FINTECH INNOVATION: THE MODERN CHALLENGES OF FINANCIAL SERVICES

by

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[NOVEMBER 2017]

CERTIFICATION OF THESIS PREPARATION

"I hereby declare that this particular thesis has been written by me, in order to obtain the Postgraduate Degree in Accounting and Finance, and has not been submitted to or approved by any other postgraduate or undergraduate program in Greece or abroad. This thesis presents my personal views on the subject. All the sources I have used for the preparation of this particular thesis are mentioned explicitly with references being made either to their authors, or to the URL's (if found on the internet)."

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Contents

1 Introduction

"FinTech" is an abbreviation of the words Financial Technology (Fin + Tech). It is the sector which researches and implements innovative solutions from Technology to the Financial World. Technology was never separate from Finance. One of the first applications of the Telegraph was to transfer the quotes of stock prices from the exchanges along the country back in the late 1800s. Credit cards were introduced in late 1950s and the first ATMs came out back in late 1960s early 1970s. Finance is a business close to the society and every form of new technology that could benefit communication and effectiveness was significant.

The majority of the FinTech companies now, have been influenced by the philosophy of Tech Startup companies. The evolution of Internet to the Web 2.0 era, (Web 1.0 ended in early 2000s) has facilitated the introduction of many new business models and practices from the online businesses world. These innovations are able to simplify and automate operations, lower costs and also minimize the intermediation. Financial Crisis of 2008 forced the implementation of this new technology because financial sector lost clients due to trust to the system and secondly the clients under the new circumstances had lower income and net worth. These innovations were able to thrive in smaller companies because the environment was providing the required flexibility for this change. "Too-big-to-fail" business schemes in this case weren't able to provide the conditions for these changes to thrive. However, now bigger financial organizations are cooperating with FinTech startups and are able to implement these innovations by participation, acquisition and even in-house.

This thesis has a goal to delve into some of the changes and innovations in financial services. In Chapter 2 we will discuss the changes to investing and lending environment which the innovation of P2P lending had caused. We will see the dynamics and the specific features that this kind of business model possess both for investors and for borrowers. In Chapter 3 we research Crowdfunding which can be viewed as a special case of P2P Lending. We also mention information related to the incentives and goals that the participants have (Founders-Creators side, Funders side), and some specific observations related to the success of a crowdfunding campaign which the academic literature revealed. In Chapter 4 we enter to one of the most discussed and mature topics of FinTech which are the Electronic Payment Systems. In this topic we review the current ecosystem of the Electronic Payment Solutions. It would be incomplete if we didn't discuss what the academic research has concluded so far for the adoption of these kind of payment systems by the public, given the fact that this sector is the

most mature in Financial Technology sector. In Chapter 5, we present the technology of electronic investments and robotic advisory. Specifically, we discuss how this innovation makes use of automation algorithms and Artificial Intelligence to operate a robotic investment portfolio. Additionally, we examine why the future Perspectives of E-Investments and the current status related to their performance and their risks. Lastly, we believed that Cryptocurrencies as the latest payment system innovation deserved a separate chapter (in Chapter 6). We try to simplify some of the mechanics of the Cryptocurrencies and avoid being too technical and present only the economic perspective of this topic. Moreover we mention some risks that Cryptocurrencies possess and present some discussions and the latest concerns related to Cryptocurrency and BitCoin market. We have focused a little bit more on BitCoin because it has the largest market share in the Cryptocurrency market. Lastly in the conclusions we note down the conclusions we gathered after writing this thesis about the FinTech sector and some ideas for future research.

Ελληνική Περίληψη

Ο όρος FinTech είναι ακρωνύμιο των όρων Finance και Technology και αποδίδει τον επιχειρηματικό τομέα ο οποίος ασχολείται με την χρήση καινοτομιών και σύγχρονων τεχνολογιών στα Χρηματοοικονομικά. Η εισαγωγή της τεχνολογίας στα Χρηματοοικονομικά δεν είναι καθόλου καινούργιο φαινόμενο. Ο τηλέγραφος μια από τις πρώτες εφευρέσεις στον τομέα των Τηλεπικοινωνιών μια από τις αρχικές και πιο σημαντικές του εφαρμογές είχε την διάδοση των ειδήσεων και των τιμών κλεισίματων των μετοχών από τα χρηματιστήρια σε όλη την χώρα στην Αμερική. Η εφεύρεση των πιστωτικών καρτών τη δεκαετία του 50 και η εφεύρεση του ATM αρχές του 60 είναι άλλα δύο δείγματα που δείχνουν αυτό. Επειδή τα Χρηματοοικονομικά είναι κοντά στην κοινωνία, οποιαδήποτε εφεύρεση ή καινοτομία που διευκολύνει την επικοινωνία και την αποτελεσματικότητα στο τομέα αυτό είναι πολύ σημαντική.

Η πλειοψηφία των FinTech εταιρειών τώρα, έχουν επηρεαστεί από την φιλοσοφία των Τεχνολογικών Startup εταιριών. Η εξέλιξη του Διαδικτύου από την αρχική του μορφή τέλη του 1990 στην νέα χιλιετία έχει εισάγει νέα επιχειρηματικά μοντέλα και πρακτικές από τον κόσμο των online επιχειρήσεων. Αυτές οι καινοτομίες έχουν σαν κύρια φιλοσοφία την απλούστευση και αυτοματοποίηση διαδικασιών, την μείωση του κόστους, και την μείωση της ανάγκης για διαμεσολάβηση (κάτι που μειώνει το κόστος και τις διαδικασίες ταυτοχρόνως). Η οικονομική κρίση του 2008 εξανάγκασε κατά κάποιο τρόπο αυτές τις τεχνολογικές αλλαγές να υλοποιηθούν διότι ο Χρηματοοικονομικός τομέας έχασε και λόγω της έλλειψης εμπιστοσύνης που προξένησε αυτή η κρίση αλλά και επειδή ήταν αναγκασμένος να εξυπηρετεί πελάτες με λιγότερου εισοδήματος και πλούτου. Αυτές οι καινοτομικές αλλαγές ήταν δυνατό να αναπτυχθούν σε μικρότερες εταιρείες διότι σε αυτό το περιβάλλον υπήρχε περισσότερη ευελιξία για αυτή την εξέλιξη. Παρόλα αυτά όλο και μεγαλύτεροι χρηματοοικονομικοί οργανισμοί και εταιρείες συνεργάζονται με FinTech startups και είναι σε θέση να υλοποιήσουν αυτές τις αλλαγές είτε με συνεργασία, είτε με συγχωνεύσεις είτε αναπτύσσοντας λύσεις στο δικό τους επιχειρηματικό περιβάλλον.

Η παρούσα πτυχιακή εργασία σκοπό έχει να διερευνήσεις τις καινοτομικές αλλαγές στις χρηματοοικονομικές υπηρεσίες. Στο κεφάλαιο 2 γίνεται συζήτηση για τις αλλαγές που έχει φέρει το P2P Lending στο επενδυτικό περιβάλλον. Θα δούμε τις δυναμικές και τις ιδιαιτερότητες που διαθέτει το συγκεκριμένο επιχειρηματικό μοντέλο και για τους επενδυτές αλλά και για τους δανειολήπτες. Στο κεφάλαιο 3 γίνεται διερεύνηση του Crowdfunding το οποίο μπορεί να θεωρηθεί ως ένα υποσύνολο ή μια ειδική περίπτωση του P2P Lending. Επίσης

αναφέρονται και πληροφορίες σχετικά με τα κίνητρα και τους στόχους των συμμετεχόντων (από την πλευρά των δημιουργών που διενεργούν τις crowdfunding καμπάνιες και από την πλευρά των χορηγών), όπως επίσης και συγκεκριμένες παρατηρήσεις που σχετίζονται με την επιτυχία μιας crowdfunding καμπάνιας τα οποία αναφέρονται στην ακαδημαϊκή βιβλιογραφία. Στο Κεφάλαιο 4 μπαίνουμε σε ένα αρκετά συζητημένο και ίσως το πιο ώριμο θέμα του FinTech τομέα, που αφορά τα Ηλεκτρονικά Συστήματα Πληρωμών. Σε αυτό το θέμα κάνουμε ανασκόπηση του παρόντος οικοσυστήματος των Ηλεκτρονικών Συστημάτων Πληρωμών. Θα ήταν ανεπαρκές εάν δεν κάναμε λόγο για το τι συμπεραίνει για την υιοθεσία αυτών των συστημάτων από το κοινό μέχρι στιγμής, η ακαδημαϊκή βιβλιογραφία. Στο Κεφάλαιο 5 παρουσιάζεται η τεχνολογία των ηλεκτρονικών επενδύσεων και των robot advisory. Συγκεκριμένα, διεξάγεται συζήτηση σχετικά με το πώς αυτή η καινοτομία κάνει χρήση αλγορίθμων αυτοματοποίησης και ανάλυσης δεδομένων για να λειτουργήσει ένα ρομποτικό επενδυτικό χαρτοφυλάκιο. Επιπρόσθετα, εξετάζουμε, τις μελλοντικές προοπτικές των ηλεκτρονικών επενδύσεων και το υφιστάμενο περιβάλλον σχετικά με τις αποδόσεις και τους κινδύνους τους. Τελευταία, θεωρήσαμε ότι οι τεχνολογίες των Κρυπτονομισμάτων ως η πιο πρόσφατη καινοτομία στα ηλεκτρονικά συστήματα πληρωμών ότι άξιζε ειδικής αναφοράς σε ξεχωριστό κεφάλαιο (στο Κεφάλαιο 6). Προσπαθήσαμε να απλουστεύσουμε ορισμένες από τις έννοιες του πως λειτουργούν τα Κρυπτονομίσματα και να αποφύγουμε τις τεχνικές λεπτομέρειες αλλά να παρουσιάσουμε όσο το δυνατόν την οικονομική διάσταση αυτού του ζητήματος. Επιπλέον αναφέρονται ορισμένοι κίνδυνοι που ενέχουν τα Κρυπτονομίσματα και παρουσιάζουμε επίσης ορισμένα ζητήματα και αντιλήψεις σχετικά με τις αγορές του BitCoin και των άλλων Κρυπτονομισμάτων. Τέλος στα συμπεράσματα αναφέρουμε ορισμένες σκέψεις και ιδέες που έχουμε σταχυολογήσει και συγκρατήσει κατά την διάρκεια της συγγραφής της παρούσης εργασίας σχετικά με τις τεχνολογίες του FinTech τομέα και ορισμένες ιδέες για μελλοντική έρευνα.

2 Online Lending

According to the FDIC 2015 Report about under-banked minority, the forth reason which inhibits individuals for reaching to a banking service is their Credit History. Most of them are being rejected from banks, which use traditional risk measurement methods, as risky clients because their current financial position doesn't make them approvable for a loan grant by the banks.

Specifically as the FDIC 2015 report quotes, 13.7 percent of asked households had credit needs that were not fully met by banks. In that share, almost half (52.5%) managed to keep on track with the bills. In addition, of the household share that had already a bank credit but refused to get a new one, 65.1 % managed to not fell behind from their bills. Even though, staying on bills is not the only significant decision factor for giving credit, however it is still an important indicator.

The FinTech industry exploits this gap by using modern technology. Specifically they make use of Big Data Analytics procedures inputting alternative data from social media or other soft data (apart from financial).As (Petersen., 2004) argues, soft information is different from hard because it is difficult to be quantified. Hence, Data Science and Advance Analytics, have in this case primary objective to quantify all these soft data into a score to be used in credit rating. Thus, they use different more computerized methods for screening for loans and distinguish individuals which are creditworthy, that would never be able to get a loan via traditional banking, and this is the added economic value that Big Data science and Analytics are giving.

As an anecdotal example, a FinTech Lending platform would ask the potential borrower for giving them access to social media data or mobile phone data. For example, having access to mobile phone calls, data analytics has shown that people who call consistently to specific relatives and friends are more likely to repay their loan. Moreover, access to GPS data shows that people with regular commuting routine are more safe borrowers. Also, an individual who communicates more than 58 people is more likely to repay, according to some other FinTech firms. However, these type of analytics are related with firms that operate in developing countries.[1] As (Pötzsch & Bohme, 2010) quote: "Likewise, participants in online social lending do not adhere to strictly objective principles for risk assessment and they do not (only) seek to maximize their expected financial wealth. Other, anecdotal evidence suggests that

[1] Adopted by the TED Speech " A smart loan for people with no credit history (yet) https://www.ted.com/talks/shivani_siroya_a_smart_loan_for_people_with_no_credit_history_yet/transcript

online social lenders exhibit pro-social and even altruistic behavior. For instance, the not-for profit platform Kiva.org allows individuals to invest capital in small and medium-sized businesses (SMB) operating in developing countries. Although lenders receive zero interest on their investment, the platform counts 675.000 members who have invested about US$ 120 million between fall 2005 and February 2010 (www.kiva.org, n.d.). This example highlights the presence of investors' social motivations on this micro-finance market".

2.1 Overview of Peer-to-Peer Lending and Social Lending Environment:

At a glance, online platforms make use of the Internet and connect potential lenders who want to invest their money with borrowers. This process is called Peer-to-Peer lending Under P2P lending, the borrower can borrow money from many different lenders. In Figure 1 we can see how P2P Lending Business Model can be compared to other forms of investing.

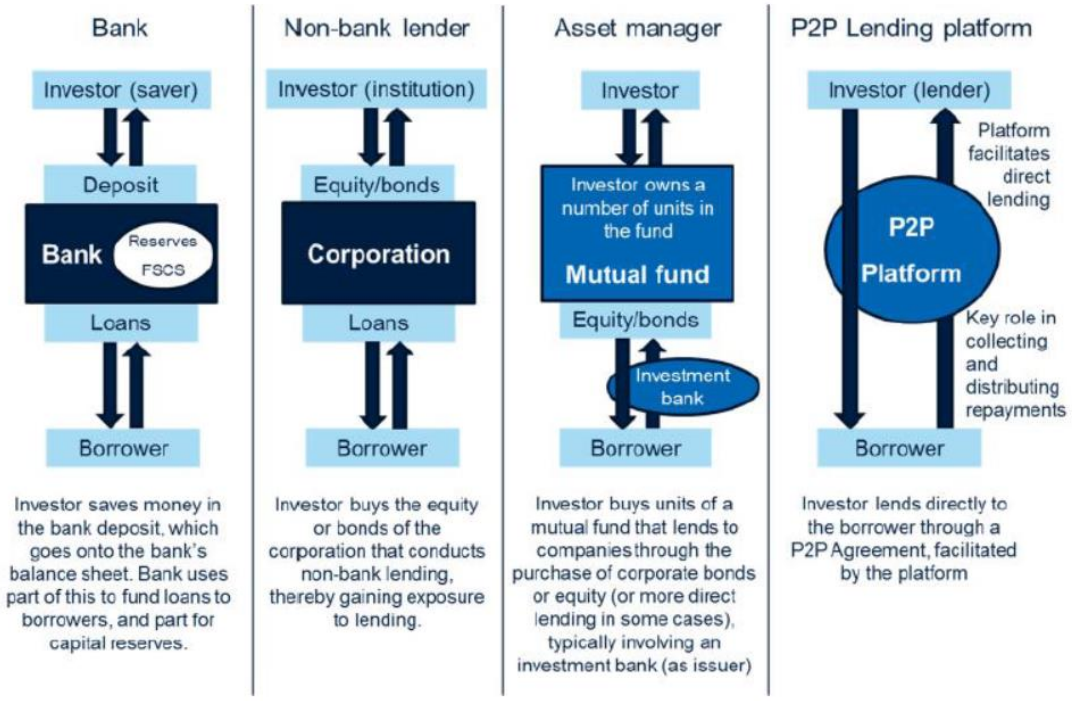


Figure 1 at the last right column we can see how P2P Lending Business Model compares to traditional form of investing
Source: (Oxera, 2016)

This is beneficial for both counterparties since borrower can borrow for a lower interest rate and lenders are diversifying their risk. Compared to stock markets, P2P investments have less volatility and a low correlation. They also offer higher returns than conventional sources of yield. (Garret, n.d.).

P2P Lending and Big Data analytics are used in synergy by the firms. Traditional Banks are aware of these new technologies and start to adopt them or collaborate with FinTech firms who specialize to that.

Some notable P2P lending platforms are Lending Club, Prosper, UpStart, Kabbage, OnDeck Capital and Lending Circle. In Table 1 it is presented some major online Platforms that operate in Europe and United States.

Company	Country	New loans	vs. previous month	vs.last years month
		[million. EUR]	%	%
Ablrate	UK	2,2	33%	538%
Arboribus	Spain	0,3	-70%	-20%
ArchOver	UK	4,1	33%	533%
Assetz Capital	UK	16,1	31%	24%
Bitbond	Germany	0,6	13%	>999%
Bondora	Estonia	2,9	-4%	7%
Comunitae	Spain	0,9	-7%	-3%
Credit.fr	France	0,7	-14%	223%
Crowdestate	Estonia	0,4	-74%	-55%
Dofinance	Latvia	1,8	10%	n/a
Estateguru	Estonia	3,2	128%	335%
Fellow Finance	Finland	9,6	25%	91%
Finansowo	Malta	1.2	0%	0%
Finbee	Belarus	O,δΓ	23%	98%
Fixura	Finland	1,5	-8%	9%
Folk2Folk	UK	3,3	-55%	159%
Funding Circle	UK	99,3	-8%	53%
FundingKnight	UK	0,0	0%	-100%
Fundingsecure	UK	12,7	16%	109%

Company	Country	New loans	vs. previous month	vs.last years month
		[million. EUR]	%	%
Geldvoorelkaar	Nederlands	Ί,2Γ	-58%	-49%
Growly	Spain	0,3	-48%	49%
Investly	Estonia	1,0	-37%	169%
luvo Group	Estonia	0,6	-6%	n/a
Klear	Bulgaria	0,2	50%	n/a
Kokos	Malta	0,2	-11%	-64%
Landbay	UK	3,2	-11%	>999%
Lendahand	Nederlands	0,8	12%	-1%
Lending Club	USA	n/a*	n/a	n/a
Lending Works	UK	5,3	26%	267%
Lendinvest	UK	n/a	n/a	n/a
Lendix	France	2,1	-82%	6%
Lendy	UK	4,IT	14%	108%
Lenndy	Latvia	0,5	7%	n/a
Loanbook Capital	Spain	0,1	-96%	>999%
Mintos	Latvia	29,3	4%	206%
MoneyThing	UK	1,8	-57%	-53%
Nucleus	UK	28,1	33%	n/a
Paskoluklubas	Belarus	0,8	8%	293%
Proplend	UK	1,2	>999%	>999%
Prosper	USA	n/a*	n/a	n/a
Ratesetter	UK	38,2	-25%	-40%
Rebuilding Soc.	UK	0,0	-100%	-100%
Savy	Belarus	0,5	108%	98%
Smartika	Italy	0,2	0%	0%

Company	Country	New loans	vs. previous month	vs.last years month
		[million. EUR]	%	%
Smava	Germany	0,3	14%	3%
Swaper	Latvia	1,7	7%	n/a
ThinCats	UK	2,8	64%	-1%
Toborrow	Sweden	0,1	-37%	>999%
Twino	Latvia	11,3	39%	38%
Unilend	France	0,3	-67%	58%
Viainvest	Latvia	3,7	20%	n/a
Viventor	Latvia	1,4	18%	13%
Zopa	UK	87,4	-25%	49%

Table 1 Loan volume of P2P lending companies. Source: P2P-Banking.com (August, 2017)

Looking at the statistics it is concluded that the market share of the Online Lending is increasing. However, the volume of loans granted by the P2P Online Lending Sector is considerably less compared to the volume of loans given by the traditional banking sector. A depiction of the aggregate growth rate of the P2P market is presented in Figure 2 and in Figure 3 we can see the future growth potential which is estimated.

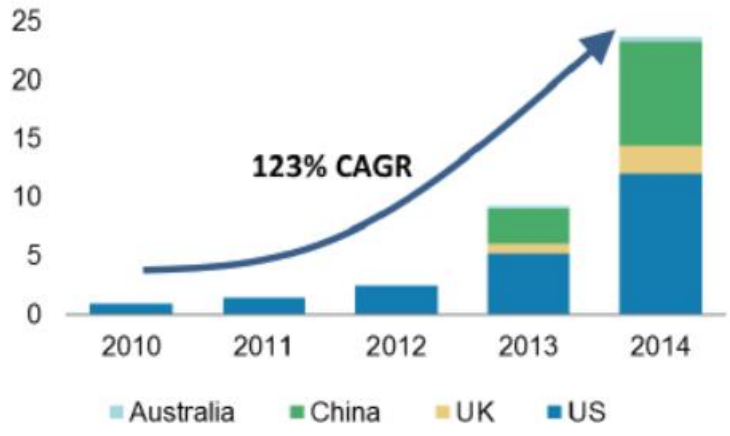


Figure 2 aggregate growth rate of the P2P market Source: Morgan Stanley Research

Figure 3 Projections about the potential growth of the P2P Sector Source: Morgan Stanley research

In Figure 4 and Figure 5 we can see how the risk profile of P2P lending is compared among other traditional investments.

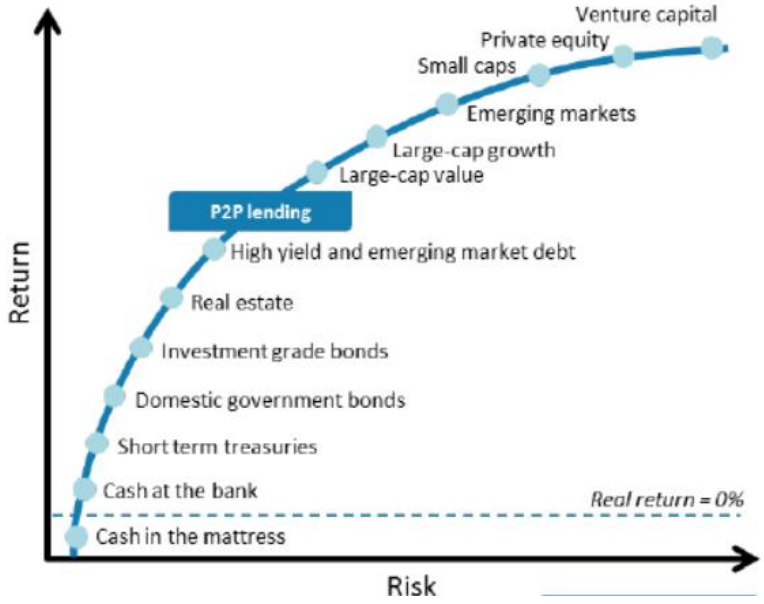


Figure 4 Risk Profile of P2P Lending against other Asset Classes Source: Money Place: Morgan Stanley "Innovations in Financials" Breakfast Series May 2015, Morgan Stanley Research

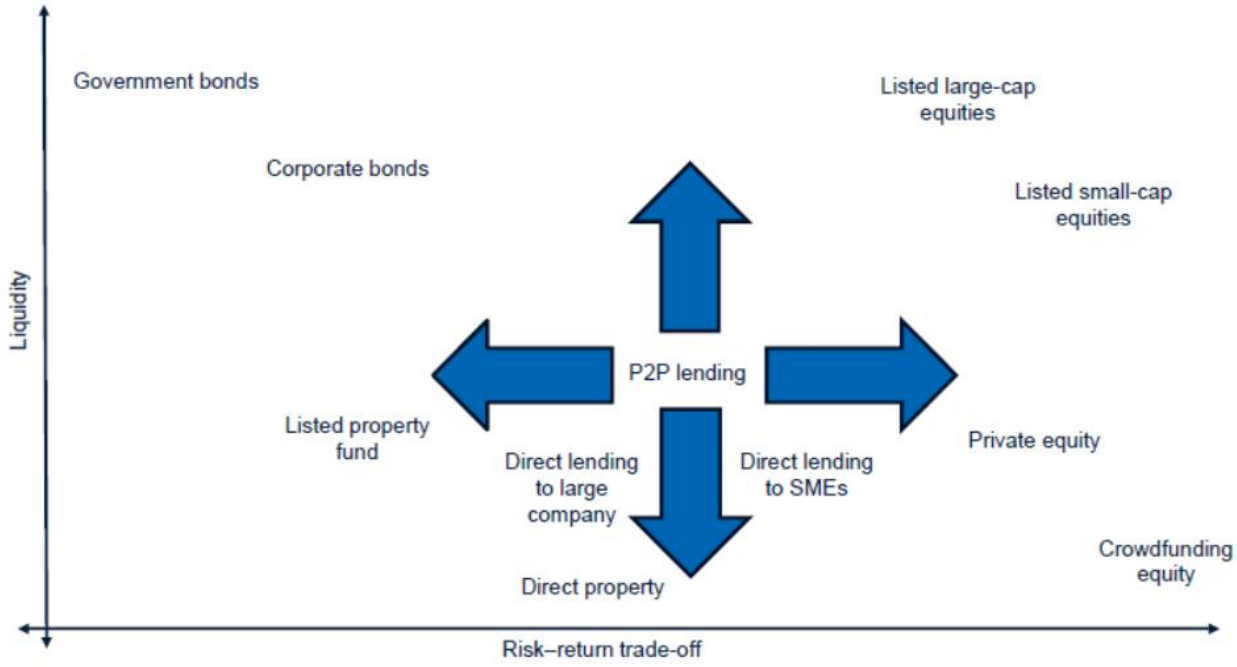


Figure 5 Profile of P2P Lending against other Asset Classes Source: (Oxera, 2016)

It's also noteworthy that P2P Lending is starting to win grounds and among institutional investors. In a UK study by (Zhang, et al., 2015) noted that 32% of the 2015 investments in P2P Lending where from institutional investors.

