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The Risk of Cryptocurrency Payment Adoption

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Short Paper

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Abstract

The rapid development of blockchain technology enables the application of cryptocurrency payment in real business practice. However, no research has examined the net effect of adopting such technologies on firm performance. Leveraging a unique research context that Booking.com starts cooperating with Travala.com, this study collects consumer reviews of the same hotels listed on Expedia and Booking.com in all states of the US and employs difference-in-differences designs. This study has three main findings. First, the adoption of cryptocurrency payment via Travala.com induces a net decrement in online sales on Booking.com. Second, the sales decrement is mainly driven by upscale hotels. Third, the sales decrement is severer when the cryptocurrency price is lower. These results are robust across hotels in all the states of USA and can be generalized using a later adoption of cryptocurrency payment. We interpret the mechanism as users' negative associations and provide evidence by an event study analysis.

Keywords: Cryptocurrency payment, payment technology, negative associations, difference-in-differences (DID)

Introduction

With the innovation and rapid development of blockchain technology, the market value of cryptocurrency is growing fast. Cryptocurrency becomes increasingly mainstream for investors and cryptocurrency payment starts to gain acceptance in business practice. Since 2020, a growing number of businesses are embracing cryptocurrency payment, including PayPal, Visa, Microsoft, and Tesla (Shepherd 2021). As of April 2022, over 29,309 businesses, retailers, ATMs, and other infrastructures accepted cryptocurrency payment.[1]

However, different from other payment technologies, cryptocurrency payment is controversial. On the one hand, cryptocurrency payment possesses many inherited advantages of decentralized technologies, such as high privacy and security, instant online trading, no reliance on third parties, and no time and place limit (Ying et al. 2018), and thus holds a huge potential to serve consumers and enterprises (Bollinger and

[1] https://coinmap.org/view/#/world

Gillingham 2012; Risselada et al. 2014; Sun 2013). Moreover, many celebrities support cryptocurrency and its application in business practice (Ramírez and Moynihan 2019). Thus, cryptocurrency payment may bring a company operational efficiency and advertising effect. On the other hand, many people believe that cryptocurrency has no intrinsic value (Smith 2021) and is related to illegal transactions and anonymous activities (Chu et al. 2019; Foley et al. 2019). Although supporters like Elon Musk advocate cryptocurrency and cryptocurrency payment, dissidents like Warren Buffett says "bitcoin is probably rat poison squared" (Kim 2018) and Charlie Munger claims "bitcoin is disgusting and contrary to the interests of civilization" (Li 2021). Apart from that, its high volatility (Chu et al. 2019), highly concentrated ownership, and highly concentrated mining capacity (Makarov and Schoar 2021) impede its acceptance. Therefore, the adoption of cryptocurrency payment may raise negative associations among consumers toward a company. Taken together, while adopting cryptocurrency payment may bring operational benefits to a business, it may also have negative implications due to its controversial social reputation.

Extant studies on cryptocurrency payment mainly investigate factors that may influence consumer acceptance and company acceptance of cryptocurrency payment through surveys or experiments(Alshamsi and Andras 2019; Catalini and Tucker 2017; Jonker 2019; Önder and Treiblmaier 2018), no research has examined the net effect of adopting cryptocurrency payment on firm performance. As more and more companies are taking attempts at cryptocurrency payment, it is essential to investigate the effect and provide guidelines to companies when considering cryptocurrency payment adoption.

We address this research gap by analyzing a series of adoptions of cryptocurrency payments by online travel agencies (OTAs). The adoptions were implemented in the form of collaboration with a cryptocurrency payment platform that specializes in the travel industry (Travala.com). We collect consumer reviews as a proxy for OTA hotel sales from all 51 states of the United States and employ sets of DID designs to empirically examine whether the online sales of OTAs increase or decrease after the adoption of cryptocurrency payment.

