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OCTOBER 2016

Internet shutdowns cost countries $2.4 billion last year

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INTRODUCTION

In 2011, Egyptian authorities were worried about street protesters who were demonstrating against the government. Seeking to disrupt their communications and ability to attract supporters, officials there shut down the entire internet for five days. The damage was swift and dramatic. Businesses could not engage in e-commerce or provide digital products and services. Friends and family couldn't communicate with one another. Students were unable to complete online assignments and teachers couldn't plan their lessons. Hospitals and factories lost access to online information, thereby undermining productivity and potentially costing jobs and lives.

In the aftermath of the shutdown, the Organization for Economic Development and Cooperation (OECD) found that the decision to cut connectivity cost Egypt $90 million. If continued for an entire year, the shutdown would have reduced the country's Gross Domestic Product by three to four percent.[1]

These results underscore the importance of the internet to the functioning of modern economies. For example, a 2015 Internet Association report found that the web generates around $966 billion in the United States, or about six percent of the entire economy.[2] In addition, according to a 2012 TechNet study, the app economy is responsible for 466,000 jobs in the United States.[3]

Around the world, digital technology is seen as vital for economic development. A 2012 World Bank analysis found "a ten percentage point increase in fixed broadband generating a 1.35% increase in per capita GDP for developing countries and a 1.19% increase for developed countries."[4] Since then, developing nations have become even more reliant on the internet and digital technology has expanded its role in the overall economy.

The centrality of the internet to social and economic life recently led the United Nations to enact a resolution supporting the "promotion, protection and enjoyment of human rights on the Internet"[5].

The resolution specifically "[c]ondemns unequivocally measures to intentionally prevent or disrupt access to or dissemination of information online in violation of international human rights law and calls on all States to refrain from and cease such measures."[6]

Yet powerful forces continue to threaten the vitality of the internet. In recent years, a number of countries have blocked particular applications, shut down specific services (e.g. instant messaging and voice over internet protocol calling), turned off mobile telecommunications services, or disrupted the entire internet. Those actions separate people from their family, friends, and livelihoods, undermine economic growth, interfere with the startup ecosystem, and threaten social stability by interrupting economic activity.

The growing scope of internet disruptions is creating significant detrimental impacts on economic activity in a number of nations around the world.

In this paper, I analyze the economic impact of temporary internet shutdowns. I examine 81 short-term shutdowns in 19 countries over the past year (see Appendix for news stories describing these shutdowns); identify their duration, scope, and the population affected; and estimate their impact on Gross Domestic Product (GDP). Based upon this analysis, I find that between July 1, 2015 and June 30, 2016, these shutdowns cost at least US$2.4 billion in GDP globally.

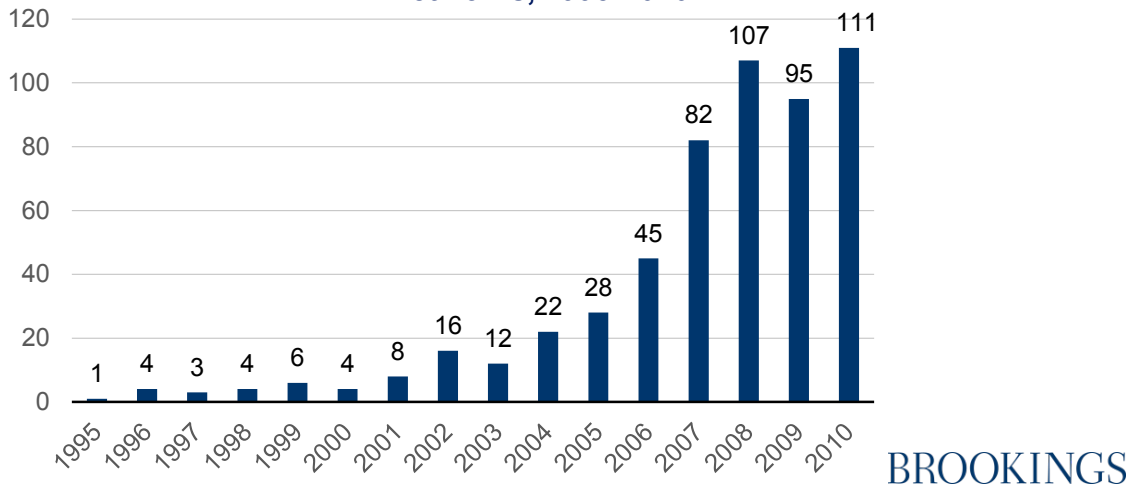
Economic losses include $968 million in India, $465 million in Saudi Arabia, $320 million in Morocco, $209 million in Iraq, $116 million in Brazil, $72 million in the Republic of the Congo, $69 million in Pakistan, $69 million in Bangladesh, $48 million in Syria, $35 million in Turkey, and $20 million in Algeria, among other places. These are conservative estimates that consider only reductions in economic activity and do not account for tax losses or drops in investor, business, and consumer confidence.

