

The Great Upgrade

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Research Questions

COVID-19 has led to many firms to move towards online sales models. At the same time, margins to invest in digital solutions have narrowed due to liquidity constraints.

1. Describe website technologies and their adoption trends at the onset of the pandemic.
 - Which technologies were/are more commonly used, and how has the landscape evolved in 2020 across countries at different levels of development?
2. The timing of lockdowns predicts the diffusion of digital technology?
 - Adoption of which technologies has accelerated?
 - Can we identify anticipation effects?
 - Does it matter how we identify the shock?
3. Digital Divide across countries – convergence or divergence?
 - Absolute vs relative growth in adoption across technologies.

BuiltWith: The largest worldwide website database

Global Coverage

- Approx. every active website (213 million websites @ Dec 2019) across **177 countries**
- Consistent coverage for secure websites since 2018 ([https](https://))
 - *“Secure Certificate Transparency” - since April 2018 it is a Google Chrome requirement. Publicly available lists of secure websites.*

High frequency

- Web scraped every 2-4 weeks

Technology Records

- 7 major Categories: E-commerce, Epayments, Advertising, Analytics, Maps, Audio/video, Mobile functionality among others.
- Adoption = date technology first found on website

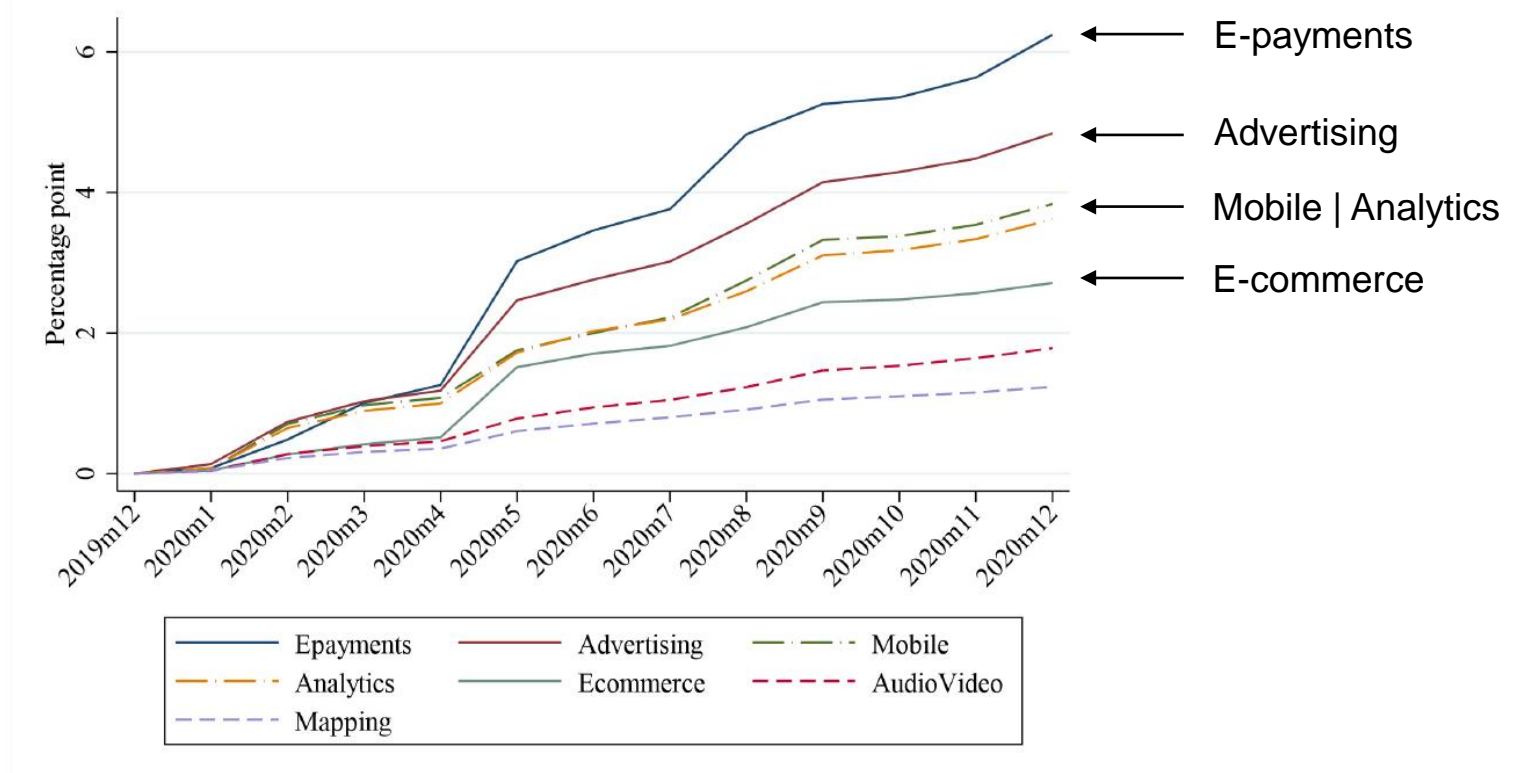
Caveats

- Map to countries – using top-level domains (.fr, .de), address & telephone, *US and “.com” websites dropped*
- Don't capture e-commerce only via platforms

Summary of findings

1. **Rapid growth of adoption of three types of technologies in 2020:** e-commerce, online payments, and digital advertising.
2. **Gaps in technology use across countries continued to widen:** Countries with the most intensive use in 2019 recorded faster percentage point growth in e-commerce, online payments or advertising
3. **The COVID-19 pandemic and the ensuing mobility restrictions appear to strongly predict the diffusion of digital technology.** Evidence of COVID-19 leading to increases in e-commerce and online payment diffusion, robust to a wide array of different estimation techniques and COVID-19-related restriction. No evidence of effect in anticipation of lockdowns.
4. **The shock appears to have accelerated divergence dynamics across countries:** stronger lockdown effects in countries with higher initial use of different functionalities.

