UNIVERSITÀ
DEGLI STUDI
DI MILANO

E-commerce and Covid-19

Farnaz Sharbafi[1], *Mahdi Sotikhiabani*[2]

Abstract

This paper discusses e-commerce and the advantage arising from adopting new technologies in different types of B-to-C and B-to-B.
The impact of Covid-19 on online shopping is investigated through two ways of comparison of Amazon's financial statements and consumer behavior for online shopping before and during Covid-19 pandemics. Total revenue of Amazon %37 increased in 2020, when Covid-19 happened. Also, a significant positive correlation between Covid-19 new cases and shares price of Amazon is found. The impact of Covid-19 on the consumers preference for online shopping based on demographic characteristics in Italy and Iran is analyzed. A remarkable negative correlation has been found between age and online purchase preference of people in Iran in both genders, in contrast there is no strong correlation between mentioned variables in Italy in both genders. An increase in online shopping in the both countries have been found at the time of Covid-19 pandemics.

Keywords: E-commerce, Covid-19, Consumer Behavior, Microeconomics.

Introduction

Coronavirus has started from Wuhan in 2019, and everyone is still struggling with that. It has changed the shopping behavior of the consumers. Bhatti et al. [1] discussed the behavior of consumers in the future due to the covid-19 pandemic. They defined that the e-commerce trend will grow rapidly in the pandemic situation. Abiad et al. [2] indicated that coronavirus has had both positive and negative impact on e-commerce, however this virus totally causes a significant grow in e-commerce, Bhatti et al. [3] expressed that coronavirus causes an increase in buyers in both developed and developing countries. Niazi [4] represented that in Pakistan 10% increase in e-commerce occurred during the coronavirus pandemic situation. Hasanat et al. [5] showed that there are various challenges retailers are experiencing in the pandemic time for instance extend the delivery time, difficulty face during movement control, social distance and lockdown.

Several researches have done to illustrate the impact of covid-19 on demand of various types of goods. Andrienko [6] mentioned that the impact of covid-19 on different types of goods is different. Dinesh and MuniRaju [7] demonstrated that more customers prefer to buy kitchen essentials, personal care products and groceries through online shopping.

Alber [8] aimed to find out that how coronavirus influenced stock market, and he understood that stock market is more sensitive on new coronavirus cases than new deaths in countries.

In addition, some studies are conducted to demonstrate the factors affecting customers shopping. Pandey and Parmar [9] mentioned demographic factors, social factors, consumer online shopping experience, knowledge of using internet and computer, website design, social

[1] Matriculation Number: 964159
[2] Matriculation Number: 976720

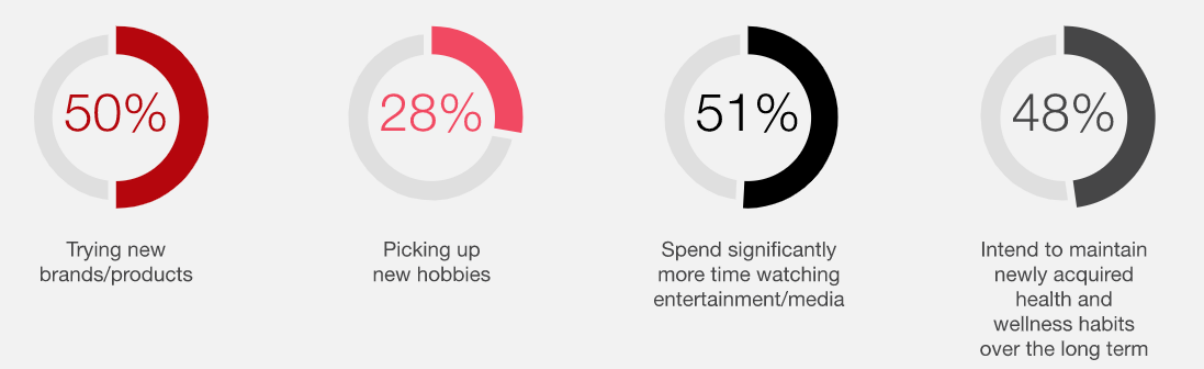
media, situational factors, facilitating conditions, product characteristics, sales promotional scheme, payment option, delivery of goods and after sales services plays an important role in online shopping. Monsuwé el at. [10] found out that consumers's attitudes and intention towards online shopping are affected by not only ease of use, usefulness, and enjoyment, but also by exogenous factors like consumer traits, situational factors, product characteristics, previous online shopping experiences, and trust in online shopping.

