Alistair Milne

Standard setting and competition in securities settlement

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Suomen Pankki
Bank of Finland
P.O.Box 160
FI-00101 HELSINKI
Finland
☎ + 358 10 8311

http://www.bof.fi

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*Cass Business School, London, UK and Monetary Policy and Research Department, Bank of Finland.
E-mail: amilne@city.ac.uk

http://www.bof.fi

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Alistair Milne
Monetary Policy and Research Department

Abstract

This paper examines the impact of messaging and technical standards on competition in the supply of securities transaction management services. Two simple switching cost models are used to clarify the impact of standards on barriers to entry and on the incentives to adopt harmonised and simplified securities processing standards. Policy implications are discussed briefly.

Key words: securities settlement, standards, inter-operability, switching costs

JEL classification numbers: L15, L86

Standardien vaikutus arvopapereiden selvityspalveluiden kilpailullisuuteen

Suomen Pankin tutkimus
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Alistair Milne
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tässä tutkimuksessa tarkastellaan, miten tekniset ja viestistandardit vaikuttavat arvopapereiden selvityspalveluita tuottavan sektorin kilpailullisuuteen. Standardien markkinoille pääsyn esteisiin liittyviä sekä niiden arvopapereiden käsittelyä yksinkertaistavien ja yhdenmukaistavien menettelyiden käyttöönottoa kannustavia vaikutuksia havainnollistetaan kahden käyttäjien vaihtokustannusten merkitystä korostavan yksinkertaisen mallin avulla. Analyysin politiikkajohtopäätöksissä viitataan mahdollisuuteen, että eurooppalaisten viranomaisten on päätöksillään pakotettava palveluiden tuottajat omaksumaan yhteinen arvopapereiden selvitysstandardi.

Avainsanat: arvopapereiden selvitys, standardit, yhteiskäyttöisyys, vaihtokustannukset

JEL-luokittelu: L15, L86

Contents

1 Introduction

This paper discusses the role of standard setting as it affects competition in securities settlement, paying particular attention to the implications for the development of pan-European and global arrangements for securities settlement. Standard setting for messages and 'interoperability' of securities settlement systems has become a central practitioner issue in the past few years. This has happened for two main reasons. The first is the widespread desire in the industry for greater automation of post-trade processing, achieving as great a degree of 'straight through processing' or STP as possible. This goal has been promoted in particular by a recent report of the Group of Thirty on global securities processing (G30, 2003). The second reason is the efforts to remove or reduce the various barriers to a single European market in post-trade securities clearing and settlement, identified by the first report of the Giovannini group (Giovannini, 2002). The second Giovannini report proposed a series of actions to address these barriers (Giovannini Group, 2003). This report gave SWIFT, together with the practitioner network SMPG (Securities Market Practice Group) supported by SWIFT, the role of facilitating an industry wide project for harmonising messaging and inter-operability standards for securities settlement across Europe, thus addressing the first of the fifteen Giovannini barriers to pan-European securities clearing and settlement.

The main point developed in this paper is that standard setting in securities settlement is not just important to lowering processing costs and improving cross-border inter-operability, it is also a central determinant of competition in associated services such as securities custody and the management of securities transactions. The harmonisation of securities settlement standards being achieved both in Europe and globally is welcome. But both customers (investors in securities) and regulators need to pay attention to how these standards evolve. It should not be assumed that producers will always fully support and implement changes in standards even when these reduce customer processing costs and promote efficient cross-border transaction management. One reason for resistance to change is that simplified open standards can be expected to lead to increased competition and hence lower profits in securities transaction services. This argument, while it has been previously made with reference to the process of standard setting in other industries (see Section 3) does not seem to have been previously articulated in relation to securities settlement.

The argument of this paper is also relevant to other account based ownership networks such as systems of payments or foreign exchange transactions.[1] In these networks standards determine the ability of different parties (owners, providers of ownership accounts, providers of transaction services) to effect changes in ownership and provide transaction services such as the monitoring of accounts and provision of credit facilities. Standard setting is not just about supporting inter-operability ('straight through processing')

[1] Milne (2005) provides a more detailed discussion of ownership networks and their role in both payments and securities settlement.

but also about facilitating competition and innovation in such transaction management services.

The modelling of this paper, analysing securities settlement as an ownership network, complements recent work on payments and securities settlement, drawing on the literature on 'two-sided platforms' (for an introduction to this literature see Rochet and Tirole (2003, 2004; Armstrong, 2004, and several other recent papers, including Chakravorti and Roson, 2004, who apply the analysis of the two-sided platform to the case of payment cards.) Payment cards are one of several examples of two sided platforms. Others include securities markets, derivative markets, gaming devices and disc players, hardware or operating systems and software, dating systems such as dating agencies or even night clubs, real estate agents (bringing together buyers and sellers), and shopping malls (ditto). This recent literature on two-sided platform literature has focussed (mostly) on the pricing of the two sides of these platform market (where buyers and sellers pay different participation and transaction fees) and the determination of any internal payment between providers, such as the interchange fee paid by merchant acquirers to credit-card issuers.

Membership and per-transaction charges are a critical aspect of two-sided platforms. In two-sided platforms charges are the principal determinants of the number of participants on each side of the market and volume of usage, with participation especially sensitive to charging when there is competition between platforms. Appropriate pricing may overcome problems of low usage volumes and lack of participation that might undermine the viability of the platform (as noted below in the concluding Section 5 there can still be a problem of critical mass in the adoption of open messaging standards, but since standards are not charged this problem cannot be overcome through pricing mechanisms as is possible in two-sided platforms).

