Perhaps no other industry has been affected by the e-commerce revolution more than financial services. The Internet, together with deregulation and globalization, has engendered a wave of hypercompetition that includes the emergence of new exchanges, markets, and distribution channels providing opportunities for cost reduction and strategic advantage [2]. While equities markets have been the focus of much research [2, 8, 12], scant attention has been paid to the structural transformation occurring within foreign exchange markets enabled by Web trading platforms. In terms of volume, foreign exchange (forex or fx) may represent the largest e-commerce opportunity yet. According to the Bank for International Settlements (BIS), forex is the leading segment of world financial markets; its roughly $1.2 trillion in daily turnover is approximately equivalent to a month of combined NYSE and Nasdaq trades. While still comprising a small portion of the overall fx market, Greenwich Associates
Participants in foreign exchange markets can be categorized according to whether they are on the buy side or the sell side of the market structure (see Figure 1). On the buy side, institutional investors, small- and medium-sized banks, and corporations trade for a variety of reasons, including to support activities in foreign markets and to hedge against equity. On the sell side, dealer banks execute trades for buy-side clients and may also trade on their own behalf for profit. Instruments range from basic spot and forward transactions to more sophisticated currency swaps and options.

In contrast to equities markets, forex markets are largely unregulated and traded primarily over the counter without a central clearinghouse, which has led to a two-tiered market structure. The first tier comprises sell-side dealer banks trading among themselves on the interdealer market. The second tier includes trading between sell-side dealers and buy-side clients. This two-tiered structure has been reinforced by electronic brokering systems open exclusively to dealer banks, which are able to leverage wider second-tier spreads and a lack of transparency to their benefit.

Three primary trading mechanisms are employed within forex markets: telephone trading among brokers in the interdealer market; electronic brokering between sell-side dealer banks; and eFX platforms (see Figure 2).

**Telephone Trading.** Traditional currency trading consists of brokers exchanging quotes for currency pairs and making trades by phone. At the end of the day, the trade is sent to the bank’s back office where settlement arrangements are made for a specific date that varies with the type of instrument (spot, forward, and so on). Still widely used, telephone trading promotes personal relationships and rich information exchange. However, the use of verbal orders and multiple, disparate IS creates a process plagued with inefficiencies and prone to costly errors. Online systems are also seen as offering critically important audit trail and monitoring capabilities. Recent currency trading scandals, such as the case of Allied Irish Bank rogue trader John Rusnak who hid $619 million in losses before being discovered, have created a curious turn in events. When once firms wor-
In 1992, Reuters innovated time by an order of magnitude. Bank consortia (see Figure 1). Arose: single-bank sponsored; independents; and emerged, and three categories of eFX subsequently systems (sometimes referred to as eFX portals) thus evolved proprietary applications directly linked to managers and corporate traders. Some banks developed multibank eFX systems. The market for Internet-based multicounterparty systems were introduced to the market to promote speed, accuracy, and productivity among sell-side banks in the interdealer market. The Reuter Monitor Dealing Service (RDS) was launched in 1981 and was an immediate success because it reduced average transaction time by an order of magnitude. In 1992, Reuters innovated again by introducing Dealing 2000–2, the first international computerized matching service for foreign exchange. In response to Reuters’ market domination, a consortium of 12 banks in 1993 launched the rival Electronic Brokering Services Limited (EBS) Spot Dealing system. RDS and EBS have emerged as de facto standards for interdealer forex, accounting in 2000 for approximately 90% of interbank trading in major currencies according to the BIS. The aggregate impact of electronic brokering has been to narrow spreads and dramatically improve both operational and market efficiency [9].

**Interdealer Electronic Brokering.** Electronic brokering systems were introduced to the market to promote speed, accuracy, and productivity among sell-side banks in the interdealer market. The Reuter Monitor Dealing Service (RDS) was launched in 1981 and was an immediate success because it reduced average transaction time by an order of magnitude. In 1992, Reuters innovated again by introducing Dealing 2000–2, the first international computerized matching service for foreign exchange. In response to Reuters’ market domination, a consortium of 12 banks in 1993 launched the rival Electronic Brokering Services Limited (EBS) Spot Dealing system. RDS and EBS have emerged as de facto standards for interdealer forex, accounting in 2000 for approximately 90% of interbank trading in major currencies according to the BIS. The aggregate impact of electronic brokering has been to narrow spreads and dramatically improve both operational and market efficiency [9].

