

# **New Perspective on FX Markets: Order-Flow Analysis**

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## **Abstract**

Though fundamental and technical analysis are still widely used in foreign exchange markets, a new type of analysis has emerged: order-flow analysis. Order-flow analysis uses the flow of buy and sell orders to both explain exchange rates contemporaneously and forecast future movements. This article contrasts order-flow analysis with the traditional approaches and reviews lessons learned. Most important among those lessons is order flow's ability to account for the lion's share of movements in the major floating rates. On the policy front, widespread availability of electronic order-flow data brings many policy questions within our reach for the first time. After reviewing these policy questions, the article closes with a discussion of how FX market institutions are evolving and how this evolution will affect application of order-flow analysis in the future.

A new approach has emerged for understanding the behavior of exchange rates: order-flow analysis.<sup>1</sup> Though fundamental analysis and technical analysis are still widely used, practitioners, policy-makers, and academics are increasingly using order-flow analysis to complement these other approaches. My thesis is that this shift in perspective is well founded: there is now considerable evidence that order flow accounts for the lion's share of floating exchange-rate movements.

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<sup>1</sup> Order flow is not synonymous with trading volume. Order flow—a concept from microstructure finance—refers to *signed* volume. Trades can be signed in microstructure models depending on whether the “aggressor” is buying or selling. (The dealer posting the quote is the passive side of the trade.) For example, a sale of 10 units by a trader acting on a dealer's quotes is order flow of -10, though volume is 10.

To put order-flow analysis in perspective, the next section provides background on the more traditional approaches, fundamental and technical. The following section introduces order-flow analysis, contrasts it with the traditional approaches, and reviews lessons learned from this new type of analysis.<sup>2</sup> I then turn to the policy implications of order-flow analysis; the widespread availability of electronic order-flow data allows us to address certain policy questions for the first time. The paper closes with a discussion of the FX market's future. FX market institutions have changed considerably over the last 10 years (e.g., the major role now played by electronic brokers), and the pace has not slowed. To what extent might these near-term changes render order-flow analysis obsolete? In fact, the approach can be successfully applied even if the structure does change. This final section explains why.

## **1. A Little Background**

Since the 1970s, fundamental analysis has viewed (nominal) exchange rates as determined by a set of macroeconomic variables that includes interest rates, money supplies, inflation rates, GDPs, government budget deficits, and current account balances (defined for both the home and foreign countries). Though conceptually sound, the approach has not fared well empirically. In particular, the macro variables that underlie the approach do not move exchange rates as predicted. The classic reference is Meese and Rogoff (1983); they show that macro-fundamental models fail to account for major-currency exchange rates better than a simple “no change” model. Thus, the macro-fundamental models are not even consistently getting the direction right. In his survey, Meese (1990) summarizes by writing, “The proportion of (monthly or quarterly) exchange rate changes that current models can explain is essentially zero.”<sup>3</sup> In a later survey in the *Handbook of International Economics*, Frankel and Rose (1995) comment on fundamental analysis this way:

To repeat a central fact of life, there is remarkably little evidence that macroeconomic variables have consistent strong effects on floating exchange rates, except during extraordinary circumstances such as hyperinflations. Such negative findings have led the profession to a certain degree of pessimism vis-à-vis exchange-rate research.

From the fundamentals perspective, there is clearly room for some fresh thinking.

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<sup>2</sup> For practitioner-oriented research using order-flow analysis, see, e.g., Citibank's *Citiflows Global Flow and Volume Analysis* (various issues), Deutschebank's *Flowmetrics Monthly* (various issues), and Lehman Brothers' *Global Economic Research Series*, particularly the issue on “FX Impact of Cross-Border M&A.” For evidence from practitioner surveys, see Gehrig and Menkhoff (2000). It is noteworthy that—unlike fundamental and technical analysis—order-flow analysis is not available to everyone: one needs sufficient order-flow data.