In any case in ownership networks, such as securities and bank accounts, transaction volumes are relatively unaffected by pricing and, moreover, there is often no clear distinction between the two sides of the network (eg active securities traders act equally as both buyers and sellers). It is then reasonable to assume (as in Milne, 2005a, and in Ackerberg and Gowrisankaran, 2002) that the volume of activity on the network is unaffected by relative pricing of the two sides of the platform. The analysis provided in this paper therefore ignores two-sided platform aspects of securities settlement. The network effects modelled here arise because of switching costs, not as a result of installed base externalities associated with the number of other users of the platform.[2]

The paper is arranged as follows. Section 2 provides a brief summary of the role of messaging and other standards in securities processing, noting some of the difficulties facing the adoption of open XML-based data standards. Section 3 then discusses some literature on the economics of standard setting, assessing how far this literature are relevant to securities processing. This literature offers different viewpoints on the relationship between standards and competition. While standardisation can reduce barriers to entry and

[2]This is an anlytical simplification, neglecting both the liquidity externalities in securities settlement (Holthausen and Tapking, 2003) and the two-sided platform incentives for issuers and investors to participate in the securities market (Rochet, 2005).

increase competition it is also possible (in the presence of network effects) for standardisation to reduce price competition and lead to higher profits. The literature also discusses the responsibility for setting of standards, whether this should be undertaken by individual firms, by consortia of firms, by industry bodies, or by public authorities.

Section 4 presents two simple models of securities securities transaction services, based on the assumption that competition in securities transaction services is limited by the costs of switching from one supplier to another. The first, basic, model considers competition within a domestic market between an incumbent and a domestic competitor. The profits of the incumbent are determined by the switching costs, the number of customers, and any cost advantage enjoyed by the incumbent.

This model is then extended to the situation of international competition, where the possibility of capture by a competitor that already has covered the fixed costs of providing securities transaction services further reduces incumbent profitability. In these models profit-maximising producers of securities transaction services are likely to resist standardisation of transaction processing, because such changes are both costly and reduce switching costs and entry barriers, hence lowering profitability.

Section 5 concludes by considering how efficient standard setting can be promoted, especially in the context of current policy debates about pan-European securities settlement. If the private business incentives for harmonising standards are indeed as weak as suggested by the models of this paper, then the ownership, objectives, and governance of post-trade institutions will be crucial to the effective adoption of harmonised standards. An Appendix provides model solutions.

2 Standard setting in securities processing

This section provides a brief introduction to the variety of messaging and other standards used in the processing of securities trades, and current progress towards the creation of open, simplified, standards. Historically securities messaging and processing arrangements have developed in an unco-ordinated fashion, sponsored by particular trading platforms and national arrangements for post-trade processing. Non-electronic (telephone and open-outcry) trading has been converted into firm-specific order and trading formats for electronic procesing. There has been diversity between different electronic platforms, thus equity trades in say Paris have been recorded using different conventions than equity trades in other centres; and within financial centres there have been different conventions for different markets (equities versus fixed income versus the different OTC derivatives and derivative exchanges). Different providers of security processing services have also developed there own procedures.

This variety has led to the promotion by regulators of minimum standards for the safe and secure operation of securities settlement, including the minimum recommendations of the CPSS-IOSCO (CPSS-IOSCO, 2003) and their extension in the European context (ECB 2005). These standards, while

of great practical importance, are not central to the argument developed in this paper and so are not considered further.

What is central are the standards and procedures used for communicating and processing messages in securities trading and processing. Over recent years the industry has been developing generic procedures that can be used across a range of trading and post-trade communications, notably the 'FIX protocol' for real-time, electronic communication between traders in securities markets (a collaborative effort between the worlds major investment banks and asset managers, see www.fixprotocol.org) and the post-trade MT message formats promoted by SWIFT (the Society for Worldwide Interbank Financial Telecommunication, a user co-operative of which most of the worlds large and medium sized financial institutions are members, see www.swift.com). These are both widely used and the development of industry software has become orientated around these two procedures, improving the automation of processing.

Nonetheless, these formats are not fully standardised, with considerable local variations in the way they are applied across systems and between firms. They are moreoever difficult to update. Changes in these standards can require wide-ranging adjustments to computer systems and business processes by financial firms. Because implementation varies widely, any change in business relationship, eg obtaining transaction management services from a new supplier, involves very substantial IT system costs. The adoption of more fully harmonised and simplified standards will reduce these switching costs, a point that underlies the analysis developed in Section 4 below.

FIX and MT are 'tag-value' based (organised as a sequence of fields, each introduced and ended by pre-defined tags, and obeying a fairly closely defined structure within each field). Future development of straight through processing will be facilitated by the use of extensible mark up (XML) data formats, developed for the sharing of data across the world wide web.[3] XML allows much richer message content, supports browser based interaction and communication and are hence are fully software and hardware independent. XML documents can also be somewhat more transparent and human readable. Moreover (because the markup tags are defined by the user rather than embodied in the standard) XML is well suited to incorporating future changes in technology and processing arrangements.

Perhaps most important of all, XML standards are especially well suited to supporting distributed rather than centralised processing (see Milne (2005) for further discussion of this point). With XML standards and distributed processing it is no longer, for example, necessary to create centralised processing hubs in order to facilitate European wide securities processing (neither 'hub and spoke' nor 'spaghetti' models of post-trade securities processing are required); instead almost aspects of securities processing can be handled through a decentralised computing network, with processing of trades handled by individual buyers and sellers, and communications with centralised institutions (settlement banks and securities depositories) only necessary to

[3] A tutorial introduction to XML, explaining how it differs from HTML, is provided on the website www.w3schools.com/xml/default.asp .

confirm transfer of securities and or money in final settlement. For more details on how such a distributed processing of securities trades can work see Leinonen (2003).

XML versions of FIX and the MT message formats are now being developed (currently there is pre-trade, FIXML, and SWIFT is working on post-trade XML formats). However the approach taken has been one of XML-conversion, little more than the addition of additional 'mark up' to existing formats so they are are consistent with XML. This approach fails to take advantage of the most important potential efficiency gains offered by XML language. Promotion of straight through processing will be much better supported by introducing entirely new protocols and message standards that take full advantage of the possibilities of XML, but to date there appears to be little appetite in the industry for this kind of radical cost-saving development. The analysis of the present paper provides one explanation of why securities service providers are reluctant to embrace new processing methods.