**Table 1. Key issues faced by leading providers of multibank eFX systems.**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank consortium eFX system</td>
<td>eFX platform owned by multiple banks.</td>
</tr>
<tr>
<td>Buy side</td>
<td>Generally, institutional funds, small and mid-sized banks, and corporations that trade currencies with dealer banks.</td>
</tr>
<tr>
<td>Central clearinghouse</td>
<td>Third-party financial organization that matches buy and sell orders and keeps track of the obligations and payments required of the clearinghouse members.</td>
</tr>
<tr>
<td>Corporate treasurer</td>
<td>Corporate officer responsible for designing and implementing many of the firm’s financing and investing activities. FX buy side player.</td>
</tr>
<tr>
<td>Currency broker</td>
<td>Agent who executes orders to buy and sell currency. Paid on commission basis. Does not act as principal or agent trading on its own account. In the forex market, brokers tend to act as intermediaries between banks, bringing buyers and sellers together.</td>
</tr>
<tr>
<td>Dealer bank</td>
<td>Firm acting as a principal, rather than as an agent, in the purchase and/or sale of securities. Dealers trade on their own account.</td>
</tr>
<tr>
<td>EBS</td>
<td>Partnership founded in 1990 to develop an electronic broking system for interbank foreign exchange to compete against Reuters. Comprised of subsidiaries of 12 banks and the MINEX Corporation of Japan.</td>
</tr>
<tr>
<td>eFX platform</td>
<td>Forex trading system utilizing Internet standards and providing enhanced functionality and value-added services relative to electronic brokering systems. Allows for multiple counterparties.</td>
</tr>
<tr>
<td>Electronic brokering system</td>
<td>System for automating forex trading process (principal systems are EBS and Reuters). Early systems utilized electronic real-time chat, which evolved toward automated order-matching functionality. Trading is carried out through a network of linked computer terminals among the participating users.</td>
</tr>
<tr>
<td>First tier (interdealer market)</td>
<td>Market for trading forex whose participants are dealers banks.</td>
</tr>
<tr>
<td>FIX</td>
<td>Financial Information Exchange.</td>
</tr>
<tr>
<td>FIXML</td>
<td>W3C XML-based variant of FIX targeted at automating front-office communications.</td>
</tr>
<tr>
<td>Foreign exchange (forex, fx)</td>
<td>The simultaneous buying of one currency and selling of another in an over-the-counter market.</td>
</tr>
<tr>
<td>Foreign exchange market</td>
<td>Set of international, 24/7 markets in which arrangements are made today for future exchange of major currencies. Used strategically and tactically, for example, to hedge against major swings in forex rates.</td>
</tr>
<tr>
<td>Forward</td>
<td>Contract that sets today the terms (including price and quantity) at which a party may buy or sell an asset at a specific time in the future.</td>
</tr>
<tr>
<td>FpML</td>
<td>Financial Products Markup Language for derivatives.</td>
</tr>
<tr>
<td>Hedge</td>
<td>An action, such as entering into a derivatives position, that reduces the risk of loss.</td>
</tr>
<tr>
<td>Independent eFX system</td>
<td>eFX platform owned by an independent party that is not a bank.</td>
</tr>
<tr>
<td>ISO 15022</td>
<td>New standard for back-office TMS processes.</td>
</tr>
<tr>
<td>Option</td>
<td>Contract giving the buyer the right, but not the obligation, to buy or sell the underlying asset at a prespecified price.</td>
</tr>
<tr>
<td>Reuters</td>
<td>A leading global provider of news, financial information, and technology solutions to financial institutions, businesses, and the media. Operates an interbank electronic brokering system.</td>
</tr>
<tr>
<td>Second tier</td>
<td>Market for trading forex in which dealer banks trade for buy-side clients, including institutional investors, small banks, and corporate treasuries.</td>
</tr>
<tr>
<td>Sell side</td>
<td>Large dealer banks that trade currencies with funds and corporations on their own account and for buy-side clients.</td>
</tr>
<tr>
<td>Single bank eFX system</td>
<td>eFX platform owned by a single bank.</td>
</tr>
<tr>
<td>Spot</td>
<td>Current market price of an asset. Transaction occurs immediately, but the funds will usually change hands within two days after the deal is struck.</td>
</tr>
<tr>
<td>Swap</td>
<td>Simultaneous buy and sell of a foreign currency amount for two different settlement dates. A swap is effected to reschedule foreign currency payments.</td>
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</table>

**eFX.** Although the sell side benefited greatly from electronic brokering, buy-side processes lagged, presenting a market opportunity to enhance trading efficiencies for investment managers and corporate traders. Some banks developed proprietary applications directly linked to clients, creating switching costs and lock-in. However, such systems do not support multiple counterparties, a requirement for most buy-side traders. The market for Internet-based multcounterparty systems (sometimes referred to as eFX portals) thus emerged, and three categories of eFX subsequently arose: single-bank sponsored; independents; and bank consortia (see Figure 1).