<sup>3</sup> The literature documenting this poor empirical performance is vast; for surveys see Frankel and Rose (1995), Isard (1995), and Taylor (1995). Macro-fundamental models do perform better over longer horizons, e.g., horizons of 3-5 years (see, e.g., Mark 1995).

The other traditional approach, technical analysis, attempts to identify future exchange-rate movements using only the pattern of past prices. Unlike fundamental analysis, which is widely used in all three circles noted above (practitioners, policy-makers, and academics), technical analysis is used mostly by practitioners. This is largely because technical analysis is targeted at forecasting rather than explanation (where by explanation I mean identification of the concurrent variables that drive exchange rates). Empirically, there is some evidence that technical rules have predictive power for exchange rates (see, e.g., Levich and Thomas 1993 and Chang and Osler 1998). Though statistically significant, however, no one has ever argued that this predictive power accounts for more than a small percentage (<10%) of exchange-rate variation.

## **2. Order-Flow Analysis**

Within the academic literature, order-flow analysis is typically referred to as “microstructure” analysis. The term microstructure comes from the field of microstructure finance, which is concerned with, among other things, the role that order flow plays in impounding information in price. Unlike macro models of exchange rates, which assume that all traders share the same information and beliefs, microstructure models recognize that individuals use different information in forming their beliefs. In a context where individuals use different information to form their beliefs, the market needs a means of measuring those beliefs. Order flow plays this role. In these models, it is precisely when a trader’s beliefs differ from the market enough to put money on the table—a trade—that those beliefs warrant counting. Think of the orders like votes. The market performs the service of tallying the order-flow votes, and setting the market price on the basis of the tally.

Figure 1 provides an illustration. In fundamental analysis, the mapping from fundamentals to price is assumed to be direct and immediate. In order-flow analysis, information flows through orders on its way to price. More recent, hybrid analysis, allows for both channels to affect price.<sup>4</sup>

What type of information is the order flow conveying? (Or, if you prefer: What is driving the order flow?) This is the right question—order flow is a proximate cause, not an underlying cause. There are many examples of dispersed information that needs to be aggregated for pricing assets: differential interpretation of news, shocks to hedging demands, shocks to liquidity demands, time-varying risk tolerances (of financial institutions, for example), and so on. Empirically, we have not determined conclusively which of these information types are the most important. What we do now know is that order flow is important for

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<sup>4</sup> Though figure 1 focuses on the complementarity between fundamental and order-flow analysis, there is also an emerging complementarity between technical and order-flow analysis. Osler (2001) in particular makes this case. Using data on stop-loss and take-profit orders in FX, she shows that clustering of these orders at particular prices helps to explain two familiar predictions from technical analysis, namely that (1) trends tend to be reversed at support and resistance levels and (2) trends tend to gain momentum if support and resistance levels are breached.

“how” exchange rates are determined—it is the transmission mechanism. Now that we know how, we are in a better position to learn “why.”<sup>5</sup>

Implicit in the last paragraph is the point that fundamental analysis and order-flow analysis differ in terms of research strategy. Order-flow analysis starts from the meeting of demand and supply and proceeds to identify the (more) exogenous variables behind that order flow. Going to the “micro source” provides exchange-rate theory with much needed empirical guidance.<sup>6</sup> A simple strategy that has already made progress along these lines is based on our ability to break order flow into parts. (That it can be decomposed is one of its nice properties.) One can test whether all parts of the aggregate order flow have the same price impact. They do not: the price impact of FX orders from financial institutions (e.g., mutual funds and hedge funds) is significantly higher than the price impact of orders from non-financial corporations (Lyons 2001). This suggests that order flow is not just undifferentiated demand. Rather, the orders of some participants are more informative than the orders of others. Analyzing order flow’s parts illuminates the information structure underlying this market.

Let me provide a brief review of what we have learned from the application of order-flow analysis. The lessons learned thus far can be divided into two broad groups: those that are more macro-oriented and those that are more micro-oriented. Because the approach is still young, more work is required before these lessons can be considered stylized facts. As data sets covering longer time periods become available, these lessons surely will be refined.

