# The Impact of the Information Revolution on Protest Frequency in Repressive Contexts

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## Abstract

Does the information revolution empower the coercive control of repressive regimes at the expense of civil resistance movements, or vice versa? One way to answer this question is to test whether the diffusion of information communication technology—measured by increasing numbers of Internet and mobile phone users—is a statistically significant predictor of anti-government protests after controlling for other causes of protests. If a positive and statistically significant relationship exists between protest frequency and access to ICT, then one might conclude that the information revolution empowers civil resistance movements at the expense of coercive regimes. If a negative relationship exists, one might deduce that repressive governments have the upper hand.

Correlation analysis and negative binomial regression analysis was carried out on 22 countries between 1990-2007. These countries were selected because their regimes have the technical capacity to repress information. Five regression models were run. The first model included all 22 countries. The second and third model split the countries between high and low levels of protests. The fourth and fifth models split the countries between high and low numbers of mobile phone users. This cluster approach was used to minimize the possibility of cancelation effects and to facilitate case study selection for further qualitative research. The cluster of countries with low levels of protests resulted in a statistically significant albeit negative relationship between the number of mobile phone users and protest frequency. This means that an increase in the number of mobile phone users is associated with a decrease in protest frequency. The cluster of countries with high levels of mobile phones produced a statistically significant and positive relationship between the number of mobile phone users and protest frequency. In other words, an increase in the number of mobile phones is associated with an increase in the number of protests. The other two country clusters, "high protests" and "low mobile phones," did not produce a statistically significant result for mobile phone use. The number of Internet users was not significant for any of the five models.

The results suggest that the information revolution empowers civil resistance movements at the expense of repressive regimes in countries with relatively high levels of access to technology. On the other hand, repressive regimes appear to maintain the upper hand in countries with low levels of protest.

## Introduction

Does the information revolution empower the coercive control of repressive regimes at the expense of civil resistance movements, or vice versa? Does access to modern information communication technology (ICT) threaten authoritarian control? Put differently, are the tactics "associated with strategic nonviolent social movements […] greatly enhanced by access to modern information communication technologies, such as mobile telephony, short message service (SMS), email and the World Wide Web, among others"? (Walker 2007).

New communication tools are fundamentally different from traditional technologies—hence the term information *revolution*. While traditional technologies restricted our mode of communication to one-to-one and one-to-many, the information revolution has spawned "many-to-many tools that support and accelerate cooperation and action" (Shirky 2008; see also Goldstein 2008; Zittrain 2008; Benkler 2006; Rheingold 2003). Modern ICTs should thus facilitate the mobilization, organization and coordination of nonviolent civilian resistance movements. Is this in fact the case? The political science literature provides two competing arguments on this question.

One school of thought maintains that the costs of networked communication are dramatically reduced as result of the information revolution, which implies that social movements may be more easily mobilized to response against government repression. The second school of thought counters with the claim that more repressive states are becoming increasingly effective in regulating the information revolution. To be sure, authoritarian regimes also benefit from the information revolution since they gain access to sophisticated tools designed to censor and control digital information (Diebert *et al.* 2008).

As Drezner (2006) rightly notes, these two contradictory trends raise a fascinating question—does the information revolution empower the coercive control of repressive regimes at the expense of citizen activists? Are state-imposed "information blockades" effective? Or does the information revolution lead to an associated increase in more frequent forms of social resistance and thus political instability?

The purpose of this large-N quantitative study is to determine whether the diffusion of modern ICTs influences the incidence of protest events in countries where governments have the capacity to use ICTs to counter social unrest. If the diffusion of ICTs were a statistically significant predictor of protest events, then one would have reason to conclude that the information revolution empowers civil society at the expense of technologically coercive regimes.

This paper is structured as follows: First, a summary of the literature review places the research question into context. Second, the model for the analysis is specified. Third, the data sources are assessed. Fourth, the regression analysis is explained and the results discussed. Fifth, the conclusion, and sixth, next steps in terms of qualitative research.

## Summary of Literature Review

Does the information revolution empower the coercive control of repressive regimes at the expense of citizen activists? Are state-imposed "information blockades" effective? Or does the information revolution lead to an associated increase in more frequent forms of social resistance and thus political instability?

Stodden and Meier (2008) explored this question by carrying out a large-N quantitative study to determine the impact of ICT diffusion on World Bank (WB) measures of governance for 82 autocratic countries between 2000 and 2006. ICT diffusion is defined as the number of Internet users and mobile phone subscriber per country year. The results of the regression analysis suggest that both variables have a statistically significant inverse relationship with the WB's measure for political instability. In other words, an increase in the number of Internet users and mobile phone subscribers is associated with decreasing political stability. When Stodden and Meier (2008) carried out the analysis on all 181 countries available, the Internet variable was still statistically significant but the coefficient was three times smaller than that for autocracies. The mobile phone variable was not significant.

The authors did not assess whether protest events were a significant factor driving some of this political instability. While there are other forms of social resistance to study besides protests, the literatures on political theory, social movements, civilian resistance and democratic transitions provide rich evidence that large-scale protests are valuable in cultivating deliberative and sustainable democracies (Ekiert and Kubik 1999; Ackerman and DuVall 2000; Inglehart and Catterberg 2002; Norris 2006; Stephan and Chenoweth 2008). Since protests require a minimum degree of communication for the purposes of mobilization, organization and coordination, then does the diffusion of ICTs have an impact the frequency of protest events?

A thorough literature review on this research question yielded the following findings:

**First**, the terms information revolution and Internet are used interchangeably when the latter is in fact only a subset of the former. The vast majority of the literature and research on the impact of ICT is biased to studying the Internet's impact exclusively. Furthermore, the terms are not differentiated on the basis that the predominant feature of the information society is the spread of the Internet. While this is true of the most industrialized democratic societies, it is not the case for the majority of developing countries where mobile phones are the most widely used communication technology.

