

ABSTRACT

Title of Thesis:

AN ANALYSIS OF VARIABILITY IN
NEWSPAPER REPORTING OF
NATIONALLY COVERED TOPICS

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This study looks into variability in newspaper reporting of important national topics. Using a sample of seven hundred articles from ten newspapers, a quantitative analysis using analysis of variance (ANOVA) found that variability in the values of reported numerical facts was statistically significant. Further, a qualitative analysis was performed to identifying potential reasons for the variability. Variability is unique to each topic being covered; however, some follow predictable patterns, such as updates on developing stories.

AN ANALYSIS OF VARIABILITY IN NEWSPAPER REPORTING OF
NATIONALLY COVERED TOPICS

by

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Introduction

Journalism seeks to produce for the public interest, to the consumer in want of information, a “journalistic truth” about a particular topic or event. Journalistic truth implies a degree of verification for accuracy through a transparent review of the evidence, an objectively established story from particular events following the scientific method (Kovach & Rosenstiel, 2001). However, that’s not always what people are exposed to. Indeed, it is not what people often seek, especially in important national news in the United States. Nationally relevant news is disseminated through many channels, such as newspapers, magazines, television stations, social media outlets, and for an increasing number of tech savvy readers, it comes in customized news feeds on a favorite handheld mobile device. News is a 24-hour business, and given the complex nature of the industry and competition for readers, variability in news reporting is inevitable.

News organizations implement shifts in practice in attempts to cater to different interests as a means to maintain and attract an audience. In politics, for example, a shift in a news organization’s delivery can split the story along ideological lines and runs the risk of being labeled partisan, or showing bias towards one perspective over others. A survey by *The Pew Research Center* (2012), measured 13 news organizations, across several mediums, (e.g.; Local television news, *ABC News*, *CBS News*, *Wall Street Journal*, *USA Today*, *The New York Times*, *NPR*), providing some interesting results on how much people that seek out news tend to believe the news they consume. The survey measured believability on a 4-point scale with 4

meaning someone believes “all or most” of what a news organization says, and 1 meaning someone believes “almost nothing” of what a news organization says. A “positive believability” ranking was considered a score of 3 or 4 on the 4-point scale. The survey found news organizations have been on a losing trend with positive believability rankings declining to 56 percent, a drop from 62 percent in the year 2010, and 71 percent in 2002. Furthermore, survey respondents identified as either Republican or Democrat divided the news organizations being measured down party lines, with Republicans more willing to point to political bias.

Articles from major newspapers have a significant effect on public perception of topics and events. Newspapers hold substantial power to influence the narrative in many situations and in some ways can help give life, or death, to many developing stories.¹ Although the goal may be objectivity, a skeptical reader may notice a splash of sensationalism or attempts to persuade them towards certain ideas in the articles they read. However, an article may be delivered, variation in the reported quantitative facts may indicate a measurable amount of variability exists in the articles about a particular topic. Given the potential weight and significance of newspaper articles in shaping public perception, just how much variability is present in newspaper reporting of nationally covered events? And more specifically, is this variability sufficiently statistically significant to warrant further analysis? Lastly, if variability is significant, what possible factors may contribute to the presence of variability in newspaper reporting?

¹ One major example is highlighted with *The Washington Post* and *The New York Times* breaking the stories that turned into the Watergate Scandal. Despite a concerted effort by President Richard Nixon, the Republican Party, and many other actors to silence the stories, the articles kept coming, eventually bearing fruit like the “I’m not a crook” statement by President Nixon and his eventual resignation.

Definitions

For the purpose of this research, variability was defined as a lack of consistency, specifically with regard to quantitative facts. Variation was defined as a change in the values of quantitative facts from one article to another and/or from one newspaper to another. Variability in this case was identified as the lack of consistency in the values of numerical facts being presented in intra-newspaper and/or inter-newspaper reporting of major nationally covered topics. Lastly, each numerical fact reported by the ten selected newspapers was described as a “quantitative fact”. For instance, The New York Times published articles that reported the number of troops (in hundreds of thousands) that were ready for the Iraq War in 2003. The quantitative fact is the number reported.

Expected Contributions

The ultimate goal of the research is to assess the presence of variability in intra-newspaper and inter-newspaper reporting, and attempt to understand the factors that contribute to this variability. Learning about newspaper variability may further the understanding behind the reasons for the emergence of different quantitative facts being reported in different articles for the same topic. Looking into newspaper variability may help guide studies attempting to identify extreme variability, or wide variations in the facts, which may indicate misleading and/or deceiving news articles. A deeper look into the factors that contribute to the manifestation of variability in newspaper reporting may help news organizations structure a reporting methodology that minimizes the chance for variation in the presented facts.

Research Questions

1. How much variability is present in newspaper reporting of quantitative facts relating to important national events?
 - How much variability is present in a particular newspaper's reporting of quantitative facts relating to important national events (Intra-newspaper variability)?
 - How much variability is present when comparing different newspapers' reporting of quantitative facts relating to important national events (Inter-newspaper variability)?
2. If variability is sufficiently present in quantitative facts concerning important national topics, what insight can be gathered through a qualitative analysis of the quantitative facts found in the articles?

Literature Review

Research considering news organizations – how stories may be shaped and/or framed to promote particular points of view, or how they may project biases actively or with subtle aims – exists in abundance covering a wide range of topics (Entman, 2007; Scheufele & Tewksbury, 2007). Comparative analyses concerning news reporting primarily fall under either an audience-based approach or a content-based approach. For instance, comparative analyses regarding the reporting of Supreme Court cases and major Congressional legislation have shown that news organizations can frame topics to fit underlying objectives. On the other hand, research has also found that readers maintain some level of control over the content in the articles they read. Articles that deviate too far from a reader’s perceived objectivity standard may be labeled as “bad news”, and rejected as not being legitimate. Comparative analysis studies have looked into many elements of news reporting, from the shaping and framing of news to how audiences interact with the news they seek; however, research is still needed on the topic of variability in news reporting.