First consider the more macro-oriented lessons. Six lessons in particular seem especially important:

- Order Flow Drives a Large Share of Longer-Horizon Price Movements. Even when based on data sets that include only a fraction of market-wide flow, the concurrent impact of these flows accounts for 40-70 percent of the persistent movements in exchange rates (i.e., at monthly horizons and longer, see e.g. Payne 1999, Evans and Lyons 1999, Evans 2001, Rime 2000). As richer order-flow data sets become available (e.g., as they span a larger share of the market and sign the flows more precisely), that percentage may rise still higher.
- Even Macroeconomic Announcements Affect Price via Order Flow. The flipside of the first lesson is that concurrent macro announcements and other readily identifiable macro changes do not *directly* explain a large share of longer-horizon price movements (i.e., after controlling for order flow; see Evans 2001, Evans and Lyons 1999). Rather, order flow appears to

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<sup>5</sup> Some skeptics argue that the order flow driving exchange rates is irrational, and therefore does not represent information. Well, irrationality is always a possibility. But even if part of the order flow is determined irrationally, if this part is affecting prices, then it is because rational players view offsetting these orders fully as being too risky. In this case, the resulting effect on prices is a portfolio-balance effect—the adjustment in price is exactly that required to induce the rational players to step in. Even in this case, then, order flow is conveying information about equilibrium risk premiums.

<sup>6</sup> As suggested below, models of market incompleteness of various types are a natural fit with current empirical results. See, e.g., Duarte and Stockman (2001) for a contact point within the theoretical literature on dynamic open-economy models.

mediate most price movements. Though in some sense this result is a re-discovery of the well-known empirical failure of macro-fundamental models, work using order-flow analysis is clarifying the factors that supplant concurrent macro variables as the driver of prices. An additional point, distinct from the first, is that effects from major announcements—direct or not—do not account for a large share of exchange-rate volatility (see Anderson and Bollerslev 1998).

- The Elasticity of Price with Respect to Order Flow is High. The elasticity of the exchange rate with respect to order flow by non-dealer customers is roughly 0.8 percent per \$1 billion (in the largest markets; see Lyons 2001, Table 9.2). With world financial wealth measured in trillions of dollars, this is puzzlingly high. The result is consistent with a common view that Milton Friedman’s “stabilizing speculators” are not bold enough. Why this boldness might be lacking remains an open question. On the other hand, from an information-theoretic perspective high elasticity may not be so puzzling: small net flows may be conveying significant amounts of information.
- Order Flow is a Factor in Floating-Rate Volatility. We now have substantial evidence that order-flow is an important proximate factor driving volatility, and may account for apparently excessive volatility under floating regimes (see, e.g., Evans and Lyons 1999, Killeen et al. 2000). Though work on order flow as a driver of price is focused on the *sign* of the relationship, there are also implications for volatility: a good model of return first moments is a good model of return second moments (but not vice versa). Also relevant for this lesson is the work of Osler (2001). She finds that stop-loss orders on the buy (sell) side tend to cluster at prices just above (below) round numbers, which can cause trends to gain momentum once support and resistance levels are crossed.
- The Accelerationist View is Not Supported. Empirical results in FX markets are not consistent with what is sometimes called the “accelerationist view”—that order flow simply impounds information in price a few minutes faster than would otherwise have been the case. Under the accelerationist view, the asset-pricing consequences of order flow are not that interesting: price paths that differ only by a time-shift of a few minutes are equivalent to a macroeconomist. If the accelerated-by-a-few-minutes view were true, then one would expect public information flow to account for as much exchange-rate variation as order flow. As noted above, however, public information flow is virtually uncorrelated with the direction of exchange-rate movements (at horizons of one year or less).