The growing scope of internet disruptions is creating significant detrimental impacts on economic activity in a number of nations around the world. As the digital economy expands, it will become even more expensive for nations to shut down the internet. Without coordinated action by the international community, this damage is likely to accelerate in the future and further weaken global economic development.

TRENDS IN THE NUMBER OF INTERNET DISRUPTIONS

There is a rising trend of governments disrupting the internet. A study by University of Washington researchers Phil Howard, Sheetal Agarwal, and Muzammil Hussain identified 606 occasions between 1995 and the first part of 2011 where 99 different governments deliberately "interfered" with the normal operation of the internet.[7] Figure 1 depicts this trend. Whereas there was a single disruption in 1995 and four in 1996, the number rose to 111 in 2010.

Figure 1: Number of Government Interferences with Digital Networks, 1995-2010



Source: Philip Howard, Sheetal Agarwal, and Muzammil Hussain, "The Dictators' Digital Dilemma: When Do States Disconnect Their Digital Networks?" Brookings Issues in Technology Innovation, October, 2011

According to Howard and his colleagues, government officials give many reasons for ordering these disruptions: safeguarding government authority, reducing public dissidence, fighting terrorism, maintaining national security, or protecting local businesses, among others. Governments are using real or perceived threats to stability, political power, or local economic interests to justify disruptions. Indeed, disruptions have become increasingly common as a response to domestic circumstances.

For example, between March 12 and 23, 2015, Pakistan shut down mobile telecommunications services due to government concern about "Pakistan Day," the country's parade celebrating the 1940 Lahore agreement which led to the creation of the state.[8] All mobile operators were told by national authorities to "shutdown mobile communications within a 5km radius of the parade site." This move affected a major hospital, an airport, and businesses near Islamabad.

In the spring of 2015, after the ruling party put forward President Pierre Nkurunziza for a third term, Burundi blocked WhatsApp and Viber. The shutdown was ostensibly aimed at preventing protesters who were upset with this decision from communicating with one another and organizing street demonstrations. Two years earlier, the country had enacted a Press Law that censored traditional news coverage and required journalists to disclose their sources, and these practices have now spread to digital infrastructure.[9]

In another instance, in the fall of 2015, Turkey blocked Twitter and Facebook in response to concern over the spread of images of a terrorist bombing of a public rally. Government officials justified this action by asserting that showing graphic images would "create a feeling of panic" among the general population.[10] Ironically, in 2016, when the Turkish military attempted a coup, President Recep Tayyip Erdogan used an internet-based video call (which was re-broadcast on national television) to ask his supporters to take to the streets and thereby help him save his regime.[11]

Judges in Brazil have blocked access to WhatsApp several times in the past year in response to legal disputes with the company over law enforcement access to encrypted user data (to which the company had no access). These actions, stemming from prosecutors' interest in a handful of users, effectively cut off tens of millions of Brazilians from their friends, family, and businesses.

India this year joined the ranks of countries, including Uganda, Algeria, and Iraq, that have disrupted internet services in response to concerns over students cheating on exams. An Indian official said, "considering the sensitive nature of the exam for recruitment of talents, internet service providers have been asked to shut down all internet-based social media services from 9 am to 1 pm to prevent the misuse of mobiles during the exam."[12] In many other instances, regional Indian officials also ordered disruptions in response to public security concerns.

> Governments are using real or perceived threats to stability, political power, or local economic interests to justify disruptions.

From these and numerous other examples in this study, it is clear that over the last year, state interference with internet services is becoming more common, even in democratic states.

INTERNET DISRUPTIONS OVER THE PAST YEAR

To determine how many times disruptions have happened in the past year, I collected cases from internet searches, English-based news outlet coverage, and lists compiled by non-profit organizations that track such disruptions. I looked for evidence of the following conditions: temporary shutdowns of the entire internet (nationally or locally), temporary shutdowns of the mobile internet (nationally or locally), and temporary blocking of specific applications and/or services (nationally or locally).

