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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

CONTEMPORARY ANALYSIS ON FINANCIAL AND TECHNOLOGICAL ASPECTS OF MOBILE PAYMENT SYSTEMS IN TURKEY

TÜRKİYE'DEKİ MOBİL ÖDEME SİSTEMLERİNİN FİNANSAL VE TEKNOLOJİK BOYUTLARINA GÜNCEL BAKIŞ

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Abstract

Today's business world moves incredibly fast as the technology's role on the processes of production, trade, and consumption is getting more dominant. The emerging technologies like mobile payment technology offer businesses an amazing support to operate their cash flow process more efficient and secure than traditional ways. On the consumer side, mobile payment applications make cashless transactions possible. In this study, the mobile payment systems in Turkey will be investigated and several correlation statistics between the mobile payment transaction numbers and the five major factors, financial and technological ones, are presented. Our analysis shown that contactless POS machine numbers, domestic credit cards penetration, 3G/4G adaptation ratio, mobile broadband internet usage rate and even smartphone sales rates are the factors for mobile payment increase in Turkey. Mobile payment solutions provided by global tech players are not available in Turkey, due to the fact that regulations and law related to these services lag behind. Absence of mobile payment technologies from global tech giants can be considered as a disadvantage for the Turkish markets but the joint efforts of established banks, new entrants and incumbent technology vendors supports a thriving ecosystem of mobile payments in our country.

Keywords: Mobile payment systems, credit card penetration, mobile broadband usage

Jel Codes: G20, L86, O14

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Öz

Günümüzün iş dünyası, teknolojinin üretim, ticaret ve tüketim süreçlerindeki rolünün daha baskın hale gelmesiyle birlikte inanılmaz hızlı hareket ediyor. Mobil ödeme sistemleri gibi yeni ortaya çıkan teknolojiler, nakit akışı yönetimini geleneksel yöntemlerden daha verimli ve güvenli bir şekilde yürütmeleri için işletmelere inanılmaz bir destek sunuyor. Tüketici tarafında, mobil ödeme uygulamaları nakit kullanılmayan işlemleri mümkün kılar. Bu çalışmada, Türkiye'deki mobil ödeme sistemleri araştırılacak ve mobil ödeme işlem miktarları ile finansal ve teknolojik beş ana faktör arasındaki çeşitli korelasyon istatistikleri sunulmuştur. Analizimiz temassız POS makinesi kullanımı, yurtiçi kredi kartlarının yaygınlığı, 3G/4G adaptasyon oranının, mobil genişbant internet kullanım oranının ve hatta akıllı telefon satış oranlarının Türkiye'deki mobil ödeme artışı ile ilişkilendiğini gösterdi. Global teknoloji oyuncuları tarafından sağlanan mobil ödeme çözümleri, Türkiye'de bu hizmetlerle ilgili düzenlemelerin ve yasaların gerisinde kalması nedeniyle mevcut değildir. Küresel mobil ödeme teknolojilerinin yoksunluğu Türkiye pazarları için bir dezavantaj olarak görülebilir, ancak kurulu bankaların, yeni iştiraklerin ve yerleşik teknoloji tedarikçilerinin ortak çabaları, ülkemizde gelişen bir mobil ödeme ekosistemini desteklemektedir.

Anahtar Kelimeler: Mobil ödeme sistemleri, kredi kartı penetrasyonu, mobil genişbant internet kullanımı

Jel Kodları: G20, L86, O14

Introduction

The technology evolves to a new era with an unprecedented speed and transforming business and daily life from uniformity centered into convenience centered. Mobile payment is quite valuable for both businesses and consumers. From businesses side mobile payment technology provide some great advantages. Firstly businesses can have better cash flow performance by shortening payment processes. For consumers, mobile payment systems are removing the need for cash for shopping and reduce dependency on physical credit cards. Customers pay by only using their smartphone, keep their expenses through mobile applications, and also get online invoices with the same way.