Kaye and Johnson (2016) used the audience-based approach when looking into partisan politics during the 2012 Presidential Election. In their research, they found both conservatives and liberals tended to search for news favoring their flavor of politics, while outlets considered neutral also showed an increased flow of bipartisan traffic. The research provided some insights in its attempt to find political bias and partisan politics, yet failed to deliver substantive results. Furthermore, the audience-based approach has not yet been applied to investigate variability in news reporting.

The content-based approach attempts to address some of the limitations of the audience-based approach and looks instead at the content (e.g.; counting particular words, identifying repetition of specific phrases used by politicians, reporting of quantifiable facts, identifying how often a political group is referenced, etc.), rather than focusing on the audience. A comparative content analysis by Bailard (2016), borrowing from a study by Gilens and Hertzman (2000)², looked into news content related to the Supreme Court decisions on the Citizens United and Hobby Lobby cases. Bailard looked to find variation regarding the reporting of the two cases. Bailard found that, as with the Gilens and Hoertzman's study, newspapers owned by companies that were to gain financially from a favorable ruling (e.g.; increased political television ads) in the cases tended to cover the cases more favorably. The study considered variation in reporting to identify potential bias.

Audience-based and content-based comparative analysis complement each other; however, both approaches still remain inherently limited in scope and do not necessarily produce absolute results. Budak, Goel, and Rao (2016) attempted to address these limitations in their research by using machine learning to assess over 800,000 news stories ultimately identifying 14 percent of the articles linked to political events. Using 749 recruited human judges, they further identified the ideological position of over 10,000 articles, finding that news outlets are rather similar, with the exception of political scandals. Further, news organizations express ideological bias with criticism of a particular party rather than advocacy for their

² Gilens and Hertzman (2000) study showed that companies that stood to gain financially from key components of the 1996 Telecommunications Act, covered it in a significantly more favorable light.

party of choice. Budak, Goel, and Rao raise questions about whether news organizations actually differed substantially in their coverage based on ideological differences, although asserting that political scandals could be an exception. However, the research did not address variability of quantitative facts.

In a preliminary study, Marciano (2017) examined the reporting of the Patient Protection and Affordable Care Act (PPACA). This study is an example of explaining and identifying variability in newspaper reporting. The PPACA was a major piece of healthcare legislation signed into law by President Barack Obama on March 23, 2010. The preliminary study found variation in the reporting of key aspects of the PPACA prior to the legislation's passage within and between three selected newspapers (*The New York Times*, *The Wall Street Journal*, and *The Washington Post*). One key aspect of the study involved the reported projected cost of the PPACA over ten years after passage and implementation. When it came to reporting the cost of the PPACA, just over half of the articles by *The New York Times* stated the cost would be under one trillion dollars over ten years. The remaining articles from *The New York Times* placed the cost of the PPACA at over one trillion dollars over ten years. *The Washington Post* articles split evenly down the middle on cost estimates under and over one trillion dollars over ten years, with a tighter grouping and therefore less variation. A notable exception was *The Wall Street Journal*, which had the majority of the articles estimating the PPACA would cost more than one trillion dollars over ten years, and of those articles, over 80 percent of the estimates were significantly higher than one trillion (i.e.; between \$1.6 - \$2 trillion dollars over ten years, while the other newspapers estimated just slightly over \$1 trillion dollars over ten years).

The reporting by the three newspapers provided an example of the variation in the cost estimates quoted in the articles, and the variability in newspaper reporting that manifested as a result.

Focusing on a singular news topic, research by Jaworski (2012) and Priebe (2013) provided insight into coverage of the PPACA. Priebe's (2013) study revealed that newspapers acted in ways that made them essentially "gatekeepers", emphasizing and maintaining PPACA keywords and themes such as "uninsured", "public option", "abortion", and "death panels", at the forefront of public conversations. Similarly, Jaworski (2012) studied how media framing of topics helped shape public perception and dissected the framing of stories and their influence in shaping public perception regarding the PPACA. Jaworski identified seven key themes in the framing of PPACA: personal versus social determinants, healthcare as a right or market regulated good, entitlement, impact of coverage on uninsured, cost, individual mandate (leading to eventual government takeover of entire healthcare system), and perceived public support. Jaworski measured whether media coverage of the PPACA was negative, positive, or neutral. The study highlighted the dominant key terms regarding the PPACA, but noted that, aside from emphasizing certain aspects of the PPACA, the coverage remained largely neutral.

Although research into how news is packaged and delivered tells us a great deal about some of the methods used to shape public perception, the reader still maintains a certain level of control over how much manipulation they are willing to tolerate. Studies by Kocher and Shaw (1981), Haskins and Miller (1984), and Fico, Richardson, and Edwards (2004) found that significant deviation from the reader's

perceived objectivity standard would negatively impact the reader's image of the newspaper. In other words, news that deviated from an expected standard was labeled "bad news" and lost credibility. An exception was found, however, the imbalance in the reporting could be tolerated if it was backed by the scientific method and clearly argued. (Fico, Richardson, & Edwards, 2004)

The studies highlighted provide relevant insight on how news is presented for various reasons. All of these studies indicate various ways in which variation in news reporting can arise. Whether intended or not, the potential for variation in the use of language gives rise to the possibility for variability. However, research specifically focused on variability in reported values of quantitative appears to be rare. This study aims to contribute to addressing this gap in the research.

Methods

The research was based on analysis of a sample of articles concerning seven important national topics from ten newspapers. This section describes the process by which the newspapers, the topics, the articles, and the particular quantitative facts were selected, and the quantitative analysis methods used to assess variability in reporting of those facts.

Selecting Newspapers

The global news database Factiva, owned by Dow Jones, contains nearly 33,000 premium sources that include licensed publications, influential websites, blogs, along with images and videos. Only about a quarter of the premium news sources (e.g.; The New York Times, The Washington Post, etc.) are available for free online in Factiva, however, with the University of Maryland's subscription, I was granted access to all ten newspaper archives. Factiva was able to provide access to thousands of articles, well exceeding the needs of this research.

