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**MOBILE PAYMENTS MARKETS IN KENYA, TANZANIA AND ZIMBABWE: A
COMPARATIVE STUDY OF CONTESTABILITY AND OUTCOMES**

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Abstract

This paper conducts a comparative review of competition dynamics in mobile payments markets in Kenya, Tanzania and Zimbabwe. Three main competition issues have been highlighted across these countries: the impact of agent exclusivity on the ability of rivals to compete; allegations of margin squeeze by dominant Mobile Network Operators (MNO); and, the limiting of interoperability to reinforce network effects and maintain dominance. Underlying all of these types of conduct is the incentive for an incumbent to maintain its dominance in the mobile payments market, and the linked benefit in terms of inducing customer loyalty in the market for traditional MNO services. The paper conducts an empirical analysis of the markets in each country in order to try to understand the extent to which market structure and the presence of a dominant incumbent influences pricing strategies and in turn the impact that these pricing strategies have had on the contestability of mobile payments markets (using market shares over time as a proxy).

The main finding is that more competitive outcomes have arisen in Tanzania (where there is greater symmetry between operators) in terms of lower prices, symmetry in the prices charged to registered and unregistered users, and interoperability between operators relative to the other countries. The results of the market structure and pricing analysis suggest that in markets dominated by one large player, regulators may need to consider interventions to ensure the development of interoperability at all three levels: agent, platform and customer; which is important in terms of levelling the playing field for competition.

JEL classification

D4, L4, L5

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1. Introduction

Mobile payments have revolutionised the payments system for consumers in a number of African countries, providing a cheap, safe and convenient means of transferring money. This is beneficial for competition as it provides the consumer with a cheaper alternative to banks and other financial institutions with a much wider footprint. Furthermore, mobile money services have evolved to offer a wider range of services such as savings and credit products, adding further value for consumers. The possibility for competition in the provision of mobile payments in particular to bring benefits to consumers is illustrated by recent developments in Kenya, where increased competition in the market appears to have led to falling prices.

However, in some countries, telecoms companies have established positions of significant market power in the mobile payments market, in addition to existing incumbent positions in the market for traditional Mobile Network Operator (MNO) services. This raises a concern that incumbent firms will engage in strategies to reinforce their dominance in both markets, particularly given the network effects present within and across them. This has been borne out in a number of competition complaints against incumbent mobile money providers in different countries. Although in the short term it does appear that MNOs are involved in rapidly developing adjacent products and services leveraging the high penetration of mobile payments services, a lack of competition in the long term may reduce the incentive for further innovation and product development and lead to higher prices.

Three competition issues have been highlighted across Kenya, Zimbabwe and Tanzania which we focus on: the impact of agent exclusivity on the ability of rivals to compete; allegations of margin squeeze by dominant MNOs who provide USSD infrastructure to other potential mobile payments providers such as banks; and, the limiting of interoperability (for example through higher charges to recipients on a different network) to reinforce network effects and maintain dominance. Underlying all of these types of conduct is the incentive for a dominant incumbent to maintain its dominance in the mobile payments market, and the linked benefit in terms of inducing customer loyalty in the market for traditional MNO services.

In this context, this paper attempts to contribute to a better understanding of the competitive dynamics in mobile payments markets and the implications of these for consumers. We do this by conducting a comparative review of market structure, competition dynamics and pricing in mobile payments markets in the three African countries, which shows that where there is a dominant incumbent, tariffs for mobile payments tend to be higher and reflect a wider gap between those for registered and unregistered customers. This is consistent with the predictions of economic theory in network industries and the incentives of incumbent operators to capture or tip the market in their favour, which also helps to reduce switching amongst existing customers in the market for mobile services.

In terms of interoperability, Motta (2004) (based on Cremer et al (2000)) show that in a market with network effects where there are two firms with asymmetric market shares, the larger firm will not prefer compatibility with rivals unless its installed base is small relative to potential demand. We extend this model to consider the case where firms have symmetric market shares and show that in this scenario, firms would prefer compatibility. Our analysis finds that for the most part these predictions are borne out in the three countries studied. Incumbent firms with a large installed base appear more likely to resist interoperability and find it in their interest to maintain their own proprietary system and even raise barriers to transacting across

networks. By contrast, where firms' market shares are more symmetrical, they are more likely to agree to compatibility, tariffs are lower and tariffs to registered and unregistered users are identical. This suggests that in markets where there is substantial asymmetry in market share and one firm has established a very strong position, some regulatory intervention may be required in order to ensure better outcomes for consumers.

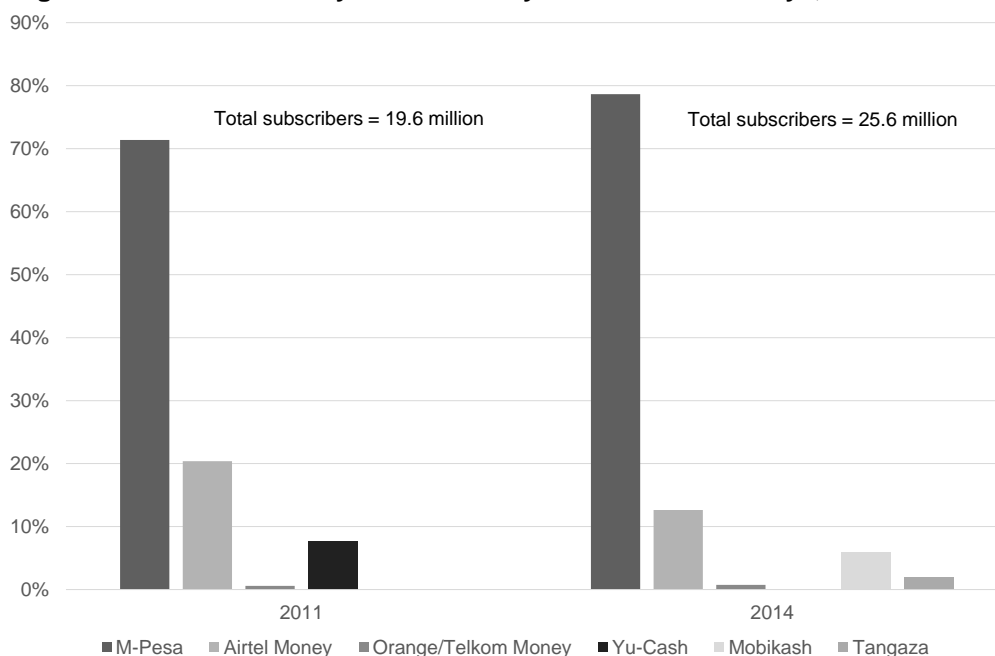
The rest of the paper proceeds as follows. Section 2 introduces the market structure in the mobile payments markets in Kenya, Zimbabwe and Tanzania. Section 3 reviews the benefits which mobile money has brought to consumers in each country. Section 4 introduces theory on competition dynamics in network markets before discussing three competition concerns which have arisen in the mobile payments markets in Kenya and Zimbabwe. Section 5 then goes on to analyse interoperability and pricing outcomes in Kenya, Zimbabwe and Tanzania and relates this to the relevant theory. Finally, Section 6 presents some concluding remarks, policy implications and areas for further research.

2. Mobile money market structure in Kenya, Zimbabwe and Tanzania

a. Kenya

The mobile money market in Kenya is the most developed in Africa where it has 14.2 million active users (CGAP, 2014). As illustrated in Figure 1, the mobile money market is highly concentrated, with the dominant firm Safaricom enjoying over 70% of the market in terms of subscribers. Recently there has been entry by some new small players, but it seems that until 2014 at least, this did not dent M-Pesa's dominance in the market. Rather Safaricom's M-Pesa is becoming more popular over time, growing its market share between 2011 and 2014 from just over 70% to almost 80%, suggesting that it is winning most new subscribers.

Figure 1: Market shares by mobile money subscribers in Kenya, 2011 and 2014

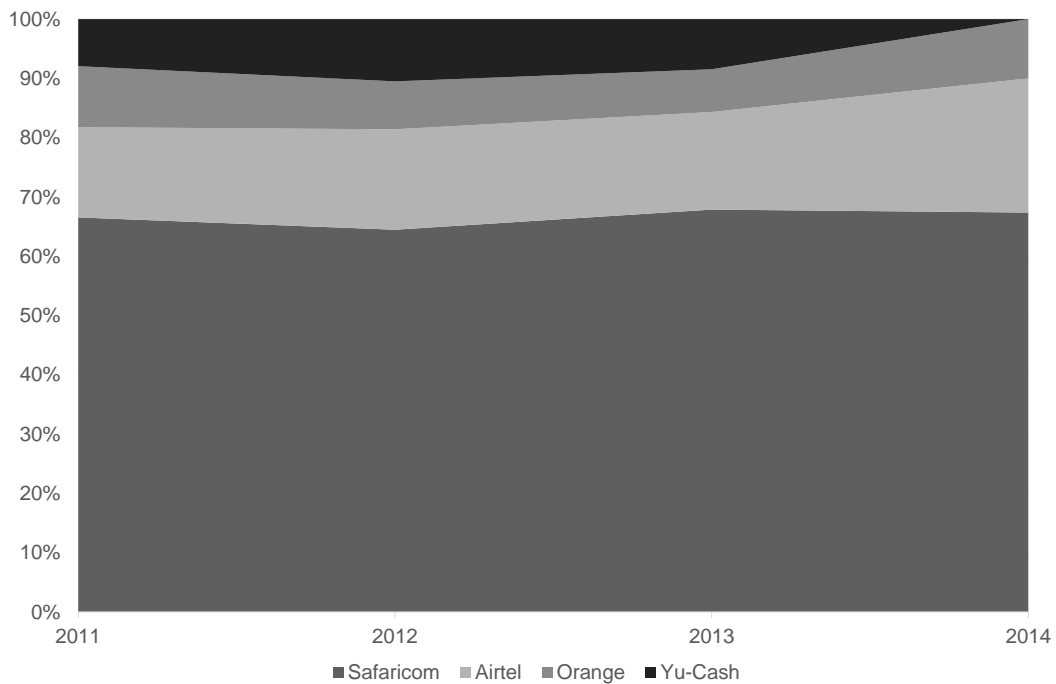


Source: USAID (2011), Kenyan Communications Authority

Figure 2 illustrates that Safaricom is also dominant in the MNO market in Kenya where it had a market share of between 60% and 70% from 2011 to 2014. Safaricom's market share has been very stable, suggesting that little customer switching has occurred. Whilst the market

share of Airtel, Safaricom’s main competitor, grew over the same period, it did so at the expense of other smaller competitors and not Safaricom.