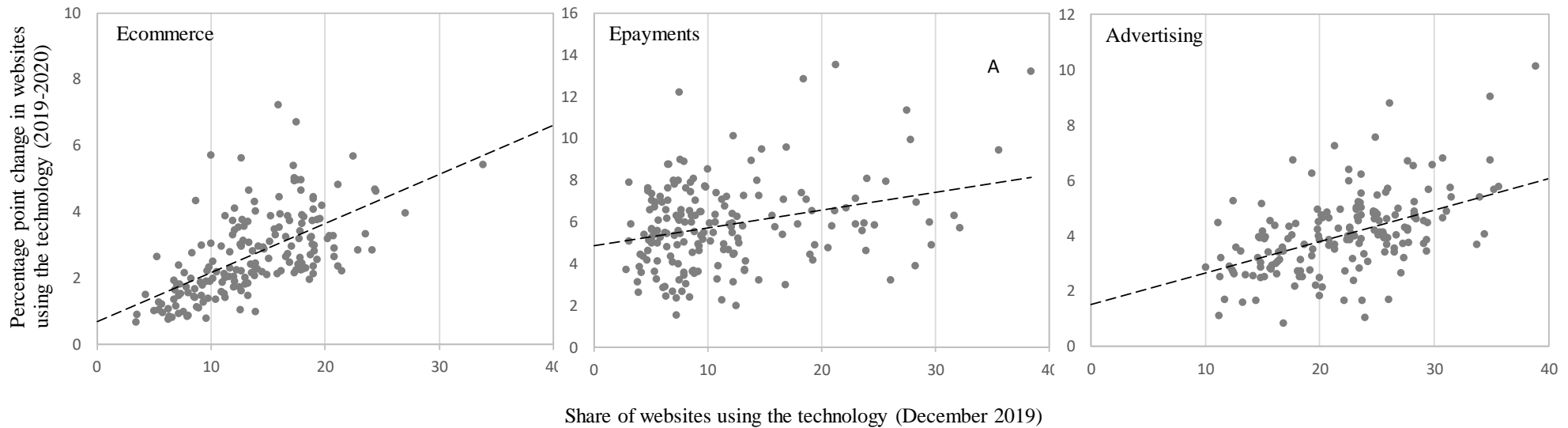
Technology Diffusion in 2020



Notes: Mean growth in technology adoption for a balanced panel of incumbent websites, that exist at December 2019 and December 2020. Technology adoption is normalized relative to December 2019, such that the figure shows the cumulative percentage point growth since December 2019. Values are calculated as a weighted average, where each country is weighted by the number of websites, equivalent to showing aggregate global usage.

Source: Authors' calculation using BuiltWith.

