 2014). In 1997, Daniel arap Moi (KANU) was elected president. In the National Assembly, KANU won the most seats by a wide margin (EISA 2010a). Election Observer Reports state that the election has likely been manipulated by the incumbent and that politically motivated violence was organized by the ruling party in order to undermine opposition parties (Ajulu 1998).

In 2002, opposition parties formed the National Alliance Rainbow Coalition (NARC) and

won the parliamentary and presidential elections; their candidate Mwai Kibaki became president (EISA 2010b). According to reports from election observers, the campaign period was more peaceful than in previous elections and voting at the polls was, for the most part, orderly (The Carter Center 2003). The NARC was divided along ethnic lines, as it was over the question of how to shape a new constitution. The president and his supporters proposed their version of a new constitution in 2005, which was then rejected in a referendum. As a result, the NARC split. The Orange Democratic Movement (ODM) emerged from the NARC in 2005 consisting of opponents of the draft constitution. The Party of National Unity (PNU) was formed from supporters of the draft constitution to support President Kibaki in the 2007 elections (Kanyinga 2014).

In 2007, Mwai Kibaki was again elected president. However, the ODM won the most seats in the National Assembly ahead of the PNU (EISA 2010c). Election observers report a lack of transparency in the processing and tallying of results and therefore consider the final results of the presidential election to be untrustworthy. The parliamentary elections gained more trust among electoral stakeholders (EU Election Observer Mission 2008). The ODM disputed the announced presidential results, the PNU denied those claims. After the results were announced, a violent conflict broke out, displacing more than 500,000 people and killing 1,133. To end the violence, a power-sharing agreement was reached between the ODM and the PNU. Kibaki became president; ODM candidate Raila Odinga was given the newly created position of Prime Minister (Kanyinga 2014). In 2010, the new constitution was approved in a referendum with the joint support of the president and prime-minister. The new constitution strengthened the power of the parliament and deepened democratic governance (Kanyinga 2014).

In 2013, Uhuru Kenyatta of The National Alliance (TNA) was elected president. The TNA gained the most votes in the National Assembly election, but the ODM won the most seats (EISA 2013). However, the Jubilee Coalition including the TNA gained more seats than the Coalition for Reform and Democracy (CORD) including the ODM (The Carter Center 2013). The PNU had disappeared since their 2007 presidential elections victory. The ODM was the only major party to show continuity since 2007. The elections took place in the context of an increased presence of the Internet (Cheeseman, Lynch, and Willis 2014). According to reports from election observers, the elections were largely peaceful, transparency was improved com-

pared to the 2007 election and election data is mostly considered credible (The Carter Center 2013). Analyses of the results show that the major parties won largely in their ethnic groups. Kenyatta and the TNA attracted voters on the issues of the economy, employment, and security. Odinga and the ODM scored well with reform-minded voters. In addition, the most important issues for ODM voters were corruption, the implementation of the new constitution, and the handling of the 2007 violence. Evidence suggests that Kenyans especially consider ethnicity and government performance when casting their votes (Ferree, Gibson, and Long 2014). In 2013, measures were taken to prevent electoral violence. Calls for peace and unity came from a wide variety of organizations, including newspapers, television networks, non-profit organizations and individuals, and were disseminated on television and the Internet, among other channels (Benesch 2014).

Furthermore, it is of interest for the election analysis that both the elections in 2007 and 2013 were held during phases of high economic growth, with a growth rate of 6.85 percent and 5.88 percent, respectively. Kenya's economic growth was low (0.47 percent) during the 1997 elections and remained low, with some positive outliers, until 2002. After the 2002 elections, growth accelerated and stayed on high levels until 2013. The only exception was a low growth rate in 2008, presumably due to the violent conflicts (The World Bank 2021).

4 Data and Empirical Strategy

4.1 Data Sources

All data used is publicly available. The treatment date of Kenya can be determined using Mahlknecht's map of submarine cables (Mahlknecht 2016) which shows the landing times of submarine cables in Africa. The first submarine cable bringing fast Internet arrived in Kenya in 2009. The Fibre Reach Map on www.africabandwidthmaps.com (Hamilton Research Ltd 2021) shows the extent of the terrestrial fibre-optic networks (links and nodes) as of June each year from 2009 to 2021 in Africa. This map is used to detect the fibre-optic nodes in Kenya at the time of the treatment date and is transformed into a dataset by geocoding the fibre-optic nodes. Using the coordinates found in this way, each node can be assigned to the constituency in which it is located with the help of a shape-file of the constituencies (The Humanitarian Data

Exchange 2018). The resulting dataset includes the coordinates and the electoral constituency for each fibre-optic node.

