The Empirical Determinants of Social Media Adoption by World Leaders and its Political Consequences.

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Abstract

An important component of leader behavior is the strategic use of communication to both domestic and international audiences. Social media, and in particular Twitter, has emerged as an import new medium for political communication Over 80% of world leaders have an active presence on the micro-blogging website Twitter. In this paper we explore which factors explain when leaders and governments choose to adopt Twitter as a means of a communication. We look at variation across levels of democratization and election timing to understand differential adoption. We find that both electoral timing and democracy strongly influence adoption of Twitter. Furthermore, we exploit this source of information to better understand the way in which governments try to communicate with their citizens and the international community. Finally, we develop a Bayesian ideal point estimation method using shared Twitter follower networks to locate world leaders on an underlying multidimensional space. We demonstrate that distances between leaders on this space are excellent predictors of bilateral trade volume, even after controlling for common determinants of trade, and argue that they better capture affinities between countries in international affairs.

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1 Motivation

Leaders recognize the importance that communicating and cultivating an image plays in maintaining power and order. For example, emperors in Rome had coins that were emblazoned with their own image and that of important victories (Jowett and O'Donnell, 2014, p. 63). The use of coins was particularly effective since they were circulated throughout the empire via trade, creating a "low cost" form of propaganda. In more recent times, leaders –particular in autocracies– have sought to further ensure their hold on power by asserting control over the mass media and intimidating independent journalists who criticize the regime (Bueno de Mesquita and Downs, 2005; Levitsky and Way, 2002; Gehlbach and Sonin, 2013).[1]

Many have argued that the rise of social media has disrupted traditional top-down political (elites → masses) communication (Shirky, 2011). Social media has already played a prominent role in many recent political events. From extensive use of social media[2] by Hamas and Israel (particularly Twitter)[3] in the 2012 Gaza Conflict (Zeitzoff, 2014), to internet censorship in Egypt (Hassanpour, 2013), social media is increasingly becoming an important arena for political competition. Much of the previous research has focused on the effect of social media and information communication technology (ICT) on mass behavior. Does access to social media and ICT increase insurgency (Shapiro and Weidmann, 2012; Pierskalla and Hollenbach, 2013), or protests (Lynch, 2011), and how can it mobilize constituents (Bond et al., 2012)? Moreover, how do governments react strategically to challenges and protests via social media (King, Pan, and Roberts, 2012)? And might it actually enable better monitoring of protest behavior (Morozov, 2012)?

The focus on mass mobilization has obscured the growth in a parallel phenomenon. Leaders themselves have signed on, and embraced their own social media accounts (e.g. Twitter, YouTube, Facebook) as political tools. By the end of 2013, over 80% of world leaders had a Twitter account

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[1]For instance, in Uzbekistan, a noted government critic, and independent journalist (Jamshid Karimov), was reported missing. He was eventually found having been forcibly committed a psychiatric clinic, where he remained captive until November 2011. He then disappeared in January 2012. http://en.wikipedia.org/wiki/Jamshid_Karimov.

[2]We follow the Oxford Dictionary and define social media as "websites and applications that enable users to create and share content or to participate in social networking."

[3]The conflict was dubbed the first "Twitter War" (Cohen, 2012).

(Burson-Marsteller, 2012). Many of these online networks of both leaders and followers, reflect offline, salient political cleavages (Barberá, 2014). Yet comparatively, little work has been done on understanding the political determinants of when and why leaders adopt social media. Given that incumbent political leaders seek to maintain political power, and strategically manipulate and use coordination goods (such as social media) to do so (Bueno de Mesquita and Downs, 2005), these remain important, and unanswered questions.

We use data drawn from Twiplomacy (Burson-Marsteller, 2012),[4] a website that tracks world leaders on social media. We extract all Twitter accounts associated with political leaders. We then match this data with political, and socio-demographic data to examine what determines adoption of social media. We find that electoral and political factors play a large role in social media adoption. More democratic countries and electoral pressure–having an election scheduled within the next six months–both significantly increase the probability that a leader will adopt Twitter. Finally, we show that the networks of Twitter followers –who follows which leaders– reflects meaningful policy positions. The results suggest that Twitter and other social media data reflect important differences in the strategic constraints placed on leaders (e.g. democracies versus non-democracies), and a new medium for political competition.

2   World Leaders on Social Media

2.1   How are world leaders using Twitter?

The use of Twitter as a tool for political communication by world leaders has become widespread. As we show in Figure 1, by the end of 2013 the governments of over 80% of countries with a population over half a million had an active presence on Twitter.[5] The list includes the Presidents or Prime Ministers of the most powerful nations in the world, such as Barack Obama, David Cameron, Dmitry Medvedev or Dilma Rousseff; and also of many other countries (e.g. Argentina,

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[4]http://twiplomacy.com/

[5]All the descriptive analysis in this section was conducted using a revised version of the Twiplomacy dataset of world leaders on Twitter (Burson-Marsteller, 2012), which we complemented with information about each Twitter users extracted from Twitter's REST API. All the results are updated as of February 1st, 2014.

France, Ukraine, Tunisia, South Africa, Philippines, Japan, etc). Leaders from countries with limited press freedom, such as Iran, Kyrgyzstan or Cuba, also have Twitter accounts. As we show in Figure 2, Twitter is used by world leaders essentially all around the world, with the exception of China.