Due to the anxiety and tension coming from the Coronavirus outbreaks, many consumers tried to adapt themselves to social distancing and health guidelines communicated by healthcare authorities. Consequently, not only the number of online purchases skyrocketed but also the actual demand changed in many categories of goods. New categories were added to consumers' "shopping cart" which never existed before.

According to the several researches which have been conducted monitoring the demand in some big retails, shows a significant shift in categories of products demanded by consumers that has not been demanded before the Covid-19 pandemics. "Are these changes in consumer behavior can have long-lasting effects?" Addressing this question is crucial to both the private and public sectors. For small, medium and, even large enterprises which will conduct their business in the period of post-pandemics is necessary to wonder deeply about this question and adapt their strategy in various areas of corporate management: from marketing to sales, human resource management, operation management, Logistics, IT, etc. For the public sector, government officials, and policymakers, it is important to monitor deeply these dramatic shifts in consumer behavior to come up with a proper recovery plan for the economy.

PWC (PricewaterhouseCoopers), the famous consulting company, has surveyed adult consumers and reached interesting results about changing priorities that can have long-lasting effects during the pandemics. The results of the survey are shown in figure 1.

Figure 1. Changes in consumer behavior that could have long-lasting effects.



Source:https://www.pwc.com/us/en/industries/consumer-markets/library/covid-19-consumer-behavior-survey.html

Covid-19 has been remarkably challenging for businesses worldwide and has given rise to the special role of e-commerce that can play in this crisis and beyond. Although a vast number of businesses and industries are facing serious problems, thanks to the technology that allows companies to still sell their products to their customers and maintain at least partially their business activities.

This paper is trying to look at e-commerce from the Microeconomics point of view. In economic terms, e-commerce will be discussed in two types, Business- to-Consumer (B2C), Business-to-Business (B2B). A survey has been designed for data collection to analyze the

effect of covid-19 pandemics on online shopping behavior before and during Covid-19 pandemics in a developed country and developing country, Italy and Iran, respectively. In this regard, demographic characteristics, age and gender, are considered to measure the association of covid-19 pandemics on online shopping before and during Covid-19 pandemics. Moreover, total revenues data of Amazon is presented, and the trend is also discussed. The association of daily worldwide Covid-19 cases and stock price of Amazon is presented.

We believe that studying about the mentioned subjects will help businesses to be aware of their target market and plan based on the consumer preferences and characteristics of the consumers in order to enhance their sale. Moreover, policy makers will understand whether they should invest on internet access and the growth of e-commerce, and to evaluate whether developments in e-commerce can be a way for the economy to back on track from the current recession.

The microeconomic impact of e-commerce on economy

In this section, the economic impact of e-commerce will be discussed, and the potential effects at the microeconomic and macroeconomic levels will be presented.

What is e-commerce? Suijker [11] mentioned that e-commerce refers to the exchange of information across electronic networks that can be implemented at any stage in supply chain. It can be implemented within an organization, between businesses, between businesses and consumers, or between the public and private sectors.

E-commerce is made possible by information and communication technologies (ICT). There are two major consequences of e-commerce. It has the potential to increase market transparency and facilitate the introduction of new products and production processes. More transparency and efficiency will have a positive impact on welfare. Efficiency gains and increased transparency can result in lower prices and higher production in the short term. Analyzing the impacts of E-commerce goes beyond the microeconomics level and can be analyzed in macroeconomics areas such as GDP growth, fiscal and monetary policy. The long-term growth of GDP is calculated by the expansion of labor supply and the expansion of labor productivity.

Due to the use of Information and communication technology (ICT), e-commerce can increase the productivity and profitability of the firms operating in retail or wholesale. ICT-related technologies (internet of things, big data, cloud computing, augmented reality, etc) are changing the fundamentals and nature of the business and economy, in a bigger picture. Nowadays, thanks to ICT, the geographical limitations and obstacles are disappearing at the level of a city, region, the whole country, or even worldwide in some cases. This means larger markets, larger demands, and more profit and growth.

Finding, using, and sharing information is cheap thanks to ICT. For businesses, this information can result even in their firm’s strategy according to consumer preference (this subject will be discussed more deeply later on B2C E-commerce). For consumers, this possibility of checking and comparing the prices and reviews of the product everywhere and every time, brings more satisfaction.