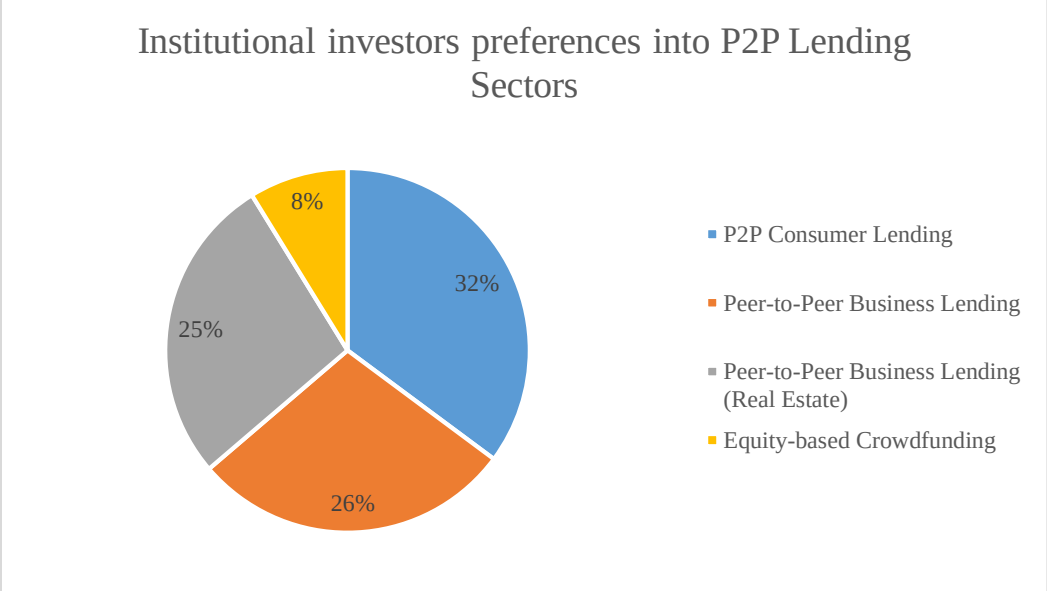


Figure 6 Institutional investors preferences into P2P Lending Sectors Source: (Zhang, et al., 2015)

The preferences of the institutional investors are depicted in Figure 6. They hold more fraction of the P2P Consumer Lending since in this type of loan portfolio, is consisted by lower volume loans and this means that they hold a defensive position in P2P Lending, given that it has a riskier profile compared to other type of investments.

2.2 Business Model of P2P Lending Online Platforms

The business model, policies and interest rates setting of P2P Lending differs from platform to platform. Some platforms specialize in personal or consumer loans and other specialize in commercial or small business loans. However, sometimes because the majority of these kind of loans are not backed by some kind of other security, they have higher interest than collateralized loans but this also depends on the credit score of the borrower. The oldest P2P platforms are using FICO rating system (in USA mainly) however modern techniques use business analytics as aforementioned in-house or outsourced. For example Prosper outsources credit rating service to Experian, and LendingClub.com outsources this service to TransUnion LLC. For the investor side, this high yield compensates them for the risk they are taking, but in case of non-performing loans, the majority of the platforms charge fees on each payment and extra charges for litigation processes.

Structure of a an electronic P2P lending platform is presented in Figure 7

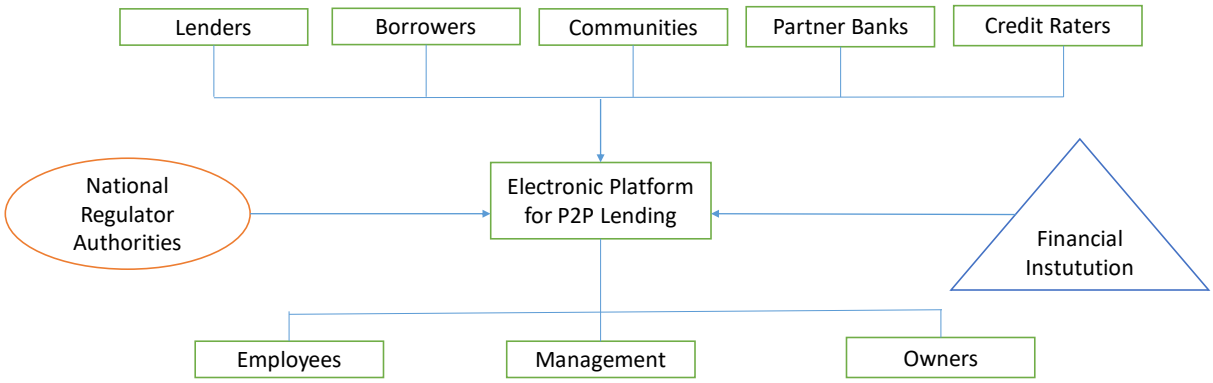


Figure 7 A Structure of an Electronic P2P Lending Platform (Bachmann, et al., 2011)

Lending process differs from platform to platform. Usually they follow either an auction process or a standardized process but nowadays auctions are used only for large loans.

When auctions were allowed, an auction is taking place lasting usually some days. Lenders are offering the minimum interest rate they can accept and the lowest bid wins. Then a team of lenders who agree with that particular interest rate is formed. Data analytics are employed also to help the lenders get a view about the credit score of the applicant.

In Prosper and some other lending platforms when auctions were allowed, there was the option of group formation between members. The members of the group when they are able to ask for a loan, they are able to get a lower interest rate on the loan. This happens because in group formation, members allow other members to their group only if they are trustworthy and have good credit ratings. When a member of a group gets a loan, in case of default, the fellow members of the group will be asked to make some payments in favor of their member. Optionally each group might have a group leader might suggest some credit review about some borrower from his group or in an auction bid for his loan. Thus, group members have the incentive to be cautious to the selection of the members in their group and the member who will be the group leader. In the aforementioned platforms there are unpaid groups and paid groups where the group leader for his services as an intermediate, receive one fee included in the loan. This was a way to reduce the effect of asymmetric information since no other knowledge was available other than what the borrower and platform possessed. Many researchers like (Lee & Lee, 2012) were able to track herding effects among the investors under this auction `model`. Herding was also a way to reduce uncertainty by following the trend of other better-informed (as assumed) investors.

In a standardized process as the majority of platforms work nowadays, where there aren't any auctions, the interest rates are standardized according to credit rating, hard data (the financial data which the borrower provides) along with the soft data like social status and other demographical data. Nowadays, additional alternative soft data like social media can be used if the borrower agrees. Unfortunately soft data cannot be always be verified because the data sources are not always reachable or trustworthy. In this case Big Data Analytics are important in the processing of the data.

In both models, the nominal loan amount is also variable apart from the interest rate. Applications with better credit rating scores are more likely to get full funding than lower credit ratings. No matter what, it is required by the regulations in the majority of the countries, that every lending platform to have partnership with some Monetary Financial Institution as it can

be seen in Figure 7. Prosper.org is partner with Wells Fargo bank, Zopa.com cooperates with Royal Bank of Scotland etc.

When the borrower gets a credit rating from the credit rating bureau, and the lenders decide on the interest rate and the amount of financing then, the loan is granted via a commercial bank, who partners with the platform. The bank has no opinion about the borrower screening and the loan granting decision and immediately securitizes the loan, thereby transferring the credit risk to the pool of borrowers (Pötzsch & Bohme, 2010).

In addition, the majority of P2P Lending Platforms uses the concept of buffer fund. The buffer fund is paid by lenders as a form of insurance to smooth out the returns even in economic downturn times when the loss rates of the borrowers increase. However in some platforms which support resolution, losses can be recovered at some level. Some platforms are also performing stress testing to these funds to check if they are robust to a deterioration of the economy (Oxera, 2016).

It's important to mention that since this investing scheme is more like DIY, platforms are required to give transparency to their data and metrics and the rest tools for analysis. The investor are needing all this capabilities and information in order to decide and implement their loan portfolio. The regulators also oblige the platforms to support for these data and information apart from the risks that the lenders are facing.

Diversification is very important in the formation of the loan portfolio for the investor. The platforms provide the required tools to help the investor diversify his investing capital. There is automatic diversification tool so as the capital gets invested as the risk preference profile of the investor firstly and secondly the diversification takes place in order to provide funding to lower rated borrowers. For more advanced investors, platforms provide some more advanced tools and they provide them with the ability to perform some minor loan picking for their portfolio but without relaxing diversification rules to a large level. In Figure 8 we present how a loan portfolio can be have optimized returns through diversification.

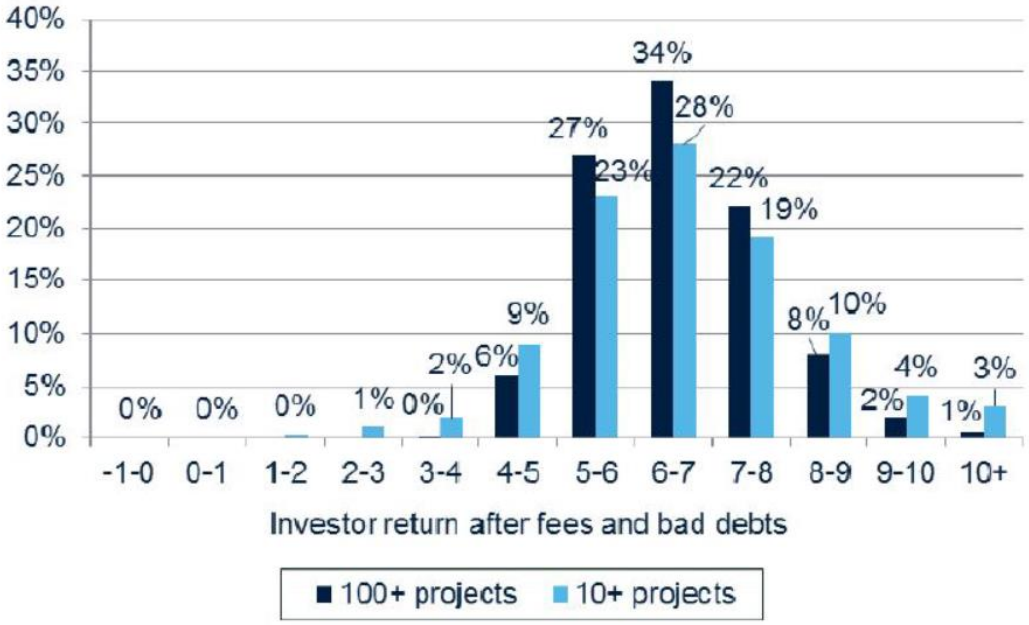


Figure 8 Distribution of returns for investors who have lent to at least 100 projects with a maximum exposure of 1%, or to at least 10 projects with a maximum exposure of 10%. Note: The returns are for investors lending for at least one year, and do not include future expected losses. Source: (Oxera, 2016), data from Funding Circle, https://www.fundingcircle.com/statistics

All platforms also provide secondary markets for loans as someone can release his investment and sell part of the loan portfolio to other investor. However as interest rates change he can sell it at a loss or gain. However as (Oxera, 2016) notes, secondary market is not used so often since investors are having a long term horizon. This is shown by size of the secondary markets which at maximum is 20% of the size of the loan volume in the primary market (Oxera, 2016).

As we can conclude by understanding the business model of P2P online lending platforms it is clear that this sector is complimentary to banks and other type of investments because it is different product. Its different from banks because these scheme of investment doesn't have the regulator guarantee that bank deposits have. Moreover, it has different risk profile and is considered a longer term investment. And lastly this type of investment is not considered liquid enough and it is not a source of liquidity provider as banks are. But as seen from US and UK experience, banks react to P2P Lending by having partnership with the existing P2P platforms or building their own in-house platforms and trying to earn market share.

2.3 Determinants of Borrow Interest Rate in P2P Lending Platforms.

Borrow interest rate is related with the return of the investors and the fees of the platform. But the most important fact is that the lender should receive return adequate of the risk that is taking by lending to an individual which can be measured by the credit rating of the borrower. Because auction mechanism for locking the interest rate for each loan (as aforementioned) resulted to an inadequate return for the lenders, not responding to the risk premium, Prosper Lending Platform stopped this option in 2011 and kept only the standardized loan granting process. Many other platforms that had auctions followed and stopped auctions for interest rates among lenders. Auctions currently are allowed only for large loans. In brief the lending determinants are in Figure 9.

Figure 9 Lending Determinants in Loan Granting Process in P2P Lending Source: (Herzenstein, et al., 2008)

According to the empirical study of (Berger & Gleisner, 2009) with 14,321 sample the most significant factors of the borrowing rate are:

- Loan amount
- Credit Rating of the Borrower
- Debt to Income Ratio
- Visual Self Disclosure (Personal Photo)
- Auction Process (if the platform allows it)

When auctions for borrowing rates where allowed, a decision for auctions was important. If a borrower wasn't using the auction choice, which was a negative signal of creditworthiness

where the marketplace requires a significant risk premium for loan listings that are not auctioned. (Berger & Gleisner, 2009). However, Auction initially was good since this mechanism allowed for competition among bidders which improves the conditions for borrowers, but this later was abandoned since lenders weren't compensated enough for the risk that were taking. Now, only large loans mostly in business and not consumer loans. Because large loans are given only to higher grade credit rating businesses auctions are used to smooth out the interest rate in favor of the borrower.

In addition some other determinants that are related with the presence of groups:

- Group affiliation (paid or unpaid)
- Group rating
- Group size
- Group Leader involvement
- Fees in case of Paid Group

A study by (Yang, 2007) notes that the outsourced credit rating isn't unfalsifiable. Specifically higher credit rating score, lower debt-to-income ratio or lower bankcard utilization rate doesn't always lead to lower default rate. Finally, a data model with nonlinear structured predicting parameters (like neural network algorithms) outperforms models with linear assumption (Yang, 2007).

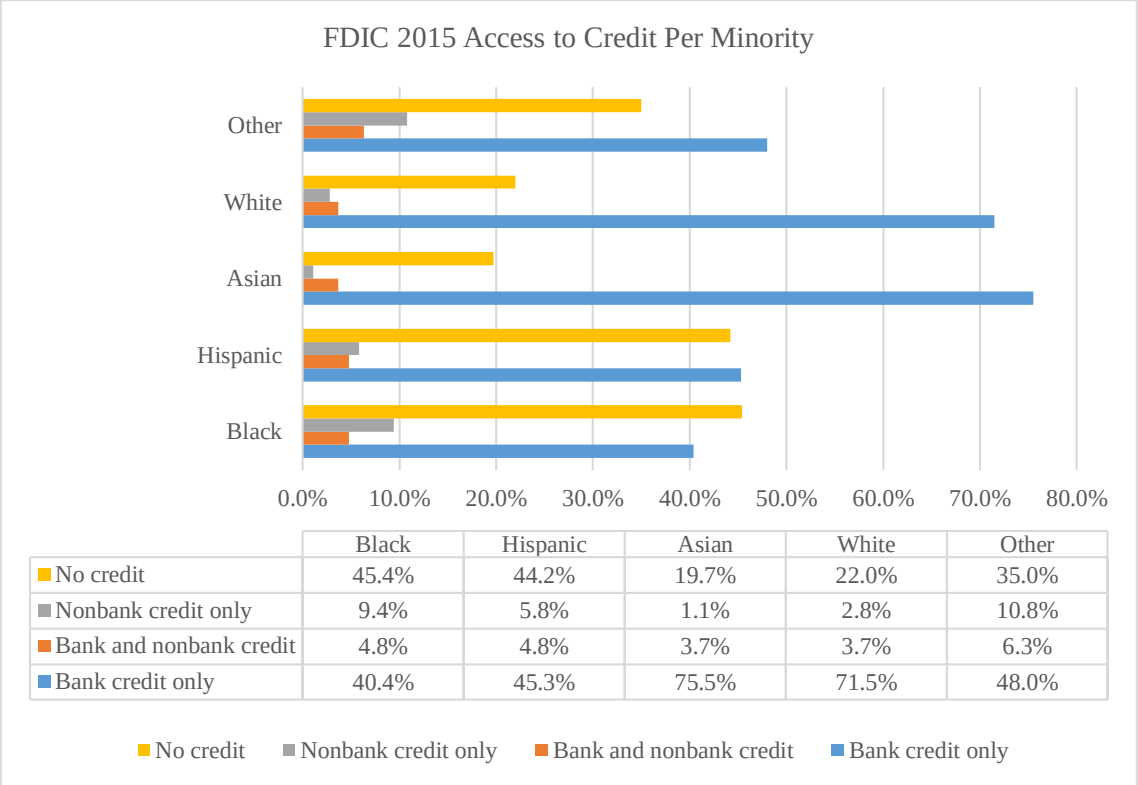
It is also worth mentioning that, home ownership is not relevant since these type of lending doesn't involve any kind of collateral, however it lowers the borrowing rate.

Better group rating lowers the cost of borrowing. Moreover, larger groups are more preferable for lenders because they are less likely to have misleading behaviors (like cartels). Furthermore, the involvement of the Group Leader is also significant. For example: if the group leader posts a mandatory review for the credibility of the borrower and even better if he bids in an auction for the loan of the borrower, both actions constitute positive signals for the credibility of the borrower. Hence, the intermediation of the group leader according to this study (Berger & Gleisner, 2009) is adding value to the transaction, since it lowers the information asymmetry between lenders and borrowers, and this fact agrees with prior traditional finance research.

2.4 Do Demographic Information affect borrow interest rates?

As far as demographic information is concerned, studies have shown that discrimination based on demographic characteristics other have only little impact on the likelihood of funding and

interest rates. (Herzenstein, et al., 2008) (Pope & Syndor, 2008) (Ravina, 2007). Specifically these demographic attributes, their effects are very small in comparison to effects of borrowers' financial strength and their effort when listing and publicizing the loan. These results are substantially different from the documented discriminatory practices of US financial institutions, suggesting that individual lenders lend more fairly when their own investment money is at stake in P2P loans (Herzenstein, et al., 2008). This is justified (from US only data) of the FDIC 2015 Access to credit as seen in Figure 10 where, access to credit is more constrained from Black and Hispanic minorities.



	Black	Hispanic	Asian	White	Other
No credit	45.4%	44.2%	19.7%	22.0%	35.0%
Nonbank credit only	9.4%	5.8%	1.1%	2.8%	10.8%
Bank and nonbank credit	4.8%	4.8%	3.7%	3.7%	6.3%
Bank credit only	40.4%	45.3%	75.5%	71.5%	48.0%

Figure 10 Access to Credit Source: (FDIC, 2015)

In addition, age seems to be factor that affects interest rates, since younger and very old borrowers are appearing more risky to the lenders. As far as the occupation is concerned, self-employed borrowers are considered more risky. (Pötzsch & Bohme, 2010)

2.5 How soft information affects borrowers' interest rates?

The question of how much does soft information discloses effect the loan interest rate in P2P Lending was the objective of several empirical studies. (Pötzsch & Bohme, 2010) in their study concluded that soft information disclosure such as personal, qualifications, hobbies, family situation etc. and description of the project containing:

- Statements that arouse pity to the reader
- Direct appeal for help
- Reference to own helpfulness
- Claimed eligibility for ban loan
- Costs already incurred.

They found that soft info lowers the cost of the loan, however the decrease is marginal and not consistent. For example, calls for help that arouse pity if are overdone result to higher interest rates. (Pötzsch & Bohme, 2010) think that this is due to the fact that at repayment of the loan the borrower will use helplessness calls again and this doesn't build trust to the lenders.

2.6 Returns for the P2P Lenders:

On the other side of the coin, the lenders need to be assured that will get a return according to the risk that they are taking for lending to borrowers. For most of the cases, each investor would await a return relative to the credit risk that the borrower has ranked for, or in other words a risk premium. In Figure 11 we look indicatively to some return statistics about the US biggest P2P Lending platform.

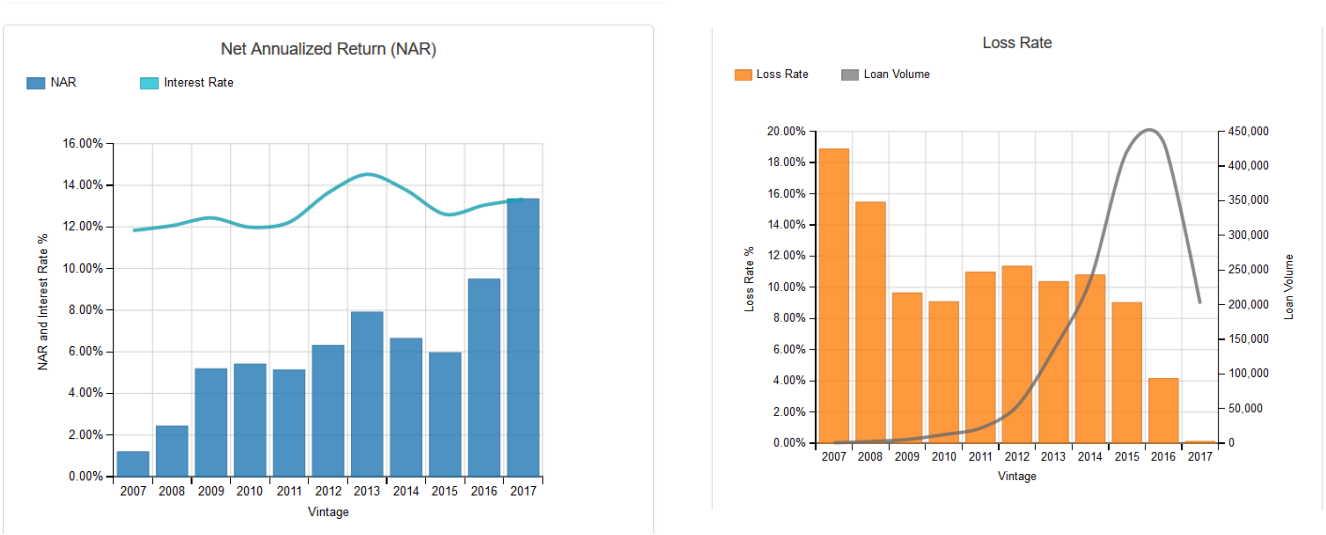


Figure 11 Lending Club Net Realizing Returns and Loss Rates Source: https://www.peercube.com/histperf/index

As it is can be concluded, P2P lending is a risky investing activity as not all platforms can guarantee the returns or exceptional performance and no loss of the initial capital committed. Moreover, no insurance or any safety net is applied as in bank deposits. Loss Rates in the very first years were increasingly high for Lending Club. (Yang, 2007) disputes these historical statistics for both Lending Club (and Prosper) as his research calculations show larger losses

and lower returns. But as the sector is moves to a more mature level and earns more market share and secondly the economic and financial situation rebounds after the Financial Crisis of 2008, the returns of the investors' smooth out and the loan volume rises. 2013 interest rates for the borrowers increased because the portfolio mix change as the loan grants to lower grade rating where increased and losses were more likely into this grade rating ranks.

3 Crowdfunding

In this particular section we delve into the industry of crowdfunding. Crowdfunding has many similarities with peer-to-peer lending however it is different and should be viewed a bit differently. To be more specific, as the two concepts look alike their relation is that peer-to-peer lending seems like a subset or a special case of crowdfunding or crowdfunding is the superset containing the concept of peer-to-peer lending. Crowdfunding gathers funds from a pool of funders. P2P Lending has the particularity that this transaction with the funders always contains a money return.

As far as the definitions of crowdfunding there are two approaches. The methodological approach defines crowdfunding as a novel method for funding a variety of new ventures, allowing individual founders of for-profit, cultural, or social projects to request funding from many individuals, often in return for future products or equity. Crowdfunding projects can range greatly in both goal and magnitude, from small artistic projects to entrepreneurs seeking hundreds of thousands of dollars in seed capital as an alternative to traditional venture capital investment (Schwienbacher & Larralde, n.d.).

The entrepreneurial approach defines crowdfunding as the efforts by entrepreneurial individuals and groups – cultural, social, and for-profit – to fund their ventures by drawing on relatively small contributions from a relatively large number of individuals using the internet, without standard financial intermediaries (Mollick, 2014).

There are various crowdfunding internet platforms and the most proponent platforms are:

- Kickstarter
- Indiegogo
- CircleUp
- GoFundMe

The crowdfunding takes two forms as various publications of academic literature support (Belleflamme, et al., 2014):

- philanthropic form
- the reward-based form
- the profit-sharing form

In the philanthropic form the crowdfunding efforts, such as art or humanitarian projects, follow a patronage model, placing funders in the position of philanthropists, who expect no direct return for their donations (Mollick, 2014).

Related to reward based form, the creator of the venture promises some kind of reward to the contributor of his venture. Depending of the type of his venture if it would be some kind of product, gadget or artist event. In this case the creator promises to pre-sale the product to the contributor with a beneficial discount or some kind of personal customization. In case of artistic ventures the creator would provide tickets of the event or even some more abstract type of rewards like credits of the contribution during the event or special meetings with some preferred donators etc. Thus, the crowdfunding seems as a unique and alternative method of financing since the incentives of the contributors are not purely monetary or utilitarian. Philanthropic and social contribution incentives are also motivating participation into this crowdfunding form even though there is some kind of reward. Moreover the funders in this funding process are interested in getting something that has some history behind it or something unique that they had participated in the making of.