Figure 1: Proportion of countries whose government has an active Twitter account
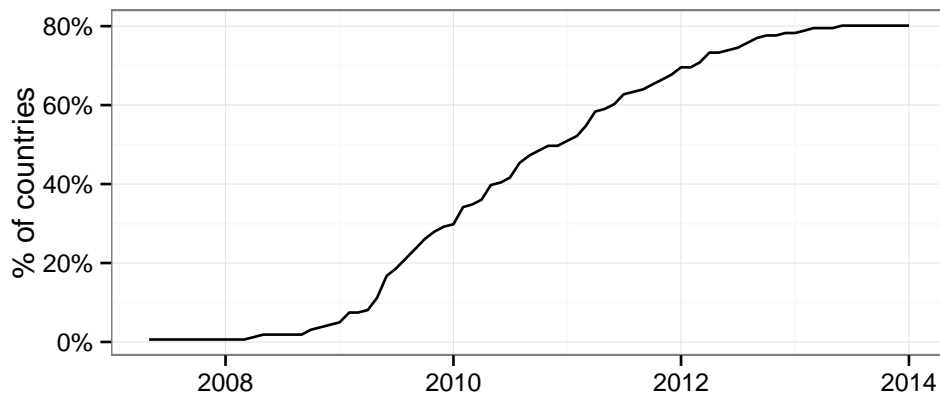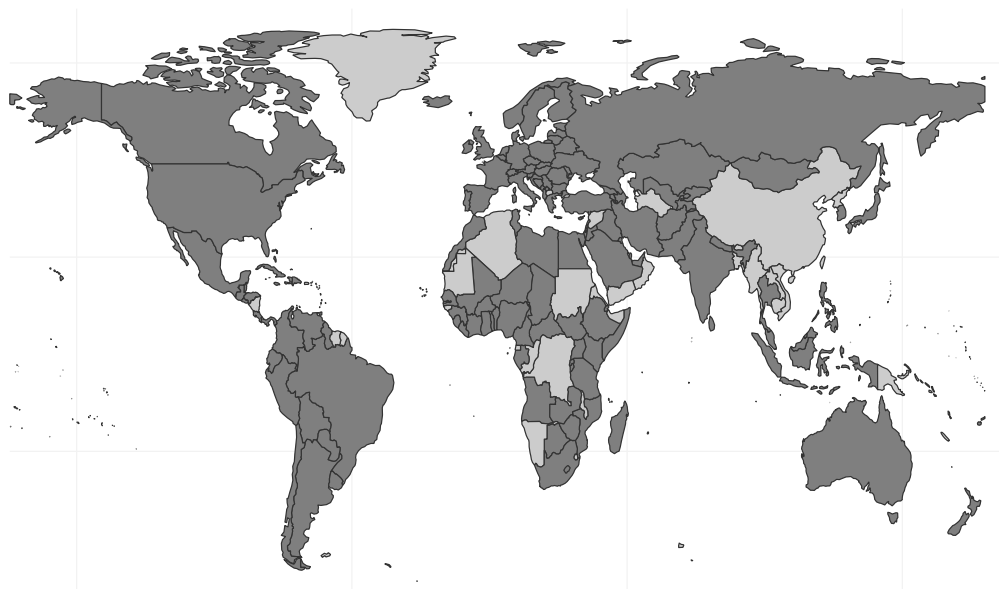

Figure 2: Countries with at least one leader on Twitter

Note: countries colored in dark grey have at least one leader (head of state or government) has an active Twitter account, either personal or institutional.

This presence takes mostly two forms. The most common (70.8% of countries) is a personal ac-

count for a representative of the government, either the Prime Minister (32.2%), President (47.8%), of Minister of Foreign Affairs (30.4%). In addition to this type of "personal" Twitter account, most countries (67%) have "institutional" Twitter accounts for their Presidency (29.8%), Government (39.1%) or Foreign Ministry (45.9%). Note that these percentages do not add up to 100 because many countries have multiple Twitter accounts. In fact, it is also fairly common to have multiple accounts for the same institution, each in a different language. For example, Dmitry Medvedev has an account in English (`@MedvedevRussiaE`) and another in Russian (`@MedvedevRussia`).

Most world leaders on Twitter are active users of this platform and also have large audiences. The median Twitter account for a world leader has sent 1,279 tweets since it was created, and has 13,590 followers. However, as we show in Figure 3, there is wide variation in their number of followers. 24 accounts have more than 1,000,000 followers, which includes the outlier on the right of the plot, `@BarackObama`, with over 40 million followers. Audience size is correlated with population (for example, the accounts with over a million followers include the prime ministers or presidents of Russia, Turkey, Egypt, Mexico, Philippines, United Kingdom, or India), but we also observe a few cases where leaders from medium-sized countries, such as Jordan, Chile or Ecuador, are able to attract international attention and increase their number of followers.
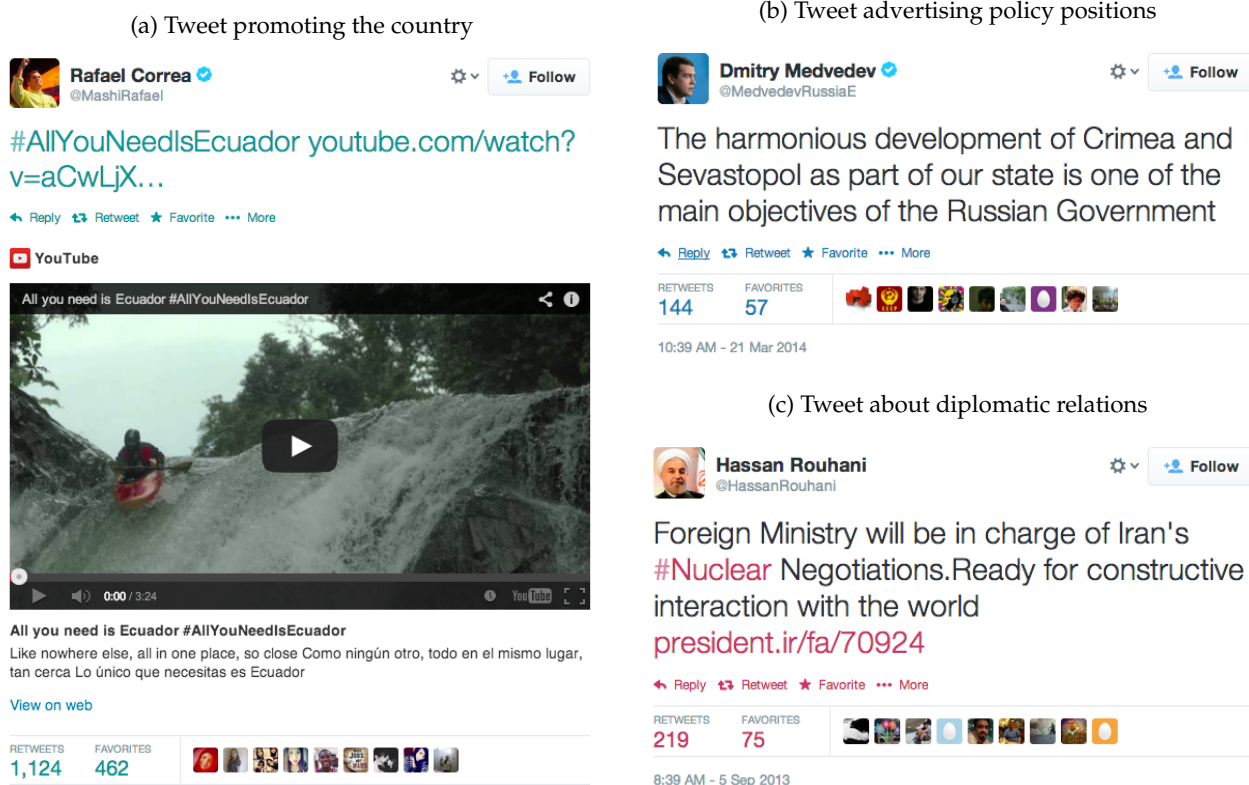
Figure 3: Distribution of Number of Followers of World Leaders on Twitter, by Continent
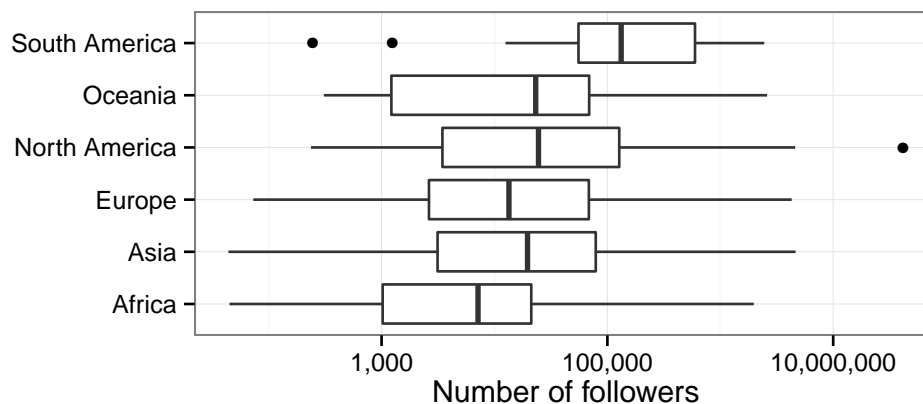
World leaders use Twitter for a wide variety of purposes. We claim that these different purposes can be collapsed into two broad categories: tweets oriented towards an international audi-