The CLEA Lower Chamber Elections Archive (Kollman et al. 2019) is consulted for data on parliamentary election results (National Assembly) in Kenya on the constituency-level for the years 1997, 2002, 2007 and 2013. For each constituency, the dataset contains information on the voter turnout, the share of invalid votes and the vote share of every party that is running for election in the respective constituency. As stated before, election observers consider the 1997 election to be rigged. Therefore, election data is not fully trustworthy. The parliamentary election results of 2002, 2007 and 2013 are mostly credible according to reports of election observers. The CLEA dataset is missing data on turnout and the number of eligible voters in the 2013 elections, but it does contain data on the votes cast in each constituency in that year. Therefore, The ACE Electoral Knowledge Network (2013) is consulted for the number of eligible voters in each constituency in 2013, and the turnout per constituency is then calculated.

Using the previously created dataset of fibre-optic nodes, a Python algorithm is created to determine the connection status of each constituency by checking if there is a node located in this constituency. A binary variable is added to the CLEA dataset which takes the value 1 if there is at least one node located in the constituency, and 0 otherwise. An additional variable is then added to the CLEA dataset to indicate whether a submarine cable has arrived in the country in the given year. The treatment variable is created by multiplying the submarine-cable variable by the connection-status variable.

As new constituencies have been created between the elections 2007 and 2013, constituencies do not always match in those two elections. There is no data available on how these constituencies were changed, and the shape-file used previously only has data for the state of 2013, but not for 2007. Constituencies for which there is no equivalent therefore need to be dropped, as well as constituencies for which data on outcome variables are missing. Both missing data and dropping the non-matched constituencies can potentially cause biased results, if changing the constituencies or data availability is not random. For the analysis of the vote share of the incumbent party, only the constituencies where the ODM runs for election are kept.

Overall, the coverage especially of election data is incomplete in many African countries. For very few countries, information on the location of electoral constituencies is available in

a format suitable for data analysis. Electoral data are either limited to a few years or lack granularity.

4.2 Empirical Strategy

An identification strategy is needed to identify causal effects of fast Internet on election outcomes, since there are endogeneity concerns about the effect of Internet access on voting behavior, as other characteristics may be correlated with both variables. When building Internet infrastructure, profit-maximizing companies tend to favor areas where there is a willingness to pay for an Internet subscription. This is more likely in areas with higher average incomes and a larger share of highly skilled workers (Falck, Gold, and Heblich 2014). Since these characteristics are also correlated with voting behavior (Sondheimer and Green 2010), any observed effect of the Internet on electoral behavior is potentially biased. Hjort and Poulsen (2019) proposed an identification strategy for the present use case which will guide this paper's empirical strategy. The authors apply a difference-in-differences (DD) approach in which the arrival of the submarine Internet cable in a given country serves as the source of external variation and as this country's treatment date. Since each country is covered by a national backbone network and there is a lack of spillovers from one coastal country's submarine connection to neighboring countries, every country has a specific treatment date which is marked by the date when the first cable has arrived in the country (Hjort and Poulsen 2019). For clarification, no time variations in the construction of the backbone network or of the nodes are used. The backbone is treated stable as of Q2/2009 when the submarine cable arrives. The first comparison of the analysis is between the periods before and after the arrival of the submarine cable. The second comparison is made between constituencies that had or did not have a backbone node and were therefore (not) exposed to faster Internet by the cable.The advantage of applying DD for election outcomes is that it compares the change in the voting choices of voters in connected areas between two elections with the change in the voting choices of voters in unconnected areas. The DD does not require the voting preferences of both voter groups to be the same. It does however require the pre-treatment trends to be the same. This parallel trends assumption is the essential assumption for identification in a DD-analysis. It states that unobserved heterogeneity affecting the outcome does not change over time with treatment status and is therefore differ-

enced out (Khandker, Koolwal, and Samad 2009). The arrival of undersea cables between the two elections affects only the voters in connected areas. If this event has an influence on voting behavior, there should be a difference in the change of voting patterns of the groups. Montalvo (2012) first applied the DD estimator for the analysis of the impact of major events on voting outcomes using actual electoral data.