Table 1 shows the total number of temporary disruptions by country from July 1, 2015 through June 30, 2016. Overall, there were 81 disruptions in 19 countries during this period. This includes 22 in India, 22 in Iraq, 8 in the non-ISIS-controlled parts of Syria, 6 in Pakistan, 3 in Turkey, and 2 each in Bangladesh, Brazil, North Korea, Republic of the Congo, Uganda, and Vietnam, among other places.

Table 1: Number of internet shutdowns by country

Country	Number of Instances
India	22
Iraq	22
Syria (non-ISIS areas)	8
Pakistan	6
Turkey	3
Bangladesh	2
Brazil	2
North Korea	2

Republic of Congo	2
Uganda	2
Vietnam	2
Algeria	1
Bahrain	1
Chad	1
Ethiopia	1
Libya	1
Morocco	1
Saudi Arabia	1
Syria (ISIS areas)	1
Total Instances	81

This analysis is similar to research undertaken by other organizations. For example, the non-profit Freedom House undertook a study of social media blockages, content blockages, and local or national ICT shutdowns in 2015. Its "Freedom on the Net" report called out 15 nations that blocked social media or communications apps and 7 that shut down the internet either locally or nationally.[13]

I identified six categories of disruptions: national internet, subnational internet, national *mobile* internet, subnational *mobile* internet, national app/service, and subnational app/service (including VoIP). As shown in Table 2, the most frequent were national internet shutdowns, followed by subnational mobile internet, national app/service, subnational internet, national mobile internet, and subnational app/service disruptions.

Table 2: Types of internet shutdowns

Type	Number of Instances
National internet	36
Subnational mobile	22
National apps/services	14
Subnational internet	7
National mobile	1
Subnational apps/services	1

MEASURING THE ECONOMIC IMPACT OF INTERNET SHUTDOWNS

Computing the economic impact of these disruptions is a complex undertaking. Apart from the OECD study cited above, there have been very few publications examining the economic impact of internet disruptions, in part due to the challenges in identifying disruptions and collecting relevant economic data.

For this study, I relied on several types of information. For each incident, I identified the size of the country's GDP (using 2014 World Bank data), the duration of the disruption (in number of days), and the percentage of the population affected by the disruption. I further examined whether each disruption was of the entire internet, the mobile internet, or of specific applications and services such as social media, search, video, or messaging platforms.

To examine the economic impact of complete national internet shutdowns, I considered the percentage of each country's GDP derived from the internet economy, based on Boston Consulting Group (BCG) projections for 2016.[14] In its study, BCG compiled data on internet expenditures and investments, and found they constituted 12.4 percent of the United Kingdom's GDP, compared to 8 percent in South Korea, 6.9 percent in China, 5.6 percent in India and Japan, 5.4 percent in the United States, 4.2 percent in Mexico, 4 percent in Germany, 3.8 percent in Saudi Arabia, 3.7 percent in Australia, 3.6 percent in Canada, 3.5 percent in Italy, 3.4 percent in France, 3.3 percent in Argentina, 2.8 percent in Russia, 2.5 percent in South Africa, 2.4 percent in Brazil, 2.3 percent in Turkey, and 1.5 percent in Indonesia.[15] The overall average for developing nations was 4.9 percent.

I also analyzed the financial impact of turning off mobile services. Based on data from the World Bank, I compiled information on mobile subscription percentages in each nation.[16] This provides us with an indicator for the importance of mobile networks in each country.

There have been very few publications examining the economic impact of internet disruptions, in part due to the challenges in identifying disruptions and collecting relevant economic data.

For the economic analysis of specific apps and services, I relied on research by MIT economists Erik Brynjolfsson and JooHee Oh. They studied 2013 use of free services such as Google, Facebook, Twitter, YouTube, WhatsApp, and Wikipedia in the United States and found that reliance upon these apps added 0.23 of one percent to national GDP.[17] Since these services have grown substantially since then, the impact very well could be higher in today's economy.

Finally, 2009 work from Professor John Quelch of the Harvard Business School has documented that there is a 1.54 multiplier effect for internet jobs and services.[18] This likely underestimates the impact since the importance of the internet has risen since then. He looked at the economic value of the internet as measured by advertising services, online retail transactions, and payments to internet service providers, and estimated that "each internet job [and payments] supports approximately 1.54 additional jobs elsewhere in the economy." Accordingly, I added that multiplier effect to the direct economic costs in order to gauge the total economic impact of an internet disruption.