B2C (Business-to-Consumer service)

Business-to-consumer (B2C) refers to the practice of marketing goods and services directly to consumers that are the end-users of the company's products or services. The bulk of businesses that sell directly to customers are referred to as B2C businesses.

With e-commerce, matching between the business or service provider and consumer is easy. Consumers can find their desired product with just a few clicks and search in the search engines. They can simply see the variety of products from different brands and compare them with each other.

On the business side of the story, the storage, analysis, and usage of data based on every single click done by the consumer can boost the performance of the company. Enables firms to monitor the preferences and desires of the potential buyers and set their strategy according to the demand of consumers on a real-time basis. They can modify their own product based on insights and knowledge obtained from consumer data analysis and in some cases, they can even target consumers to change their mind by personalized advertising. In this scenario that firms have access to information on the consumer's priorities, they can apply several known market strategies such as price discrimination and product differentiation in a much more efficient way.

Prieger and Heil [12] stated that in some cases, e-commerce can lead to lower prices particularly those for homogeneous goods. When it comes easy to search and find different brands and compare them, demand becomes more elastic. As a result, competitors should reduce the price. The growth of e-commerce in search goods[3] can be perceived as a change in the supply curve to the right, which raises welfare.

B2B (Business-to-Business service)

Business-to-business (B2B) is a situation where one business makes a commercial transaction with another. Thanks to ICT and e-commerce finding the supplier for the intermediate goods or service used in the business is no more difficult like it was in the past. Nowadays, it is easier to find the supplier in the right place, at the right time, and at the right price.

A lot of costs can be saved by finding a supplier with e-commerce. Brokers, content aggregators, auctioneers, dealers, and exchanges can link larger businesses through e-commerce and to do it more efficiently than can catalog-based or other non-electronic systems, Prieger and Heil mentioned [12].

When it comes to managing physical inventory, by adopting ICT tools, inventory management becomes less important, and this adoption leads to the better and more efficient management of it.

Price discrimination

Setting different prices for different consumers has always been a wise strategy adopted by different businesses (travel industry, pharmaceutical industry, book industry etc.). It can be in the form of coupons or it can be based on age, gender, and occupation.

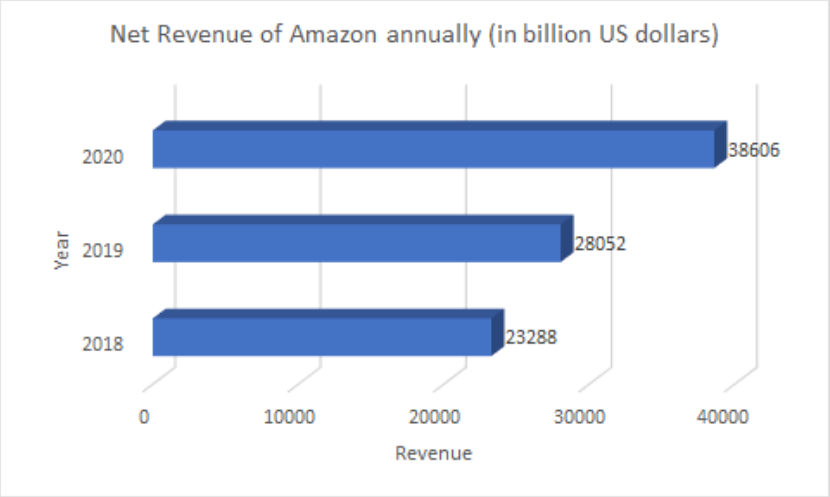
E-commerce can do even better, thanks to the data collected and analytical tools, firms can target consumers with different levels of willingness to pay, with the price personalized for them. Nowadays, e-commerce firms do not have to tag the price physically and make it visible for everyone. As a result, they can develop advanced algorithms that can produce the right price for the user based on his/her profile or previous activity. This efficient price discrimination can improve the productivity of the firm.

Revenues of Amazon at the time of the Covid-19

[3] A search good is a product or service that is simple to determine prior to purchase.