Kenya is chosen for the analysis as it is a coastal country with a submarine cable arriving in 2009/Q3 (Mahlknecht 2016). Moreover, there is data available for the election after the treatment and for multiple elections before the treatment date, aggregated at the constituency-level. Furthermore, it is essential to have information available about the location of the constituencies, which is the case for Kenya.

The analysis will focus on the effect of new access to fast Internet in Kenya on the voter turnout, the vote share of the ruling party and the share of invalid votes. The Orange Democratic Movement, who won the 2007 parliamentary elections, is meant when talking about the ruling party, although the ODM is not the party of the president.

A simple difference-in-differences table makes no allowance for different specifications like fixed effects. Therefore, the following regressions are run:

$$Y_{it} = \alpha + \beta * submarine_t + \gamma * connected_i + \delta(submarine_t * connected_i) + u_{it} \qquad (1)$$

where Y_{it} represents the following outcomes: The voter turnout in two consecutive elections (in years t and *t-1*) in constituency i is given by $\%turnout_{it}$, the proportion of voters for the ruling party in two consecutive elections (in years t and *t-1*) in constituency i is denoted by $\%rulingparty_{it}$, and the proportion of invalid votes in two consecutive elections (in years t and *t-1*) in constituency i is given by $\%invalidvoteshare_{it}$. The variable $submarine_t$ is a dummy variable which takes the value 1 if the backbone network in Kenya has been connected to at least one submarine cable at t, and 0 otherwise. The dummy variable $connected_i$ takes the value 1 if constituency i is connected to the national backbone network, and 0 otherwise. The coefficient δ represents the effect of fast Internet. In other words, the changes in outcomes for constituencies that gain access to fast Internet and the change in outcomes for other constituencies that do not gain access at the same point in time are compared, and the difference between those identifies the impact of gaining new access to fast Internet on election results.

Furthermore, the following second regression including fixed effects is run:

$$Y_{it} = \alpha + \delta(submarine_t * connected_i) + \mu_i + \sigma_t + u_{it} \quad (2)$$

where μ_i are constituency fixed effects that control for any time-invariant differences in election outcomes that may be correlated with access to fast Internet, and σ_t are time fixed effects that control for any time trends that may influence election outcomes and that may be correlated with getting access to fast Internet.

5 Results

5.1 Descriptive Statistics

Table 1 and Table 2 show the number of eligible voters, the total number of constituencies, and the constituencies in which the ODM is running for election, broken down by connection status. There are more unconnected constituencies than connected constituencies, and also the majority of eligible voters live in constituencies not connected to the fibre network. In 2013, the number of constituencies was increased. The changes in connection status are not caused by changes in the fibre network, but rather by changes in the drawing of constituencies.

Table 1: Numbers of Eligible Voters, Total Constituencies and Constituencies where ODM is present (1997 and 2002)

	1997 connected	1997 unconnected	1997 total	2002 connected	2002 unconnected	2002 total
Eligible Voters (in Million)	1,383	7,221	8,605	1,708	8,693	10,402
Number of Constituencies	25	173	198	27	182	209
Number of Constituencies with ODM	-	-	-	-	-	-

Table 2: Numbers of Eligible Voters, Total Constituencies and Constituencies where ODM is present (2007 and 2013)

	2007 connected	2007 unconnected	2007 total	2013 connected	2013 unconnected	2013 total
Eligible Voters (in Million)	2,332	11,771	14,103	2,164	11,816	13,981
Number of Constituencies	27	181	208	33	251	284
Number of Constituencies with ODM	23	165	188	22	227	249

Table 3 and Table 4 show the means of voter turnout, incumbent vote share and invalid vote share in the elections from 1997 to 2013, each in connected and unconnected constituencies as well as in Kenya overall, according to own calculations from the CLEA dataset. Voter turnout is determined by the number of votes cast divided by the number of people eligible to vote. Turnout in connected areas is always slightly lower in connected areas, but in 2013 the means almost align. This suggests an effect of treatment on the voter turnout in treated areas. Overall, turnout increased strongly in the elections after treatment compared to the previous elections. As the Orange Democratic Movement was only founded in 2005, there is no data on the vote share of the ODM for the 1997 and 2002 elections. The ODM won the 2007 parliamentary elections with a total of 30.97 percent of votes. However, it is noticeable that the ODM only averages a vote share of 14.17 percent in connected areas and gains most of its votes in unconnected constituencies. Post-treatment, the overall vote share for the Orange Democratic Movement decreased to 21.39 percent. This is mainly due to a strong loss of votes in unconnected areas. The vote share in connected areas, who are affected by the treatment, remains constant at just under 15 percent. The proportion of invalid votes in the total number of votes cast remains at low levels over the course of all elections. There are no sizeable differences between connected and unconnected regions.