Fueled by worldwide heavy investments in telecommunications sector, mobile network types have increased rapidly and the speed of data connection and transmission has grown through 3G, 4G, and 4.5G, in some cases 5G, respectively in decade. A report published by the Pew Research Center in February 2016, shows the rate of having smartphones and Internet usage in emerging economies continues to increase. But in advanced economies, technology utilization is still higher (Poushter, 2016).

Mobile payments become widespread payment method around Europe and USA but in Turkey there are some steps to be taken. In this study, the financial and technological aspects related to mobile payment systems in Turkey will be investigated through correlation statistics between the mobile payment transaction numbers and selected variables. Simply, contactless Point-of-Sale (POS) machine penetration, domestic credit card use, 3G/4G adoption ratio, mobile broadband Internet usage rate and even smartphone sales rates were picked as the factors that shape the state of mobile payments in Turkey.

1. Technology behind mobile payments

There are two types of mobile payment based on technology used. First category of payments refers to the act of paying with a mobile device using a contactless 'proximity' technology. It allows consumers to purchase goods and services directly at the Point-of-Sale (POS) using their mobile phone. Second technology category is the m-payment or mobile 'remote' payments. Remote payments are independent of the customer and merchant location and are practiced through a mobile phone app or via SMS for online shopping. Purchases are billed to the mobile phone subscriber's mobile account or the subscriber pays directly online by using payment systems like PayPal or credit and debit cards.

Near field communication (NFC) technology enables the transfer of information by providing a connection between the devices carrying NFC chips. NFC standard has three distinct modes of operation but the most common use in smartphones is the peer-to-peer mode (Timalsina et. al. 2012). By providing wireless data transmissions at 13.56 megahertz frequency, NFC technology in smartphones can be used for transactions, such as public transportation payments and contactless POS. Main advantage of NFC over Bluetooth technology is that NFC eliminates the need for searching and finding the device first, in other words, coupling is easy and does not require any authentication or authorization with passwords etc.

Except from Apple, major smartphone producers like Sony and Samsung offer many NFC related services and applications with their products. Apple products use NFC only for Apple Pay transactions but in 2018 the company announced that iOS 12 would support NFC "background tag reading". Today, apart from smartphones, most consumer electronics goods like speakers, cameras, televisions, refrigerators and many other appliances have adapted NFC technology.

QR Code – Quick Response Code is a unique matrix barcode that can only be read by QR code readers and phones' camera. Scanning a QR code from a mobile app completes mobile payment. There are two categories embodying most QR code payments. In the first category, a provider in the central position issues a QR code with an identifier so that the transaction or a point of sales can de identified. The mobile app scans the QR code first and then communicates with the provider in order for the payment to be processed. Enabling distributed models, second category is standard-based (like EPC069 in EU). In the distributed model, the QR code contains the data (in compliance with a given standard) necessary to describe the payment and such a QR can be created by anyone and any application that understand the standard can process the payment.

RFID (Radio Frequency Identification) technology is a technology that transfers data using radio waves through an electronic tag called RFID tag. Passive or active, RFID tags can be a read from a few meters away. Some active tags, having their own source of power, can have longer ranges up to 1000+ meters. In late 2000s mobile carriers (especially in China) created RF-SIM cards by inserting a RFID radio chip in a SIM card. RF-SIM card is one kind of active tags and sends out information regularly. While working RF-SIM needs to acquire power from a battery and the RF tag could not work when it runs out of battery (Dai et. al., 2011). Operating at 2.4GHz frequency, RF-SIM modules were able to communicate with external device at an automatic-adjusted distance of 10cm to 500cm through the built-in antenna. Because RF-SIM terminals (operating at higher frequency that

has short wavelength) were incompatible with NFC terminals, RF-SIM technology never gained traction in the market.