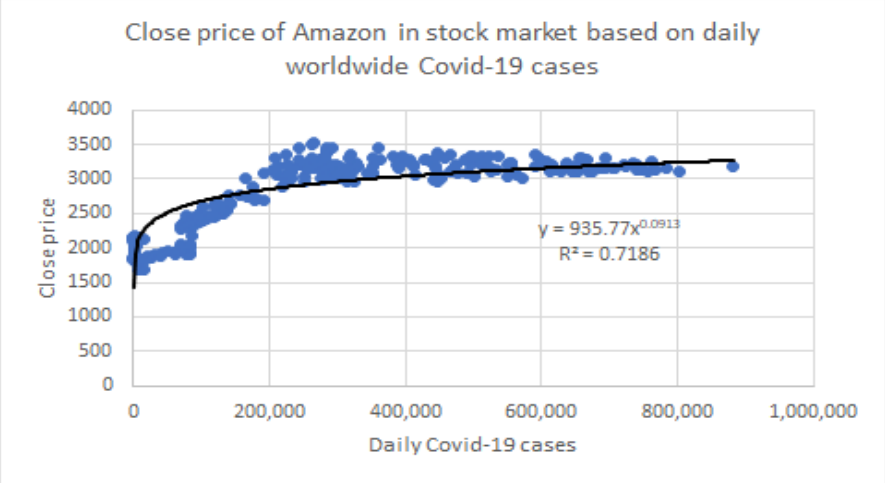
In this section, Amazon's financial statements are investigated to see how much money the leader of tech industry made from selling goods before and during the Covid-19 pandemics. Revenues generated by Amazon before and during the covid-19 pandemics have been significantly increased. According to figure 2, in 2020, Amazon's financial statement shows an increase of 37% in total revenues which is 17.17% more than the growth recorded in the same time interval just before the pandemics.

Figure 2. The revenues of Amazon before and during Covid-19 pandemics (annually)



Amazon is selected to investigate the respond of shares price of this company to the daily Covid-19 cases. A significant correlation (0.77) has been found between daily worldwide covid-19 cases and daily amazon stock prices. A power regression model $y = 935.77x^{0.0913}$ with $R^2 = 0.7186$ is designed as shown in figure 3. A sharp increase happened at the start, but after that since the power of the model is lower than one (0.0913), y (dependent variable) grows slightly given each amount of x (independent variable). In general, from this analysis we can conclude that although during Covid-19 many companies have faced financial crises, Amazon (as the leader of e-commerce industry) has had a growth in shares price because of the increase in the company's earnings.