ence; and tweets that are related to the internal politics of the country.

Figure 4: Examples of Tweets Sent by World Leaders (International)

(a) Tweet promoting the country

(b) Tweet advertising policy positions

(c) Tweet about diplomatic relations

Starting with the first category, world leaders can send tweets to their international audiences with different objectives. They often send tweets that promote specific aspects of their country, in order to attract tourists, or improve the international image of the country. Tweet (a) on Figure 4 provides an example: here, the President of Ecuador is using Twitter to advertise the touristic appeal of its country, adding a Youtube video and using a hashtag. A second category of tweets would refer to those that advertise policy positions about international relations. As an example, tweet (b) shows a recent message by Russia's Prime Minister in which he informs of his position on the Crimea crisis. Finally, there are also cases of what the media has coined "Twitter diplomacy". Tweet (c) is the most visible example of this pattern: here, Iranian president Hassan Rouhani used Twitter to inform his followers of the state of the negotiations about Iran's nuclear plan. It is obvious that Twitter is not a substitute for traditional diplomacy, but it has become an outlet by

which world leaders can communicate directly with citizens all around the world, without the need of traditional news media as an intermediary agent.

The second category encompasses all uses of Twitter that have the internal audience of each country as the target audience. Figure 5 shows examples of the four types of tweets we consider within this category. Tweet (a) is an instance of what appears to be the most common use of Twitter: to provide information about the government's daily agenda. Here, Mexico's president announces that he participated in the inauguration of a new dam. Other activities that are frequently reported are meetings with other political actors, international visits, participation in political rallies, etc. Tweet (b) provides an example of another frequent use: to influence offline and online political agenda. US President Barack Obama and the White House appear to be particularly successful at this, often creating hashtags that become trending topics in the United States. A more specific subtype of tweet is that illustrated with tweet (c). Here, Spain's prime minister advertises the proposal of a new policy to promote entrepreneurship. Finally, Twitter is also often used to provide information about the personal life of the world leaders, often with pictures about how they spend their leisure time with family. Tweet (d) is an example of that. Interestingly, it is extremely rare that world leaders use Twitter to interact directly with their citizens, which suggests that they use Twitter as a top-down channel to broadcast information. In fact, the median number of users they follow is only 99 other users.

Figure 5: Examples of Tweets Sent by World Leaders (National)

(a) Tweet about government's agenda

(b) Tweet influencing political agenda

(c) Tweet about country policies

(d) Personal tweet

2.2 Theories of social media adoption

The amount of resources world leaders spend curating their Twitter accounts, as well as their large audiences online, highlight the potential importance of this platform as a mechanism for political communication. A key debate that many scholars have focused on is whether social media plays an important role in political behavior (Tufekci and Wilson, 2012), or whether it is simply epiphenomenal (Gladwell, 2010). We argue that if social media is an important political tool, then leaders are likely to use this to maximize power and survival in office (Bueno de Mesquita and Downs, 2005).

What factors explain leaders' adoption and use of social media? We also seek to understand differential rates of adoption, and the factors associated with active use of this tool by leaders. We argue that there are three potential channels, or hypotheses that could influence social media adoption if social media indeed, is an important political tool for leaders:

1. **Modernization hypothesis**. Social media adoption depends on the sociodemographic characteristics of the country. In countries with high income per capita, and high internet and social media penetration, world leaders should adopt Twitter at higher rates in order to adapt to communication practices by members of their society. This is related to the modernization hypothesis –democracy consolidation occurring at higher levels of income– that Lipset (1959) proposed.

2. **Electoral pressure hypothesis**. World leaders (incumbents) create Twitter accounts in order to promote their political activities, with the purpose of getting reelected. If so, we would expect rates of adoption to be higher in the months before an election.

3. **Transparency/democracy hypothesis**. Governments create Twitter accounts in order to communicate directly with their constituents, as a complement to other existing communication mechanisms, such as a campaigns in the press, press releases, etc. If so, we would expect democracies to adopt Twitter at higher rates.

Conversely if none of these three hypotheses are borne out, then this would suggest that the

null hypothesis–social media is tangential to world leaders' principal concerns of staying in office and maximizing power–is more likely.

3 Research design

3.1 Data

Our main source of information about world leaders on Twitter is the "Twiplomacy" dataset (Burson-Marsteller, 2012), which we revised and updated as of February 1st, 2014. We then collected additional information about each user from Twitter's REST API, including the number of followers and tweets sent, when each account was created, and the date in which the first tweet was published. We also extracted the entire list of followers for the 470 world leaders in our sample. Our dependent variable – social media adoption– was constructed using this information. Table 1 provides more details about the operationalization of this variable, as well as information and source for our independent variables, which include the Polity 2 score, GDP per capita, proportion of English speakers, and indicators for each continent and whether an election was going to be held in the coming 6 months.

Our measure of social media adoption by ordinary citizens in each country required the collection of a new dataset, given that this type of information is not released by Twitter and does not appear to be available. In order to estimate the number of Twitter users by country and month, we collected a large random sample of geolocated tweets, which we then classified according to the country from which they were sent, building upon the technique developed by Mocanu et al. (2013). We rely on a dataset of 130 million geolocated tweets sent by 7 million unique users between November 6th, 2013 at 00:00:00 GMT and December 5th, 2013 at 23:59:59 GMT. Tweets were captured using the Streaming API and the streamR package for R (Barberá, 2013) and a geographic bounding box that spans the entire globe.[6] We then extracted the user information for

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[6]Given the limitations of the API (only up to 1% of all tweets sent at any given time can be accessed), these 130 million tweets represent a random sample of the approximately 300 million geolocated tweets that were sent during the same period. This number was estimated based on the "track limit errors" returned by the Twitter API, which indicate the number of tweets that were missed due to the 1% rate limit.