**Second**, an important gap exists in the civilian resistance literature with respect to studying the uses and impact of ICTs in nonviolent movements. There are no rigorous case studies available that specifically assess the intersection between civilian resistance and ICTs in the context of nonviolent political transitions. The only systematic study carried out on the role of technology in nonviolent action is by Martin (2001). However, the majority of references in this study date from the early 1990s, i.e., before the information revolution. It is therefore unclear whether ICTs have played an instrumental role in recent nonviolent revolutions.

**Third**, the academic literature is overwhelmingly qualitative. Apart from Eyck's 2001 study (which focused on empirical trends in the 1970s), there don't appear to be other large-N quantitative studies on the impact of information communication technology on protests. The popular literature is mired with anecdotes that ultimately suffer from severe selection bias.

The purpose of this large-N quantitative study is thus to determine whether the diffusion of modern ICTs influences the incidence of protest events in countries where governments have the capacity to use ICTs to prevent or counter social unrest. If the diffusion of ICTs were a statistically significant predictor of protest events, then one would have reason to conclude that the information revolution empowers civil society at the expense of tech-savvy regimes that actively filters political, social, conflict and security content on the Internet.

## The Model

The purpose of the regression analysis is to determine whether the diffusion of ICTs is a statistically significant predictor of protests and if so, whether that relationship is positive or negative. The dependent variable protests is the number of protests per country-year. The ICT variables used in the model are: Internet users, mobile phone subscribers and number of telephone landlines per country-year. The control variables, identified following an in-depth literature review, are percentage change in GDP, unemployment rate and degree of autocracy per country-year.

Figure 1 below summarizes the four plausible outcomes of the regression analysis.

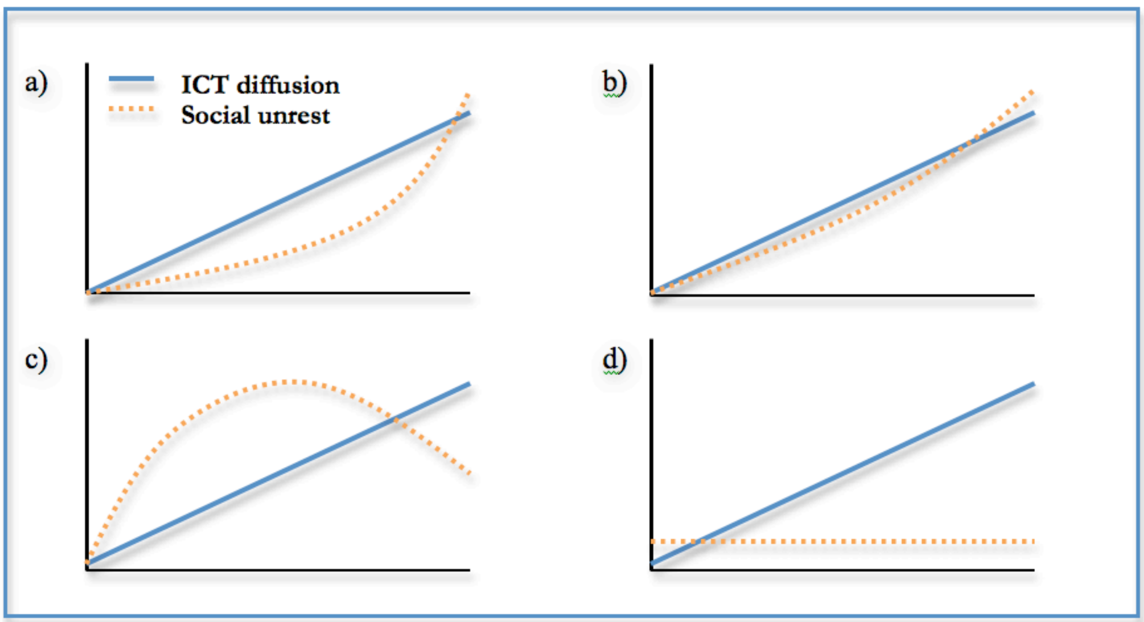


**Figure 1:** Plausible time series of ICT diffusion versus anti-government protests.

Graph (a) suggests a statistically significant relationship between the use of ICTs and the variation in incidents. This may imply that the impact of the information revolution empowers civil resistance movements at the expense of tech-savvy regimes. Graph (b) suggests a marginal increase in the frequency of incidents in response to the diffusion of ICTs, i.e., the relationship is not statistically significant. The graph depicted in (c) suggests a statistically significant—albeit inverse—relationship between ICTs and incidents. This may imply that regimes have been effective repressing anti-government protests. Graph (d) may also suggest that governments have been effective at maintaining their information blockade.

The econometric model for this study is specified in Figure 2 below. Negative binomial regression analysis is used to carry out the statistical analysis. The rationale for using this type of regression analysis is articulated after the next section on data.

**Econometric Model**

Using negative binomial regression analysis, the large-N quantitative analysis will test whether the diffusion of information communication technology is a statistically significant predictor of protests (*R*) in 22 countries between 1990-2007 by estimating the effect of technology (*T*), political (*P*), economic vectors/variables on the incidence of protest:

$$(1)\quad \boldsymbol{R} = f\,(\boldsymbol{T}ech + \boldsymbol{P}ol + \boldsymbol{E}con) + \varepsilon$$

Or more formally:

$$(2)\quad \boldsymbol{P}_{c,t} = \beta_0 + \beta_1\, \boldsymbol{T}_{c,t} + \beta_2\, \boldsymbol{P}_{c,t} + \beta_3\, \boldsymbol{E}_{c,t\ i} + \varepsilon_{i,t}$$

*Where:*

$P_{c,t}$ = the number of protest/riot events in a country *c*, in a given year, *t*.

$T_{c,t}$ = a vector of information communication technologies relevant for capturing the diffusion of the information revolution in country *c*, in a given year, *t*.

$P_{c,t}$ = a vector of political variables to control for influences on social unrest.

$E_{c,t}$ = a vector of economic variables to control for influences on social unrest.

$\varepsilon_{i,t}$ = error term, distribution assumed to be normal.

**Figure 2:** The econometric model for the quantitative analysis section of the dissertation.

## The Data

This section reviews the data used in this study. The dependent variable is the frequency of protests per country-year. The independent variables are number of Internet users, number of mobile phone subscribers per 100 and the number of landlines. The control variables are percentage change in GDP, unemployment rate and degree of autocracy. The descriptive statistics for the dataset used in this study is available in the Appendix.