In the profit sharing form however, the creators of the venture are promising reward in the form of the revenue sharing. In this particular crowdfunding form the incentives of the participants are more similar to investing. For this reason this type of crowdfunding depending on the conditions set can be viewed as equity crowdfunding where the reward of the contributors' is similar with the dividend earned by investors in a typical corporation firm because they have shares. Similarly if the conditions are more close to a syndicate loan with some interest then it is a case of peer-to-peer lending as aforementioned in the introduction.

The internet platforms earn their revenues by realizing a fee on the collected funds by the contributors. The fee usually is from 5% to 10%. Each funding round has a time limit and a target of funds that need to be reached so as the creators of the venture to be in position for cashing out the funds. For example: goal collect 50.000 $ in 60 days. Moreover the creative sectors for which crowdfunding platforms operate according to (Mollick, 2014) are:

- Art
- Comics
- Dance
- Design
- Fashion

- Film
- Food
- Games
- Music
- Photography
- Publishing
- Technology
- Theater

Each platform tries to diversify among these topics but there are platforms that specialize in some of these. In addition some of the crowdfunding platforms are specialized in crowdfunding for philanthropy.

3.1 Incentives and Goals of Creators-Founders, Platforms and Funders:

In this section details related to the objectives and incentives of people needing crowdfunding: creators and people providing the funding: funders, are discussed. In other words the agents of demand and supply in this alternative market. Furthermore several findings from the academic literature related with the crowdfunding agents' interaction will also be important in this discussion.

The creator entering a crowdfunding round has the objective to collect capital with lower cost or couldn't collect otherwise (from other traditional financing means). Furthermore, the creators or founders are trying to assess the demand for their product which is in progress. In other words they are gathering information and feedback from the crowd for their product. With this way, when an amount of capital can be collected and demonstrate the demand for their design they are in position to seek funding from other more traditional resources. A similar case like this was with the creation of Pebble Smartwatch which was refused funding from the majority of Venture Capital firms and was able to earn attention and significant funds through crowdfunding and have a significant success in gadget market. It's also possible that a crowdfunding round takes place for marketing reasons creating interest from the early stages of the development (Mollick, 2014). This is important because after launching a product the creators could possibly release other complimentary products and they want to set the foundation from the pre-development stage. This also happened with the case of Pebble Smartwatch aforementioned which succeeded in crowdfunding and Venture Capital rounds and software developers were able to create applications for the watch before the official release to

the market. Assessing demand through crowdfunding provides useful information. This information will likely lower the cost of capital if the signal from the market is positive. In principle, the same effect could be achieved without crowdfunding by preselling the invention and then presenting the sales information when raising capital through traditional channels. However, if the additional information is negative relative to expectations, then this may work in the opposite direction and increase the cost of capital (Agrawal, et al., 2014). Moreover, (Agrawal, et al., 2014) quotes also: that if crowdfunding increases competition in the supply of early stage capital, then it may drive down the cost of capital across other channels for early-stage funding.

As far as the funders' goals and incentives the general view is that their goals are extremely heterogeneous (Mollick, 2014). As a rule of thumb it depends of the crowdfunding platform since a priori each platform specializes in a different sector (design, technology, film, music, theater etc.) and with a different model philanthropic, reward-based or equity-based and as a result they attract the relevant crowd. In a philanthropic context, the funders are operating to support a cause that they personally view as important. In return based models they have also heterogeneous preferences since each funder would likely fund according to the sector that likely prefers. However, in both models, (philanthropic and reward) the funders are investing funds in a project that they expect to end successfully. Thus even in altruism driven contributions the funder would examine indicators of quality in the working project even though that he would not expect any financial return in the end. Additionally in reward-based models the funder would behave as an investor and try figuring out and fund a project that would have success.

The funder is not a typical consumer as seen in the retail market but more like an investor. Accessing in a reward based product crowdfunding market the funder can have early access to a new product release. In this way the funder can have a product with a significant discount before official release. In addition, during early development stage, the funder can give feedback about the product and/or have customization according to his preferences. This way the funder is in place to satisfy his needs for buying something unique, and customized in an undervalued price, that has a story behind it and himself with his funds was able to participate to that. For many funders, investing on a crowdfunding platform is an inherently social activity, and they commit capital partly to obtain preferential access to the creator (e.g., updates, direct communication), which they value. They also derive consumption value from the feeling of

being part of the entrepreneurial initiative (Schwienbacher, & Larralde., 2010). Moreover, as (Agrawal, et al., 2014) quotes, crowdfunding platforms formalize financial contracts between family and friends which are the early investors of a project. This formalization is important among social relationships because it reduces risk taking as a formal contract is exposing the liabilities and the requirements of the creator and this doesn't endanger the social relationship. In addition, the intermediation of a crowdfunding platform acts as an arbitrative mechanism that ensures funders that their funds would proceed for the cause that they have chosen.

So far, none crowdfunding platform operates as a non-profit organization and as aforementioned they charge a 5-10% fee on the collected funds in a successful project. Specifically, all platforms have several operating schemes:

- Fixed Funding, (all-or-nothing), which the founder of the project can only keep the money only if he reaches the funding target or in case that he fails the funders get refunded. In this scheme, the fees are lower or close to 5%.
- Floating Funding (keep it all), which the founder of the project can keep the money even that he fails to reach the funding goal. In this scheme in case of a failed project, the founder keeps the funds but is charged usually, with larger fees usually 15-20%.

Thus the crowdfunding platforms have incentives to maximize the number and size of successful projects. This requires attracting a large community of funders and creators as well as designing the market to attract high- quality projects, reduce fraud, and facilitate efficient matching between ideas and capital (e.g., by increasing the degree of disclosure by the entrepreneurs and allowing for effective search on the side of the funders). (Agrawal, et al., 2014). Moreover, crowdfunding platforms are willing to preserve:

a) Their reputation for successful projects
b) A growing funders' base due to network effect.

They have as an objective to promote projects that can attract attention of media and their followers.

3.2 Inherent Characteristics and Findings of the Crowdfunding Market:

The findings from the academic literature related to the market interactions and interplay among the basic agents are presented in the following paragraphs.

Firstly, one of the most significant findings that is regularly seen in the academic literature is that the distribution of succeeded funded projects is highly skewed. Very few projects are able

to gather the targeted amount of funds in time and the failure rate is very high. Specifically, according to (Mollick, 2014) projects which gather funds below the 5% of their goal is close to 55%. Moreover, as (Agrawal, et al., 2011.) noted, in Sellaband a music crowdfunding platform (operating with an all or nothing scheme), in their study, only 34 artists were able to gather the 50000$ required funds to record their music album. Moreover, these 34 artists gathered the 73% of the total invested funds in the crowdfunding platform during the whole period.

Secondly, funders are reactive to other funders' action. Academic literature notes that in online crowdfunding platforms there is evidence of herding and bystander effects. More specifically, as (Kuppuswamy, & Bayus,, 2013) suggest about the pattern of funders behavior in reward-based crowdfunding is bathtub shaped. Specifically in Kickstarter projects typically get a lot of backer support in the first and last weeks of their funding cycle. A high level of initial project interest in the first few days is quickly followed by decreasing support over most of the funding cycle. As the project nears the end of its funding cycle, successful projects are able to generate renewed excitement which results in a rise in backer support (Kuppuswamy, & Bayus,, 2013).Moreover, (Agrawal, et al., 2011.) also agree that the funding would most likely grow when the funding goal is close. However, (Mollick, 2014) suggests that the inherent characteristics and nature of each project, are also playing a role in the funding process. Quality signals, the nature of projects and the aforementioned behaviors of the funders are some of the factors that explain the un-uniformity of the funding in these crowdfunding platforms.

As far as fraud rates are concerned, (Mollick, 2014) suggests that from empirical evidence are very rare. In particular, the direct failure rate, therefore, was 14 out of 381 products, or 3.6%. Further, the projects that were not responding totaled just $21,324 in pledges, compared to nearly $4.5 million for the remaining projects (Mollick, 2014). As the author suggests, "even though Kickstarter has no enforcement mechanism to prevent con artists from using the system to raise funds for fake projects, it is clear that with a direct failure rate well below 5%, founders appear to make attempts to deliver their products". However, as the regulation for crowdsourcing financing mechanisms are established (JOBS Act in USA signed in 2012) as crowdsourcing is gaining in popularity, close monitoring by the regulation bodies is needed. Furthermore, as frauds rates are staying low, the delays in the delivery of the promised return are usually the norm. Specifically, as (Mollick, 2014) empirical evidence suggests of the 126 projects that were delayed, the mean delay to date was 2.4 months and only 24.9% of projects delivered on time, and 33% had yet to deliver at the time of the study. This happens due to the

overconfidence of the creators about the results of their ventures, problems related to management and paperwork (patenting etc), and issues in manufacturing a large scale of their products (mass production) (Belleflamme & Lambert , 2014).

With Crowdfunding the creators are able to attract funders globally as long as the rules of the crowdfunding platform and the monitoring body are allowing it. As (Agrawal, et al., 2011.) study suggests, the mean distance between funder and artist of Sellaband crowdfunding platform (dedicated to music) was 3000 miles. However as (Mollick, 2014) suggests, in a USA study there is geographic clustering per project sector. Specifically more film crowdfunding projects are located in Los Angeles, more technology crowdfunding projects are located in San Francisco, and more fashion design crowdfunding projects are located in New York etc.

Crowdfunding although offers benefits for creators and investors has several drawbacks that inhibit both sides. Firstly, for creators, they are able to lose the advantage of the secret of their innovation to other competitor since crowdfunding requires disclosure. This is crucial for the creator for this time span between pre-development stage and launch of the product since any imitation would threaten the venture. Also, disclosure of the crowdfunding figures puts creators to a low negotiating position since their suppliers know exactly the margins that they have. Legal issues with patents or royalties would also be possible to arise. Secondly as (Agrawal, et al., 2014) point out, crowdfunding compared to Venture Capital lacks since in the second case Angel Investors bring know-how of the particular market, connections and networking with potential clients and suppliers and status to the start-up company. These extra features are not reachable in a crowdfunding process. Moreover, in case where the crowd offers feedback or demands customization of the product this amount of knowledge is too large to be able to be distilled to the product design and hard to manage in contrast with the expert advice which is pointed to the right direction.

The drawbacks for funders, in summary have many commonalities with the risks that traditional investors or retail customers of a company face. (Agrawal, et al., 2014) identified three types of risks that donors encounter in crowdfunding:

- Creator Incompetence
- Fraud
- Project Risk

Specifically they face the risk that the creator would not be able to perform as promised and reach the milestones required. Moreover, fraud risks are also present, however the new developed regulation requires platforms to reduce it. Moreover, startups and pre-develop projects are risky, and the risk level is not always able to be forecasted from before how is going to result, and sometimes even when the creator is competent and willing to act as promised. Thus, funders should include these risk factors in their requirements from the creators and ask an adequate return.

(Mollick, 2014) suggests some of the factors that can predict success in a crowdfunding round. Kickstarter suggests some video description of the anticipated venture. Absence of video description indicates lack of preparation which is a negative quality signal. In addition, (Mollick, 2014) supports that updates just after the release of the crowdfunding campaign related with the venture advancements is also very important. Presentation and neatness of the prospectus of the venture is also very important. Correct spelling is very important as (Cabral, 2012) suggests for online auctions and (Mollick, 2014) argues that this also holds and for crowdfunding campaigns. Moreover (Mollick, 2014) adds that larger goal size and duration of the crowdfunding campaign act as negative signals to funders. Lastly, network size of each creator is detrimental for the campaign success since larger networks imply larger likelihood of potential funders. Since crowdfunding is operating with individuals and not institutions or investors (Mollick, 2014) research was done with individual persons, however academic research suggests that network effect matters and in case of more formal investor roles.

The basic question related to an entrepreneur that seeks financing through crowdfunding campaigns is which model needs to follow. A presale or an equity-profit sharing model? A study of (Belleflamme, et al., 2014) using Game Theory and Mathematics to model the crowdfunding process resulted to many interesting conclusions related to this decision. According to them a presale is more profitable for the creator if he has a small need for capital but if the capital exceeds some threshold then an equity-profit sharing crowdfunding campaign is more profitable. The capital needed must be assessed relative to the market that the venture is related. As they specifically quote," If we keep the level of funding needs constant, this implies that pre-ordering is more likely in larger markets and, thus, for products that can reach a large base of customers. In contrast, products that are very specific in nature and are only of use to a narrow set of consumers (e.g., a comic book or an obscure movie) may be more often funded through a profit-sharing scheme or donations". In addition, (Belleflamme, et al., 2014),

in cases where there is asymmetric information such as quality concerns etc. an equity-profit sharing model is also more suitable.

Related with the decision which is more appropriate, Fixed or Floating Funding, a study conducted by (Cumming , et al., 2015) has concluded that a Fixed Funding is better. As they analyzed data (47,139) from several online crowdfunding platforms they concluded that the most funding was gathered by campaigns following the Fixed Model. The findings are depicted in Figure 12 and for funders in Figure 13 respectively.

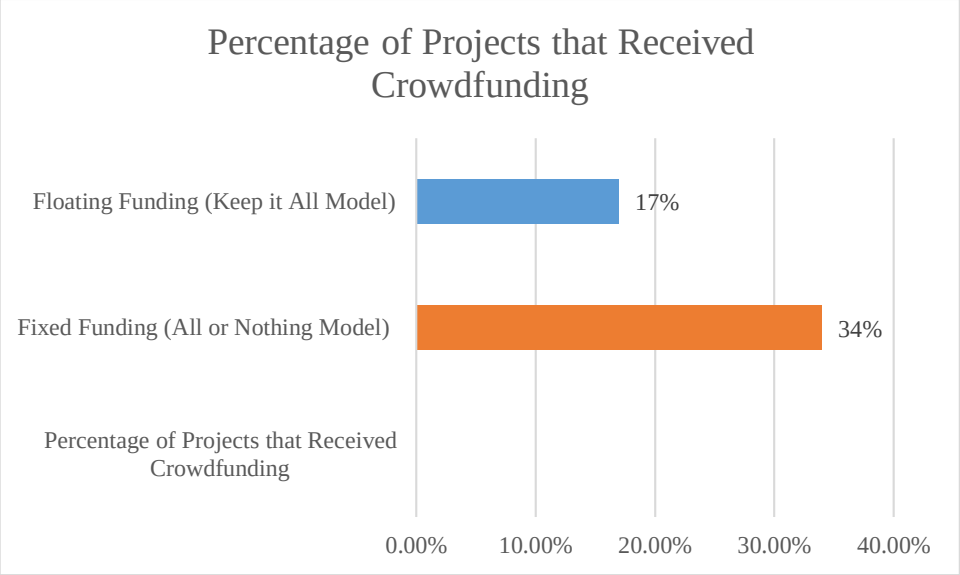


Figure 12 (Cumming , et al., 2015) study Percentage of Projects that Received Crowdfunding Source: (Cumming , et al., 2015) (Kolenda, 2017)

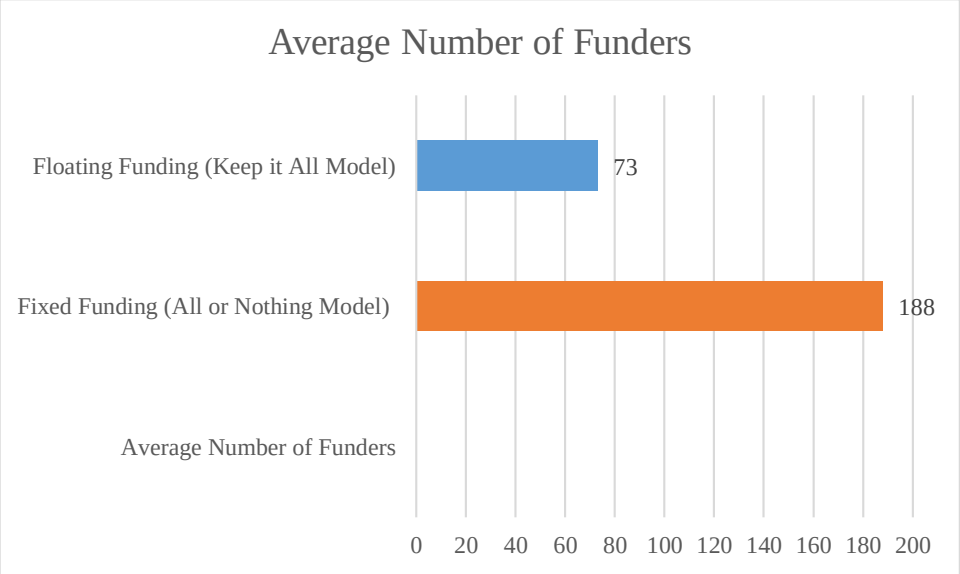


Figure 13 (Cumming , et al., 2015) study Average Number of Funders Source: (Cumming , et al., 2015) (Kolenda, 2017)

As they suggest, a possible explanation for that is the selection of an all or nothing scheme is a quality indicator towards funders that creator fully dedicates to complete the project as he was planned. Thus this signal operates as a risk reducing factor.

Additionally, a breakdown of the costs and disclosure of the budget of the project enhances transparency to funders. According to (Bekkers & Wiepking, 2010) study on philanthropy, a detailed report of the costs helps funders to have a clearer picture of the upcoming project and they feel that their donations are going to be used in an efficient manner. It implies that this would hold and for return-based models.

(Agrawal, et al., 2014) as aforementioned outline the risk factors that funders face. Any attempt to offset them and disclose that to funders is considered a good marketing strategy for crowdfunding campaign. This can be archived through presentation of the creator's reputation and expertise with project-related factors. This is backed up by (Hsu, 2007) in a study in venture capital sector related with significance of founder's expertise. The funding is even more likely to succeed if the creator was involved in a previous successful crowdfunding campaign noted by (Kuppuswamy, & Bayus,, 2013). Furthermore, since crowdfunding is a financial activity but with social and altruistic aspects the crowd also is more eligible to fund a creator if it is disclosed that the creator is an active member in the crowdfunding community and has funded as a funder other past projects(Giudici, et al., 2013).

As aforementioned before in the Peer-to-Peer Lending section, also in crowdfunding, disclosure of personal information is helpful because it personalizes the project since funders are unlikely to fund a vague or abstract project which is not known by whom is managed. Moreover, academic research (Small, et al., 2007) in charity financing has shown that identifiable persons are more likely to get funding since sympathy emotions arise (Kolenda, 2017).

Publication of the names of donors can enhance funding in donation-driven crowdfunding models. According to (Bekkers & Wiepking, 2010) a study that research traditional charity campaigns pointed out among several other donation incentives, that individuals donate funds when they are willing to be perceived by their social environment as compassionate (Kolenda, 2017). Although, compassion incentive holds, it is more fruitful when the crowdfunding campaign that someone launches to has a targeted audience. People who relate and have empathy for the cause of the crowdfunding campaign are more likely to donate. For example, people who funded a music concert in the past or were the founders of that event are more

likely to offer funding to a similar new project since they can relate. In addition, it is more convenient to provide to the crowd the lowest amount possible that can be donated, such as $1 or $0.50. This will increase the number of funders since even the low-budget funders can afford funding. More funders in an early stage of crowdfunding is a quality signal and will motivate potential funders to contribute in more mature stages of the campaign (Kolenda, 2017).

Preserving the momentum of the crowdfunding process is very important. As aforementioned updates related with the project are likely to increase the funding rate since progress towards the planned goaled is archived. Specifically, (Xu, et al., 2014) found out from a sample of 8,529 projects in Kickstarter platform that the most regularly updated projects are more likely to succeed. Some general statistics are presented in Figure 14.

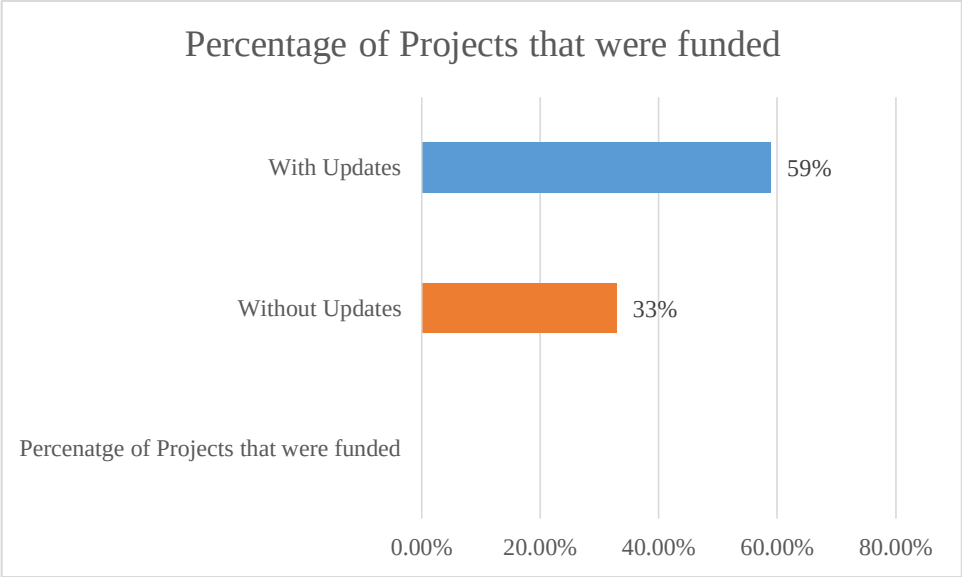


Figure 14 Percentage of Projects that were funded Source: (Xu, et al., 2014), (Kolenda, 2017)

(Xu, et al., 2014) specifically clustered the updates related with the project into seven major categories that were detrimental to a successfully funded crowdfunding campaign (Xu, et al., 2014) (Kolenda, 2017):

1. New Content: Reports of addition of new ideas into the venture.
2. Progress Report: Disclosure of the stage that the venture is and improvements of past updates and content.
3. Answer Questions: Frequently Asked Questions and feedback was given related with the crowd's questions.
4. New Reward: New Reward levels were also available often related with some new content that was available to the venture.

5. Reminder: Reminders were sent to interested potential funders related to the remaining time left before the deadline.
6. Appreciation: Past contributors and special funders were acknowledged
7. Social Promotion: Contributors and other potential donors were persuaded to share the crowdfunding campaign to their social media accounts and other social networks.

Related to 4. (Kolenda, 2017) supports that new free reward additions will encourage potential donors to offer funding and keep the crowd motivated throughout the duration of the crowdfunding campaign. Considering this, and the bathtub effect that was noticed by (Kuppuswamy, & Bayus,, 2013), that funding is most active during first and last days of the campaign, the updates can give a boost to the funding during the middle stages of the crowdfunding. (Xu, et al., 2014) also supports the idea of adding some rewards at the ending stages of the crowdfunding campaign.

Additional to 7 about Social Promotion, (Agrawal, et al., 2014) argue that a significant proportion of the early funding stage is consisted by family and friends of the creator of the venture. (Mollick, 2014) also supports that there is a positive correlation with the Facebook number of creator's connections (Kolenda, 2017). This is a positive signal for two reasons. Firstly an initial capital is gathered and secondly if a creator is involving persons of his personal social environment to his venture this signals a dedication which acts positively.

Some further info concerning the reward structure support that, incorporation of many reward tiers proportional to the funding is enhancing the campaign (Kuppuswamy, & Bayus,, 2013). (Kolenda, 2017) also supports that rewards that are appealing and amusing are also considered a successful approach. Moreover, (Kolenda, 2017) argues that many reward tiers are stimulating the crowd to climb up to the highest reward tier giving more. This fact is also mentioned in (Cowan, et al., 1997) is used by more traditional charity financing schemes (Kolenda, 2017). Finally, tangible rewards also seem to enhance crowdfunding success since funders feel that they are receiving something of economic value for their funding move (Harms, 2006-2007). But as (Kolenda, 2017) supports both tangible and experiential rewards such as creators and funders meetings can be equally effective.

4 Electronic Payment Systems

Looking at the history of the electronic payment systems, their emergence is due to the fact that there is a large percentage of individuals which cannot reach to a financial service. The global literature calls them “unbanked” or “under banked”. The Federal Deposit Insurance Corporation (FDIC) which is the subsidiary of Federal Reserve Responsible for deposit issues in United States, regularly publishes a report for this under banked minority. According to the 2015 report 7 % of Americans households do not have a relationship with a bank, thus no access to banking and payment services.

This fact as seen from a business perspective is a whole separate market which can be served by alternative financial services and it was foreseen by startups like PayPal back in early 2000. Nowadays this subset of unbanked or underbanked individuals is even larger. It is interesting to see the reasons of why this minority of the market remains under banked. Specifically, according to the FDIC, the main reason is that these individuals maintain the opinion that “they don’t have enough money for a bank account”. This goes together with the third in ranking reason that they maintain that “Account fees are too high or unpredictable”. In addition, the second main reason that these people lack banking services is that they “do not like dealing with banks or they mistrust them”. Thus, these individuals need a different model of financial services, with lower costs to service their needs.

This gap is covered by FinTech companies specialized in alternative payment systems, with lower maintenance fees and transaction costs. These companies are archiving this lower operation because they operate electronically over the internet and they exploit the plethora of the available alternatives of interfaces.

The electronic payment systems are categorized into three categories, Peer-To-Peer Payment Systems, Mobile Wallets and cryptocurrencies.

4.1 Peer-To-Peer Payment Systems:

A typical Peer to Peer Payment system platform brings together the two counterparties, the payer and the receiver without the need of a third intermediate entity to close the deal. Both parties need to be members of that platform and connect to that over the internet to transact. Because this system is avoiding the need for a third party and succeeds electronic automation, it has lower transaction costs than the traditional methods.

Figure 15 a simple P2P Payment Process via PayPal Source: https://www.evoluted.net/thinktank/web-development/paypal-php-integration

Figure 15 depicts an example of the simple transaction that someone can establish into his online e-commerce website using P2P Payment system by PayPal. It is a fact that electronic payment systems have many commonalities between them and some services overlap specifically P2P Systems with Mobile Electronic Wallets.