Table 1: **Summary Statistics (Monthly data from 2007-2012)**

Variable	N	Mean	Std. Dev.	Min	Max	Description
Twitter Account	9936	0.433	0.495	0	1	Is there a Twitter account associated with the head of state.
Active Twitter Account	9936	0.407	0.491	0	1	Is there an active (tweeted at least once) Twitter account associated with the head of state.
Personal Twitter Account	9936	0.289	0.453	0	1	Is there a personal Twitter account associated with the head of state.
Active Personal Twitter Account	9936	0.190	0.392	0	1	Is there an active (tweeted at least once) personal Twitter account associated with the head of state.
Polity 2	11940	3.721	6.336	-10	10	Democracy data from Polity (Jaggers and Gurr, 1995)
Election Within 6 Months	12240	0.143	0.350	0	1	Is the country holding an election within six months of the.
Social Media Users	12240	0.311	0.791	0	8.6	Proportion of Twitter users per one thousand inhabitants.
Internet Users	7980	34.084	28.102	0	95	Internet users per 100 inhabitants (via the World Bank Development Indicators).
Log GDP Per Capita	11424	8.843	1.326	5.5	12.2	
% English Speakers	12240	22.865	29.87	0	98.4	
South America	12096	0.137	0.344	0	1	Dummy Variable if country is in the region.
Africa	12096	0.387	0.487	0	1	Dummy Variable if country is in the region.
Europe	12096	0.292	0.455	0	1	Dummy Variable if country is in the region.

each tweet, which contains the date when they created their account. Under the assumption that users are tweeting from the country they live in, we thus consider the distribution of creation dates as equivalent to the rate of adoption in each country.

Table 2 displays our estimates of the number of users per million inhabitants in every country, as of December 2013. Our results match the main results in Mocanu et al. (2013). We find that

countries in the Arabian peninsula, as well as Turkey, Spain, United Kingdom, and the United States have the highest Twitter penetration. The countries with lowest proportion of Twitter users are mostly in central Africa, and also Cuba, China and North Korea, where Twitter is blocked.

Table 2: Estimated number of Twitter users, by country

|	Top 15 countries		Bottom 15 countries	
	Country	Users	Country	Users
1	Kuwait	10594	Lesotho	0
2	Qatar	8235	Chad	2
3	Bahrain	7781	Togo	2
4	United Kingdom	7609	Burundi	3
5	Saudi Arabia	7308	Niger	5
6	Spain	6982	Democratic Republic of Congo	5
7	Malaysia	6695	Central African Republican	6
8	Ireland	6660	Madagascar	6
9	United Arab Emirates	6134	Guinea-Bissau	6
10	Turkey	6003	Burkina Faso	6
11	United States	5363	Bangladesh	7
12	Oman	4677	Cuba	9
13	Cyprus	4563	Sierra Leone	9
14	Panama	4352	China	9
15	Latvia	4330	North Korea	10

Note: quantities measure the estimated number of Twitter users per million inhabitants in each country. Only countries with population over 500,000 people were included in the sample.

Figure 6 demonstrates that the speed at which Twitter became an important tool for communication varies across countries. Here, we display our estimates of Twitter adoption over time for a set of eight different countries with high Twitter penetration. English-speaking countries like United States and United Kingdom were early adopters, with high rates of Twitter use since 2009. Kuwait represents the opposite case: here the number of users per capita has been increasing exponentially since late 2012.

3.2 Modeling social media adoption

To better understand the factors that influence Twitter adoption by world leaders, we use event history analysis (Box-Steffensmeier and Jones, 2004). We model the risk (hazard rate) that a country's leadership will adopt Twitter, and examine how political and demographic variables influ-

Figure 6: Twitter adoption, by country
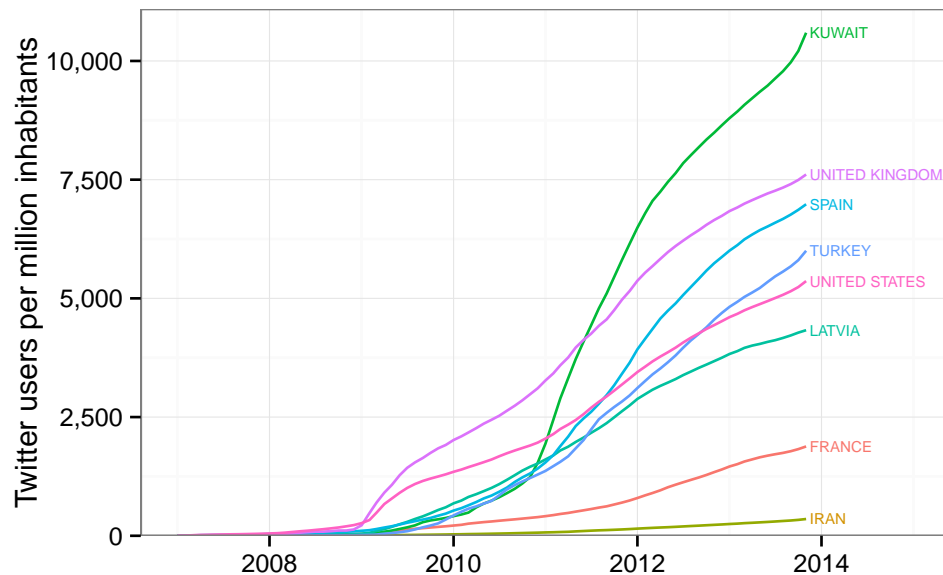
ence the probability of adoption using monthly data from 2007-2012. Our main question is how do political factors–democracy and electoral considerations (whether an election is happening within 60 days)–influence adoption and use of Twitter by world leaders. Previous research suggests that leaders in democracies must be extremely sensitive to media and campaign coordination (Howard, 2005). This is especially true during election time, when leaders may want to shape the popular narrative in order to fend off challenges (Shirky, 2011).[7]

We look at the probability of Twitter adoption using Kaplan-Meier plots comparing adoption in democracies versus non-democracies. We then extend the analysis using Cox proportional hazard models to control for whether there is an election in six months social media adoption in individual countries, GDP per capita, access to the internet, and include region dummies.

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[7]The recent attempts by Turkish Prime Minister to censor Twitter ahead of the 2014 Turkish municipal elections represents an important, if extreme case of politicians seeking to control the narrative on social media. See http://www.nytimes.com/2014/03/27/world/middleeast/turkey-twitter.html.

4 Results

The Kaplan-Meier plots in Figure 7 show the probability of Twitter adoption as a function of time comparing democracies and non-democracies.[8]The results show fairly consistently that across time democracies were much more likely to adopt Twitter than non-democracies.

