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Access pricing, data externalities and sub-acquirers in payment markets

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Abstract

This paper analyses how the introduction of sub-acquirers affects the pricing and market structure in the payment market. When the sub-acquirers and acquirers compete in the same downstream market, the acquirer allows socially desirable entry as they can extract total efficiency gains through the access fee paid by sub-acquirers. However, when large data externalities and bargaining power of sub-acquirers are introduced, the acquirer has incentives to deter entry due to imperfect rent extraction. Separately, when the sub-acquirers enter niche markets, the acquirer obtains extra profits, and thus has no incentives to foreclose.

Keywords: Access pricing, Data externalities, Digital payments, Interchange fees, Sub-acquirers, Two-sided markets

JEL Classification: G21, L11, L4, L5

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1 Introduction

In recent decades, payments with credit, debit and prepaid cards, as well as mobile money, have increasingly replaced the use of cash. Moreover, the coronavirus pandemic highlighted the relevance of digital payments; in particular, card payments as an alternative when fearing viral transmission through cash (banknotes and coins) (Alfonso et al., 2020; Auer et al., 2020). Despite these positive facts, low-income and unbanked people still use cash as their only payment instrument (Aurazo and Vega, 2021b; Shy, 2020) and many micro and small merchants do not accept digital payments in developing countries. A few reasons behind the low merchant card acceptance are related to demand-side factors such as tax evasion (Aurazo, 2020; Aurazo and Vasquez, 2020; Aurazo and Vega, 2021a) or supply-side factors such as cost inefficiencies and operational risk management (Müller, 2023).

In this context, new players so-called payment facilitators or payment aggregators, or more generally sub-acquirers, have emerged.[1] They offer a cheaper and easier way for merchants, especially micro and small firms, to accept card payments. Indeed, sub-acquirers could bring an efficient remedy to the higher costs that merchants usually face (due to vertical and horizontal integration and exclusivity arrangements between acquirers and card networks) or the null perception of a real benefit from accepting payment cards.[2] However, unlike acquirers, sub-acquirers do not have a direct connection to the card network, but rather work through the acquirer to provide merchant card acceptance.[3]

The aim of this paper is to analyse how the introduction of sub-acquirers affects pricing and market structure in the payments industry. For this purpose, I analyse two extreme scenarios, one in which the sub-acquirer competes with the acquirer in the same downstream market, and the other in which the sub-acquirer enters niche markets that are not yet covered. In the first scenario, the acquirer allows socially desirable entry because it can extract total efficiency gains through the access fee paid by the sub-acquirers, which is consistent with the Chicago School argument.[4] However, when large data externalities and bargaining power of sub-acquirers are introduced, the acquirer has incentives to foreclose entry due to imperfect rent extraction. In practice, the acquirer might be more likely to deter bigtech entry than fintech entry as the former has larger bargaining power on data externalities. On the other hand, if sub-acquirers enter niche markets that are not yet covered, the acquirer is better off, as it gains additional profits from niche markets.

[1] In the card industry, there is a large discussion about payment aggregators and payment facilitators. For simplicity, this paper treats both terms as sub-acquirers (third-party providers) that have a contractual relationship with acquirers to provide merchant card acceptance instead of a direct connection with the card network.

[2] For instance, in Peru both sub-acquirers Izipay and Vendemas allowed merchants to accept all the card networks at the point of sale when the main acquirers were exclusive with only one card network (Visa or Mastercard); i.e., instead of contracting with Niubiz and PMP separately and incurring double costs, small merchants opted to affiliate with the sub-acquirer to accept both card networks. Another example is MercadoPago which is an e-commerce platform that allows merchants to accept all cards in Latin America and the Caribbean.

[3] For instance, Visa and Mastercard establish specific transactions thresholds for sub-acquirers as well as other requirements.

[4] The Chicago School states that a vertically related monopoly has no incentives to deter entry or behave anti-competitively with efficient entrants.

The model is built upon Rochet and Tirole (2011) but includes a sixth player (sub-acquirer) that can compete with the acquirer in the downstream market, and splits the acquiring market into upstream and downstream activities. On the one side, there is an upstream market in which the acquirer grants connection with the card network and allows transactions from sub-acquirers to be validated and processed; on the other side, there is a downstream market in which acquirers provide card acceptance to merchants and they can compete with sub-acquirers. In the upstream market, the acquirers provide an essential input (bottleneck) to sub-acquirers and charge an access fee whenever sub-acquirers process a transaction in the downstream market.

From a regulatory perspective, the regulator can play an essential role in increasing welfare by setting alternative access charges when the acquirer deters socially desirable entry, i.e., when data externalities and bargaining power of the sub-acquirer are introduced. That said, it is interesting to analyze the impacts of some alternative access regimes applied in other network industries such as the first-best rule (access fee equals to costs) and the efficient cost pricing rule (ECPR).[5] In particular, a first-best rule (margin cost rule) or the ECPR leads to a welfare-increasing situation in which the sub-acquirer serves the whole downstream market.

On the other side, when entry to niche markets occurs, i.e., markets that are not covered yet, the acquirers are less likely to deter entry as they obtain an extra profit from granting access, so welfare is increased as end users make transactions with cards instead of cash which is a less efficient means of payment. Therefore, in this context, the role that a regulator can play is less focused on access pricing (eg on quality and safety standards). However, although this scenario has been the most applicable in developing countries in recent years, sub-acquirers, especially bigtechs, are willing to enter markets traditionally served by acquirers, and vice versa, and thus the access charge is becoming a relevant variable in the market for payment cards.

In sum, the introduction of sub-acquirers, data externalities and bargaining power could lead to under-provision of digital payments, particularly in activities where cash is still the king and for micro and small-sized businesses. That said, in markets that are already covered by the acquirers, they might have incentives to set an access fee such that they prevent efficient entry from new entrants such as sub-acquirers, in particular when acquirers cannot extract fully large data externalities from sub-acquirers. The payment markets with sub-acquirers are thus a novel case of opening of competition in network industries. Therefore, it raises the questions whether payment markets should be regulated since the owners of an essential input have little incentives to let others compete (Tirole, 2022). Although this paper describes the card industry, this new market structure could be easily extended to other payment instruments.

The paper is structured as follows. Section 2 discusses the literature related to the paper on payment cards, access pricing and vertical foreclosure. Section 3 describes the institutional

[5]The most applied access rule is the Baumol-Willig rule, also called the Efficient Price Cost Rule (ECPR) which states that price setting should be guided by efficiency considerations, which means that the access charge should not be as low as to allow an inefficient competitor to enter profitably nor as high as to render entry unprofitable to a more efficient rival.

background on sub-acquirers. Section 4 describes the model setup when sub-acquirers and acquirers compete in the same downstream market. Section 5 introduces data externalities and bargaining power of sub-acquirers. Section 6 discusses the implications of public intervention by setting two alternative access charges (i.e., the cost-margin rule and the ECPR). Section 7 shows the socially and privately optimal interchange fees. Section 8 analyzes the situation in which sub-acquirers enter niche markets that are not covered by the acquirers. Finally, Section 8 gives the key insights of the paper.

