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E-commerce in the pandemic and beyond: online appendix

This online appendix gives further information on the drivers of e-commerce developments, e-commerce business model innovations and e-commerce firm performance during the Covid-19 pandemic.

Drivers of e-commerce developments

E-commerce volumes differ sharply across countries.[1] Based on private sector estimates from Statista, e-commerce revenues range from 0.5% of GDP in Kazakhstan to 3.7% of GDP in Korea. Data from a global card network show a wide variation in the growth of card-not-present (CNP) transactions (expressed as an index relative to September 2019, at weekly frequency for 18 countries). These have seen changes between –75% and +91%. The CNP share, denoting the proportion of CNP transactions in overall card transaction values (in USD) at the sectoral level, ranges from 0.01 to 100%. Similarly, the expectations for e-commerce after the pandemic differ, with 38% of consumers expecting to shop online more frequently after the outbreak, but a range of 23 to 56%, according to GlobalWebIndex. Table A1 gives descriptive statistics.

Descriptive statistics — Table A1

Variable	Observations	Mean	Standard deviation	Min	Max
E-commerce revenue (% of GDP)[1]	47	1.21	0.53	0.49	3.69
WIPO Global Innovation Index[2]	47	34.25	11.9	13.76	62.75
Covid-19 containment stringency index[3]	47	48.68	9.76	29.79	68.74
Card-not-present transactions (country index)[4]	702	98.33	22.00	25.35	190.72
Card-not-present transaction share (ratio to total transactions by sector)[5]	7595	30.61	29.54	0.01	100
Consumers who expect to shop online more frequently after the outbreak (%)	18	37.75	10.01	22.5	55.5

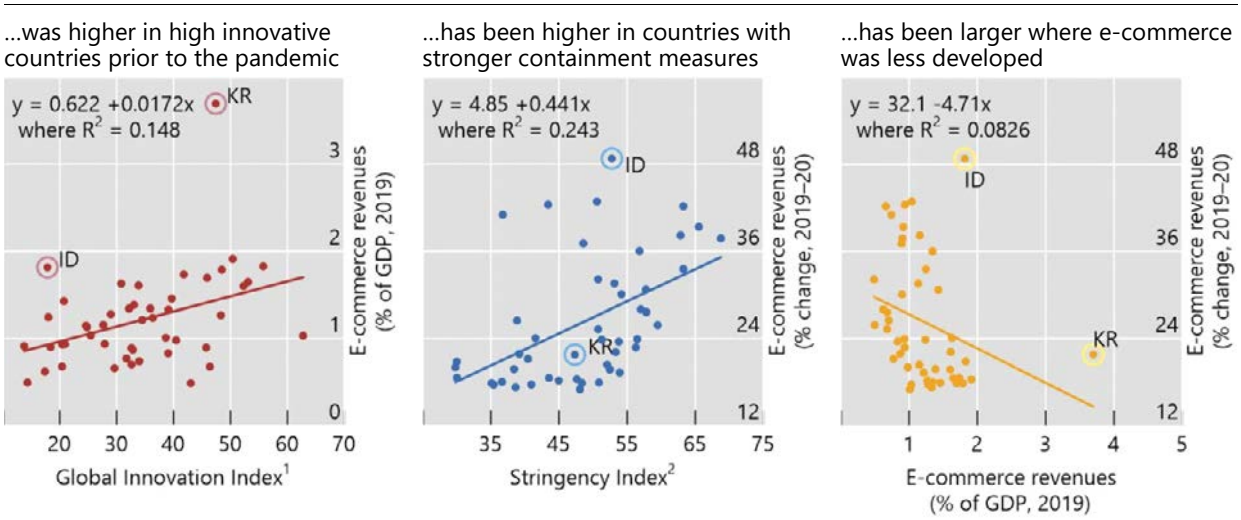
[1] Data for 2019. [2] Data for 2020. The WIPO Global Innovation Index (GII) is a measure of an economy's innovation performance. The GII is composed of three indices: the overall GII, the Innovation Input Sub-Index, and the Innovation Output Sub-Index (the one used in this data set). The Innovation Output Sub-Index provides information about outputs that are the result of the innovative activities of economies. There are two output pillars: (i) knowledge and technology outputs; and (ii) creative outputs. Score ranges between 0 and 100. The higher the score, the more innovative the country. [3] Data for from 1 January 2020 to 18 October 2020. The Oxford Covid-19 Government Response Tracker stringency index is calculated as an average of the following component indicators: school closing, workplace closing, cancel public events, restrictions on gathering size, close public transport, stay at home requirements, restrictions on internal movement, restrictions on international travel, and public information campaigns. The higher the index, the more stringent the implemented measures. [4] Total net transaction value (includes all transaction type) in USD and indexed to the first week of September 2019 = 100. Data for 18 countries from 1 September 2019 to 30 May 2020. [5] Card-not-present transaction value (measured in USD) / total net transaction value (measured in USD). Data for 34 industries from 1 September 2019 to 30 May 2020.