We find that the adoption of cryptocurrency payment significantly reduces the sales of OTAs and this phenomenon mainly exists among upscale hotels and during the period of cryptocurrency price decline. These results are robust across hotels in all 51 states of the United States. Finally, we assess the generalizability of the findings using a later adoption of the cryptocurrency payment by a different OTA. The results suggest that, although the adoption of cryptocurrency payment still induces a negative consequence on online sales, its magnitude and duration decrease. At the same time, the negative impact continues to manifest among upscale hotels. We attribute the negative consequence to users' negative association based on the associative learning model and conduct an event study analysis to confirm it.

This study contributes to the literature on new technology adoption. Our finding suggests that the adoption of new technology needs to be assessed not only on the operational ground but also on the social ground. The adoption of controversial new technologies could alienate customers, especially high-end customers.

Related Literature

Business Value of New Technology Adoption

In business operations, adopting new technologies is essential to enhance productivity and efficiency (Bartel et al. 2007; Bustos et al. 2016; McAfee 2002; Rawley and Simcoe 2013; Tang et al. 2021), improve collaboration network and employee performance (Bretschneider and Wittmer 1993; Leonardi 2013; Wu and Kane 2021), cut costs and increase profitability (Chen et al. 2021; McElheran 2015), and make technological innovation (Lee and Grewal 2004). For example, Lee and Grewal (2004) studied the relationship between firm performance and new technology adoption and found a positive influence induced by the adoption of the Internet. Wang (2010) indicated that chasing IT fashion may bring firms a better reputation and higher performance. Tan and Netessine (2020) found that new technology adoption in the service industry improves sales.

Adoption and Acceptance of Cryptocurrency Payment

Extant studies about the adoption of cryptocurrency payment mainly focus on factors that may affect consumer and firm acceptance of cryptocurrency payment. For example, based on TAM, Mendoza-Tello et al. (2019) and (Roussou et al. 2019) investigated the factors that may influence user acceptance of

cryptocurrency payment and found that perceived usefulness, security, and compatibility are determining factors. Jonker (2019) collected survey data about cryptocurrency payment adoption from a large representative sample of retailers in Netherlands and found that these retailers are interested in adopting cryptocurrency, but the lack of consumer demand, transactional benefits, and perceived accessibility lie barriers to cryptocurrency acceptance. Polasik et al. (2015) found that Bitcoin payment has a large share of adoption in low GDP countries and national cultural values also affect the willingness of cryptocurrency adoption (Salcedo and Gupta 2021). Moreover, early adopters play an important role in the diffusion of cryptocurrency (Catalini and Tucker 2017). Wei and Dukes (2021) found that speculative price bubbles accelerate the diffusion and adoption of cryptocurrency. Although current studies have investigated the influencing factors of cryptocurrency payment acceptance, the lack of empirical analysis with rigorous methods and secondary datasets makes it difficult to evaluate the net effect of cryptocurrency payment adoption on sales.

Research Context and Research Design

Research Context

Travala.com is a cryptocurrency payment platform that specializes in the travel industry. It accepts more than 80 cryptocurrencies and also fiat money. On Nov 25th, 2019, it announced its first cooperation with Booking.com. Since then, Travala.com established partnerships with other popular OTAs like Priceline, Expedia, and Agoda. Table 1 lists five cooperation events reported by Travala.com. In this study, we choose to analyze the first and the last event for two reasons. First, the research context of the first cooperation between Travala.com and Booking.com is clean, but there is extensive overlap across the #2, #3, and #4 cooperations. Second, the #2, #3, and #4 events are also affected by COVID-19. We thus use the first event for the main analysis and the last event for the generalizability test.