Table 3: Voter Turnout, Incumbent Vote Share and Invalid Vote Share by Status of Connection of Constituencies in 1997 and 2002

	1997 connected	1997 unconnected	1997 total	2002 connected	2002 unconnected	2002 total
Turnout (%)	66.39	68.21	67.91	56.09	57.86	57.57
	(12.02)	(11.86)	(11.89)	(9.64)	(8.92)	(9.05)
ODM Votes (%)	-	-	-	-	-	-
Invalid Votes (%)	1.30	1.62	1.57	1.57	1.72	1.70
	(0.86)	(1.53)	(1.47)	(0.91)	(1.37)	(1.32)

Standard deviation in parentheses

Table 4: Voter Turnout, Incumbent Vote Share and Invalid Vote Share by Status of Connection of Constituencies in 2007 and 2013

	2007 connected	2007 unconnected	2007 total	2013 connected	2013 unconnected	2013 total
Turnout (%)	67.04	69.35	68.97	85.76	85.84	85.83
	(13.13)	(12.16)	(12.34)	(7.68)	(6.72)	(6.84)
ODM Votes (%)	14.17	34.18	30.97	14.54	22.61	21.39
	(12.87)	(29.14)	(27.00)	(19.69)	(21.26)	(20.90)
Invalid Votes (%)	1.28	1.16	1.18	1.10	0.96	0.99
	(0.86)	(0.93)	(0.92)	(0.35)	(0.43)	(0.42)

Standard deviation in parentheses

5.2 Empirical Results

Table 5 reports this paper's main findings: The estimated effect of the arrival of fast Internet on electoral outcomes in Kenya. The first column shows the basic model without fixed effects for voter turnout. One observes a positive but insignificant effect of the treatment. When adding constituency fixed effects and time fixed effects, the estimated effect becomes significant on the 10-percent-level, as shown in the second column. The more comprehensive equation including fixed effects increases the confidence in the coefficient and the results are more reliable. The coefficient means that the estimated impact of "being connected to the fibre network and fast Internet" is 2.96 percentage points. In other words, if a constituency becomes connected to fast Internet, its turnout will increase by almost 3 percentage points, which is a sizeable effect. This is evidence that the new access to high-speed Internet did in fact increase the turnout in the 2013 Kenyan parliamentary election in treated areas.

The third column reports the estimated effect of treatment on the vote share of the incumbent

Table 5: Fast Internet and Election Outcomes

Unit of Analysis	Constituency					
Outcome	Turnout		Incumbent Vote Share		Invalid Vote Share	
	(1)	(2)	(3)	(4)	(5)	(6)
Connected	0.0296	0.0296*	0.1037	0.1056	0.0007	0.0007
x Submarine	(0.0117)	(0.0163)	(0.0934)	(0.0671)	(0.0023)	(0.0020)
Observations	344	344	282	282	344	344
Time FE	No	Yes	No	Yes	No	Yes
Location FE	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
**** p-value <0.01, ** p-value <0.05, * p-value <0.1*

party in the basic model without fixed effects. The number of observations is lower for this outcome because the ODM did not run in every constituency. The analysis shows that the new access to fast Internet had a positive effect on the vote share of the ODM. This result is however not significant at the 10-percent-level. Controlling for constituency fixed effects and time fixed effects further decreases the p-value, but the coefficient is still not significant on conventional levels. Nevertheless, the results show that the incumbent party possibly profited from the arrival of fast Internet.

There is no effect of treatment on the share of invalid votes in the basic model. The coefficient is almost zero and highly insignificant. The results are similar when running a fixed effects regression. There is therefore no evidence that the arrival of high-speed Internet impacted the number of spoiled ballots.