Sources: Statista (2020); WIPO (2020); global card networks; GlobalWebIndex; Oxford Covid-19 Government Response Tracker.

[1] Electronic or e-commerce is defined here as the buying and selling of retail goods or services over the internet, eg by computer or mobile device. There are some differences in definitions across data sources, in particular around the inclusion of e-services such as digital media downloads and streaming, business-to-business sales, digital resales and shipping costs. For our empirical analysis, we rely on the definition used by the Statista Global Consumer Survey.

The drivers of e-commerce activity have changed during the pandemic. Graph A1 repeats Graph 4 from the main text, but includes all observations, including outliers. Prior to the pandemic, there was a strong correlation between e-commerce to GDP and the innovation capacity of an economy (Graph A1, left-hand panel), as measured by the WIPO Global Innovation Index (WIPO (2020)). The Innovation Index is an aggregate measure of the innovative activities of economies based on: (i) knowledge and technology outputs; and (ii) creative outputs. The score ranges between 0 and 100. The higher the score, the more innovative the country. Korea and Indonesia are clear outliers, with relatively high levels of e-commerce, yet overall there is a positive correlation. During the pandemic, e-commerce growth has been faster where containment measures were stricter, as measured by the Oxford Covid-19 Government Response Tracker stringency index (centre panel). The stringency index is calculated as an average of the following component indicators: school closing, workplace closing, cancel public events, restrictions on gathering size, close public transport, stay at home requirements, restrictions on internal movement, restrictions on international travel and public information campaigns (Hale et al (2020)).

E-commerce development… Graph A1



[1] The WIPO Global Innovation Index (GII) measures an economy's innovation performance. The GII is an aggregate measure of the innovative activities of economies based on two elements: (i) knowledge and technology outputs; and (ii) creative outputs. The score ranges between 0 and 100. The higher the score, the more innovative the country. [2] The Oxford Covid-19 Government Response Tracker stringency index is calculated as an average of the following component indicators: school closing, workplace closing, cancel public events, restrictions on gathering size, close public transport, stay at home requirements, restrictions on internal movement, restrictions on international travel, and public information campaigns. The index is the simple average of the number of measures adopted in each country over 1 Jan–18 Oct 2020. The higher the index, the more stringent the measures.

Sources: Oxford Covid-19 Government Response Tracker; Statista (2020) and WIPO (2020).

The pandemic has promoted a "catching-up" process in e-commerce growth among countries. The lower the level of e-commerce in a given country in 2019, the higher the growth rate of e-commerce during the Covid-19 pandemic. This implies that countries with very low e-commerce volumes have been catching up (Graph A1, right-hand panel). This is broadly confirmed in regressions. The first column of Table A2 shows that where e-commerce revenues were 1 percentage point lower, the range in revenues was 4.7% higher in 2020. The explanatory power increases in the second column with the inclusion of the stringency index, but the 2019 e-commerce share becomes insignificant. In the third column, without the outliers of Korea and Indonesia, the results are even stronger – both a lower 2019 e-commerce share and a higher stringency index are associated with significantly greater growth in e-commerce over 2020. These results are shown graphically (without the outliers) in the main text of the Bulletin.