***Dependent Variable Data***

Protest data on the following 22 countries is used for the regression analysis: Azerbaijan, Bahrain, Burma, China, Cuba, Egypt, India, Iran, Malaysia, Morocco, Pakistan, Philippines, Saudi Arabia, Singapore, South Korea, Sudan, Syria, Thailand, Tunisia, Ukraine, United Arab Emirates, and Zimbabwe. The countries listed above were selected based on evidence of Internet censorship and filtering using the most recent empirical study on global Internet filtering (Faris and Villeneuve 2008). In other words, empirical evidence of regimes engaged in Internet filtering of political social and conflict and security content is used a proxy for technology savvy governments.[1] See Table 1 below for a summary of Internet filtering.

While many previous empirical studies have been limited to examining "protest potential," this represents an inadequate indicator of actual protest behavior (Norris 2006). Since surveys are usually more appropriate for capturing attitudes rather than actual behavior, this study must focus on datasets that document past incidents of protests instead of surveys. There are a number of datasets available that focus on (or include) protest event-data. The most commonly used include the *World Handbook of Political and Social Indicators* (Taylor and Jodice 1983), the *Prodat Project* (Kriesi *et al*. 1995), the *Cross-National Time Series* (Banks 2001) and the *Protest and Coercion Data* (multiple contributors, 2008). Table 2 below compares these datasets.

[1] The analysis by Faris and Villeneuve (2008) identified 26 countries actively filtering political, social, conflict and security information. This study uses 22 countries because data on unemployment were unavailable for 4 of the 26 countries.

| | Political | Social | Conflict and security | Internet tools |
|---|---|---|---|---|
| Azerbaijan | ● | — | — | — |
| Bahrain | ●● | ● | — | ● |
| Belarus | ○ | ○ | — | — |
| China | ●●● | ●● | ●●● | ●● |
| Ethiopia | ●● | ● | ● | ● |
| India | — | — | ● | ● |
| Iran | ●●● | ●●● | ●● | ●●● |
| Jordan | ● | — | — | — |
| Kazakhstan | ○ | — | — | — |
| Libya | ●● | — | — | — |
| Morocco | — | — | ● | ● |
| Myanmar | ●●● | ●● | ●● | ●● |
| Oman | — | ●●● | — | ●● |
| Pakistan | ● | ●● | ●●● | ● |
| Saudi Arabia | ●● | ●●● | ● | ●● |
| Singapore | — | ● | — | — |
| South Korea | — | ● | ●●● | — |
| Sudan | — | ●●● | — | ●● |
| Syria | ●●● | ● | ● | ●● |
| Tajikistan | ● | — | — | — |
| Thailand | ● | ●● | — | ● |
| Tunisia | ●●● | ●●● | ● | ●● |
| United Arab Emirates | ● | ●●● | ● | ●● |
| Uzbekistan | ●● | ● | — | ● |
| Vietnam | ●●● | ● | — | ●● |
| Yemen | ● | ●●● | ● | ●● |

●●● Pervasive filtering; ●● Substantial filtering; ● Selective filtering; ○ Suspected filtering; — No evidence of filtering.

**Table 1:** Empirical evidence of regimes actively engaged in Internet filtering.

| **Dataset** | **Time Period** | **Countries** |
|---|---|---|
| 1948-1992 | 156 | All members of the United Nations in 1975 |
| Prodat Project | 1975-1989 | France, Germany, the Netherlands, Switzerland |
| Cross-National Series | 1815-1999 | 167+ |
| Protest/Coercion Data | Multiple | 27 European states (1980-1995), Burma (1988), S. Korea (1990-1991), Colombia (1988-1997), El Salvador (1979-1991), Peru (1980-1995). |

**Table 2:** Available datasets that document past instances of protest events.

As Nam (2006) rightly notes, a serious debate on the quality of protest datasets has been lacking in the literature. The datasets listed above have practical and theoretical limitations. First of all, the categories of events coded in these traditional datasets “are often too general, arbitrary and inaccurate” (Nam 2006). The second problem is that the protest data is only available in annually aggregated numbers, thus “eliminating the possibility of quarterly or monthly, let alone weekly or daily analyses (Nam 2006).

Indeed, “the annual measures omit the substantive ebb and flow of daily and weekly interactions between citizens and authorities (Dahlerus 2006). Furthermore, for the purpose of this study, “if communication and information technologies are a part of political protests, then we must get more detailed information on the timing of the protests to see if they occur in clusters, which we would expect to happen” (Eyck 2001). Third, and perhaps most important, these traditional datasets have typically relied on a limited number of sources. When protests are sampled from just one or two sources, especially non-local sources, the data is very likely to be incomplete and biased (Dahlerus 2006; Nam 2006).

These traditional datasets generally draw on the “hand-coding” of event-data based on national and international news reports. Strictly speaking, then, event data are no more than simple observations of media reporting patterns as opposed to a valid sample of protest and repressive events (Danzger 1978; Franzosi 1987; Mueller 1999; Hocke 1998). To complicate matters, “news-sources contain internal biases that influence how protest and repressive events are reported, who is involved, what happened, and why” (Dahlerus 2006; see also Davenport 2001). To be sure, “coverage in Western European and international media sources are more likely to pay attention to larger protests that involve property destruction or other more visible qualities” since these obviously make for good headlines which increases profits (Dahlerus 2006; see also Clutterbuck 1980; Franzosi 1987; Herman and Chomsky 1988; Turow 1997; Wolsfeld 1997).

Furthermore, international media coverage of  “protest is skewed toward political contention in established democracies, while protest and in particular repression in authoritarian states receive less attention outside of large scale dramatic events” (Dahlerus 2006). Local media sources also come with a host of issues. Press freedom is endogenous to democratization and consolidation, which means that in the context of repressive or closed regimes, getting accurate reports on anti-government protests from national sources may be difficult to come by. Indeed, national media outlets in nondemocratic countries are almost always state-run and thus virtually guaranteed to omit any indication of resistance against the ruling regime.