The newspapers analyzed in this study were chosen based on circulation rates, with the understanding that the bigger the circulation, the wider the audience and thus, the greater potential to influence public opinion. The Alliance for Audited Media (AAM), a non-profit organization founded in 1914 as a means of ensuring transparency and trust in media, provided circulation figures that defined the list of top ten newspapers in the United States. AAM specializes in data distribution, cross-media data and analytics, and expertise in multiple media platforms (e.g.; print, mobile, web, email, etc.), giving them a solid reputation for working with media-

related data. I was granted student access to AAM's Media Intelligence Center, where I was able to retrieve detailed information about newspaper circulation rates.

The AAM database interface allowed for a filtered search of the top national newspapers by circulation. Using the AAM database interface, it was possible to narrow the pool of newspapers to the top 25 newspapers available for download and review. It was possible to download general information and AAM reports with more complete breakdowns of circulation based on many subscription options for each newspaper. The downloaded files from AAM contained detailed information regarding subscriptions and the local, state, and national reach of each newspaper. The extracted data for the pool of 25 newspapers included summaries of several specific circulation categories (e.g.; Home Delivery and Mail, Single Copy Sales, Hotel Distribution - Room/Lobby Copies, Business/Traveler Paid Circulation, Educational Copies, University Copies etc.), all of which went into calculating the overall circulation figures. Once the newspapers were ranked from 1st to 25th based on overall circulation, the top ten were selected ([Table: 1](#)), making for a more manageable study. A brief review of the selected newspapers ([Table: 2](#)) was conducted to ensure, for instance, that ownership of the selected newspapers were not confined to a few owners.

(Table: 1) Top Ten Newspapers Based on Circulation

The table displays circulation information for the ten selected newspapers in the study.

Publication Name	Founding Date	Sun/Sat & Weekdays Report Date	Sun/Sat	Weekdays	Digital Report Date	Digital	Total
USA Today (USA Today, Local/Life)	1982	12/2016-AR	3,362,312	3,816,923	03/31/2013	249,900	7,429,135
The Wall Street Journal (Eastern, Central, & Western)	1889	09/2017-AR	1,169,402	1,152,553	03/31/2013	898,102	3,220,057
The New York Times (excluding special editions)	1851	09/2016-AR	1,096,866	694,912	03/31/2013	1,133,923	2,925,701
The Atlanta Journal-Constitution	*1868 **1883 ***2001	09/2016-AR	606,689	524,276	03/31/2013	6,704	1,137,669
New York Post	1801	09/2016-AR	387,112	433,606	03/31/2013	200,571	1,021,289
The Washington Post	1877	09/2016-AR	522,055	350,859	03/31/2013	42,313	915,227
Daily News	1919	09/2016-AR	336,367	274,816	03/31/2013	155,706	766,889
The Philadelphia Inquirer	1829	03/2016-AR	363,700	210,652	03/31/2013	67,958	642,310
Tampa Bay Times (formerly St. Petersburg Times)	1884	12/2016-AR	370,983	230,473	03/31/2013	17,099	618,555
The Boston Globe	1872	03/2017-AR	323,524	221,406	03/31/2013	73,524	618,454

The Atlanta Journal-Constitution was the result of a merger of The Atlanta Constitution*, and The Atlanta Journal**, to form The Atlanta Journal-Constitution***.

(Table: 2) **Newspaper Profiles** (Descending order by circulation)

Publication Name	Daily News
Parent Company	New York Daily News
City	New York, NY
Brief History/Ownership	The Daily News was founded by Joseph Medill Patterson in 1919, as the Illustrated Daily News. The newspaper is currently owned by Tronc.
Type	DLY
Report Date	09/2016-AR
Sun/Sat Circulation	336,367
Weekday Circulation	274,816
Digital Report Date	03/31/2013
Digital Circulation	155,706
Total Circulation	766,889

Publication Name	New York Post
Parent Company	News Corporation
City	New York, NY
Brief History/Ownership	New York Post was established on November 16, 1801, as New-York Evening Post. Alexander Hamilton founded the Post with about \$10,000 dollars from a group of investors in the autumn of 1801. The newspaper is currently owned by Rupert Murdoch News Corporation.
Type	DLY
Report Date	09/2016-AR
Sun/Sat Circulation	387,112
Weekday Circulation	433,606
Digital Report Date	03/31/2013
Digital Circulation	200,571
Total Circulation	1,021,289

Publication Name	Tampa Bay Times (formerly St. Petersburg Times)
Parent Company	Times Publishing Company
City	St. Petersburg, FL
Brief History/Ownership	The newspaper began as the West Hillsborough Times, a weekly newspaper established in Dunedin, Florida on the Pinellas peninsula in 1884. The newspaper changed name to Tampa Bay Times January 1, 2012, and is currently owned by Times Publishing Company.
Type	DLY
Report Date	12/2016-AR
Sun/Sat Circulation	370,983
Weekday Circulation	230,473
Digital Report Date	03/31/2013
Digital Circulation	17,099
Total Circulation	618,555

Publication Name	The Atlanta Journal-Constitution
Parent Company	Cox Media Group
City	Atlanta, GA
Brief History/Ownership	Carey Wentworth Styles, James H. Anderson and W. A. Hemphill bought the Atlanta Daily Option and renamed it The Atlanta Constitution with the first publication released in June 16, 1868. In 1883, Edward F. Hoge launches The Atlanta Journal as a means to cover local news. James M. Cox purchased the newspapers by buying The Atlanta Journal in 1939 and The Atlanta Constitution in 1950. In 1976 the Saturday editions of both newspapers are combined, and in 1982 the two newsrooms are combined. In 2001 the two newspapers officially become The Atlanta Journal-Constitution. It is currently owned by the Cox Media Group, Cox Enterprises.
Type	DLY
Report Date	09/2016-AR
Sun/Sat Circulation	606,689
Weekday Circulation	524,276
Digital Report Date	03/31/2013
Digital Circulation	6,704
Total Circulation	1,137,669

Publication Name	The Boston Globe
Parent Company	Boston Globe Media Partners LLC
City	Taunton, MA
Brief History/Ownership	The Boston Globe was founded in 1872 by Charles H. Taylor and was a private company until going public as Affiliated Publications in 1973. The New York Times purchased Affiliated Publications for \$1.1 billion dollars making it a wholly owned subsidiary. In 2013, Boston Red Sox principal owner John W. Henry purchased The Boston Globe taking ownership in October of that year.
Type	DLY
Report Date	03/2017-AR
Sun/Sat Circulation	323,524
Weekday Circulation	221,406
Digital Report Date	03/31/2013
Digital Circulation	73,524
Total Circulation	618,454