Some notable P2P Payment platforms are PayPal, Venmo (acquired by PayPal in 2013), Square Cash, and Circle etc. In

Table 2 a comparison between some major P2P Payment systems is depicted.

Provider	Bank-Centric?	Fees?	Stored Value?
PayPal	No Publicly held company NASDAQ: PYPL $9.2 billion revenue reported for full year 2015	Send p2p using debit /creditcard: 2.9% plus $0.30 USD Free if using bank account (ACH)	Yes.
Venmo	No Acquired by PayPal in 2014.	Send p2p using credit card: 3%. Free if using debit/prepaid/bank account (ACH)	Yes.
Dwolla	No. Privately held by investors	None for P2P	Yes.
ClearXchange (Zelle)	Yes. ClearXchange (an Early Warning company) is owned by Bank of America, BB&T, Capital One, Chase, PNC, U S Bank, and Wells Fargo.	None for P2P	No.
Popmoney	Yes. Service provided by Fiserv, integrated into over 1000 FIs	Send p2p using debit / bank account (ACH): $0.95. Credit cards not accepted.	No
Snapcash	No. Built on top of Square Cash.	None. Debit Cards only.	No
Facebook Messenger	No.	None. Debit Cards only.	No
Google Wallet	No	Send p2p using debit /creditcard: 2 9% plus $0 30 USD Free if using bank account (ACH)	Yes.
Square cash	No	Send p2p using credit card: 3%. Free if using debit/prepaid/bank account (ACH)	No Funds come directly from bank account, sent directly to bank account tied to debit card.

Table 2 a comparison between some major P2P Payment systems (http://www.thepaymentsreview.com/a-look-at-p2p-payments, n.d.)

The most interesting fact about these electronic systems is that they simplify the transactions because it requires only the email or the username of the receiver, and there is no need for bank account numbers or several other complex other personal identity information which are security-sensitive.

4.2 Mobile Wallets:

Mobile Wallets are systems that are trying to be more comprehensive solutions than P2P systems. A Mobile Wallet Platform incorporates all cards Debit and Credit cards into a digital wallet and facilitates payments not only electronically over the Internet but also in store. These platforms also are able to operate and as P2P payment systems. Particularly, it makes use of terminals that are being use by various stores such as NFC Technology (Near Field Communication, which is an evolution of Bluetooth). That technology operates on Mobile Phones which carry NFC hardware. The user is holding his device over the NFC reader terminal when he wants to pay and the transaction is accomplished. It's very similar with the contact-less debit-credit card technology which banks provide, however the interface facilitates the balance and transaction monitoring because it is connected live with the software on the device. Thus the user is more able to monitor his spending compared to the traditional card payment systems. This system is also compatible with smartwatches for example Apple Watch with Apple Pay Wallet.

Figure 16 Android Mobile Pay in a Payment Terminal Source: http://www.androidauthority.com/android-pay-now-available-belgium-755126/

Figure 17 Apple Pay in Apple Smartwatch in a Payment Terminal Source: https://blog.passkit.com

Mobile Wallets also have lower costs due to the technology and automation also. Due to the fact that this Payment system is connected with the hardware device many tech and e-commerce firms have endorsed their own Mobile Wallets Platforms like Apple Pay (provided by Apple), Android Pay (provided by Google), Samsung Pay (provided by Samsung), and Ali Pay (provided by AliBaba). Moreover, due to the overlap of the relevance of the services most P2P payment providers are also having a Mobile Wallet solution such as PayPal. Almost all banks, also have also endorsed their own Mobile Wallet platforms from big global banks to the smallest commercial banks.

4.3 Cryptocurrencies:

Cryptocurrencies are actually a form of intangible currency in an electronic form. They are called cryptocurrencies because they utilize methods of advanced cryptography algorithms for the protection of their users and their circulation, thus prevent double spending and boundless money printing. BitCoin and Ethereum are the most popular. They are different from other payment methods because they are seen as a different currency and they have an exchange rate with the most prominent currencies such as US Dollar, Euro, and Japanese Yen etc.

Figure 18 A BitCoin ATM, Someone can insert money using Cash or Credit cards and buy BitCoins for his mobile Wallet
Source: https://www.financemagnates.com/wp-content/uploads/2016/08/bitcoin_atm2.jpg

Specifically if someone wants to make payments with a cryptocurrency, he needs firstly to buy the cryptocurrency that he wishes at the current exchange rate from an accredited exchange vendor which sells cryptocurrencies. This process can be made electronically over the Internet or at the ATM of the vendor. Having an amount of cryptocurrency someone can make payments to merchants who accept cryptocurrencies, in particular BitCoin or Ethereum etc. Due to the fact that this type of payment systems are novel and innovative and still are work in progress (e.g. very volatile exchange rate) everybody dealing with them need to acquire adequate education.

4.4 Statistics of Adoption of mobile payments systems:

It is interesting to note down some current forecasts and statistics forecasts about mobile payments systems and other related issues in Europe and USA.

Multiple forecasts have been made about mobile payments globally, anticipating a rising trend. Specifically, global volume in- store mobile payments according to BI Intelligence estimates that will reach $503 billion. On the other hand, global volume of mobile Point-Of-Sales will reach $50 billion according to Juniper Research. Moreover, they also quote that 1 out of 3 Point-of-Sales would be mobile. [2]Moreover, in US by the end of 2020 is expected that mobile payments will be surpass the use of debit and credit cards combined.[3]

Currently in Europe, according to Visa's 2016 Digital Payments Study which surveyed more than 36,000 online consumers in 19 European countries claims that consumer adoption of digital payments has shifted dramatically. Specifically, 54% of consumers surveyed reported that they, regularly use a mobile device (mobile phone, tablet or a wearable device) to make payments compared to 18% of 2015 study.[4] In Europe, the British are leading adoption of mobile payment, with 74% of that population using a mobile device to make payments and manage their finances according to Mobile Payments World.[5]

As far as US market is concerned, according to FDIC 2016 Consumers and Mobile Financial Services Report, 24 percent of those with access to a mobile phone reported that they made a mobile payment in the 12 months prior to the survey. Rates of mobile payment usage are somewhat higher among smartphone users: 28 percent of smartphone users reported having made a mobile payment in the previous 12 months (FDIC, 2016). Additionally, FDIC supports that Mobile Banking is more popular among consumers, than mobile payments.

Moreover, Walker Sands survey among 1400 US consumers was able to find out the results depicted in Figure 19 for the preferred payments methods:

[2] http://www.reuters.com/article/us-europe-mobilepayments/europes-mobile-payment-players-braced-for-battle-as-u-s-rivals-move-in-idUSKCN11C0UT
[3] http://www.worldpay.com/global/insight/articles/2016-11/global-payments-report-2016
[4] https://www.visa.co.uk/newsroom/mobile-payments-soar-as-europeans-embrace-new-ways-to-pay-1600684?returnUrl=/newsroom/listing
[5] http://www.mobilepaymentsworld.com/mobile-payments-are-taking-off/?v=f214a7d42e0d

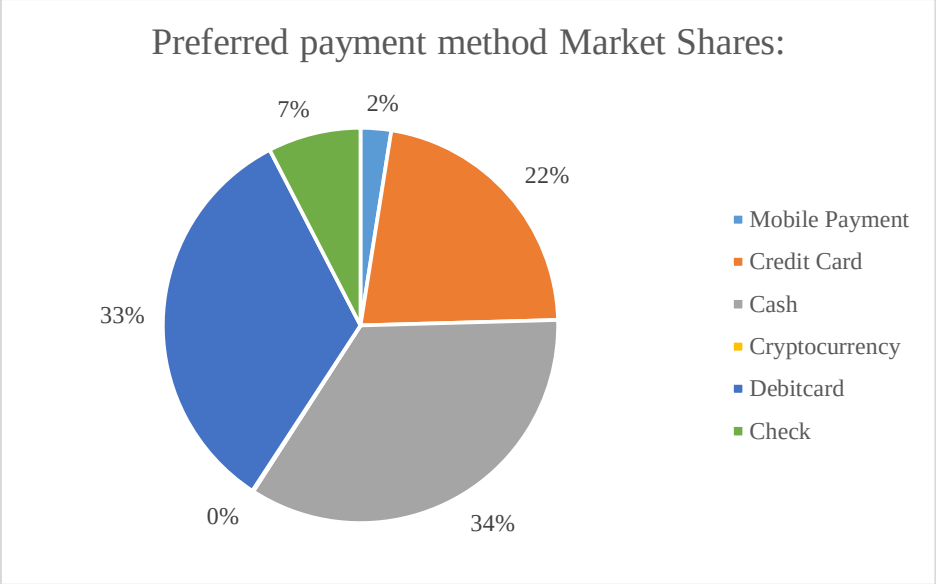


Figure 19 Preferred Payment Method for Everyday Activities Source: Walker Sands

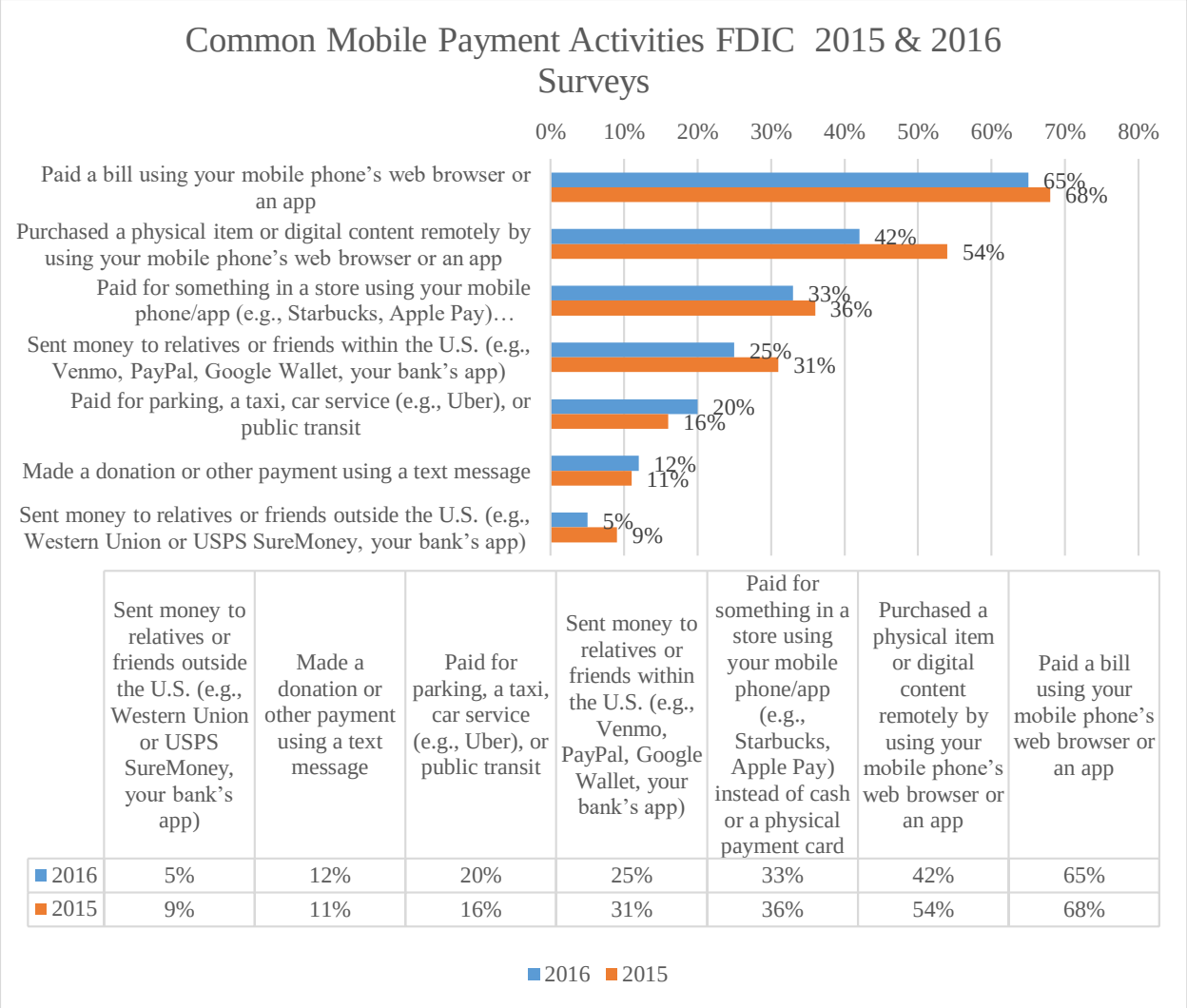
Furthermore, the Chinese mobile payment market is noted to be 50 times larger than the US activity reaching $5.5 trillion according to consulting firm iResearch. [6]

The most common mobile payments according to Visa European survey are done for the following purposes:

- 59% mentioned that they used mobile applications for transferring money to friends and family
- 53% paid their household bills
- 47% used m-payments for buying transportation tickets
- 44% paid with mobile platforms to buy high-value like holidays, and household appliances.
- 36% purchased music, TV shows, movies and other online content.

FDIC Consumers and Mobile Financial Services Report also mentions the common reasons that US consumers use mobile payments and are depicted in Figure 20. A small drop is noticed but this might be a consequence of the general economy (US Elections, Brexit etc.). Although US mobile payments, has declined a little bit the global aggregated volume has raised due to Europe payments surge.

6 https://www.forbes.com/sites/franklavin/2017/08/15/china-e-commerce-taking-root-in-us-and-europe/#50a2e2454482



	Sent money to relatives or friends outside the U.S. (e.g., Western Union or USPS SureMoney, your bank's app)	Made a donation or other payment using a text message	Paid for parking, a taxi, car service (e.g., Uber), or public transit	Sent money to relatives or friends within the U.S. (e.g., Venmo, PayPal, Google Wallet, your bank's app)	Paid for something in a store using your mobile phone/app (e.g., Starbucks, Apple Pay) instead of cash or a physical payment card	Purchased a physical item or digital content remotely by using your mobile phone's web browser or an app	Paid a bill using your mobile phone's web browser or an app
2016	5%	12%	20%	25%	33%	42%	65%
2015	9%	11%	16%	31%	36%	54%	68%

Figure 20 Common Mobile Payment Activities Source: FDIC Consumers and Mobile Financial Services 2015 & 2016

Related to demographics FDIC quotes that Younger consumers are more likely to make mobile payments. Of those with a mobile phone in 2015, 30 percent of individuals ages 18 to 29 and 32 percent of individuals ages 30 to 44 have made mobile payments. By comparison, 13 percent of those ages 60 or over reported making mobile payments (FDIC, 2016).

It is also very interesting to point out the mobile banking and mobile payments activity among the unbanked and underbanked users.

In Figure 21 it is easily concluded that even though unbanked and underbanked individuals have less access to smartphone devices, however they are surpassing the fully banked consumers. This is also due to the fact that a larger fraction of younger people are using mobile services and younger people are more likely to belong to the unbanked or underbanked categories, as aforementioned.

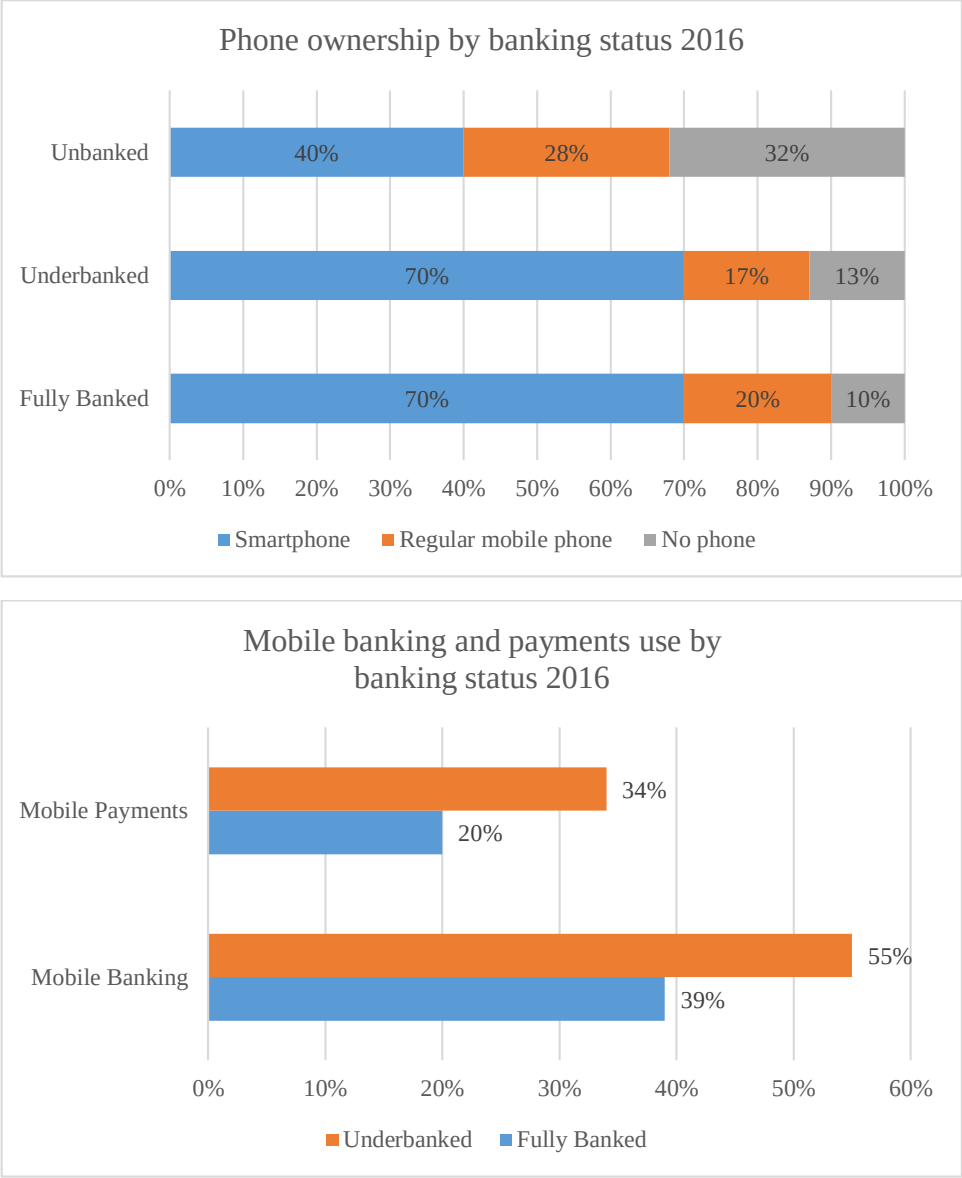


Figure 21 Phone ownership by banking status and Mobile banking and payments use by Banking status Source: (FDIC, 2016)

Given the fact that unbanked and underbanked are able to reach mobile banking and mobile payments services, this suggests that technology use in financial and payments services can achieve the object reducing the service costs and penetrating into lower income markets.

Furthermore, according to Walker Sands 2016 Report aforementioned, the most prominent mobile payment platforms are presented in Figure 22. Android Pay is the most popular and second choice is a Retailer Mobile App usually related with the shop that the consumer is shopping, for example Walmart Pay.

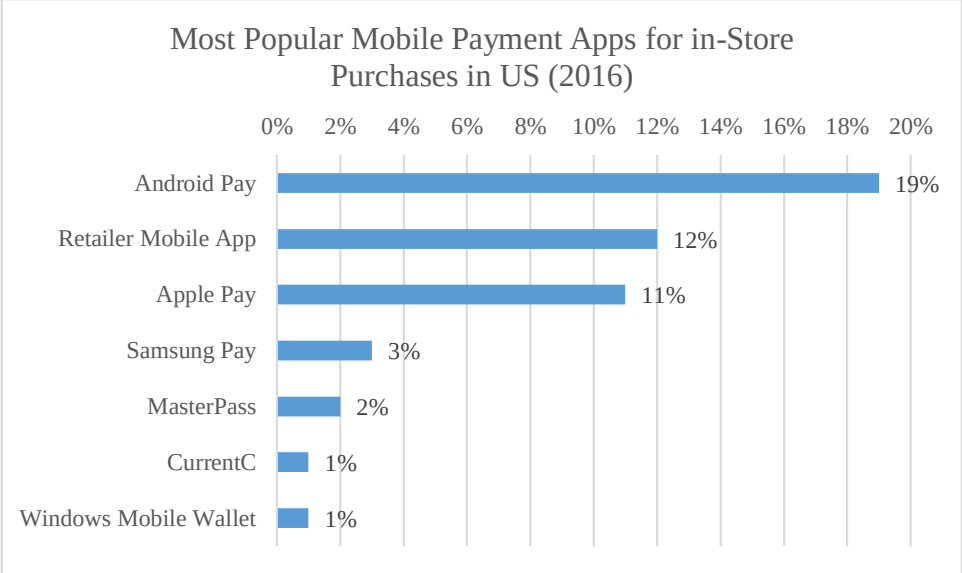


Figure 22 Most Popular Mobile Payment Apps for in-Store Purchases in US Currently Source: Walker Sands

According to the same survey, the most favorite payment platforms for Peer to Peer Payments is depicted in Figure 23. Consumers prefer for their first choice an application from their bank.

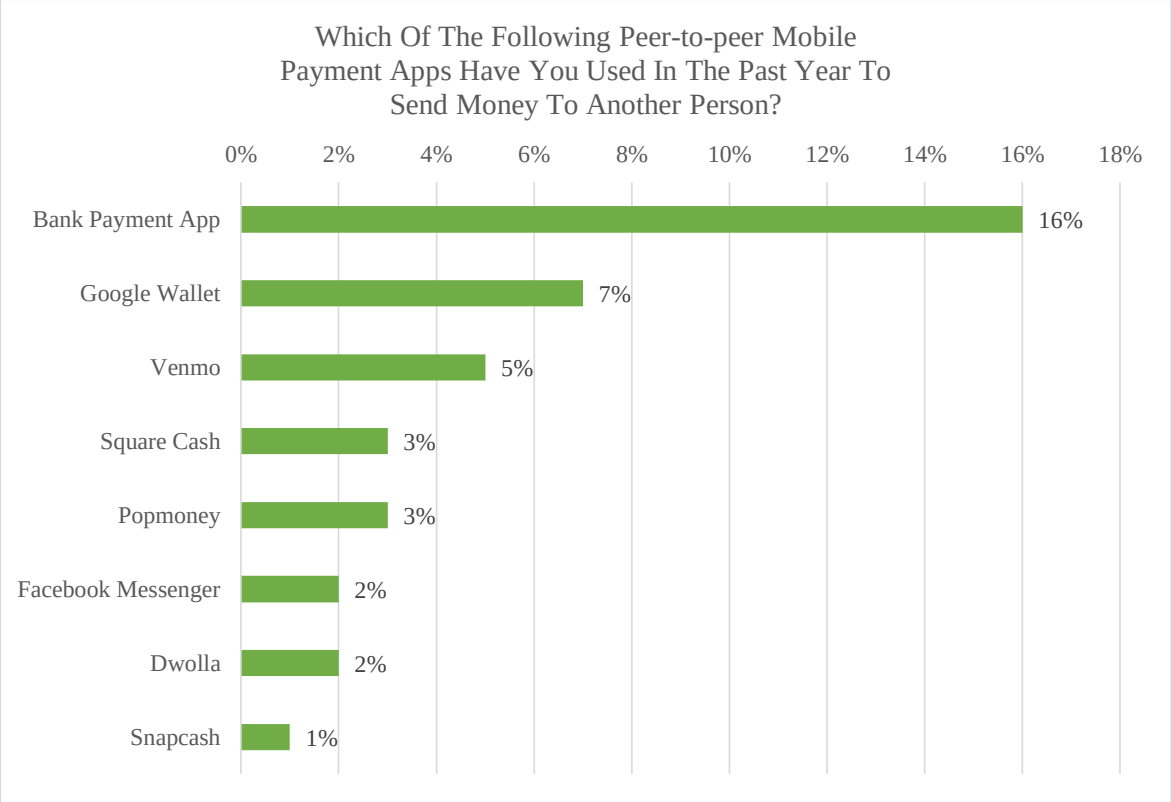


Figure 23 Most Popular Payment apps for P2P Payments Source: Walker Sands

As far as the merchants' perspective is concerned, Financial Times notes in a 2015 conducted survey 50% of the merchants who were asked, planned to upgrade their Point-Of-Sales with devices that would accept Near Field Communication technology by the end of 2016.[7]

The findings of a poll among cybersecurity specialists are interesting. Specifically forty-seven percent of the experts express doubts about the security of mobile payments, and only 23% are confident that the personal information used in association with mobile payments is safe. Eighty-nine percent agree that cash is the most secure payment method available, but only 9% prefer to use it. [8]

Moreover, mobile transactions are particularly at risk of fraud. While mobile transactions only accounted for 14 percent of transaction volume in 2014, they made up 21 percent of all fraudulent transactions. That's bad news for merchants who sell through mobile channels, as they lost 70 percent more revenue due to fraud in 2014 than in 2013. [9]

[7] https://home.bluesnap.com/snap-center/blog/22-mind-blowing-mobile-payment-statistics/
[8] http://www.isaca.org/SiteCollectionDocuments/CSX-Mobile-Payment_whp_eng_0915.pdf
[9] https://www.creditcards.com/credit-card-news/credit-card-security-id-theft-fraud-statistics-1276.php

4.5 Market adoption of an electronic payment system – Conceptual and Academic models:

Nowadays the growth of modern technology and of electronic commerce a plethora of electronic payment systems have been released. According to Bank of International Settlements, back in 2006 there were close to 150 different mobile electronic payment systems. So a plausible question arises: Out of all these different payment systems which are more possible to succeed and continue to the future and what are the defining factors that determine the adoption of each system?