2 Literature review

This paper contributes to the literature on payment cards, access pricing and vertical foreclosure. First, the paper does something novel by modelling the card industry with sub-acquirers and splitting the acquiring market into upstream and downstream activities. Secondly, the paper shows that large data externalities and bargaining power of sub-acquirers can be a source of anti-competitive vertical foreclosure. Finally, the paper extends the application of access pricing theory to payment cards in particular and payment markets in general.

Payment cards are usually defined as a two-sided market in which consumers and merchants interact through a card network to purchase goods and services without cash. There exist indirect network externalities, i.e., the utility of cardholders (merchants) increases when more merchants accept (cardholders use) cards as a means of payment. Rochet and Tirole (2003) formally define a two-sided market as one market in which the price structure (how much each side pays) matters rather than the price level (the sum of price for each side). Fees are usually biased against merchants, while cardholders are rewarded to incentivise the use of payment cards (Bedre-Defolie and Calvano, 2013; Mariotto and Verdier, 2017; Rochet and Tirole, 2003, 2006, 2011; Rysman and Wright, 2014; Schmalensee, 2002; Wang, 2023; Wright, 2012).

In this regard, some papers analyze the card industry through a monopoly card platform that serves directly to consumers and merchants (a closed or third-party scheme) as it can be easily extrapolated to platform monopolies in other business models (AirBnb, Google, Facebook, Uber, etc.) (Rochet and Tirole, 2003). However, most card schemes in practice are four-party in which the card network delegates the issuing and acquiring functions to third entities. For instance, Visa and Mastercard are the most typical examples within the four-party schemes, in which the interchange fee plays a crucial role in the price structure (Rochet and Tirole, 2003, 2006). This fee is an income from the acquirer to the issuer which allows the latter to give rewards to cardholders but also is a price floor for merchants which sometimes can hinder the merchant card acceptance. Therefore, in general, a higher interchange fee incentivizes cardholders to use their cards (i.e., it is more attractive for cardholders) while a lower interchange fee promotes merchant card acceptance (i.e., it is less costly for merchants). Carbo-Valverde et al. (2016) find that reductions of interchange fees have a considerable impact in increasing merchant acceptance and card transactions.

The optimal determination of the interchange fee has been the center of academic and policy discussions in the past years. On the research side, Baxter (1983) is the first to study

this situation. Rochet and Tirole (2002, 2006, 2011) formalize the card industry and the determination of the interchange fee and its role in the price structure. Bedre-Defolie and Calvano (2013) analyze optimal interchange fees when consumers decide to adopt and use cards while merchants only make one decision (adoption). Ding and Wright (2017) analyze the price setting under different scenarios depending on the possibility of discriminating the cardholder price or not. Reisinger and Zenger (2019) study the interchange fee regulation and service investments, in which the card network invests to improve quality on both sides. Aurazo and Vasquez (2020) study how tax evasion through cash payments affects social and private interchange fees. Shy (2022) analyzes the interchange fee set in the presence of cashless stores, cashless consumers, and cash-only consumers. From the policy side, some jurisdictions have established caps on interchange fees such as the EU, Brazil, Chile, U.S., South Africa, and Australia. In developing countries, some papers also argue that interchange fees should reflect tax evasion issues as it reduces the cost of cash from the merchant perspective (Arango-Arango et al., 2022; Aurazo and Vega, 2021a).

On the other side, the literature on access pricing has been widely analyzed in utility industries such as telecommunications (Armstrong, 2002; Vogelsang, 2003). The issue arises when the monopoly owner of the essential facility also operates in the downstream market (a vertically integrated incumbent), and the entrant has to gain access to the incumbent to compete in the market for the final product. Therefore, the price the incumbent may charge for access is excessive and non-competitive. More recently, Tirole (2022) discusses the importance of preserving fair access by third parties to an essential facility in the digital era.

The well-accepted Chicago School critique states however that an incumbent does not have incentives to deter entry or behave anti-competitively with an efficient entrant. There are at least three situations where the Chicago School argument does not hold: i) imperfect rent extraction, ii) dynamic vertical foreclosure and iii) raising rival costs (Motta, 2023). The Chicago School assumes that the owner of an essential input has the freedom to determine the retail price and the access fee. In some markets, however, one or both fees are regulated, leading to an imperfect rent extraction. In digital markets, Motta (2023) argues that the zero pricing policy set by the digital platform leads to anti-competitive foreclosure. The Chicago setup is static as it does not consider changes in the market conditions in the near future where new entry may be possible. In this regard, Carlton and Waldman (2002) elaborate on exclusionary tying between a primary product and a complementary one. They show that tying discourages current entry in the complementary market, thereby making future entry into the primary market unprofitable. Fumagalli and Motta (2020) identify a dynamic rationale for anti-competitive foreclosure where the upstream monopolist may have an incentive to foreclose a more efficient downstream rival even though it sacrifices current profits. This paper proposes that large data externalities and bargaining power of sub-acquirers on this are a source of failing the Chicago School argument. The idea behind this is that the acquirer (i.e., the incumbent) is unable to perfectly extract data externalities, which are monetized with the payments information. These results are in line with Bianchi et al. (2023) and Choi and Jeon (2021) who conclude that the incumbent may have incentives to tie products (alternatively to foreclose) by introducing data externalities in mobile payments and two-sided markets, respectively.

The literature of access pricing has proposed two different solutions. One is to separate the vertically integrated monopoly, and the other is to regulate the access charge. In the latter case, which is of interest in this paper, it is important to distinguish between one-way and two-way access. In the first situation, the access moves in one direction, from the entrant to the incumbent, while in the second one, the access is bilateral as the entrant and the incumbent have to interconnect each other to compete in the downstream market. In contrast to the telecommunications industry where the access pricing is mainly two-way, the interconnection between an acquirer and a sub-acquirer in the market for payment cards is one-way.[6] As Vogelsang (2003) points out, the nature of one-way access regulation is exclusively driven by the containment of market power. In this regard, Bianchi et al. (2023) study interoperability (also understood as compatibility) in mobile payments distinguishing among mobile network interoperability, platform-level interoperability, and agent-level interoperability. In all these scenarios, the access charges play an important role in expanding the benefits of interoperable platforms.