Publication Name	The New York Times (excluding special editions)
Parent Company	New York Times Company
City	New York, NY
Brief History/Ownership	Henry Jarvis Raymond and George Jones (Raymond, Jones & Company) established the paper in 1851 in New York City as The New-York Daily Times, with an appeal towards a cultured and intellectual readership as opposed to the typical mass audience. The newspaper is currently owned by the Ochs-Sulzberger Family (newspaper dynasty) and Trust.
Type	DLY
Report Date	09/2016-AR
Sun/Sat Circulation	1,096,866
Weekday Circulation	694,912
Digital Report Date	03/31/2013
Digital Circulation	1,133,923
Total Circulation	2,925,701

Publication Name	The Philadelphia Inquirer
Parent Company	Philadelphia Media Network, PBC d/b/a/ Interstate General Media
City	Philadelphia, PA
Brief History/Ownership	Currently the third oldest daily paper, The Philadelphia Inquirer was founded on June 1, 1829, and is currently owned by the Philadelphia Media Network Interstate General Media, LLC
Type	DLY
Report Date	03/2016-AR
Sun/Sat Circulation	363,700
Weekday Circulation	210,652
Digital Report Date	03/31/2013
Digital Circulation	67,958
Total Circulation	642,310

Publication Name	The Wall Street Journal (Eastern, Central, & Western)
Parent Company	Dow Jones/A News Corporation Co.
City	New York, NY
Brief History/Ownership	The Wall Street Journal was founded by Charles H. Dow, of Dow Jones & Company, primarily to cover business and financial news. The newspaper is currently owned by the Rupert Murdoch News Corporation.
Type	DLY
Report Date	09/2017-AR
Sun/Sat Circulation	1,169,402
Weekday Circulation	1,152,553
Digital Report Date	03/31/2013
Digital Circulation	898,102
Total Circulation	3,220,057

Publication Name	The Washington Post
Parent Company	Nash Holdings, LLC
City	Washington, DC
Brief History/Ownership	The Washington Post was founded in 1877 by Stilson Hutchins, later owned by Philip Graham and the Graham Family. The newspaper is currently owned by Jeff Bezos, founder of Amazon.com
Type	DLY
Report Date	09/2016-AR
Sun/Sat Cir.	522,055
Weekday Cir.	350,859
Digital Report Date	03/31/2013
Digital Cir.	42,313
Total Cir.	915,227

Publication Name	USA Today (USA Today, Local/Life)
Parent Company	Gannett Company Inc.
City	Washington, DC
Brief History/Ownership	USA Today was founded by Allen H. Neuharth, launched on September 15, 1982, through Gannett Company. It is still currently owned by the Gannett Company.
Type	AP
Report Date	12/2016-AR
Sun/Sat Cir.	3,362,312
Weekday Cir.	3,816,923
Digital Report Date	03/31/2013
Digital Cir.	249,900
Total Cir.	7,429,135

Selecting Topics

With the list of top ten newspapers finalized, the next steps was to identify topics and at least two quantitative facts associated with each topic. The topics were selected by first doing a simple search using a Google Chrome search engine, employing search terms such as “top news”, “important news stories”, “top national news”, and “most important news stories”. The search produced a list of topics and topic keywords, which was the starting basis of the selection process. Using the Factiva database

archives, after setting the parameters for the ten selected newspapers, the topic keywords were used to produce a list of newspaper articles. After refining the search for the most relevant articles and the year the story first broke, the topics that returned over 5,000 or more articles (Table: 3) were included in the study. Out of this set, a final list of seven topics remained that touched on a mix of national politics, the environment, war, and finance.

(Table: 3) **List of Topics** (Alphabetical Order)

Topic	Keywords	Date Range/Year	Relevant Articles
BP Gulf Oil Spill	BP Gulf Oil Spill 2010	Jan. 1 - Dec. 31, 2010	23,621
Bush Tax Cuts	Bush Tax Cuts 2001	Jan. 1 - Dec. 31, 2001	139,272
Hurricane Katrina	Hurricane Katrina 2005	Jan. 1 - Dec. 31, 2005	9,666
Iraq War	Iraq War 2003	Jan. 1 - Dec. 31, 2003	105,252
Presidential Election 2000	Presidential Election 2000	Jan. 1 - Dec. 31, 2000	88,588
Presidential Election 2008	Presidential Election 2008	Jan. 1 - Dec. 31, 2008	102,512
Wall Street Bailout	Wall Street Bailout 2008	Jan. 1 - Dec. 31, 2008	67,222

Selecting Quantitative Facts

After setting the search criteria specifically for the ten selected newspapers, based on relevance, and limiting only to the year the topic first appeared, the first 100 articles from the search results for each topic were downloaded from the Factiva database archives. Once downloaded, each set of 100 articles were read and reviewed to identify potential quantitative facts. The review involved searching for quantitative facts directly related to the seven identified topics. Each review captured identifying information about the article (e.g.; newspaper name, headline, edition, author's name,

credit information, and date), along with every quantitative fact which appeared in the article.

The seven topic sets of 100 articles produced between ten to twenty quantitative facts, however, only a couple of the quantitative facts for each topic was referenced enough times for variability to be a meaningful possibility. Often a quantitative fact was referenced two or three times, which while it may be meaningful a particular article is not sufficient detect significant variability. Ultimately, the review of the 100 articles resulted in data sufficient to analyze that the variability in two quantitative facts for each topic ([Table: 4](#)).