The difference of a payment system from other kind of products it's that it addresses two different agents with different incentives and interests, the buyers and the merchants. In addition, an electronic payment system its high dependable on the current technology innovation landscape and on the regulation environment, because it's also related with trust and security issues and prevention of frauds.

(Dahlberg, et al., 2008) conducted a literature review to assess the environment and the framework in which a mobile payment system is acting.

As they support, there are two groups of factors, internal or competitive and external or contingency that impact the ecosystem of mobile payment systems.

The external or contingency factors are:

- Changes in Social/Cultural Environment
- Changes in Technological Environment
- Changes in Commercial Environment
- Changes in Legal/Regulatory/Standardization Environment

The internal or competitive factors are:

- Consumer Power
- Merchant Power
- Traditional Payment Services
- New Payment Services
- Current Mobile Payment Services

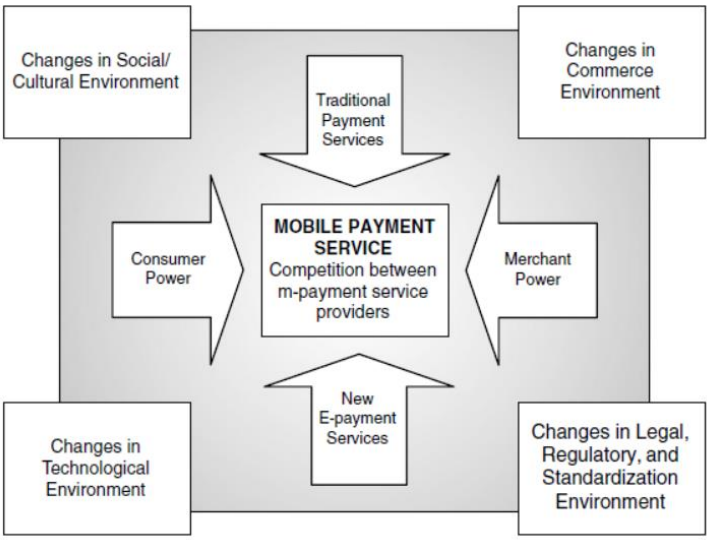


Figure 24 Framework of factors impacting the mobile payment services Market. Source: (Dahlberg, et al., 2008)

The factors involving this framework are depicted in Figure 24. As it can be also seen, the contingency factors effect in a more long term or macro level the course of the industry as the competitive forces interact in more direct, or micro level.

In the academic literature the most researched concept is related with the factors who determine the adoption of a payment system from the consumers and secondly, the concept of the technological improvements in the mobile payments sector.

Since many academic studies are using only country data and not intercultural data the most useful and quoted studies are cross-cultural studies and metastudies which conduct and summarize the findings from many individual academic studies. Also the time dimension is important, since more recent studies are more compatible with the current opinion of the users of the current electronic mobile payment systems.

Specifically a metastudy conducted by (Shaikh & Karjaluoto, 2015) is summarizing the adoption factors by the users of the mobile payment system by reviewing several studies (55 studies). Their findings are that the majority of studies are explaining the diffusion of a mobile payment systems with the Technology Acceptance Model (TAM) introduced by Davis, 1989.

Under this model, perceived ease of use (PU) [the degree to which a person believes that using a particular system would enhance his or her job performance) and perceived usefulness (PU) [the degree to which a person believes that using a particular system would be free from effort] are the most commonly used factors (Wikipedia) (Davis, 1989) (Shaikh & Karjaluoto, 2015). Moreover, other commonly used explaining factors include trust, social influence, perceived risk, self-efficacy, compatibility, facilitating conditions, cost, credibility, culture, demographic factors, and structural assurance (Shaikh & Karjaluoto, 2015). Most of the studies include mobile payment solutions from development countries.

Other study performed by (Schierz, et al., 2009) with a sample of 1447 respondents individuals, based on the framework of Technology Acceptance Model (TAM) additionally, was one of the first to empirically test determinants of the consumer acceptance of mobile payment services (Schierz, et al., 2009). Specifically they also provided a ranking among the driving factors for mobile payments acceptance from users which is presented in
Table *3*:

Factor	Total effect on intention to use
Perceived compatibility	0.82
Individual mobility	0.09
Subjective norm	0.04
Perceived usefulness	0.02
Perceived security	0.02
Perceived ease of use	0.02

Table 3 Total Effects Source: (Schierz, et al., 2009)

The most significant finding in this study was that perceived compatibility has the greatest impact on the intention to use mobile payment services. It is important for the reason that perceived compatibility is not part of the original TAM and thus is often not considered by acceptance researchers (Schierz, et al., 2009).

Other study conducted by (Changsu, et al., 2010) with a sample of 269 questionnaires, they clustered the sample to two categories, early and late adopters of mobile payments. Their findings proved that compatibility does not have an effect on either perceived ease of use or perceived usefulness which is contradicting to the (Schierz, et al., 2009) argument that perceived compatibility is significant. Specifically, the results indicated

that both perceived ease of use and perceived usefulness exerted significant effect on the intention to use m-payment. Among the variables under study, perceived ease of use is the greatest predictor of perceived usefulness. (Changsu, et al., 2010). In other words users believe that a payment system as easy is to be used is more likely to be useful to them also. Moreover, early adopters believe that knowledge about mobile payments is important, and they are less skeptic against new mobile systems which are less easy to use since they are under the final development stage. Thus, this type of users possess a more innovative thinking about mobile payment system. On the other hand, late adopters, who are relatively passive and cautious in technology adoption and need extended help in using the m-payment systems, think the provision of convenience to be essential for the usefulness (Changsu, et al., 2010). This the reason why (Changsu, et al., 2010) argue that reachability and innovativeness are important predictors of the perceived ease of use of m-payment among this category of users. And because they consider the convenience of each payment solution significant, they need extended help to reach a satisfactory level of user experience. Lastly, in the conclusion of this particular study, all users support that, to continue to use m-payment, mobile payment services should be designed and developed to deliver value to them (Changsu, et al., 2010). Thus, design and development for ease of use should be reconsidered frequently.

A study performed by (Yaobin, et al., 2011) with an online survey of 961 responses assessed the dynamics between Internet based payments and Mobile based payment and how this interplay is affecting the trust in a mobile payment system. As they showed, initial trust in an internet payment platform is likely to influence positively a mobile payment system, as the companies launch both PC and mobile applications for their payment system. Consequently, a customer's perception of risk reduces their intention to use mobile payment services, and their initial trust in mobile payment services negatively influences this perceived risk (Yaobin, et al., 2011).

An interesting metastudy composed by (Shidrokh, et al., 2013) summarizes all factors related to trust to Internet Banking payment applications proposed by a variety of similar studies like those aforementioned. In addition they proposed the framework as seen in Figure 25

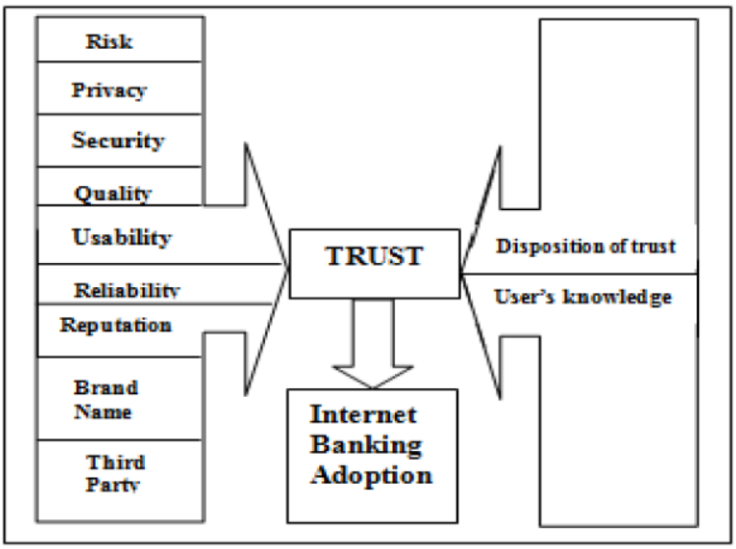


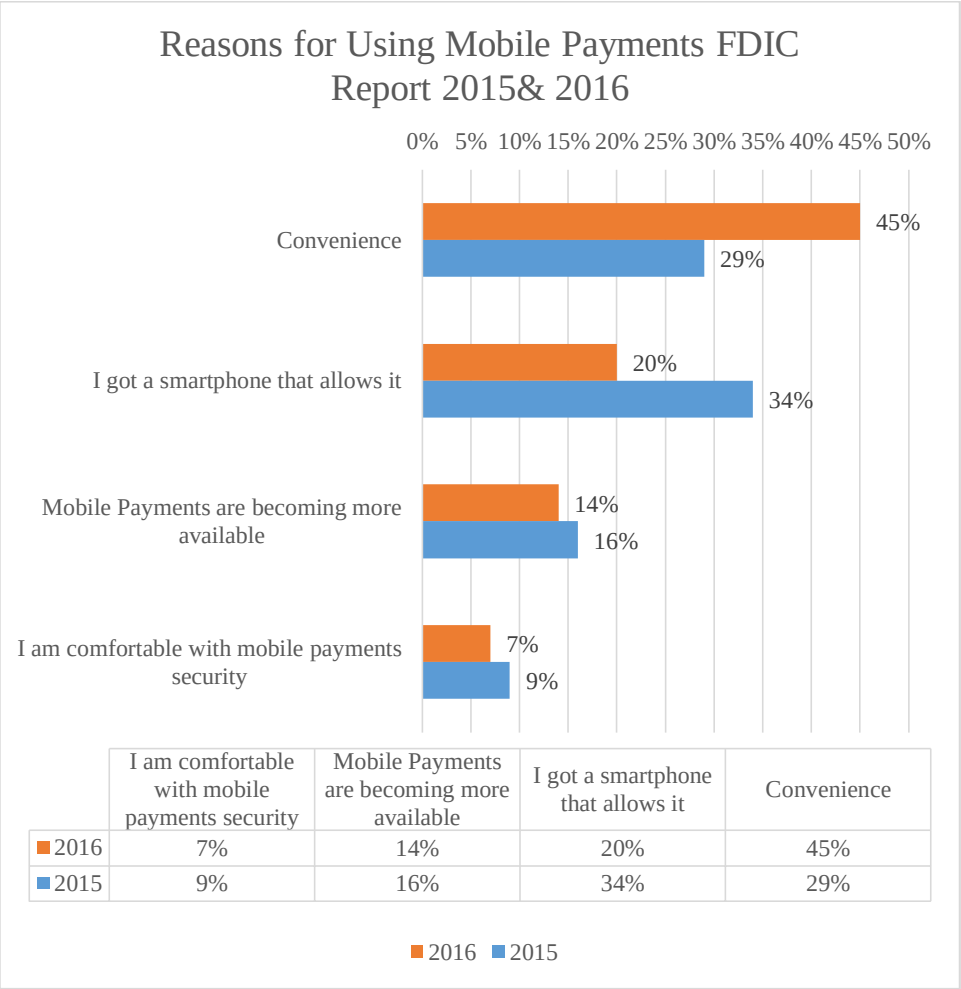
Figure 25 Framework for impact of trust on Internet banking adoption Source: (Shidrokh, et al., 2013)

As far as the merchant perspective is concerned the studies about that subject are not many. This is also quoted and by (Dahlberg, et al., 2008). However a qualitative study by (Mallat, 2007) states some merchant views through interviews. Specifically, the findings suggest that the relative advantages of mobile payments are related to the specific benefits provided by the new mobile technology; time and place independent payments, remote and ubiquitous access to payment services, and the possibility to avoid queuing and complement cash payments (Mallat, 2007). Moreover, digital payments systems are able to reduce queues, handle better the unexpected need for payments and several cash issues (lack of cash). Furthermore, they also suggest that compatibility is important since it creates payment volume as other users from other devices or infrastructure and financial institutes are able to enter the current payment system. However, this research gap about merchant perspective seems important as PayPal in the past when first operated addressed the needs of online buyers and merchants simultaneously. In other words, PayPal faced the e-commerce needs as an integrated market, and thus they succeeded market penetration (apart from the ease and the safety of their application, anyone would only need only the beneficiary's email to send money).

4.6 Convenience and Security in Electronic Payments:

Lastly, I would like to mention the issues of convenience and security related with electronic payments through the consumer's perspective.

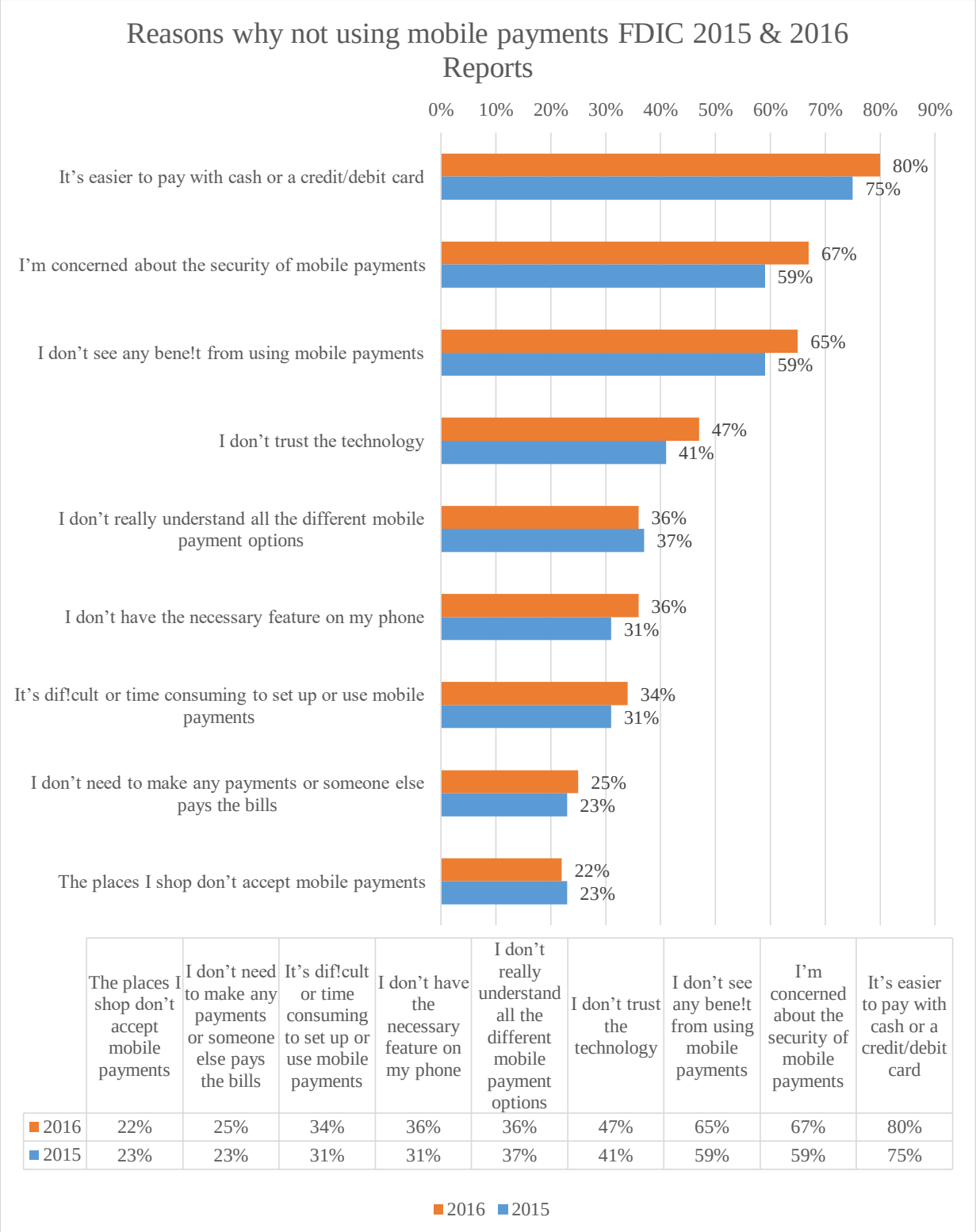
The FDIC Survey (2016 & 2015) related to reasons for and against for using mobile payments systems. In Figure 26 the first two reasons are related with convenience reasons. The launch of Apple Pay, Android Pay etc. from smartphone manufactures have enhanced the ability for consumers to proceed with mobile payments.



	I am comfortable with mobile payments security	Mobile Payments are becoming more available	I got a smartphone that allows it	Convenience
2016	7%	14%	20%	45%
2015	9%	16%	34%	29%

Figure 26 Reasons for Using Mobile Payments FDIC Report 2015& 2016 Source: FDIC Mobile Consumer Reports 2016 & 2015

As it can be also seen, the consumers who think that security is adequate in mobile payments are declining. This is also presented and in Figure 27, where security reasons for not adopting mobile payments, is the second in importance, reason. Finally, Figure 26 and Figure 27 are also concluding that convenience and ease of use and trust are a major reasons for adopting mobile payments which comes with agreement with the aforementioned conceptual adoption models in academic literature. It seems that there is a tradeoff between ease of use and security and every electronic application which achieves a better tradeoff between these two concepts by making use of an innovative system architecture, technology and keeping the costs low, is more likely to prevail.



	The places I shop don't accept mobile payments	I don't need to make any payments or someone else pays the bills	It's dif!cult or time consuming to set up or use mobile payments	I don't have the necessary feature on my phone	I don't really understand all the different mobile payment options	I don't trust the technology	I don't see any bene!t from using mobile payments	I'm concerned about the security of mobile payments	It's easier to pay with cash or a credit/debit card
2016	22%	25%	34%	36%	36%	47%	65%	67%	80%
2015	23%	23%	31%	31%	37%	41%	59%	59%	75%

Figure 27 Reasons why not using mobile payments Source: FDIC Mobile Consumer 2015 & 2016 Reports

5 E-Investments

In this section we will include the current status of the new facilities that the FinTech sector is able to provide.

Technology has made feasible the analysis of large chunks of Data. Moreover advanced algorithms have also provided us with the chance to analyze these data in more efficient and effective way because this type of technology is able to extract information from structured and unstructured data. Furthermore, it is also possible to be able to make use of this technology consistently with reliable results, and thus automate processes. This, in Financial Technology sector is important since these processes are more cost effective and provide scalability. In addition lowering the operational costs through automation, results in lower costs for financial products and this is reflected specifically to electronic investments and electronic financial advisory.

Specifically, firms who are providing electronic investments platforms and electronic financial advisory services, are making use of this technologies like Big Data Analytics, Artificial Intelligence and Robotic Process Automation

The financial crisis of 2008 has shaken the trust of clients in Financial Institutions. Financial Technology startups, used this opportunity to establish innovative solutions to provide financial services more effectively and in lower costs. Specifically, these firms, employed by Financial Specialists and Software Engineers provide these financial solutions through online platforms.

In particular there are two type of models of these e-investments platforms:

- Fully automated electronic platforms: Investment Services which employ fully automated are operating autonomously without the assistance of an advisor. A new client is screened through a risk profile questionnaire and then assigned to a standardized predefined portfolio according to his risk profile (Is he risky-adverse or risk-seeking?). Most of the times this portfolio is an exchange-traded-fund (ETF) with low cost fees. Afterthought, this automated investment scheme is also providing direct deposit, dividend reinvestment and periodic rebalancing capabilities. Usually the amount of capital that is employed is 20.000 to 100.000 dollars. Some prominent platforms that operate under this fully automated model are Betterment and Wealthfront and will be presented later.

- Hybrid Semi-automated advisor assisted platforms: This type of service is semi-automated because it is not operating fully automatic but it is backed up by an assistance by a human financial advisor. The financial advisor runs the processes that are more custom-made that cannot be run automatically by the computer system such as financial planning, reviewing etc. Moreover, they offer more integrated advice by aggregating all client's assets and liabilities. Some renowned platforms that use this type of operating model are LearnVest, Personal Capital and Future Advisor.

In

Table 4 the major features and capabilities of each digital financial service platform are presented.

Automated investment firm	Assets under mgmt	Financial planning	Account aggregation	Asset allocation	ETF	Individual Stocks	Single-stock diversification	Automated rebalancing	Automated deposits/ transfers	Dividend reinvestment	Tax-Loss harvesting
Wealthfront	$2 b			X	X	X	X	X	X	X	X
Betterment	$1.6 b			X	X			X	X	X	X
Personal Capital	$1 b	X	X	X	X	X		X	X	X	X
Future Advisor	$ 0.45b		X	X	X	X		X	X	X	X
LearnVest	N/A	X	X	X							

Table 4 Major product and service offerings in the digital advice market Source: (Lopez, et al., 2015)

The commonality that both models have is that they lower the costs of operation and thus making access to financial advisory of people that never had or rarely had the chance to get it. Moreover, automation lowers the demand for expert staff which also lowers operation costs.

Additionally, e-investment platforms are designed to establish better user experience. Media web designers are making use of graphics to provide more useful content to the clients regarding to their investments. Thus, High quality user experience and information sharing is providing transparency to the clients and facilitates communication. Furthermore, detailed fees reports are making users able to comprehend exactly the expenses of their investment advice and management.

5.1 Mechanics of Financial Robot-Advisor:

Regardless of the type of the platform, (fully or semiautomatic, according to the level of the human intervention) the operating procedure is more or less the same. The questionnaire for screening risk profile of the clients is unavoidable as a traditional financial advisor would proceed. The client is called to upload his financial documents online. Platform flexibility lessens the amount of paperwork and time that a traditional financial advisor would need.

The drawbacks of an automated questionnaire process about the preferences of the client is that a one-sized is unintentionally encrypting significant information. For example an investor who is saving for his kids is different for an investor who is saving for just in case his financial situation faces a downturn. Moreover, automated questionnaires are not able to detect biases in the client's answers. For example, if an investor is asked about a 4% drop in portfolio price, this itself doesn't say anything since the investor might answer differently if the loss is related to 400 $ or 4000$. These shortcomings can be reduced if the questionnaire includes some small case studies with quantified examples to be able to have a brighter picture about his risk appetite. Platforms also have the possibility to include multimedia such as videos to be more specific about goals and risk profile and other matters that the client is also interested such as Financial Planning.

After the screening process the robot-investment platforms need to implement the strategy according to the client's preferences. In almost all cases all robot-advisors are using ETF instruments. ETFs are diversified and follow a passive approach thus they need smaller fees. In Figure 28 we can see the preferences specifically.

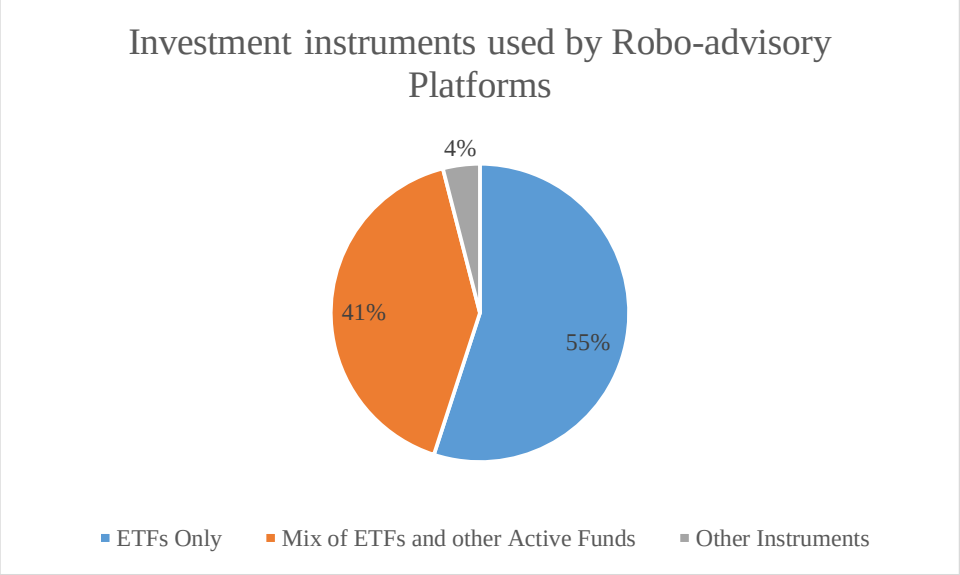


Figure 28 Investment instruments used by Robot-advisory Platforms Source: Deutsche Bank Research

Automation and passive investment strategies are the value giving factors. Minimizing human intervention and selecting low cost ETF instruments lowers the fees the investor needs to pay. Moreover, automation lowers internal conflicts that emerge between clients and their customers. There is a lot of scrutiny over this issue since there is adverse selection because financial advisors recommend financial strategies that are inadequate or don't fit to the clients' needs. A study by CFA Institute over 1145 investment managers in April 2017 shows that in Figure 29 where over the half of the sample agree that there is a problem.