Laggard countries do not adopt digital technologies fast enough to catch up.



Empirical Approach

Staggered Treatment Event Study

- New-style difference-in-differences = Event study + Compare treated to not-yet treated (Callaway & Sant'Anna, 2021)
 - Event = First Covid lockdowns (until April 2020)
 - Countries without lockdowns are control group for countries imposing lockdowns

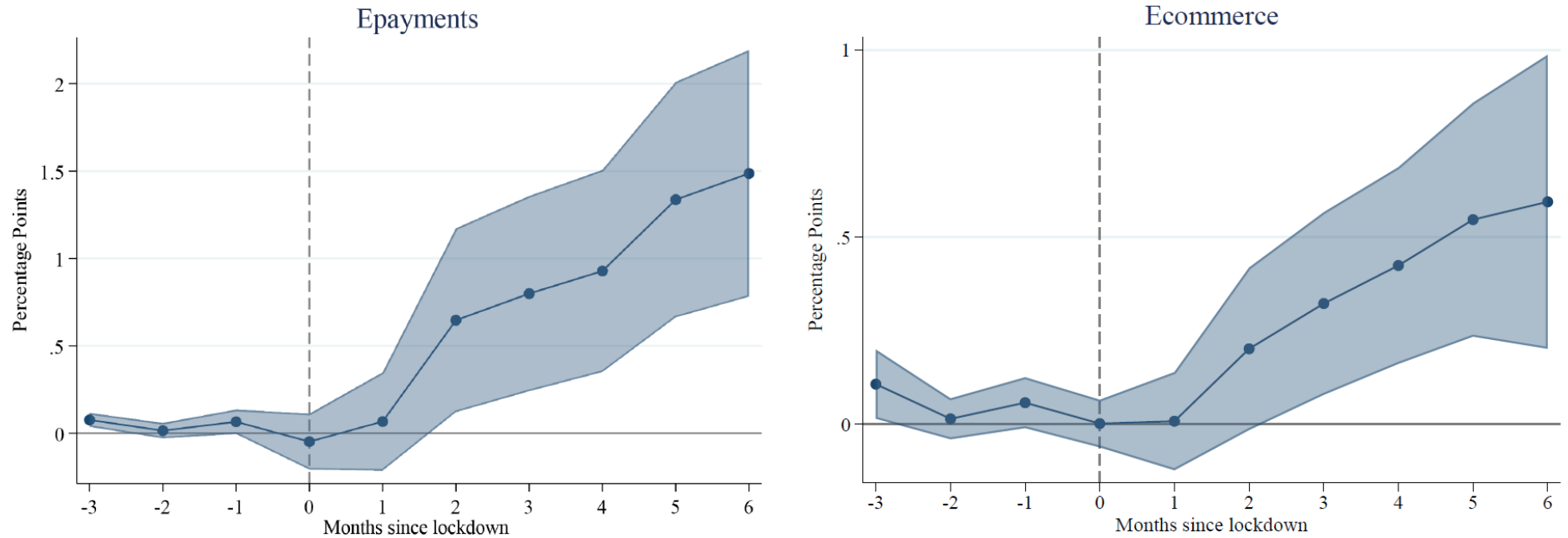
$$y_{it} = \gamma_i + \lambda_t + \sum_{l=-3, l \neq -1}^6 \hat{\beta}_l 1\{F_i = t - l\} + \varepsilon_{it}$$

y_{it} is the adoption rate in country i at month t ;