No.	Event	Time	News
1	Travala.com & Booking.com Strategic Partnership	2019/11/25	https://blog.travala.com/travala-com-booking-com-strategic-partnership-targets-massive-crypto-adoption/
2	Travala.com Partners With Leading Travel Provider, Priceline	2020/03/07	https://blog.travala.com/travala-com-partners-with-leading-travel-provider-priceline/
3	Expedia and Travala.com Join Forces to Offer Frictionless Cryptocurrency Travel Booking	2020/07/06	https://blog.travala.com/expedia-and-travala-com-join-forces-to-offer-frictionless-cryptocurrency-travel-booking/
4	Travala.com and Agoda Partner to Boost Travel with Bitcoin and other Cryptocurrencies	2020/08/03	https://blog.travala.com/travala-com-and-agoda-partner-to-boost-travel-with-bitcoin-and-other-cryptocurrencies/
5	Travala.com Signs Enhanced Partnership with Expedia Partner Solutions	2021/03/19	https://blog.travala.com/travala-com-signs-enhanced-partnership-with-expedia-eps/

Table 1. The Timeline of Travala's Cooperation Events.

The cooperation between Travala.com and Booking.com on Nov 25th, 2019 is widely reported by the mainstream media like Yahoo Finance and no other important events involving Booking.com are observed on Seeking Alpha during the study time window[2]. As shown in Google Trends (see Figure 1), the search term "Travala" peaked thereafter. The cooperation allows all the hotel listings on Booking.com available via Travala.com. That is, consumers can book all the hotels listed on Booking.com via Travala.com using cryptocurrency payment, but consumers cannot directly use cryptocurrency to book hotels on Booking.com. Moreover, consumers cannot post reviews on Booking.com and Travala.com for reservations that they make through Travala.com. This unique context enables us to observe the change in online hotel sales proxied by the number of consumer reviews on Booking.com before and after its cooperation with Travala.com. To

[2] https://seekingalpha.com/symbol/BKNG/press-releases

https://www.nasdaq.com/market-activity/stocks/bkng/press-releases

perform a rigorous empirical study, we use a DID design that uses the same set of hotels listed on Expedia as the control group (unaffected by the event and other events[3]) to capture the net effect of cooperation with Travala on the sales of Booking.

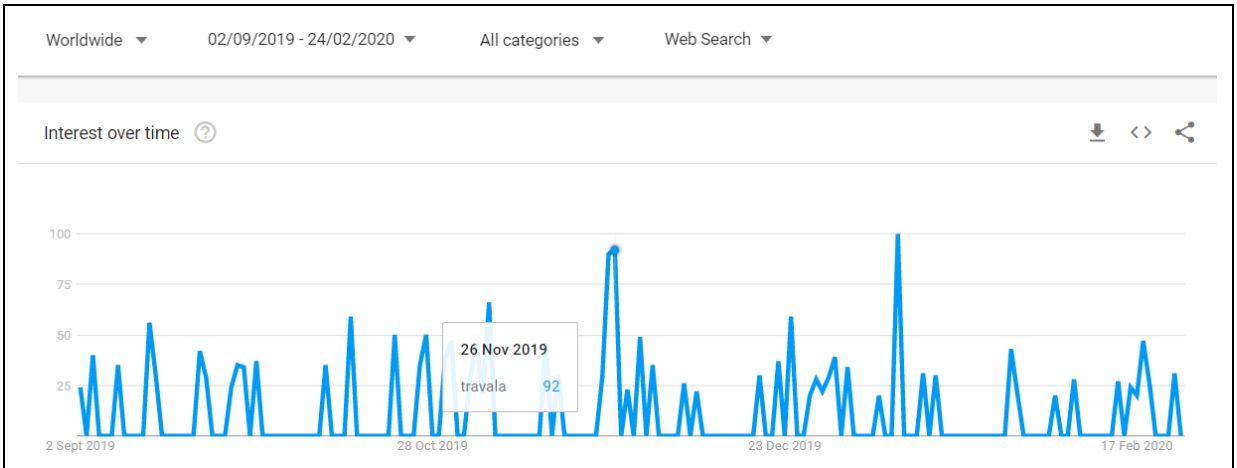

Figure 1. Google Trends' Interest over Time of "Travala"

Although the sales decrease on Booking.com can be compensated by the sales increase on Travala.com via cryptocurrency payment, the sales made on Travala.com are quite small and can be neglected in comparison with the sales made on Booking.com (see Table 2[4]). Therefore, the DID estimation provides a good estimate of the overall impact on hotel sales on Booking.com after its cooperation with Travala.com.