The 'Tower report' (SWIFT, 2005) commissioned by SWIFT confirms that adoption of open standards-based technologies is at best a slow evolution. This survey based report found that client demand is the critical business driver, with most financial services firms anticipating – for the foreseeable future – coexistence of proprietary and open (especially XML-based) standards. XML and other open standards are not without their challenges, including that of achieving critical mass, and so may never be widely adopted. Survey participants supported SWIFT's cautious approach to standards, encouraging a common standardisation methodology and process and a common repository for financial message standards (see www.swift.com), but agreeing that the range of standards initiatives is simply too great to achieve complete uniformity.

Both FIX and MT standards have been developed in connection with the ISO15022 standards for financial market messaging. As described on the ISO15022 webpages (www.iso15022.org) 'ISO 15022 sets the principles necessary to provide the different communities of users with the tools to design message types to support their specific information flows. These tools consist of a set of syntax and message design rules, a dictionary of data fields and a catalogue for present and future messages built by the industry with the above mentioned fields and rules. To address the evolving needs of the industry as they arise, the Data Field Dictionary and Catalogue of Messages have been kept outside the standard. They are made available by the Registration Authority which maintains them as necessary upon the request of industry participants.' The Registration Authority function for ISO15022 is provided by SWIFT. Parallel XML standards for financial market messaging fall under ISO20022 (www.iso20022.org).

Further evidence of the challenges to harmonisation of standards in securities processing can be found from the website of the securities market practice group (www.smpg.info). This documents the monthly meetings of the various national market practice groups, and the two meetings per year of the SMPG. In the recent past these meetings have covered a great number of issues ranging from the specific such as 'standardised methods of informing custodians to transfer securities' and 'resolution of cross-matching at

central securities depositories', to the strategic such as creation of NMPGs in non-participating countries and the development of multi-year project plans. All this makes clear that establishing global or even European standardisation of securities processing is a substantial and detailed task.

To summarise, while there has been progress on developing open financial messaging formats and standards, the use of these formats continues to differ significantly from one trading context to another and from one firm to another. This creates substantial switching costs, for any firm that moves securities processsing business from one supplier to another. There are moreover a number of other continuing differences in market practice and conventions, such as those identified by the Giovannini (2001) report. Thus, despite the increasing adoption of FIX-protocols and use of SWIFT message formats, harmonisation of securities messaging and other processing standards remains far from complete. The shift to XML formats, while offering great potential for improved automation, still has a long way to go.

Why has adoption of new standards been so slow? Convergence on standards on is ultimately a business decision for individual financial market participants. Changes can be costly, because legacy computer systems then have to be re-engineered or replaced. Furthermore, as argued formally in Section 4 below, providers of securities transactions services can also lose competitive advantage from the shift to shared and simplified standards. Full harmonisation of securities processing standards is likely to require sustained pressure from final customers, especially institutional investors and trading institutions, and also from public authorities.

3 The economics of standard setting

This section briefly reviews some of existing literature on the economics of standard setting and its relevance to securities processing standards.[4] Individual firms,industry bodies, and government are all concerned with various aspects of standards. These standards include rules on health and safety, on minimum product quality, restrictions on product design to ensure compatibility of complementary products (eg electrical or plumbing standards that ensure not just safety but also that a range of different components work together) as well as compatibility standards for specific products.

A major question addresed in the literature is who should take responsibility for setting standards? Health and safety standards are usually the responsibility of government or regulators (thus financial regulators, through CPSS/IOSCO, have taken the lead in setting standards for safety in payment and settlement systems). Public sector bodies, such as telecommunications regulators, may also play a co-ordinating role in standard setting. At the opposite extreme from these standards set by public bodies are those set by a coalition of voluntary participants, most notably the

[4] Blind (2004) provides detailed review of the economics of standards. See also discussions of standard setting in surveys of the economics of networks such as Shy (2001), Farrell and Klemperer (2001), and Scotchmer (2004) chapter 10.

open-standards supporting the internet (TCP/IP data transfer protocols, HTML display, XML data storage standard), such standards are the outcome of innovation and co-operation between various users, many in public sector defense and research institutions. The 'open-source' software movement reflects a continued commitment to this mechanism of creating and developing standards.

Finally standards may be set by industry participants, either by individual firms, by consortia of firms, or by industry established standard setting organisations (or SSOs). This is the usual practice for many engineering, product compatibility and communication standards. The FIX consortium and SWIFT are examples of such industry based standard setting organisations in securities trading and settlement. The standard setting process is likely to favour such industry based mechanism, in cases where public sector bodies lack the necessary technical knowledge and where existing incumbents in the industry have a strong interest in influencing the development of standards.

The academic literature has paid particular attention to cases of 'de facto' standards for complementary products with 'adoption' or 'installed base' externalities (also often referred to as 'network externalities' although this term is used in other senses as well). Such standards can usually be described as 'de facto' because they are established through competition in the market place, after being introduced by a single producer or group of producers. There are many well known examples where such de facto standards are of importance, including computer operating systems and software; games consoles and games; and other entertainment platforms such as VHS, DVD, CD, and the disks or cassettes they play. Standards are essential because the two products will not work together without them. In these cases there is then an 'installed base' externality associated with the number of consumers using the product – for example the greater the market share of a particular console, then the more games that can be viably marketed with that console format and the more attractive is this console to the consumer.

Where there are network externalities of this kind then individual producers may gain substantially if they establish their own proprietary standards as the dominant standard (leading to the phenomena of 'standard races' where competing firms seek to establish their own patented standard). Producers of complementary products (eg game designers) may then pay substantially to make use of the standard. The literature examines many particular examples of competing standards including 52K modems, betamax versus VHS videocassettes, and others. Because of the possibility of losing a standard race, providers may seek from the outset to establish the acceptance of a standard amongst a consortium of producers. Strategic aspects have also been explored, including the choices of open licensing (VHS succeeded in capturing the videocassette market by making its standard freely available) or second sourcing (eg free distribution of Adobe Reader), commitment and reputation for commitment (eg Sony maintaining commitment to losing brand Betamax may have been rational), pre-announcement (including the phenomena of 'vapourware' announced products that never appear). There are more than 50 academic articles around these issues.