3 Institutional background

Before moving on to the model, it is important to understand what a sub-acquirer is. The formal definition of a sub-acquirer varies slightly across the card networks. For instance, Mastercard defines it as *"a service provider that is registered by an acquirer to facilitate transactions on behalf of sub-merchants"*. Meanwhile, Visa defines it as *"a third-party agent that may sign a merchant acceptance agreement on behalf of an acquirer and receive settlement of transaction proceeds from an acquirer, on behalf of a sponsored merchant"*.[7]

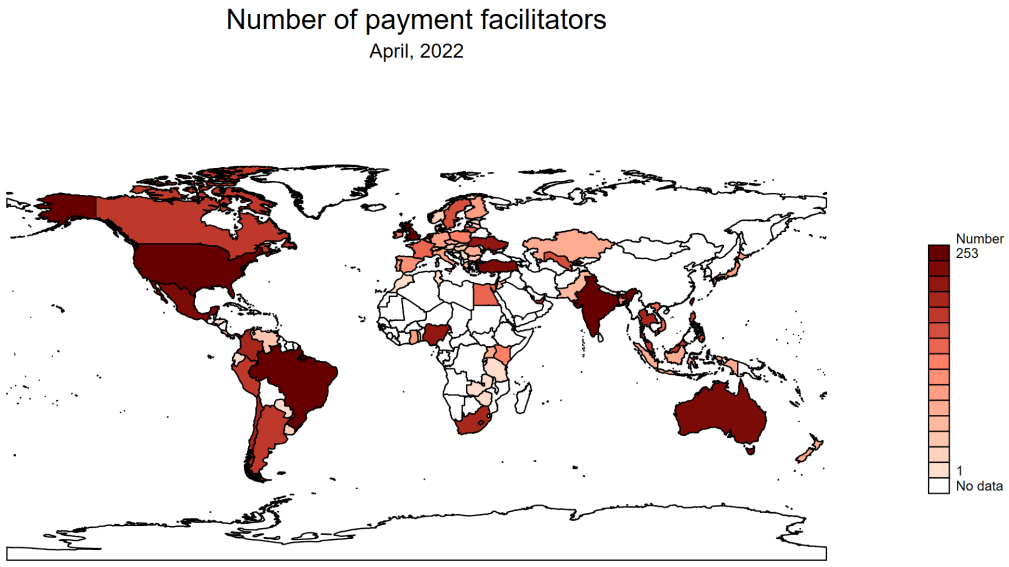
In practice, sub-acquirers play similar roles as acquirers: i) provide point-of-sale (POS) devices or payment solutions for e-commerce platforms to merchants, ii) deposit funds in the merchants' bank account, iii) have contractual responsibilities with merchants, among others. They invest in innovative products such as new POS devices (eg, mobile apps that enable mobile phones to be used as POS devices) or provide value-added services such as account balances, access to loans in the financial sector or a shorter time to deposit funds in merchants' bank accounts. However, sub-acquirers usually facilitate card payments in segments where the acquirer has to incur high costs or has no incentives to provide better services or even enter, either through e-commerce (on-line channels) or at the point-of-sale (on-site channels). From the acquirer perspective, however, sub-acquirers are more than large merchants, they also exert competition pressure in the acquiring market.

Unlike acquirers (and issuers), sub-acquirers are not members of the card networks. They do not have a direct connection with the card network but through the acquirer to provide payment services to merchants, including the validation, authorisation and settlement of funds.[8] The latter also means that sub-acquirers do not receive funds from card purchases

[6] The interconnection problem can become two-way when two exclusive acquirers (i.e., one acquirer belonging to one card network) should interconnect each other.

[7] For more detail, visit https://usa.visa.com/content/dam/VCOM/global/support-legal/documents/visa-payment-facilitator-model.pdf (last access on 15/04/2022).

[8] The connection with the card network is essential, otherwise the merchants affiliated with the sub-acquirer would not be able to accept payment cards.



Source: Mastercard

Figure 1: Number of sub-acquirers (payment facilitators) around the world

directly from the card network, but is done indirectly by the acquirer (i.e., the card networks send settlement funds to the acquirer, and then it deposits them in the sub-acquirer's account).

In terms of compliance and costs, the acquirer is responsible for the sub-acquirer's compliance with the card network. As the sub-acquirer is not a member of the card network, the latter cannot impose penalties directly on the former, but only on the acquirer that allows the connection.[9] Card networks are concerned about the potential risks of sub-acquirers entering the payment system, so they set some thresholds (eg transaction volumes) that sub-acquirers should meet.[10] In a way, the card network mitigates the potential risks by limiting the importance of sub-acquirers within the payment system, and on the other hand, the lower entry and compliance costs that sub-acquirers should incur are offset by their lower growth potential.[11]

As of April 2022, there were 1,448 sub-acquirers around the world with an agreement within the Mastercard network, from which there were 382 sub-acquirers in Latin America while the Middle East and Africa had only 151 sub-acquirers registered.[12] Figure 1 shows the

[9]Card networks do, however, have the power to accept or reject any entry or connection of third parties such as sub-acquirers.

[10]Once met, the sub-acquirers should become acquirers.

[11]It is important to note that card networks only set the rules for entry, exit and operation within the payment system. Whether sub-acquirers, acquirers or issuers should be licensed to operate in a particular jurisdiction is determined by local authorities.

[12]Data taken from https://www.mastercard.us/en-us/business/overview/start-accepting/payment-