Based on these data, I estimated economic impact for six different types of digital shutdowns using the following formulas:

> ***National Internet Shutdown Costs*** = *National GDP * Duration (measured as percent of the year based on number of days the Internet was shutdown) * Extent of Digital Economy (measured by the percentage of that nation's economy derived from the digital economy) + the multiplier effect of the disrupted digital economy*
>
> ***Subnational Internet Shutdown Costs*** = *National GDP * Duration (measured as percent of the year based on number of days the Internet was shutdown) * Extent of Digital Economy (measured by the percentage*

*of that nation's economy based on the digital economy) * Extent of Population Affected (measured by the percentage of the country that is in the neighborhood, city, or state affected by the shutdown) + the multiplier effect of the disrupted digital economy*

***National Mobile Shutdown Costs** = National GDP * Duration (measured as percent of the year based on number of days the Internet was shutdown) * Extent of Digital Economy (measured by the percentage of that nation's economy based on the digital economy) * Extent of Mobile Penetration (measured as the percentage of the country having mobile subscriptions) + the multiplier effect of the disrupted digital economy*

***Subnational Mobile Shutdown Costs** = National GDP * Duration (measured as percent of the year based on number of days the Internet was shutdown) * Extent of Digital Economy + the multiplier effect of the digital economy (measured by the percentage of that nation's economy based on the digital economy) * Extent of Population Affected (measured by the percentage of the country that is in the neighborhood, city, or state affected by the shutdown) * Extent of Mobile Penetration (measured as the percentage of the country having mobile subscriptions) + the multiplier effect of the disrupted digital economy*

***National Free App Shutdown Costs** = National GDP * Duration (measured as percent of the year based on number of days the Internet was shutdown) * Free Digital App GDP Impact (measured by Erik Brynjolfsson and JooHee Oh at 0.23 of one percent of national GDP)[19] + the multiplier effect of the disrupted digital economy*

***Subnational Free App Shutdown Costs** = National GDP * Duration (measured as percent of the year based on number of days the Internet was shutdown) * Extent of Population Affected (measured by the percentage of the country that is in the neighborhood, city, or state affected by the shutdown) * Free App GDP Impact + the multiplier effect of the disrupted digital economy*

THE IMPACT ON GROSS DOMESTIC PRODUCT

In Table 3, I show the total economic impact of internet disruptions, both in terms of number of days and total GDP lost. Overall, these disruptions cost countries a total of at least US$2.4 billion over the past year, with impact ranging from US$968 million in India to US$313,666 in North Korea. Leading examples of countries that lost money included US$968 million in India, US$465 million in Saudi Arabia, US$320 million in Morocco, US$209 million in Iraq, and US$116 million in Brazil. These disruptions lasted 753 days in total across all countries.

Table 3: Economic costs of internet shutdowns by country

Country	Number of Days	Total Dollar Costs
India	70.54	$968,080,702
Saudi Arabia	45	$465,280,632
Morocco	182	$320,456,034
Iraq	2.75	$209,578,705
Brazil	5	$116,038,230
Republic of Congo	15	$72,514,694
Pakistan	3.83	$69,769,394

Bangladesh	25	$69,178,309
Syria (ISIS areas)	348	$47,945,886
Turkey	2.75	$35,142,917
Algeria	6	$20,504,794
Vietnam	4	$11,921,178
Ethiopia	30	$8,539,355
Syria (non-ISIS areas)	0.60	$8,323,938
Chad	1	$3,712,931
Uganda	5	$2,160,617
Bahrain	8	$1,246,616
Libya	0.04	$414,194
North Korea	0.29	$313,666
Total	753	$2,431,122,803

Table 4 breaks down costs by the type of disruption. The most costly were disruptions of specific apps and services ($1.04 billion), followed by subnational mobile internet ($934.6 million), national internet ($294.9 million), subnational internet ($91.5 million), national mobile internet ($60.9 million), and subnational disruptions of specific apps and services ($8.5 million).