γ_i and λ_t are country and month fixed effects

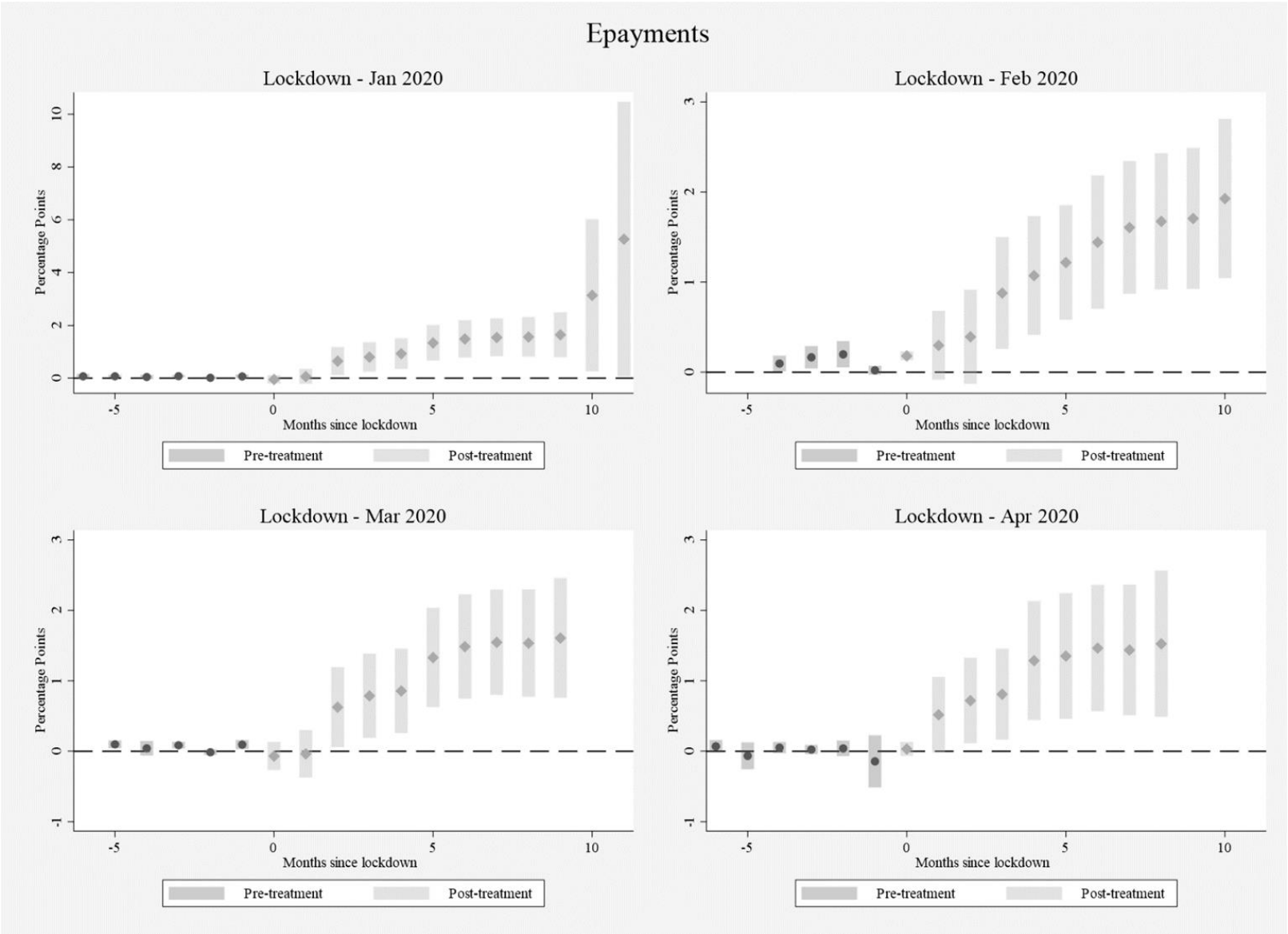
$\{F_i = t - l\}$ are a set of event time dummies equal to 1 when country i 's first lockdown is l months ago.