(Table: 4) **Topics & Quantitative Facts**

1. BP Gulf Oil Spill
 - a. Crude Spilled (gallons/barrels)
 - b. Total Cost (dollars)
2. Bush Tax Cuts 2001
 - a. Total tax cut (total dollar amount over 10 years)
 - b. Surplus at risk (total dollars amount over 10 years)
3. Hurricane Katrina 2005
 - a. Storm Category (Category 1 – 5)
 - b. Damage Cost (dollars)
4. Iraq War 2003
 - a. Number of Troops (number of military personnel)
 - b. War/Occupation Cost (dollars)
5. Presidential Election 2000

- a. Disputed Ballots (number of ballots)
 - b. Vote Count Lead (number of votes)
- 6. Presidential Election 2008**
- a. Polls Lead Margin (percentage points)
 - b. Campaign Money Raised (dollars/month)
- 7. Wall Street Bailout of 2008**
- a. Package cost (dollars)
 - b. Cost of funds for Automakers (dollars)

Because the articles were chosen from the FACTIVA database based on relevance, the first 100 articles selected did not necessarily include articles from all ten newspapers. Rather, there were cases where a newspaper was not represented in the article sample for a particular topic. ([Table: 5](#)) Moreover, another issue arose during the article review concerning non-standard article types, such as blogs, opinion pieces, and a few summary pieces (e.g.; election vote count figures, hurricane damage estimates, etc.). To maintain consistency of article genre, these articles (5) were not included in the final analysis dataset, which consisted of 695 articles.

(Table: 5) **Number of Newspaper Articles by Topic**

Newspapers	Number of Articles for Each Topic							
	BP Oil Spill	Bush Tax Cuts	Iraq War	Hurricane Katrina	2000 Election	2008 Election	Bailout	Totals
The Atlanta Journal-Constitution	1	3	3	29	0	7	6	49
The Boston Globe	1	9	5	3	8	0	4	30
The New York Daily News	0	0	1	2	1	0	2	6
The New York Post	1	4	2	1	2	1	2	13
The New York Times	42	22	61	26	44	19	28	242
The Philadelphia Inquirer	0	1	0	6	0	0	8	15
The Tampa Bay Times (formerly St. Petersburg Times)	6	5	5	3	9	17	1	46
The Wall Street Journal (Eastern, Central, & Western)	35	27	8	8	6	18	20	122
The Washington Post	6	19	9	21	13	29	25	122
USA Today	7	10	6	1	16	6	4	50
Totals	99	100	100	100	99	97	100	695

*A total of five articles were dropped from the sample because they were non-standard types (e.g. an opinion piece, a blog, or a summary of articles).

Statistics & Analysis

In order to measure the variability in the quantitative facts found during the analysis of the newspaper articles, a measure of the number of unique values reported was created for each newspaper, topic, and fact combination. Descriptive statistics of this measure were used to characterize overall variation. Analysis of variance (ANOVA) was used to assess differences within and between newspapers. The statistical models sought to measure variability to determine if the reporting of quantitative facts varies significantly among articles within a single paper or between papers. Two statistical packages were used, the ANOVA toolkit provided by Microsoft Excel, and R-Studio, an open source tool designed to improve the capabilities of the R programming language. Following the statistical analysis of the quantitative facts for each topic, a qualitative review was conducted to gain new insights and further understanding of the quantitative statistical analysis.

Limitations

Although the selected newspapers are the biggest based in circulation, and were distributed across the United States, they do not represent all news organizations across all mediums to which national events are reported. Similarly, the relatively small sample of articles selected for each of the topic is likely to result in an underassessment of variability (due to absence of sufficient reference to many particular qualitative facts).

Variability was measured using common statistical analysis processes and clearly defined in the final research paper. Deviation from potential results is likely to

stem from a sample of different nationally covered topics. A better topic selection, a larger sample of relevant articles, and an automated method for identifying numerical values and the associated quantitative fact may help address this limitation.

Findings

The analysis of variance models showed that the variability in the values reported for quantitative facts identified in the study was statistically significant. The models returned statistically significant F-values when calculating the quantitative facts for each topic, in both inter-newspaper and intra-newspaper reporting, 3.182 and 1.844 respectively. Further, the analysis produced low P-values (Inter-newspaper P-value 0.001, intra-newspaper P-value 0.030), which further support the claim that the analyses are statistically significant.

The quantitative analysis involved counting the number of articles from each newspaper that covered the selected topics, and the number of articles that included a selected quantitative fact for each topic. Lastly, the quantitative analysis focused on the number of different numerical values reported for each selected topic. Tables 6 and 7 help illustrate the findings from the quantitative analysis, and how the quantitative facts were distributed throughout the newspaper articles based on the selected topics.

(Table: 6.1) Newspaper Article Quantitative Facts – BP Gulf Oil Spill

BP Gulf Oil Spill 2010						
Newspapers	Crude Spilled			Total Cost		
	# of Diff. Values	# of Articles in which fact appears	Total Articles	# of Diff. Values	# of Articles in which fact appears	Total Articles
The Atlanta Journal-Constitution	1	1	1	0	0	1
The Boston Globe	0	0	1	0	0	1
The New York Daily News	0	0	0	0	0	0
The New York Post	1	1	1	0	0	1
The New York Times	7	10	42	3	4	42
The Philadelphia Inquirer	0	0	0	0	0	0
The Tampa Bay Times (formerly St. Petersburg Times)	0	0	6	0	0	6
The Wall Street Journal (Eastern, Central, & Western)	3	14	35	3	3	35
The Washington Post	0	0	6	0	0	6
USA Today	0	0	7	0	0	7
Totals		26	99		7	99

(Table: 6.2) Newspaper Article Quantitative Facts – Bush Tax Cuts 2001

Bush Tax Cuts 2001						
Newspapers	Total Tax Cut			Average Tax Cut		
	# of Diff. Values	# of Articles in which fact appears	Total Articles	# of Diff. Values	# of Articles in which fact appears	Total Articles
The Atlanta Journal-Constitution	2	3	3	1	1	3
The Boston Globe	3	6	9	1	1	9
The New York Daily News	0	0	0	0	0	0
The New York Post	2	2	4	0	0	4
The New York Times	3	15	22	0	0	22
The Philadelphia Inquirer	0	0	1	0	0	1
The Tampa Bay Times (formerly St. Petersburg Times)	2	2	5	0	0	5
The Wall Street Journal (Eastern, Central, & Western)	5	18	27	1	1	27
The Washington Post	7	12	19	1	3	19
USA Today	3	11	10	0	0	10
Totals		69	100		6	100