At the same time, a fascinating possibility is that an “accelerationist” story is indeed operating, but over much longer horizons. Suppose the information conveyed by order flow reflects changing market expectations about macro-fundamentals that are more distant (i.e., beyond the next month, quarter, or even year). In that case, order flow serves to telescope these forward-looking fundamentals into today’s spot rate. Note too that

this possibility is consistent with findings that over longer horizons (e.g., three to five years), macro variables do begin to account for a substantial share of exchange-rate variation (despite concurrent macro-fundamentals being virtually uncorrelated with exchange rates; see, e.g., Mark 1995).<sup>7</sup>

- Order Flow Does Not Have to Sum to Zero. The Evans and Lyons (1999) model shows why order flow between dealers does not have to sum to zero. Conceptually this is important, because many people are under the mistaken impression that order flow must sum to zero (and therefore that any flow measure that correlates positively with price must be unrepresentative in some way). This is not always the case.

Let me turn now to more micro-oriented lessons. By micro-oriented, I mean that they are based on intraday analysis of individual dealers. As such, they parallel more closely bread-and-butter work within microstructure finance.

- Order Flow is Private Information. The behavior of individual dealers shows that they consider FX order flow to be a source of private information, and that they set prices accordingly (see, e.g., Lyons 1995). This empirical result at the micro level accords well with the above-noted importance of order flow at lower frequencies. Moreover, all orders are not alike in terms of their information content. Identifying which orders are the most informative, and who is behind them, is helping to decipher the market's underlying information structure.
- Dealer Inventories Affect Price. Inventory control among spot FX dealers is strong relative to that found for other markets. Most spot FX dealers prefer to end their trading day flat—that is, with no net position. Accordingly, the half-life of the typical dealer's inventory is significantly less than one day, and has been estimated to be as low as ten minutes (e.g., Lyons 1998). These half-lives are much shorter than those found in equity and futures markets, where half-lives longer than one week are common.<sup>8</sup> Not only do FX dealers control their inventories intensively, some also adjust their prices to induce inventory-decumulating order flow. (Lyons 1995 finds these inventory effects on price, but Yao 1998 does not find them for

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<sup>7</sup> This conjecture circumvents a misleadingly compelling argument why order flow cannot be conveying macro fundamentals. That misleading argument starts by supposing that the R-squared statistic from a regression of exchange-rate returns on order flow is one. Because the R-squared statistic from regressing exchange-rate returns on macro variables is nearly zero, the argument goes, order flow cannot be picking up macro information. The shortcoming in the argument is that regressions using current and past macro variables very likely provide poor measures of expected future macro paths.

<sup>8</sup> Resolving these differences may lie in the fact that non-FX marketmakers hedge inventory risk with instruments other than those in which they make the market (e.g., with related derivatives), whereas spot FX dealers find that inventory control using spot currencies alone is least expensive. See Naik and Yadav (2000) for evidence that non-FX marketmakers do indeed use derivatives for inventory control. Another possible resolution of these differences lies in the obligation of the NYSE specialist to smooth prices, a task which existing inventory may facilitate.

the dealer he tracks.) This finding of inventory effects on price is important: these effects are the linchpin of the whole inventory branch of micro-structure theory, despite the fact that empiricists working on markets other than FX have not found them.<sup>9</sup>

- Hot Potato Trading Contributes to Trading Volume. Hot potato trading is the passing of positions from dealer to dealer in the process of interdealer risk management. Dealers describe this type of trading as an important source of the FX market's enormous trading volumes. The large share of trading between dealers that we find in FX relative to other markets is consistent with a significant role for hot potato trading. On the theoretical front, our models show that hot potato trading is consistent with optimizing behavior (e.g., Lyons 1997). On the empirical front, we also find direct evidence that hot potato trading is present (e.g., Lyons 1996).

Having reviewed what we have learned, let me close this section with some thoughts on what we still need to know. First, we need to determine why the price impact of order flow from different customer types is so different, which links to the nature of the underlying information. Second, we need to determine which components have the most out-of-sample forecasting power and at what horizons. (That they have forecasting power is not a violation of efficient markets because these data are not publicly available.) An answer to the forecasting question should help us answer the first question about the nature of the underlying information. Third, we need to close the gap between order-flow analysis and fundamental analysis. Are order flows conveying changing expectations about future macro paths? Does order flow—or parts of order flow—link to balance-of-payments flows of various types? These are some of the larger open issues that researchers in this area are poised to address.