Lately, RFID technology is integrated into wristbands and other wearables used during the events. Festivals and live events are utilizing RFID wristbands as a means of payments besides keeping track of their attendees (Mavadiya, 2018). For large, open-air, multi-day events, wearables with RFID tags are preferred over NFC technology as NFC's effectiveness is limited by the short battery life and theft risk of smartphones. PayPal, in cooperation with Belgian firm PlayPass, introduced RFID wristbands at Spain's Low Festival in 2014 and reported 20% increase in spending of attendees. (Swedberg, 2014) For museums also, possible RFID implementations regarding interactive exploration, venue access, and cashless payments can improve patron experience. (Padelford, 2016)

WAP (Wireless Application Protocol) facilitates instant connectivity between mobile phones and the Internet. Additional applications that are available over WAP can be installed on mobile phones. Applications installed on the mobile phone can be used for POS payments and also WAP billing mechanisms are provided by service providers to complete transactions between the customer, e-tailers and third party content providers. Because new smartphones produced in Europe and America support HTML since 2013, WAP technology is not widely used. However, iBeacon (a next generation location application that uses the Bluetooth low energy technology to transmit information to the iPhone device via informational devices) and Host Card Emulation are expected to gradually replace WAP and HTML.

2. Factors influencing adoption of mobile payments

When mobile phones first came out, there were a few mobile phone makers and their products had very limited features. Offering a few simple operations other than speech and messaging, mobile phones of 20th century were rather simple devices-often called as brick phones – compared to today's mobile technology. Emergence of smartphones was the most important breakthrough in the mobile industry, as they not only transformed the industry and its players but also the consumption of everything digital.

With the launch of Apple's iOS and Google Android operating systems, smartphones had become familiar and easy to reach. Today, smartphones and other smart mobile devices turned out to be the indispensable part of our life as we can do most of our day-to-day business chores, access all kinds of information and services, and also shop via mobile web traffic. Even firms are increasingly opening up their innovation efforts to allow users to tap into the benefits they can offer, such as mobile data service (MDS) innovation on iOS and Google Android platforms. For this purpose, platforms typically provide toolkits to facilitate user participation, aiming to create an ecosystem for sustainable innovation. (Kankanhalli, et.al. 2015)

Highly innovative mobile industry simultaneously creates new value propositions through novel service offerings, while developing better technologies but acceptance of these products and services depends on a number of factors. Previous research addressing the consumers' adoption of new

technologies (Dewan and Chen, 2005; Dapp et. al., 2012; Lai, 2014) emphasized factors such as reliability, security and privacy, availability, and consumers' expectations and needs. In addition to these cited factors, some structural and socio-technological factors must be taken into consideration, including telecommunications infrastructure, investment climate for new ventures and startups developing new applications, and the adoption of other financial services like credit card penetration. For Turkey, similar and mainly technological factors influencing mobile payment systems are, mobile telecommunications deployments, available mobile payments applications, and mobile technology penetration in the country. In addition to some of these technological factors, financial basis such as domestic contactless POS device and credit card use will be the center of attention in following sections.

2.1. Mobile Infrastructure in Turkey

The rate of having a smartphone is most visible in vibrant economies. According to a 2015 survey conducted in 40 countries, Turkey ranks 12th in the world with 59%, figures represents a significant increase from 17% of 2013. Among the countries with high smartphone holdings are South Korea with 88%, Australia with 77%, Israel with 74%, America with 72% and Spain with 71% (Poushter, 2016). In Turkey, share of e-commerce in total retail is increased on a yearly basis passing 4% in 2017 and, as a part of e-commerce transactions, 44% were made on mobile devices in 2016 (Tusiad 2017). High rate of smartphone use in Turkey also creates demand for mobile data traffic, and the availability of bandwidth fuels e-commerce and mobile payments. Incumbent GSM operators provide the supply of bandwidth through the licenses in Turkey.