Figure 3. Impact of worldwide daily covid-19 cases on shares price of Amazon

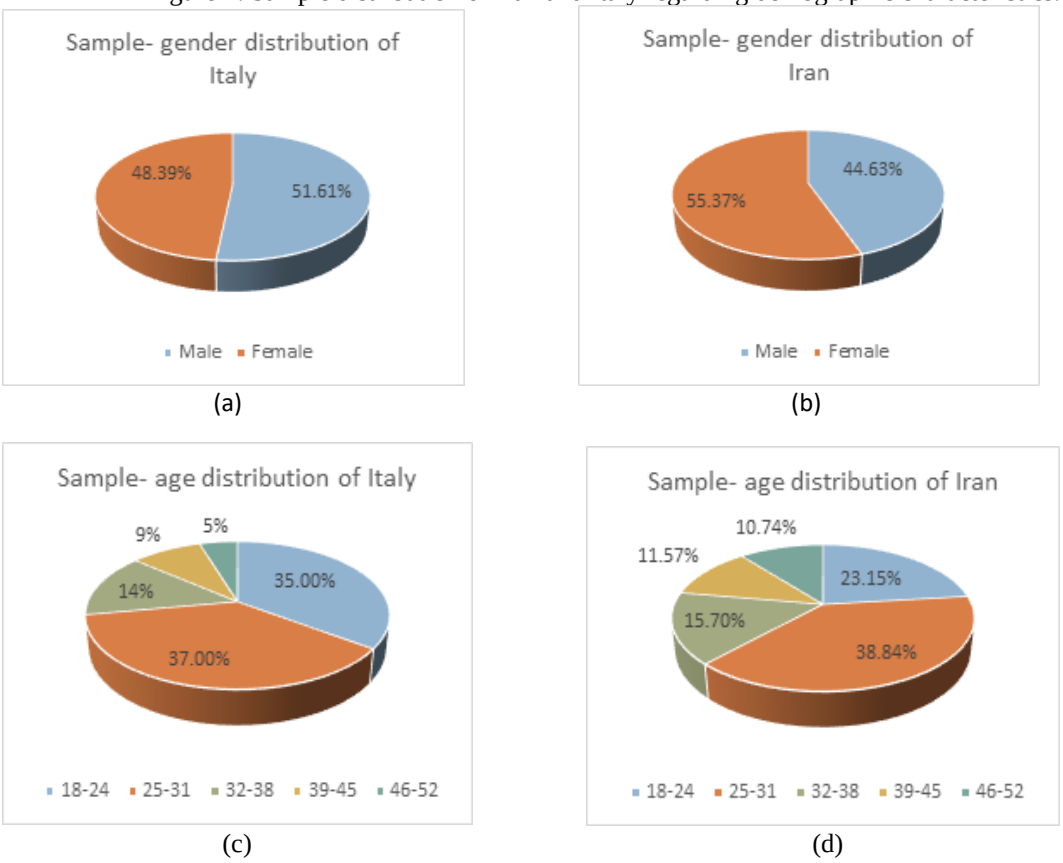


Online shopping behavior before and during Covid-19 pandemics in Italy and Iran

In this section, the shopping behavior of consumers regarding their demographic characteristics (age and gender) before and during Covid-19 pandemics will be discussed in a developed and

a developing country, Italy and Iran, respectively. In this regard, a survey is designed for data collection. 121 persons from Iran and 124 persons from Italy have responded to our survey. The tendency of online shopping before and during Covid-19 was asked from the responders with qualitative options (always, frequently, sometimes, rarely, never). Then these qualitative descriptions were changed to quantitative numbers. People between 18-52 years old in both countries are considered. Figure 4 shows the distribution of the responders regarding their demographic characteristics.

Figure 4. Sample distribution of Iran and Italy regarding demographic characteristics.



To know whether there is any association between age and online shopping before and during Covid-19 pandemics in Italy, correlation and p-value is calculated among several groups of samples. According to table1, there are no strong correlations between ages and online shopping behavior in both times of before Covid-19 pandemics and during Covid-19 pandemics in both genders in Italy. It means that there is no strong association between the changes in the independent variable (age) and the shifts in the dependent variable (online shopping). In addition, by considering the amount of p-value, the null hypothesis that is no relationship between variables exists cannot be rejected, since the amount of p-value is greater than alpha (0.05).

Table1. Correlation and p-value results between ages of men and women and online shopping before and during Covid19 pandemics in Italy.

	r_{xy}	P-value
Age- Online shopping before Covid-19 pandemics in Italy	-0.1457	0.1063
Age- Online shopping during Covid-19 pandemics in Italy	0.021	0.8162
Age- Online shopping before Covid-19 pandemics in Italy (female)	-0.12	0.3583
Age- Online shopping during Covid-19 pandemics in Italy (female)	0.054	0.68

Age- Online shopping before Covid-19 pandemics in Italy (male)	-0.198	0.1158
Age- Online shopping after Covid-19 pandemics in Italy (male)	-0.01	0.9362

Note: Age is independent variable and online shopping tendency is dependent variable.

The difference of confidence interval between online shopping before Covid-19 and online shopping during Covid-19 pandemics is estimated by using formula 1. By calculating of difference of confidence interval, an estimation with 1-α percent probability about the difference of online shopping mean in populations between our selected groups is provided.

$$p\left((\overline{x_1} - \overline{x_2}) - Z_{\frac{\alpha}{2}}\sqrt{\frac{\delta_1^2}{n_1} + \frac{\delta_2^2}{n_2}} < \mu_1 - \mu_2 < (\overline{x_1} - \overline{x_2}) + Z_{\frac{\alpha}{2}}\sqrt{\frac{\delta_1^2}{n_1} + \frac{\delta_2^2}{n_2}} \right) = 1 - \alpha \qquad (1)$$