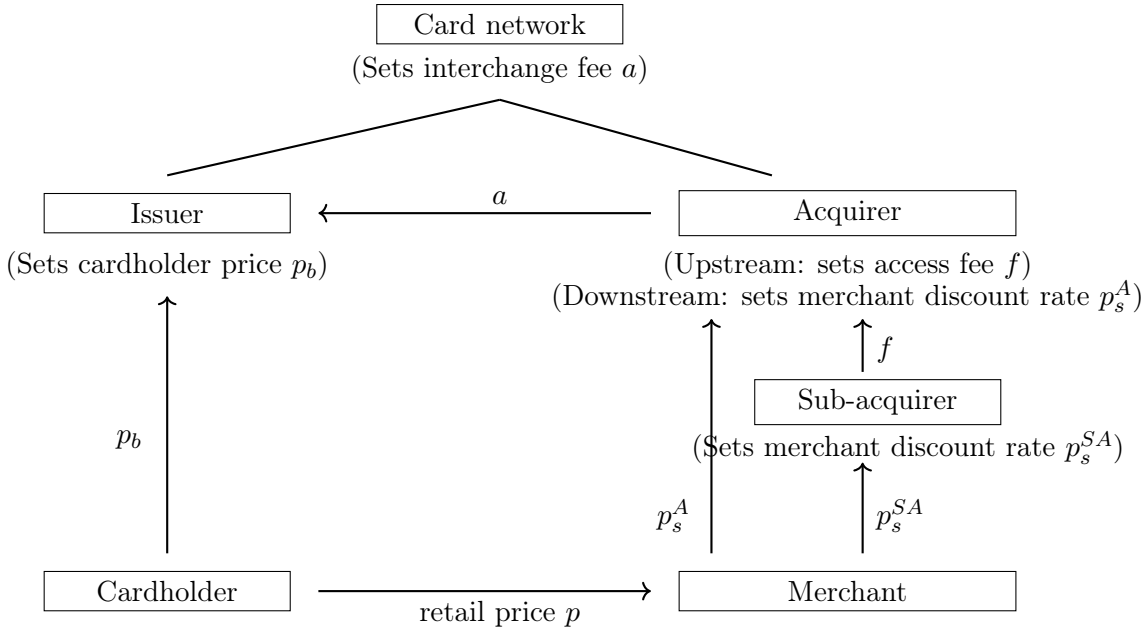


Figure 2: Four-party payment scheme with sub-acquirer

distribution of sub-acquirers across countries. The United States is the largest country with sub-acquirers accounting for 252, followed by Brazil with 236. Much more far from them, the United Kingdom registered 76 sub-acquirers while India only 60.

4 The baseline model

Figure 2 describes the traditional four-party payment scheme but considering the presence of a sub-acquirer. There are six players, namely consumers, merchants, issuers, acquirers, sub-acquirers and the card/payment network. The main modification is that the acquiring market is split into downstream and upstream activities. In the downstream market, acquirers provide card acceptance services to merchants, and they can compete with sub-acquirers. In the upstream market, the acquirer provides sub-acquirers with a connection to the card network and allows their transactions to be validated and processed. The acquirer also charges an access fee whenever sub-acquirers process a transaction in the downstream market. In this section, I analyze the case where the acquirer and the sub-acquirer compete in the same downstream market. In section 5, I introduce data externalities and bargaining power on it of sub-acquirers. In section 8, I analyze the case where the sub-acquirer enters niche markets not covered yet.

Consumers and the issuing market. Consumers face an inelastic demand for a good and must decide on one store and once there, decide how to pay (by cash or by card). Whenever a card transaction is done, buyers pay issuers a transaction fee p_b, (negative if they receive air miles, interest-free period or any reward provided by the issuer). There are no annual

facilitators.html (last access on 15/04/2022).

fees (membership fees) and it is assumed all consumers have a card.

The consumer's convenience cost of paying by cash (equivalent to the convenience benefit of using a card since its cost is zero) differs across consumers and is a random variable $\widetilde{b_b}$ drawn from cumulative distribution function $H(b_b) = Pr(\widetilde{b_b} \leq b_b)$ with density $h(b_b) = H'(b_b)$. The distribution has a monotone hazard rate $\frac{h(b_b)}{1-H(b_b)}$.

Suppose, consumers pay the same retail price p regardless of the payment instrument (i.e., price coherence, uniform pricing or the no surcharge rule). Therefore, a card payment is optimal if and only if $\widetilde{b_b} \geq p_b$. The proportion of card payments at the store is $D(p_b) = Pr(\widetilde{b_b} \geq p_b) = 1 - H(p_b)$. The average net cardholder benefit per card payment is defined by $v_b(p_b) = E[b_b - p_b | b_b \geq p_b]$ and is decreasing in p_b.

On the other hand, issuers incur a per-transaction cost c_b and receive an interchange payment of a from the acquirer in a card transaction known as interchange fee, and charge a constant markup ($m_I > 0$) above the total issuing costs, so the cardholder price is:

$$p_b = c_b - a + m_I \tag{1}$$

Merchants and the acquiring market. Merchants belong to the same retail market and they can contract with the acquirer (A) or the sub-acquirer (SA) to accept card payments, and obtain a net convenience benefit of a card payment denoted by b_s^i where $i = \{A, SA\}$ whenever a consumer pays by card instead of cash. This merchant net benefit of card payments (or equivalently, net convenience cost of cash payments) is homogeneous across merchants and refers to the net convenience savings that merchants obtain from not having to handle and manage cash relative to cards.

Let us assume that, $b_s^{SA} > b_s^A$; i.e., the sub-acquirer provides the merchant a higher net convenience benefit than the acquirer does. The reader can think about the time that merchants have to wait until funds derived from a purchase with a card are deposited in their bank account. Suppose, the acquirer guarantees merchants their funds will be in their accounts after 48 hours while the sub-acquirer enters the market with a disruptive strategy and ensures merchants that their funds will be deposited within 24 hours after the purchase. This shorter deposit time is positively valued by the merchant and then it increases his/her net convenience benefit from accepting cards. Similarly, this assumption can be realistic when sub-acquirers provide merchants a disruptive technology (contactless payments, QR codes, or links for non-present sales), so it reduces their sales time or improves their sales systems.

Since there is price coherence, the retail price p is the same regardless of the payment instrument. In addition, merchants pay a transaction fee known as merchant discount rate p_s^i to the firm with which is affiliated where $i = \{A, SA\}$. As Rochet and Tirole (2011) and Wright (2012), I assume full merchant internalization, implying that merchants will accept card payments with firm i if and only if

$$p_s^i \leq b_s^i + v_b(p_b) \tag{2}$$

where $i = \{A, SA\}$

Given this setup, the merchant internalization condition can be rewritten as:

$$v_b(p_b) \geq \left(p_s^A - b_s^A\right) \chi^A + \left(p_s^{SA} - b_s^{SA}\right) \chi^{SA} \tag{3}$$

where χ^A and χ^{SA} are the market shares for the acquirer and sub-acquirer, respectively. Let us assume that the average net cardholder benefit $v_b(p_b)$ is sufficiently high, so Equation 1 is always satisfied.

Acquirers operate in the downstream and upstream activities. In the downstream market, they incur a per-transaction cost c_s^A, have to pay the interchange fee a to issuers and have an ex-post market power m_A^D if they are the sole provider, so the merchant discount rate p_s^A is equal to total acquiring costs plus the markup:

$$p_s^A = c_s^A + a + m_A^D \tag{4}$$

In the upstream market, acquirers incur a cost of providing access for sub-acquirers to the card network denoted by c_e. They charge an access fee denoted by f to sub-acquirers whenever the latter enter the downstream market and capture a card transaction with their own POS device or payment solution in e-commerce platforms. Let us assume that there are no network fees (fees paid to card networks), so the total cost in the upstream activity is the cost of providing access c_e plus the interchange fee a that they have to pay to the issuer whenever a card payment is done.