Figure 2: Market shares by mobile subscribers in Kenya, 2011 – 2014

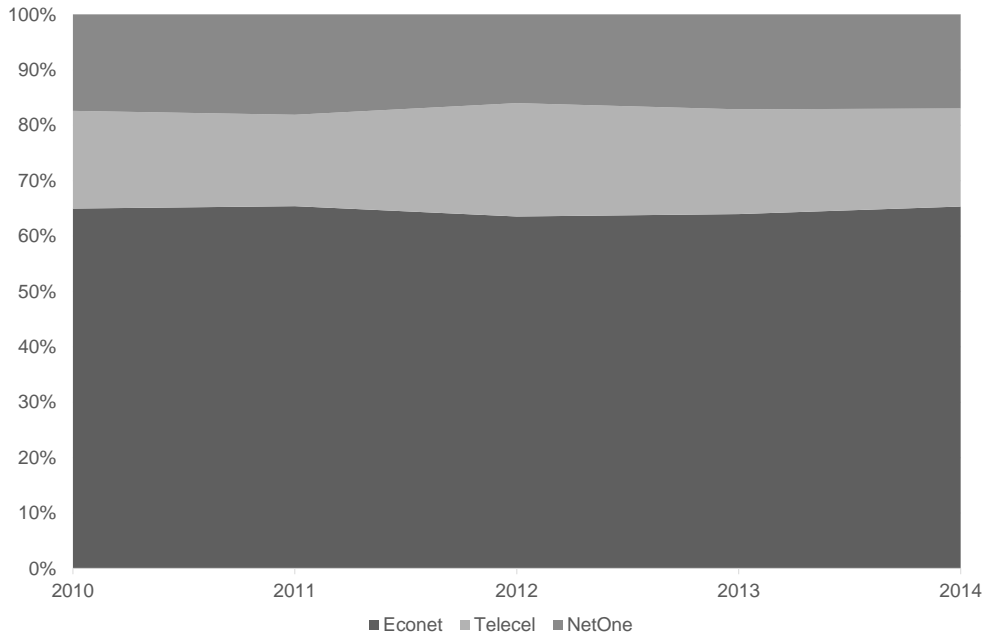


Source: Kenyan Communications Authority

b. Zimbabwe

The structure of the Zimbabwean mobile market is even more extreme than that of Kenya. In Zimbabwe there are three MNOs operating, all of whom have a mobile money platform; however, the market is heavily dominated by Econet and its mobile money platform, Ecocash. Figure 3 illustrates that Econet had around 65% of the MNO market in terms of subscribers between 2010 and 2014, with very little variability in market shares. The other two competitors NetOne and Telecel share the rest of the market equally between them.

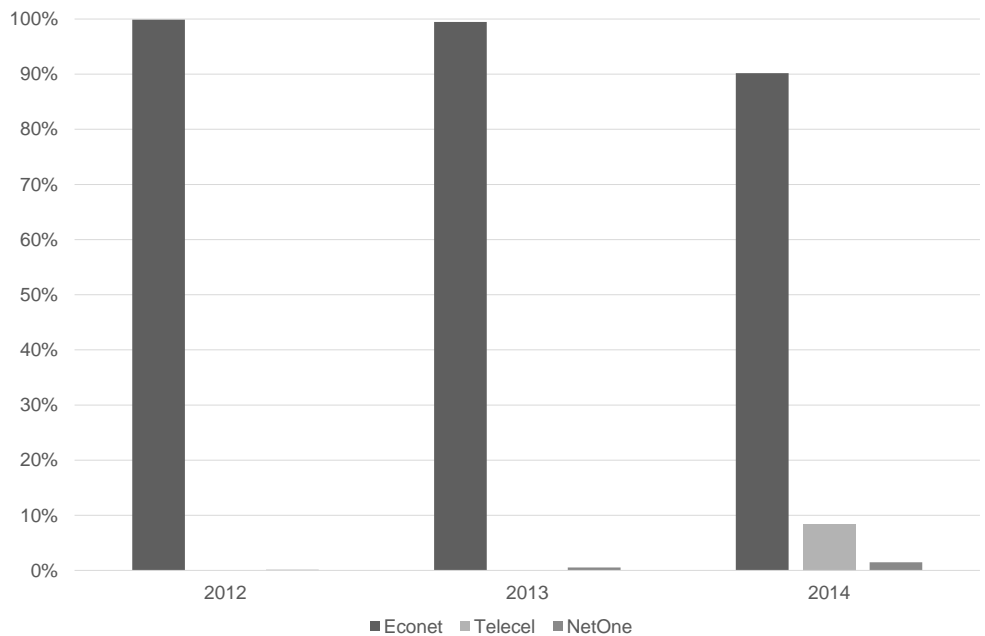
Figure 3: Market shares by mobile subscribers in Zimbabwe, 2010 – 2014



Source: Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ)

Figure 4 illustrates that even more than M-Pesa, Ecocash is a virtual monopoly in the mobile money market. Encouragingly, Telecash quickly gained around 8% in terms of subscriber market share on re-entering the market in early 2014,¹ however, in terms of transaction value Telecash’s market share is much smaller (POTRAZ, 2014) and Ecocash still clearly dominates the market.

Figure 4: Market shares by mobile money subscribers in Zimbabwe, 2012 - 2014



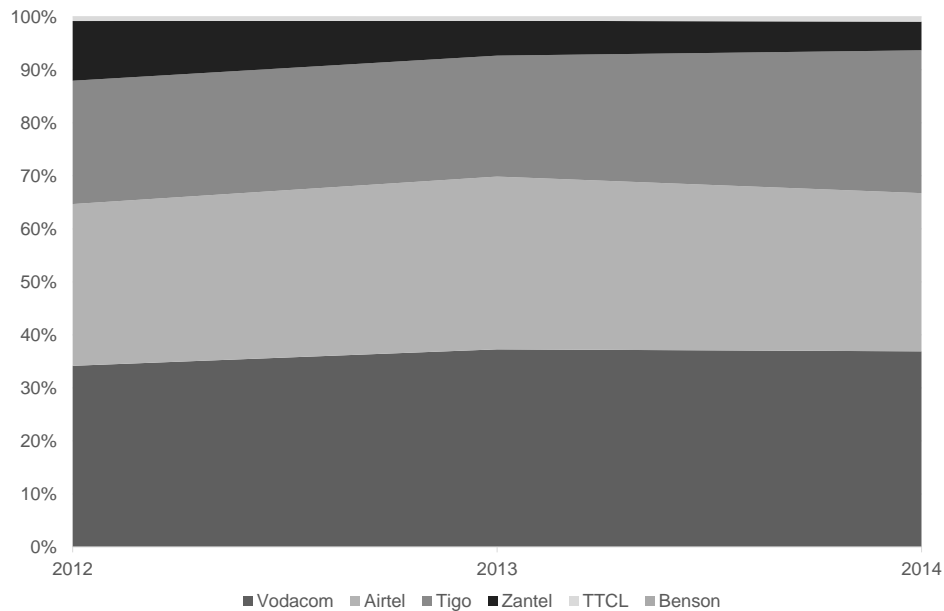
Source: POTRAZ

¹ Telecel had initially introduced a mobile money product, Skwama, in January 2011 using a bank-led model in partnership with Kingdom Bank, however they subsequently withdrew the product due to concerns that partnering with a single bank was limiting their potential growth.

c. Tanzania

The Tanzanian market is somewhat different to those in Kenya and Zimbabwe. Tanzania has a much more competitive MNO market than either Kenya or Zimbabwe, as illustrated in Figure 5. There are three players each with around 30% of the market and a few small fringe players.

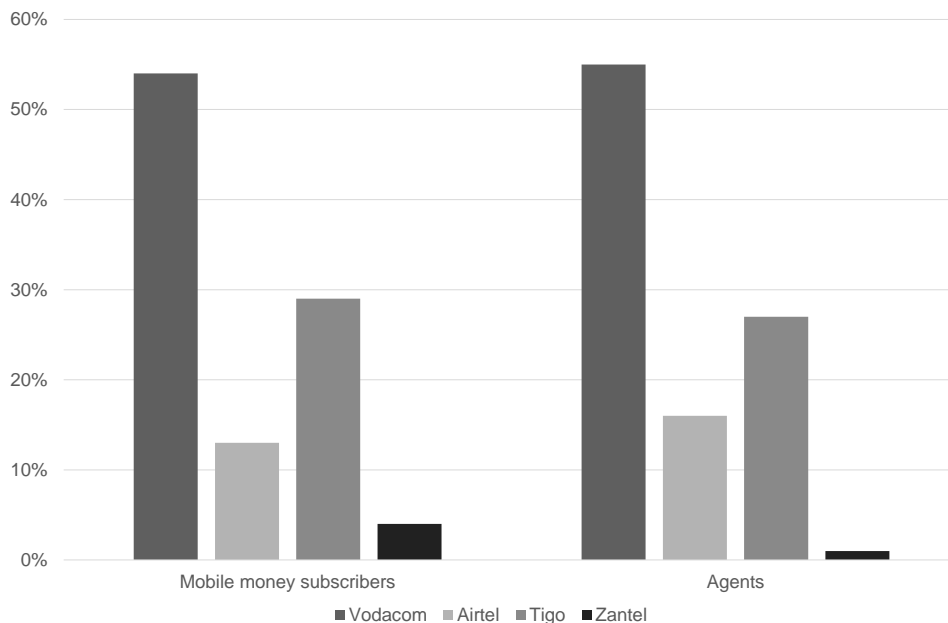
Figure 5: Market shares by mobile subscribers in Tanzania, 2012 – 2014



Source: Tanzania Communications Regulatory Authority

In terms of mobile money, Vodacom is bigger in terms of active wallets than the other two main players with a 54% market share 2014 (CGAP, 2014). Thus although the market appears to be more competitive than the Kenyan and Zimbabwean mobile money markets, there is still one large player which is almost twice the size of its nearest rival (Figure 6).

