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Very Preliminary

**404 Not Found:
The Internet and International Trade***

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Abstract

The internet is widely believed to make cross-border business easier, thereby increasing the volume of international trade. This paper aims to provide evidence in support of this stylized fact which is typically difficult to identify empirically. Specifically, I use the country-wide internet blackout in Tonga in January 2019 as a natural experiment to examine the effect of the internet on trade. Analyzing monthly trade data for Tonga over the period from 2014 to 2019, I find an economically and statistically sizable, temporary decline in trade when the country's internet connectivity was lost. Consequently, the damage of sudden disruptions in the existing technological infrastructure in terms of foregone trade may be indeed sizable.

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1. Introduction

For decades, if not centuries, technological advances have been a major driver of the expansion of world trade. Inventions such as the railroad, the steamship, and the container have dramatically reduced transportation costs; new technologies like the telegraph and the internet have made communication speedier and cheaper. Overall, improvements in technology have allowed for greater economic integration, thereby making the world a smaller place.

While it seems obvious, however, that technological progress has contributed to the growth in world trade, the effect of individual innovations is hard to identify empirically. In particular, it is difficult to distinguish the effect of a new technology from other confounding trends during that period. In fact, it is even possible to make a strong antitechnology case, as argued by Krugman (1995, p. 341), who notes that: “[i]t is clear that the volume of world trade is not completely determined by technology: transportation and communication technology were considerably better in 1950 than they were in 1913, but the world economy was substantially less integrated.”

Despite these challenges, there have been a number of studies attempting to estimate the effect of a new technology on trade. These studies often use large panel data sets exploiting the variation in the adoption and diffusion of a new technology across space and over time. Bernhofen, El-Sahli, and Kneller (2016), for example, analyze the effects of containerization on trade by identifying, in a sample of 157 countries over the period from 1962 to 1990, the trading partners’ first recorded use of either containerized seaports or inland railway container facilities. Other studies examine in detail the effects of a new technology at the time of adoption which may provide a useful historical experiment, dependent on circumstances. Focusing on the role of information flows, for instance, Steinwender (2018) analyzes the effects of the establishment of the transatlantic telegraph in 1866 on cotton exports from New York to Liverpool.

Examining the effects of technological change on trade, most studies tend to focus on improvements in transportation technology. Key innovations in the physical movement of goods for which sizable trade effects have been documented include, among others, marine steam propulsion (Harley, 1988; Pascali, 2017) and containerization (Bernhofen, El-Sahli, and Kneller, 2016; Coşar and Demir, 2018; Ducruet, Juhász, Nagy, and Steinwender, 2024). Much less evidence, in contrast, is available for the effects of technological breakthroughs in information and communication technologies. Moreover, findings that new technologies for connecting people and devices induce greater trade integration are often based on indirect

evidence. Online trading platforms, for instance, seem to benefit particularly trade between more distant partners; transactions at online marketplaces, such as eBay, are less sensitive to geographic distance than offline commerce (Hortaçsu, Martínez-Jerez, and Douglas, 2009; Lendle, Olarreaga, Schropp, and Vézina, 2016). The availability of flight links, allowing easier face-to-face interaction, is typically found to be associated with tighter business connections (Cristea, 2011; Campante and Yanagizawa-Drott, 2018).

In this paper, I examine the trade effect of the arguably most disruptive technological innovation for the exchange of information, the internet.¹ Freund and Weinhold (2002, 2004) provide, in a series of papers, an early empirical assessment of the role of the internet for international trade. Analyzing the patterns of trade for a large set of countries over the period from 1995 to 1999, they find a positive correlation between a country's number of internet hosts and its trade in goods and services in both growth rates and levels. In a slightly more general approach, Fink, Mattoo, and Neagu (2005) examine the effect of bilateral telecommunications prices on trade. Similar to Freund and Weinhold (2002, 2004), they estimate a gravity model of trade and find that, in 1999, higher calling prices are associated with lower trade values.

I deviate from this work, apart from using more recent data, along various lines. Instead of looking for a proxy for internet penetration in a broad cross-section of countries, I examine the experience of a single country which was accidentally shut off from the internet for an extended period of time. In particular, it is argued that the internet blackout in Tonga from January 20, 2019 to February 2, 2019, caused by a break of the underwater fiber-optic cable that connects the island nation to high-speed internet, provides a unique experiment to estimate how the internet affects international trade. Moreover, since Tonga is a small, poor and remote country, which is not integrated in global value chains, this episode is likely to provide a lower bound estimate of the effect of the internet on cross-border trade.