On the other hand, the sub-acquirers cannot connect directly with card networks (i.e., there is no bypass).[13] Therefore, if sub-acquirers enter the market, they have to contract with the acquirer (which owns an essential input like processing, connecting to the card network, and depositing funds from card purchases) to operate in the downstream market. In each card transaction, they have to pay an access fee f to the acquirer, and they incur a per-transaction cost c_s^{SA} to deliver merchants. I assume that the sub-acquirer is more efficient in costs than the acquirer, so $c_s^{SA} < c_s^A$. In sum, it is assumed that sub-acquirers are doubly efficient as they offer greater convenience to merchants ($\Delta b_s = b_s^{SA} - b_s^A > 0$) while incurring lower costs ($\Delta c_s = c_s^A - c_s^{SA} > 0$) than acquirers.

DEFINITION 1. *The entry is privately desirable if and only the profits from upstream activities are higher than the profits from downstream activities*: $f - (c_e + a) > m_D^A$.

DEFINITION 2. *The entry is socially desirable if and only if the total efficiency gains are higher than the cost of providing access*: $\Delta > c_e$, where $\Delta = \Delta b_s + \Delta c_s$.

Card/payment network. The card platform is a non-profit organization and maximizes the joint profits of its members (issuers and acquirers) by setting an interchange fee that the issuer will receive in each card transaction.[14] As discussed in section 2, the interchange fee is instrumental in balancing the two sides of the market.

[13] As discussed in Section 3, the card networks set the rules for entry, exit and operation within the payment system, including those for third-party providers (eg sub-acquirers). If sub-acquirers wish to bypass the intermediary and connect directly with the card network, they must become acquirers and meet the card networks' requirements, which include high-quality standards and effective risk management.

[14] Notice that the card networks are not concerned by the sub-acquirers' profit since they are not members of the payment system.

The timing of the model is as follows:

Stage 1: The card/payment network sets the interchange fee a.

Stage 2: Acquirer banks set the access fee f to be paid by sub-acquirers.

Stage 3: Given the access fee, the sub-acquirers decide whether to enter the downstream market or not. If they accept the access fee, the acquirer banks and sub-acquirers set simultaneously and non-cooperatively their merchant discount rates p_s^A and p_s^{SA}, respectively. Without entry of sub-acquirer, the acquirer is the sole provider in the downstream market and sets p_s^A. Issuer banks set the cardholder price p_b.

Stage 4: Retailers decide whether or not to accept cards, decide which firm (acquirer or sub-acquirer) to contract with, and set their retail prices p.

Stage 5: Consumers decide which retailers to patronize, and, after the realization of the benefit of paying by card, they decide which payment instrument to use.

Downstream and upstream equilibrium. The merchant will contract with the firm that gives him/her the maximum net utility: $b_s^i - p_s^i + v_b(p_b)$. Let us assume that if the merchant is indifferent, he/she will choose the sub-acquirer which provides a higher net convenience benefit from accepting cards.

The total volume of card payments can be divided into those captured by the acquirer and by the sub-acquirer; i.e., $D_b(P_b) = D_b^A(P_b) + D_b^{SA}(P_b)$, so the market share of each competitor depends on the merchant discount rate charged by each one of them, as follows:

$$D_b^A(p_b) = \chi^A D_b(p_b), \;\; where \quad \chi^A = \begin{cases} 0 & \text{if } p_s^{SA} \leq b_s^{SA} - b_s^A + p_s^A \\ 1 & \text{if } p_s^{SA} > b_s^{SA} - b_s^A + p_s^A \end{cases}$$

$$D_b^{SA}(p_b) = \chi^{SA} D_b(p_b), \;\; where \quad \chi^{SA} = \begin{cases} 0 & \text{if } p_s^{SA} > b_s^{SA} - b_s^A + p_s^A \\ 1 & \text{if } p_s^{SA} \leq b_s^{SA} - b_s^A + p_s^A \end{cases}$$

If the acquirer deters entry, eg by setting a high access fee, the acquirer will set the merchant discount rate at $p_s^A = c_s^A + a + m_D^A$, so the acquirer's (downstream) profit is $\Pi_D^A = m_D^A$. If the acquirer allows entry, eg by maintaining the mark-up without entry, the sub-acquirer will set a merchant discount rate such that the merchant is indifferent between contracting with the acquirer and the sub-acquirer, so the sub-acquirer will win the market by setting the merchant discount rate as:

$$p_s^{SA} = b_s^{SA} - b_s^A + c_s^A + a + m_D^A \tag{5}$$

The sub-acquirer will enter the market if and only if the profit is non-negative, i.e., $\Pi^{SA} = p_s^{SA} - c_s^{SA} - f \geq 0$. Assuming that there are no fixed costs nor an entry cost, the sub-acquirer will enter the market if only if the access fee does not exceed:

$$f \leq p_s^{SA} - c_s^{SA} \tag{6}$$

Replacing equation 5 in 6, the maximum access fee that sub-acquirer accepts and which is set by the acquirer is:

$$f^* = \Delta + a + m_D^A \tag{7}$$

PROPOSITION 1. *The acquirer allows entry if and only if the entry is socially desirable.*

Proof. Replacing Eq. 7 in Definition 1, we have that the acquirer allows entry if and only if $\Delta - c_e > 0$, which is the definition of a socially desirable entry. □

The Chicago School argument. Proposition 1 refers to the Chicago school critique which states that a vertically related monopoly has no incentives to deter efficient entry into the downstream market (Armstrong, 2002). This means that vertical integration has no anti-competitive effects and thus the regulator plays no role in increasing welfare. The acquirer withdraws to compete in the downstream market and manages to obtain the efficiency gains and the sub-acquirer lefts with nothing. The acquirer is better off not competing with the sub-acquirer in the merchant market but extracting all the total efficiency gains through the access fee. In doing so, the acquirer would continue acting as a monopoly but with a superior acquiring technology to serve the merchants. Here, the privately optimal and socially optimal decisions are aligned.

However, there are at least three situations where the Chicago school result does not hold: i) imperfect rent extraction, ii) dynamic vertical foreclosure and iii) raising rival costs (Motta, 2023). In the next section, I include the monetization of payment data and the bargaining power of sub-acquirers, which leads to imperfect rent extraction and thus acquirers have incentives to foreclose efficient entry.

5 The baseline model with data externalities

As Bianchi et al. (2023) and Choi and Jeon (2021), let's introduce the presence of data externalities, which are a natural feature of payments. Let us assume that both the acquirer and sub-acquirer can externally monetize payment data at rate β per transaction in the downstream market. This means that if the acquirer only operates in the upstream market, the sub-acquirer will obtain β additionally. When the acquirer is the sole provider in the downstream market, it also obtains β while the sub-acquirer is out.