While using newspapers for events-based information collection is far from ideal, one must recognize that no other available source could realistically fulfill the stringent requirement of objectivity and completeness. To be sure, it is very well known biases exist in official state reports especially in authoritarian systems that seek to restrict the outflow of information (Dahlerus 2006). While police reports will underreport the number of people participating in anti-government protests, social movements tend to inflate crow magnitude (Beissinger 1998; McPhail *et al*. 1998).

Moreover, despite the implicit biases that exist in news-generated events data, “scholars who rely on newspapers for information about contentious [sic] suggest that newspapers are overall accurate in the information they do report” (Dahlerus 2006; see also Franzosi 1987, 7; Wolsfeld 1997; Beissinger 1998; Olzak and Olivier 1998; Ekiert and Kubik 1999). To this end, while all events are not captured by the news media, one can still “rely on an overall accuracy of information contained in reports of the essential ‘who,’ ‘what,’ ‘where,’ and ‘when’ issues of contentious events” (Dahlerus 2006). In short, newspapers may provide biased coverage, but they seldom print false information (Franzosi 1987; Dahlerus).

Since this study focuses on the likely impact of ICTs on the frequency of protest events, the ideal dataset would need to cover the time period prior to the information revolution through to present time. In the context of nondemocratic (generally developing) countries, the ICT data (described in more detail below) suggests that the information revolution begins to take around the year 2000. None of the traditional datasets listed above include protest events-data beyond 1999.

Since there is rich evidence that large-scale protests are valuable in cultivating deliberative and sustainable democracies (Ekiert and Kubik 1999; Ackerman and DuVall 2000; Inglehart and Catterberg 2002; Norris 2006; Stephan and Chenoweth 2008), this study is not particularly interested in small-scale protests that may not be reported by mainstream media. Moreover, sizeable events will require more extensive use of ICTs to mobilize, organize and coordinate. Using this reasoning, then, the constraints of international news media as a source for protest event-data are not particularly problematic. On the contrary, relying on international news serves to filter out small-scale, politically insignificant protest events.

This study therefore draws on the conflict event-dataset developed by the private company Virtual Research Associates, Inc. (VRA). VRA uses a patented natural language parsing algorithm to parse Reuters newswires in near real-time for over 60 countries. The algorithm codes events into a 157-indicator framework called the Integrated Data for Events Analysis (IDEA) framework. For each event, the parser codes the following parameters, "who (source), did what (event), to whom (target), where (country) and when (day)?" (Bond *et al.* 1997; Bond *et al.* 2001; Bond *et al.* 2003; King and Lowe 2003). To this end, the dataset specifies whether the state or society is the initiator of the event.

Unlike traditional datasets on protest events, the VRA data uses automated coding. An important question then is how hand- and automated coding compares in terms of reliability. Harvard University Professor Gary King and Dr. Will Lowe carried out an independent and comprehensive evaluation of the VRA dataset in 2003. They conclude their in-depth study with some optimism:

> In our view, the results in this article are sufficient to warrant a serious reconsideration of the apparent bias against using events data, and especially automatically created events data, in the study of international relations. If events data are to be used at all, there would now seem to be little contest between the machine and human coding methods. With one exception, performance is virtually identical, and that exception (the higher propensity of the machine to find "events" when none exist in news reports) is strongly counterbalanced by both the fact that these false events are not correlated with the degree of conflict of the event category, and by the overwhelming strength of the machine: the ability to code huge numbers of events extremely quickly and inexpensively.
>
> Although the machine performed approximately equally to our trained human coders in this study, the machine would be far better over the long run. Hiring people of the quality we were able to recruit to code many more events than we asked of them is probably infeasible, and doing so for the many years it would take to do this right would undoubtedly reduce performance to levels significantly below that of the machine. Longer-term coding by human coders would result in lower performance, either because we would have to resort to using less-qualified coders or because their attention to the extremely tedious and boring task would wane over time.

Unlike the more common datasets describe above, the VRA parser picks up distinct events as they occur throughout a given day or week. For example, as a demonstration unfolds, the natural language parser will not code one event only but rather a series of events just as long as the underlying news reports are different. Only if two reports are exactly alike does the parser only code the event as one event. To this end, both the frequency and duration of protests can be extracted from the VRA database. Furthermore, because the data is generated using newswires, any period of specific interest in the time series data can be interpreted by reading the associated news reports themselves. These can easily be found using Lexus Nexus and Factiva, as well as Google News archives. In sum, the VRA data is not aggregated by year.

Furthermore, the dataset includes the following six directly relevant event types:

- **Protest altruism:** protest demonstrations that place the source (protestor) at risk for the sake of unity with the target.
- **Protest defacement:** performance protests, graffiti and desecration of symbols.
- **Protest obstruction:** sit-ins and other non-military occupation protests.
- **Protest procession:** picketing and parading protests.
- **Protest demonstration:** all protest demonstrations not otherwise specified.
- **Riot:** civil or political unrest explicitly characterized as riots.

These six event types will be combined in the analysis to serve as a proxy for protest incidents. Finally, the VRA dataset covers over 60 countries between 1990 and 2007, i.e., from pre-information revolution and through to the current Web 2.0 and mobile technologies revolution. Furthermore, the dataset is not limited to Western democracies, which is another distinct advantage over traditional datasets.

### *Independent Variable Data*

The data on ICT diffusion is drawn from the 2007 edition of The World Telecommu-nication ICT Indicators Database produced by the International Telecommunications Union (ITU). This database contains annual time series data from 1975 to 2006 for around 100 communications statistics including the number of mobile phone users and Internet users.

The statistical analysis includes several control variables. Based on a thorough literature review, regime type, unemployment rate and GDP growth were identified as statistically significant predictors of protest events. The regression analysis will thus employ these variables as control variables. The data for these variables is drawn from the Polity IV dataset, the International Labor Organization's (ILO) labor statistics and the World Bank's data development indicators.