(Table: 6.3) Newspaper Article Quantitative Facts – Hurricane Katrina 2005

Hurricane Katrina 2005						
Newspapers	Storm Category			Damage Cost		
	# of Diff. Values	# of Articles in which fact appears	Total Articles	# of Diff. Values	# of Articles in which fact appears	Total Articles
The Atlanta Journal-Constitution	2	2	29	2	2	29
The Boston Globe	0	0	3	0	0	3
The New York Daily News	1	2	2	1	2	2
The New York Post	1	1	1	0	0	1
The New York Times	2	6	26	2	2	26
The Philadelphia Inquirer	1	3	6	2	2	6
The Tampa Bay Times (formerly St. Petersburg Times)	0	0	3	0	0	3
The Wall Street Journal (Eastern, Central, & Western)	0	0	8	1	1	8
The Washington Post	3	6	21	0	0	21
USA Today	1	1	1	0	0	1
Totals		21	100		9	100

(Table: 6.4) Newspaper Article Quantitative Facts – Iraq War 2003

Iraq War 2003						
Newspapers	Number of Troops			War/Occupation Cost		
	# of Diff. Values	# of Articles in which fact appears	Total Articles	# of Diff. Values	# of Articles in which fact appears	Total Articles
The Atlanta Journal-Constitution	0	0	3	1	1	3
The Boston Globe	1	2	5	0	0	5
The New York Daily News	1	1	1	0	0	1
The New York Post	1	1	2	1	1	2
The New York Times	5	7	61	3	3	61
The Philadelphia Inquirer	0	0	0	0	0	0
The Tampa Bay Times (formerly St. Petersburg Times)	2	2	5	1	1	5
The Wall Street Journal (Eastern, Central, & Western)	0	0	8	0	0	8
The Washington Post	1	1	9	0	0	9
USA Today	2	3	6	0	0	6
Totals		17	100		6	100

(Table: 6.5) Newspaper Article Quantitative Facts – Presidential Election 2000

Presidential Election 2000						
Newspapers	Total/Disputed Ballots			Vote Count Lead		
	# of Diff. Values	# of Articles in which fact appears	Total Articles	# of Diff. Values	# of Articles in which fact appears	Total Articles
The Atlanta Journal-Constitution	0	0	0	0	0	0
The Boston Globe	0	0	8	3	2	8
The New York Daily News	1	1	1	0	0	1
The New York Post	0	0	2	0	0	2
The New York Times	0	0	44	2	2	44
The Philadelphia Inquirer	0	0	0	0	0	0
The Tampa Bay Times (formerly St. Petersburg Times)	2	2	9	3	3	9
The Wall Street Journal (Eastern, Central, & Western)	1	1	6	1	1	6
The Washington Post	1	1	13	3	3	13
USA Today	2	2	16	4	2	16
Totals		7	99		13	99

(Table: 6.6) Newspaper Article Quantitative Facts – Presidential Election 2008

Presidential Election 2008						
Newspapers	Polls			Money Raised		
	# of Diff. Values	# of Articles in which fact appears	Total Articles	# of Diff. Values	# of Articles in which fact appears	Total Articles
The Atlanta Journal-Constitution	4	2	7	4	3	7
The Boston Globe	0	0	0	0	0	0
The New York Daily News	0	0	0	0	0	0
The New York Post	1	1	1	0	0	1
The New York Times	1	2	19	4	4	19
The Philadelphia Inquirer	0	0	0	0	0	0
The Tampa Bay Times (formerly St. Petersburg Times)	14	10	17	0	0	17
The Wall Street Journal (Eastern, Central, & Western)	3	3	18	4	4	18
The Washington Post	1	1	29	3	3	29
USA Today	3	3	6	1	1	6
Totals		22	97		15	97

(Table: 6.7) Newspaper Article Quantitative Facts – Wall Street Bailout 2008

Wall Street Bailout 2008						
Newspapers	Package Cost			Automaker's Cut		
	# of Diff. Values	# of Articles in which fact appears	Total Articles	# of Diff. Values	# of Articles in which fact appears	Total Articles
The Atlanta Journal-Constitution	1	4	6	1	1	6
The Boston Globe	1	3	4	0	0	4
The New York Daily News	1	1	2	0	0	2
The New York Post	1	2	2	0	0	2
The New York Times	2	14	28	1	1	28
The Philadelphia Inquirer	1	6	8	0	0	8
The Tampa Bay Times (formerly St. Petersburg Times)	1	1	1	0	0	1
The Wall Street Journal (Eastern, Central, & Western)	1	9	20	4	5	20
The Washington Post	2	12	25	1	1	25
USA Today	1	4	4	0	0	4
Totals		56	100		8	100

(Table: 7) **Variation in Quantitative Facts**

Topic	Variation in Quantitative Facts
BP Gulf Oil Spills	
<i>Crude Spilled (per day)</i>	5,000 - 62,000 barrels
<i>Total Cost</i>	\$2 - 3 billion - \$100 billion dollars
Bush Tax Cuts 2001	
<i>Total Tax Cut Cost (over ten years)</i>	\$700 trillion - 1.6 trillion dollars
<i>Surplus at risk (over ten years)</i>	\$2.7 - 5.6 trillion dollars
Hurricane Katrina	
<i>Storm Category (1 - 5 scale)</i>	Category 1 through 5
<i>Damage Cost</i>	\$6 - 100 billion dollars
Iraq War 2003	
<i>Number of Troops</i>	130,000 - 350,000 troops
<i>War/Occupation Cost (for year)</i>	\$47 - 200 billion dollars
Presidential Election 2000	
<i>Disputed Ballots</i>	9,000 - 10,750 ballots
<i>Vote Count Lead</i>	300 - 1,784 votes
Presidential Election 2008	
<i>Polls Lead Margin</i>	0 - 10 point lead
<i>Campaign Money Raised</i>	varied by month and state
The Wall Street Bailout 2008	
<i>Bailout Cost</i>	\$700 - 850 billion dollars
<i>Automaker's Cut</i>	\$15 - 50 billion dollars

Discussion

The findings indicate that there is meaningful variability in reporting of quantitative facts associated with the selected topics (Table 7), and that the degree of variability is different across newspapers and topics. Given that variation is present in reporting of quantitative facts, a reader that encounters more than one value for the same fact associated with a topic may experience confusion or doubt about the newspaper as a source. Moreover, following the findings from Kaye and Johnson (2016), if liberals and conservatives gravitate to news more likely to re-enforce their brand of politics, variation in reporting of quantitative facts may also be part of the process of responding the interests and expectation of a hoped for audience. However, the findings are somewhat split when compared to Budak, Goel, and Rao (2016). The fact that variability is statistically significant counters their finding that news outlets are rather similar. Yet, Budak, Goel, and Rao make the exception for political scandals. Some of the selected topics touched on politically sensitive topics. To understand possible causes of the variation in reported values for quantitative facts, the profiles of each topic were examined.