Previewing the empirical results, I find a substantial decline in Tonga's external trade in the first quarter of 2019.

The remainder of the paper is structured as follows. Section 2 provides some background on the episode that motivates the analysis. Section 3 describes the empirical strategy and data. Section 4 presents the main empirical results and various robustness checks. Finally, Section 5 briefly concludes.

¹ As Krugman (2011, p. 8) puts it: "When we think about technology that changed the world, we think about glamorous things like the internet."

2. Internet Blackout

With a population of 100,000, Tonga is one of the smallest countries in the world. It is also one of the most geographically remote countries. Located in the South Pacific Ocean, the territory consists, in total, of about 170 islands. Most of the activity, however, is concentrated on the main island, Tongatapu, which is home to about three quarters of the population and also hosts the capital city of the kingdom, Nuku'alofa.

Tonga essentially entered the digital age in August 2013, when a new 827km submarine fiber-optic cable linked the country to Fiji (and then on to Sydney and Hawaii via the South Cross Cable Network) and established a broadband internet connection.² Before that, the internet could only be accessed through expensive satellite links, a service available to only two percent of the population.³ With the new connection, in contrast, international bandwidth increased substantially. Also, prices fell dramatically. The World Bank, for instance, estimates that by July 2018 the average retail cost of broadband internet was reduced by 97 percent.⁴ More notably, taking advantage of the improved infrastructure, internet usage and international traffic increased sizably, far exceeding projected rates. Broadband service penetration rates, for instance, are estimated to have risen to about 50 to 60 percent by 2018.⁵

Tonga's connection to the internet abruptly ended on January 20, 2019. As it turned out, the underwater communications cable between Tonga and Fiji was severed multiple times probably by a ship dragging its anchor along the seabed. The service disruption was completely unexpected. A spokesperson of the Tonga government declares: "People didn't think it would come to this. We were actually given guarantees that the chances of damage like this happening was 0.001 percent." ⁶

Lacking the equipment for a quick repair, Tonga was left with low bandwidth satellite internet connections. These connections were only available at the headquarters of the two telecommunications companies in Nuku'alofa where people had to wait in line for limited-time access. Also, in an effort to preserve bandwidth for essential services, officials blocked sites like Facebook and YouTube. Overall, the internet was effectively no longer available for many cross-border economic activities of Tonga, from merchandise trade to financial

² The World Bank co-financed this project; see https://www.worldbank.org/en/news/press-release/2013/08/21/high-speed-broadband-goes-live-in-tonga?cid=EXT_TWBN_D_EXT.

³ See <https://www.worldbank.org/en/results/2019/09/16/closing-the-digital-divide-in-tonga>.

⁴ See <https://www.worldbank.org/en/results/2019/09/16/closing-the-digital-divide-in-tonga>.

⁵ See <http://documents.worldbank.org/curated/en/844361556573010769/pdf/Tonga-Pacific-Regional-Connectivity-Program-Project.pdf>.

⁶ See <https://www.radionz.co.nz/international/pacific-news/381580/internet-back-at-full-strength-in-tonga-after-2-week-blackout>.

transfers and tourism (e.g., flight reservations, hotel bookings). According to the president of Tonga's Chamber of Commerce, "[t]here was a lot of disruption. [...] Businesses had taken a significant hit. [...] A lot of the people that I've talked to, some of the suppliers couldn't get their orders out in time, regular orders didn't happen. Families were hit, too, with banking and money transfer agencies unable to process remittances coming into the country from abroad."⁷

Ultimately, Tonga's internet blackout lasted twelve days. After the arrival of the cable repair ship 'Reliance', the damaged fiber-optic cable was located at sea and work to splice the cable started. On February 2, 2019, the internet connection was fully restored. While satellite services were retained as a backup, early discussions began about the possibility of a second cable to connect Tonga.