Single-bank-sponsored multibank systems are owned and operated by one bank, but permit other banks to participate and compete for business along with the sponsor. The pioneer and market leader is State Street’s FX Connect, which is the forex component of its Global Link financial portal. FX Connect was launched in 1996 to serve the bank’s institutional clients via spot, forward, and swap transactions. In contrast to the wide availability of equities market information, forex markets have no equivalent mechanism available to all market participants. State Street fills this gap by providing unique market research—daily volumes,
price swings, cross country flows—to asset managers and institutional clients. By supplying anonymous and aggregate market information that is otherwise unavailable to money managers, State Street demonstrates how synergies among IT-enabled core businesses and monetizing information can generate a competitive resource that is difficult for rivals to match [5]. Principal sources of information are its growing custody business, which as of early 2004 amounted to over $9.4 trillion in assets, accounting for some 15% of the world’s tradable securities, and the firm’s dominant market share of institutional forex. It is this access to strategic information coupled with trading process automation, rather than the narrowing of spreads, that provides the adoption incentive for institutional investors.

The second category of eFX is the independent provider: one example is the start-up Currenex, which began trading in April 2000. Independent providers of eFX systems offer a multibank platform, but unlike single-bank-sponsored systems do not function as a counterparty in the exchange. This characteristic creates both the greatest strength and most glaring weakness of the independents. For example, client firms are attracted to independent eFX systems specifically because the owners are not controlled by banking interests [11]. Conversely, independents may suffer from resource limitations necessary for achieving a sustainable electronic market, including brand awareness, trust, liquidity, and complementary service offerings. Revenue from such additional services may be particularly important, given the razor-thin margins in exchange operation. The 2001 failure of independent CFOWeb illustrates the difficulty in developing a successful independent platform.

The third category of eFX system operators, bank consortia, emerged later than single bank and independent systems, suggesting a reactive competitive posture. Bank consortia partners have an immediate market advantage in terms of liquidity, trust, and customer relationships, but demonstrate concerns over heightened competition, narrower spreads, and waning profits. In addition, potentially bitter rivals must partner on a shared platform and develop and maintain successful cooperative relationships—no simple task. For example, Atriax was formed when Chase, Citibank, and Deutsche Bank withdrew from talks with 13 rivals, who subsequently formed the competing FXall platform [10]. After less than a year Atriax announced its closure, illustrating that the backing of industry leaders is no guarantee of success. Bank consortia also are subject to potential antitrust scrutiny.

**Economics, Incentives, Markets, and Technology**

A complex set of interrelated phenomena are rapidly transforming forex markets. To shed light on such forces, how they relate, and their potential implications, we examine four principal dynamics within forex markets: business models; network effects and liquidity; market segmentation; and standards and technology. We focus on differential resources and capabilities of firms and partnerships, in particular, intangible assets enabled or leveraged by information systems that may provide competitive advantage (see Table 1). Understanding such dynamics is critical to success within forex and other digital goods markets.

**Business Models.** Independent eFX providers must achieve profitability to remain in business. In contrast, single-bank and consortia systems can be sustained as loss leaders provided that they fuel demand for complementary revenue-generating services. As such, a firm with scope across many services can afford to subsidize an eFX platform provided that profits are transferred from other areas of the firm. Independents are thus at a disadvantage in this regard. Moreover, though banking consortia systems may yield operational savings for owner-members, market forces are likely to reduce spreads and trading margins, enhancing the need for complementary information-based services. For example, users of the free services within State Street’s Global Link platform consume considerably more of the firm’s fee-based services than non-Global Link customers [1]. In contrast, the Atriax consortia was unable to leverage complementary informational services, resulting in three of the world’s largest forex banks consuming approximately $100 million before going out of business.

**Network Effects and Liquidity.** Directly related to the issue of revenue models and economic viability is the need to attract a critical mass of buy-side and sell-side firms so that an efficient market can be developed and sustained. It might appear that bank consortia have an advantage in this regard due to long-term client relationships and the explicit bond of an established credit line, both of which are reinforced by daily conversations between the dealer and client. As banks and bank clients account for a significant portion of existing forex not conducted via eFX systems, banks that can migrate current customers to an online system should achieve immediate liquidity. Despite these apparent advantages, however, the ability of consortia banks to establish client interest and achieve bank commitment to migrating clients to the consortia eFX platform is
counteracted by the desire to preserve client relationships and limit competition.