### *Descriptive Analysis*

Descriptive data with measures of central tendency were defined for the variables of the dataset. The Appendix includes descriptive statistics of the overall sample ($N = 396$) and for each of the 22 country sub-groups ($n = 18$). Table 2 lists the 5 highest and 5 lowest scoring countries according to mean values on each of the seven variables.

For all 22 countries over the 18-year period ($N = 396$), protests ranged from 0 -30 per year, with a mean of 3.15 per year ($SD = 4.65$). Internet use ($M = 6.80$, $SD$ 13.63) ranged from 0 to 72.2%. Mobile subscribers ($M = 12.73$, $SD = 13.03$) ranged from 0.2% to 56.2% and fixed phone lines per 100 persons ($M = 15.99$, $SD = 28.73$) ranged in number from 0 – 173.4 indicating that for some countries the number of landlines exceeds one per person. Autocracy scale values overall ($M = 4.68$, $SD = 3.26$) ranged from scores of 0 to scores of 10. The unemployment rate for the sample ($M = 11.54$, $SD = 12.73$) ranged from 0 to 80%. GDP values overall (M = 4.75, $SD$ = 6.00) ranged from -23.1 to 34.5.

## The Method and Results[*]

This section describes the correlation analysis and negative binomial regression analysis used to determine whether the diffusion of ICTs is a statistically significant predictor of protest events and explains the ensuing results. First, the assumptions for the analysis are articulated. Second, the correlation analysis is described and the results interpreted. Third, the negative binomial regression analysis is explained and described.

### *Assumptions for Inferential Analysis*

All seven variables had means lower than their standard deviations. In addition, the median values for all but two variables (autocracy and %GDP change) were smaller than the mean values. This indicates that the variables are not normally distributed. A histogram of the Protests variable revealed a long positive skew, with most values close to the lower end of the scale, but with a number of values dispersed at the high end of the range like a Poisson distribution (see Figure 3 below). In other words, the Protests variable is not normally distributed.

Transformations of the variable were performed with logarithms, square roots, and inverse-logarithms, but the distribution did not transform to a normal distribution.

This means that ordinary least squares (OLS) type of regression cannot be used for statistical analysis. Also of concern is the mean to variance ratio for the dependent variable. The variance ($s^2 = 21.6$) was almost seven times larger than the mean ($M = 3.15$) indicating over-dispersion of the data points for the Protest variable. This explains why a negative binomial regression is needed to evaluate the data since the negative binomial distribution allows for a variance with a larger value than the mean (Hilbe 2008; Jewell and Hubbard 2006; Cameron and Trivedi 1998). STATA command for a negative binomial regression model with panel data "xtnbreg" is used to fit a negative binomial model to the dataset, with the autoregressive (AR1) correlation option chosen due to the repeated measures nature of the data.

Since only 22 out of all possible countries are included in the analysis, they should have random effects on the model. However, the analysis assumes that the 22 countries constitute the total population of available countries so the regression model uses fixed effects.

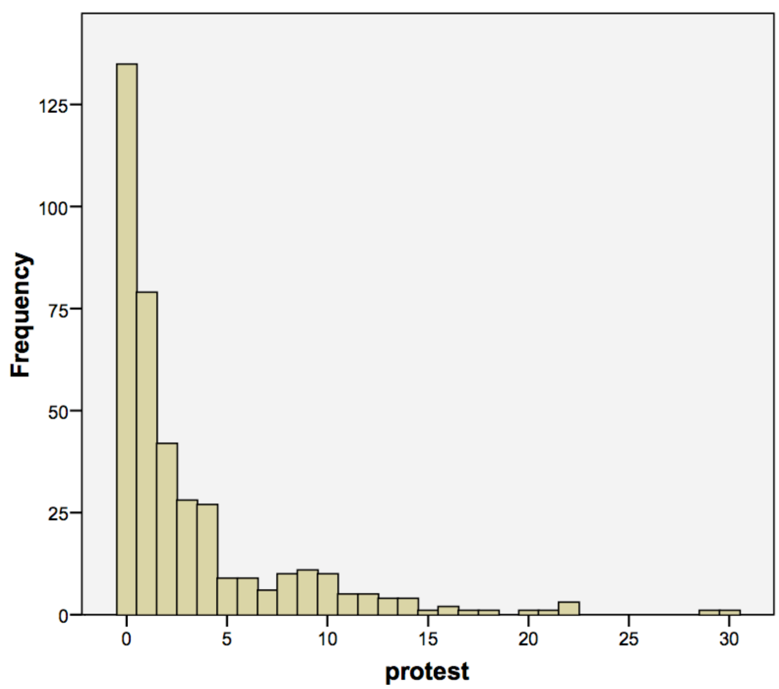


**Figure 3:** The protest variable is not normally distributed.

Correlation analysis was also performed on the dataset. A normal distribution was not assumed for any of the variables in the data. Linearity was not assumed either. Spearman's rho correlations are based on rank order of data values and not on a normal distribution, and they can be used with count and ordinal data (Acock 2006). This nonparametric alternative is therefore used in this study in order to maintain a conservative approach to assessing correlation significance.

***Correlation Analysis***

Spearman's rho correlations were performed on the study variables of (a) Protest, (b) Autocracy, (c) Unemployment, (d) GDP, (e) Internet, (f) mobile phones, and (g) phones. Table X lists the bi-variate correlations between the variables.

There was a small significant negative relationship between the variables of protests and autocracy ($\rho = -.294$, $p < .01$) indicating that when values of autocracy increase, protests decrease and/or when autocracy scores decrease, protests increase. There was also a small negative relationship between protests and mobile phones ($\rho = -.114$, $p < .05$) indicating that an increasing number of mobile phones are associated with lower numbers of protests. Internet was negatively correlated with autocracy ($\rho = -.139$, $p < .01$), indicating that increased values of autocracy are associated with decreasing values of Internet use. GDP was significantly negatively correlated with unemployment ($\rho = -.204$, $p < .01$) indicating that when GDP values increase, unemployment values decrease. GDP was positively correlated with Internet use ($\rho = .102$, $p < .05$) and phone use ($\rho = .187$, $p < .01$). Indicating when one variable rises or falls in value; so does the other variable. Unemployment had a small significant negative correlation with Internet use ($\rho = -.179$, $p < .01$) indicating lower rates of unemployment with higher rates of Internet use. Unemployment had a medium negative correlation with phone use ($\rho = -.308$, $p < .01$) and a strong negative association with mobile phone use ($\rho = -.518$, $p < .01$) indicating that unemployment rates decrease when phone use increases. Strong positive correlations were also indicated for Mobile phone use and Internet use ($\rho = .596$, $p < .01$), phone use and Internet use ($\rho = .911$, $p < .01$), and phone use and mobile phone use ($\rho = .679$, $p < .01$), indicating that when values of one variable increase or decrease the values of the other variable move similarly.