Where there are switching or co-ordination costs then several contributions to the literature suggests that there can be 'lock in' to inferior standards, because the installed based cannot be easily replaced by the newer superior standards (Katz and Shapiro, 1994), although this has been contested eg by Liebovitz and Margolis (1999), while Farrell and Saloner (1985) have argued changes in standards can be inefficiently costly (so called 'excess inertia'). Another issue is whether the introduction of 'convertors' between standards can overcome inefficiencies (Choi, 1996), although David and Steinmuller (1990) have argued that this can frustrate the development of more efficient overarching standards.

The literature on the economics of standards has paid relatively less attention to the alternative to 'de facto' standard setting, where standards are instead agreed amongst industry participants through so called standard setting organisations (or SSOs). Standards set by SSOs are open, not closed, so they do not provide any participants with the competitive advantage of an installed base locked into a dominant proprietary standard. They do however help overcome the potential co-ordination costs of moving to a new industry standard.

There are a number of case studies of SSOs (eg Sirbu and Zwimpfer (1985), an examination of the X25 packet switching standard, the Besen and Johnson (1986) analysis of broadcast standards, and the wider-ranging comparisons found in Wiess and Sirbu (1990)). Chiao et al (2005) provide an empirical analysis of standard setting using data on some sixty SSOs in the engineering industries. They find broad support for the predictions of the theoretical model of Lerner and Tirole (2004), which suggests that the degree of concessions to users (eg access to royalty free licensing) is positively correlated with the degree of user-orientation of the SSOs (specifically their results are based on a set of measures of the extent to which the SSO is run by standard providers rather than users). Chiao et al (2005) also find that willingness to disclose technical details (such as underlying patents) is also positively related to the degree of user-orientation.

A case more closely related to that of complementary products with installed based externalites, but with some additional specific features, is that of communication networks. Examples include telecommunications, email, internet. Communication networks are also characterised by 'adoption externalities', the utility from owning the product or joining the network is directly increasing in the number of other customers (this is thus slightly different from the indirect externality associated with installed base and the variety of complimentary products). Standards are essential for communication to be possible (a rather hackneyed example is that a fax machine must obey the same standards as other fax machines, or provide a translation between standards, in order to send/recieve faxes to/from other fax machines.)

Standards for communication networks are usually established by a consortia of companies or by a standard setting organisation, not by a single company. But there are exceptions eg computer files. Other aspects of standards are specific to communication networks eg the necessity of agreed routing standards (such as international phone prefixes) where a central

authority may be needed to maintain such arrangements. There are also strong incentives, at least at regional level, to harmonise communication standards across an industry. Thus within Europe for example, or North America, public sector authorities play an important role in co-ordinating standard setting eg for mobile telephony.

One further conclusion from the study of communication networks, is that imposing standards to ensure that different systems can communicate with each other (interconnection or interoperability) does not ensure that such interconnection is efficiently priced. An example is the termination of mobile telephone calls. This is an access monopoly, only the subscribers host network can successfully locate the subscriber and ensure that they receive a call intended for them. They may charge callers a large fee, in order to exploit the lack of competition in call termination. At domestic level access-pricing regulations generally limit the ability of host networks to exploit this access monopoly. But there is no such access-pricing regulation for calls that are terminated for roaming mobile telephones, temporarily hosted by networks in other countries. The termination of calls to roaming mobile telephones thus typically leads to inefficiently high levels of charges to both the owner of the phone and to the incoming caller.[5]

It is sometimes argued that 'open standards' are better for competitive efficiency than closed proprietary standards. But this is not always true. Incentives for innovation must also be taken into account. Furthermore a proprietary standard, which can be exploited for profit, may be more aggressively promoted and therefore stand a greater chance of being accepted than an open standard (Katz and Shapiro, 1994).

Also, where there are network externalities associated with the size of installed base, firms competing under incompatible standards may compete more aggressively to raise market share and hence exploit these externalities. This can lead to greater price competition with incompatible standards, than when standards are open (see Shy, 2001, chapter 3 for application of this argument to the case of competition between software).

For standards agreed at pan-industrial level, including communication standards such as those of FIX or SWIFT in securities trading and settlement, the issue of open versus closed is not central. In these cases patents are not used to limit access, rather these standards are designed to be open to all participants. Nonetheless the issue still arises as to whether consumer interests are adequately reflected in the process of setting such standards; or whether these favour existing industry incumbents at the expense of smaller firms or new entrants and hence at the cost of higher customer prices or reduced incentives for innovation.[6] The argument of the present paper, that communication standards play a key role in determining the level of competition in securities transaction services, implies that regulators and

[5] There is an apparent parallel with the argument for access regulation in network utilities such as gas, electricity. Milne (2006b) argues that such access regulation can be appropriate for securities settlement.

[6] An example of the strategy of raising rival's costs, identified by Salop and Scheffman (1983).

consumers (in particular institutional investors) should be concerned with the outcome of standard setting in securities settlement.

4 Models of standard setting in an securities ownership network

This section presents two simple formal models, with the goal of clarifying the role of standard setting in determining competition in securities securities transaction services. These securities securities transaction services include monitoring and predicting the balances in accounts, summarising this information for clients, preparing for transfers of ownership by ensuring that both securities and cash are 'positioned' (ie ready for final delivery versus payment), dealing with any processing exceptions, and where necessary providing loan facilities (securities or cash lending) in order to fulfill transaction obligations. These 'value added' services are major sources of revenue for custodians and CSDs.