Figure 7: Kaplan-Meier Graph of Active Twitter Adoption by Democracies vs. Non-Democracies
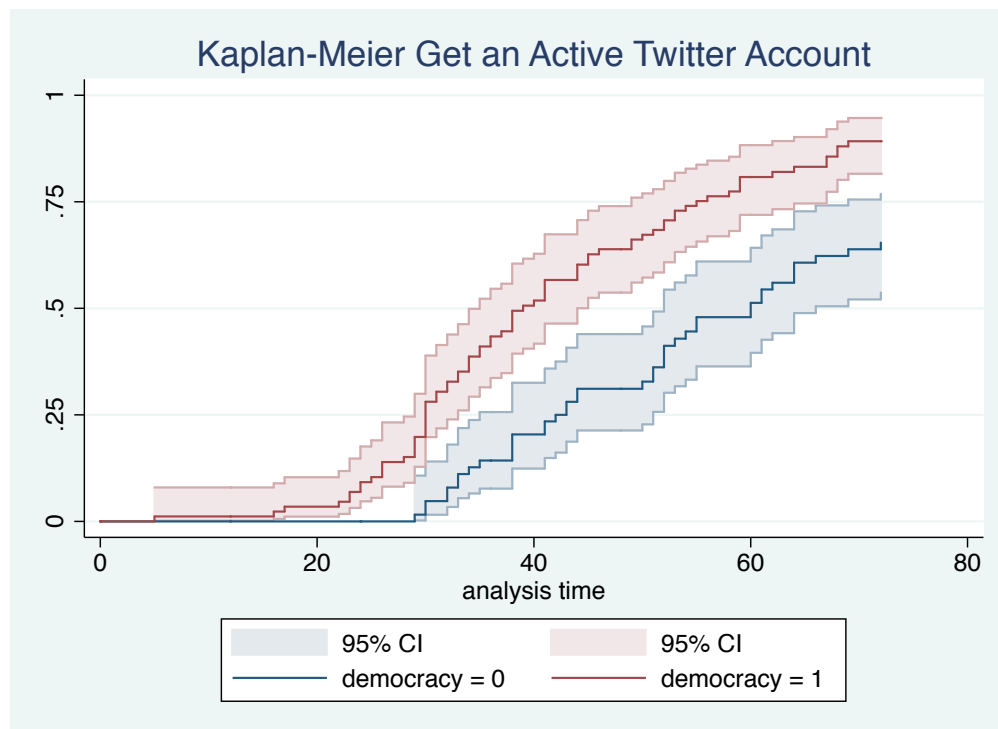
Note: The failure plot looks "failure," or active Twitter adoption (i.e. whether a country has an active Twitter account associated with a leader). Following standard practice (Jaggers and Gurr, 1995), code countries with a Polity 2 score of +6 or higher as democracies.

In Tables 3 we use Cox proportional hazard models to further explore the correlates of Twitter adoption.[9] The results show that more democratic countries are more likely to adopt Twitter more quickly. Moreover, having an election within 60 days increases the baseline hazard ratio of Twitter adoption by approximately 230%.[10] However, the level of GDP per capita does not appear to have

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[8]Figure 10 in the appendix replicates this figure using active adoption as dependent variable (i.e. actually send tweets), finding very similar results.

[9]We did look at using time-varying covariates for the number of social media users, Polity score, and election window variables (results not presented). Yet, much like the plots in Figure 7, there does not appear to be a violation of the proportional hazards assumption (i.e. the effect of the covariates is proportional across time).

[10]Using the coefficient from Table 3 on the election we plug in $e^{0.6} = 2.28$. to see the increase in the hazard ratio.

a significant effect on the likelihood of social media adoption.[11]

Table 3: Cox Proportional Hazard Model

	1	2	3	4
Polity 2 Score	0.08***	0.08***	0.08***	0.03
	(0.02)	(0.02)	(0.02)	(0.02)
Election Within 6 Months		0.47**	0.52**	0.42*
		(0.22)	(0.22)	(0.23)
Social Media Users			0.96***	0.45**
			(0.14)	(0.22)
Internet Users				0.01*
				(0.01)
Log GDP Per Capita				-0.05
				(0.14)
% English Speakers				0.00
				(0.00)
South America				0.91**
				(0.41)
Africa				0.43
				(0.38)
Europe				0.58
				(0.36)
Observations	7219	7219	7219	3311
Number of Countries	149	149	149	131
Number Get Twitter	117	117	117	101

Dependent variable: Does Any Leader Have an Active Twitter Account? Robust standard errors in parentheses. Signif.: *10% **5% ***1%.

The results strongly suggest that electoral incentives and level of democracy shape politicians decisions to get and be active on Twitter. The fact that democracies[12] are quicker to adopt and use Twitter is likely due to the role that accountability (Przeworski, Stokes, and Manin, 1999) and communication (Howard, 2010) play in democratic states. The political constrains and need to please a larger constituency–compared to non-democracies–leads democratic leaders to be more proactive in their communication (Bueno de Mesquita, Smith, Siverson, and Morrow, 2005). Elections also raise leaders' desires to communicate with their constituencies, and Twitter is a good

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[11]Tables 5–7 in the appendix replicate our analysis with different operationalization of the dependent variable. The interpretation of our results remains unchanged.

[12]The results for the Kaplan-Meier plots and the Cox proportional hazard models (not shown) when using a binary dummy variable for democracy or non-democracy mirror the findings of the our analysis here.

tool to do so.

5   Measuring political affinity using Twitter data

5.1   Estimation

Studies of the determinants of bilateral trade, inter-state militarized disputes, and coalition-building require measures of dyadic distance between countries in latent policy scales. Existing empirical work often relies on trade flows, information about common political history, or voting patterns in the United Nations to derive estimates for such construct. In this section we propose an alternative measure that relies on the structure of follower networks of world leaders in order to compute affinity scores.

In earlier work (Barberá, 2014), we showed that Twitter follower networks can be highly informative about policy positions on a latent space. Under the assumption that users prefer to follow political actors they perceive as "spatially close" to them on the relevant political dimensions, we were able to estimate valid ideology scores for legislators and citizens in the United States.

Here we extend our analysis to world leaders, in order to examine whether this method can also yield estimates of their ideal points on an affinity scale. First, using the list of their followers, we constructed a large adjacency matrix, $\mathbf{Y}$, with ordinary users on the rows and world leaders on the columns, where each element $y_{ij} = 1$ if user i world leader j and $y_{ij} = 0$ otherwise.[13] Then, we used correspondence analysis (Greenacre, 1984, 2010), implemented in the `ca` package for `R` (Nenadic and Greenacre, 2007), to scale this matrix and project both users and leaders onto a low-dimensional space. As Lowe (2008) shows, this method is mathematically close to a log-linear ideal point model.