Month	Travala.com Sales (room nights)	Quarter	Booking.com Sales (room nights)	Expedia Sales (room nights)
2019/08	1,045	2019/Q3	223 million	116.5 million
2019/09	1,009			
2019/10	1,105	2019/Q4	191 million	91.6 million
2019/11	1,326			
2019/12	1,528			
2020/01	1,755	2020/Q1	124 million	69.4 million
2020/02	2,364			

Table 2. Sales Made on Travala.com vs Booking.com Three Months Before and After Nov 2019.

Data

We employ the review number as the proxy of hotel sales. The reasons are as follows. First, both Booking.com and Expedia.com guarantee to publish every qualified review and the published reviews are from real consumers[5]. Second, a stream of literature has shown that the review number is a valid proxy

[3] https://seekingalpha.com/symbol/EXPE/press-releases

https://www.nasdaq.com/market-activity/stocks/expe/press-releases

[4] https://blog.travala.com/travala-com-monthly-report-november-2019/

https://blog.travala.com/travala-com-monthly-report-february-2020/

https://s201.q4cdn.com/865305287/files/doc_news/2020/05/07/BKNG-Q1-2020-Press-Release-Final.pdf

https://s27.q4cdn.com/708721433/files/doc_financials/2020/q1/EXPE-Q1-2020-Earnings-Release.pdf

[5] https://www.expedia.com/lp/b/content-guidelines

measurement of hotel sales (Ye et al. 2009). Third, existing research (Wu et al. 2016) suggests that the willingness of posting reviews is driven by self-enhancement theory. Consumers post reviews to boost their self-image in traditional user-generated content communities. But in our research context, both in Booking and Expedia, every reviewer is anonymous, even without a reviewer page. The only information is the reviewer's nickname and the review-related content corresponding to a truly finished hotel reservation. Therefore, we argue that the willingness of posting reviews is not supposed to change in our research context. So, the ratio of hotel sales and the review number will be an approximately constant value.

We collected all the consumer reviews of hotels listed on Booking and Expedia in all 51 states of the United States. We then matched these hotels across the two OTAs using their names and addresses and identified the same set of hotels listed on Expedia as the control group. The total number of matched hotels is 30,940 across the 51 states, ranging from 92 (Rhode Island) to 2,597 (California) with an average of 606.7. Among these matched hotels, the average number of reviews posted on each hotel per state per semi-month ranges from 1.74 to 23.03 on Booking.com and 2.84 to 31.3 on Expedia. The overall average number of hotel reviews across all 51 states is of the same order of magnitude between Booking.com (4.972) and Expedia (5.469). For brevity, we do not list the detailed statistics here.

Research Design

We utilize the DID design to estimate the effect of cooperation with Travala.com on hotel sales of Booking.com. In Model (1), *i* denotes hotel, and *t* indexes time (semimonthly). The dependent variable is the logged value of the semimonthly number of reviews posted on hotel *i* and in time period *t* (*LogRevNum*). *Treat* is a dummy variable to denote the treatment group, which is set to 1 (0) for hotels on Booking.com (Expedia); while *Post* is a dummy variable to denote whether the reviews are posted after (*Post*=1) or before (*Post*=0) Nov 25th, 2019. We also include the cumulative review number on the month before the starting day of period *t* (*CumRevNum*), the hotel ID fixed effect, and the time fixed effect in Model (1) to control for hotel heterogeneity and time-variant factors. The coefficient of the interaction term *Treat*Post* captures the treatment effect of cooperation with Travala.com on hotel sales of Booking.com. To get robust empirical results, we use three different time windows (2, 4, and 6 semi-months before and after Nov 25th, 2019).