5.3 Tests for Parallel Trends

The parallel trends assumption states that unobserved characteristics affecting the outcome do not vary over time with treatment status. This is essential for the validity of the identification strategy. To test whether it is valid to assume parallel trends, one can look at the trends of the outcome variables of the treatment group and the untreated group before the arrival of the submarine cable. It is not possible to observe the pre-trends for the vote share of the Orange Democratic Movement since the party was only founded in 2005 and there is thus no historical election data before the 2007 elections. However, the trends of the turnout and the share of invalid votes, averaged over connected and unconnected constituencies, can be observed from own calculations using the CLEA dataset. Figure 1 shows that, for the voter turnout, the pre-

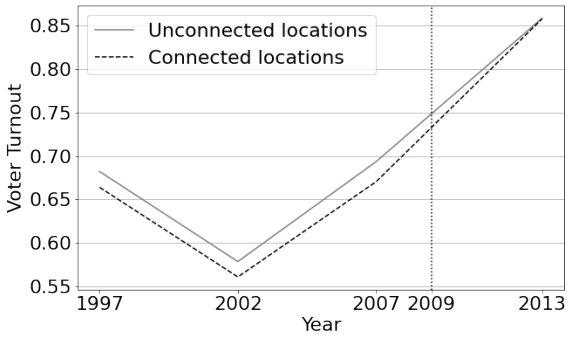

Figure 1: Trend of Voter Turnout

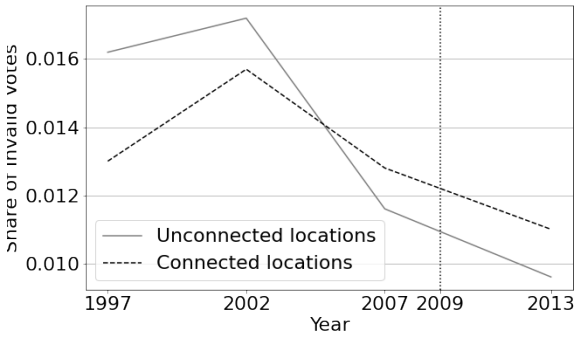

Figure 2: Trend of Invalid Vote Share

treatment trend is the same for both groups, decreasing from 1997 to 2002 but increasing in the year 2007, the amplitude being similar over both groups. Also, the levels are very similar for both groups throughout the years, with the turnout being slightly higher in unconnected areas in each year. After treatment, connected areas then catch up to the unconnected areas.

Regarding the share of invalid votes, the trend is the same for both groups, increasing from 1997 to 2002 but decreasing even more in the year 2007, as it can be observed in Figure 2. The decrease in 2007 is bigger for unconnected areas. However, the levels are very similar for both groups throughout the years.

Overall, these results show that the electoral outcomes followed the same trends before treatment in both connected and unconnected constituencies. This also gives reason to believe that the incumbent vote share would have followed the same trend in both areas. It is therefore reasonable to assume that the election outcomes would have followed parallel trends in the 2013 election if there had been no treatment. Therefore, it can be concluded that deviations from these trends are caused by the treatment and the observed effects can be attributed to the arrival of fast Internet.

5.4 Robustness Checks

Table 6 shows the result of a robustness check, where constituencies, that changed from the 2007 to the 2013 elections, are manually merged before the analysis and are not simply dropped if they have no equivalent. Since there is no data available on how these constituencies were changed, and the shape-file on the locations of constituencies only has data for the state of 2013 but not for 2007, one can only assume the way in which some constituencies have changed. For

Table 6: Robustness Checks

Unit of Analysis	Constituency					
Outcome	Turnout		Incumbent Vote Share		Invalid Vote Share	
	(1)	(2)	(3)	(4)	(5)	(6)
Connected	0.0238	0.0238	0.0995	0.1012	0.0001	0.0001
x Submarine	(0.0302)	(0.0160)	(0.0866)	(0.0632)	(0.0021)	(0.0019)
Observations	366	366	306	306	366	366
Time FE	No	Yes	No	Yes	No	Yes
Location FE	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
**** p-value <0.01, ** p-value <0.05, * p-value <0.1*

cases where it is more obvious (e.g. in 2013 there is 'Kibwezi' and in 2007 there are 'Kibwezi East' and 'Kibwezi West'), constituencies are merged accordingly. This method increases the number of observations but may also induce inaccuracies. After this procedure, constituencies that still have no equivalent are dropped.