DEFINITION 3. *With data externalities, the entry is privately desirable if and only if the upstream profits are higher than the downstream profits from providing payment services and monetizing data externalities:* $f - (c_e + a) > m_D^A + \beta$.

The sub-acquirer will now enter the market if and only if the access fee is not higher than:

$$f \leq p_s^{SA} - c_s^{SA} + \beta \tag{8}$$

In addition, the sub-acquirer has a bargaining power on data externalities $\alpha \in [0, 1]$. The latter means that the acquirer can only partially extract data monetization from the sub-acquirer at rate $(1-\alpha)$ through the access fee in the upstream market. Therefore, the access fee set by the acquirer will be as maximum:

$$f \leq p_s^{SA} - c_s^{SA} + (1-\alpha)\beta \tag{9}$$

Replacing Equation 5 in 9, the acquirer will set the access fee at:

$$f^{**} = \Delta + a + m_D^A + (1-\alpha)\beta \tag{10}$$

PROPOSITION 2. *With data externalities, the acquirer allows socially desirable entry, if and only if:*

1. *The sub-acquirer has no bargaining power on the monetization of data externalities, or*
2. *Data externalities are small enough such that* $\beta < (\Delta - c_e)/\alpha$

Proof. Replacing Equation 10 in Definition 3, we have $\Delta - c_e > \alpha\beta$. i) When the sub-acquirer has no bargaining power ($\alpha = 0$), the acquirer will allow socially desirable entry given that it is able to extract perfectly total efficiency gains and data monetization through the access fee. ii) With small data externalities, the acquirer has incentives to allow entry, as the total efficiency gains that can be extracted through the access fee are higher than the data monetization that cannot be extracted. □

Clearly, the introduction of large data externalities and bargaining power of the sub-acquirer challenges the Chicago School argument. This introduction could shed light on potential anti-competitive behavior in the payment markets, depending on the type of the entrant. When the entrant is a bigtech, i.e., $\alpha \to 1$, the acquirer is more likely to deter entry as it cannot extract data monetization. On the contrary, when the entrant is a fintech, i.e., $\alpha \to 0$, the acquirer is more likely to allow entry. This result is in line with Fumagalli and Motta (2020), Choi and Jeon (2021), Bianchi et al. (2023) and Motta (2023) who find arguments against the Chicago School critique.

6 Public intervention and alternative access regimes

From a public perspective, the regulator seeks to increase welfare. In section 4 we saw that the acquirer's rationale is aligned with the best outcome for society by allowing socially desirable entry. In this case, the regulator can only play a distributive role. Given that the acquirer extracts the total efficiency gains through the access fee and the sub-acquirer is left with nothing, innovation in the payment market could be diminished. The regulator could therefore seek to share the efficiency gains between the acquirer and the sub-acquirer by imposing alternative access fees which limits the acquirer's upstream profit.

It is more interesting to analyze when the acquirer has incentives to foreclose socially desirable entry. This situation is observed in Section 5 when we introduce large data externalities and bargaining power leading to imperfect rent extraction. Therefore, the regulator can promote socially desirable entry by imposing alternative access charges. In this section, we discuss two different alternative access regimes, namely the cost-margin rule and the efficient cost pricing rule.

6.1 Cost margin rule

Whenever the acquirer processes a transaction either from the merchant directly or from the sub-acquirer, the acquirer has to pay the interchange fee to the issuer, which allows the latter to incentivize cardholders to use their cards, but it also has to incur a per-transaction cost of providing access for the sub-acquirer. Therefore, in the absence of other network fees, the interchange fee and the cost of providing access are the only directly attributable

costs when the sub-acquirer contracts with the acquirer. Therefore, the access charge under this regime should be $f^{FB} = a + c_e$.

The sub-acquirer will enter the market if and only if this access charge leads to non-negative profits, in other words, if the access charge according to the margin rule is not higher than the maximum access fee the sub-acquirer is willing to pay:

$$f^{FB} \leq a + \Delta + m_D^A + \beta$$

Given that the entry is socially desirable, the sub-acquirer enters and fully covers the market. With this alternative access fee, the acquirer's profit is zero while the sub-acquirer's profit is $\Pi^{SA} = m_A^D + \Delta - c_e + \beta > 0$.

Nevertheless, it is unlikely that the acquirer will be motivated to accommodate entry. This phenomenon is commonly observed in other network industries, where the regulator mandates access and issue complementary policies (e.g. on quality) to ensure fair competition between acquirers and sub-acquirers.

6.2 Efficient cost price rule (ECPR)

A usual access regime applied in other network industries is the ECPR which internalizes the opportunity cost of the incumbent. In this scenario, the alternative access fee should be equal to the interchange fee plus the opportunity cost of the acquirer, i.e., the acquirer markup and the monetization of data externalities in the downstream market, thus we have: $f^{ECPR} = a + c_e + m_A^D + \beta$.

Under this regime, the sub-acquirer will enter the market if and only if:

$$f^{ECPR} \leq a + \Delta + m_D^A + \beta$$

Given that the entry is socially desirable, the sub-acquirer enters and fully covers the market. Therefore, the sub-acquirer's profits are $\Pi^{SA} = \Delta - c_e > 0$ while the acquirer's profits are $\Pi^A = m_A^D + \beta > 0$.

7 Socially and privately optimal interchange fees

As discussed in section 2, the interchange fee plays a crucial role. This section shows the optimal interchange fees derived from three different maximisation functions, namely social welfare, total user surplus, and monopoly platform, considering the model with data externalities presented in section 5. Before discussing each, I present the different components of social welfare and profits.

Consumer surplus

$$CS = u - p - p_b D_b(p_b) - \int_{-\infty}^{p_b} b_b \cdot dH(b_b)$$

Where u is the utility of a good for consumers, p is the retail price, p_b is the cardholder price (reward program) and $\int_{-\infty}^{p_b} b_b \cdot dH(b_b)$ represents the expected convenience cost of cash payment.

Retailer's profit

$$RP = p - \gamma - \left(p_s^A \chi^A + p_s^{SA} \chi^{SA}\right) D_b(p_b) - \left(b_s^A \chi^A + b_s^{SA} \chi^{SA}\right) (1 - D_b(p_b))$$

Where γ is unit cost, p_s^i is the merchant discount rate charged by the acquirer ($i = A$) or the sub-acquirer ($i = SA$), b_s^i is the net convenience cost of cash and χ^i is the market share in the downstream market with $i \in \{A, SA\}$.

Issuer's profit

$$\Pi_b = (p_b - c_b + a) D_b(p_b) = m_I D_b(p_b)$$

Where c_b is the issuer's cost, a in the interchange fee they receive from the acquirer/sub-acquirer, m_I is the ex-post markup they obtain.