### **3 Policy Implications**

There are five broad areas where I envision order-flow analysis having impact on policy. I introduce each of these with an eye toward future work that is likely to be useful. Though in some areas there is already a basis for specific recommendations, in other areas recommendations will have to wait for further analysis of these policy questions.

#### **Policy Area 1: The Price Impact of Order Flow**

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<sup>9</sup> In an empirical analysis of NYSE specialist trading, Madhavan and Sofianos (1997) find that specialists tend to manage inventory by strategically timing their trades, rather than through adjusting their own prices.

It would be useful for official institutions to begin collecting data on FX order flows.<sup>10</sup> This is likely to be particularly valuable for policy-making in developing countries. Specifically, order-flow data allow one to quantify the price impact of currency trades (both transitory and persistent), as demonstrated repeatedly in existing empirical work. This is a direct measure of market liquidity: price impact is what liquidity is all about. The lower the price impact, the higher the liquidity, other things equal. It would be interesting to get a sense for how price impact in developing-country markets changes as a function of the state of the market (devaluation likelihood, etc.). Also, one could determine whether customer forward trades have the same price impact as customer spot trades of similar size. If not, one could quantify the difference. (Many developing countries restrict or even forbid forward trading on the belief that such trading is more “speculative” in nature than spot trading and is therefore more destabilizing.) One might also compare price impact across countries, in an effort to determine which institutional structures are better at promoting liquidity.

The question of price impact is related to the issue of stability. Policymakers in some developing countries appear to believe that additional liquidity is destabilizing. In theory, it is less liquidity that is destabilizing, not more liquidity: the less the liquidity, the larger the price impact, and the more prices move, other things equal. To make the case that other things are not equal, in a way that might reverse the relationship between liquidity and stability, one might use the discipline of microstructure trading models to identify the countervailing forces at work.

Another issue that is relevant the world over is stability of exchange-rate pegs. Microstructure-style trading models help us to understand how and why particular types of orders have price impact when exchange rates are pegged (see, e.g., Calvo 1999, and Corsetti, Morris, and Shin 1999). As an empirical matter, we have a lot to learn about which types of order flow cause pegs to collapse (see Carrera 1999). A better understanding of these issues will aid in the design of more resilient pegged regimes.

## Policy Area 2: Central Bank Intervention

Central bank intervention is a classic topic within exchange-rate economics. It is also a natural topic for order-flow analysis. A key open issue in the intervention literature is whether different-currency assets are imperfect substitutes. Imperfect substitutability is important because it governs whether portfolio-balance effects are being driven by order flow (irrespective of whether those orders are from the central bank or the private sector). Portfolio-balance effects on price arise under imperfect substitutability—even if order flow is known to be liquidity motivated (i.e., known to be uncorrelated with traditional macro fundamentals)—because risk-averse participants need to be compensated

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<sup>10</sup> Indeed, data availability is absolutely essential for keeping this empirically driven area of research moving forward. Part of the challenge for official institutions will be to convince private-sector firms to part with the employee time and money involved in providing such data. I hope that the progress I have surveyed above will help make the case that the effort is a worthy one.

with additional expected return to take the other side of order flow. In contrast, if at a given expected return investors were indifferent to holding dollar- or yen-denominated assets (perfect substitutability), then exogenous innovations in order flow would have no price effect.<sup>11</sup>

As an empirical matter, we have not yet reached consensus on the relevance of FX portfolio-balance effects. Views about their presence have shifted over the last twenty years from negative to moderately positive. The earlier negative view was based on early empirical work that finds no evidence of portfolio-balance effects (for an overview see Dominguez and Frankel 1993b, page 105). These early studies examine FX markets at a broad level, and address whether different-currency returns are driven by changing asset supplies. In general, these studies suffer from lack of statistical power, however, because changing asset supplies are notoriously difficult to measure. Studies that focus narrowly on the effects of central-bank intervention—a kind of “event study” on changing asset supplies—are more successful in finding effects from portfolio balance (e.g., Loopesko 1984, Dominguez 1990, Dominguez and Frankel 1993a). But even with this narrow focus on intervention events, results are not exclusively positive (e.g., Rogoff 1984).