Figure 6: Market shares by active wallets and agents in Tanzania, 2014, 2013



Source: CGAP (2014), Helix (2013)

3. The benefits of mobile money to consumers

It is widely accepted that mobile payments yield substantial benefits to consumers, not least because of the ability of these payment mechanisms to offer a secure, cheaper and more convenient method for people (particularly in poor or rural settings) to send and receive money (Klein and Mayer, 2011). This includes the ability to bring people that were previously not catered for under traditional payment systems into more formal systems of transacting. This contributes substantially to increasing financial inclusion. A key component driving the penetration of mobile money (and electronic payments in general) across several countries is the ability of these platforms to disaggregate or unbundle the services traditionally offered by banks into less expensive and accessible platforms (see Zollmann and Cojocar, 2015; and Klein and Mayer, 2011). These developments are especially important in the Zimbabwean setting following the period of economic hardship in the mid-2000s, wherein most people developed a significant distrust for formal banking systems and reverted to using largely cash-based methods and direct, informal cash transfer mechanisms such as through mini-bus taxi services and travelling relatives or friends (Dermish et al, 2012).

Mobile payments systems largely compete with formal mechanisms offered by banks, as well as cash-based and informal systems. The former is a dynamic growth area in terms of competition in so far as MNOs have drawn in people who were previously unbanked as well as some proportion of traditional bank clients. In turn, banks increasingly offer mobile banking and mobile money as value-added services to their customers although this relies on the infrastructure of mobile operators.

From a competition perspective, there is clearly some overlap in the customers of banks and MNOs in particular, as well as a degree of imperfect substitution between these services and informal mechanisms of sending and receiving money. A key determinant of the extent of this rivalry is accessibility, for example in terms of agents and cash-out facilities, and price. Bank services have traditionally been perceived to be expensive (Dermish et al, 2012; Zollmann and Cojocar, 2015), and informal transfers less reliable and convenient. Importantly, the parameters on which competition between these modes takes place extends beyond price, to aspects of quality of service such as safety, reliability, convenience and accessibility. For example, 65% of respondents in a FinScope survey of individuals in Zimbabwe said that they used mobile money largely for sending and receiving money because it was most convenient (in terms of time taken), while 36% considered that it was cheap, 24% that the service was trustworthy, with 23% saying that mobile money was the only service available in their area (FinScope, 2015). However, to the extent that consumers are willing to pay a non-trivial amount for a more convenient and safe service relative to informal mechanisms, and in so far as tariffs for mobile money are below those of banks, the price level set by operators remains critical and a key strategic lever.

While the data were not available to assess the degree of substitutability at the margin, say for a small but significant and non-transitory increase in the tariffs charged by mobile money providers (which would bring the price closer to those of banks and make it more expensive for those formerly using informal modes), there are some insights to be drawn from recent developments in each of the markets we consider.

a. Kenya

In 2014, the Communications Authority of Kenya provided three new Mobile Virtual Network Operators (MVNOs) with licences - Fincell (owned by Equity Bank), Zioncell Kenya (a subsidiary of Mobile Decisioning), and Mobile Pay (backed by Tangaza Pesa) - which allow them to provide mobile money services using their own sim cards and without necessarily rolling out their own infrastructure. Publicly available information suggests that the entrants have entered arrangements with Airtel Kenya to use their 60% excess capacity (Equity Bank, 2014).

Most relevant here, is the fact that around the time of this announcement by the authority, Safaricom announced new tariffs which took effect on the 21 August 2014 (Nleya and Robb, 2014). Safaricom introduced tariffs which were 67% lower for transaction values of KSh 10-1500, while withdrawal fees remained unchanged, and tariffs for amounts above KSh 1500 would be an average of 0.8% of the transaction value (Safaricom, 2014). This seemed to follow Equity Bank's own announcement that their pricing strategy upon entry would be aggressive and seek to undercut significantly prevailing prices for money transfer in the market (Equity Bank, 2014).

The fees that Equity Bank has proposed are lower than their own retail banking rates on the Equity Bank Ordinary Account product.² Setting aside the requisite opening balance for opening an account of KSh 400, Equity Bank charges KSh 150 for an ATM cash withdrawal, KSh 100 for an electronic fund transfer (EFT) to an Equity Bank account holder, and KSh 300 for an EFT to a customer of another bank. However, its proposed transfer fees for mobile money range from KSh 1.00 (for KSh 100 transfer) to a maximum of KSh 25.00 which is irrespective of the amount transferred (Equity Bank, 2014).

Although low entry price strategies are common for new entrants seeking to gain market share, and while it is not clear that Safaricom's announcement is a direct response to the impending entry of rivals, it is significant that the operators have presented significantly reduced prices. For Equity Bank and Fincell, the ability to offer reduced prices is likely linked to the ability to leverage existing infrastructure to connect Equity Bank's more than nine million banking customers to mobile money mechanisms through Airtel whilst offering an even wider range of related financial services. In the case of Safaricom, it is likely that the new pricing strategy is in response to entry and may be geared to capture a portion of the growing market and reduce the ability of entrants to gain share. Even if this is not the intention of the strategy, it may still have this effect.

Equity Bank has also announced that it would have access to a network of 11 000 agents to facilitate its entry (Equity Bank, 2014), which is due in part to the Competition Authority's intervention on agent exclusivity in the market in 2014 which we return to below. Increased access to agents for cash-in and cash-out transactions enhances benefits to consumers, as well as welfare to businesses operating as agents.

b. Zimbabwe

In Zimbabwe, Ecocash has had to on a number of occasions reduce tariffs for mobile money following interventions by both the Post and Telecommunications Regulator of Zimbabwe

² Using tariffs effective 1 May 2014. Tariffs available on the Equity Bank company website.

(POTRAZ) and the Reserve Bank of Zimbabwe (CBZ). In 2013 for example, the RBZ issued guidance to MNOs to enhance interoperability with banking platforms and a directive for tariffs to be lowered (see for example, RBZ, 2013). These measures were recommended with a view to enhancing the progress with regards to financial inclusion and a shift to an economy less dependent on cash-based transactions. In this same period, perhaps linked to this development, Econet reduced their tariffs by up to 34%, and set tariffs for transfers of less than \$1.00 to zero (Econet, 2013). At the time, Econet announced that their EcoCash platforms was up to 50% cheaper than the cheapest alternative, and cheaper by a larger margin than bank and non-bank offerings such as ATMs, and credit and debit cards, Western Money Union and Moneygram for local transfers (Econet, 2013). According to the Econet webpage (Econet, 2013):

“Econet even compared its service with those of Western Money Union and Moneygram, which are by far the most expensive. For example, sending \$150 locally would cost \$5 with Western Union against only \$2.45 with EcoCash. For most other options available the charges include a minimum fee plus a percentage of the amount to be sent which makes it expensive for the lower band transactions and complex for the customers. For example, if one is to send \$5 using EcoCash they are charged only 9 cents while TextaCash charges 25 cents and other banks charge as high as a dollar. For sending \$500, EcoCash charges \$4.49 while TextaCash charges \$5.20 and some banks will charge as high as \$6”.

Data were not available to verify the assertion, however it is expected that mobile money platforms have over time presented a significantly cheaper, and more accessible money transfer mechanism to the benefit of consumers in Zimbabwe (see for example, FinScope, 2015). Importantly, for the assessment of competitive dynamics in this market, we do not expect that EcoCash could decrease tariffs significantly over time if it was not profitable for them to do. This suggests that margins on mobile money tariffs are sufficient to sustain a decrease in price and tariffs are likely to have been above a competitive level before a reduction. However, absent detailed price and cost data, it is difficult to draw strong conclusions noting the high likelihood of cross-subsidization across services by MNOs, required returns on investments made, and common costs.

c. Tanzania

The analysis of prices across the markets in sections to follow shows that prices for transactions across various transaction values in Tanzania are well below those in both Kenya and Zimbabwe (Figure 12). The growth of mobile money is also reflected in the Bank of Tanzania statistics on various payment systems, whereby in 2010 and 2011 the volume of transactions made using mobile payments began to exceed those made using internet banking and mobile (SMS) banking, and other forms of payment mechanisms significantly.³ While this is not reflective of the value of transactions made, for which mobile payment values tend to be lower than traditional banking mechanisms, it does suggest that mobile payments are filling a clear gap in consumer demand and thus enhancing consumer welfare whether due to price or non-price factors.

Based on the available data on mobile payments tariffs, the charge to a consumer for transferring the equivalent of \$10 to a registered user on M-Pesa would be \$0.15 (based on

³ Bank of Tanzania website.