$$LogRevNum_{it}=\beta_o+\beta_1 Treat_i*Post_t+\beta_3 Controls_{it}+U_i+V_t+\xi_{it} \quad (1)$$

To further examine which segment is affected by the event, we divide the hotels into budget hotels (hotel star<=3) versus upscale hotels (hotel star>3) and use a dummy variable *HotelClass* to denote this classification (1: upscale hotels; 0: budget hotels;). We then interact this variable with *Treat*Post* as in Model (2) wherein other variables remain the same as in Model (1).

$$LogRevNum_{it}=\beta_o+\beta_1 Treat_i*Post_t+\beta_2 Treat_i*Post_t*HotelClass_i+\beta_3 Controls_{it}+U_i+V_t+\xi_{it} \quad (2)$$

To examine the role of cryptocurrency price (*CryptoPrice*), we interact this variable with *Treat*Post* in Model (3). Three proxies are used to measure cryptocurrency prices.[6] First, the mega-cap index (*Mega*) follows the performance of Bitcoin and Ethereum. Second, the large-cap index (*Large*) follows the performance of cryptocurrencies with the largest market capitalizations. Third, the broad digital market index (*Broad*) follows the performance of digital assets satisfying certain liquidity and market capitalization requirements detailed in its eligibility criteria.

$$LogRevNum_{it}=\beta_o+\beta_1 Treat_i*Post_t+\beta_2 Treat_i*Post_t*CryptoPrice_t+\beta_3 Controls_{it}+U_i+V_t+\xi_{it} \quad (3)$$

Main Results

Before performing the DID estimation, we first depict the trends of the semimonthly average of *RevNum* for both Booking (red) and Expedia (blue) in Figure 2. Figure 2 shows that the two lines are largely parallel before the event, which supports the parallel trend assumption.

The first part of Table 3 presents the DID estimation results of Model (1) using different three time windows (i.e., two, four, and six semi-months before and after event #1). We observe that the coefficients of the

https://www.booking.com/reviews_guidelines.html

[6] https://www.spglobal.com/spdji/en/index-family/digital-assets/cryptocurrency/#overview

interaction term *Treat*Post* are significantly negative across all time windows. In column 1 (one month before and after event #1), the magnitude of the coefficient is -0.2889, indicating that the cooperation with Travala.com leads to about 25% (1-exp(-0.2889)) decrement in online sales on Booking.com. However, this negative consequence weakens over time as shown in column 2 (-0.1682) and column 3 (-0.0971). If we focus on the time window of three months before and after the event, the decrement magnitude is about 9% (1-exp(-0.0971)) of online sales on Booking.com. These results indicate that the cooperation with Travala.com exerts a short-term negative effect on the platform sales of Booking.com.