The order-flow analysis of Evans and Lyons (2000) is a new approach to measuring portfolio-balance effects. They measure portfolio-balance effects directly from the order flow of non-central-bank participants. Though this new approach is not without drawbacks, it does avoid several of the drawbacks of the earlier literature. For example, the Evans-Lyons approach is arguably more powerful (statistically) than the approach of the early broad-level studies because it does not rely on measuring changing assets supplies, making it less vulnerable to measurement error. It may also be more powerful than the event-study intervention approach because the number of intervention events one can examine is not large, and the average size of interventions is small.

Let me try to make this point about statistical power more vivid. Envision the FX market as a “choke point.” The choke point is where portfolios are actually being balanced (which includes the portfolios of central banks). Measures of order flow provide precise measures of this rebalancing, and the price effects that arise as a result. As a choke point, the FX market is the venue where market participants (effectively) say to one another, “Here, hold this,” where “this” might be 10 billion euros. If we are to detect portfolio effects anywhere, this may be the right place to look.

### Policy Area 3: Emerging market design

A bread-and-butter policy issue in microstructure finance is how best to design markets. This issue is relevant to FX as well. Its relevance in FX is limited, however, by the fact that the major currencies are traded in a truly worldwide market, making it difficult for any single regulatory authority to

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<sup>11</sup> For a survey of the macro literature on portfolio-balance models, see Branson and Henderson (1985). The macro literature does not address order flow per se. Nevertheless, the exogenous shifts in asset demands and supplies the literature does address have a natural counterpart in order flow (as long as that order flow is not motivated by traditional macro fundamentals).

impose structural changes. Any country attempting to alter or constrain the structure of trading within its own borders would find order flow migrating rapidly to other trading venues. As a practical matter, worldwide harmonization of this type of policy change is infeasible at present.

The area where FX market design remains a hot topic is in emerging markets. Most of these currencies are not traded on a worldwide basis, due to lack of convertibility of one form or another. Because trading in these currencies is largely within-country, it is feasible to legislate market design in a way that is not possible in major markets. Microstructure analysis is well-suited to address whether fledgling FX markets should be organized as auction markets, or as dealer markets, or both (for analysis along these lines see Kirilenko 1997), as well as the level of transparency that should be required. Institutions like the International Monetary Fund confront this type of policy question regularly. The microstructure approach provides valuable guidance.

#### Policy Area 4: International currencies

What role should specific currencies play in the international monetary and financial system? Recent introduction of the euro has brought this question to a level of policy relevance not seen since the early 1970s (when the Bretton Woods fixed-rate system collapsed). The issue of international currencies—those that act as a universal means of exchange—centers on three key aspects: (1) use as a reserve currency by central banks, (2) use as an invoicing currency for international transactions, and (3) use as a vehicle currency for currency transactions. (Vehicle currencies are used when the transaction cost of trading two currencies directly is higher than the cost of trading them indirectly, via two transactions through the vehicle currency.) For aspects (2) and (3), a single currency's success as an international currency is heavily dependent on the level of transaction costs. So, to predict whether the euro will be successful as an international currency, one needs to model the transaction costs that will arise once it is fully adopted. Though not an easy task, it is one that microstructure analysis is well suited to address (see, e.g., Hau, Killeen, and Moore 2000). This type of analysis can also identify which institutional features of the new euro will help to reduce those transaction costs. In this analysis, a central issue is the degree to which a reduction in transaction costs stimulates trading, both directly, and indirectly through adoption as a vehicle currency. These volume and liquidity responses to various policy alternatives are the focus of recent work by Hartmann (1998a, 1998b, 1999), and Portes and Rey (1998).