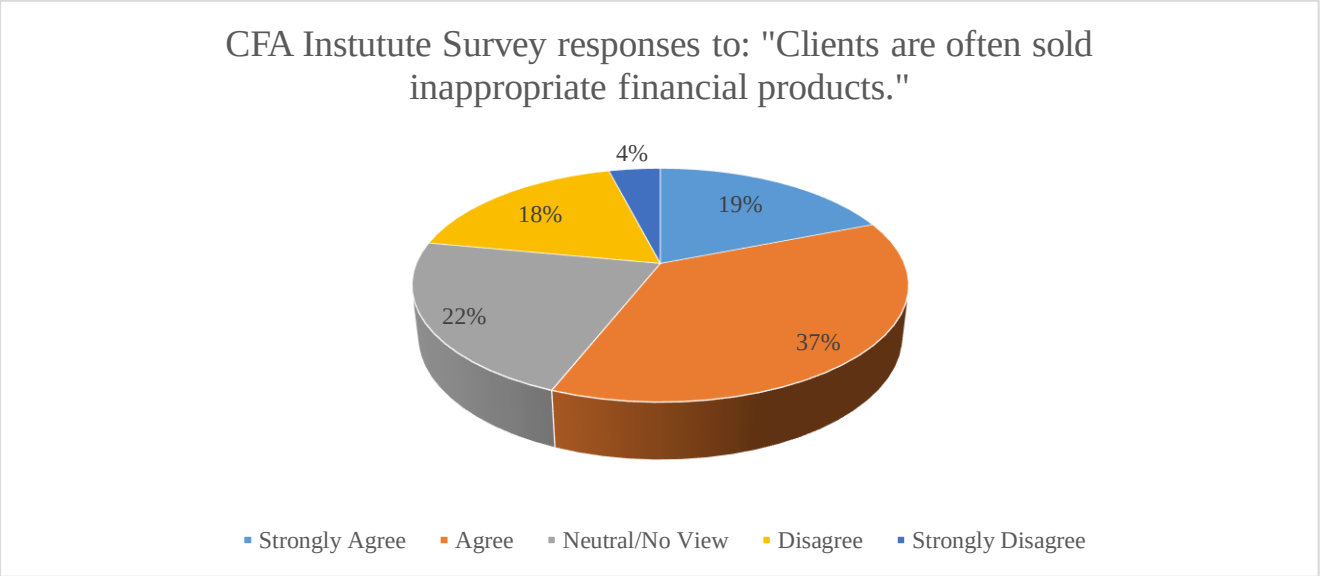


Figure 29 CFA Survey responses among Investment managers to: "Clients are often sold inappropriate financial products." Source: CFA institute

Robot-Advisory tackles that since the human intervention is minimized. This issue is not 100% extinguished since this can be programmed into robot-advisor's operations, however this practice if it is executed is easily traceable.

The robot-advisors usually follow a top down approach when they are called to select the ETF instruments that they would invest. The criteria for selecting ETFs for the passive strategies aforementioned are:

ETFs that are not allowed:

- No short history or new ETFs
- No leveraged ETFs
- No ETFs that are not diversified enough
- Not enough liquidity
- Poorly Performed ETFs

- High Fees ETFs

The criteria for selection do not end since there are also special categories of ETFs for example monthly dividend ETFs if the investor include that preference into his wishes. After that exclusion usually there are a few left from the sample.

Asset allocation, is implemented using algorithms based to Markowitz model, risk – return optimization. The algorithms of robot-advisor calculate all parameters from the ETF time series dataset and create the efficient frontier portfolios. Then they select the portfolio which maximizes the utility of the client according to his profile as he was screen at the questionnaire process. Since real time series data are rarely normally distributed, the portfolio allocation need to be back-tested or stress-tested or some other kind of test to trace its sensitivity over adverse or unpredictable market movements.

The robot-advisors are also able to perform rebalancing of the portfolio weights. Rebalancing is needed when the parameters of the portfolio deviate from the targeted values. This is due to market movements or changes in client's targets and preferences. This can be archived with consistent monitoring daily, weekly, monthly etc. Another way that rebalancing is considered is with predefined thresholds. Specifically, in order to avoid constant monitoring of the targeted parameters of the portfolio, a threshold is set and if exceeded then the portfolio is rebalanced. For example if a weight of an ETF rises from 30% to 35% and the threshold is 3% then the rebalanced is executed by selling excess share and investing the proceedings to another underweighted ETF asset.

The benefit of rebalancing when done by a robot-advisor is that there is hardly any biases like selling investments with an upside potential too early since judgments for buying or selling are only after calculations results. In addition, overreactions that investors face to sudden short term movements are also minimized.

As an additional tool, the robot-advisor also is able to do tax-loss harvesting thus, offset capital gains with capital losses to minimize required tax payments and optimize after-tax returns (Kaya , 2017).

5.2 Future Perspective of E-Investments:

The development of e-investment platforms is able to penetrate to a market that has growth capabilities. According to Future Advisor CEO, only 20% of the US consumers are having a financial advisor. This is due to the fact that the majority of traditional firms are focusing to

high net worth clients, neglecting the rest of the market.[10] In short term, managing high net worth clients might be rewarding since wealth managers would be able to benefit from high managing fees. Specifically, as seen in Figure 30, High Net worth clients and Ultra high net worth clients hold larger piece of the pie.

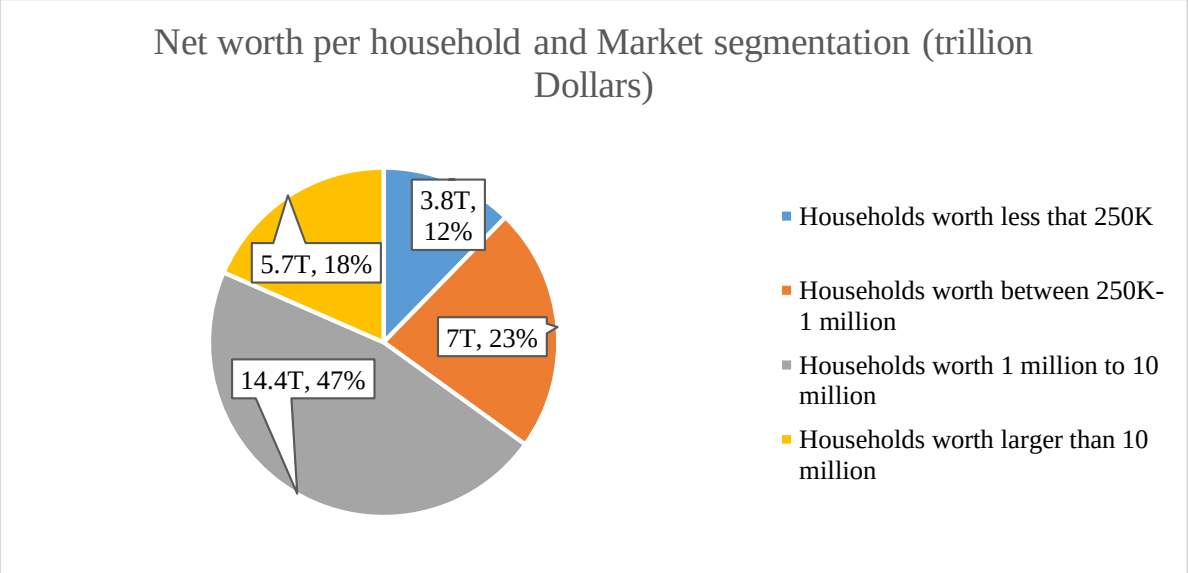


Figure 30 Net worth per Household and Total Volume in Trillion dollars per category Source: Federal Reserve, Ernst and Young[11]

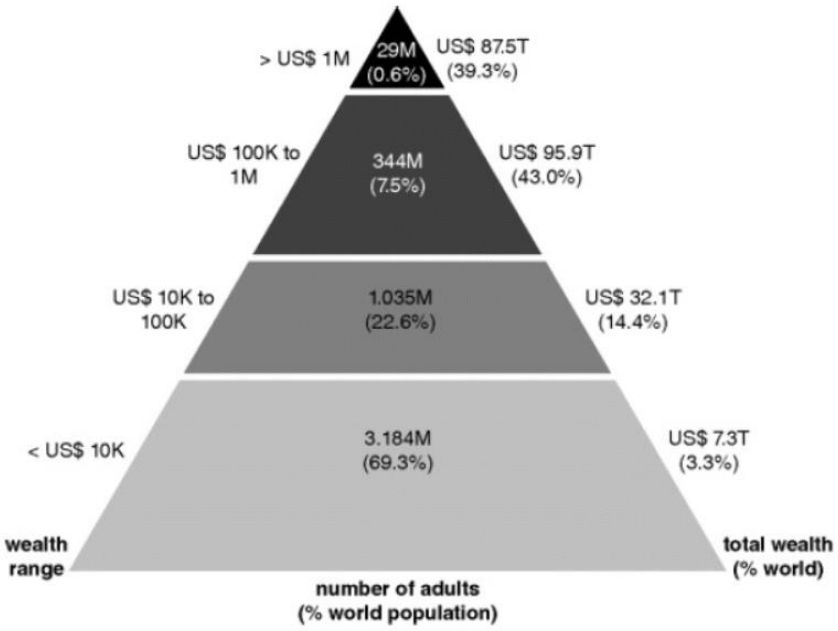


Figure 31 Net worth per Population and Market Segmentation Source: (Sironi, 2016)

[10] https://www.cnbc.com/2014/05/21/silicon-valleys-plan-to-replace-wealth-managers.html#
[11] http://www.ey.com/Publication/vwLUAssets/Advice_goes_virtual_in_asset_management/$File/ey-digital-investment-services.pdf

Figure 31 shows the same concept with Figure 30 using pyramid graphic and slightly different segmentation of the market.

Using technology makes asset management companies able to service and lower segments of the market with lower income and net worth. This is feasible since robotic advisors operate at a lower cost, needing lower fees and they have larger economies of scale. Thus the firm is able to earn a larger market share of the pie and achieve larger profit margins.

The second perspective of the e-investments ecosystem is related with time. Firstly as, time passes people are getting more and more familiar with technology. Secondly, more young people, millenials (people born during late 80s and 90s) are inheriting the wealth from the past generations and are more tech-savvy and adapted, and used to technology and internet solutions. FinTech firms and startups with their business models and their services and solutions are more likely to penetrate and earn the trust of this audience as older generations are retiring.

Moreover, as Social networking grows through the internet, electronic investment platforms are able to make use of this network effect to grow even faster. Thus, we notice the emergence of platforms such as eToro which is considered the Facebook of Investors where it operates as a trading and investing platform and a social network at the same time. This fact is indicated by, Wealthfront's partnering with Facebook, Google and Twitter (Lopez, et al., 2015). Specifically, according to Wealthfront, Venture capital investors are already investing to startups centered to this business of e-investments.[12] Additionally, it is awaited that the demand for user-friendly and interconnected digital services permeates our society across all demographics as aforementioned social networking and technological companies have achieved. Even though the investments industry is totally different market, however similar growth patterns are going to reflect and to this sector (Lopez, et al., 2015).

Based on the previous facts the estimates for the robot-advisory market are:

- $ 500 billion projection for the value of digital advice market in 2020[13]

[12] https://blog.wealthfront.com/one-billion-assets-under-management/

[13] "2,500% asset growth projected for robo-advisor platforms–according to Cerulli Research" (Investment News, November. 4, 2015)

- $ 2.0 Trillion projection for the value of Assets under management controlled by robot-advisor platforms.[14]

5.3 Robotic Investments Market Share, Returns, Risks and Regulation issues:

In the US, Assets under Management of robot-advisory start-ups (FinTech firms that exclude established asset management providers who offer automated portfolio management) has seen an 8-fold increase from USD 2.3 billion in 2013 to USD 20 billion in Q1 2017 (Kaya , 2017).

The competition in for robot-advisory sector is growing since larger companies are getting involved. Startups are more likely to be acquired by bigger companies and banks. Blackrock acquired Wealthfront in August 2015 and Wells Fargo has partnered with SigFig platform. Vanguard and Schwab had developed their platform in-house but they have managed to have large volume of Assets under Management due to their brand name and large customer base as seen in Figure 32.

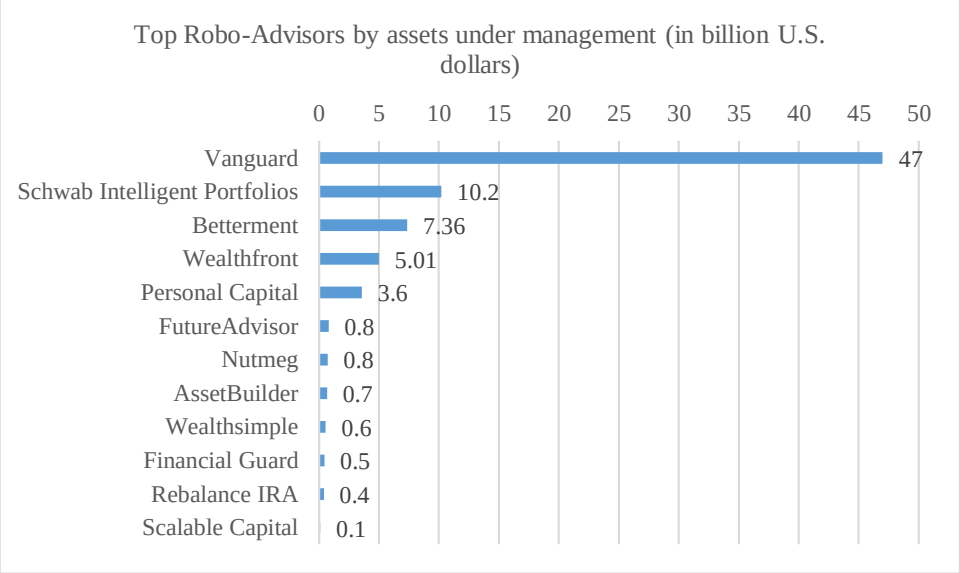


Figure 32 Top Robot-Advisors Platforms by assets under management (in billion U.S. dollars) Source: Statista February 2017

In the EU available figures suggest that their Assets under Management is 5-6% of that in the US (Kaya , 2017). UK and Germany are the leading countries in robot-advisory market in the EU as seen in Figure 33.

[14] https://www.bloomberg.com/news/articles/2015-06-18/robo-advisers-to-run-2-trillion-by-2020-if-this-model-is-right

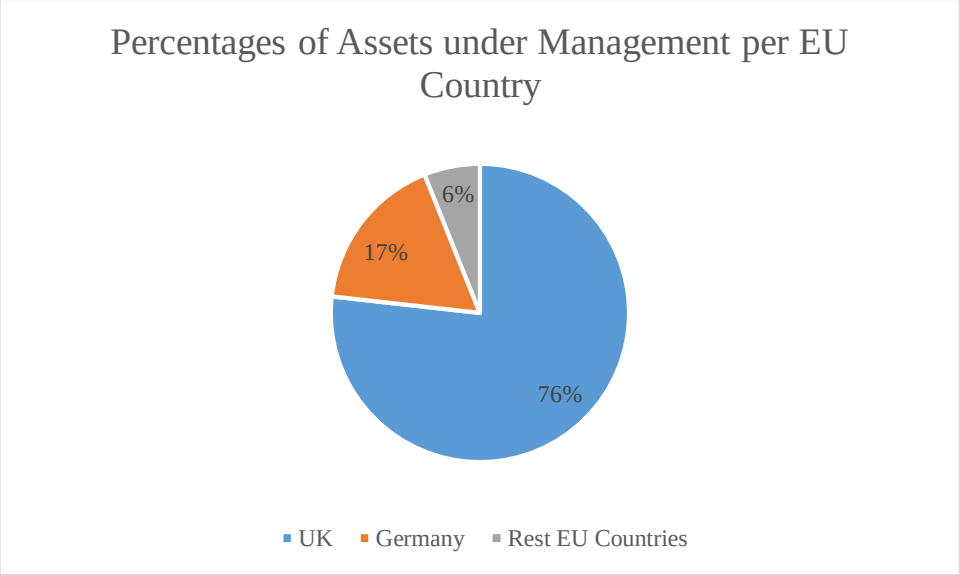


Figure 33 Percentages of Assets under Management per EU Country Source: Deutsche Bank Research

As aforementioned the main audience of the robot-advisory investments are millenials whose net worth is increasing. Specifically, in the early days of robot-advisory in 2013-2014, 50-60% of its clients were millennials (Kaya , 2017). However, this has been changing in recent years. Industry estimates indicate that US robot-advisory clients are on average in their mid-40s with account balances that tilt slightly towards six-digit figures (Kaya , 2017). This is also due to the involvement of many traditional investment firms which possessed a larger client network.

Looking at the statistics of the required management fees for the investments it is noticed on Figure 34, that on average robot-advisors charge almost the half or the one-third of the fee of the traditional financial advisors. Traditional Financial Advisors charge on average 1% and this is backed up by Figure 35, were the distribution of traditional financial advisors fees in is mainly between 0.5% and 1.0%. On the other hand, robot-advisors charge 0.4% and this was one of the main basic arguments for turning to robot-advisory.

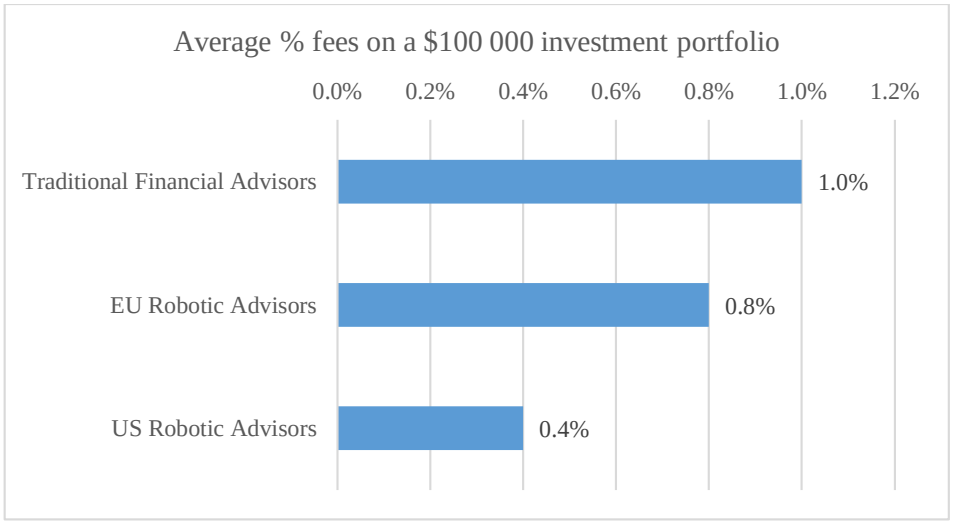


Figure 34 Average % fees on a $100 000 investment portfolio Source: Deutsche Bank Research

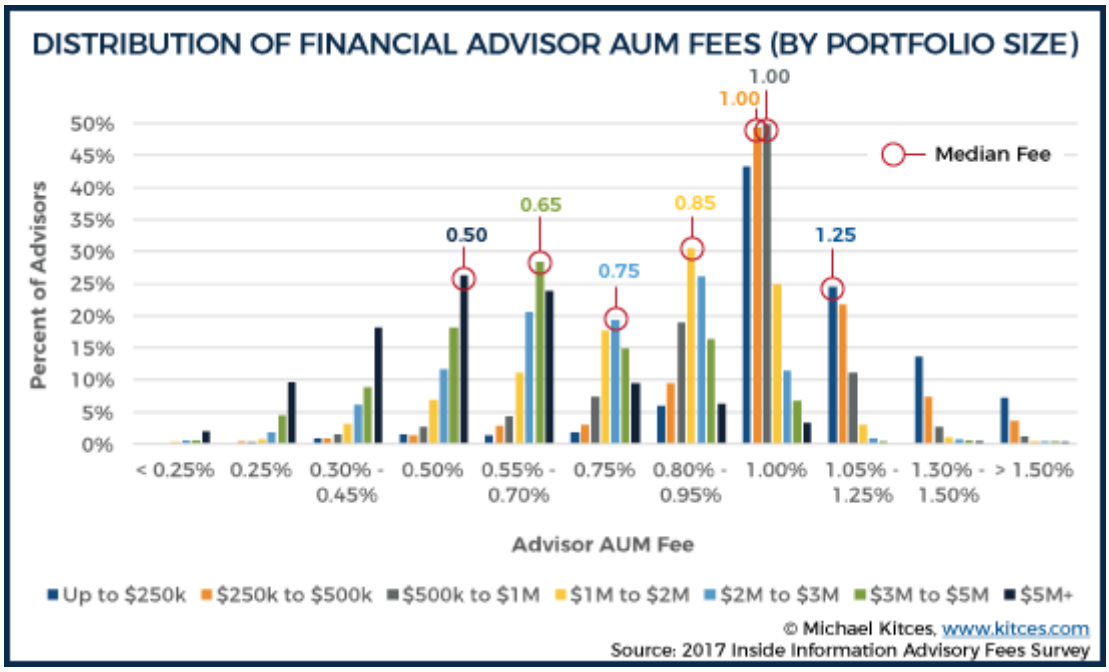


Figure 35 Distrubution of Traditional Financial Advisor Fees Source: https://www.kitces.com/blog/independent-financial-advisor-fees-comparison-typical-aum-wealth-management-fee/

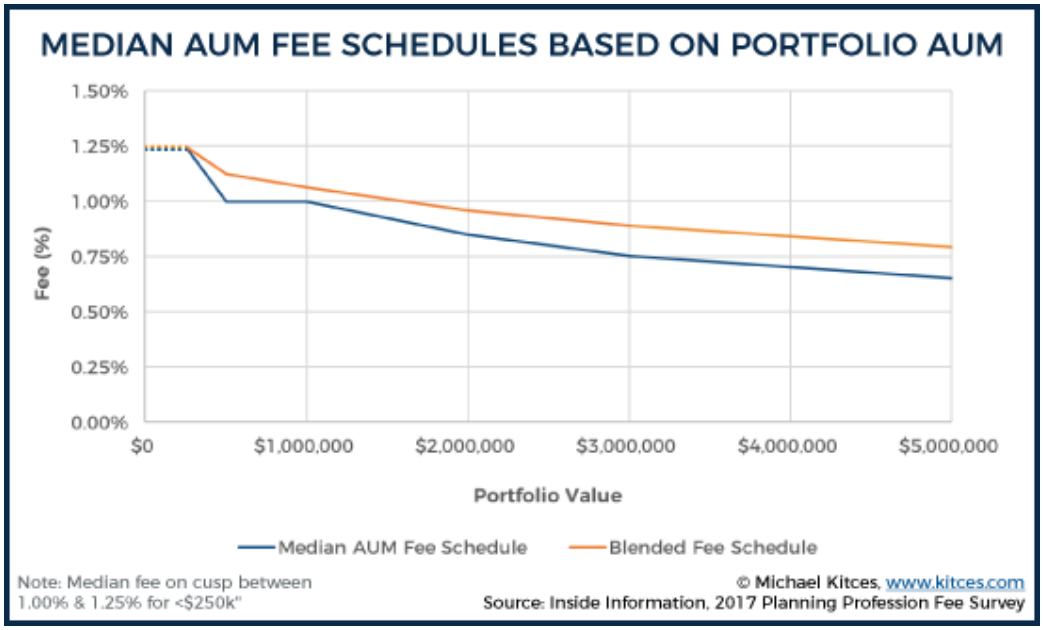


Figure 36 Median Asset under Management Fees based on Portfolio AUM Value Source: https://www.kitces.com/blog/independent-financial-advisor-fees-comparison-typical-aum-wealth-management-fee/

In addition, as far as EU market is concerned, the robot-advisory fees are more expensive since the market is smaller and still the technology is on mitigation-developing stage compared to US which is more mature.

The second most important argument related to the comparison of traditional financial advisors and robot-advisory is related to performance. If the traditional advisors perform better than robot-advisors then the extra fees are justifiably more expensive. In this case (Kaya , 2017) suggests, and as seen in Figure 37 that only in 2007 and 2009 the actively managed mutual funds overperformed ETFs significantly. Moreover, 50% approximately of the actively managed mutual funds, fail to overperform ETFs. Thus, the demanded fees that traditional financial advisors demand are not justifiable nowadays.

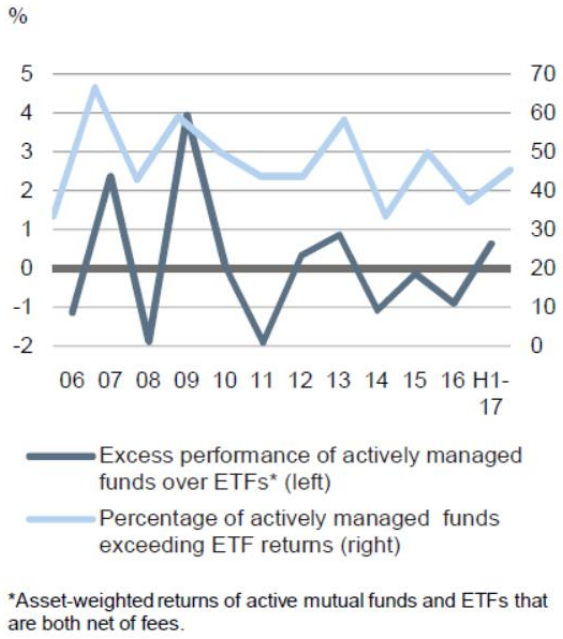


Figure 37 Excess performance of Active Funds vs. ETFs and Percentage of Active Funds that overperform ETFs Source: Deutsche Bank Research

Another matter of robot-advisors is related with their operation during extreme market movements and high volatility conditions. Since the cornerstone of the robot-advisory is passive investing it is awaited that the decision-making is conservative. To be specific, robot-advisors usually have a policy of entering the market 30 minutes after it opens and to leave it before it closes. Moreover, some robot-advisors suspend trading for a few hours before and after market-moving events such as central bank announcements about interest rates. These are precautionary measures designed to reduce the algorithm's potential overreaction to market movements that could otherwise lead to unnecessary losses for clients (Kaya , 2017).

As additionally (Kaya , 2017) quotes is that Brexit referendum acted as a test over the operation of the algorithms of robotic advisors. As seen in Figure 38 it resulted to a high volatility environment in markets, before and after the event.