Acquirer's profit

$$\Pi_A = \underbrace{\left[f - c_e - a\right] \chi^{SA} D_b(p_b)}_{\text{Upstream profit } \Pi_A^U} + \underbrace{\left[p_s^A - c_s^A - a + \beta\right] \chi^A D_b(p_b)}_{\text{Downstream profit } \Pi_A^D} = \left[(f - c_e - a) \chi^{SA} + (m_A^D + \beta) \chi^A\right] D_b(p_b)$$

Where f is the access charge they receive from the sub-acquirer, c_e is cost incurred in the upstream market to ensure access, c_s^A is the acquirer's cost in the downstream market, and m_A^D is the markup in the downstream market if they are the sole provider.

Sub-acquirer's profit

$$\Pi_{SA} = \left[p_s^{SA} - c_s^{SA} - f + \beta\right] \chi^{SA} D_b(p_b)$$

Where c_s^{SA} is the sub-acquirer's cost to provide merchant card acceptance in the downstream market.

7.1 Social welfare

The social welfare is the sum of the consumer surplus, retailer's profit, issuer's profit, acquirer's profit and sub-acquirer's profit:

$$W = \int_{p_b}^{\infty} (b_b - c_b + \beta + (b_s^A - c_s^A)\chi^A + (b_s^{SA} - c_s^{SA} - c_e)\chi^{SA}) \cdot dH(b_b) \tag{11}$$

Therefore, the welfare is a single-peaked function of p_b reaching a maximum at:

$$p_b^W = c_b + (c_s^A - b_s^A)\chi^A + (c_s^{SA} + c_e - b_s^{SA})\chi^{SA} - \beta \tag{12}$$

And the corresponding interchange fee is:

$$a^W = c_b - p_b^W + m_I = (b_s^A - c_s^A)\chi^A + (b_s^{SA} - c_s^{SA} - c_e)\chi^{SA} + m_I + \beta \tag{13}$$

Notice that data externalities are internalized in the interchange fee, regardless of who is providing the payment service to merchants. The social planner incentivizes the usage of payments with the monetization of data externalities that acquirers or sub-acquirers obtain.

7.2 Total user surplus

The total user surplus (TUS) only focuses on the end users (consumers and merchants):

$$\phi = \int_{p_b}^{\infty} \left[b_b - p_b + (b_s^A - p_s^A)\chi^A + (b_s^{SA} - p_s^{SA})\chi^{SA} \right] \cdot dH(b_b) \tag{14}$$

Using Eq. 1, 4 and 5, the cardholder price that maximizes TUS is then:

$$p_b^{TUS} = c_b + m_I + c_s^A + m_A^D - b_s^A \tag{15}$$

The interchange fee that corresponds to this maximisation is:

$$a^{TUS} = c_b - p_b^{TUS} + m_I = b_s^A - c_s^A - m_A^D \tag{16}$$

Notice that the interchange that maximizes total user surplus is the same regardless of which firm serves in the downstream market.

7.3 Monopoly platform

As the card platform is a non-profit organization, it seeks to set an interchange fee that maximizes the net income of issuers and acquirers. Notice that the sub-acquirer's profits are not directly taken into consideration by the card network, but indirectly as it affects the acquirer's profits through the profits in the upstream activity.

The interchange fee set by the card network is restricted to the maximum interchange fee that merchants are willing to accept which is derived from the merchant internalization condition in Equation 3. Using Equation 4 and 5, the maximum interchange fee derived from the merchant internalization condition is:

$$a \leq v_b(p_b) + b_s^A - c_s^A - m_A^D \tag{17}$$

The optimization problem of the monopoly card platform is as follows:

$$\max_a [\Pi_b + \Pi_A] = \left[\underbrace{m_I}_{\text{Issuer's markup}} + \underbrace{(f - a - c_e)\,\chi^{SA}}_{\text{Acquirer's upstream profit}} + \underbrace{(m_A^D + \beta)\chi^A}_{\text{Acquirer's downstream markup}} \right] D_b(p_b) \tag{18}$$

When entry is not privately desirable ($\chi^{SA} = 0$ and $\chi^A = 1$), the optimization problem can be re-expressed as:

$$\max_a [\Pi_b + \Pi_A] = \left[m_I + m_A^D + \beta \right] D_b(p_b) \tag{19}$$

s.t. i) Equation 17

When entry is privately desirable ($\chi^{SA} = 1$ and $\chi^A = 0$), the optimization problem can be re-expressed as:

$$\max_a [\Pi_b + \Pi_A] = [m_I + f - a - c_e]\, D_b(p_b) \tag{20}$$

s.t. i) Equation 17 and $f = f^{**} = \Delta + a + m_D^A + (1 - \alpha)\beta$

In both cases, the first-order conditions are

$$\frac{\partial \Pi}{\partial a} = h(c_b - a + m_I) > 0$$

which implies that the interchange fee is set at the maximum level to ensure merchant acceptance as well as the cardholder price:

$$a^M = v_b(p_b^M) + b_s^A - c_s^A - m_A^D \iff p_b^M = c - b_s^A + m_I(p_b^M) + m_A^D(p_b^M) - v_b(p_b^M) \quad (21)$$

8 Entry to niche markets

The sections above consider the scenario in which acquirers and sub-acquirers compete in the same downstream market that is currently covered by the acquirer. In this section, I analyze the situation in which sub-acquirers enter niche markets that are not covered yet (eg micro and small-sized merchants). In addition, I assume that there is no data externalities.[15]

The no coverage can be motivated by diverse factors. For instance, the niche markets can be characterized by some idiosyncratic aspects that the acquirer misunderstands, eg there is tax evasion, informality, or high dependence on cash which is difficult to overcome (Aurazo, 2020), the costs to incur are higher than the maximum willingness-to-pay of merchants (cost-driven exclusion), higher operational risks management (Müller, 2023), and thus entering this segment is not profitable for the acquirer. The reader can think about the following example. There is a small merchant dedicated to selling street food, who lives day-to-day, and her ecosystem is entirely based on cash. This segment is not covered by the acquirer as it might be difficult to change the merchant's mind at the expense of higher costs. This small merchant is more likely to evade taxes, operate small-ticket transactions, and be more sensitive to high merchant discount rates. Therefore, if the acquirer enters this market, it is quite likely that her current service does not match well with the small merchant's needs and then there would be no merchant card acceptance. Thus, sub-acquirers often provide card acceptance to small merchants with an innovative product that meets their needs. For instance, sub-acquirers in Peru were initially focused on small merchants who were not able to multi-home (they were not able to contract with Visa and Mastercard's acquirers at the same time) and then offered an interoperable POS that allowed them to accept payments with all card networks.