Topic 1: BP Gulf Oil Spill 2010

The New York Times and The Wall Street Journal accounted for most of the reporting for both quantitative facts with 31 mentions, 24 about the amount of crude oil spilled, and 7 regarding cost/liabilities. The New York Post, The Atlanta Journal-Constitution, and The Tampa Bay Times provided a single article each out of the 100 reviewed.

The New York Times reported multiple values for the amount of crude spilled with a range between five thousand barrels spilled a day up to 60 thousand barrels spilled per day. Similarly, The Wall Street Journal also had a wide range between five thousand to 62 thousand barrels spilled per day. Initial estimates were based on conservative calculations using limited data provided immediately after the accident. However, the article that supplied the clearest explanation for such a drastic increase in the crude spilled estimates came from The Tampa Bay Times, reporting that scientific teams studying the leak believed as much as tens of thousands of barrels were leaking each day. The article provided several estimates from different sources.

The New York Times and The Wall Street Journal provided all of the seven instances of quantitative facts regarding total cost/liability in billions of dollars. The variation in the figures from different articles ranged widely for both newspapers, with The Wall Street Journal providing the lowest estimate of \$2 - 3 billion dollars, to The New York Times's high estimate of \$100 billion. The Wall Street Journal lower value may be explained by the fact that it was released June 2nd, ten days before an article by The Tampa Bay Times with new information drastically increased the amount of crude oil being spilled. Subsequent articles from The Wall Street Journal adjusted and remained fairly consistent, with two articles estimating \$15 - \$60 billion in July, and \$40 billion dollars in a December article. The New York Times, however, provided an estimate of \$75 billion on June 2nd, but this was an article that was primarily based on damage done and clean-up, versus on the amount of crude oil spilled.

Topic 2: Bush Tax Cuts 2001

In 2001, President George W. Bush requested that Congress help his efforts by providing a bill to help stimulate the economy by providing certain tax cuts. Congress responded with the Economic Growth and Tax Relief Reconciliation Act of 2001, and the Jobs and Growth Tax Relief Reconciliation Act of 2003.

Out of the 100 articles analyzed, 68 contained a reference to the amount of the total tax cut over ten years. However, the variation in the quantitative facts was primarily held within a tight grouping. The overwhelming majority of instances were for an estimate of \$1.6 trillion over ten years. The Washington Post published two articles that provided lower figures, \$700 billion and \$900 billion, yet they also gave a high estimate of \$1.6 trillion. The New York Post only had two instances of this quantitative fact; however, they provided the high estimate of \$2.2 trillion over ten years, and the more popular estimate of \$1.6 trillion over ten years.

Of eleven articles from the 100 analyzed that reported a value for the surplus at the time, all but one reported \$5.6 trillion over ten years. The New York Post had four articles, yet only one article mentioned the quantitative fact, the only estimate at \$2.7 trillion dollars. The primary account for any variability noted here, aside from the estimate in the New York Post article, were due simply to the wording in the articles (e.g.; trillion, trillion over ten years, trillion spent over ten years).

Topic 3: Hurricane Katrina 2005

Hurricane Katrina made landfall in Florida as a category 1 hurricane with minimal damage. Nevertheless, as the hurricane swept through the Gulf of Mexico, it

picked up power and fluctuated between a category 4 and category 5 hurricane until it hit Louisiana on August 30th, 2005.

The New York Times and The Washington Post made up the majority of the recorded instances of the quantitative fact on the storm category. The Washington Post had at least one article for all but one category (e.i.; hurricane categories one through five), and three articles for category 4, making it the newspaper with the widest variation. In The New York Times, on the other hand, following a timeline from earliest to latest release of the articles, the categories fluctuated between 4 and 5 as the storm traveled over the gulf, and as it made landfall going into the month of September. Overall, the number of values reported for the category rating for the storm followed a pattern that would be expected of a newspaper reporting regularly on the evolving conditions related to an incoming major storm.

The newspapers that report on the cost of the hurricane damage in the sample of articles placed the dollar amount within a wide range. Two articles, one from The Atlanta Journal-Constitution and another from The New York Times specifically referred to the cost for Florida at between \$9 - 16 billion dollars. Concerning the hurricane entirely, the New York Daily News quoted up to \$30 billion dollars of damage. On the high end The Philadelphia Inquirer had an article stating an estimate of \$100 billion in damages, and The Atlanta Journal-Constitution, though it had the lowest quote, also had the highest at \$200 billion dollars of damage. Interestingly, both The Atlanta Journal-Constitution articles were written at least in part by the same author.

Topic 4: Iraq War 2003

The Iraq War began in 2003 as part of a military campaign against terrorism, a response after the events of September 11, 2001 in New York and Washington DC.

In regards to the number of troops, 17 articles across seven of the ten selected newspapers mentioned the quantitative fact. The estimates varied from 130,000 troops to as much as 350,000. The USA Today articles had the widest variation from one article to another with one estimate of 130,000 troops and another at 350,000 troops. The New York Times followed with the largest number of references to the number of troops, which similarly to USA Today, ranged from 130,000 to 300,000.

Similar to the reporting on the number of troops, articles that mentioned the war and post-occupational costs produced a wide variation. The lowest estimate came from the Tampa Bay Times, which reported the cost between \$47 - 67 billion dollars. The New York Times had the most articles, quoting from \$87.5 billion dollars to \$120 - 200 billion dollars. However, the widest variation came from The Atlanta Journal-Constitution, with a low figure of \$87 billion to \$100 - 500 billion dollars.