3G technology, which was first seen in Japan in 2001, is in operation at European countries since 2003. In 2009, 3G services were introduced in Turkey with Turkcell (A License), Vodafone (B License) and Avea (C License). In July 2009, Turkcell and Vodafone launched 3G services across all provinces, with Avea (later Turk Telekom) rolling out only in 16 provincial centers. [1] According to the 2012 data from Information and Communication Technologies Authority (ICTA) there were 41.8 million 3G subscribers in Turkey and as of 2016, mobile broadband subscriptions outpaced those of fixed broadband by 37.3 million to 9.2 million, and 3G penetration reaching to 65.9 million. [2]

4G is the fourth generation broadband wireless technology and it is expected to use same cellular networking system and solve some problems, mainly the problem of coverage in the third generation. Also, 4G system provides end-to-end IP solution that can serve users of voice, data and stream multi-mass communication "at any time, anywhere" based on higher data rates than previous generations. Moreover, 4G connection bandwidth is similar to WiMAX bandwidth and even wider. Turkey's three incumbent operators won the licenses for 4.5G in August 2015. LTE-Advanced (4.5G) is a 4G cellular broadband technology that is capable of real (typical/average) download speeds of 12–21

1 The Report: Turkey 2013. Oxford Business Group

2 Information and Communication Technologies Authority, "Electronic Communications Market in Turkey – Market Data, http://www.btk.gov.tr

Mbps versus 7–12 Mbps over early LTE/4G technology (Avcı, 2015). In the fourth quarter of 2017, the number of 3G subscribers decreased to 10,249.69 and the number of 4.5G subscribers increased to 64,558,929. The number of mobile broadband subscribers receiving mobile Internet services through mobile phones or computers increased to 56,944,673 with 3G and 4.5G services. [3]

2.2. Financial Component of Mobile Payments

One of the evident advantages of mobile payments is that they eliminate the need for carrying cash and physical cards. Cards are the most prevalent and universal payment channel that includes credit, debit and stored value cards. Vast majority of remote mobile payment applications use consumers' card information to complete a transaction, therefore remote mobile payment technology often requires a card issued by a financial institution. However having a card is not enough, the financial institution that issued the credit or debit card must be participating to add it to a payment-enabled phone or device.

Credit cards are the most important financial component of mobile payments ecosystem. By the end of 2018, credit cards issued by domestic banks passed 66 million mark in Turkey. Earlier, total number of credits cards reached to 63 million at the end of first quarter 2018 whereas POS machine use were low at 1.6 million in total. For the same period of 2018, 29 billion Turkish Liras worth of e-commerce transactions were completed by credit cards, which is equal to 16% of all payments. Contactless credit cards share and mobile contactless POS terminals share were equal at 40% respectively (Demirdöğmez et. al. 2018). Domestic contactless POS terminal penetration rate is important for mobile payments as the contactless terminals support NFC technology similar to those found in mobile devices.

Direct debit platforms are also utilized as a part of mobile payment transactions worldwide. Mobile direct debit is an authorized one-time payment which allows a bank to pay certain amount directly to a bank or merchant/company and the money is withdrawn from the customer's bank account. In Europe, Single Euro Payments Area (SEPA) system processes direct debits in real time directly from consumers'bank accounts in 45 countries and territories. With SEPA, all electronic payments are considered domestic across Europe and happen in Euros even if the relevant accounts are not in Euros. Launched in 2009, both B2C (Business-to-Consumer) and B2B (Business-to-Business) schemes of SEPA are in operation.

SEPA's B2C scheme is also called the *Core* scheme and the customer initiates a B2C transaction on merchant's website by sending a mandate filled out online. Merchants are free to design their own SEPA mandate forms but a mandate must contain the customer's name, IBAN (International Bank Account Number), merchant/company's name. For authorization, customers enter their phone number to receive the one-time password (OTP); a PIN code in general. The PIN code is sent in an SMS to the customer's phone number. Once the PIN code is entered at the checkout the transaction is approved and completed.