The set ups explored here do not distinguish custodian services (managing security income, taxation, or dealing with corporate actions such as voting in annual shareholder meetings, rights issues, or proposed mergers and acquisitions) from transaction management. Also as already discussed they also ignore pricing issues of the kind explored in the literature on two-sided platforms, assuming that demand for the number transactions is fixed, customers engaging in a given number of security transactions in each period.

In practice firms typically obtain securities transaction services from a principal supplier (a major bank or a securities depository) for each national market. They do not 'shop' around, switching from one supplier to another or obtaining these services from a large number of competitors. These features suggest that the relationship with the supplier is important and that there are significant costs to ending this relationship and turning to a new alternative supplier. However the adoption of open and more flexible standards is likely to make such a switch less costly.

The provision of both underlying security accounts and of bank accounts for the settlement of securities trades are exogenous to these models. Thus these models are not appropriate for examining the competitive impact of settlement in central bank money versus settlement in private commercial bank money. Nor do they allow for the liquidity externalities that play a key role in determining the supply securities accounts (such as appear in Holthausen and Tapking, 2003). Trading activity in securities and derivatives tends to migrate towards a single market platform, because increasing liquidity reduces bid-ask spreads and hence achieves lower trading cost, so attracts more trading and further reduces liquidity. There is a similar 'virtuous circle' of liquidity that attracts securities transactions to dominant CSDs or ICSDs. For this reason most settlement volumes for securities, even international securities, is attracted to a single dominant location. The models presented here simply assume that accounts for any given security are initially provided by a single encumbent provider (though such liquidity effects and the resulting need

to co-ordinate a shift to an alternative supplier could be considered as one component of the switching cost C).

These models make further simplifying assumptions. All producers are assumed to be profit maximisers (in practice many suppliers of securities transaction services eg Euroclear or DTCC are owned by customers and trading platforms and so are clearly not profit maximisers). All customers are assumed to be the same size, and the only variability in their demand for transactions is that foreign investors may have a lower level of transactions demand in domestic securities than domestic investors. It is assumed that switching costs C are the same for all customers, so the incumbent or competitor capture either none or all of the market. Finally all providers of securities transactions services have access to the same basic technology, implying common variable costs of provision. This might seem inconsistent with the presence of significant switching costs. But if different providers use the same technology operated under their own proprietary standards, or even with relatively small differences in the implementation of common standards, a switch in supplier can still be a costly exercise.

4.1 Model 1: competition between domestic CSD and custodian

This first model explores how the profitability of securities transaction services depends upon the fixed costs C to customers of switching from one domestic service provider to another. Messaging and communication standards can alter these switching costs as well as the costs of providing these services.

4.1.1 Switching costs and CSD pricing and profits

There is a single security, for which the security accounts are provided by an incumbent CSD. These N account holders obtain securities transaction services, either from the CSD or from a competing custodian bank. The CSD operates with a fixed cost of X_0. The competing custodian bank operates its own security account with the CSD and also uses this account to provide security loans to account holders, but to do this must pay additional fixed linkage costs of X_1 and so has a total fixed cost of $X_1 + X_0$.[7]

Initially the CSD provides securities transaction services to all N transactors in the security. There are variable per customer costs of X_2 and per transaction costs of X_3. These are assumed to be the same for both the CSD and the custodian.

[7] There are two elements to X_1, the linkage charge by the CSD and the technical costs of establishing and maintaining the link. It will turn out that incumbent profits are increasing in X_1, creating an incentive to increase the linkage charge element of X_1 as much as possible; however this is a very visible contribution to post-trade processing costs, so it seems appropriate to assume that the charged element of X_1 is set on a cost plus basis, ie it is limited by regulation or customer ownership.

Normalising the average level of transactions to unity, the total costs of providing N customers with securities transaction services are $X_0 + N(X_2 + X_3)$ for the incumbent CSD and $X_0 + X_1 + N(X_2 + X_3)$ for the competitor custodian.

Price announcements are staggered. The incumbent CSD first chooses a fixed price per customer for securities transaction services of Λ. The competing custodian then either chooses not to enter the market or chooses to enter the market charging a fixed price of Λ' per customer. The volume of customers choosing the incumbent CSD is then given by

$$\begin{cases} N & \Lambda \leq \Lambda' + C \\ 0 & \Lambda > \Lambda' + C \end{cases}$$

Because the switching cost is the same for all customers, the incumbent either captures the entire market for transaction management ($n = N$), with no entry, or cedes the entire market for transaction management to the competitor ($n = 0$).

In this case potential competition from the competing custodian restrains the fixed price Λ set by the CSD for providing securities transaction services. If it chooses $\Lambda > \frac{X_1}{N} + X_2 + C$ then the competing custodian bank is able to choose $\Lambda' = \Lambda - C + \epsilon = \frac{X_1}{N} + X_2 + \epsilon$ for some $\epsilon > 0$, capturing all the customers ($n = 0$), and making a positive profit $\Pi' = N \times \epsilon > 0$. Hence profits are maximised by choosing $\Lambda = \frac{X_0 + X_1}{N} + X_2 + X_3 + C$, retaining all N customers and obtaining profits from securities transaction services of

$$\Pi = N \times C + X_1$$

Profits thus equal the number of customers times the switching cost $N \times C$ plus the incumbent's fixed cost advantage X_1.

4.1.2 The impact of simplified standards

Consider now an agreement across the industry, introducing simplified communication standards. Suppose this has the following impacts on costs:

- It reduces the fixed cost C of switching to an alternative supplier of transactions management services, from the CSD to the custodian bank, ie it alters C by $\Delta C < 0$
- It lowers the per account costs of providing securities transaction services, so X_2 alters by by $\Delta X_2 < 0$ and X_3 by $\Delta X_3 < 0$.
- It lowers the fixed costs of providing securities transaction services, to incumbent and to the competitors, so X_0 alters by $\Delta X_0 < 0$ and X_1 by $\Delta X_1 < 0$.
- The change in standards involves a fixed investment cost of K for each CSD and custodian.