### *Negative Binomial Regression Analysis*

A negative binomial regression analysis was performed on the dependent variable Protests with six independent variables of (1) Internet use, (2) mobile phone use, (3) phone use, (4) autocracy, (5) unemployment, and (6) GDP. STATA v10.0 was used for inferential analysis with the code "xtnbreg" for panel data with autoregressive correlation (AR1). The negative binomial regression was chosen over a Poisson model because the data for the Protest variable were over-dispersed (M = 3.15, Variance = 21.65) and the variable was also zero-inflated, containing 135 (34.1%) protests with the count of zero.

Five separate regressions were performed using STATA command "xtnbreg" for a negative binomial regression with panel data. The first regression included all 22 countries (n =396). The dataset was then divided into two groups according to number of protests for countries groups as (a) low protest, and (b) high protest. The groups were formed using a median split on the protest variable, with records containing protests of less than 1 being considered low (9 countries, n = 162), and protests as greater than or equal to one as high protest (13 countries, n = 234). The split was performed on the median in an attempt to achieve a number as equal as possible between the two country groups while still making use of a parameter of central tendency. The mean was not chosen for the split because (1) the data distribution was not normal, and (2) the mean was inflated due to over-dispersion.

After two regressions were performed on the protest sub-groups, the aggregated data was then divided into two groups using a median split on the mobile phone variable. This variable was used as a proxy for the degree of technology development per country. The two groupings were categorized as (a) mobile use low (10 countries, n = 180), and (b) mobile use high (12 countries, n = 216). Again the median of the mobile phone variable was used to define the split with countries at less than 8.5 percent mobile use assigned to the low group, and countries with greater than or equal to 8.5 percent mobile phone use assigned to the high group. See Figure 4 below for a graphical representation of the approach.

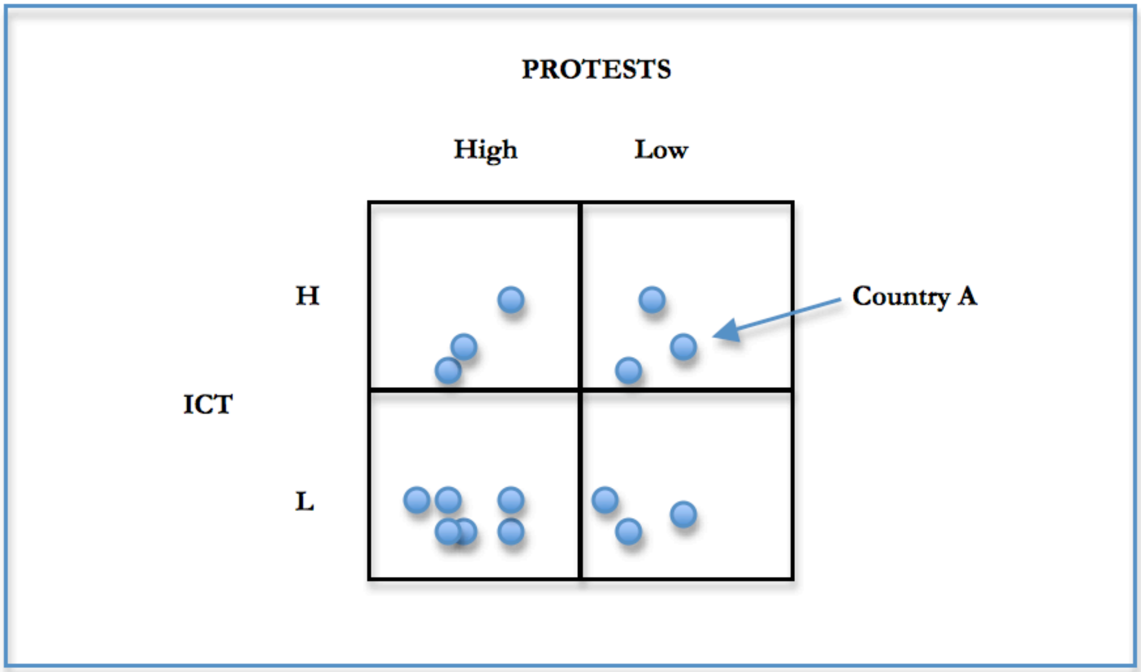


**Figure 4:** The countries were grouped into 4 clusters of high/low levels of protests & technology.

The purpose of clustering the data as such is to minimize the possibility of certain effects canceling themselves out in the large-N regression analysis. For example, if there were positive and negative statistically significant relationships between ICT diffusion and protest incidents, these would be aggregated in the analysis thereby loosing important information. Sorting countries into different clusters is one way to minimize the possible loss of information in the quantitative data.

The statistical hypotheses for all five regression analyses were as follows:

> **Null Hypothesis:** None of the predictors of (a) Internet use, (b) mobile phone use, (c) phone use, (d) autocracy, (e) unemployment rate, or (f) GDP, are statistically significant predictors of the number or protests.
>
> **Alternative Hypothesis:** At least one of the predictors of (a) Internet use, (b) mobile phone use, (c) phone use, (d) autocracy, (e) unemployment rate, or (f) GDP, is a statistically significant predictor of the number or protests.