COVID-19 lockdowns predicts faster diffusion of tech for online transactions

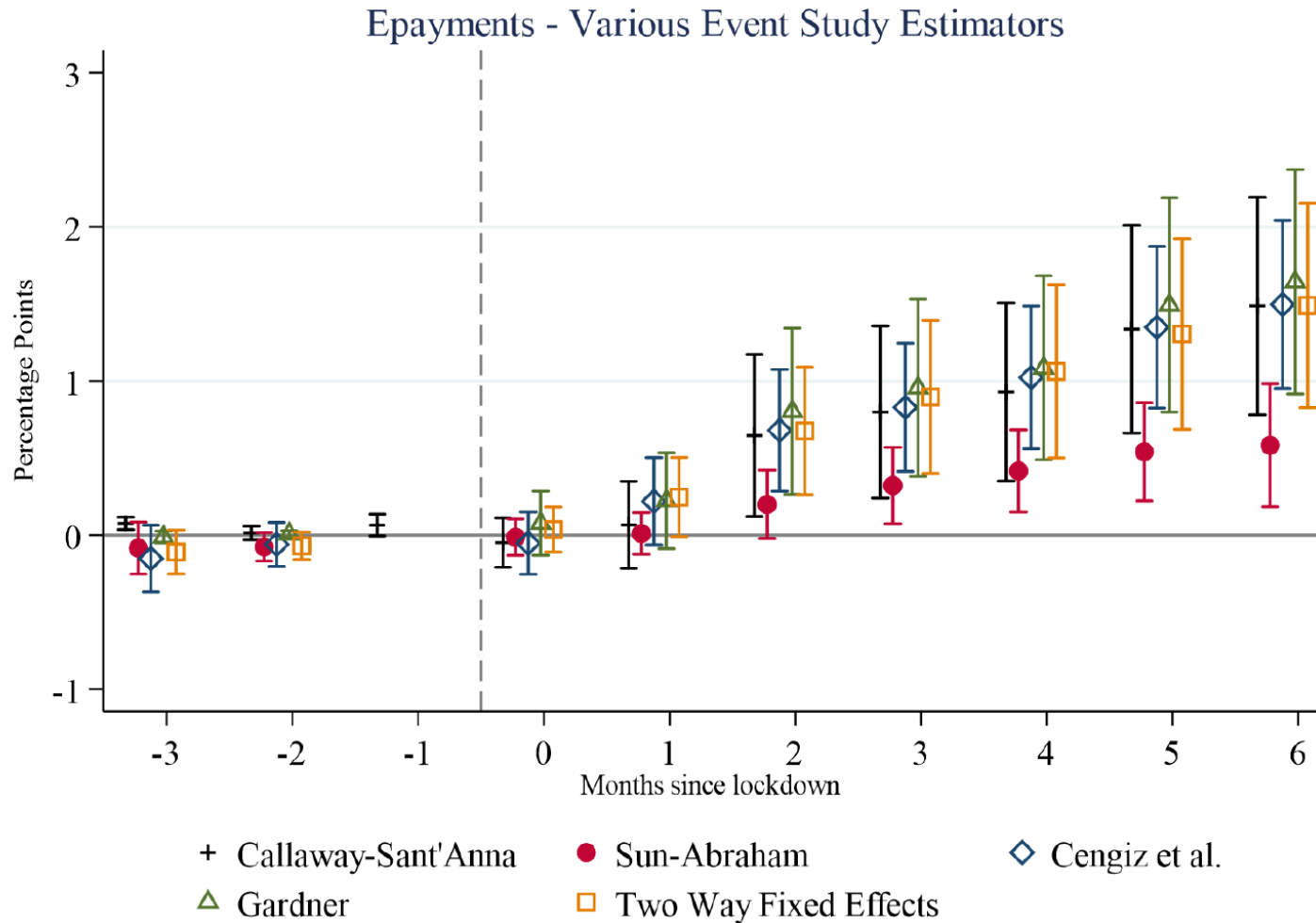


Notes: The figure presents group-time average treatment effect estimates, averaged across each cohort of lockdown countries, from the event study regression $y_{it} = \gamma_i + \lambda_t + \sum_{l=-3, l \neq -1}^6 \hat{\beta}_l 1\{F_i = t - l\} + \varepsilon_{it}$, following Callaway and Sant'Anna (2021), where y_{it} is the adoption rate in country