Figure 8 displays our results. Each label indicates the approximate position, in a two-dimensional

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[13]Note that in order to reduce the sparsity of this matrix, we only included in the estimation users who follow 10 or more world leaders, which results in a total of 300,244 Twitter users, down from 61,012,158 users who follow at least one leader. Despite dropping such a large proportion of the users from our original population, we believe this approach is more adequate, since it leaves us only with users who are highly interested in international politics, whose following decisions are likely to be more informative about affinity between countries.

latent space, of each world leader with more than 800,000 followers. The small plot on the top left corner indicates the positions of all leaders in our sample. We find that leaders' positions appear to be clustered by continent, as indicated by the color on the small plot, and also by country, whenever it has more than one leader on Twitter. For example, the four leaders on the top right corner are all Turkish; while those on the left are South American leaders. Barack Obama appears to be located in the middle of the latent space, which is explained in part by its large audience.

Figure 8: Twitter-based ideal point estimates for world leaders
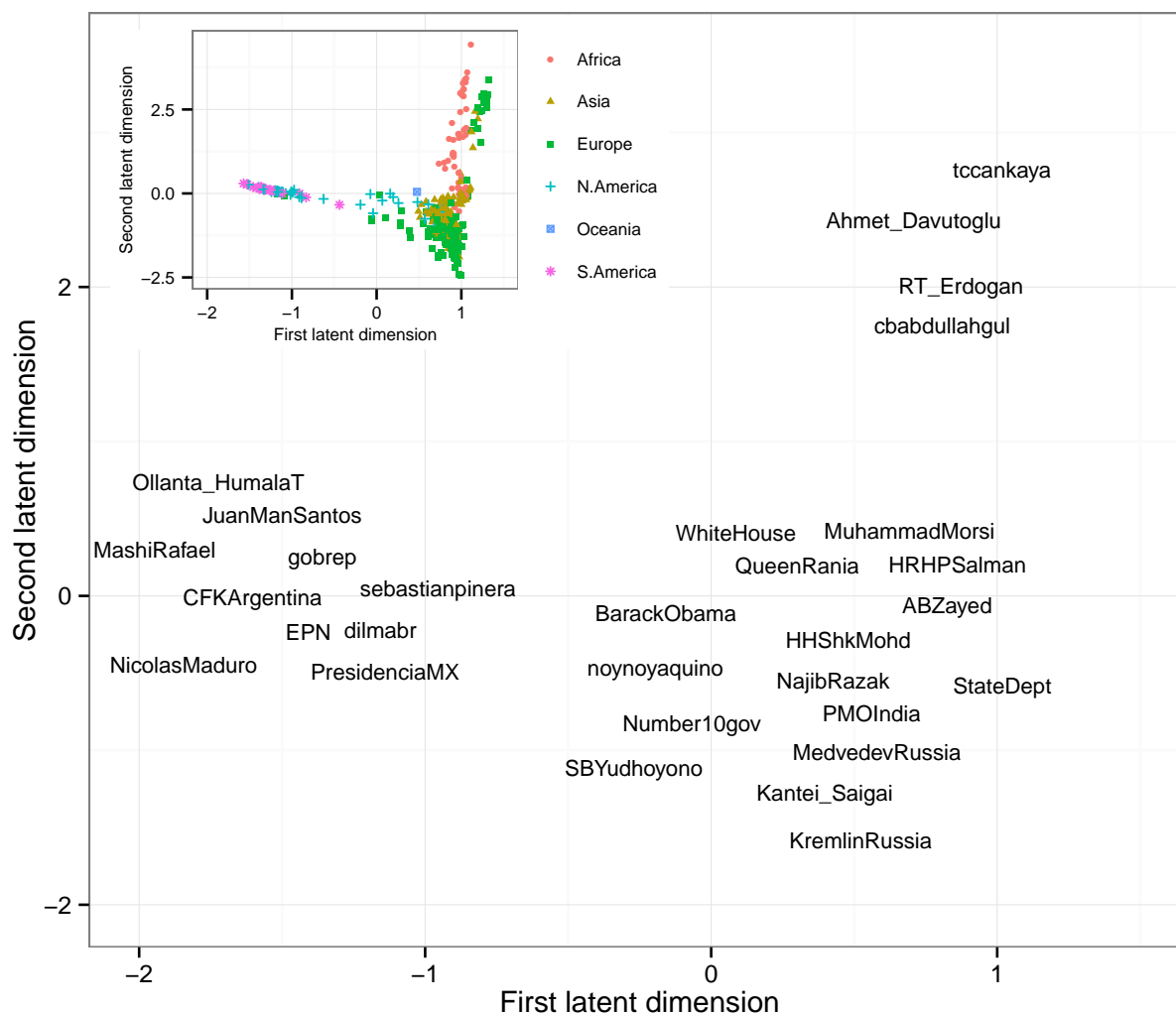
Note: only Twitter accounts with more than 800,000 followers are included in the plot. In order to avoid text overlaps, labels have been slightly moved using a text layout algorithm. The smaller plot on the top left corner shows the original locations of all accounts, colored by continent.

5.2 Twitter distance scores predicts bilateral trade flows

As a proof of concept showing how our measure could be useful, we now turn to assess to what extent distance on the first two latent dimensions predicts bilateral trade flows. Table 4 shows the results of our analysis. The dependent variable is the logged total bilateral trade flows, in millions of dollars, between the 113 countries in our sample for which such data was available on the Correlates of War Project dataset.[14] Our main independent variable is the Euclidean distance between a dyad of countries on the latent affinity space estimated using Twitter networks. In order to compute it, we took the most popular Twitter account from each country in dyad, and then estimated the Euclidean distance between the two accounts, considering only the first two latent dimensions. To benchmark the effect of our variable of interest, we also introduce in the model as additional covariates the geographic distance between capitals (in thousands of kilometers),[15] the GDP per capita of each country,[16], common official language,[17] and the correlation in votes in the United Nations Assembly General (Gartzke and Jo, 2006), which is often considered a measure of affinity in political interests.

We find that our metric of distance is an excellent predictor of bilateral trade flows. A one-unit increase in Twitter distance (equivalent to the difference between the US–Canada dyad and the US–Argentina dyad) is expected to decrease trade flows by half. This effect is equivalent to that of increasing geographic distance in 10,000 kilometers. Furthermore, despite the geographic clustering that we showed in Figure 8, these results show that the latent dimensions are capturing more than just geography or language, as the coefficient for Twitter distance remains large and statistically significant even after controlling for the distance between capitals and whether both countries in the dyad share the same common language.

In fact, when we standardize the coefficients to account for the different levels of variance of each variable, we find that Twitter distance has a largest substantive effect than affinity in UN

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[14]Note that we use the most recent data available for each country, which is 2009 in most cases. We assume that the relative flow amounts haven't changed significantly since then.

[15]Source: Mayer and Zignago (2011).

[16]Source: World Bank Development Indicators, 2013

[17]Source: CIA World Factbook.