Independent and single-bank eFX platforms must also secure buy-side clients and sufficient numbers of liquidity providers. A frequent tactic of start-up firms has been to attract blue-chip clients with aggressive pricing or equity stakes, then leverage these clients in public relations campaigns that strengthen the firm’s branding. Network effects suggest the firm that moves early will see the market tip in its favor. If participants seek the most efficient and largest market, then this would spark adoption of any effort with a liquidity advantage relative to others. Currenex adopted this tactic, both by touting its blue-chip client list to the press (buy-side clients include MasterCard, Caterpillar, Intel, and Nokia), and by selling an equity stake to Royal Dutch Shell, a firm with the potential to migrate $200 billion in annual forex trades. Sell-side firms interested in working with the independents include second-tier fx banks that were not backers of the other consortia efforts. Banks may participate in multiple eFX systems simultaneously, and smaller banks have an incentive to join multiple systems to gain scale that might not otherwise be available to them. By 2004, Currenex claimed over 50 sell-side liquidity providers as members, many of whom also participated in other eFX systems.

By contrast, State Street’s focus on the institutional market meant it had already established relationships with a significant portion of the target buy-side customer base. However, the participation of equal-status sell-side dealer banks was vital to creating a truly neutral platform with broad appeal. State Street was able to attract dealer banks by recruiting existing buy-side clients as de facto sales representatives. These institutional investors were interested in the automational benefits of the FX Connect system, so they aggressively solicited the participation of dealer banks with which they had established relationships. Since most institutions deal with multiple banks, the risk of a bank not adopting is one of losing business to a competitor who has joined FX Connect and who also services the client. While State Street’s competitors may have ignored its offer to join FX Connect, they did not ignore the requests of their influential clients and risk losing their business.

Alliances with firms providing key distribution channels can further enhance liquidity and network effects. In Nov. 2003, an alliance with treasury systems provider SunGard gave State Street immediate access to the corporate fx market, which it previously did not serve. The alliance embeds FX Connect into the 1,400 client workstations used by SunGard customers. Similarly, Interdealer fx provider EBS has struck a distribution alliance with Bloomberg to carry EBS Trader, the firm’s entry into the dealer-to-client fx market.

**Market Segmentation.** The market for foreign exchange can be classified into different segments, including institutional, corporate, and speculation, with each segment having distinctive characteristics. Segmentation is related to eFX adoption and may be

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**Table 2. eFX terminology.**

<table>
<thead>
<tr>
<th>Platform Type</th>
<th>Single Bank Sponsored</th>
<th>Independent Non-bank</th>
<th>Consortia Sponsored</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>State Street FX Connect (profitable)</td>
<td>Currenex (Cashflow positive by 2004)</td>
<td>FXall (Cashflow positive in 2003)</td>
</tr>
</tbody>
</table>
| Revenue Model | • Transaction fee paid by price maker  
• Low margins, but cross-complementarities with many fee-based services  
• eFX can serve as a loss leader for other services | • Transaction fee paid by both counterparties  
• Low margins with limited complementary services  
• Sustainability in question | • Transaction fee paid by price maker  
• Low margins  
• Potential for cross-complementarities with fee-based services unclear |
| Network Effects and Liquidity | • Sell-side banks reluctant to join effort run by competitor  
• Employ buy-side customers as sales force to recruit their sell-side banks  
• Sell-side bank adoption incentive is retaining currency trading business | • Lack of an initial buy-side client base  
• Incentives include equity stakes and aggressive pricing  
• Large sell-side banks may follow big customers  
• Smaller banks join multiple efforts hoping to gain scale | • Liquidity base through scale and established client relationships  
• Potential for narrower spreads, weaker client relationships, and commoditization acts as disincentive |
| Market Segmentation | • Initially focused on institutional market  
• High volume  
• Relatively smaller number of clients  
• Entered corporate market via alliance with tech provider (SunGard) | • No clear segmentation  
• Lack of existing relationships with multiple buy-side clients  
• Poor ability to interact with and reinforce client ties with platform owner | • Corporate market  
• Large, diverse customer base  
• Smaller transaction volume  
• Growing institutional client base |
| Standards and Technology | • Complex technology, learning curves, and uncertainty regarding platform survival  
• Lower and slower time to entry  
• Industry requires further standardization for widespread system interoperability  
• Open-standards efforts under way, but high risk and cost deterred early progress | • Increasing adoption as reliable integration between trading platforms, banks, and treasury management systems is achieved | |
inhibiting eFX growth. Specifically, many buy-side firms value personalized service over the speed and cost advantages of eFX. Phone orders provide a comfort factor in that the dealer can verbally assist a client with complex trades. This attention is important in many firms with less-aggressive fx policies and where the trader represents a high-turnover staff position occupied by individuals advancing within a firm's internal finance organization.