The effect of treatment on turnout is now not significant anymore. This is potentially due to the overall low number of observations, especially of treated units, which makes the results sensitive to small changes. However, the regression with fixed effects (column 2) still gives some evidence for an increase in turnout. The fourth column reports the results of a fixed effects regression of the incumbent's vote share on treatment. The p-value is lower compared to the previous regression presented in Table 5. There is thus some evidence that treatment increased the election result of the ODM, although the p-value associated to this coefficient is marginally above conventional levels (0.111). Despite this result not being very robust, this seems to suggest that fast Internet had a positive impact on incumbent's vote share. The coefficients for the share of spoiled ballots stay insignificant.

Furthermore, placebo treatments are performed, where 'fake' treatment dates are imposed. Looking at the coefficients of the interaction term, one should therefore expect no effect. The results are presented in Table 7. Again, it is not possible to do this for the party vote share because the ODM only runs in the 2007 and 2013 elections. However, it is possible to perform this for the turnout and control whether the results are significant for a 'fake' treatment.

The first column of Table 7 shows the result of a placebo treatment between the 1997 and 2002 elections. The regression with fixed effects yields a highly insignificant effect of the placebo treatment on turnout and the coefficient is the reverse effect of the actual treatment.

Table 7: Placebo Treatments

Unit of Analysis	Constitiuency	
Outcome	Turnout	
Placebo Treatment	1997 - 2002	2002 - 2007
	(1)	(2)
Connected	–0.0107	–0.0058
x Submarine	(0.0172)	(0.0184)
Observations	380	404
Time FE	Yes	Yes
Location FE	Yes	Yes

Standard errors in parentheses
**** p-value <0.01, ** p-value <0.05, * p-value <0.1*

Another placebo treatment is performed for a treatment date between the elections 1997 and 2002. The coefficient of the regression with fixed effects is again highly insignificant and negative, in contrast to the actual treatment.

As expected, there is no impact detectable in both placebo regressions. These results further reinforce the validity of the parallel trends assumption as again no underlying difference in trends between the groups is found. Presumably, this can be transferred to the results on the incumbent's vote share. This further strengthens the result that the new access to fast Internet had a significant positive impact on turnout and possibly on the election result of the ODM.

6 Interpretation

To contextualize the results, it is useful to draw on the theoretical and empirical literature as well as the political and economic situation in Kenya during the elections. The literature is consistent in saying that information increases voter turnout and influences political outcomes. However, the direction of influence on the shares of votes for the incumbent and invalid votes depends mainly on the performance of the government and the evaluation of it by the voters. In addition, it was questionable whether the Internet increases or decreases voter turnout, depending on its use, and therefore the impact of the Internet on election outcomes was ambiguous. This paper shows that the introduction of high-speed Internet in Kenya increased voter turnout and possibly the incumbent party's vote share in the subsequent elections, while the proportion of invalid ballots was not affected.

The significant positive effect of treatment on voter turnout suggests that the voters are ac-

tually better informed (Banerjee et al. 2011; Aker, Collier, and Vicente 2017) and Internet does not substitute news consumption by entertainment. An increased level of political information gets the affected voters more involved in the political process, who are then more likely to vote. Indeed, this result was predicted by Minard and Landriault (2015), who found different effects of the Internet on turnout depending on regime type, namely an increase in turnout in immature anocracies, to which Kenya can be counted. Moreover, voter turnout is higher in highly contested elections (Blais 2006). Since Kenya experienced a close election in 2007, and information about this was likely improved by the treatment, turnout also increased as a result of the treatment. Considering the violent events in 2007, the result might be surprising, as turnout is usually lowered by violence (Mac-Ikemenjima 2017). However, this may have been offset by the anti-violence measures taken before the 2013 elections, which were disseminated via the Internet (Benesch 2014). Overall, this finding suggests that the Internet, like radio and newspapers, can increase the level of political information and thus voter turnout.