3 Information and Communication Technologies Authority, "Electronic Communications Market in Turkey – Market Data, http://www.btk.gov.tr

3. Methodology

In parallel with the increasing use of mobile payment technologies in the world, the number of mobile payments in Turkey is increasing rapidly. Especially the increase of mobile technology usage and investments in related sectors, especially done by banking sector, may have an influence on adoption process of mobile payments in general. The objective of this study is to identify the factors affecting mobile payment usage rate in Turkey. In seeking of these factors, statistical correlation analysis are employed.

First variable of a possible relationship is determined as the NFC supported POS machines which customers can easily pay through the banking or telecom operator applications. Secondly 3G technology adaptation rates is investigated to demonstrate the relation between used network technology and mobile payment usage rate. Thirdly, the relation between broadband internet usage rates by mobile devices is checked and then a comparison between usage rates by years and mobile transaction numbers was made. Fourthly, mobile telecom operator investments by years is considered to figure out the interaction between the investments and transactions.

Finally, based on smartphone sales numbers by years, our analysis tried to reveal the effects of sales on mobile payment transaction numbers. All enquiries intends to reveal the factors affecting the mobile payment technology usage in Turkey on yearly basis. For this purpose five hypothesis were tested to analyze the relationship between above mentioned factors and mobile payment transaction numbers/volumes by years. Correlation study run through SPSS to detect the interactions by using BKM (Bankalararası Kart Merkezi) data and BTK (Bilişim Teknolojileri ve İletişim Kurumu) data to have reliable and actual results.

4. Results

Our study suggested possible effects of financial and technological factors on mobile payments in Turkey. The relationships were examined between mobile payment transaction numbers and five parameters mentioned above. Table 1 below represents the number of transactions via mobile banking in Turkey by years, and these numbers will be used for the next five analysis. Results of correlation analysis were disclosed separetely below.

Table 1. Number of Transactions via Mobile Banking in Turkey by years (x1000)

2011	2012	2013	2014	2015	2016	2017	2018
33,258	36,708	41,695	48,748	45,612	44,445	40,246	~49,234

Source: https://www.tbb.org.tr/tr/bankacilik/banka-ve-sektor-bilgileri/istatistiki raporlar/59

4.1. Correlations related to Financial Components

Following table represents the numbers for contactless POS device penetration in Turkey. In this analyses, mobile payment transaction number is the dependent variable and contactless POS numbers is the independent variable. Thus y= transaction number and x= POS number.

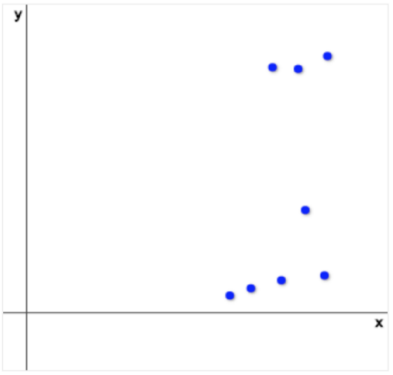
Table 2. Contactless POS Numbers in Turkey by years

2011	2012	2013	2014	2015	2016	2017	2018
43.000	61.000	81.000	93.000	256.000	608.000	612.000	640.000

Source: https://bkm.com.tr/wp-content/uploads/2018/05/1.aradonemfa.rap_.2018.pdf

Each point represents an (x,y) pair (in this case the transaction number, measured in millions, and the pos numbers, measured in thousands). The independent variable is on the horizontal axis (or X-axis), and the dependent variable is on the vertical axis (or Y-axis). The scatter plot shows a moderate positive relationship between transaction number and pos numbers. The data are displayed in a scatter diagram in the figure below.