i at month t ; γ_i and λ_t are country and month fixed effects respectively, $\{F_i = t - l\}$ are a set of event time indicators equal to 1 when country i is first treated l months ago. We report doubly-robust difference-in-difference estimates using countries that have not yet experienced lockdowns as controls for each cohort of lockdown countries.

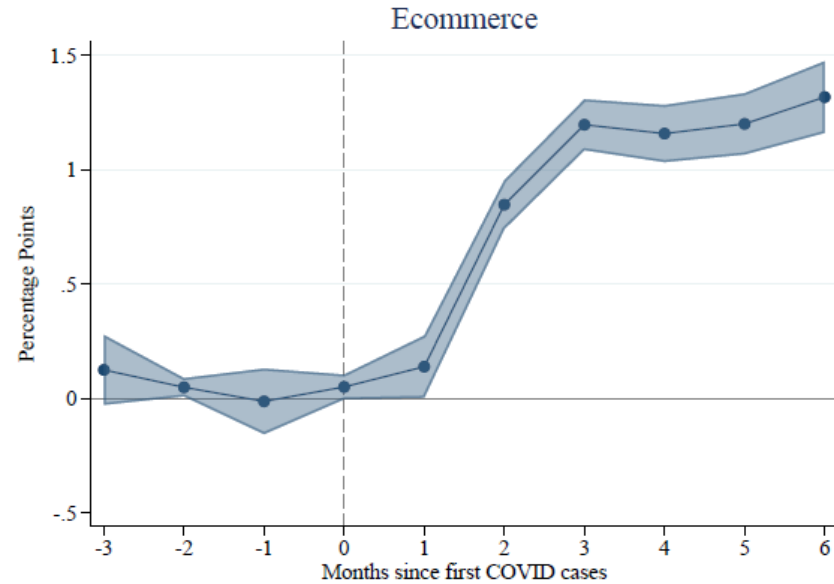
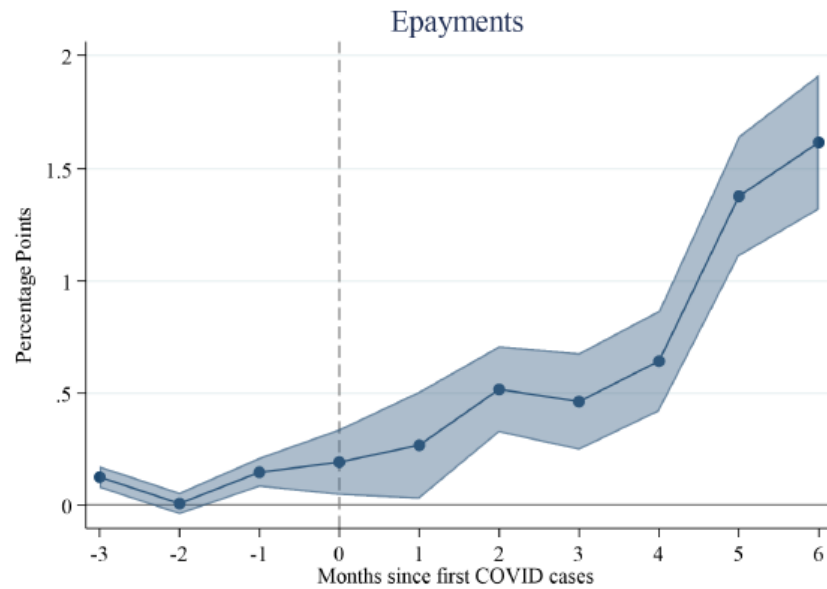
No evidence on anticipation effects