***Regression 1, All Data (n = 396)***

The model for all data was significant (Wald $\chi^2$ = 42.77, p < .0005), indicating that the predictor model using the dataset was improved over a model in which all predictors were set to zero. Significant predictors included phone use (z = -2.51, p = .012), autocracy (z = -5.01, p < .0005), and GDP (z = 2.87, p = .004). Incidence rate ratios (IRR) were computed for the three significant predictors. The IRR for phone use (.985) indicates that if all other predictor variables are held constant, then a one point increase on the percentage of a country's phone use would decrease the number of protests by a factor of .985. The IRR for autocracy (.869) indicates that if all other predictor variables are held constant, then a one point increase in the autocracy score would decrease the number of protests by a factor of .869. The IRR for GDP (1.034) indicates that, given the other predictors held constant; a percentage point increase would increase the number of protests by a factor of 1.034.

**Table 3** below presents the results of Regression 1.

| Variable | *B* | *SE B* | *z* | *p* |
|---|---|---|---|---|
| Internet use | 0.005 | 0.013 | 0.41 | .679 |
| Mobile phone use | 0.006 | 0.009 | 0.65 | .515 |
| Phone use | -0.016 | 0.006 | -2.51 | .012 |
| Autocracy | -0.140 | 0.028 | -5.01 | <.0005 |
| Unemployment rate | -0.006 | 0.008 | -0.77 | .443 |
| GDP | 0.034 | 0.012 | 2.87 | .004 |
| Wald $\chi^2$ = 42.77 | | | | |
| $p$ < .0005 | | | | |

***Regression 2, Low Protest Cluster (n = 162)***

The model for the low protest cluster was significant (Wald $\chi^2 = 13.60$, $p < .034$), indicating that the predictor model using the dataset was improved over a model in which all predictors were set to zero. Significant predictors included mobile phone use ($z = -2.60$, $p = .009$), and GDP ($z = -2.11$, $p = .035$). Incidence rate ratios (IRR) were computed for the two significant predictors. The IRR for mobile phone use (.962) indicates that if all other predictor variables are held constant, then a one point increase on the percentage of a country's mobile phone use would decrease the number of protests by a factor of .962. The IRR for GDP (.964) indicates that, given the other predictors are held constant; a percentage point increase would decrease the number of protests by a factor of .964.

**Table 4** below presents the results of Regression 2.

| Variable | *B* | *SE B* | *z* | *p* |
|---|---|---|---|---|
| | | | | |
| Internet use | 0.016 | 0.021 | 0.75 | .452 |
| Mobile phone use | -0.039 | 0.015 | -2.60 | .009 |
| Phone use | 0.001 | 0.009 | 0.07 | .947 |
| Autocracy | -0.017 | 0.068 | -0.24 | .807 |
| Unemployment rate | -0.005 | 0.008 | -0.55 | .583 |
| GDP | -0.037 | 0.018 | -2.11 | .035 |
| | | | | |
| Wald $\chi^2 = 13.60$ | | | | |
| $p = .034$ | | | | |

***Regression 3, High Protest Cluster (n = 234)***

The model for the high protest cluster was significant (Wald $\chi^2 = 30.80$, $p < .0005$), indicating that the predictor model using the dataset was improved over a model in which all predictors were set to zero. Significant predictors included phone use ($z = -2.26$, $p = .024$), autocracy ($z = -3.53$, $p < .0005$), and GDP ($z = 3.37$, $p = .001$). Incidence rate ratios (IRR) were computed for the three significant predictors. The IRR for phone use (.982) indicates that if all other predictor variables are held constant, then a one point increase on the percentage of a country's phone use would decrease the number of protests by a factor of .982. The IRR for autocracy (.896) indicates that if all other predictor variables are held constant, then a one point increase in the autocracy score would decrease the number of protests by a factor of .896. The IRR for GDP (1.063) indicates that, given the other predictors are held constant; a percentage point increase would increase the number of protests by a factor of 1.063.

**Table 5** below presents the results of Regression 3.

| Variable | *B* | *SE B* | *z* | *p* |
|---|---|---|---|---|
| | | | | |
| Internet use | -0.000 | 0.016 | -0.01 | .991 |
| Mobile phone use | 0.022 | 0.012 | 1.79 | .073 |
| Phone use | -0.018 | 0.008 | -2.26 | .024 |
| Autocracy | -0.110 | 0.031 | -3.53 | <.0005 |
| Unemployment rate | -0.003 | 0.014 | -0.22 | .827 |
| GDP | 0.062 | 0.018 | 3.37 | .001 |
| | | | | |
| Wald $\chi^2 = 30.80$ | | | | |
| $p < .0005$ | | | | |

***Regression 4, Low Mobile Use Cluster (n = 180)***

The model for the low mobile use cluster was significant (Wald $\chi^2$ = 27.65, p = .0001), indicating that the predictor model using the dataset was improved over a model in which all predictors were set to zero. Significant predictors included autocracy (z = -3.77, p < .0005), and unemployment rate (z = -2.02, p = .044). Incidence rate ratios (IRR) were computed for the two significant predictors. The IRR for autocracy (.868) indicates that if all other predictor variables are held constant, then a one point increase on the autocracy score would decrease the number of protests by a factor of .868. The IRR for unemployment rate (.983) indicates that, given the other predictors are held constant; a percentage point increase in unemployment rate would decrease the number of protests by a factor of .983.

**Table 6** below presents the results of Regression 4.

| Variable | *B* | *SE B* | *z* | *p* |
|---|---|---|---|---|
| | | | | |
| Internet use | 0.013 | 0.043 | 0.30 | .763 |
| Mobile phone use | 0.049 | 0.027 | 1.84 | .066 |
| Phone use | -0.019 | 0.014 | -1.37 | .171 |
| Autocracy | -0.142 | 0.038 | -3.77 | <.0005 |
| Unemployment rate | -0.017 | 0.009 | -2.02 | .044 |
| GDP | 0.038 | 0.021 | 1.80 | .071 |
| | | | | |
| Wald $\chi^2$ = 27.65 | | | | |
| *p* = .0001 | | | | |

***Regression 5, High Mobile Use Cluster (n = 216)***

The model for the high protest cluster was significant (Wald $\chi^2 = 36.94$, $p < .0005$), indicating that the predictor model using the dataset was improved over a model in which all predictors were set to zero. Significant predictors included mobile phone use ($z = 2.78$, $p = .005$), autocracy ($z = -4.52$, $p < .0005$), and unemployment rate ($z = 2.18$, $p = .029$). Incidence rate ratios (IRR) were computed for the three significant predictors. The IRR for mobile phone use (1.035) indicates that if all other predictor variables are held constant, then a one point increase on the percentage of a country's mobile phone use would increase the number of protests by a factor of 1.035. The IRR for autocracy (.831) indicates that if all other predictor variables are held constant, then a one point increase in the autocracy score would decrease the number of protests by a factor of .831. The IRR for unemployment rate (1.052) indicates that, given the other predictors are held constant; a percentage point increase in a country's unemployment rate would increase the number of protests by a factor of 1.052.