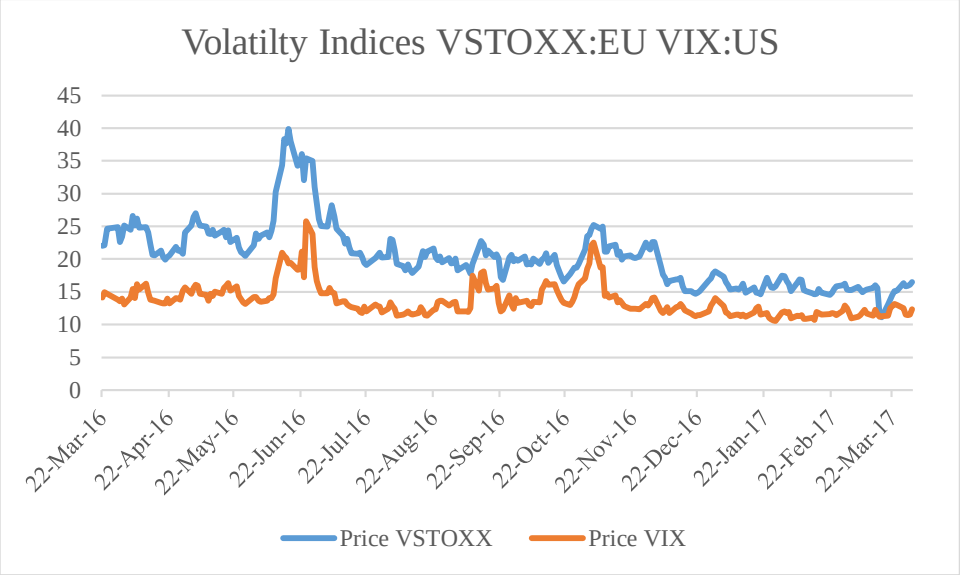


Figure 38 Volatility indices around Brexit Date Source: Deutsche Bank Research, Data Source: Yahoo Finance, Investing.com

As aforementioned before the algorithms halted trading during overreaction periods. Moreover, the platforms informed the investors about this fact and the trading continued after the overreaction passed away (Kaya , 2017). This fact is evidence that robot-advisors avoid overpanics fairly contrariwise to humans as previous crises showed.

Supervision and Regulation of Robot-advisory is a significant matter as any disrupting technology. Supervision topics can be clustered to two pillars: Issues related to the operation of robot-advisory and issues related to external factors.

Supervision related to operation of robot-advisors is opted to safeguard the interests of investors. Specifically, clients should be aware to all information that is related with their investments. Risks, strategy, and limitations should be disclosed in a way that is understandable and reachable to clients of any financial education levels. Fees and rest of the transaction costs that the client is bearing should also be known. Thankfully, the level of technology that robot-advisory is applying is able to provide the transparency and disclosure that is required. The challenge however remains of how to inform the customer that the applied strategy is related with his preferences and interests. The situation becomes more complicated when sudden market moves are occurring or market is entering a high volatility period. In particular, it is hard to explain the halt of any trading activity in occasions like Brexit as aforementioned, especially to a new client who would wondering why his investment is being postponed. This is an important issue that many critics of robot-advisors are referring to. Moreover, there is a

grey zone of who is responsible, if there is a malfunction to the algorithm of the robot-advisor that results to a financial loss of a client since no human intervention is taking place.

Secondly, risks related to external factors and specifically with cybersecurity is another arising issue novel for the investment sector however, widely discussed in computer and data science. Sensitive customer data need to be protected against external misuse. Moreover, the systems of any firm that is involved with robot-advisory need to be protected against hacking, as for example a cyber "trespasser" would can have access to the operating environment of the robot-advisor and alter the code of the algorithm in order to harm the firm's interests and reputation.

6 Cryptocurrency Technologies

Cryptocurrencies were mentioned in a previous section as an innovative form of payment systems. In this section we will delve into more details related to this new invention. Cryptocurrencies are a different kind of digital currencies which operate as a decentralized payment system. Thus they operate without an intermediate or a central authority like banks or some other kind of clearing house and the validation of the transactions takes place in a different way. Before cryptocurrencies, a central intermediate scheme was required to validate the transaction as seen in Figure 39.

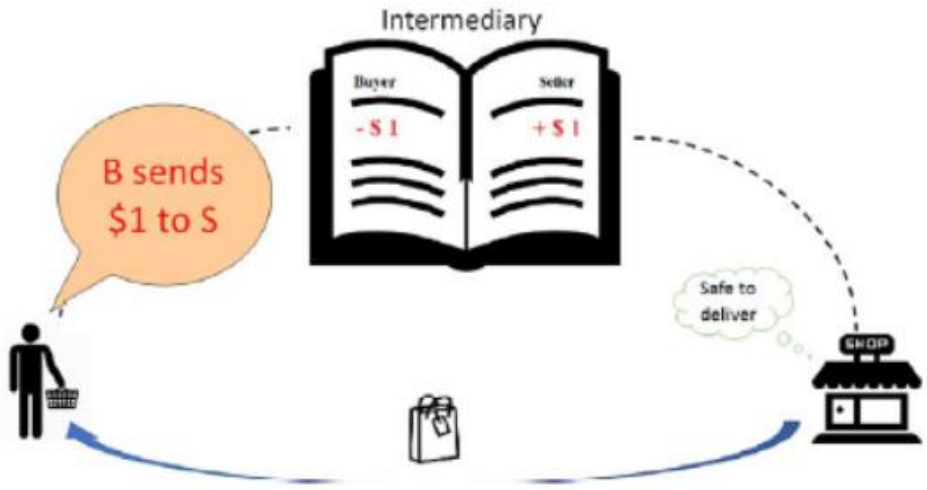


Figure 39 Centralized Payment system Source: (Chiu & Koeppl , 2017)

They are called cryptocurrencies because these payment systems employ a series of cryptographic algorithms to operate. Decentralised cryptocurrencies don't have central control and they are controlled by developers investors-users and miners (transaction validators).

Nowadays there are various forms of digital money. In fact most of the conventional currency is circulating in digital format in bank's ledgers than in physical format. A bank when is selling a loan, actually deposits the money in the borrower's digital account. The same holds also for an electronic exchange between a merchant and a customer. In addition, another form of digital "virtual" currency are the airlines loyalty points or some other kind of coupons. In fact with this way, the customer exchanges his loyalty to the brand with some benefits like a discount or some other return.

6.1 A Transaction in Cryptocurrency Environment , Basic Mechanics and Properties of its Cryptocurrency technology

The problem of money in digital form is because it is actually some kind of digital record in some electronic database how can someone be stopped from copying and pasting in one or another way (formally or through hacking), enjoying of infinite liquidity?. And if that happens by a large number of users how we prevent this type of hyperinflation?

It's easier to understand how cryptocurrencies work through an example of transaction. Suppose Anna wants to send to Irene some BitCoins in exchange for a backpack. The transaction includes three parts:

- An input: This is a record of the BitCoin address from which Anna initially received the BitCoin he wants to send to Irene.
- An amount: This is the specific amount of Bitcoins Anna wants to send Irene.
- An output which is Irene's public key which is also called as her "Address"

An address-public key looks random string of numbers and letters but it is the part that Irene needs to share to Anna to receive her payment. However, each public key or address is related with a private or secret key which must be kept safe and secret like a password or a pin number. With this private key, Anna will use her private key to sign digitally (the cryptographic algorithm aforementioned) a message containing the transaction details input, amount (2 BitCoins in this example), and output as seen in Figure 40.

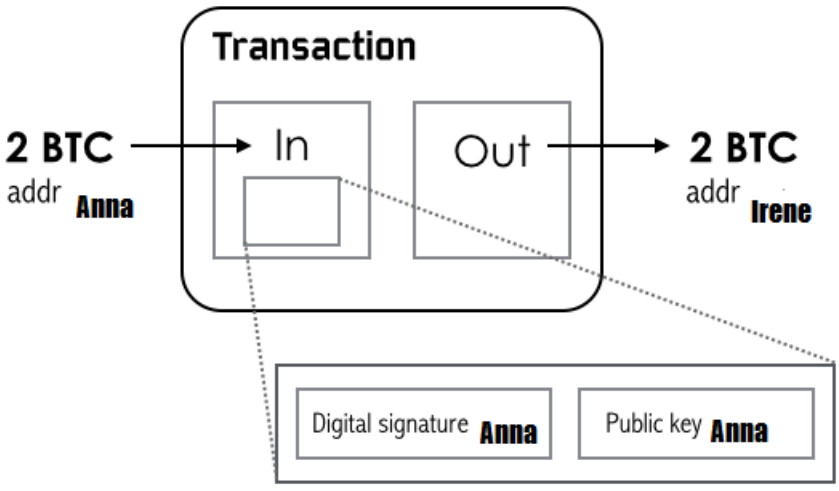


Figure 40 Example of a Transaction in BitCoin

Afterwards the Anna-Irene transaction is transmitted to all the nodes of the network where is validated by the miners. Many transactions are collected into blocks which are bonded together with the Hash (H- cryptographic function) of the previous block forming a coherent series of blocks, a Blockchain as seen in Figure 41.

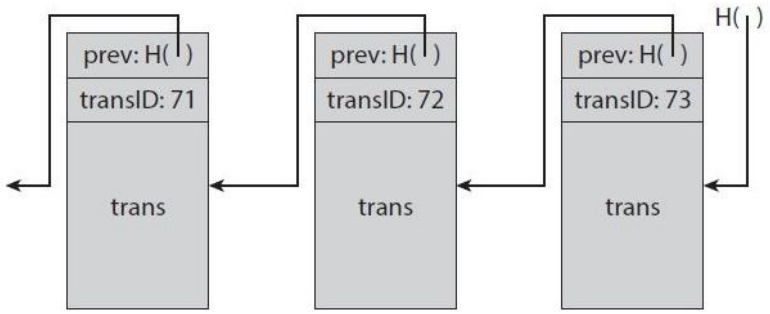


Figure 41 A transaction blockchain Source: https://docs.google.com/presentation/d/15Y-kCduAYVCqZA97B4o0zcPFa42N4PEs-uPBJu58E2g/edit?amp;authuser=0#slide=id.p

Blockchain algorithm as one of the leading cryptographic algorithms which is used for making electronic transactions. Blockchain operates as a ledger in which every transaction is recorded.

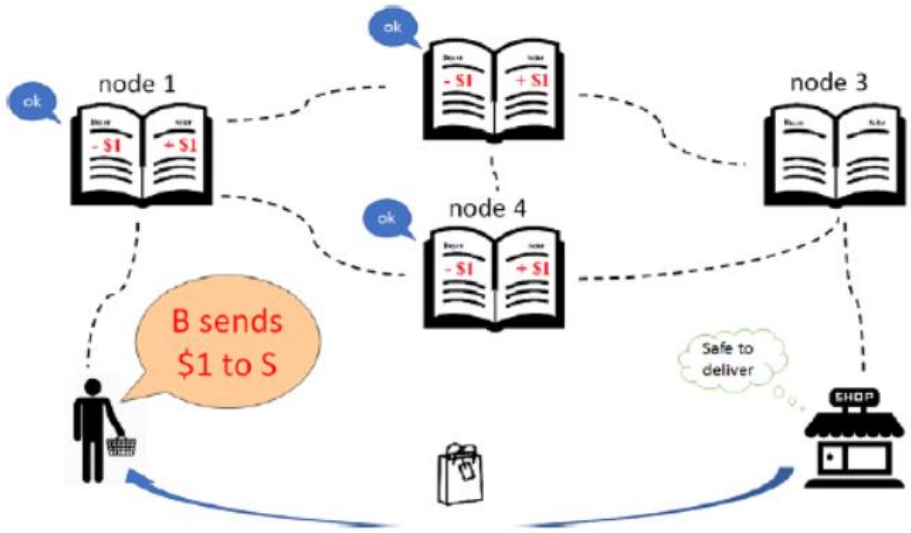


Figure 42 A Decentralized Payment System Source: (Chiu & Koeppl , 2017)

This ledger is then notified to all users however the identity of the each user is being encrypted. Transactions in blockchain algorithm cannot be manipulated in some way because once verified they are bind together with other verified transactions and this process to be reversed

or edited costs significant processing speed and algorithmic complexity and not economically feasible. An example of why hacking, is difficult in a cryptocurrency is seen in Figure 43.

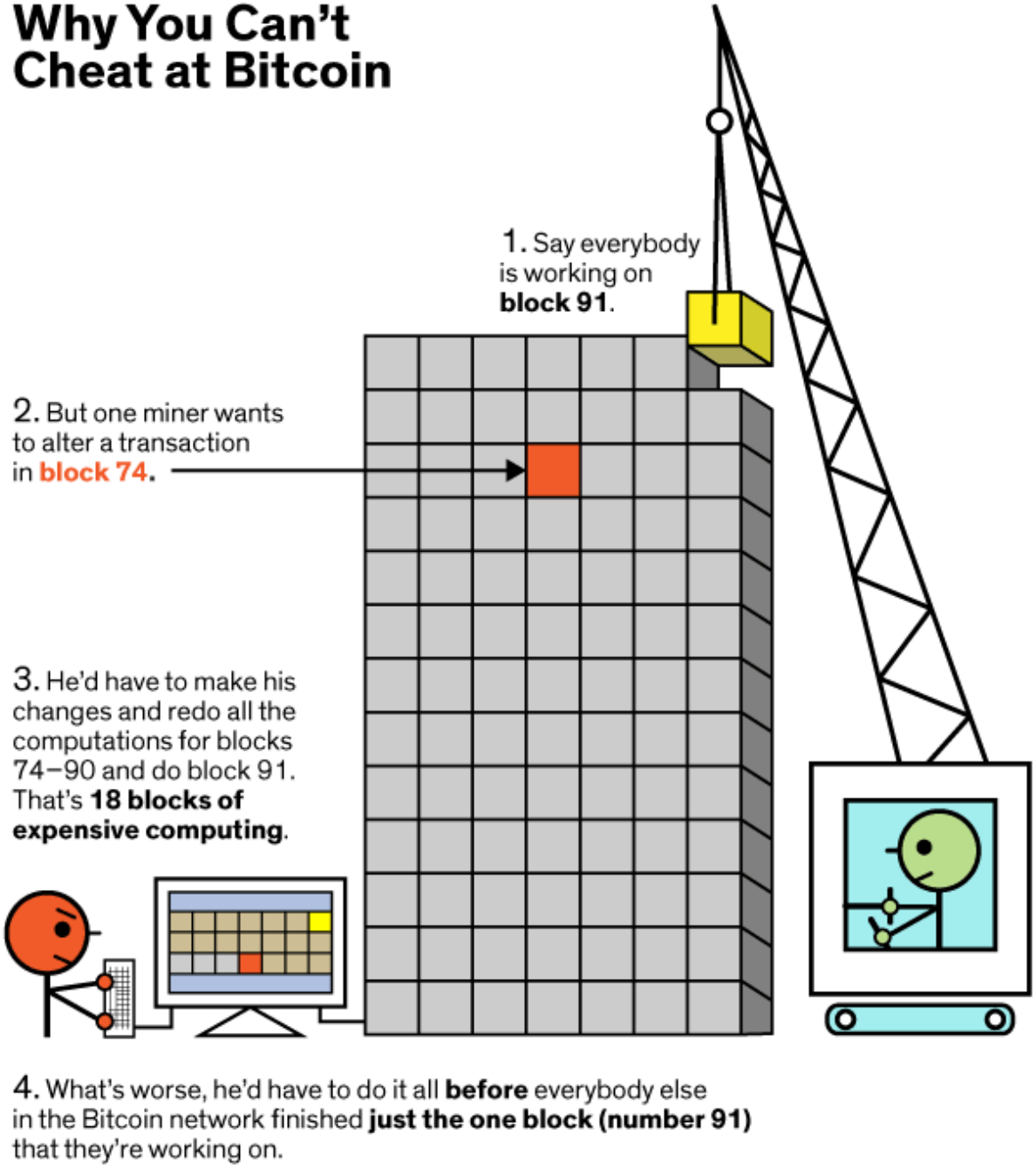


Figure 43 Hacking Obstacles in Cryptocurrency Source: BitCoin FAQ

Old and new transactions are being verified by other users in the system where they confirm the changes in the ledger as the protocol and rest cryptographic algorithm suggests. These users are called "Miners" because by doing these verification they earn a compensation for their computing costs and this is the way where new money is issued to the system. The miner is

verifying the transactions by forming them into blocks according to the protocol that the cryptocurrency has and adds them to the blockchain. A graphical example of how mining works in cryptocurrencies is depicted in Figure 44

Figure 44 Mining in BitCoin Source: BitCoin FAQ

Computing work and proof of work are required algorithms that establish the decentralization in cryptocurrencies. It is mandatory in order to keep away the denial of service attacks, double spent and other attacks and establish trust to the system. Proof of work usually is a cryptographic puzzle that miners need to process so as to merge new blocks to the existing blockchain of transactions.

The cryptographic parameters, distribution and mining protocols are different among various cryptocurrencies. For example in BitCoin the validation time for a new block of transactions is 10 minutes but in LiteCoin is 2.5 minutes. BitCoin mining process is based on computing work (proof-of-work) protocol, on the other hand BlackCoin mining process is based on (proof-of-stake) protocol.

The proof-of-stake algorithm suggests that the miner of the next block is chosen via various combinations of random selection and wealth or age (i.e. the stake). It's also possible that a combination of the two algorithms to be used as Ethereum. In addition, various cryptocurrencies use different cryptographic algorithms related to encryption of data, for example BitCoin uses SHA-256 and LiteCoin uses Scrypt.

It is also important to mention that the blockchain and other distributed ledger systems applications are examined separately (apart from the cryptocurrency concept) as standalone solutions from banking institutions since it facilitates many operations done by banks and other clearing houses. However in this concept the participant nodes in this kind of network are need to be permissioned contrary to cryptocurrency network where the nodes are permission-less and in anonymity. In fact, blockchain technology itself has so disruptive outcome that a whole new business emerged, separate from cryptocurrency.

The majority of academic research in cryptocurrencies was conducted on BitCoin since it is the oldest, prevalent and popular cryptocurrency. However it is interesting to mention some other notable cryptocurrencies which are noted in Figure 45 and Table 5 based on the current market capitalization.

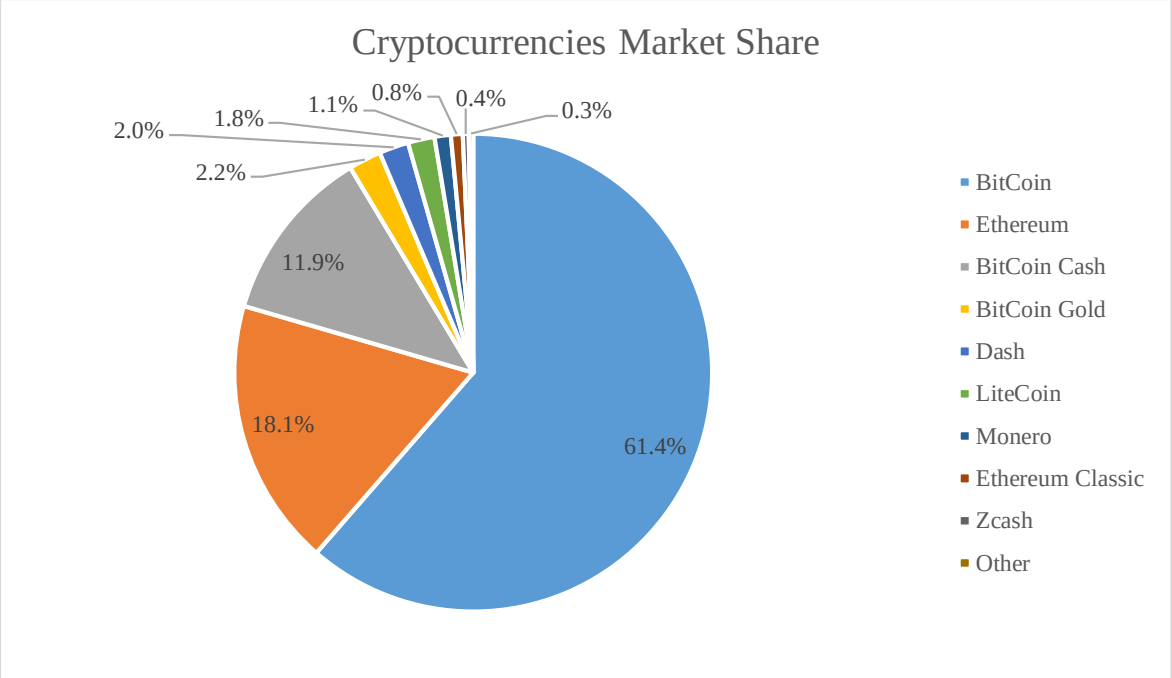


Figure 45 Major Cryptocurrencies according to Market Cap as November 2017 Source: bitinfocharts.com

	Market Share	USD
BitCoin	61.4%	136,423,248,061
Ethereum	18.1%	40,189,988,625
BitCoin Cash	11.9%	26,341,746,690
BitCoin Gold	2.2%	4,742,264,109
Dash	2.0%	4,447,133,782
LiteCoin	1.8%	4,088,057,194
Monero	1.1%	2,553,270,601
Ethereum Classic	0.8%	1,833,452,012
Zcash	0.4%	852,541,206
Other	0.3%	639,405,905
Total Market Cap	100.0%	222,111,108,185

Table 5 Major Cryptocurrencies according to Market Cap Source: bitinfocharts.com

Another use of cryptocurrency but not as a form of exchange medium is through the use of crypto-tokens (or tokens) for crowdfunding and investing purposes. The issuing company releases these tokens through a similar system as seen in cryptocurrencies but each token can redeem some kind of return. In this context tokens are some kind of security. It is still new way of financing used by startups and unregulated. But due to the fact that that it is similar to stock these token offerings (Initial Coin Offering – ICOs similar to IPOs- Initial Public Offerings for stocks) are considered to be regulated by global regulator bodies under the context that holds

for securities offerings. However there isn't any specific regulation yet and SEC and global regulators are considering each case independently.

6.2 Are Cryptocurrencies really decentralized?

Related to cryptocurrency decentralization and the mining process of BitCoin specifically we should note that control of the currency is held by miners and developers of the software. It's a fact that due to economies of scale, large mining pools were formed because mining has expensive fixed and variable costs (due to specialized equipment and electricity needed for mining and cooling). Specifically, miners are forming these pools to establish more efficiency and less volatility in their income from the mining spending less money as possible in electricity. Nowadays in order to get involved with mining efficiently someone needs to possess specialized computers and expensive equipment. It's true that centralization trend has emerged when specialized equipment became available as in Figure 46

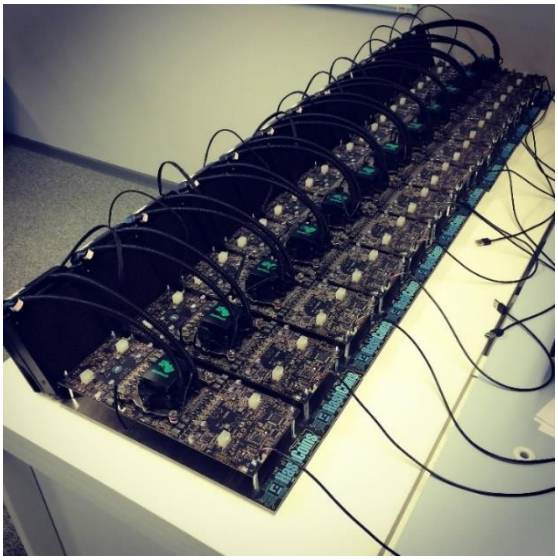


Figure 46 Cryptocurrency Mining Hardware (ASIC- Application-specific integrated circuit) Source: Wikipedia

The major mining pools and their percentage in mining process is shown in Figure 47.

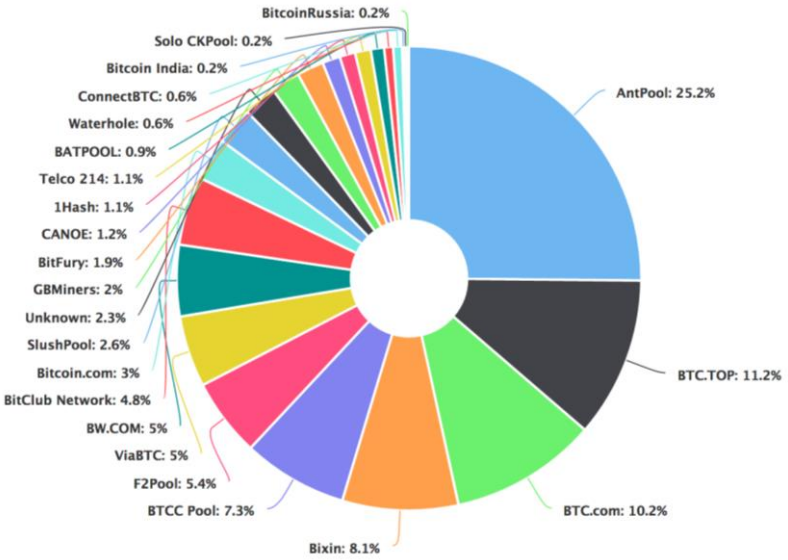


Figure 47 Mining Pools Shares as November 2017 Source: https://www.buybitcoinworldwide.com/mining/pools/

This fact has arisen concerns related with the decentralized character of BitCoin since it becomes less and less decentralized as bigger companies get larger market share. (Beikverdi & Song, 2015) have measured a centralization factor from 2011 to 2014 as seen in Figure 48.

