Tobin Tax Effects Seen from the Foreign Exchange Market's Microstructure

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Discussion paper No. 268

January 2003

ISSN 0949-9962

Abstract

The Tobin tax is in high demand for many groups. Despite its popularity, research has not yet made full use of available insights from the recent microstructure literature. The role of banks in foreign exchange trading is quite different from what proponents usually assume. The most probable decisive group for shorter-term exchange rate movements is asset managers. They speculate under comparatively longer horizons than FX dealers although they also tend to behave short-termist. There is no tax rate that could influence their behavior and at the same time keep the desired high liquidity. Thus no uniform proportional Tobin tax can reach its goals.

JEL Classification: F31
Keywords: Tobin tax, market microstructure

* We would to thank Michael Frömmel and seminar participants in Stuttgart-Hohenheim for their helpful comments.

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1. Introduction

The Tobin tax ranks high on the agenda for many non-government organizations (NGOs), trade unions, political parties and even governments but has remained comparatively less researched by academia. A major exception in this respect is the volume edited by ul Haq, Kaul and Grunberg (1996) reflecting the discussion around an expert meeting in 1995.[1] This volume covers a wide range of issues and conflicting views. Among them is Jeffrey Frankel's (1996) paper addressing the core question whether a Tobin tax might help to heal markets' shortcomings. The novelty of his contribution is to introduce the concept of market microstructure to the Tobin tax discussion. As the microstructure concept has led to a wealth of fruitful research over the last few years (see e.g. Lyons, 2001, Sarno and Taylor, 2001), it seems well motivated to continue Frankel's approach by drawing on latest results (see also Lyons, 2001a). It can be shown, indeed, that the old Tobin tax concept does not survive in the light of new findings.

The motivations to endorse a Tobin tax proposal are quite different and may serve various concerns. Some proponents would like to reduce welfare-reducing waste of resources for speculative activities (Arestis and Sawyer, 1997), others see the Tobin tax as a means to put a strain on banks' profits (Wahl and Waldow, 2001) and possibly most proponents nowadays have the income generating potential of this tax in mind, which should be directed towards the needs of the poor (see ul Haq et al., 1996, Reisen, 2002). This paper does not discuss these and other motivations but concentrates on the financial markets' aspects. Tobin's idea was to guide decision-making in foreign exchange in such a way that the overwhelming amount of short-term transactions would be restricted in favor of longer-term oriented transactions. Whereas this guidance objective is adequately addressed by a proportional tax on all foreign exchange transactions, the academic discussion has revealed a non-trivial price: the reduction in short-term transactions can markedly reduce market liquidity, which will most probably increase volatil-

[1] This effort was organized by people from the UNDP vicinity with Barry Eichengreen as lead consultant.

ity. Consequently, there is a conflict between the objectives of "guidance" and "liquidity" that has to be addressed. Market microstructure research provides some useful insights in this respect.

As Frankel and Rose (1995) or Taylor (1995) have noted, the failure of traditional exchange rate modeling to explain shorter-term price movements provides a powerful motivation to search for new avenues, such as microstructure research. Two strands of this research program are clearly related to the issues raised by a Tobin tax. First, studies have differentiated the often assumed representative agent forming perfectly rational expectations and have instead suggested heterogeneous agents with different behavior (see e.g. Sarno and Taylor, 2001). Second, studies have examined the impact of certain actions on the market and postulate the existence of "high impact" market participants (Fan and Lyons, 2002). It is the purpose of this paper to make fruitful use of this literature to clarify the relation between the above stated conflicting objectives of guidance and liquidity.

We find that the conception of foreign exchange markets implicitly underlying the Tobin tax proposal is misleading under the current circumstances. There are at least three groups to be differentiated, i.e. banks, asset managers and commercial firms. Each of these groups behaves differently and has its own characteristic impact on the market. The role of banks in particular is at the same time overstated and underrated: banks do not speculate as assumed but they are essential in providing liquidity and allocating risks. Instead, asset managers are most probably the force moving shorter-term exchange rates. They are the true kingpins of foreign exchange markets and should be the focus of any appropriate Tobin taxing. Finally, commercial customers seem to be by-and-large irrelevant for the shorter-term issues being addressed here.

We conclude that a proportional Tobin tax applied on all transactions can not contribute to solving the conflicting goals: a low tax rate does not influence asset managers' decision making, whereas any noticeable tax burden will damage liquidity provisioning. There is no tax rate that would be able to satisfy the guidance and the liquidity objective at the same time. Consequently, the concept of a Tobin tax in its present form has to be dropped. Whether it can be usefully reformulated is up to further research.