3. Methodology and Data

The internet blackout affected Tonga in many ways, especially because of the economy's strong dependence on tourism. In this paper, however, I am particularly interested in one possible consequence, the effect of having no internet on international trade. Given its size and location, Tonga's integration with the rest of the world is generally low. According to the World Trade Organization (2019), Tonga ranks at 190 out of 197 trading nations on which they report trade figures in 2018. Also, Tonga is not participating in global value chains. The country's main export commodity, vegetable products, accounts for almost 70 percent of domestic exports. Still, trade seems to have been seriously affected by the sudden lack of access to internet. According to the Tonga agent for global freight company DHL, the first week of the outage created "major issues" for the company, noting that "[w]e could not send our shipments because we have to upload documents before they are put onto the plane."⁸

To examine the impact of the internet blackout on trade, I perform an event study analysis on monthly trade. In particular, I estimate regressions of the form:

$$(1) \quad \text{Trade}_{c,t} = \alpha_c + \text{Month-of-Year}_t + \text{Year}_t + \gamma \times \mathbf{1}(\text{Blackout}) + \varepsilon_{c,t},$$

where Trade is a measure of Tonga's trade with country c in month t , country fixed effects α_c absorb time-invariant differences in the levels of trade across countries, and time fixed effects

⁷ See <https://www.radionz.co.nz/international/pacific-news/381580/internet-back-at-full-strength-in-tonga-after-2-week-blackout>.

⁸ See <https://www.france24.com/en/20190205-learning-talk-again-life-without-internet-tonga>.

Month-of-Year and Year hold constant for seasonal and annual variation in trade. The main coefficient of interest is γ , which captures any systematic deviation in trade during the blackout period.

The main source of data is Tonga's International Merchandise Trade Statistics. Figure 1 plots Tonga's exports and imports in monthly frequency.

4. Results

[to be completed]

5. Conclusion

The internet is widely believed to make cross-border business easier, thereby increasing the volume of international trade. This paper aims to provide evidence in support of this stylized fact which is typically difficult to identify empirically. Specifically, I use the country-wide internet blackout in Tonga in January 2019 as a natural experiment to examine the effect of the internet on trade. Analyzing monthly trade data for Tonga over the period from 2014 to 2019, I find an economically and statistically sizable, temporary decline in trade when the country's internet connectivity was lost. Consequently, the damage of sudden disruptions in the existing technological infrastructure in terms of foregone trade may be indeed sizable.

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Figure 1: Trade of Tonga, 2014-2019

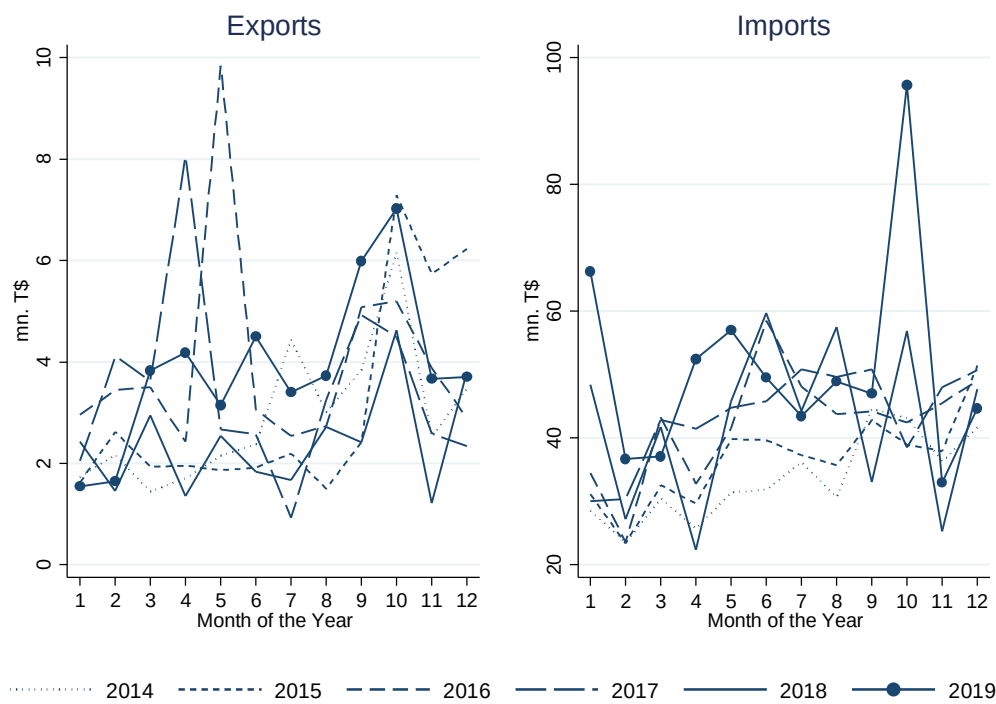


Figure 2: Map