M-Pesa tariffs in 2015), and \$0.17 for transferring \$20 which is nearer to the average transaction value of \$20 (CGAP, 2014). The latter is lower than the fee charged in Kenya for the same transaction (CGAP, 2014). Tariffs charged for higher value transactions of TSh 50 000 (about \$25) in Tanzania, on Airtel and Vodacom, were up to five times lower than those available for an EFT across Tanzanian banks (USAID, 2013). Similarly, 51% of households (in a sample of 828 households surveyed) used mobile money for delivery of remittances (any provider) at an inclusive cost (median) of TZS1500 (about \$0.96 at the time of the study) to send a median amount of TZS38 375 (InterMedia, 2013). For a direct deposit with a bank (only used by 2% of households in the survey), the median amount sent or received was TZS240 000 (about \$153 at the time of the study) at a cost of TZS3625 (around \$2.31). Other things equal, the median cost for mobile money transactions in the study, were lower than those for a range of other transaction mechanisms including bank deposits.

Non-price benefits to consumers are far-reaching as well. For instance, households with at least one mobile money user are more likely to make use of adjacent financial services such as savings and insurance products, and overall are four times more likely to send or receive remittances in a period of six months (InterMedia, 2013). Consumers also benefit from access to a wide agent network (larger than in Kenya) of 166 000 agents of which 52% serve multiple operators (CGAP, 2014).

4. Competition issues in network industries: the case of mobile payments

Mobile money markets exhibit both direct and indirect network effects. A mobile money product becomes more attractive to customers as more people join the network and it also becomes more attractive to agents as more customers join and vice versa. Network effects tend to increase barriers to entry as larger networks are more attractive to consumers and small entrants can struggle to attract customers. They may also cause markets to tend towards “tipping points” where one technology becomes the dominant standard (Anderson, 2012). Such outcomes can still be efficient where ex-ante competition “for the market” ensures that ex-post rents are passed through to pivotal buyers (although there may be distributional concerns as locked-in buyers are forced to pay more) (Farrell and Klemperer, 2006). However, such models tend to be overly-simplistic and in reality there are a number of ways in which incompatibility harms consumers and reduces efficiency (Farrell and Klemperer, 2006).

A market is likely to be served by a single platform when multi-homing costs are high for users, where network effects are positive and strong and where users do not have a strong preference for special features (Anderson, 2012). Mobile banking in developing markets has the potential to tip towards a dominant platform, especially in situations where a proprietary platform is launched by an established MNO that already has a dominant market position (Anderson, 2012). This may be of concern since network effects also tend to increase the opportunity and incentive for strategic behaviour by incumbent firms as entry is already difficult and the benefits to achieving dominance are particularly large (Farrell and Klemperer, 2006).

The emergence of a dominant player in the mobile payments market can result in a lack of competition (CGAP, 2012), and dominance in the mobile payments market and the market for traditional MNO services can be mutually reinforcing due to the network effects in both markets. Indeed it is possible that an MNO which is dominant in both markets may seek to leverage its market power in the mobile services market into the mobile payments market as a means of protecting rents in the mobile services market. Mobile payments have proved

extremely popular in all three of the countries we have studied. The MNOs themselves acknowledge the value of mobile money as a means of inducing customer loyalty in the mobile services market.⁴ This indicates that part of the value of the mobile money platform is derived from its ability to help the incumbent retain subscribers in the mobile services market and to reduce subscriber switching. Furthermore, to the extent that the incumbent expects a dominant standard to emerge in the mobile payments market, it may have a further incentive to ensure that its platform becomes that standard, in order to protect its position in the mobile services market. To the extent that the conduct raises barriers to entry and expansion in both markets which are reinforced by the pre-existing network effects, this conduct could result in harm to competition and hence to consumers.

Bearing this out to some extent, recently a range of competition concerns have emerged in mobile payments markets, mostly relating to the behaviour of large incumbent MNOs. Three of the major issues which have been raised are discussed below.

a. Interoperability

A key question in network markets is whether compatibility or interoperability between platforms is desirable and whether this is likely to develop naturally through agreements between firms in the industry or whether a regulatory intervention will be required. Katz and Shapiro (1986) consider the impact of compatibility on competition. They find that compatibility relaxes competition early in the product life-cycle since the likelihood of the market tipping towards one product is reduced, meaning that firms have less to gain from competing hard. However, it also tends to intensify competition later in the life-cycle, as one firm is not able to gain control of the market.

A firm benefits from interoperability (or compatibility in the terminology used by the author), if the marginal externality (i.e. the marginal network effect) is strong, if the firm is to join a large network and if competition is not increased to a significant degree as a result (Economides, 1996). The inherent network effects in the market mean that as a given network grows (for example through interoperability), it becomes more attractive to members, meaning that their willingness to pay increases and the market price can increase (Economides, 1996). However, interoperability may also increase the level of competition faced by a firm, as it weakens the loyalty effect of having a proprietary network and takes away its competitive advantage in terms of network size. Where the network externality is strong enough, the network effect can outweigh the competition effect (Economides, 1996).

Given this trade off, it is clear that the incentive to allow interoperability with competing platforms will not be uniform across firms. In terms of the three criteria given above, a large firm with more customers will have less to gain and more to lose from pursuing interoperability. The bigger the size disparity between firms, the less likely the large firm is to have an incentive to agree to interoperability. This is confirmed by Farrell and Klemperer (2006) who describe the process of “leveling” where interoperability neutralizes the competition advantage of the firm with more customers. Thus *“a firm with a big locked-in installed base, or a firm that is exogenously expected to be big, is apt to resist compatibility with a smaller but fierce rival.”* (Farrell and Klemperer, 2006: 86).

⁴ Econet’s 2014 Annual Report for example describes Ecocash as “a key value driver, subscriber retention and loyalty product”.

Katz and Shapiro (1994) agree, stating that since markets with network effects are prone to tipping, there are likely to be strong winners and losers from incompatibility, and if a firm is confident that it will be the “winner”, for example because it is already dominant in the market, then it will tend to oppose compatibility. In addition, if there is a subset of consumers who have a preference for one firm’s products and who are unlikely to switch, this represents a major advantage to the firm, even when selling to consumers with no brand preference (Katz and Shapiro, 1994). In such circumstances, the firm with the existing base of customers may prefer incompatibility.

Motta (2004) presents a model based on Cremer et al (2000) which analyses the incentives for interoperability of two firms with asymmetric networks. In addition to the insight that an incumbent with a larger installed base may have the incentive to resist interoperability, the model illustrates that where its installed base is small relative to the number of potential new customers in the market, it is more likely to gain from interoperability. Thus it is also important to consider the size of the incumbent’s network relative to the total potential market. With a simple adjustment to this model we can vary the assumption of asymmetric networks and assume instead that firms have networks of the same size. Under this assumption, the model shows that both firms would always prefer to have interoperability (see Appendix 1 for further discussion of this model). This suggests that in contrast to the situation of asymmetric networks, where firms have similar-sized networks, interoperability is more likely to be implemented voluntarily firms.

In terms of mobile money, interconnection increases the number of potential transaction partners for customers, which should make using mobile money more attractive and lead to a higher number of transactions taking place. However, we know from the theoretical discussion above that there is another effect to take into consideration – the impact of compatibility on competition. The discussion above suggests that where there is one large firm which already has a dominant position in the market and therefore a high probability of “winning” the market for itself, it may well not have an incentive to interoperate despite the positive network effects. On the other hand, if there are two or more networks of similar size, then mobile payments providers may be more likely to voluntarily enter into interoperability agreements.

CGAP (2011) suggests three categories of possible interoperability: platform, agent and customer interoperability. Platform interoperability suggests that customers can send money from their mobile money account on one network to a mobile money account on a different network. Agent interoperability implies the ability for agents to serve more than one network. Finally, customer interoperability means that customers are able to access their mobile money account through any SIM.

The most common in our three focus countries is agent interoperability, although as discussed below, concerns have been raised in some jurisdictions around agent exclusivity and the impact of this on competition. Customer interoperability is currently not available anywhere, however, platform interoperability has been implemented to a limited extent in both Tanzania and Zimbabwe. In Zimbabwe the smaller mobile payments providers have agreed to link their platforms together, and using the national payment switching platform ZimSwitch, without the participation of the largest player. In Tanzania the four main mobile money providers have developed and agreed to common operating standards to enable them to facilitate cross-platform transactions, although there is currently no regulatory mandate to force the firms to implement the standards and it is a purely voluntary agreement (CGAP, 2015).

An even more limited form of interoperability where money can be sent by SMS to an unregistered recipient is available in all three countries, but recipients are forced to cash out the received funds, incurring transaction costs. A means of further limiting the attractiveness of this option is to charge higher fees for transactions to unregistered recipients. This practice has been raised as competition concern by some competitors. For example, Airtel, one of Safaricom's competitors, has complained to the Competition Authority of Kenya (CAK) about the differential tariffs which Safaricom charges for money transfers to other networks. Similarly, in Zimbabwe, the incumbent provider Econet charges significantly higher rates for transfers to unregistered recipients. Such differential tariffs tend to exacerbate the network effects inherent in the market, as they make it more expensive to send money to any other network. We discuss this issue further in Section 5.

b. Agent exclusivity

Competition concerns have also been raised regarding the requirement by some operators that the agents which provide the cash-in/cash-out facility to their customers only serve one mobile payments provider. For example, competing operators complained to the CAK about the fact that Safaricom required its agents to operate exclusively for M-Pesa and did not allow them to also deal with other networks (Heuler, 2013).