We proceed in three steps. Section 2 reviews in short the original Tobin tax concept in order to gain hypotheses that can be empirically tested. The confrontation of

theoretically justified hypotheses with empirical findings of the microstructure research is presented in Section 3. Section 4 concludes with policy considerations.

2. The Tobin tax concept

James Tobin (1978) made his by now very prominent tax proposal as president of the Eastern Economic Association in 1978. He detailed then the general idea which he had already advanced in 1972. Further roots go even deeper into the history of economic reasoning, most prominent being the statement of Keynes (1936) that transaction taxes on financial assets might help to dampen economically unjustified speculation and thus reduce volatility. Although this objective of volatility reduction is in the forefront of economic discussion nowadays, it was not Tobin's major motivation when floating his proposal. Instead, his main focus was on increasing the space for national economic policy making, in particular for monetary policy. The tax was primarily seen as a means to detach national currencies from each other.

As an important side-aspect, however, Tobin discussed shortcomings of flexible exchange rates as they really are. Most important from his viewpoint is a distinction into "mechanically efficient" markets which lack anchoring in fundamentals (elaborated further in Tobin, 1984). According to his analysis it is the short-term oriented, self-referential speculation of banks that drives exchange rates away from fundamentals.

The background for this view from the 1970s is the emergence of international financial markets being fostered by the floating of major exchange rates since 1971 and finally 1973. It became obvious that foreign exchange markets are not really mirrors of international flows of goods and foreign direct investments. It is rather financial flows which determine exchange rates over relevant horizons, as the famous Dornbusch model has made explicit (see Rogoff, 2002, for an acknowledgment). Financial flows adjust to expectations, which makes their reaction to changes in environment quicker than for goods flows and which makes them sensitive to rumors and other non-fundamental influences. Tobin's skepticism against the fundamental evaluation efficiency of foreign exchange markets corresponds well with the failure of respective modeling efforts. Although advances have been made and although exchange rates do react on news and regime changes, the task of formulating a general exchange rate model that

holds – or even holds out of sample – has not been mastered yet (see e.g. Neely and Sarno, 2002).

The upcoming microstructure research in the 1990s has, however, created serious doubts regarding this picture of destabilizing bank speculation. In particular, Frankel (1996) has made the point that the high trading volume of banks is due to their intermediation function in decentralized markets. They trade foreign exchange in order to allocate open positions to those market participants who are willing to hold them. It is part of this process that large orders will be packed into smaller sizes which will more easily be accepted by risk-adverse agents. This function of banks at foreign exchange markets is most important from an economic point of view as it ensures liquidity that serves to allocate risks and to dampen volatility.

The most important consequence of this debate was the further decline in the proposed tax rate. Whereas Tobin (1978) originally mentioned a rate of 1% and later published a rate of 0.5% (Eichengreen, Tobin and Wyplosz, 1996), the first microstructure findings suggest even lower rates. In the volume of ul Haq et al. (1996) the discussion sticks to a range of 0.05% and 0.25%, with 0.1% as the most often mentioned figure. The purpose of this low tax rate is twofold: first, it is intended to limit incentives for tax avoidance and, second, a low rate should ensure the smooth functioning of the interbank market even after introduction of the tax.

We take this state of the debate as our reference point to derive four hypotheses about the perceived functioning of the foreign exchange market and the expected effect of introducing the Tobin tax. These hypotheses are formulated in a way to make them testable by new evidence from the microstructure research. Starting point is the implicit notion that the foreign exchange market consists of two major groups, that is, "good" firms engaged in foreign trade and "bad" banks speculating at short-term horizons.

H1 Banks dominate the foreign exchange market by volume, they act on very short-term horizons and they speculate heavily.

A second important concern to justify a Tobin tax is the argument that the short-term horizons do not reflect most efficient ways of collecting und using fundamental news. It is rather suggested that short-term horizons are related with the use of non-fundamental information, such as technical analysis.

H2 Short-term horizons indicate the use of non-fundamental information.

Finally, the introduction of a proportional Tobin tax has its strongest effect on shorter-term oriented trading activities and thus sets an incentive towards more long-term views when taking positions. As longer-term speculation is seen as clearly more stabilizing – in the sense of reaching fundamentally justified exchange rates – than shorter-term speculation, which causes rather erratic or self-enforcing deviations from fundamentals, a Tobin tax corrects a distorted decision making calculus. The effect from this "correction" would be more fundamentally based exchange rates, less or less severe bubbles and thus less (excessive) volatility.