Regression results

Table A2

	E-commerce revenue growth in 2020 (percentage change from 2019)		
	Full sample	Full sample	Excluding KR and ID
E-commerce revenue in 2019 (% of GDP)	–4.713**	–2.914	–7.339***
	(2.211)	(2.020)	(2.617)
Covid-19 containment measure stringency index		0.403***	0.324***
		(0.101)	(0.105)
No of observations	47	47	45
Estimation method	OLS	OLS	OLS
R^2	0.083	0.272	0.359

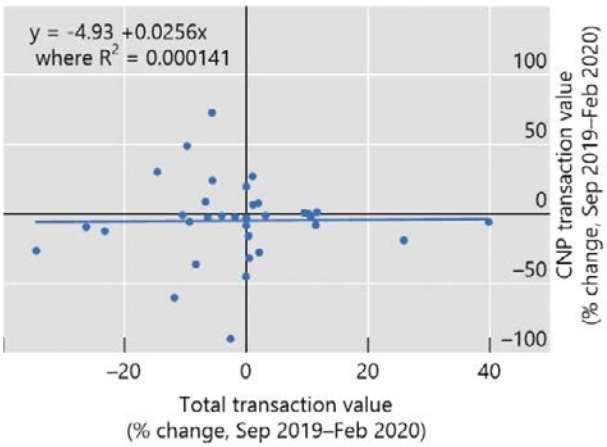
Robust standard errors in parentheses. ***/**/* denotes results significant at the 1/5/10% level.

Those sectors that saw growth in overall transactions also had a higher growth in the share of CNP transactions in the pandemic. The correlation between the increase in transactions in the pre-Covid period and the change in CNP transactions is statistically not different from zero (Graph A2, left-hand panel). In the pandemic period, in connection with the greater use of e-commerce, the correlation between the increase in overall transactions and changes in the CNP share is statistically positive and economically very strong (right-hand panel). Heterogeneity across industries also rises dramatically. Some sectors were able to increase transaction volumes by 70–90%, thanks to greater use of CNP payments.

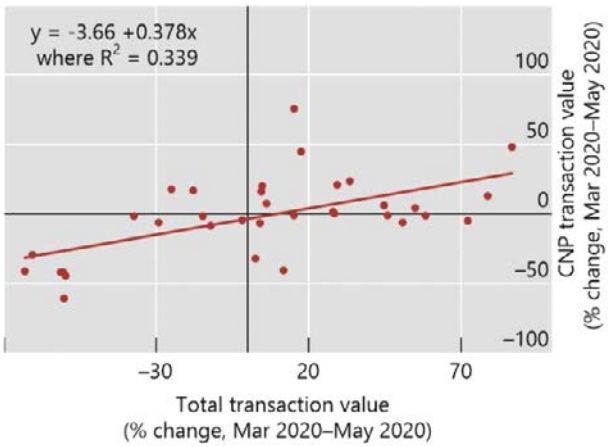
Change in total transaction values and share of CNP transaction values…[1]

Graph A2

…in the pre-Covid-19 period



…during the pandemic



[1] Median changes in the weekly index.

Source: A global card network.

E-commerce business model innovations

E-commerce has faced three main challenges during the pandemic: (i) product availability; (ii) logistics and transportation disruptions; and (iii) consumer protection. First, e-commerce often

depends on global supply chains, and staggered lockdowns have often caused dislocations. Second, e-commerce has been subject to disruptions in the availability of services to support distribution, shipment and after-sale requirements by customers. Third, the accelerated shift to digital purchases also highlighted online consumer protection as one of the main challenges. Reports of fraudulent and dishonest practices increased during the lockdowns.[2]

To respond to these challenges, e-commerce firms have adapted their business models and expanded services. E-commerce firms have used new technologies for logistics and last-mile deliveries during the pandemic. E-commerce giants such as Alibaba, Amazon and JD have employed automated technologies, such as autonomous cars, robots and drones to provide "contactless" deliveries safely to customers (Lin (2020)). E-commerce platforms have burgeoned out to cover new societal needs, such as online education and telemedicine. Finally, to reduce fraud and ensure fair pricing, Amazon, Mercado Libre and others removed offers with excessively high prices on products and shipping from their platforms.[3] Similarly, some public sector authorities have launched investigations into excessive pricing, for instance for sanitiser gels, facemasks, viral testing and funeral services, as well as fraudulent treatments or protective measures sold online (OECD (2020a)). Some authorities have implemented temporary price regulation for essential products (OECD (2020b)).