Table 2. Difference of confidence intervals with several α in Italy

α	0.01	0.02	0.03	0.04
Online shopping before Covid-19 in Italy - Online shopping during Covid-19 in Italy	-1.132<$\mu_1 - \mu_2$ < -0.529	-1.102<$\mu_1 - \mu_2$ < -0.558	-1.084<$\mu_1 - \mu_2$ < -0.576	-1.070<$\mu_1 - \mu_2$ < -0.590
Online shopping before Covid-19 pandemics in Italy (female) - Online shopping during Covid-19 pandemics in Italy (female)	-1.363<$\mu_1 - \mu_2$ < -0.503	-1.321<$\mu_1 - \mu_2$ < -0.545	-1.295<$\mu_1 - \mu_2$ < -0.571	-1.276<$\mu_1 - \mu_2$ < -0.590
Online shopping before Covid-19 pandemics in Italy (male) - Online shopping during Covid-19 pandemics in Italy (male)	-1.158<$\mu_1 - \mu_2$ < -0.310	-1.117<$\mu_1 - \mu_2$ < -0.351	-1.091<$\mu_1 - \mu_2$ < -0.377	-1.072<$\mu_1 - \mu_2$ < -0.396
Online shopping before Covid-19 pandemics in Italy (female) - Online shopping before Covid-19 pandemics in Italy (male)	-0.618<$\mu_1 - \mu_2$ < 0.237	-0.576<$\mu_1 - \mu_2$ < 0.195	-0.550<$\mu_1 - \mu_2$ < 0.169	-0.531<$\mu_1 - \mu_2$ < 0.150
Online shopping during Covid-19 pandemics in Italy (female) - Online shopping during Covid-19 pandemics in Italy (male)	-0.418<$\mu_1 - \mu_2$ < 0.434	-0.376<$\mu_1 - \mu_2$ < 0.393	-0.350<$\mu_1 - \mu_2$ < 0.367	-0.331<$\mu_1 - \mu_2$ < 0.348

Note: All of the calculated intervals are considered with 0.001 accuracy.

Table 2 reveals the difference of confidence intervals to find out the difference between two populations about online purchasing in Italy. According to our statistical analysis represented in table 2, online shopping in total has increased in Italy at the time of Covid-19, because our estimation of difference confidence intervals in the first three rows are negative which means that the mean of online shopping during Covid-19 pandemics is greater than mean of online shopping before Covid-19 pandemics ($\mu_2 > \mu_1$). In addition, in the last two rows no significant difference about mean of online shopping between men and women is found in Italy.

Table 3. Correlation and p-value results between ages of men and women and online shopping before and during Covid19 pandemics in Iran

	r_{xy}	P-value
Age- Online shopping before Covid-19 pandemics in Iran	-0.7907474	< 2.2e-16
Age- Online shopping after Covid-19 pandemics in Iran	-0.4451397	3.125e-07
Age- Online shopping before Covid-19 pandemics in Iran (female)	-0.7670324	3.777e-14
Age- Online shopping after Covid-19 pandemics in Iran (female)	-0.3592499	0.00283
Age- Online shopping before Covid-19 pandemics in Iran (male)	-0.8140139	7.217e-14
Age- Online shopping after Covid-19 pandemics in Iran (male)	-0.5517831	1.526e-05

Note: Age is independent variable and online shopping tendency is dependent variable.

To know whether there is any association between age and online shopping before and during Covid-19 pandemics in Iran, correlation and p-value is calculated among several groups. According to table 3, a significantly negative correlation in the age of people in Iran is with online shopping in total sample and in each gender separately is found. It means that younger people tended to do more online shopping before Covid-19 pandemics. The reason is that many online shopping companies in Iran do not provide sufficient after sale services such as money reimbursement, and many people (particularly elderly ones) did not believe that online shopping can be reliable.

Online shopping companies started to provide better services on shipment and after sale services in Iran when Covid-19 started. The absolute value of this correlation has decreased during Covid-19 pandemics, because older people also started online shopping when Covid-19 pandemics started.