Under the assumptions of this model, the introduction of the new standards will then result in a change of profits for the CSD of:

$$\Delta\Pi = \Delta X_1 + N \times \Delta C + K < 0$$

Because competitors have access to the same technology, the reductions in the per account costs X_2 and X_3 and fixed costs X_0 have no impact on profits. Thus even if processing costs are substantially reduced by the introduction of new standards, incumbent revenues decline by more than costs and profits fall. Even in this case where switching costs and linkage costs remain unchanged, CSD profits are still reduced by the cost of implementing the standard K.

The introduction of new standards could only raise incumbent profits if it had a differential impact on costs, lowering the processing costs of the incumbent by more than the processing costs of the potential competitor. While this is not impossible the impact would have to be large enough to more than offset the increase in competition arising from lower switching and linkage costs and the fixed costs of implementing the standard.

4.2 Model 2: the case of domestic and foreign customers

This subsection extends the simple model of the previous sub-section to a situation where there are two securities, for which transaction accounts are each provided by a different CSD. These two securities can be interpreted as domestic securities located in different countries a and b, although they could as well be a domestic and an international security. Assume that there are N customers in country a (domestic customers) seeking to settle 1 transaction per period of securities located in a. There are also n customers from country b (foreign customers) seeking to settle $\theta \leq 1$ transactions per period of securities located in country a. Discriminatory charging (different prices for domestic and foreign customers) is prohibited.

4.2.1 Domestic competition for foreign and domestic investors

The Appendix derives the equilibrium average pricing and profits in this extended model. Consider first the situation where (for legal or other reasons, including differing national standards) only domestic firms are able to compete in the market for transaction processing of securities traded and issued in country a. Since foreign customers have different transaction volumes than domestic customers, it is now necessary to distinguish per-customer membership charges (Λ) from per transaction charges (λ). Note that average per-customer revenue will be a weighted average of Λ and λ, with the weights depending upon both the numbers of domestic and foreign customers (N, n) and the volume of transaction undertaken by each customer $(1, \theta)$. As shown

in the appendix, the equilibrium average per customer revenue is then subject to the constraint[8]

$$\Lambda + q\lambda \leq C + X_2 + qX_3 + \frac{X_0 + X_1}{N + n} \tag{4.1}$$

where q is the average number of transactions per customer given by:

$$q = \frac{N + \theta n}{N + n}, \qquad \theta < q < 1$$

and when this constraint binds, ie when charges are set so as to maximise profits, the domestic incumbent makes profits of

$$\pi = (N + n)\, C + X_1 \tag{4.2}$$

ie the incumbent now makes profits that capture the switching costs of both domestic and foreign customers.

Note that foreign investor business is much more profitable, on a per transaction basis, than domestic investor business. This is because the rent per customer C extracted from the switching cost is spread over a much smaller number of transactions. The model thus also explains why 'cross-border' securities processing is relatively expensive, a consequence of the smaller volume of transactions per customer.

4.2.2 International competition for foreign and domestic investors

As shown in the Appendix, in this model allowing foreign CSDs to enter intensifies competition in the market for transactions processing of domestic securities. In this case the average per customer revenue constraint is

$$\Lambda + q\lambda \leq C + X_2 + qX_3 + \frac{X_1}{N + n}$$

and when this constraint binds the domestic incumbent now makes profits of

$$\pi = (N + n)\, C + X_1 - X_0 \tag{4.3}$$

The reason for the lower level of profits in (4.3) compared to (4.2)is that the fixed costs X_0 of foreign CSDs are already covered by their own processing and custodian business. Unlike domestic potential entrants they only have to cover the additional linkage costs X_1 in order to compete for domestic business. The profits of the domestic incumbent are reduced by X_0.

The outcome is displayed geometrically in Figure 1. Here the horizontal axis represents the per-transaction charge while the vertical represents the charge per customer. The upper solid line is the constraint when there is only domestic competition. The middle dashed line is the constraint when there

[8]There are additional constraints on pricing, stated in the appendix, avoiding the possibility that either domestic or foreign customers are captured by the domestic competitor. These constraints affect the relative magnitude of Λ and λ but do not affect total revenues or profits.

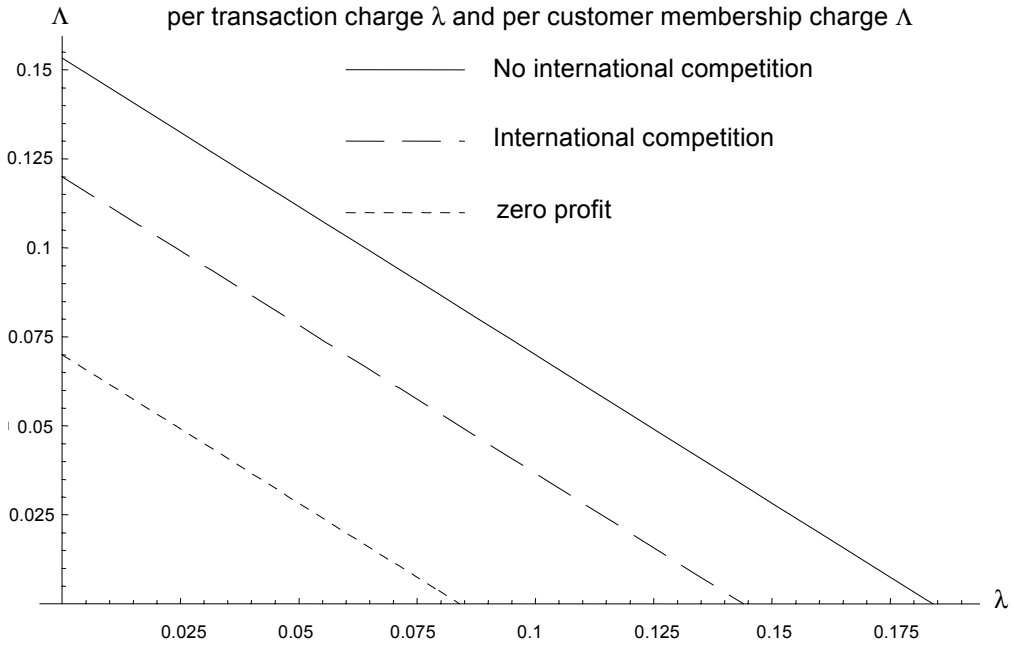

Figure 1: Pricing constraints on incumbent

is foreign competition. The profits of the incumbent are represented by the distance between these lines and the zero-profit charging line (the dotted line). The introduction of foreign competition moves the pricing constraint inward and reduces profits. Note that shifting the mix of charging – for example reducing the per customer charge while increasing the per-transaction charge, while keeping average per-customer charges constant – does not affect profits. The mix of charges is undetermined in this model.