Platforms focusing on a particular market segment can differentiate offerings in a competitive market and can assist platform owners in efficiently allocating resources for technical and business development [7]. These benefits of a segment-focused strategy are evident in State Street’s initial targeting of FX Connect at institutional investors. Although the number of institutional investors is much smaller than the number of corporate clients, institutions are responsible for the majority of forex growth in recent years and now account for the largest segment of currency trading outside of the interbank markets, a segment roughly twice the size of the corporate market (see Figure 3). In addition to synergies with State Street’s core businesses, the firm’s initial focus allowed it to realize significantly greater volume distributed across a much smaller customer base that is easier to service.

Noninstitutional markets are diverse, including segments focused on trading to support cross-border transactions, to hedge foreign exposure, and to better enable speculation. The diversity in these offerings may provide some room for niche players to survive. However, it remains to be seen whether it is possible or even desirable to exploit these segments via niche eFX when rivals in larger market segments may threaten entry.

Standards and Technology. Market formation for digital products is highly dependent upon technical soundness and the wide adoption of compatible technology. Poor technology can raise implementation, learning, and support costs, and stifle adoption. While the size and reputation of backers can be important in bringing potential clients to the table, eFX systems are fundamentally technology based, and effective technical implementation is critical to success. Both the failed CFOWeb and Atriax systems developed their platforms using technology from the same vendor. Atriax’s technical platform was so suspect, it led Euromoney magazine to label the effort “yet another example of how bad technology and poor management can ruin a good idea” [6]. A key factor in the downfall of Atriax was the substantial difficulty that dealer banks had in integrating with its technology platform—at its closing only three of 20 member banks had successfully merged with the system.

Standardization can be critically important because widely adopted standards expand the usability—and hence the appeal of a platform—and create lock-in favoring those controlling the standard. While proprietary systems can dominate markets if such efforts are able to tip usage in their favor, in an emerging market without a leading proprietary standard, embracing open standards can create price benefits and motivate adoption [3]. Standards that are able to link buy-side treasury systems with sell-side banks are vital for realizing straight-through processing from placement to settlement, widely considered to be a key benefit of eFX systems. One of the principal reasons for initially slow adoption was the initial lack of straight-through processing support among eFX platforms, as well as a reluctance to invest in systems prior to the emergence of clear standards. Treasury management systems (TMS) handle currency position, registration of trades, settlement, and cash management functions. For maximum efficiency, a common standard is needed to integrate the various TMS and eFX offerings to fully automate currency dealing and settlement. Several efforts to provide such integration are under way, including TWIST, FIX, FIXML, ISO 15022, and FpML (see Table 2).

Conclusion
Our analysis of business models, network effects and liquidity, market segmentation, standards, and technology has implications for forex and digital goods markets. Profit does not automatically result from the application of technology to exploit an existing market inefficiency, no matter how massive the potential opportunity. While market timing and traditional competitive resources such as scale and customer base remain important, they are not sufficient. Only firms with the ability to create institutional resources for sustainable advantage [5] and that are strategically aligned to be sufficiently motivated to aggressively pursue such markets have any strong potential for success.

eFX platforms are driving forex markets toward commoditization, complete transparency, improved efficiency, and end-to-end automation via straight-through processing. However, benefits for participating within various segments of the buy- and sell-side communities remain uncertain. Successful eFX platforms must not only solve nontrivial technical problems—notably, integration with heterogeneous back-end TMS—they must also establish the proper incentives to sustain a viable, liquid exchange
that can generate enough return to justify investment. Millions of dollars have been lost in efforts that have failed to overcome these challenges. Following patterns that have occurred in industries as diverse as retail merchandising and computer hardware, the commoditization of foreign exchange may push competition to extremes of scale-based efficiency or the provision of value-added services (see Figure 2). eFX may become a marginal contributor or even a loss leader for firms with the scope to leverage FX in cross-complementary markets. Yet, given an opportunity to exploit switching costs and network effects, those few platforms that remain are likely to yield advantages to parent firms comparable to those of the classic examples of strategic electronic marketplaces.

**References**


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