Figure 1. Correlation Between Transaction Numbers and the Total POS Numbers



n=8, **Σx**=339.946, **Σy**=2394, **(Σx)^2**=115563.282916, **(Σy)^2**=5731236, **Σ(xy)**=106419.685, **Σx^2**=14667.952198, **Σy^2**=1240124**r = 0.43450605537544**

The correlation result shows that there is a moderate positive relationship with r=0.434 between mobile payment numbers/volume and contactless POS machine/device penetration in country. Therefore, the contribution of the increase of contactless POS numbers to the numbers of mobile payment in Turkey is positive.

The association between mobile payment transaction numbers and total credit card numbers is analyzed next. For the year 2011, more than 51 million credit cards are in use. By 2018, the number of credit cards issued rose to above 66 million. This data represents almost 30% increase in credit cards held by individuals, households and businesses. Table 3 represents total number of credit cards issued by banks in Turkey.

Table 3. Total Number of Credit Cards in Turkey by years (x1000)

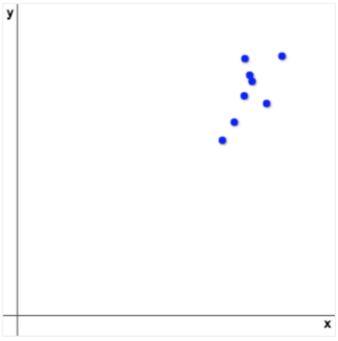
2011	2012	2013	2014	2015	2016	2017	2018
51.361	54.342	56.835	57.007	58.215	58.795	62.435	66.304

For the same 8 years period, mobile payment transactions in Turkey grew almost 50%, as shown in Table 1, compared to 30% increase in credit cards issued. In the following analysis, mobile payment transaction number is the dependent variable and total credit card numbers is the independent variable. Thus y= transaction number and x= total credit card numbers. The data are displayed in a scatter diagram in the figure below.

Each point represents an (x,y) pair (in this case the transaction number, measured in millions, and the total credit card numbers, measured in percent). The independent variable is on the horizontal axis (or X-axis), and the dependent variable is on the vertical axis (or Y-axis). The scatter plot shows a moderate positive relationship between transaction number and total credit card numbers. The data are displayed in a scatter diagram in the figure below.

The correlation result shows that there is a moderate positive association with r= 0.68 between mobile payment numbers/volume and total credit card numbers. Therefore, the increase of total credit card numbers may have helped the volume of mobile payments in Turkey.

Figure 2. Correlation Between Transaction Numbers and the Credit Card Penetration



n=8, Σx=465.312, Σy=339.946, $(\Sigma x)^2$=216515.257344, $(\Sigma y)^2$=115563.282916,
Σ(xy)=19898.003764, Σx^2=27213.456434, Σy^2=14667.952198r = 0.688451762856893

4.2. Correlations related to Technology-based Components

As the second phase of the study's correlation analysis, the relationship between information technologies and the mobile payments are tested. Three main technology-based components are wireless networks' 3G usage rates, broadband mobile internet usage and smartphone sales in the country. Table below represents 3G data traffic in percentages.

Table 4. 3G Technology usage rates in Turkey by years

2011	2012	2013	2014	2015	2016	2017	2018
%31.4	%41.8	%49.3	%58.3	%64.3	%65.9	%74.8	%78

Source: https://www.btk.gov.tr/uploads/pages/pazar-verileri/2018-3-ceyrekraporu-26-12-18-kurum-disi.pdf

Association of broadband mobile internet usage rates with mobile payments is also analyzed. Table 5 represents broadband mobile Internet usage percentage rates in Turkey by years.