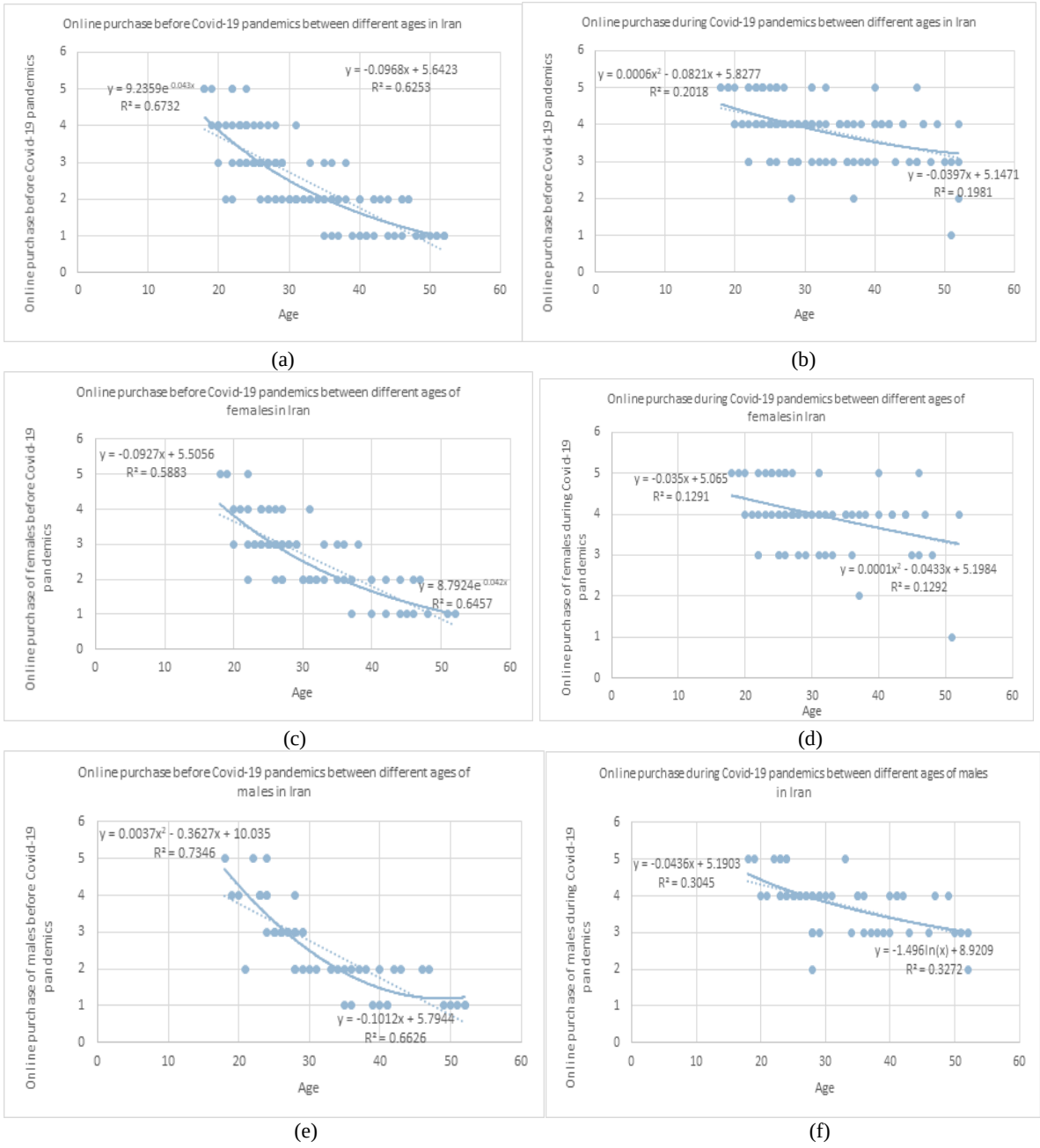
P-value shows that null hypothesis that is no association between our variables exists will be rejected because the amount of p-value is lower than alpha (0.05). Since strong correlations have found between all the groups of samples in Iran, we have tried to fit our data with the best regression model. In figures 5, our data are plotted, and regression models also are illustrated. It worth to mention that greater number on y-axis in figures 3 shows greater tendency for online shopping.

According to figure 5-a, the exponential regression $y = 9.2359e^{-0.043x}$ with R^2 equals to 0.6732 is considered for our total sample of people in Iran before Covid-19 pandemics. Online shopping decreases significantly from the age 18 to around 32, then from around 32 to 52 age, as the independent variable increases the dependent variable decreases moderately, because the slop of the regression model is lower after the age around 32. Figure 5-b also shows plotted data of online purchases for total sample of Iran during Covid-19 pandemics and the nonlinear polynomial regression model $y = 0.0006x^2 - 0.0821x + 5.8277$ with $R^2 = 0.2018$ is calculated. According to the model, as the independent variable grows, dependent variable drops slightly. Consequently, it is evident that online purchase has increased during Covid-19 pandemics in Iran even in the older age groups.

In addition, we have categorized our sample based on gender. According to the figure 5- c, the best fitting curve for our sample data for the relationship between age of the Iranian females and online purchase before Covid-19 pandemics, is an exponential regression model $y = 8.7924e^{-0.042x}$ with $R^2 = 0.6457$. About men before covid-19 pandemics, a polynomial regression model $y = 0.0037x^2 - 0.3627x + 10.035$ with $R^2 = 0.7346$ is calculated (figure 5- e). If these two models are compared from the ages 18 to around 32, a remarkably negative correlation in online purchase of males can be seen, however this association has been weaker for women in this age range.