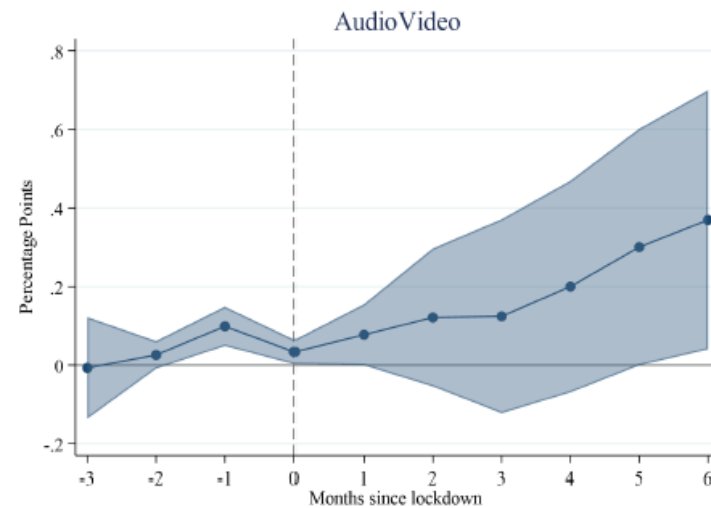
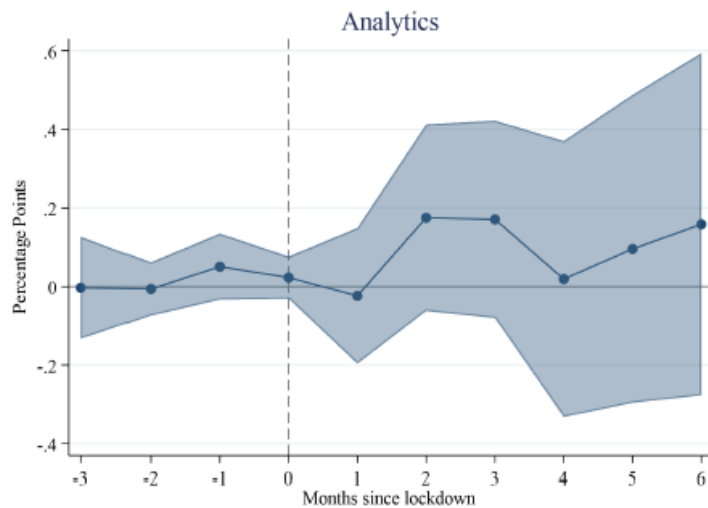
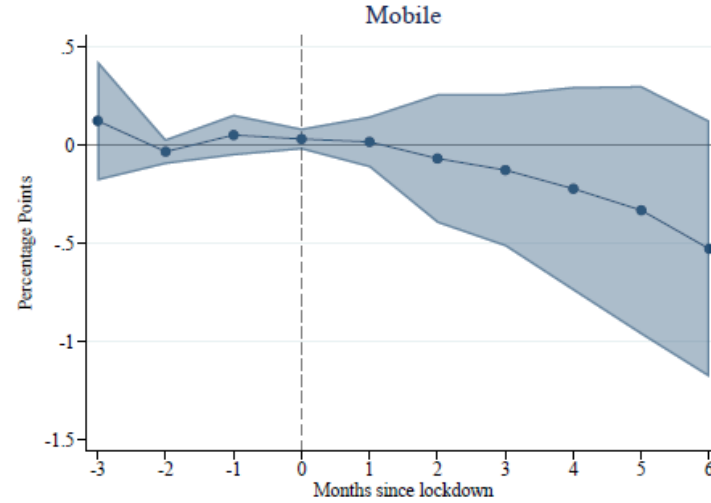
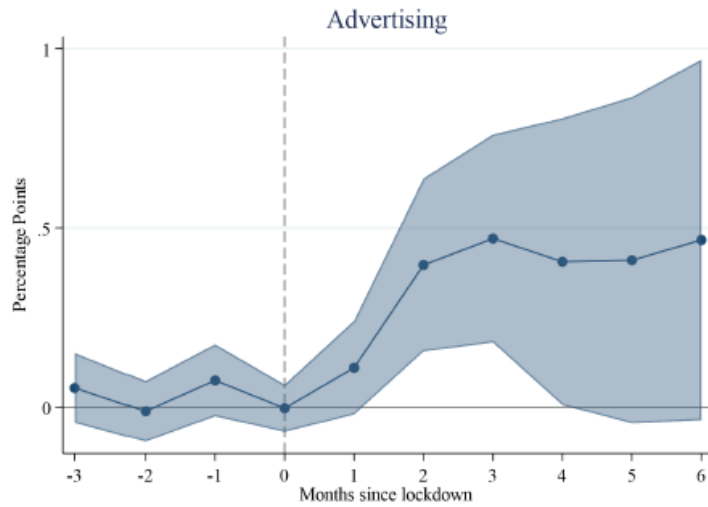
Robust to many recent staggered treatment estimation methods