Table 5. Broadband mobile Internet usage rates in Turkey by years in percentages

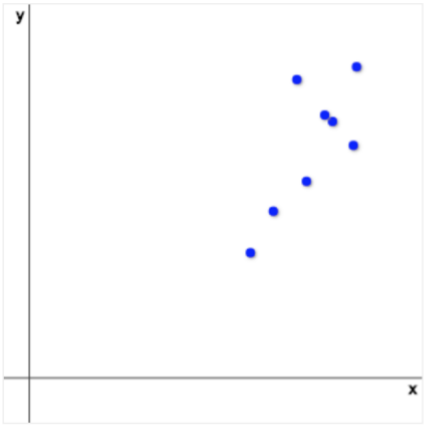
2011	2012	2013	2014	2015	2016	2017	2018
14.7	19.7	24.2	32.4	39.1	51.7	56.9	60.8

Source: https://www.btk.gov.tr/uploads/pages/pazar-verileri/2018-3-ceyrekraporu-26-12-18-kurum-disi.pdf

In this analysis, mobile payment transaction number is the dependent variable and 3G Technology usage rate is the independent variable. Thus x= transaction number and y=3G technology usage rates. The data are displayed in a scatter diagram in the figure below.

Each point represents an (x,y) pair (in this case the transaction number, measured in millions, and the 3G technology adoption rates, measured in percent). The independent variable is on the horizontal axis (or X-axis), and the dependent variable is on the vertical axis (or Y-axis). The scatter plot shows a positive or direct association between transaction number and 3G technology adaptation rates. The correlation result shows that there is a strong positive association with r= 0.75 between mobile payment numbers/volume and 3G technology usage. Therefore, the volume of mobile payments in Turkey is strongly reinforced by the increase in adoption of 3G technology.

Figure 3. Correlation Between Transaction Numbers and the 3G Technology Adoption Rates



n=8, **Σx**=339.946, **Σy**=463.8, **(Σx)^2**=115563.282916, **(Σy)^2**=215110.44, **Σ(xy)**=20188.6974, **Σx^2**=14667.952198, **Σy^2**=28718.92**r = 0.752649760742406**

In the following analysis, mobile payment transaction number is the dependent variable and broadband mobile internet usage rate is the independent variable. Thus y= transaction number and x= broadband mobile internet usage rates. The data are displayed in a scatter diagram in the figure below.

Figure 4. Correlation Between Transaction Numbers and the Broadband Internet Usage

n=8, Σx=339.946, Σy=299.5, $(\Sigma x)^2$=115563.282916, $(\Sigma y)^2$=89700.25, Σ(xy)=13165.1547, Σx^2=14667.952198, Σy^2=13375.53r = 0.631920810754244

Each point represents an (x,y) pair (in this case the transaction number, measured in millions, and the broadband mobile internet usage rates, measured in percent). The scatter plot shows a moderate positive relationship between transaction number and broadband mobile internet usage rates. The correlation result shows that there is a moderate positive association with r= 0.63 between mobile payment numbers/volume and broadband mobile internet usage rates. Therefore, the high correlation indicates strong relationship between increase of broadband mobile internet usage and the numbers of mobile payment in Turkey.

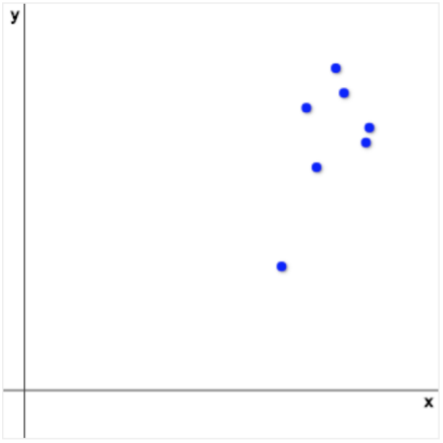
Finally, relationship between the total smartphone sales and the mobile payment transactions is examined. Smartphone sales numbers are strong indicator for the technology's penetration rate (although one can purchase more than one phone within the fiscal year, but such cases are rare and teherefore ignored) Turkey's total sales numbers for smartphones are given in Table 6 below.