This strategy could be anti-competitive if pursued by a dominant incumbent with the aim of preventing smaller rivals from growing in the market. Exclusive dealing can be anti-competitive if it forecloses competitors from a substantial portion of the market and where there are scale economies, particularly if the exclusive agreements are of long duration or indefinite (Motta, 2004). In two-sided markets with network effects it is possible for a dominant incumbent to sign up one side of the market exclusively and extract the full network benefits from the other side resulting in the anti-competitive foreclosure of entrants (Dogonoglu and Wright, 2010). It is easy to see how this strategy could be used by a dominant incumbent in a mobile payments market – through tying up many agents in exclusive arrangements, it can ensure that customers have little choice but to use its platform. Furthermore, the direct and indirect network effects present in the market mean that it may not even be necessary to compensate agents for agreeing to exclusivity, since, by virtue of its much larger installed base, the incumbent's product is already much more attractive than that of the entrant. If the agent is forced to choose between selling the incumbent's product and that of another provider, it is likely to choose the incumbent's product as it will make many more sales. Finally, the more agents sign up to sell the incumbent's product, the more customers are disincentivised to switch networks. Thus unless agents can coordinate their decisions (which is unlikely as they are many and dispersed), they are likely to all individually choose to sell the incumbent's product.⁵

In Kenya, competitors argued that Safaricom's policy made it difficult for them to compete with Safaricom which, due to its first-mover advantage, had a far greater number of agents in Kenya than any of its rival operators and arguably had already tied up the most attractive agents in exclusive arrangements. On the other hand, Safaricom argued that it had invested heavily in setting up the agent network, in terms of finding and training the agents who had not previously had any experience of the concept of mobile payments, and was entitled to

⁵ This logic is similar to the theory of "naked exclusion" discussed by Rasmusen et al (1991) and Segal and Whinston (2000)

protect this investment through exclusivity. From an economic perspective, there is some merit in Safaricom's claim that opening up the network would enable newer entrants to free-ride on its investment in the agent network. However, there is a balance to be struck between allowing the incumbent to achieve a return on its investment and allowing it to enjoy supernormal profits indefinitely. Eventually, after the matter was investigated by the CAK, Safaricom decided in mid-2014 to open up its agent network to competing providers.

Research by the Helix Institute of Digital Finance (2013) indicates that this may be a positive development for mobile money agents in Kenya as well as for consumers. The study involved a survey of agents in Tanzania, Kenya and Uganda, and revealed that agent profitability and support was higher in Tanzania than in the other two countries due to greater competition and much lower levels of agent exclusivity.

c. USSD as an essential facility/margin squeeze

The final concern which has been raised in relation to mobile payments is the ability of non-MNO competitors to access their USSD facilities on fair terms. Access to USSD services, which are operated by MNOs, is critical to the provision of mobile payments services. In MNO-led models, MNOs own the key infrastructure involved in providing these services, but they also compete with other providers of mobile payments such as banks. Importantly, while individual MNOs may have their own infrastructure, banks and other providers leverage the infrastructure of the same MNOs to compete with them. This increases the likelihood that access to infrastructure which is not on fair and reasonable terms can place a constraint on the ability of rival providers, particularly non-MNO operators, to compete effectively. This may have to do with the wholesale price at which access to the USSD services or platform is granted, particularly where the price charged is high relative to the costs of providing the service and relative to the price which the MNO that owns the infrastructure applies in the determination of its own price (Hanouch and Chen, 2015). In some cases, it may be that the costs of providing services to other users is higher due in part to technical considerations and the costs of acquiring and maintaining additional infrastructure such as servers. However, dominant MNOs may also have the incentive to exclude competitors by decreasing the quality of access to infrastructure and USSD services or charging a very high price.

These aspects formed part of a complaint raised with the competition authority by banks in Zimbabwe. Econet had initially refused to allow banks access to its Ecocash platform making it impossible for bank customers using Econet to pull money from their bank account to send via Ecocash. Econet subsequently granted access to banks however applied conditions of access which were considered unfavourable by the banks. In 2014, the Bankers' Association of Zimbabwe (BAZ) complained on behalf of its members about the conditions of access granted by Econet which included a \$0.30 charge per session for person-to-person transactions whereas the charges for access for other mobile banking transactions was \$0.05 or zero in some cases. They also argued that in order to make a payment, customers were required to access a secondary USSD code separate from that used for other mobile banking transactions, which inconvenienced bank customers and implied an additional charge. Finally, the session times available to bank customers would be limited to 20 seconds whereas those which Econet set for their own clients were wider at 40 seconds. The higher charge in this case could effectively be classified as a margin squeeze or constructive refusal to supply. As in the case of Safaricom, the operator argued that the additional charge was justified by the costs of servicing additional bank clients.

In 2014, the Kenyan competition authority announced a market inquiry into the provision of USSD services covering prices, other conditions of access and consumer protection concerns. The inquiry has as its objectives “to assess whether the provision and pricing of USSD services leads to constrained competition in the financial services market” (FSD Kenya, 2014). While the findings of the enquiry are as yet unavailable, it is clear that the concerns identified in Zimbabwe regarding the price and conditions of access are common in markets where rivals of MNOs rely on the key infrastructure owned and operated by those MNOs who can face incentives to raise rivals’ costs. However, as noted above, it is important to consider the costs and investments involved in providing access to these users and the investment justifications of MNOs in charging rates which reflect these.

5. Outcomes for consumers: interoperability and transaction fees in Kenya, Zimbabwe and Tanzania

In order to understand the importance of market structure and competition dynamics on outcomes for consumers, we have conducted an analysis of the likely incentives for interoperability and outcomes in terms of transaction fees in the three countries. We consider each country in turn and then draw together some overall conclusions.

a. Kenya

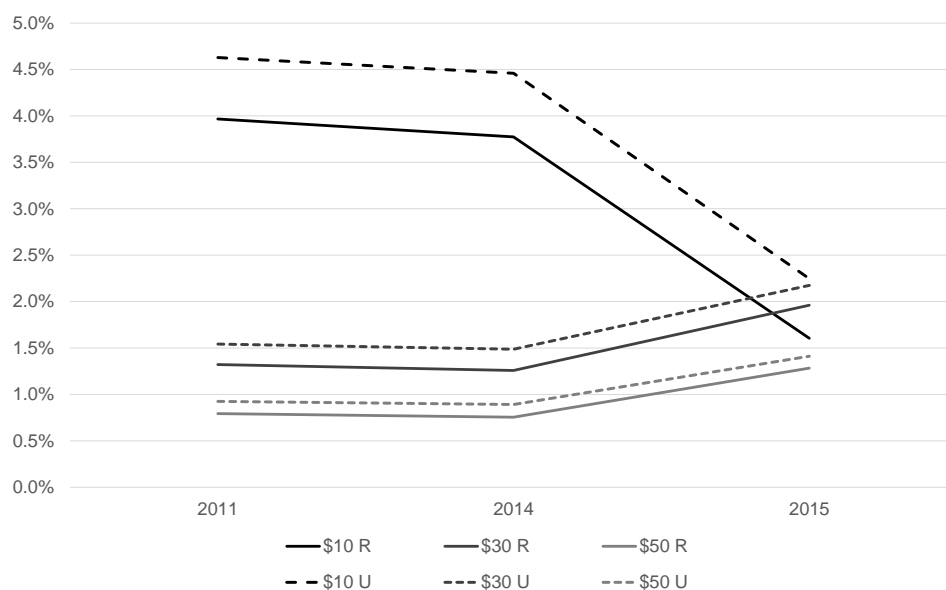
Following from the theoretical review above, we would expect that Safaricom, as by far the biggest player in both markets, may have little to gain and a lot to lose by allowing smaller competitors to interoperate with M-Pesa. It already has 20.2 million out of 25.6 million mobile money subscribers (KCA, 2014) and as such the marginal network externality of growing its subscriber base further is likely to be much lower than that of Airtel and the other competitors.

On the other hand, the M-Pesa network is more than six times the size of its nearest rival and therefore is likely to be significantly more attractive to customers. Safaricom is likely to already expect to be the “winner” in this market, reducing its incentive to allow platform or customer interoperability with rivals. Rather than opening up its network to competitors, it may have an incentive to maintain its dominance, particularly given the knock-on benefits in terms of inducing customer loyalty in its core market for MNO services. Based on the number of mobile phone subscribers in Kenya, there are only 8 million potential new customers in the market, compared to M-Pesa’s installed base of 20.2 million, which further suggests that interoperability is unlikely to be in its interest based on the model discussed above.

Figure 7 analyses M-Pesa’s pricing in 2011, 2014 and 2015 at three different transaction levels.⁶ It illustrates that prices for the lowest (and most common) transaction values were much higher as a proportion of transaction value than they were for higher value transactions until 2015 when the cost of sending \$10 was substantially reduced. In 2011 prices varied between 0.5% and 4.5% for the three transaction values, but by 2015, the range had narrowed to between 1% and 2.5% of transaction value. The change in pricing structure in late 2014 may have been in response to an increase in competitive activity in the sector, with the launch of new MVNOs (such as Tangaza) with mobile money offerings and an announced partnership between Airtel and Equity Bank (Nleya and Robb, 2014).

⁶ In early 2015, the average mobile payment transaction size in Kenya was around KSh 2580 or \$28 (Reserve Bank of Kenya, 2015) but the median transaction value is likely to be substantially lower.