#### Policy Area 5: Transaction taxes

The issue of transaction taxes has attracted much attention among exchange-rate economists. Proponents of levying transaction taxes tend to associate high volume with excessive speculation. As the literature has shown, however, much FX volume reflects dealer risk management (hot-potato trading), rather than speculation. Imposing a transaction tax would therefore impede risk management. Though unintentional, this misunderstanding of the causes of high

volume could lead to bad policy. I emphasize the word “could” here because order-flow analysis only adds a new dimension to this important policy question, it does not invalidate the arguments of transaction-tax supporters. Looking forward, I expect that order-flow analysis has a good deal more to contribute to this policy issue. (For recent treatments using order-flow analysis, see Hau and Chevallier 2000 and Habermeier and Kirilenko 2000.)

#### **4 Where FX is Going—Implications for Order-Flow Analysis**

The FX market has undergone important changes over the last ten years. Perhaps the most important change is the shift from voice-based interdealer brokers to electronic interdealer brokers. This trend away from human-intermediated transactions is evident in many securities markets throughout the world.<sup>12</sup> It shows no sign of abating.

The shift from voice-based interdealer brokers to electronic brokers is important in itself because electronic brokers provide a different (mostly higher) level of order-flow transparency than was provided by the voice-based brokers. This alters dealers’ information sets, which affects their trading strategies.

A larger implication of the shift to electronic brokers, however, is that it suggests a future for spot FX trading that is more centralized, electronic, and—this is the crucial part—open to customers. Major markets will shift toward a structure with open, electronic limit-order books that are accessible to a large number of market participants.<sup>13</sup> Under this scenario, institutions I have been calling “customers” would be able to provide liquidity to one another, rather than having to depend wholly on dealers. At that point, they would cease being customers—in the sense of always demanding liquidity—transformed instead into both liquidity demander and supplier.

How can one be confident that the market is going in this direction? Three pieces of evidence support this view. First, in June of 2000, three investment banks (Goldman Sachs, Merrill Lynch, and Morgan Stanley Dean Witter) announced that they will be launching an electronic system of this kind for the US bond markets (government and corporate bonds). The past structure of the US bond market shares many characteristics with FX markets. Though several equity and derivatives markets have already shifted to a centralized-electronic structure, those markets do not share the same FX-market characteristics that the bond markets share, and are therefore not as appropriate as models. Second, in the last year, new companies have introduced forms of centralized FX trading for

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<sup>12</sup> For an interesting article on the advent of electronic trading in FX, see Euromoney (2000). For equity markets, Institutional Investor (2000) is a nice treatment of the electronic-trading threat to more traditional trading methods.

<sup>13</sup> Frankel (1996) was perhaps the first to write about such a scenario in FX, though he was considering a Tobin tax as the possible trigger. He wrote: “It is possible that the imposition of a Tobin tax ... would alter the structure of the market in a fundamental way. It might become more like other major financial markets, in which a sale or purchase by a customer generates only one or two transactions, rather than five or eight. This would be the case particularly if such a tax triggered a transition to a new trading structure equilibrium, with the decentralized dealer network ...replaced by a system in which foreign currency was traded on a centralized exchange in the manner of the NYSE.”

customers (e.g., FXall.com, FXchange, FXconnect, Atriaux, Gain.com, MatchbookFX.com, among others). These new companies typically promote themselves as operating at the fringes of the dealer-market structure, coexisting with it. But there is nothing obvious that prevents one of them from growing to a scale that captures the network externalities inherent in concentrating liquidity into a single pool.<sup>14</sup>

The third piece of evidence that, in my judgment, points to more centralized FX trading in the future is that existing interdealer systems like EBS can be opened to customer-companies quite easily. (EBS is an electronic trading system—a limit-order book—that is available only to dealers.) The customer relationships are there: banks that own EBS are the same banks that have customer relationships via their dealing services. The technology is not a major hurdle; the switch could be flipped in much the same way as it promises to be flipped in the US bond markets. What might the catalyst be? A natural catalyst would be significant growth in market share by one of the new electronic entrants. If EBS decided to open its system to customers, it would be difficult for any competitor to beat it. From the EBS perspective, it is essential to maintain the threshold effects of network externalities in its favor—if the market is going in the direction of centralized customer trading, EBS cannot afford to wait.