Table 6. Total Smartphone sales numbers in Turkey by years (x1000)

2012	2013	2014	2015	2016	2017	2018	2012
5.000	9.000	10.000	12.000	13.000	11.400	10.600	5.000

Each point represents an (x,y) pair (in this case the transaction number, measured in millions, and the total smartphone sales numbers, measured in million). The independent variable is on the horizontal axis (or X-axis), and the dependent variable is on the vertical axis (or Y-axis). The scatter plot shows a medium severe association between transaction number and smartphone sales. The correlation result shows that there is a medium severe association with r= 0.57 between mobile payment numbers/volume and smartphone sales. Therefore, the increase of smartphone sales has strong effect on the numbers of mobile payment in Turkey.

Figure 5. Correlation Between Transaction Numbers and the Total Smartphone Sales



n=7, **Σx**=306.688, **Σy**=71, **(Σx)^2**=94057.529344, **(Σy)^2**=5041, **Σ(xy)**=3152.0888, **Σx^2**=13561.857634, **Σy^2**=761.32**r = 0.576846207885724**

As presented in figures above –and although correlation doesn't necessarily imply causation, association or correlation between mobile payments transaction numbers and chosen variables simply indicates that the values vary together. By looking at the numbers of different variables that shows a growth trend in mobile payments ecosystem, our analyses shed light on the determinants of mobile payments in Turkey, pointing to the trends seemingly fluctuating in tandem.

Discussion

In the field of banking and payment technologies, innovative solutions led by banks and financial institutions are substituting conventional methods and the use of cash is rapidly disappearing. In the near future, it is envisaged that cash usage will be replaced by credit cards and contactless payment solutions. Credit card usage has been used as an alternative to cash for many years, but contactless payment solutions are becoming increasingly widespread and innovations are emerging every day.

In Turkey there are some factors vary in parallel with mobile payment transaction numbers that of the increasing of contactless POS machine numbers, 3G/4G adoption rate, mobile broadband internet usage rate, smartphone sale rates and credit cards issued by domestic banks. Among the technological and financial aspects of mobile payments, only three components has shown high correlation with increasing mobile payment transaction numbers; and they are credit cards in use, mobile broadband internet usage, and 3G adoption rate. These results may seem as expected, although correlation doesn't necessarily imply causation rule, the domestic mobile broadband internet usage is increased subsequently in recent years because of the investments in 3G and 4.5G investments by the incumbent GSM operators along with the consumers' apetite for smart phones in

general. Availability of mobile data bandwidth and the increase in credit card usage may have created opportunities for developing and launching mobile payment systems in Turkish markets by FinTech companies.

From FinTech perspective, our study's results revealed positive indicators for local entrepreneurs and startups as well as the large foreign companies that have plans to expand into the domestic market. However, it is the incumbent players in Turkey that are driving the FinTech scene and innovation. In our country, unlike Europe and America, mobile payment solutions provided by global tech players like Apple Pay, Google Pay, Samsung Pay and Ali Pay are not available due to the fact that regulations and law related to these services lag behind. Such void is filled by the services developed by the domestic banks, financial institutions and telecom operators. The most common of these products are mobile applications that are widely used and many of them have contactless payment feature. Some examples include Maximum Mobil from Türkiye İş Bankası, Bonus Flash of Garanti Bankası, and Yapı Kredi Cüzdan (World Mobil) developed by Yapı Kredi Bankası. In addition to the banks, incumbent GSM operator Turkcell offers PayCell service enabling its customers to make mobile payments without sharing credit card information during the transactions.

Turkey's young population and rapid technology adoption has always taken its place over the European average respectively. Turkey is also witnessing a continuous growth in mobile payments and almost 65% of FinTechs [4] are focusing on providing digital alternatives for cashless payments. ING Group's April 2015 survey [5] showed that 56% of the population in Turkey used a mobile payment app, almost twice of the numbers in France or Germany (25% and 23% respectively). Absence of mobile payment technologies from global tech giants can be considered as a disadvantage for the Turkish markets but the joint efforts of established banks, new entrants and incumbent technology vendors who choose to collaborate on infrastructure while competing on product offering level separates Turkey from rest of the world – our own model of mobile payment systems thrive.

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