Figure 7: M-Pesa charge to registered and unregistered recipients as a % of transaction value for \$10, \$30 and \$50 transactions



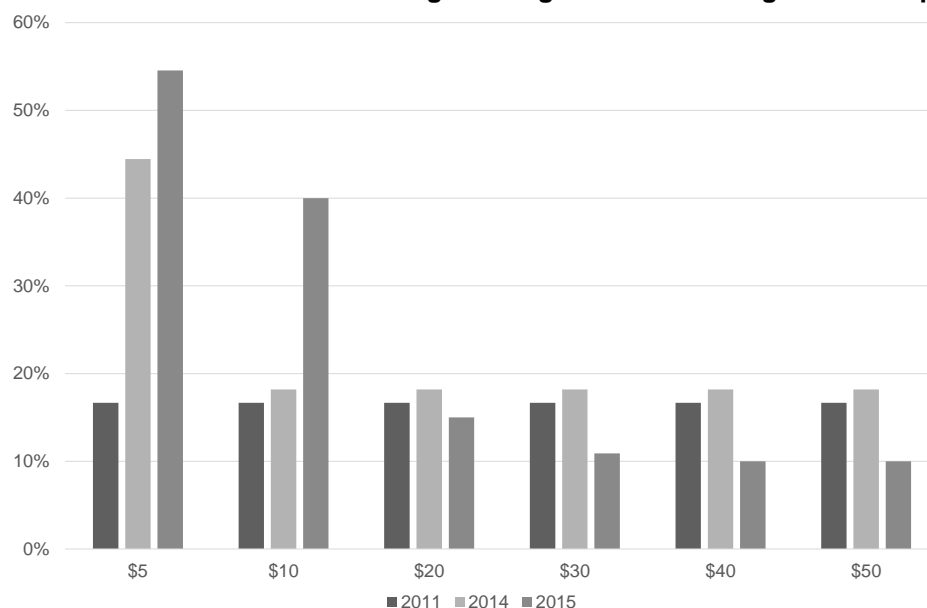
Source: Authors' own calculations based on USAID (2011), Safaricom website

Note: all transaction values have been deflated such that the charges are comparable across years.

Another interesting point which emerges from the pricing analysis is that M-Pesa charges significantly more to send money to unregistered than to registered users. Figure 8 illustrates that in 2014, M-Pesa charged between 10% and 55% more to send money to an unregistered user. Thus, although it is technically feasible to send money to a recipient on a different mobile network, M-Pesa's pricing makes it unattractive to do so. This was the subject of a complaint by Airtel to the CAK as discussed above.

Another interesting development is that with the recent reduction in prices at low transaction values, the price differential between transactions to registered and unregistered recipients has grown substantially. This makes sense in terms of the theory discussed above. As Safaricom has reduced its prices in response to competition from new entrants, it has simultaneously increased the charge to send money to unregistered recipients which tends to reinforce its network effects advantage and discourage the use of new, smaller networks.

Figure 8: Difference between M-Pesa charges to registered and unregistered recipients in %



Source: Authors' own calculations based on USAID (2011), Safaricom website

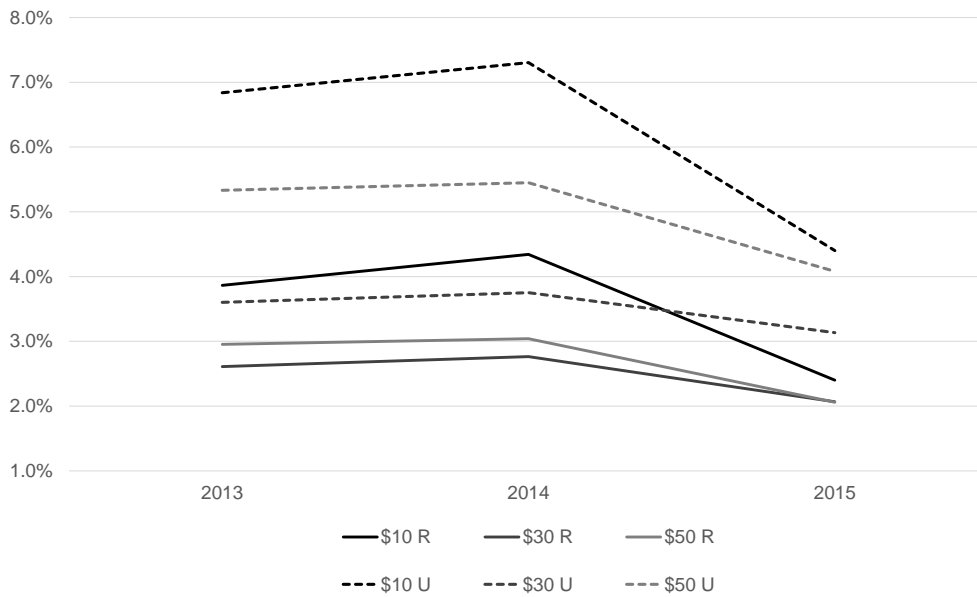
Note: all transaction values have been deflated such that the charges are comparable across years.

b. Zimbabwe

In this case even more than in the Kenyan market, one would expect Econet to have little incentive to agree to interoperability. On the other hand, there are a large number of potential new customers in Zimbabwe as in 2014 there were 13.9 mobile subscribers and only 3.7 mobile money subscribers: a difference of 10.2 million. According to the theory discussed above, this should make it more likely that Ecocash will benefit from interoperability. However, in practice although NetOne and Telecel have integrated their mobile payments platforms through the national payments switch, ZimSwitch, Econet will not agree to link its Ecocash platform into the system, preferring to maintain a proprietary system. One possible reason for this is that only 6.7 million people in Zimbabwe know about mobile money, and of these only 45% are registered (Finscope, 2014). The majority of those who know of it but do not use it state that this is because they either do not have money to send or do not have a cellphone. Thus, in reality, the potential market is likely to be significantly less than 6.7 million people.

Turning to an analysis of Ecocash's prices, Figure 9 illustrates that prices stayed largely the same from 2013 to 2015 (the appearance of a price fall in 2015 is a result of changing transaction bands due to deflating the transaction amounts being tracked). Again the lowest transaction value is the most expensive as a proportion of transaction value. Prices as a proportion of transaction value are high at between 2% and 8% of transaction value.

Figure 9: Ecocash charge to registered and unregistered recipients as a % of transaction value for \$10, \$30 and \$50 transactions⁷

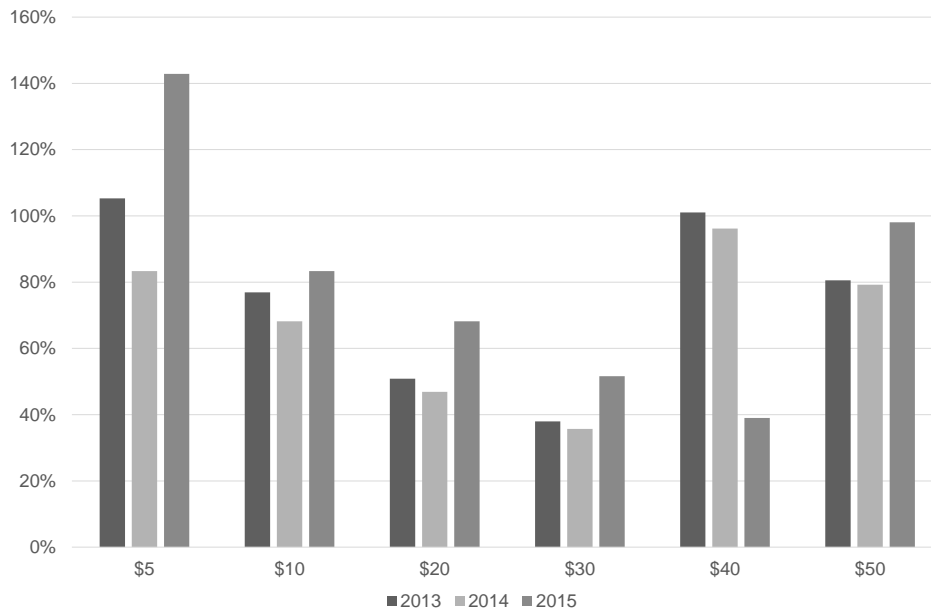


Source: Authors' own calculations based on Econet website

Note: all transaction values have been deflated such that the charges are comparable across years.

Figure 10 illustrates that there is an even bigger difference between charges to registered and unregistered recipients than that charged by M-Pesa in Kenya at between 40% and 140%. Again, the greatest difference is at the most common low transaction values.

Figure 10: Difference between charge to registered and unregistered recipients in %



Source: Authors' own calculations based on Econet website

Note: all transaction values have been deflated such that the charges are comparable across years.

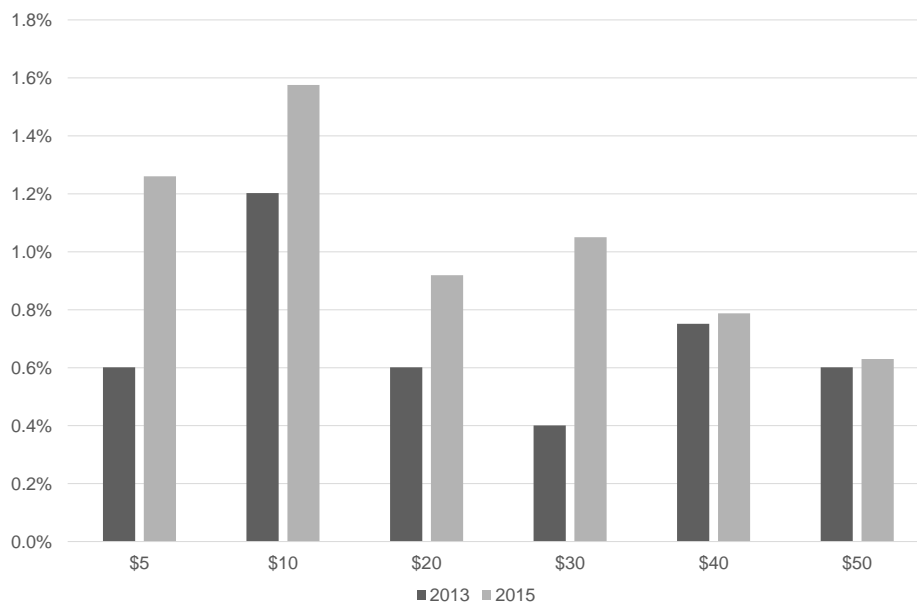
⁷ In 2014, the average mobile payment transaction size in Zimbabwe was \$18 (Reserve Bank of Zimbabwe, 2014) but the median transaction size is likely to be much lower.

c. Tanzania

The greater symmetry between players appears to have had a positive impact on competition in Tanzania, with Vodacom, Tigo, Airtel and Zantel all signing up in late 2014 to a set of voluntary standards which will govern how cross-platform payments will work (CGAP, 2015). Tigo, Airtel and Zantel had previously announced an agreement to allow interoperability in their mobile money platforms in mid-2014, which would have created a network of similar size to Vodacom’s M-Pesa. This may have made it more attractive to Vodacom to join the initiative than to keep its platform separate. Initial indications from Tigo suggest that they believe that opening up to interoperability has been a good decision (CGAP, 2015).