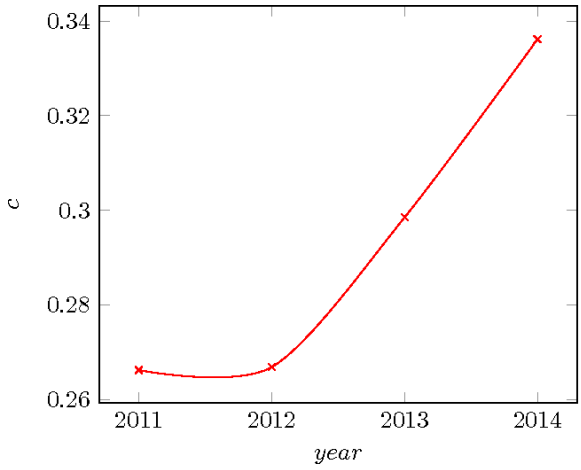


Figure 48 Shows trend of centralization in BitCoin Mining. X-axis shows the years and Y-axis indicates the centralization factor c. 0 shows an absolute decentralized system and 1 shows an absolute centralized system Source: (Beikverdi & Song, 2015)

It is important to point out that overcentralisation and gathering of 51% of mining power into one entity endangers BitCoin since the entity would be able to harass transactions, promote double spending and this would lead to collapse of the system. For that reason, newer cryptocurrencies like Ethereum have tried to modify their code related to the mining process in order to be ASIC-resistant thus, the mining process should not be able to be operated in expensive specialized chips to cut out the centralization trend that has emerged.

6.3 Other Technical Factors that empirically affect the value of the Cryptocurrency

It is interesting to note down some of the factors that influence the value of a cryptocurrency. A study conducted by (Hayes, 2014) investigated the relation between cryptocurrency prices, computational mining power, mining coin rate, percentage of coin mined, cryptographic algorithm (SHA-256, or Scrypt) and the number of calendar days from launch of the cryptocurrency. These parameters were tested through regression. It was found that only statistically significant parameters were computational mining power, mining coin rate, and cryptographic algorithm with an R-Squared of 84%. So it is expected that as computational power to mine a crypto-coin rises, its price also rises. In addition, as the coin rate is decreasing the price rises because the resource becomes rarer. Lastly, a newer and more optimized cryptographic algorithm as Scrypt (compared to SHA-256) makes the cryptocurrency more valuable. These findings related to rarity characteristics of cryptocurrency are supporting the view that some economists hold that major cryptocurrencies emulate the gold standard.

Another factor that influences the price of a cryptocurrency is the hard fork events during it's lifetime. A hard fork happens when an update of the protocols and rules related to the software isn't agreed unanimously by the miners and a fraction of miners decide to continue mining with old rules. A hard fork event is depicted in Figure 49.

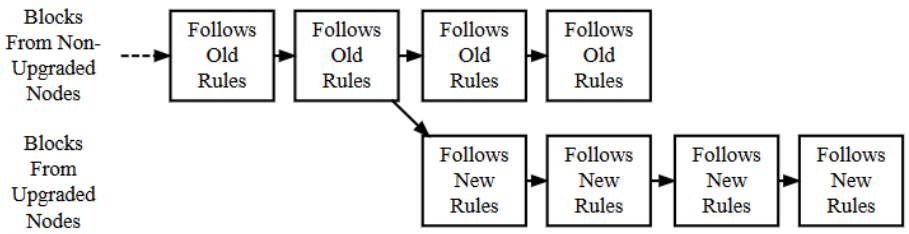


Figure 49 A Hard Fork: Non Upgraded Nodes Reject the New Rules Diverging the Blockchain.

When this event happens, and the miners that provoked this divergence don't give in and continue mining eventually leads to a formation of a new cryptocurrency. This happened twice in BitCoin with a hard fork on August 2017 with the emergence of BitCoin Cash and in October 2017 with the formation of BitCoin Gold. The new divergent blockchain continues separately as a variation of a cryptocurrency and it is sold exclusively in exchanges with a different price. A hard fork event has usually negative impact for the price of the old cryptocurrency and the new formed currency usually is sold at a lower price. Also, using a hard fork is the way to

increase the supply of the cryptocurrency when the upper limit is reached but this fact still never happened.

6.4 Theft Risk and Other Side Risks and Issues Related With Cryptocurrencies:

It's crucial for the success of a currency to earn the trust of the potential holders. Users shouldn't be in fear constantly if someone with a deeper understanding of how algorithms work might break into the BitCoin system and force everything to his benefit, nor take illegally the digital assets stored in online wallets since no custodian or a bank is present in this case as in a traditional banking system. As far as the safety is concerned, cryptographic algorithms are safe however they would definitely need regular updates especially when quantum computing will become available. However, hacking and theft are still potential risks. The biggest online theft incident was with the Mt. Gox Corporation. Mt Gox, based in Tokyo Japan, was the biggest BitCoin exchange corporation until 2014 where it filed for bankruptcy. When the liquidation process began, it was found that 850,000 BitCoins that belonged to company's clients and company itself where missing. With 2014 BTC/USD rate the worth of the missing money was about $450 million. This case is still open until today investigated by Japan's legal authorities. It's important to mention that this event is not unique. A study by (Moore & Christin, 2013), examined the track record of 40 BitCoin exchanges established over the period 2010-2013, and found that 18 have since closed, with customer account balances often wiped out.

Apart from this risk of theft, Kaspersky Lab in their quarterly report on Spam and phishing in Q3 2017 indicates that the rise of BitCoin, Blockchain and cryptocurrencies in general has been used by hackers and spammers for creating scams for users. According to (Kaspersky-Lab, 2017) there are four types of cryptocurrency related scams:

1. Scammers send emails to users promising "alternative" and "profitable" investments on cryptocurrencies like binary options. But there is no guarantee that the potential victim would get his money back. It is similar to casino scams which victims lose all of their money by playing to a rigged virtual casino.
2. Emails are sent to potential victims promising better and more trustful online wallet services for their cryptocurrencies. However, the user who is sending his money to this "service" would never have access again to his funds as the scammer would be disappeared.
3. An email offer promising educational workshops on cryptocurrencies and cryptocurrency and blockchain investing is sent to the users. Victims would be

convinced that this is a legitimate offer and would pay for the "workshop" but eventually the scammer would disappear with the money again without delivering back at all.

4. Another not email-related scam related with cryptocurrency is when a hacker is forwarding a bot program to a massive amount of computers illegally which uses the infected computer as a mining device for cryptocurrency. This when takes place in many computers cumulatively can benefit the intruder since he earn money. (Kaspersky-Lab, 2017) (Capital.gr, n.d.)

Theft and Cybersecurity risks are among the most significant risks that investors and users of cryptocurrencies take. Moreover, BitCoin especially, was criticized to a large degree that it became popular and prominent because it was used in illegal online activities such as the Silk Road which it was an online black market selling illegal drugs and arms and was closed down by FBI in 2014. Thus regulators around the world worry about the Anti-Laundry regulation and think that they should include regulation related with cryptocurrencies.

It's important to note down that cryptocurrencies do not guarantee anonymity. They are characterized by pseudonymity as users are using public key or address which decrypts their personal data. However the addresses are able to be located and searchable in the databases if someone knows the public address of a person can see transactions of that address and spending patterns. For that reason it's advisable for better security of personal data, users should possess several public addresses different for each transactions although there are ways to distinguish several public addresses that belong to one entity.

6.5 Scalability and Energy Consumption issues in Cryptocurrencies

It seems that there are scalability issues related with cryptocurrency technologies. BitCoin current statistics show that 3-5 transactions per second on average are feasible and in Ethereum around 20. This compared to VISA 2000 transactions per second (56000 transactions per second on busy days) and PayPal 200 transactions per second (450 transactions per second on busy days) shows very low service capabilities for cryptocurrencies with the current technology. (Narayanan, et al., 2016)

There are issues related with the energy consumption that the mining network, (the network that is responsible for BitCoin transaction validation). Electricity is crucial in Cryptocurrency mining since it is required for solving the proof-of-work puzzles for validation of the transactions. According to (Digieconomist, 2017) the power use needed for BitCoin mining is 30.25 TWh per year. This power is enough to provide electricity to a country larger than Ireland

(Hern, 2017). In addition, (Digieconomist, 2017) shows that the Electricity consumed per transaction is 275 KWh which is adequate to provide power to 9 households for one day. Moreover (Hern, 2017) argues that one of the two, VISA datacenters uses around 2% of the power needed by BitCoin network. With these data and with the previous data related to efficiency of transaction validation Cryptocurrencies are still way back on efficiency and energy consumption. For that reason cryptocurrency and blockchain developers are researching towards a better proof-of-work protocol which is more cost efficient.

6.6 "Can Cryptocurrencies stand as a medium of exchange?" and "How exchange rate volatility affects cryptocurrency?"

Money is typically defined by economists as having three characteristics: it functions as a medium of exchange, a unit of account, and a store of value (Yermack , 2013). This is also repeated and by many other economists. The most prominent cryptocurrencies like BitCoin are nowadays increasingly satisfies the first of these three criteria, because a growing number of merchants, especially in online markets, appear willing to accept it as a form of payment (Yermack , 2013). But as far as the third criterion the volatility of the price of the studied asset comes into play.

An interesting study by (Baek & Elbeck, 2015) related to the volatility of BitCoin and included comparisons between other assets sheds some light to this fact. Specifically they found that the BitCoin market is about 26 times as volatile as the stock market during 2010-2014. Moreover, the BitCoin market has a positive excess kurtosis that causes a fat tail events. This means that it is more likely for extreme values to occur (Baek & Elbeck, 2015). (Yermack , 2013) includes a comparison of BitCoin/USD with other assets in his study. Figure 50 shows the annualized volatility of the percentage change in daily exchange rates for four major currencies, gold, and BitCoin, all measured against the U.S. dollar. Volatilities are calculated for the period January 1, 2013 up to November 29, 2013 .

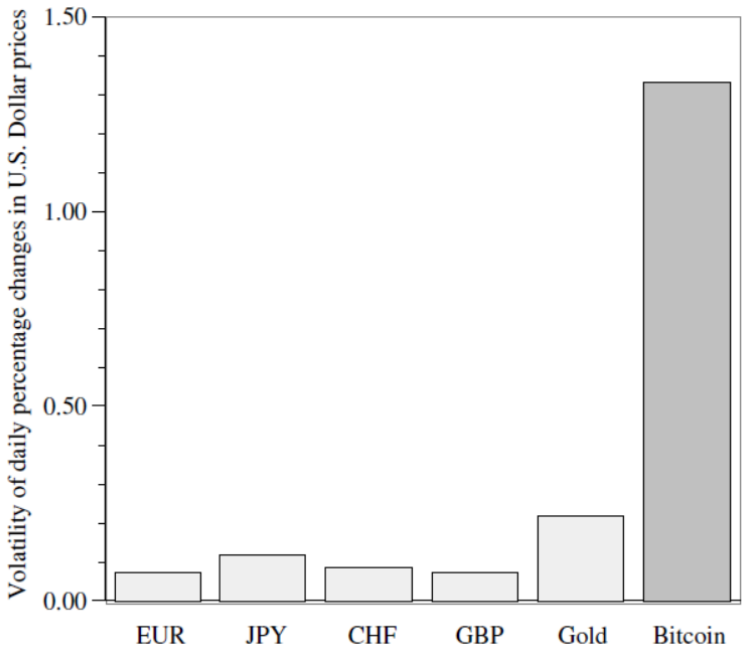


Figure 50 Volatility of BitCoin compared to major currencies (Yermack , 2013)

Since (Yermack , 2013) was 3 years ago recent data (USD/BitCoin) from coindesk.com were downloaded for the period November 2016 – November 2017 for comparison. The result was that the annualized volatility in that period was 81%. Less but still very high compared to other assets and Gold prices.

In addition (Baek & Elbeck, 2015) performed a regression on BitCoin/USD price data with other basic economic factors such as the CPI index, the change in industrial production, the change in personal consumption expenditure, the change in S&P500 index, the change between US Treasury 10 year note interest rate, the change between USD/Euro exchange rate, the change in unemployment rate and the spread between the daily high and low BitCoin prices. They concluded that only the spread between daily high and low prices as an internal factor of the BitCoin market is statistically significant. The rest of external economic factors do not appear to have any significant influence on the BitCoin market returns. This implies that the BitCoin market returns are mostly internally driven by market participants (Baek & Elbeck, 2015). And this is indicative of a high speculative instrument since it is driven by BitCoin exchange participants (buyers and sellers). (Baek & Elbeck, 2015) argue that "if BitCoin usage grows, then we expect BitCoin volatility to drop and attract market and economic influence representing a more balanced internally and externally driven investment vehicle". However as (Harvey, 2014) notes about the BitCoin volatility "This extreme volatility means that BitCoin is not a reliable store of value. While retailers are willing to accept BitCoins for

payment, this is the reason that they immediately dump the BitCoin for traditional currency. Even holding BitCoin for a single day is risky because the fluctuation could wipe out the savings vs. a credit card transaction (retailers usually get charged a 3% fee for credit card transactions)". This undermines the use of BitCoin as a medium of exchange however there are intermediate services like in Figure 51.

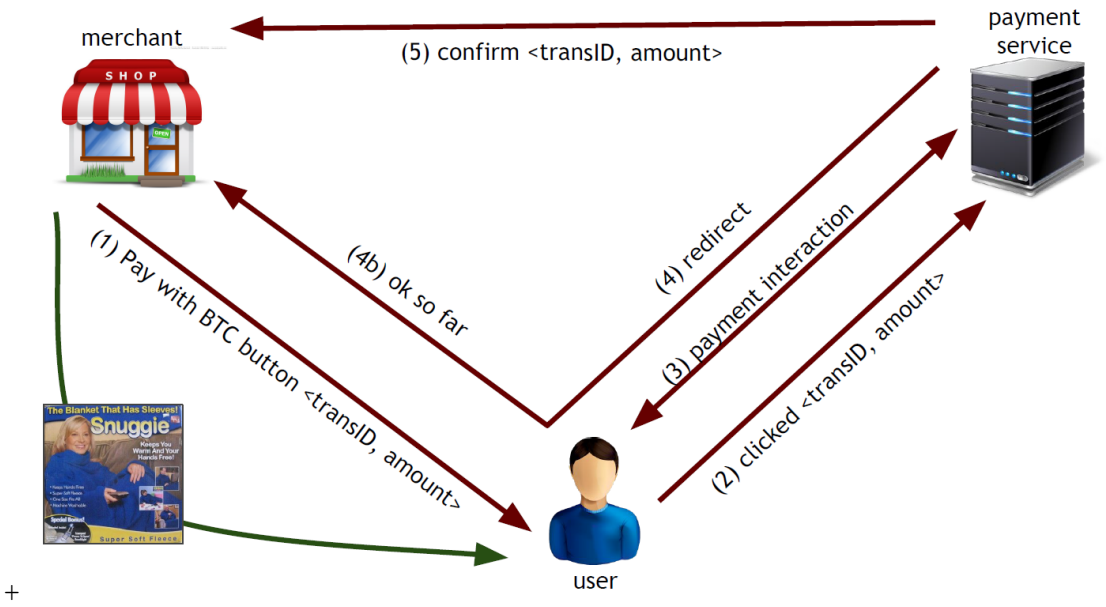


Figure 51 BitCoin Payment Intermediate service when the user wants to pay in Cryptocurrency but the merchant wants his payment in local currency Source: https://docs.google.com/presentation/d/1vZ7rlE8habBuMllGjdwxtIqk3-Ssk6eJz03fc2Ong3s/edit?usp=sharing

The merchant provides an address with a button and the required data (address etc.). The user pays in BitCoin in an address given by the payment service. The payment service sends confirmation to the user and confirmation message to the merchant and hands over the item. At the end of the day usually the merchant receives the amount of the payment in local currency. However intermediates services (and BitCoin users) are vulnerable to the volatility of the exchange rate and still there aren't any hedging derivatives for cryptocurrencies. However the CME – the Futures Derivatives exchange in United States is considering the creation of a USD/BitCoin future derivative by the end of 2017.

Some cryptocurrencies are difficult to do accounting with them. For example BitCoin lowest division is 1 Satoshi = 0.00000001 BitCoin and for Ethereum 1 Wei = 0.000000000000000001 ETH. This is because the majority of cryptocurrencies are deflationary, thus less and less money is supplied as time passes as their price rises as long as they become more popular. For example BitCoin has an upper limit of money supply of 21 million and the money supply is halved every four years. This makes the accounting and every day calculations very hard with

so many decimals. Some other economists and other are offering explanations how they disagree with this deflationary design that the majority of cryptocurrencies have.

It was mentioned before that the high volatility of the exchange rate cryptocurrencies against other currencies impedes their use as medium of exchange. But how high volatility and speculative behavior can be explained in more detail? A study dated back in 2013 by (Ron & Shamir, 2013) analyzed the transaction patterns in the BitCoin network and came into some very interesting conclusions. Firstly, they found that the recipient addresses that receive and do not sent to other addresses are 70-73%. This conclusion came after analyzing the transaction value. (Ron & Shamir, 2013) repeated the analysis using the final balance of the recipient addresses and with this method they found that the aforementioned statistic was 50%. This points that the majority of BitCoin users, at least in the past, were hoarding BitCoins because they were expecting that their price would rise rather than to use it to make their payments. A second fact that this study showed by (Ron & Shamir, 2013) was related with the large transactions of over 50,000 BitCoins. All transactions over 50,000 BTC were 363 and the earliest large transaction (on 8th November 2010) with 90,000 BitCoins. The researchers found out performing transaction analysis and matching of the recipient addresses and found that 348 over 363 over total large balance transactions were actual successors of this initial transaction (Ron & Shamir, 2013).

Another interesting metric which shows the hoarding behavior of BitCoin users is the concept of BitCoin Days Destroyed. It is used as an alternative of the velocity of money that is used in traditional currencies. Suppose for example, someone has 50 BitCoins (or some other cryptocurrency if they record the particular metric) and doesn't use them until after 100 days to buy a TV. This means that there are 5000 BitCoin days destroyed. This shows how much the BitCoins were kept before cashed out for something. (Seward, 2013).

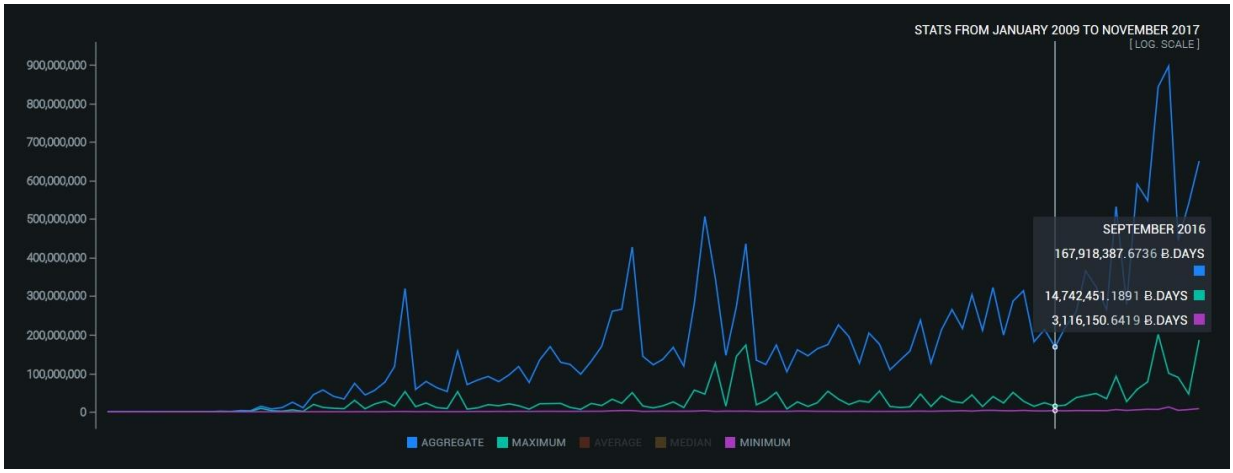


Figure 52 BitCoin Days Destroyed (BDD) in Y-axis and in X-axis is the timeline. We can see how the hoarding pattern is rising throughout the years. Source: https://oxt.me/charts

In Figure 52 (for a larger image check Appendix 8.1) we can see how the hoarding pattern is rising throughout the years as the BDD metric shows. Some researchers like (Cheah & Fry, 2015) and (MacDonell, 2014) following the log periodic power law modelling for bubble formation as first suggested by (Johansen, et al., 2000) have warned for a bubble creation in BitCoin market in late 2013. There is a surge pattern in BDD metric in those days (January 2013-december 2013) that is similar to September 2016-Today.

7 Conclusions

After writing this present thesis and reviewing all these different innovational changes in the financial services I still want to emphasize the influence of the FinTech sector by the philosophy of Technology Startup companies. New business models and practices from the Technology Sector have been transferred to FinTech with the goals of reducing operating costs, minimize intermediation and simplify processes and automate operations.

As far as P2P lending is concerned, academics and practitioners await that every major bank is going to operate a P2P Platform. Thus the use of this service would be expanded and changes need to be considered in the regulatory systems of the countries that haven't regulated this service yet. The same argument holds and for the Crowdfunding market with the focus of the regulation waited to be on the theft and the misuse of this kind of platforms.

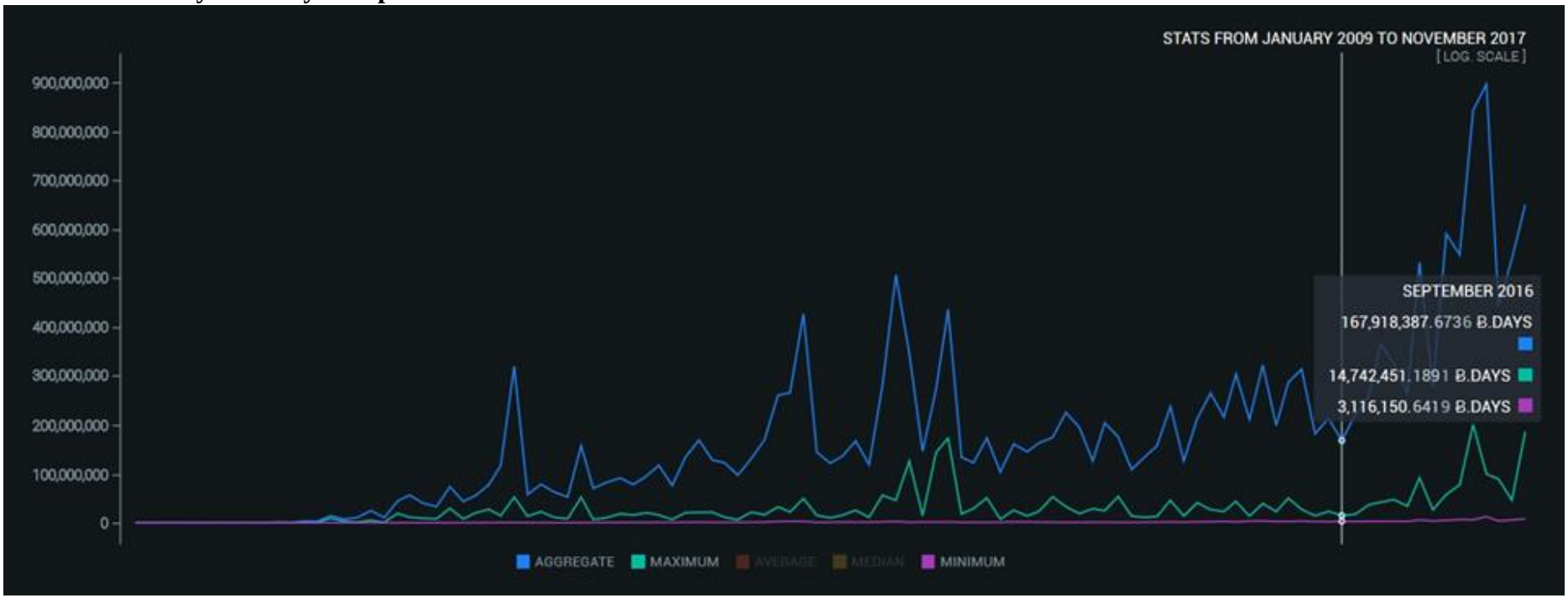
Electronic payment systems are considered to be more mature and saturated sector in FinTech. The remaining issues that need to be optimized and researched for the future are the concepts of convenience, ease of use and cyber-security. Cryptocurrency underlying technologies are awaited to influence and be used in this service.

E-Investments are also going to expand as a service from the major banks and asset management firms. The question here is for the financial advisor staff that needs to be educated about robotic-advisory and investment technology something which the CFA institute is going to include in its Certification programs.

Lastly, Cryptocurrency and Blockchain technologies are considered very disruptive. Blockchain and Cryptocurrency protocols and algorithms are very smart inventions with many applications. However, there is an exuberance in this sector which looks very similar with the Dot-Net exuberance in Tech and Internet companies in the late 90s- early 2000s and for that reason there is a warning for a bubble from many experts. However in the next decade we will be able to have a clearer picture. As an idea for future research would be in the research of the cryptocurrency and digital token market and its dynamics. Specifically it would be very interesting to find similarities and differences of these markets with the traditional securities markets. For instance a comparison between an ICO (Initial Coin Offering) and an IPO (Initial Public Offering) would be useful to trace if we have undervaluing effects and in ICOs also.

8 Appendix

8.1 BitCoin Days Destroyed September 2016-Novemeber 2017



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