The principal additional insight offered by this extended model with international competition is that the introduction of European or global standards, that allow cross border supply of securities transaction services, will further increase competition and reduce the profitability of incumbent suppliers by more than a similar change to standards affecting only domestic suppliers. This is because these new foreign entrants do not need to cover the fixed cost X_0 which domestic entrants must pay in order to compete for customers transacting in domestic securities. Entry barriers are effectively reduced. Increased foreign competition provides a further reason why the profits incumbent service providers may fall following a change in processing standards that facilitates cross-border settlement transactions.

5 Conclusion: governance and the promotion of efficient securities processing standards

This paper has reviewed standard setting in post-trade securities processing and analysed how changes in these standards impact on the profitability of providing securities transaction services. The main point developed here, supported by the models presented in Section 4, is that the introduction of harmonised simple standards for messaging and other aspects of securities processing is likely to lower the profitability of the providers of securities transactions services, by reducing the costs of switching between suppliers and the costs of market entry by overseas competitors. Consumers of these services, mostly broker-dealers and institutional investors, gain from harmonisation and simplification of processing standards, through lowered transaction costs and more reliable and faster automated processing. But firms supplying transaction services may be reluctant to implement these changes.

This is not the situation in all industries. As discussed in section 3 it is possible for standardisation to have the opposite impact, reducing competition and increasing profitability. For example where customer demand depends on market share (eg where there is an 'adoption' externality for compatible products) then standardisation, widening these externalities to cover all products on the market, reduces incentives to compete for market share and this in turn can lead to higher prices and increased profitability. Standardisation may also promote growth in demand. In communication industries such as telecoms, there are strong business incentives to create common standards, eg for international traffic, to support market growth. These mechanisms do not appear to be anything like so strong in the case of securities processing where 'adoption externalities' are not so obviously important and where the volume of transactions is not greatly dependent on standards.

While outside the formal modelling presented in this paper, other factors also inhibit the introduction of new simplified standards in securities processing. Adoption of standards in financial markets is, generally, voluntary. Individual institutions may be reluctant to replace legacy processing systems. They may agree to minor changes in standards that can be adopted through adjustments to existing procedures; but be reluctant to agree to radical change such as the introduction of entirely new XML formatting. The new formats may struggle to acquire critical mass.

This implies that the ownership, objectives, and governance of post-trade institutions; and of industry standard-setting bodies are critical to the successful introduction of new standards and the promotion of fully automated straight through processing. Both broker dealers and final customers, particularly institutional investors and trading institutions such as hedge funds, need to be represented in the process of standard setting for the securities processing industry and would be well advised to pay careful attention to the setting of standards.

This also draws attention to questions of ownership structure and governance. Some providers are customer owned and sometimes also not-for

profit (eg DTCC in the US, Euroclear in Europe). Others, notably banks providing cross-border securities processing such as Citigroup and BNP-Paribas, are for private public-equity firms. Finally there are some subsidiaries of for-profit securities exchanges (including the Deutsche Borse subsidiary Clearstream). There is no obvious solution to the challenge of persuading a such wide group of suppliers, each with their own business interests, to accept simplified, and harmonised processing standards. It is not even clear which form of ownership creates the strongest incentives to adopt new standards. Customer-owned suppliers may have relatively weak incentives introduce new processing standards, since they are in large part owned by exchanges and broker-dealers who do not benefit directly from lower charges to final investors. Final investors on the other hand, may be able to influence for profit companies to introduce new standards, because they are the ultimate owners.

SWIFT plays a central role, because of its broad industry ownership and the important function it already plays in establishing messaging formats. But as noted above in Section 2, SWIFT cannot make firms adopt new standards, these are ultimately individual business decisions. In the context of promoting standardised common arrangements for securities processing across Europe, public authorities will need to pay close attention to both the efforts of SWIFT and of the securities market practice group (SMPG) to develop and establish common European securities processing standards; and to the adoption of these standards across the industry. Little progress may be made without the threat of regulatory intervention, for example to impose standards on the industry.

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Appendix

Model solution

This appendix presents the solution of model 2 of Section 3. model 1 is a special case of model 2 when $n = 0$ and there is only domestic competition for securities processing business. A solution to the model is described by the equilibrium pricing decisions of the incumbent CSD (membership fee Λ and per transaction fee λ), as constrained by the pricing decision of the potential competitors (the domestic competitor setting a membership fee Λ' and per transaction fee λ' and the foreign CSD setting a membership fee Λ'' and per transaction fee λ'')

Profits
Assuming it retains the business of both foreign and domestic customers, the profits of the incumbent can be written as

$$\pi = N(\Lambda + \lambda - X_2 - X_3) + n(\Lambda + \theta\lambda - X_2 - \theta X_3) - X_0$$