An analysis of Vodacom’s pricing suggests that its prices are lower as a proportion of transaction value than Safaricom’s or Econet’s which may be indicative of greater competition. Figure 11 illustrates that prices range between 0.4% and 1.6% of transaction value and increased at most levels between 2013 and 2015 such that prices as a proportion of transaction value are highest at the low end. What is striking about an analysis of Vodacom’s prices in Tanzania, however, is that there is no difference in the prices charged to registered and unregistered recipients. This may also reflect greater competition in both the mobile money market and the broader MNO market and therefore the much greater likelihood that a given recipient will be a customer of another network.

Figure 11: Vodacom charge as a % of transaction value for \$5, \$10, \$20, \$30, \$40 and \$50 transactions⁸



Source: USAID (2013), Vodacom website

Note: all transaction values have been deflated such that the charges are comparable across years.

A study carried out by Helix (2013) suggests that in urban areas, the mobile money market may be even more competitive than the market shares suggest. The study found that only about half of agents in Tanzania are exclusive and the figure is less than 20% in Dar es Salaam where market shares in terms of agents are relatively more equal between the three main players (41%, 17%, 37%). They found that agent exclusivity was much more common outside Dar es Salaam and in rural areas where Vodacom has a higher market share in terms of

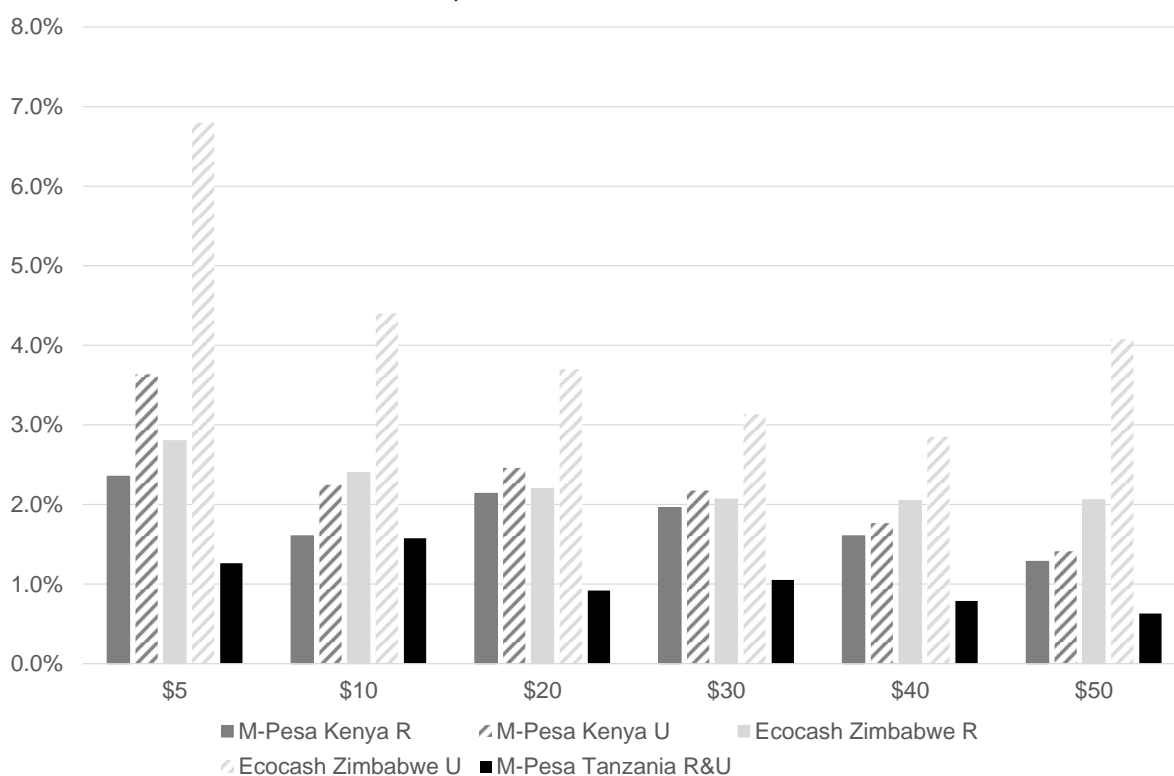
⁸ The average mobile payment transaction size in Tanzania in 2014 was \$29 (CGAP, 2014) but the median transaction is likely to be lower. The median transaction size (sent or received) found in a survey of households in Tanzania was approximately \$24.50 (InterMedia, 2013).

agents (Helix, 2013). This may explain the more competitive outcomes that are observed in terms of pricing and interoperability in Tanzania.

Comparison of the three countries

A comparison of Kenya, Zimbabwe and Tanzania has suggested a number of interesting differences in the structure and dynamics of their mobile payments markets which tend to reflect the economic theory of network industries and which suggest certain policy implications. The pricing analysis of the largest mobile money provider in each country shows that the most expensive is Zimbabwe’s Ecocash and the cheapest is Tanzania’s M-Pesa, with Kenya’s M-Pesa falling in the middle. This reflects precisely the degree of competition in the three countries, with Tanzania’s mobile money and MNO markets being the least concentrated and Zimbabwe’s being the most. Similarly, Ecocash charges significantly more to transfer money to unregistered recipients compared to registered recipients, with Kenya’s M-Pesa charging slightly more. Tanzania’s M-Pesa on the other hand charges the same transfer fee to registered and unregistered recipients.

Figure 12: Cross country comparison of charges as a % of transaction value for \$5, \$10, \$20, \$30, \$40 and \$50 transactions⁹



Source: see Figures 3, 7 and 11

In general, the predictions of economic theory relating to network effects and compatibility appear to be borne out in the three examples we have studied. Interoperability seems to be more likely to be in the interest of firms where markets are more symmetrical and there is not one super-dominant player with a great deal to lose from opening up the market. Interestingly, even though there is a substantial number of potential new customers in Zimbabwe, the fact that Ecocash is a near monopoly seems to have reduced its incentive to agree to

⁹ The average mobile payment transaction sizes in Kenya (2015), Zimbabwe (2014) and Tanzania (2014) respectively in 2014 were \$28, \$18 and \$29 (CGAP, 2014) but the median transaction is likely to be much lower.

interoperability. It may be that its expectation of “winning” the market is strong enough to make it certain of winning most, if not all, new customers.

Of concern to policymakers in Zimbabwe and Kenya is the fact that the incumbent in both markets is in a very strong position which far from being eroded by competition, appears to have strengthened over the past three or four years. Both theory and practice seem to suggest that in these markets interoperability is unlikely to develop naturally, and some form of intervention may be required in order to ensure that there is a level playing field for competition. This is particularly important given the fact that incumbents in markets with network effects are more likely to have the ability and incentive to engage in anti-competitive conduct in order to protect their profitable position in the market. They are also more likely to engage in market strategies that leverage the strong position in adjacent and growing markets, to strengthen their position in the primary markets such as those for traditional MNO services. Recent competition cases in Zimbabwe and Kenya bear this out. In Tanzania on the other hand, full interoperability between the different platforms is already on the way to developing naturally by agreement between the different players. Regulators would still be well-advised to monitor the development of the market, but there is likely to be less need for active intervention.

6. Concluding remarks

This paper has attempted to highlight both the benefits and some of the potential problems with developing mobile payments markets. Available information on the relative tariffs of traditional banking services versus mobile money suggest that mobile payments are a significantly cheaper method of sending and receiving money. However, it is also clear that non-price factors in favour of mobile payments as a mode of transacting such as convenience, accessibility, safety and reliability are just as important if not more so. Rivalry between operators in this regard can take place through tariffs charged, but also the size and footprint of the operator’s agent network and the quality of service offered. In each of these areas, various competition complaints have been raised in the three countries including on agent exclusivity and prices and access charges.

Experience in Kenya, Zimbabwe and Tanzania has illustrated the challenge of encouraging competitive rivalry in network markets where one firm has a dominant (or even super-dominant) position and therefore has little incentive to open up its network to smaller competitors. The emerging experience of countries with such a market structure suggests that there may also be an incentive for firms to use their dominant position in the market to pursue strategies to exclude and marginalise competitors. This is particularly problematic in mobile payments markets, where network effects and a dominant position in the market for traditional MNO services can easily be translated into a virtually unassailable position in the market for mobile payments. This in turn can be used to protect the incumbent’s position in the market for mobile services. The pricing analysis shows that where there is a dominant incumbent, tariffs for mobile payments tend to be higher and reflect a wider gap between those for registered and unregistered customers, which has the effect of strengthening the incentives of existing customers to remain on the network (including for traditional MNO services), and attracting new ones. While this pattern is beneficial for customers, the likely long-term consequences can be that the market tips towards the dominant player denying rivals scale and reducing the incentives of the incumbent to innovate further and maintain competitive prices relative to rivals.

Whilst investments made by the dominant incumbent in its network must be acknowledged, and it must be allowed to make a reasonable return on such investments, there is a risk that if left to themselves, such markets will tip towards sub-optimal equilibria. In the long term, the ability of new players to come into the mobile payments space and compete effectively for

customers is important to ensure continued innovation, quality and low prices and therefore to preserve and extend the dynamic benefits to customers that have been discussed above. This will also have knock-on benefits in terms of reducing barriers to entry in terms of consumer switching in the market for mobile services. The results of the market structure and pricing analysis conducted in this paper suggest that in markets dominated by one large player, regulators may need to consider interventions to prevent the exclusion of competitors and to ensure the development of interoperability at all three levels: agent, platform and customer. This will be important in terms of levelling the playing field for competition.