Robust to using timing of first COVID cases (rather than lockdowns)



Limited impact of COVID-19 on other website technologies more generally



The shock has accelerated divergence dynamics

	(1)	(2)	(3)	(4)	(5)	(6)
Technology:	Advertising		E-payments		E-commerce	
	TWFE	Gardner	TWFE	Gardner	TWFE	Gardner
Post-lockdown	0.371*** (0.071)	0.504** (0.250)	0.870*** (0.096)	1.131*** (0.285)	0.478*** (0.058)	0.575*** (0.205)
Post-lockdown ×Initial Technology	0.071*** (0.004)	0.074*** (0.019)	0.062*** (0.006)	0.065*** (0.022)	0.105*** (0.005)	0.104*** (0.025)
<i>N</i>	2816	2816	2816	2816	2832	2832

Notes: Regression estimated by following two-way fixed effects (TWFE) and Gardner (2021). Post-lockdown refers to periods after the first time of stay-at-home requirements (at least level 1 indicator, see section 2 for more details), which is interacted with initial levels of advertising, e-payments or e-commerce use. All regressions include country and time fixed effects and are estimated from September 2019 to December 2020. Standard errors clustered at the country level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Summary

- COVID accelerated tech adoption for online transactions ...
but widened gaps between frontier and laggard countries

Policy Challenges

- Recent advances reduced costs of e-business (offshelf websites, mobile money, platforms) but barriers remain....
- Digital and other broader skills needed to run an online business
- Banking and logistics services often remain weak.
- Mobile broadband is not always reliable or affordable.

Future work using Builtwith? Tell us your thoughts

A lot remains to be unpacked about the impact of COVID-19 on digital markets, such as the impacts on the volume and value of online transactions, or e-commerce trends via platforms other than the firms' own websites which we do not measure.