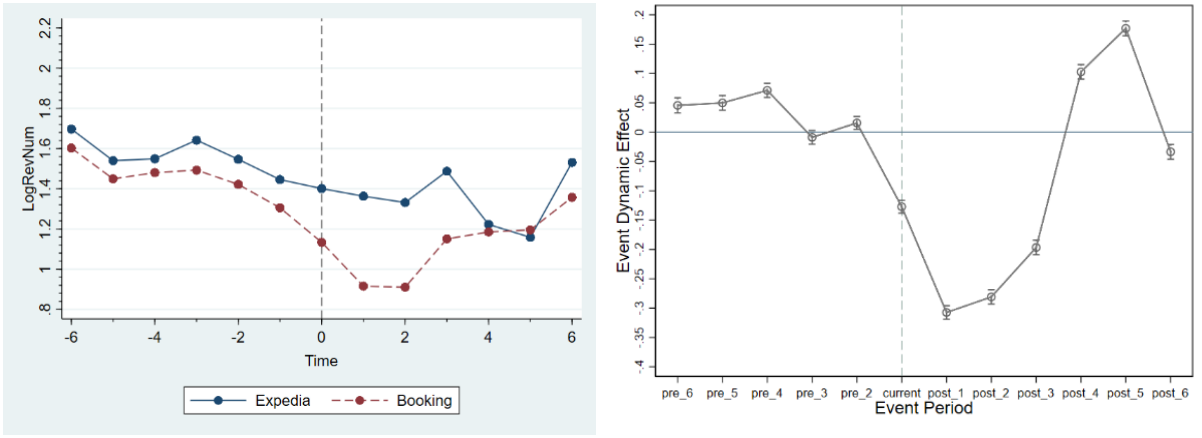

Figure 2. Parallel Trend Illustration

Model (1)			
Time Window	[-2,0)&(0,2]	[-4,0)&(0,4]	[-6,0)&(0,6]
*Treat*Post*	-0.2889***(0.0044)	-0.1682***(0.0032)	-0.0971***(0.0027)
Observations	219,192	438,384	657,576
R-squared	0.7285	0.6935	0.6762
Model (2)			
Time Window	[-2,0)&(0,2]	[-4,0)&(0,4]	[-6,0)&(0,6]
*Treat*Post*	-0.3274***(0.0034)	-0.2038***(0.0025)	-0.1163***(0.0021)
*Treat*Post*HotelClass*	-0.0633***(0.0066)	-0.0091*(0.0049)	-0.0374***(0.0041)
Observations	219,192	438,384	657,576
R-squared	0.7283	0.6933	0.6761
Model (3) with Time Window [-6,0)&(0,6]			
Price Index	*Mega*	*Large*	*Broad*
*Treat*Post*	-0.1894***(0.0021)	-0.1914***(0.0021)	-0.1924***(0.0021)
*Treat*Post*CryptoPrice*	1.8369***(0.0200)	1.7319***(0.0187)	1.7041***(0.0184)
Observations	657,576	657,576	657,576
R-squared	0.6803	0.6804	0.6804

Table 3. Main Results.

Note: All covariates and constants are omitted here for brevity. *** p<0.01, ** p<0.05, * p<0.1.

To explore which segment (upscale versus budget hotels) is more likely affected by the event, we conduct further empirical analysis on the basis of Model (2) and report the results in the second part of Table 3. The coefficients of the interaction term *Treat*Post*HotelClass* are all negative and significant at the 0.01 level, indicating that the sales decrease on Booking.com is driven more by the upscale hotels. The finding suggests that upscale consumers reacted more negatively to the news of Booking.com's cooperation with Travala.com.

We use three measures (*Mega*, *Large*, and *Broad*) to reflect the trend of cryptocurrency price and explore whether the decrease in online sales on Booking.com induced by the cooperation with Travala.com can be mitigated when cryptocurrency price goes up. We conjecture that consumers' sentiments towards cryptocurrency are influenced by cryptocurrency price movement. As observed in Table 3, no matter which cryptocurrency price index is utilized, the coefficients of the interaction term *Treat*Post*CryptoPrice* are all positive and significant. These results indicate that the sales decrease on Booking.com after its cooperation with Travala.com is more severe when the cryptocurrency price is lower.

Robustness Check

There is an alternative explanation that consumers have heterogeneous seasonal behavior. For example, many Chinese people will travel during Spring Festival, so Trip.com would see an increase in hotel sales every year around the Spring Festival. A similar situation could happen in Booking and Expedia. To rule out the heterogeneous seasonal effect, we do a placebo test by utilizing the same time period of 2020 and 2021. We do not observe a significant negative effect in both two groups.

To assess the robustness of our empirical results, we also replicate Model (1)-(3) using the dataset of all 51 states of the US, separately. For brevity, we do not show the results here. All the results shown in Table 3 still hold.