Does immanent market-structure change threaten the relevance of the order-flow analysis? My answer should not surprise anyone who has read this far. Order-flow analysis is not concerned only with whether the market is organized with a single dealer, multiple dealers, or a limit-order book. The role of order flow in conveying information transcends market structure. And the types of information that order flow conveys—particularly the types with persistent price effects—are not likely to change radically when (if) the FX market structure changes in the future. Put another way, the underlying information structure of this market has more to do with the properties of the asset being traded—foreign exchange—than it does with the market structure per se. Order flow will continue to tell us something about people's view on how public information should be mapped into price. It will continue to tell us something about current risk preferences and endowments. In short, it will continue to convey dispersed information that needs to be aggregated. And that is what the FX market is all about.

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<sup>14</sup> For a theoretical treatment of whether centralized limit-order structures are likely to capture liquidity and thereby dominate trading, see Glosten (1994). An issue not addressed in that paper that is important for FX is credit risk. Bank dealers may have a comparative advantage in managing the credit risk arising from large transactions with customers. New entrants who want to centralize this market around an electronic trading platform need to solve this problem because non-financial corporations do not want to take the counterparty credit risk that banks are comfortable taking. The standard approach is to establish a clearing-house system with margin accounts (akin to those used in futures markets).

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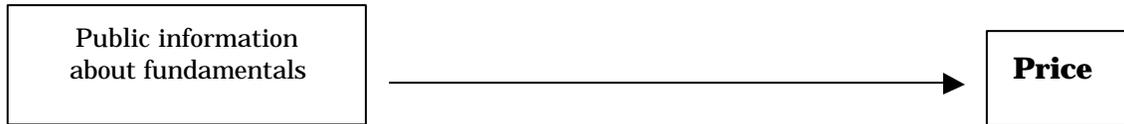
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**Figure 1**

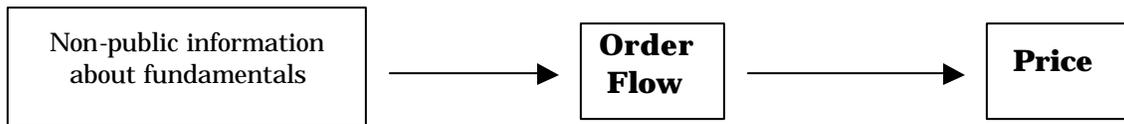
Macro-Fundamental Analysis versus Order-Flow Analysis

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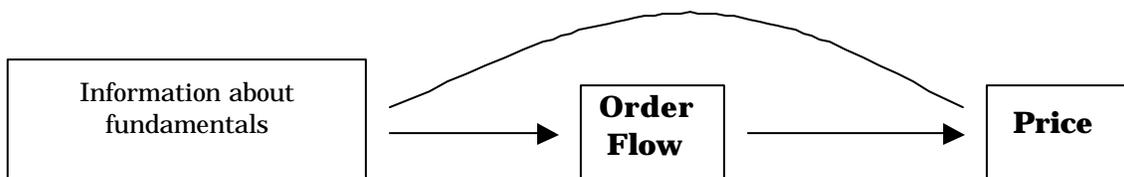
**Macro-Fundamental Analysis**



**Order-Flow Analysis**



**Hybrid Analysis**



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\* The top panel illustrates the connection between fundamentals and price in macro-fundamental analysis: information about fundamentals is public, and so is the mapping to price, so price adjustment is direct and immediate. The middle panel illustrates order-flow analysis. The focus in that case is information that is not publicly known. This type of information is first transformed into order flow,

which becomes a signal to the price setter (e.g., dealer) that price needs to be adjusted. Actual markets include both, which is illustrated in the bottom panel—hybrid analysis.