Table 4: OLS regression (dependent variable: logged bilateral trade)

	Model 1	Model 2	Model 3	Model 4
(Intercept)	5.09*	5.54*	3.90*	4.97*
	(0.06)	(0.07)	(0.09)	(0.14)
Twitter distance	−1.01*	−0.90*	−0.68*	−0.67*
	(0.03)	(0.03)	(0.03)	(0.03)
Geographic distance		−0.09*	−0.07*	−0.07*
		(0.01)	(0.01)	(0.01)
GDP per capita (Country 1)			0.04*	0.03*
			(0.00)	(0.00)
GDP per capita (Country 2)			0.02*	0.02*
			(0.00)	(0.00)
Common official language			0.54*	0.78*
			(0.15)	(0.15)
Affinity based on UN Votes				1.35*
				(0.14)
N	6338	6338	5913	5717
R^2	0.17	0.18	0.27	0.28
Resid. sd	2.57	2.55	2.42	2.39

* indicates significance at $p < 0.05$

voting patterns. A one-standard-deviation increase in Twitter distance decreases the log of bilateral trade in 0.27 standard deviations. In contrast, a one-standard-deviation increase in UN voting affinity only increases it by 0.11 standard deviations.

To be clear, we're not claiming that Twitter distance has any type of causal effect on trade flows. And of course we expect the magnitude of its effect as we include additional covariates in the model, such as common political background and conflict history. However, we claim that Twitter distance scores can be very useful for the study of dyadic relationships in the IR literature, as an alternative measure of political affinity that does not rely on the problematic assumptions of UN voting affinity (e.g. votes are strategic; and only on contentious issues).

5.3 Twitter distance scores change in response to diplomatic events

One important advantage of the use of Twitter data is that it is highly dynamic: users change who they follow in response to current events. So far, we have computed our estimates of Twitter distance between countries by scaling the follower network as it was as of February 1st. Here,

we exploit the fact that followers lists are available in chronologically inverse order to observe changes in the network. This allows us to compute highly granular dynamic positions of parties, at essentially any point in time. To illustrate the potential of our Twitter distance scores, we focus on five dyads of high interest for the international community, and observe how their distance changes over time. This also allows us to validate that our estimates response to changes in international relations in expected ways.

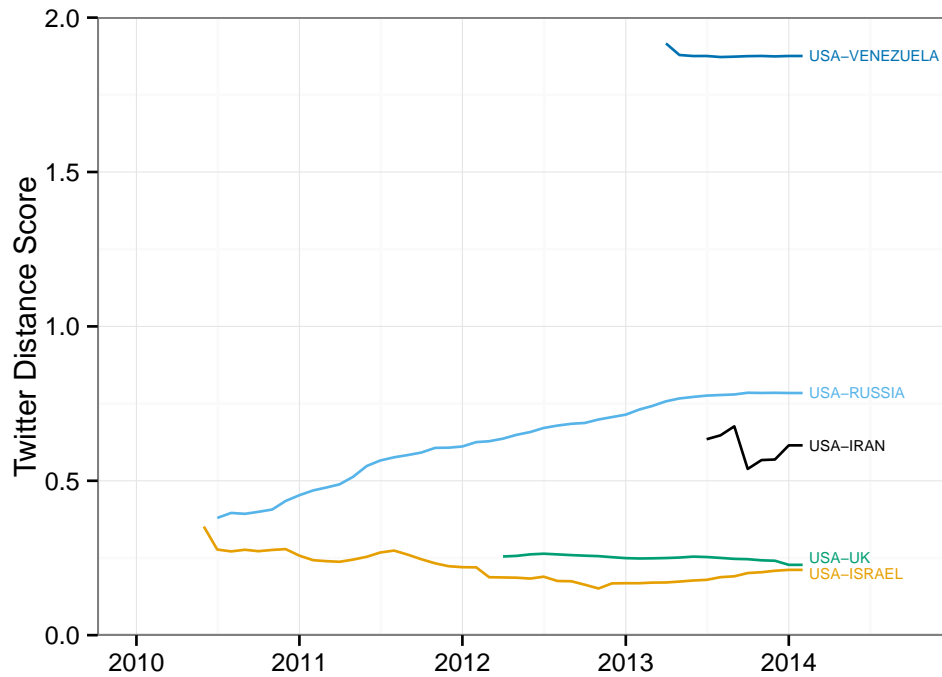Figure 9: Dynamic Twitter distance scores for a selection of dyads

Figure 9 displays the Twitter distance score between the United States (@WhiteHouse) and four other countries: Venezuela (@NicolasMadura), Russia (@MedvedevRussia), Iran (@HassanRouhani), the UK (@Number10gov), and Israel (@netanyahu). First, we observe that the distance between countries is consistent with the current status of the diplomatic relations between countries, with Venezuela having the highest distance and Israel the lowest distance. Second, the changes over time also correspond with relevant international events. For example, we observe a secular increase in the distance between Russia and the U.S. Although the time series it not as long in the case of Iran, given that Rouhani did not open a Twitter account until 2013, we do observe a sud-

den decrease in the distance with the U.S., which corresponds with a change in Iran's diplomatic policy. Additionally, the growing distance between Russia and US leaders based on our affinity scores corresponds to what many observers term as an increasingly frosty relationship between the two countries.[18]

The new estimates of affinity between countries we introduce here still requires further validation to show that it is properly capturing what we claim it does. However, it underscores the potential of big data to provide researchers with fine-grained measures of relevant political phenomena. Even if most Twitter users are not very knowledgeable about international politics, when we aggregate the following decisions of hundreds of thousands of them we can observe patterns that can be highly informative about how political elites are perceived.

6 Discussion and Conclusion

In this paper we have shown that world leaders are strategic in their adoption of social media, which strongly suggests that Twitter (and likely other social media sources), play an important, and growing role as a tool for political communication. We first establish that world leaders are increasingly adopting social media–particularly Twitter–for political purposes. Our results also show that leaders in democratic states adopt Twitter at a quicker rate than those in autocracies, and that electoral incentives–having an upcoming election–also increase the probability of adoption. In addition, we exploit shared follower relationships on Twitter to map world leaders in a common latent affinity space. We show that distance on this latent space is highly correlated with bilateral trade and changes in diplomatic relations. We further show that dynamic, dyadic changes in affinity between countries corresponds to real- world political events. Taken together, this suggests that our affinity measure can be used as an additional measure of affinity between countries–both statically and dynamically. In all, our analysis reveals that Twitter reflects political competition within and between states, and that it is becoming an increasingly relevant arena for

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[18]See "Feinstein: U.S.-Russia relationship is at Cold War levels" *The Washington Post.* July 20, 2014.

political competition.[19]

Future work should unpack the role that Twitter and social media play in contentious politics. Do leader's use Twitter strategically to counter domestic protests? What about sway international opinion amid accusations of fraud? Furthermore, how do protests change the nature of political leader's messages on Twitter? Are they more likely to engage the opposition, or with their own supporters? How does the distance on Twitter (as measured by shared followers) between leaders correlate with reactions to foreign policy crises? Tracing out the effects of Twitter usage by leaders on contentious politics (protests, civil war, etc.) and foreign policy remains an important next step.