Moreover, since the first cooperation between Booking.com and Travala.com in Nov 2019, many OTAs have cooperated with Travala.com (see Table 1). We choose the latest cooperation (event #5) between Expedia and Travala.com in Mar 2021 to assess the generalizability of our findings, since there is extensive overlap between events #2, #3, and #4 and these three events are affected by COVID-19. For brevity, we do not show the results here. Compared with the results in Table 3, we observe that the negative effect induced by the cooperation with Travala.com is short-lived and becomes positive thereafter. However, the moderating effect of hotel class is still robust and negative, we thus divide the samples into upscale and budget and replicate the estimation. The negative impact of the cooperation with Travala.com on the sales of upscale hotels still holds. These results suggest that although the negative impact of the adoption of cryptocurrency payment eases overtime on budget hotels, its negative effect on upscale hotels remains.

Mechanism Analysis

Based on the associative learning model (Washburn et al. 2004), we conjecture that cryptocurrency payment induces negative associations that alienate customers, especially high-end customers. If negative associations occurred, they were expected to not only affect customers but also investors. We thus infer that the stock price of the companies which have announced the adoption of cryptocurrency payment should show a temporary decline. Accordingly, we conduct an event study (Subramani and Walden 2001) to test this conjecture. We collect the stock price data and announcement date of all the listed companies on the US stock market that officially announce the embracement of cryptocurrency payment, including TSLA, MSFT, T, SUBX, PYPL, YUM, OSTK, QSR, EXPE, and BKNG. We set the event time window as one month before and after the event date and an estimation time window as one year before the beginning day of the event time window. We then calculate the abnormal returns based on the Fama-Carhart four-factor model.

We observed a significant negative cumulative abnormal return (CAR) on the following day of the event. The results in Table 4 indicate the CAR of companies that adopt cryptocurrency payment show significant decreases after the adoption events, which provides evidence for the users' negative associations.

Date Index	0	1	2	3	4	5	6
Coef	-0.027	-0.038	-0.029	-0.039	-0.037	-0.033*	-0.037**
Date Index	7	8	9	10	11	12	13
Coef Index	-0.031*	-0.033*	-0.045**	-0.043*	-0.048**	-0.041*	-0.067***
Date Index	14	15	16	17	18	19	20
Coef	-0.068***	-0.061**	-0.069**	-0.069**	-0.071**	-0.075***	-0.085***

Table 4. The Significance Tests of CAR.

Note: Standard error and t-value are omitted here for brevity. *** p<0.01, ** p<0.05, * p<0.1.

Discussion and Conclusion

The nature of new technologies often makes their adoption controversial among the general public and thus the adoption of new technologies needs to be assessed not only from the operational perspective but also from the social perspective. Leveraging a unique research context that Booking.com cooperated with Travala.com wherein consumers are allowed to order all the hotels listed on Booking.com via cryptocurrency payment, this study collects consumer reviews of the same hotels listed on Expedia (control group) and Booking.com (treatment group) in all 51 states of the US and employs DID designs. This study has three main findings. First, the adoption of cryptocurrency payment via Travala.com induces a significant decrease in sales on Booking.com. Second, the sales decrease on Booking.com is driven more by upscale hotels. Third, the sales decrease on Booking.com is more severe when the cryptocurrency price is lower. The generalizability of these findings is validated with a later event involving cryptocurrency payment adoption.

This study is the first attempt to empirically examine the effect of adopting cryptocurrency payment on platform sales and get robust findings. Our findings indicate that the adoption of cryptocurrency payment could invoke negative reactions from consumers and thus have an unexpected albeit short-term negative impact on sales, which provides implications to company managers and industry regulators. Moreover, we extend the associative learning model into the field of new technology adoption.

Our study also has several limitations. In particular, Booking.com and Expedia are two giants in the market of online travel agencies, the transactions lost from Booking.com may flow to Expedia. Thus, our estimations may be up-biased. However, from the parallel trend in Figure 2, we can see that the sales of Expedia did not show much increment when the sales of Booking.com is decreasing, suggesting that the up-biased degree of our estimations should not be serious. In addition, we are unable to examine the long-term effect of adopting cryptocurrency payment on platform sales because only short clean estimation windows are available. Our ongoing work will focus on these unsolved problems.

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