Table 4: Economic costs of internet shutdowns by type

Shutdown Type	Number of Days	Total Dollar Costs	Number of Instances
National App	272.75	$1,040,682,715	14
Subnational Mobile	65.97	$934,621,861	22
National Internet	19.70	$294,861,053	36
Subnational Internet	363.45	$91,526,656	7
National Mobile	1	$60,894,082	1
Subnational App	30	$8,539,355	1

NOTABLE DISRUPTIONS

There have been a number of notable internet disruptions. One took place in Saudi Arabia in May 2016. Citing economic damage to telecommunications providers, the government blocked functionality of a number of apps related to VoIP, texting, and instant messaging; those impacted included WhatsApp, Facebook Messenger, and Skype, among others. Local news sources noted that "the free internet messenger and call services are failing to comply with the telecom regulations in the Kingdom…. Loss of revenues by the telecom operators in the Kingdom is cited as the main reason to put constraints on the use of internet voice calls."[20] Overall, the move cost the country US$465 million in GDP.

Morocco incurred US$320 million in economic damage beginning on January 1, 2016. VoIP functionality of services such as Skype, Viber, Tango, WhatsApp, and Facebook Messenger was blocked nationwide. The Moroccan regulatory authority ANRT blocked these services on the grounds that "the free internet voice calls do not respond to the required legal gateway."[21]

India shut down mobile internet services in Rohtak on February 19, 2016 in response to street demonstrations in Rohtak and Jhajjar. The disruption lasted more than a week and cost US$190 million. Law enforcement officials explained that "this has been done so that rumours are not spread as this could lead to the situation getting out of hand."[22]

A local Brazilian judge ordered telecommunications companies to block access to WhatsApp on May 2, 2016 following an earlier shutdown in December 2015. The May shutdown blocked access to the predominant communications service across the country for a day and cost the Brazilian economy US$39 million. Judge Marcel Maia Montalvao of Sergipe did not explain his decision, but ordered five wireless operators to keep the app's 100 million users from accessing call and messaging services.[23]

CONCLUSIONS

In sum, government officials in many countries around the world appear increasingly comfortable blocking access to online services and apps, despite the significant economic and social damage that internet service disruptions bring to their countries. Whether their ostensible motivations are public security or political self-preservation, government officials should understand the wide-ranging and destructive consequences of these moves. Shutting down access to popular services or to the whole internet – even for a short period of time – undermines economic growth, puts lives in jeopardy, separates people from friends and family, and erodes confidence in the governments that take such drastic and ill-advised steps.

It is important to point out that this analysis only looked at the economic impact on Gross Domestic Product. It did not include estimates for lost tax revenues associated with blocked digital access, impact on worker productivity, barriers to business expansion connected with these shutdowns, or the loss of investor, consumer, and business confidence resulting from such disruptions. As such, the $2.4 billion figure is a conservative estimate that likely *understates* the actual economic damage.

> As long as political authorities continue to disrupt internet activity, it will be difficult for impacted nations to reap the full benefits of the digital economy.

Also of note, the tracking and monitoring of government-ordered internet disruptions is very difficult and publicly available data are likely incomplete. Given the nature and complexity of the internet, it is often difficult even for technical experts and internet companies to understand exactly what is causing a localized traffic anomaly. In addition, in some cases governments may have an incentive to claim that certain disruptions are the result of technical errors or infrastructure failure, rather than intentional government actions. Consequently, there is a need for both more research in this areas and more investment in technology and organizations to independently track and monitor such disruptions.

Most of the documented shutdowns we were able to identify were in the developing world. If there were a temporary shutdown of the internet in a developed economy, the economic damage would be enormous. For example, the United States currently has a Gross Domestic Product of US$18.438 trillion, six percent of which is derived from the internet sector.[24] If there were a national internet outage for one week (or 1.9% of the year), that would reduce economic activity by at least US$54.1 billion. And if that outage lasted an entire year, the economic costs would be at least US$2.8 trillion.

From this analysis, it is clear that the growing scope of internet disruptions is impeding a significant amount of economic activity in a number of nations around the world. Apart from disrupting lives and families, it is weakening overall economic development and exacerbating the plight of small and medium-sized businesses in these countries. As long as political authorities continue to disrupt internet activity, it will be difficult for impacted nations to reap the full benefits of the digital economy.

Every year, more and more consumers and businesses are engaging in e-commerce and online transactions. Internet disruptions slow growth, cost governments tax revenue, weaken innovation, and undermine consumer and business confidence in a country's economy. As internet-powered businesses and transactions continue to grow to represent an increasingly significant portion of global economic activity, the damage from connectivity disruptions will become ever more severe.

APPENDIX: NEWS STORIES ABOUT INTERNET SHUTDOWNS

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ENDNOTES

Note: I would like to thank Hillary Schaub, Jacob Lineberry, and Grant Michl for their outstanding research assistance. Niam Yaraghi offered valuable comments on this paper.

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