If the domestic competitor attracts both domestic and foreign customers it earns profits of

$$\pi = N(\Lambda' + \lambda' - X_2 - X_3) + n(\Lambda' + \theta\lambda' - X_2 - \theta X_3) - X_0 - X_1$$

while if it attracts only domestic customers it earns profits of

$$\pi = N(\Lambda' + \lambda' - X_2 - X_3) - X_0 - X_1$$

If the overseas competitor attracts both domestic and foreign customers it earns profits (from this additional business) of

$$\pi = N(\Lambda'' + \lambda'' - X_2 - X_3) + n(\theta\lambda'' - X_2 - \theta X_3) - X_1$$

while if it attracts only the foreign customers it earns profits of

$$\pi = n(\theta\lambda' - X_2 - \theta X_3) - X_1$$

Incentives to switch
The domestic customers will switch to the domestic competitor if the reduction in charging exceeds the switching cost

$$\Lambda - \Lambda' + \lambda - \lambda' > C$$

and

$$\Lambda' + \lambda' \leq \Lambda'' + \lambda''$$

while they will switch to the foreign competitor if

$$\Lambda - \Lambda'' + \lambda - \lambda'' > C$$

and

$$\Lambda' + \lambda' > \Lambda'' + \lambda''$$

The foreign customers will switch to the domestic competitor if the reduction in charging exceeds the switching cost

$$\Lambda - \Lambda' + \theta(\lambda - \lambda') > C$$

and

$$\Lambda' + \theta\lambda' \leq \Lambda'' + \theta\lambda''$$

while they will switch to the foreign competitor if

$$\Lambda - \Lambda'' + \theta(\lambda - \lambda'') > C$$

and

$$\Lambda' + \theta\lambda' > \Lambda'' + \theta\lambda''$$

Determination of pricing: domestic competition only
Λ and λ are set at levels at which a zero profit competitor(s) imposing prices of Λ' and λ' or Λ'' and $\theta\lambda''$ can just persuade both domestic and foreign customers to switch.Consider first the domestic competitor competing for all customers. Λ and λ must satisfy

$$\pi' = N(\Lambda' + \lambda' - X_2 - X_3) + n(\Lambda' + \theta\lambda' - X_2 - \theta X_3) - X_0 - X_1 \leq 0$$

and

$$\begin{aligned} \Lambda^* - \Lambda' + \lambda^* - \lambda' &= C \\ \Lambda^* - \Lambda' + \theta(\lambda^* - \lambda') &= C \end{aligned}$$

which yields the following constraint on average revenue per customer (which is also a constraint on total revenue since when this constrain applies the incumbent retains all the customers):

$$\Lambda + q\lambda \leq C + X_2 + qX_3 + \frac{X_0 + X_1}{N + n} \tag{5.1}$$

where q is the average number of transactions per-customer given by:

$$q = \frac{N + \theta n}{N + n}$$

(note that since $\theta < 1$ and $n < N$ $qsatisfies$ $\theta < q < 1$.) When this constraint binds the domestic incumbent makes profits given by (4.2)

Determination of pricing: foreign competition
Consider next the introduction of the foreign competitor. Λ and λ must satisfy

$$\pi'' = N\left(\Lambda'' + \lambda'' - X_2 - X_3\right) + n\left(\theta\lambda'' - X_2 - \theta X_3\right) - X_1 \leq 0$$

and

$$\begin{aligned} \Lambda^* - \Lambda'' + \lambda^* - \lambda'' &= C \\ \Lambda^* + \theta\left(\lambda^* - \lambda''\right) &= C \end{aligned}$$

which yields the total revenue constraint

$$\Lambda + q\lambda \leq C + X_2 + qX_3 + \frac{X_1}{N+n} \tag{5.2}$$

and when this constraint binds the domestic incumbent makes the lower level of profits given by (4.3).

Additional pricing constraints
Finally there is the possibility of losing only a subset of customers, either the domestic customers alone, or the foreign customers alone. This imposes additional constraints on the relative values of Λ and λ (the balance between per transaction and per member charges). There are two such constraints when there is no foreign competition and two more constraints when there is foreign competition.

When there is competition from only a domestic potential entrant then the incumbents prices must be such that

$$\pi' = N\left(\Lambda' + \lambda' - X_2 - X_3\right) - X_0 - X_1 \leq 0$$

when

$$\Lambda - \Lambda' + \lambda - \lambda' = C$$

yielding

$$\Lambda + \lambda \leq C + X_2 + X_3 + \frac{X_0 + X_1}{N}$$

and also

$$\pi' = n\left(\Lambda' + \theta\lambda' - X_2 - X_3\right) - X_0 - X_1 \leq 0$$

when

$$\Lambda - \Lambda' + \theta\left(\lambda - \lambda'\right) = C$$

yielding

$$\Lambda + \theta\lambda \leq C + X_2 + \theta X_3 + \frac{X_0 + X_1}{n}$$

Computing the price levels at which these constraints bind, together with the aggregate per customer revenue constraint (5.1) yields upper and lower bounds on the per transaction prices of:

$$X_3 - \frac{X_0 + X_1}{n\,(1-\theta)} \leq \lambda \leq X_3 + \frac{X_0 + X_1}{N\,(1-\theta)}$$

When there is competition from a foreign competitor then the incumbents prices must be such that

$$\pi'' = N\,(\Lambda'' + \lambda'' - X_2 - X_3) - X_1 \leq 0$$

when

$$\Lambda - \Lambda'' + \lambda - \lambda'' = C$$

yielding

$$\Lambda + \lambda \leq C + X_2 + X_3 + \frac{X_1}{N}$$

and also

$$\pi'' = n\,(\theta\lambda'' - X_2 - X_3) - X_1 \leq 0$$

when

$$\Lambda + \theta\,(\lambda - \lambda') = C$$

yielding

$$\Lambda + \theta\lambda \leq C + X_2 + \theta X_3 + \frac{X_1}{n}$$

Combined with (5.2) these constraints imply that the per-transaction charging must satisfy

$$X_3 - \frac{X_1}{n\,(1-\theta)} \leq \lambda \leq X_3 + \frac{X_1}{N\,(1-\theta)}$$

In practice these additional constraints (computed using reasonable parameter values such as those adopted for Figure 1) are rather wide, allowing for the possibility even of negative values for either Λ or λ.

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Suomen Pankki
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