During covid-19 time, the polynomial regression model $y = 0.0001x^2 - 0.0433x + 5.1984$ with $R^2 = 0.1292$ for females and the nonlinear logarithmic regression model $y = -1.496\ln(x) + 8.9209$ with $R^2 = 0.3272$ for men are considered. According to the figure 5-d and figure 5-f, much more consumers in even older age groups shifted to online shopping in both gender groups when Covid-19 pandemics occured.

Figure 5. Plotted sample data of Iran, regarding the age and online shopping of the whole sample, female and male



Conclusion

The coronavirus pandemics have deeply affected, accelerated, or even changed many global trends. These changes were so fast due to the emergency condition that the world faced accidentally, and in a short period, everyone all over the world needed to come up with a solution that can minimize the damages caused by the pandemics. In many cases, the answer is online shopping and e-commerce.

In this study, the potential impact of e-commerce on economy that brings transparency and efficiency which leads to the welfare is presented. E-commerce makes it easy to connect a

company or service provider with a customer (B2C) or a company to another company (B2B). The financial statement of Amazon shows an %37 rise in total revenue in 2020, when Covid-19 started. Also, a strong correlation between Covid-19 new cases and shares price of Amazon has found.

Today, after more than one year of the Covid-19 crisis, world leaders have shifted their attention from managing the pandemics to the recovery process. In this phase, analyzing the impacts of the pandemics and restricting regulation such as lockdown on how people live would be a great help to recover from the pandemic situation. The Covid-19 pandemics has changed consumer behavior across all shapes of life. It has had a significant consequence on working, shopping and consumption, learning, communication, information, entertainment, health, travel and mobility. The consumer behavior in online shopping regarding the demographic characteristics is investigated before and during Covid-19 pandemics in a developed country and a developing country, Italy and Iran, respectively. There is no strong correlation between age and online shopping neither in men nor in women in Italy. Conversely, a remarkable negative correlation between age and online shopping has found in Iran in both men and women samples. In general, at the time of Covid-19 pandemics, online shopping in both countries has increased. This study would assist companies in becoming more conscious of their target market and planning based on customer desires and characteristics to maximize sales. Furthermore, policy makers will be able to determine if they should invest in internet access and e-commerce growth, as well as whether e-commerce innovations will help the economy recover from the current crisis.

References

1. Bhatti, A., et al., *E-commerce trends during COVID-19 Pandemic.* International Journal of Future Generation Communication and Networking, 2020. **13**(2): p. 1449-1452.
2. Abiad, A., R.M. Arao, and S. Dagli, *The economic impact of the COVID-19 outbreak on developing Asia.* 2020.
3. Bhatti, A., et al., *Coronavirus affects e-commerce globally.* Journal of Xi'an Shiyou University ISSN No. **1673**: p. 064X.
4. Niazi, A., A.S. MA, and H. Naqvi, *The pandemic is e-commerce's time to shine. But will it last*. 2020.
5. Hasanat, M.W., et al., *The impact of coronavirus (COVID-19) on e-business in Malaysia.* Asian Journal of Multidisciplinary Studies, 2020. **3**(1): p. 85-90.
6. Andrienko, O., *Ecommerce & Consumer Trends During Coronavirus*. 2020.
7. Dinesh, S. and Y. MuniRaju, *SCALABILITY OF E-COMMERCE IN THE COVID-19 ERA.* International Journal of Research-GRANTHAALAYAH, 2021. **9**(1): p. 123-128.
8. Alber, N., *The effect of coronavirus spread on stock markets: The case of the worst 6 countries.* Available at SSRN 3578080, 2020.
9. Pandey, A. and J. Parmar. *Factors Affecting Consumer's Online Shopping Buying Behavior*. in *Proceedings of 10th International Conference on Digital Strategies for Organizational Success*. 2019.
10. y Monsuwé, T.P., B.G. Dellaert, and K. De Ruyter, *What drives consumers to shop online? A literature review.* International journal of service industry management, 2004.
11. Suijker, F., *Economic effects of e-commerce.* Corporation for Public Broadc.(CPB) Report, 2002.
12. Prieger, J.E. and D. Heil, *The microeconomic impacts of E-business on the economy*, in *Encyclopedia of e-business development and management in the global economy*. 2010, IGI Global. p. 12-22.