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[19]See (King, Pan, and Roberts, 2012; Zeitzoff, 2014) for a more empirical treatment of political competition on social media.

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Appendix. Additional results

Figure 10: Kaplan-Meier Graph of Active Twitter (Personal Account) Adoption by Democracies vs. Non-Democracies
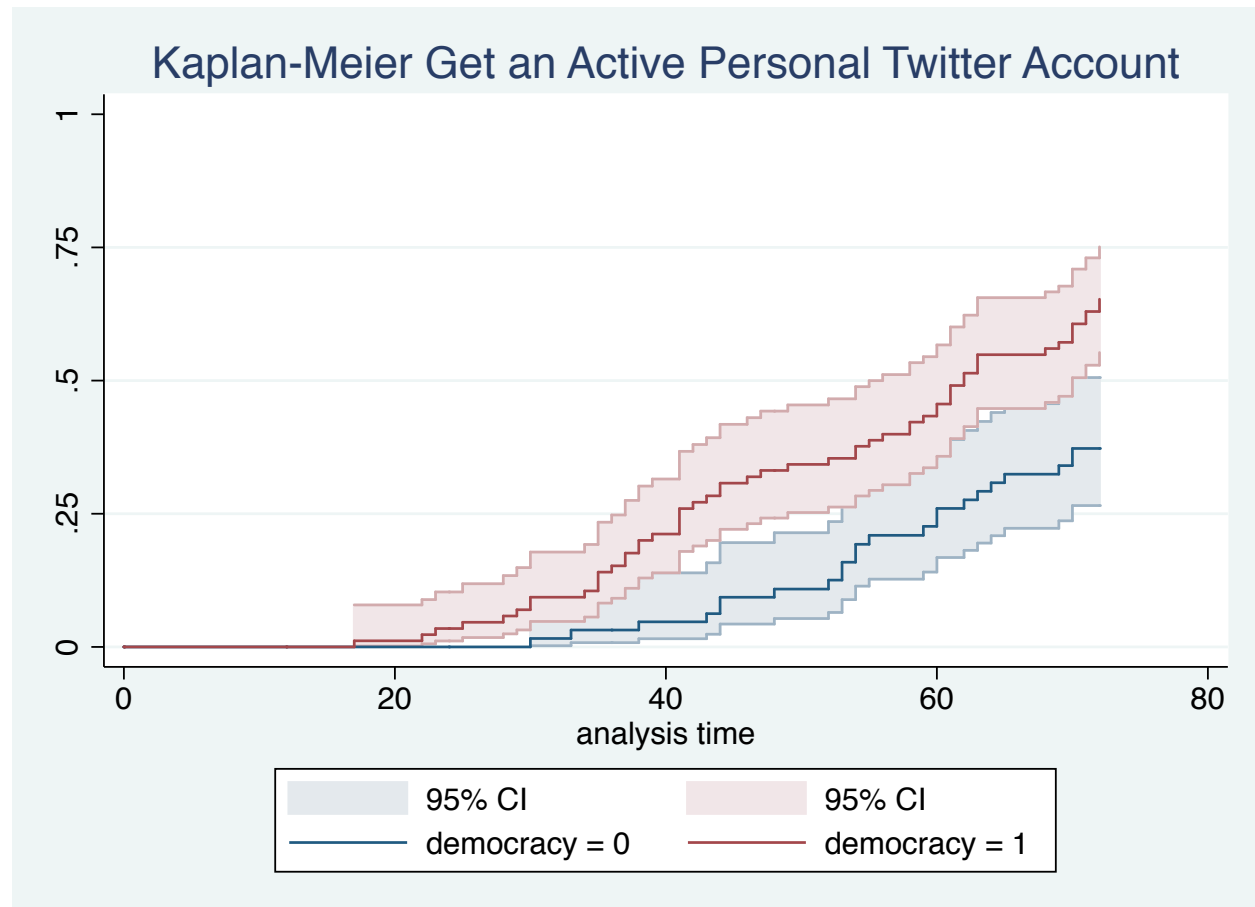
Note: The failure plot looks "failure," or active Twitter adoption (i.e. whether a country has an active Twitter personal account associated with a leader). Following standard practice (Jaggers and Gurr, 1995), code countries with a Polity 2 score of +6 or higher as democracies.

Table 5: Cox Proportional Hazard Model

	1	2	3	4
Polity 2 Score	0.09***	0.09***	0.09***	0.07***
	(0.02)	(0.02)	(0.02)	(0.03)
Election Within 6 Months		0.75***	0.75***	0.56**
		(0.23)	(0.23)	(0.25)
Social Media Users			0.09	0.12
			(0.07)	(0.10)
Internet Users				0.01
				(0.01)
Log GDP Per Capita				-0.23
				(0.19)
% English Speakers				0.00
				(0.00)
South America				0.72*
				(0.39)
Africa				0.40
				(0.41)
Europe				0.39
				(0.45)
Observations	8953	8953	8953	4897
Number of Countries	149	149	149	136
Number Get Twitter	79	79	79	70

Dependent variable: Does the Leader Have an Active Personal Twitter Account? Robust standard errors in parentheses. Signif.: *10% **5% ***1%.

Table 6: Cox Proportional Hazard Model

	1	2	3	4
Polity 2 Score	0.11***	0.11***	0.11***	0.09***
	(0.02)	(0.02)	(0.02)	(0.03)
Election Within 6 Months		0.71***	0.71***	0.68***
		(0.22)	(0.22)	(0.24)
Social Media Users			-0.00	-0.06
			(0.17)	(0.27)
Internet Users				0.01
				(0.01)
Log GDP Per Capita				-0.16
				(0.18)
% English Speakers				0.00
				(0.00)
South America				0.94**
				(0.43)
Africa				0.42
				(0.42)
Europe				0.53
				(0.42)
Observations	8169	8169	8169	4229
Number of Countries	149	149	149	132
Number Get Twitter	88	88	88	74

Dependent variable: Does the Leader Have a Personal Twitter Account? Robust standard errors in parentheses. Signif.: *10% **5% ***1%.

Table 7: Cox Proportional Hazard Model

	1	2	3	4
Polity 2 Score	0.08***	0.08***	0.08***	0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Election Within 6 Months		0.25	0.26	0.13
		(0.23)	(0.23)	(0.23)
Social Media Users			1.01***	0.33
			(0.24)	(0.34)
Internet Users				0.02**
				(0.01)
Log GDP Per Capita				-0.02
				(0.15)
% English Speakers				0.00
				(0.00)
South America				1.05***
				(0.40)
Africa				0.73*
				(0.40)
Europe				0.86**
				(0.35)
Observations	7030	7030	7030	3192
Number of Countries	149	149	149	129
Number Get Twitter	117	117	117	99

Dependent variable: Does Any Leader Have a Twitter Account?
Robust standard errors in parentheses. Signif.: *10% **5% ***1%.