**Table 7** below presents the results of Regression 5.

| Variable | *B* | *SE B* | *z* | *p* |
|---|---|---|---|---|
| | | | | |
| Internet use | -0.001 | 0.015 | -0.10 | .922 |
| Mobile phone use | 0.034 | 0.012 | 2.78 | .005 |
| Phone use | -.013 | 0.008 | -1.78 | .075 |
| Autocracy | -0.186 | 0.041 | -4.52 | <.0005 |
| Unemployment rate | 0.050 | 0.023 | 2.18 | .029 |
| GDP | 0.016 | 0.016 | 1.03 | .301 |
| | | | | |
| Wald $\chi^2 = 36.94$ | | | | |
| $p < .0005$ | | | | |

*Negative Binomial Regression on Sub-groups of Time Span*

The results of the first set of regressions indicated that Internet use was not significant for any of the models. It was considered possible that the variable of Internet use could be impacting the dataset with a jump in use as the Internet gained popularity. The Internet grew in use over the timeframe of this study, with earlier years showing considerably less use of the Internet, and more recent years showing considerably increased Internet use over the earlier years. Also, these factors apply to the variable of mobile phone use. It was hypothesized that a structural break could exist in the Protest model along the variables of Internet use and mobile phone use as relates to the years of lower Internet/mobile phone use and the years of higher Internet/mobile phone use. Two additional regressions were thus performed to answer the following research question and associated statistical hypotheses:

> **Research Question 2:** Is there a structural break in the Protest model as relates to timeframe and the predictors of Internet use and mobile phone use?
>
> **Null Hypothesis 2:** There is not a statistically significant difference in the protest model as relates to the time spans of 1990-1999 inclusive vs. 2000-2007 inclusive, or for the predictors of Internet use and mobile phone use.
>
> **Alternative Hypothesis 2:** There is statistically significant difference in the protest model as relates to the time spans of 1990-1999 inclusive vs. 2000-2007 inclusive, or for the predictors of Internet use and mobile phone use.

Two separate regressions were performed using STATA command “xtnbreg” for a negative binomial regression with panel data. The first regression included data for the years 1990-1999 inclusive ($n$ = 220). The second regression included records for the years 2000-2007 inclusive ($n$ = 176).

Results for Regression 6 (years 1990 – 1999 inclusive; Wald $\chi^2 = 0.95$, $p = .623$), and Regression 7 (years 2000-2007 inclusive, Wald $\chi^2 = 3.33$, $p = 0.190$), were not significant. Therefore we do not reject Null Hypothesis 2. There is not sufficient evidence to indicate a structural break in the protest model between the two time spans.

## Conclusion

All five negative binomial regression models on the entire 18-year time panel for the study data were significant. Of note, however, is the non-significance of the Internet variable in all models analyzed. Mobile phones were only significant in the regression models for the "Low Protest" and "High Mobile Phone Use" clusters. However, the relationship was negative in the former case and positive in the latter.

In sum, an increase in mobile phone users in countries with low protest counts decreases the number of protests. The overall correlation analysis showed a strong significant negative relationship between mobile phone use and unemployment. This may imply that an increase in mobile phone users in low protest countries leads to a decrease in unemployment and hence less protests. Another explanation might be that regimes in the "low protest cluster" are tech-savvy and able to prevent mass social unrest. The regression analysis on the "high mobile phone use" cluster revealed a significant positive relationship between mobile phone users and protests. This may imply that social unrest is facilitated by the use of mobile communication.

These conclusions require some qualifications. First, as discussed in the data section, the protest data may suffer from media bias. Second, the protest data does not provide any information on the actual magnitude of the protests. Third, economic data on countries under repressive rule need to be treated with suspicion since some of this data is self-reported. For example, authoritarian regimes are unlikely to report the true magnitude of unemployment in their country. ICT data is also self-reported. Fourth, the data is aggregated to the country-year level, which means potentially important sub-national and sub-annual variations are lost. Fifth and finally, the regression results may be capturing other dynamics that are not immediately apparent given the limits of quantitative analysis.

This explains why case-based qualitative research is needed before the tentative conclusions from the quantitative analysis can be trusted.

## Next Steps

A comparative case study analysis needs to be carried out in order to substantiate or refute the findings summarized above. In other words, what are the underlying dynamics that explain the findings from the regression analysis? Why are mobile phones a statistically significant predictor of protests in “Low Protest” and “High Mobile Phones” countries?

The following four countries (one per cluster) will be used to carry out the qualitative comparative case study analysis:

1. High Protests – Iran
2. Low Protests – Tunisia
3. High Mobile Phones – Ukraine
4. Low Mobile Phones – Myanmar

These countries were selected based on four specific criteria (1) they are in the top five highest and lowest mean rankings for protests and mobile phones (see the Appendix for the full list); (2) they are geographically distinct and represent four different continents; (3) the regimes in these countries they are considered repressive; (4) there was evidence of active anti-government resistance in the country between 1998-2008.

The guiding research questions for the qualitative research will be why mobile phones don’t appear to significantly influence the frequency of protests in Iran and Myanmar, and why they do in Tunisia and the Ukraine. The mini case studies will be carried out using congruence based theory testing and process tracing in combination with semi-structured out-of-country interviews. The purpose of combining these qualitative methodologies is to “improve the quality of conceptualization and measurement, analysis of rival explanations, and overall confidence in the central findings of a study” (Lieberman 2005).

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