The issue of competitive dynamics in mobile payments markets and their implications for consumer outcomes is a relatively unstudied area, probably due to the novelty of these markets and the scarcity of data pertaining to them. However, it is a highly topical area of interest for a number of countries, including the three we have discussed in this paper who are currently grappling with the appropriate regulatory approach to mobile payments markets in order to promote competition without dampening incentives for investment and innovation. This paper has attempted to contribute to filling this gap by drawing together economic theory and available data on three countries, however, it has been limited by data availability. Further work in this area could seek to analyse more countries and consider in greater depth the developing dynamic rivalry between mobile payments and traditional modes of sending and receiving money, including the growing participation of banks as providers of overlapping services, and particularly where detailed price data for the banking sector is available.

7. References

- Anderson, J. (2011). 'Competitive and regulatory implications of mobile banking in developing markets'. *Technology Banker*, 25 August 2011.
- CGAP (2011). 'Interoperability and related issues in branchless banking: a framework'. Available online: http://www.cgap.org/sites/default/files/Interoperability_in_Electronic_Payments.pdf
- CGAP (2012). 'Interoperability in electronic payments: lessons and opportunities'. Available online: <http://www.slideshare.net/CGAP/interoperability-and-related-issues-in-branchless-banking-a-framework-december-2011>
- CGAP (2014). 'Infographic: Tanzania's Mobile Money Revolution'. Available online: <http://www.cgap.org/data/infographic-tanzanias-mobile-money-revolution>
- CGAP (2015). 'How Tanzania established mobile money interoperability.' Available online: <http://www.cgap.org/blog/how-tanzania-established-mobile-money-interoperability>
- Hanouch, M. and Chen, G. 'Promoting competition in mobile payments: The role of USSD'. CGAP Brief (February 2015).
- Communications Authority of Kenya (2011 – 2014). 'Quarterly Sector Statistics Report, Oct – Dec'.
- Cremer, J. Rey, P, and Tirole, J. (2000). 'Connectivity in the commercial internet'. *Journal of Industrial Economics*, Vol. 48: 433 – 72.
- Dermish, A., Hundermark, B. and Sanford, C. (2012). 'Mapping the retail payment services landscape – Zimbabwe'. FinMark Trust.
- Doganoglu, T. and Wright, J. (2010). 'Exclusive dealing with network effects'. *International Journal of Industrial Organization*, Vol. 28 (2): 145 – 154.
- Econet Wireless Zimbabwe. 'EcoCash tariffs slashed' (11 March 2013). Available: <https://www.econet.co.zw/media-centre/general-news/ecocash-tariffs-slashed>
- Economides (1996). 'The economics of networks'. *International Journal of Industrial Organization*, Vol. 14 (1996), 673 – 699.
- Equity Bank. Equity MVNO Strategy & Roll-out Plan. Presentation for Investors Briefing on 26 May 2014. Available: <http://equitybankgroup.com/index.php/blog/2014/05/equity-bank-unveils-mvno-strategy-and-rollout-plan>
- Farell, J. and Klemperer, P. (2006). 'Coordination and lock-in: competition with switching costs and network effects'. Competition Policy Centre, UC Berkeley.
- FinScope (2015). FinScope Consumer Survey Zimbabwe 2014.
- Financial Sector Deepening (FSD). Competition enquiry into USSD service provision in Kenya.

Hanouch, M. and Chen, G. 'Promoting competition in mobile payments: The role of USSD'. CGAP Brief (February 2015).

Helix Institute of Digital Finance (2013). 'Agent Network Accelerator Survey: Tanzania Country Report 2013'. Available online: http://helix-institute.com/sites/default/files/Publications/Agent%20Network%20Accelerator_Tanzania%20Country%20Report%202013_0.pdf

Heuler, H. (2013). *How Kenya's mobile money is opening up now middlemen have been set free*. August 22 2014, ZD Net. Available online: <http://www.zdnet.com/article/how-kenyas-mobile-money-is-opening-up-now-middlemen-have-been-set-free/>

InterMedia (2013). 'Mobile money in Tanzania: Use, barriers and opportunities'. The Financial Inclusion Tracker Surveys Project.

Katz, M. and Shapiro, C. (1985). 'Network externalities, competition and compatibility'. *The American Economic Review*, Vol. 75. No. 3: 424 – 44.

Katz, M. and Shapiro, C. (1994). 'Systems competition and network effects'. *The Journal of Economic Perspectives*, Vol. 8. No. 2: 93 - 115.

Klein, M. and Mayer, C. *Mobile banking and financial inclusion: the regulatory lessons*. World Bank Policy Research Working Paper No. 5664 (May 2011).

Motta, M. (2004). *Competition Policy: Theory and Practice*. Cambridge University Press (New York).

Nleya, L. and Robb, G. (2014). *Part Two: Mobile money in Kenya and Zimbabwe*. Quarterly Review, Centre for Competition, Regulation and Economic Development. 7 November 2014. Available online: <http://www.competition.org.za/review/2014/11/7/part-two-mobile-money-in-kenya-and-zimbabwe>

Rasmusen, E., Ramseyer, J. and Wiley, J. (1991). 'Naked exclusion'. *American Economic Review*, Vol. 81: 1137 – 1145.

Reserve Bank of Zimbabwe (RBZ). Monetary Policy Statement, 31 January 2013.

Safaricom. 'Safaricom cuts M-Pesa transaction fees for low and medium value cash transfers'. Safaricom Press Release 19 August 2014.

Segal, I. and Whinston, M. (2000). 'Naked exclusion: Comment'. *American Economic Review*. 90: 296 – 309.

Tanzania Communications Regulatory Authority (2012 – 2014). 'Quarterly Telecom Statistics' December.

USAID (2011). 'Better than cash: Kenya Mobile Money Market Assessment'.

USAID (2013). 'Tanzania mobile money assessment and case study: examining cash payment streams and their electronic alternatives among USAID implementing partners'.

Zollmann, J. and Cojocaru, L. (2015). 'Cashlite: Are we there yet? Rethinking the evolution of electronic payments in Kenya based on evidence in the Kenyan and South African financial diaries'. Bankable Frontier Associates report commissioned by Financial Sector Deepening Kenya.

Appendix 1: Modelling the incentives for compatibility in industries with network effects

As noted above, the model presented below is the same as that discussed by Motta (2004: 485 – 490) which is in turn based on that of Cremer, Rey and Tirole (2000). We first present the model as discussed by Motta (2004) and then use the model to illustrate one additional result.

In a market with network effects there are two firms, Firm 1 and Firm 2 who each already have an installed base of customers: β_1 and β_2 . Customers attach an intrinsic value T to the network. Therefore to the consumer, the net benefit from network product i is:

$$S_i = T + s_i - p_i \quad (1)$$

where p_i is network i 's price, and s_i is the benefit to the customer from the network effect, given by:

$$s_i = v[\beta_i + q_i + \theta(\beta_j + q_j)] \quad (2)$$

where q_i and q_j represent the number of new consumers buying from firm i and j , $v < \frac{1}{2}$ is a parameter (common to all consumers) that indicates the importance of the network externalities and $\theta \in [0,1]$ is a parameter that indicates the quality of interoperability between the two networks. If $\theta = 0$, there is no interoperability and if $\theta = 1$, there is full interoperability. Motta (2004) shows that in this situation, firm i 's demand function takes the form:

$$p_i = 1 + v(\beta_i + \theta\beta_j) - (1 - v)q_i - (1 - v\theta)q_j \quad (3)$$

Assuming that each firm chooses output to maximise its profits, Motta (2004) shows that finding the intersection of the firms' best reply functions gives the equilibrium of the game:

$$q_i^* = \frac{1}{2} \left(\frac{2(1-c) + v(1+\theta)(\beta_i + \beta_j)}{2(1-v) + (1-v\theta)} + \frac{(1-\theta)v(\beta_i - \beta_j)}{1(1-v) - (1-v\theta)} \right) \quad (4)$$

Motta then sets $\beta_2=0$ (so that the entrant has zero installed base) and $c = 0$ (to simplify the example) and considers whether Firm 1 and Firm 2 will be better off where $\theta = 1$ or $\theta = 0$. He finds that Firm 1 will prefer full interoperability if:

$$q_1^*(\theta = 1) - q_1^*(\theta = 0) = \frac{v(1-2v-\beta_1(3-4v+2v^2))}{3(1-v)(3-8v+4v^2)} > 0 \quad (5)$$

which is true for $\beta_1 < \frac{1-2v}{3-4v+2v^2}$. Thus when the incumbent has a much larger installed base than the entrant, the incumbent will only find it profitable to agree to interoperability if its installed base is small relative to potential (new) demand. On the other hand, if the installed base is large relative to potential demand, interoperability will make the incumbent worse off. The entrant is always made better off by agreeing to interoperability because:

$$q_2^*(\theta = 1) - q_2^*(\theta = 0) = \frac{v(1-2v+\beta_1(6-11v+4v^2))}{3(1-v)(3-2v)(1-2v)} > 0 \quad (6)$$

In order to look at a further example relevant to our discussion, we set $\beta_1 = \beta_2$ to illustrate the situation when the two firms have the same installed base. Following Motta (2004), we also set $c = 0$. Firm 1 will prefer full interoperability when:

$$q_1^*(\theta = 1) - q_1^*(\theta = 0) = \frac{2v(1+\beta_1(3-v))}{3(1-v)(3-2v)} > 0 \quad (5)$$

Expression (5) shows that in this model, where firms have the same size of installed base, they will always prefer full interoperability.