Topic 5: Presidential Election 2000

The 2000 presidential election was contested for several weeks after the election, specifically in regards to ballots in Florida, and required intervention by the Supreme Court to ultimately declare the victor George W. Bush over Al Gore.

As was the case with reporting on Hurricane Katrina's hurricane category, the reporting on disputed ballots followed a similar trend in where it simply followed the latest updates from ballot officials. Following the timeline of developments after the

Election Day, a pattern developed where the disputed ballot count reduced as more and more are reviewed each day.

Looking into the data on the vote count and by how much one candidate was in the lead over the other, the variation between the low vote count and the high vote count ranged between a 327 vote lead to a 1,784 vote lead by Bush. Again a similar pattern across the timeline emerged where the count was large immediately after Election Day, yet diminished significantly by mid-November.

Topic 6: Presidential Election 2008

The Presidential Election of 2008 came down to Barrack Obama representing the Democratic Party, and John McCain representing the Republican Party.

In total, 22 articles referenced at least one poll estimating which of the two candidates held the lead leading up to the election. The poll results varied, but a subtle trend emerged. The articles covered a timeline from June 15th to November 5th, 2008, one day after the election. The polls came from a wide variety of sources (e.g.; Rasmussen Florida poll, Fox News/Rasmussen Florida poll, The Tampa Bay Times/News 9/Miami Herald Florida poll, Florida Chamber, Of Commerce poll, Allstate/National Journal poll, Reuters/Zogby Florida poll, etc.).

The variation in the polls ranged from a low of 43 to a high of 51 for Obama, and a low of 41 and high of 51 for McCain, with the margin of error at 3 points. As the months passed the lead that began with McCain began to shift to Obama. One Atlanta Journal-Constitution article at the end of October referenced three polls, each showing McCain in the lead, two showing him beyond the margin of error. Just five days earlier on October 20th, The Tampa Bay Times, Bay News 9, and Miami Herald

Florida collaborated on a poll showing Obama in the lead with 49 points versus McCain's 42. These fluctuations across different polls in different newspapers showed a high level of variability, with variation in poll results showing a low at 41 and high at 51.

In this case, as the candidates campaigned and raised money leading up to the election so would the estimates provided by the newspapers from article to article across time.

Topic 7: Wall Street Bailout of 2008

Formally known as The Emergency Economic Stabilization Act of 2008, the Wall Street Bailout of 2008 was an attempt to curb the depth of the recession brought on by the housing crisis across the United States.

The cost of the bailout package appeared in 56 articles out of the 100 analyzed. The articles overwhelmingly reported the same figure of \$700 billion dollars, which is somewhat surprising since that is what the Bush Administration proposed. The Washington Post had one article suggesting the cost would be \$750 billion dollars, and The Tampa Bay Times had one article stating, \$850 billion dollars. The high figure came from an article stating that the House of Representatives rejected a bill for \$850 billion dollars.

When it came to analyzing quantitative facts regarding the amount, in billions of dollars, needed to bailout Detroit automakers, of the 100 analyzed articles, eight mentioned the quantitative fact. The Wall Street Journal was the only newspaper with multiple articles, five to be exact. From The Wall Street Journal, the variation in the quantitative facts ranged from at least \$25 billion to \$25 - 50 billion dollars. The

estimates from The Wall Street Journal crept up slowly from the first article in mid-November (\$25 billion dollars) through to mid-December (\$34 billion dollars).

Though variability was present in the order by which the articles were published, the variation in the reported quantitative facts was narrow. The Washington Post had the lowest number, quoting the automakers bailout at \$15 billion dollars.

The presence of variation in the reporting of the same facts across different newspapers may be explained by the following reasons. If reporters are seeking answers to the same questions from different sources, each with their own unique interpretation of the topic, it is quite possible that reporters may be given different answers (e.g.; Different economists might use different theories or data analysis approaches that apply similarly to the same topic, yet produce different results). It is possible that reporters may choose to frame an article by presenting a more conservative or a more exaggerated estimation of the quantifiable facts in the story to promote a particular position. Some facts change as the story develops and through no fault of the reporter or the newspapers, yesterday's facts may no longer apply to the following day's situation and must be updated in upcoming stories (e.g.; a weekly poll on candidates leading up to an election, or changes to proposed legislation that can impact taxpayer cost estimates).

Future Work

The topic selection process does not necessarily meet the methodological standards needed for a more complex dive into the analysis of quantitative facts. It is important to consider a method of gathering topics that is neutral and considers the most popular national news using a standardized scale. A script may be created to

scrape the internet for news and retrieve only filtered results based on pre-set parameters. The script may filter through newspaper websites and retrieve items such as most viewed or shared articles pages on social media sites, most linked to articles from third party sites, among other criteria. Also, the script can provide information about these articles, and a simple review can help identify key markers. A process of elimination using a script and summary review of the results can provide a better, and more neutral selection of the newspaper topics.

Further progress in this research area can also be made by applying a better coding process for review of the newspaper articles. An automated process may provide an easier method of sorting out quantitative facts, and eliminate the potential for human error during the article review. Using a method with regular expressions, for example, may allow for the collection of a higher number of instances of the targeted quantitative facts from a larger number of newspapers articles, which may better stand statistical scrutiny. And finally, a more thorough qualitative analysis using proper content analysis methods could provide deeper insights to complement the quantitative analysis.

Conclusion

The study aimed to analyze variability in reporting of quantitative facts in newspaper reporting of important national topics across the top ten newspapers in the United States based on circulation, and identify whether the variability was statistically significant and worth qualitative analysis. Prior studies have identified potential reasons for the rise of variability in newspaper reporting, but none attempted to dissect the factors that contribute to the variability. The study found that, yes, variability in newspaper reporting is statistically significant, and the qualitative analyses found that each topic has its own unique reasons for variability. However, variability is also present simply as a byproduct of circumstances such as changing weather conditions, shifting popularity between two political candidates, or new information drastically alters the course of the topic.

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