There is some evidence of a possible positive effect of treatment on the incumbent's share of the votes. This can only be partially explained by a higher level of information, as the incumbent would only benefit if people are satisfied with the government's performance (Banerjee et al. 2011; Ferraz and Finan 2008). Why might voters be content with the incumbent party in the period from 2007 to 2013? One possible reason is that the 2013 elections took place during an economic boom with Kenya's GDP growing at a rate of 5.88 percent. In addition, the ODM was the only political party that maintained continuity from 2007 to 2013. The new constitution, which strengthens democratic participation at the expense of presidential powers and was approved in a referendum after being promoted by the ruling party and its prime minister, could also play an important role. This success of adoption could be attributed to the ODM, and the literature indicates that ODM voters attached great importance to the implementation of the new constitution.

No effect of treatment on the share of spoiled ballots was detected. A high share is usually a sign of dissatisfaction with the government, dependent on having access to political information (Moral 2016; Driscoll and Nelson 2014; Cohen 2018). The fact that there was no increase in the share of invalid votes in treated constituencies complements the previous interpretation that voters affected by the treatment were not dissatisfied with the incumbent party.

It may be counter-intuitive to suggest satisfaction with the ruling party when its overall vote share fell by nearly 10 percentage points. One possible explanation is that satisfaction was higher in connected constituencies, where voters were informed, and the drop in votes is attributable mainly to unconnected areas and therefore occurred among less informed voters who may have motives other than the incumbent's performance.

The effects of treatment on voter turnout, incumbent's vote share and invalid vote share combine to provide coherent evidence pointing towards the final interpretation that the new access to fast Internet in Kenya increased the level of political information. Thus, the results suggest that there is no crowding out of information consumption by entertainment consumption via the Internet and Internet is in fact used for accessing political information which in turn increases electoral accountability. With regard to the literature, the results support the findings of those papers that also find an increase in information through the Internet.

The analysis shows that the parallel trends assumption is reasonable and that the identified estimated effects are caused by the treatment. This is further confirmed by the analysis of placebo treatments. The robustness tests show that the results are sensitive to changes in units because the number of observations and, in particular, the number of units treated is relatively small. To gain more confidence in the results, one would need to increase the number of observations if data coverage permits. This may also allow the identification of significant effects on the incumbent vote share. However, the results clearly suggest positive effects of the new access to high-speed Internet on voter information.

7 Conclusion

This paper identifies causal effects of the arrival of fast Internet on election outcomes using a difference-in-differences approach with the arrival of a submarine cable in Kenya as the treatment. The results show a significant positive effect of treatment on voter turnout. There is some evidence of a possible positive effect of treatment on the incumbent's share of the votes, but no evidence for an effect on the share of invalid votes. The effects of treatment on electoral outcomes combine to provide coherent evidence suggesting a higher level of political information due to the introduction of high-speed Internet. The parallel trends assumption needed for the

validity of the identification strategy is reasonable and the analysis of placebo treatments further strengthen the findings. The robustness tests show that the results are sensitive to changes in units due to a small number of treated observations.

These findings contribute new insights into the impact of the Internet on information in developing countries to the empirical literature, which has yet to reach a final assessment. However, answering this question is of great importance because access to political information is a basic requirement for the success of democracies. This paper argues that Internet contributes to voter information.

The findings give rise to some policy implications: When seeking to strengthen democracy, it is essential to engage people and offer ways of accessing information. These include the Internet. Given the low percentage of Internet use in Africa compared to the rest of the world, the Internet infrastructure and people's access to it must be further developed, not least to strengthen democracy, as the results indicate that it is used for political information. Moreover, one lesson of this paper is the importance of the availability of electoral data in African countries. Details about constituencies and their location, as well as the breakdown of results into granular electoral units, increase transparency and confidence in results and allow for the analysis of election outcomes in the context of political, social, or economic developments.

Some limitations affect the robustness of the results and can be addressed in further research. Limited data availability prevented obtaining a higher number of observations and reduced the accuracy of the assessment of constituency-locations. The absence of relevant data on the constituency-level also hindered the inclusion of covariates. In addition, there are some concerns about the reliability of the election data, particularly for the 1997 elections. If data constraints allow, further research can consequently aim to extend the analysis to more African countries and observations in order to increase the robustness of the results and to gain more confidence in the findings. In addition, it is relevant to examine the channels of impact, possibly using Afrobarometer data, and to assess the satisfaction with policy offerings and government performance during the investigated elections, as well as to determine how information levels, political participation, and attitudes toward democratic principles have changed as a result of the treatment. Moreover, the impact of the Internet on election violence, protest incidence and further measures of accountability, such as the distribution of funds, can be evaluated.

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