E-commerce firms have introduced a range of new products and services in the pandemic. During Covid-19, the growth of the "stay-at-home" economy, including e-commerce, online media and social media platforms, has blurred lines among different platforms. These are evolving from collaboration to venturing into one another's territory. For instance, ByteDance's Douyin, the short video giant, has reportedly ended its partnership with Alibaba and encouraged merchants to open their own stores on its platform (UBS (2020)). WeChat introduced livestreaming in its social media platform in February 2020 and hosted a livestream e-commerce festival with the Guangzhou government. Such newly developed models are likely to stay after Covid-19. Virtual shopping – which allows customers to virtually visit a shop, try on clothing or see a simulation of furniture in their homes – may increase. Cashierless checkouts, automated shelf restocking and robotic fulfilment may become a reality in physical stores (CBInsights (2020)).

E-commerce firms are also branching into new services. During the pandemic online learning took off (World Bank (2020)) as 1.5 billion children had to study from home (UN (2020)). With the advance of so-called "edtech", e-learning is more than simply moving education online.[4] Virtual healthcare ("telemedicine") has also increased, especially when patients were advised to seek physicians' help online right after the first wave of Covid-19 hit. In China, some leading virtual healthcare platforms are subsidiaries of e-commerce giants, such as Tencent-backed WeDoctor and Alibaba Health. Led by China, countries around the world have expediently transformed to virtual health care to ensure safe and quick doctor consultation (Webster (2020); Cantú et al (2020)). Meanwhile, a number of e-commerce platforms have continued financial services offerings during the Covid-19 pandemic. The announcement by Amazon of a joint credit card with American Express for small and medium-sized enterprises in late September marks one example of these firms' entry into financial services (Clymo (2020)).

E-commerce firm performance

The shift to online shopping boosted both revenues and costs of online marketplaces. Revenues rose in the first half of 2020 for Amazon (34% year on year), Alibaba (27%), JD (28%), Shopify (74%), Rakuten (16%) and Mercado Libre (50%). At the same time, Amazon hired 175,000 new employees during the

[2] Complaints include, among others, online sellers offering inferior products, such as fake or unsafe hand sanitisers, surgical facemasks or disinfectant (FDA (2020)) and price gouging practices seeking profit from the surge in demand (Cabral and Xu (2020)).

[3] In the US, Amazon removed over half a million offers due to price gouging and suspended more than 3,900 selling accounts.

[4] Edtech has been boosted by the availability of big data during pandemic. Examples include gamification and "edutainment", which aim to support students' self-motivation, as well as adaptive learning that provides learning tailored to personal needs.

pandemic because of the extra business and spent an estimated $4 billion on protective equipment, including testing labs and thermal cameras, and $2/hour bonuses for staff. From 13 March to 24 April, Shopify created 62% more new stores than the previous six weeks as locked-down retailers rushed online. Alibaba and Mercado Libre saw an increase in costs of around 37% during the first half of 2020.

Despite the remarkable sales growth, online marketplaces face important challenges. Further bans on Chinese companies by the US leave Alibaba's ecommerce business and cloud services especially vulnerable. Alibaba also faces rising competition from Pinduoduo and JD; this is one reason for its underperformance relative to other big tech firms. Amazon has faced some productivity drags in its warehouses due to the enforcement of social distancing rules, extended breaks for workers and other coronavirus-related measures that have increased costs.

Still, leading e-commerce players may emerge from the pandemic in stronger positions. The stock prices of e-commerce platforms rose soon after the lockdowns were announced in different jurisdictions and markets. Valuations suggest a potentially permanent shift in consumer behaviour towards online shopping, especially in categories like groceries, which previously had less traction online (Bloomberg (2020)).

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