Let us assume that there are two separate markets (the traditional and the niche market) in which there is a mass of 1 of consumers and merchants in each one. Also, assume for simplicity that the card network and issuers perfectly observe in which market the transaction is done and then can discriminate prices (interchange fees and cardholder prices) across markets. Finally, assume that the acquirer has a constant ex-post markup in the traditional market denoted by m_A^D and an ex-post markup in the upstream market denoted by m_A^U in the niche market. The sub-acquirers have an ex-post markup in the downstream market denoted by m_{SA}^D.

Therefore, the cardholder price in the market i is $p_b^i = c_b - a^i + m_I^i$ where $i = \{A, SA\}$ refers to the traditional (A) and the niche market (SA). In the traditional market, the merchant

[15] The results discussed in this section hold when data externalities is introduced.

discount rate set by the acquirer is $p_s^A = c_s^A + a^A + m_A^D$. In the niche market, the access fee set by the acquirer in the upstream market is $f = c_e + a^{SA} + m_A^U$ while the merchant discount rate set by the sub-acquirer is $p_s^{SA} = c_s^{SA} + f + m_{SA}^D$.

The cardholder will use his/her card in market i if the net benefit is at least equal to the cardholder price set by the issuer $p_b^i \leq b_b^i$. Meanwhile, the merchant in market i will accept card payments if the merchant discount rate is not higher than the sum of net convenience benefit plus the net consumer benefit from using cards $p_s^i \leq b_s^i + v_b^i(p_b^i)$. For convenience, let us assume that $c_s^A > b_s^{SA} > c_s^{SA}$ which ensures that the acquirer has no incentives to enter the niche market.

Therefore, the social welfare is denoted by

$$W = \underbrace{\int_{p_b^A}^{\infty} (b_b^A + b_s^A - c_b - c_s^A) \cdot dH(b_b^A)}_{\text{Social welfare in traditional market}} + \underbrace{\int_{p_b^{SA}}^{\infty} (b_b^{SA} + b_s^{SA} - c_b - (c_s^{SA} + c_e)) \cdot dH(b_b^{SA})}_{\text{Social welfare in niche market}}$$

Regarding the total user surplus, it is now denoted by:

$$TUS = \underbrace{\int_{p_b^A}^{\infty} \left[b_b^A - p_b^A + b_s^A - p_s^A\right] \cdot dH(b_b^A)}_{\text{TUS in the traditional market}} + \underbrace{\int_{p_b^{SA}}^{\infty} \left[b_b^{SA} - p_b^{SA} + b_s^{SA} - p_s^{SA}\right] \cdot dH(b_b^{SA})}_{\text{TUS in the niche market}}$$

Finally, the monopoly platform profits are:

$$\Pi = \Pi_I + \Pi_A = \underbrace{\left(m_I^A + m_A^D\right) D_b(p_b^A)}_{\text{Banks' profit in the traditional market}} + \underbrace{\left(m_I^{SA} + m_A^U\right) D_b(p_b^{SA})}_{\text{Banks' profit in the niche market}}$$

Notice that the entry of the sub-acquirer to the niche market increases social welfare, total user surplus and platform profits as there are now merchants accepting cards and then consumers are replacing cash with cards. Prior to the entry, the acquirer was not covering the niche market and then the merchant ecosystem in that market was entirely based on cash leading a loss of welfare.

PROPOSITION 3. *When the sub-acquirer enters niche markets, i.e., markets which are not covered by the acquirer, this leads to:*

1. *Increase total social welfare, total user surplus and the monopoly profit.*
2. *The acquirer allows entry as it obtains an extra benefit from granting access for the sub-acquirers to the card network.*

Proof. i) See preceding discussion. ii) Without entry, the acquirer's profit is $\Pi^A = m_A^D D_b(p_b^A)$, while with entry the profit is $\Pi^A = m_A^D D_b(p_b^A) + m_A^U D_b(p_b^{SA})$. Clearly, the profit with entry is higher. □

Unlike the case in which sub-acquirers enter markets covered by the acquirer, in niche markets the interconnection problem as well as the foreclosure issue are less important as the acquirer does not have any incentive to deter entry. On the contrary, the acquirer obtains an extra benefit from granting access for the sub-acquirers to the card network in the niche market. Likewise, both society and end users are now better off in comparison to the situation in which the niche market is not covered. In this scenario, the necessity of setting access charges in the upstream market is less important. However, although this scenario has been the most applicable in developing countries in recent years, sub-acquirers, especially bigtechs, are willing to enter markets traditionally served by acquirers, and vice versa, which leads to the scenario discussed previously. Therefore, the access charge between acquirers and sub-acquirers becomes a relevant variable in the market for payment cards.

9 Conclusion

This paper presents a model of the card industry that takes into account the presence of sub-acquirers, also known as payment facilitators. The novelty lies in the division of the acquiring market into two distinct activities. On the one hand, there is an upstream market in which the acquirer provides a connection to the card network and allows the transactions of sub-acquirers to be validated and processed; on the other hand, there is a downstream market in which acquirers provide card acceptance to merchants and can compete with sub-acquirers. In the upstream market, acquirers provide an essential input (bottleneck) to sub-acquirers and charge an access fee whenever sub-acquirers process a transaction in the downstream market. This new market structure is not limited to payment cards but could be extended to any payment platform.

The aim of this paper is to analyse how the introduction of sub-acquirers affects pricing and market structure in the payments industry. For this purpose, I analyse two extreme scenarios, one in which the sub-acquirer competes with the acquirer in the same downstream market, and the other in which the sub-acquirer enters niche markets that are not yet covered. In the first scenario, the acquirer allows socially desirable entry because it can extract total efficiency gains through the access fee paid by the sub-acquirers, which is consistent with the Chicago School critique. However, when large data externalities and bargaining power of sub-acquirers are introduced, the acquirer has incentives to deter entry due to imperfect rent extraction. In practice, the acquirer might be more likely to deter bigtech entry than fintech entry as the former has larger bargaining power on data externalities. That said, the regulator can play a relevant role in increasing welfare by setting alternative access fees. In particular, a first-best rule (margin cost rule) or the commonly applied efficient cost price rule (ECPR) leads to a social welfare-increasing situation in which the sub-acquirer serves the whole downstream market.

On the other side, when the entry to niche markets occurs, i.e., the sub-acquirer enters markets that are not covered yet, the acquirer is less likely to deter entry as it obtains an extra profit from granting access in this new market. Likewise, both society and end users are better off as they can make transactions with cards instead of cash which is a less efficient means of payment. Therefore, in this context, the role that a regulator can play is less focused on access pricing. However, although this scenario has been the most applicable

in developing countries in recent years, sub-acquirers, especially bigtechs, are willing to enter markets traditionally served by acquirers, and vice versa, and thus the access charge is becoming a relevant variable in the payment markets.

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