H3 A Tobin tax reduces excessive exchange rate volatility.

So far, these three hypotheses refer to the guidance of foreign exchange markets. A Tobin tax is seen as an appropriate measure to ensure more fundamentally based exchange rates. Even if one accepts this position there is the problem with the liquidity objective. The discussion referred to above has led to the conclusion that a tax rate of 0.1% would be able to provide a solution to the conflicting goals: with this rate, it is claimed, decisions will be significantly more oriented towards fundamentals without distorting the existing market structure. In short, there is a tax rate that satisfies at the same time the guidance as well as the liquidity objective.

H4 There is a tax rate of about 0.1% to satisfy the guidance as well as the liquidity objective.

In summary, the first three hypotheses reflect the state of thinking of Tobin tax proponents, such as Eichengreen, Tobin and Wyplosz (1995), before the UNDP expert meeting in 1995, whereas the fourth hypothesis takes the findings of Frankel (1996) and related work into account (see Eichengreen, 1996). In the following section we are going to test these hypotheses by drawing on available material.

3. Confronting the Tobin tax hypotheses with recent market microstructure findings

This section uses two sources of material for hypotheses tests. First, available findings from the literature are applied to the Tobin tax issues, following the impetus of Frankel, who has bridged these two strands of literature. Second, we use some addi-

tional material from our own empirical studies to complement other data. The analysis is organized according to the four hypotheses introduced in Section 2.

3.1 Dominate banks the market by short-term speculation?

The notion of speculating banks dominating foreign exchange markets has its basis in the ratio between foreign exchange transactions and international goods trade. This ratio has mushroomed since the late 1970s and is now in the region of about 50. It seems an obvious conclusion that those transactions which do not serve the goods trade must be largely of speculative nature. The suspect for this speculation are banks which intermediate the customers needs. To clarify the issues involved, hypothesis 1 is split into its three logical parts, i.e. banks dominate, they act on short-term notice and they mainly speculate.

Regarding banks' dominance, the Bank for International Settlements produces a survey study every three years which informs among other things about the market share of the main groups in the foreign exchange market. According to this source (BIS, 2002) the share of banks ("reporting dealers" in the BIS terminology) is still the largest with 59%. However, their relative importance is declining and the shooting-star is the "other financial institutions" which rank now second with 28% and which have outpaced "non financial customers" with 13% share. It is thus obvious that banks still dominate volumes, not with a ratio such as 98% to 2%, but rather about 60% to 40% and with a declining share.

The second part of hypothesis 1, i.e. short-term orientation, can be also verified and does not require any qualification. The few available studies since the 1990s exactly documenting the behavior of single FX dealers all reveal a very short-term behavior. To show this in a graphical form we have plotted the net positions, i.e. the inventory, of two dealers in Figure 1. The left-hand graph informs about the first surveyed large US dealers with figures from August 1992 (Lyons, 1995). The right-hand graph shows a medium-sized dealer from Germany with data from September 2001 (Mende and Menkhoff, 2002). Although nine years have passed by and despite their different size and business structure, it is directly obvious that both dealers follow short-term strategies and change their position frequently. Even the sign of their net positions switches several times per day. This short-term orientation is unanimously confirmed by all available

studies and can be thus regarded as a stylized fact of banks' FX trading behavior (see also Yao, 1998, and Bjønnes and Rime, 2001).

This leads to the third part of hypothesis 1 that banks are mainly speculating in their foreign exchange business. A look at Figure 1 already causes doubt about this proposition. Skepticism is nurtured by further facts. The above mentioned studies indicate that dealers usually close or drastically reduce their open positions when ending day's business. Figures from the one FX-dealer study covering the longest period, i.e. four months of trading, reveal a clear picture (data from Mende and Menkhoff, 2002):[2] On a daily volume of roughly 50 Mill. USD/EUR trading, this bank has a median open position of only about 2 Mill. USD and the median of the daily closing position is a meager 1 Mill. USD.

Figure 1 has not only demonstrated comparatively low open positions but also often marked reversals. Calculating the half-life of open positions further questions the notion of speculating behavior. All available studies show again unanimously that this half-life is only minutes, implicating that banks try to reduce open positions not just during the day but rather within minutes (see Figure 2). It should be thus obvious that banks can not be the participants which move foreign exchange markets beyond the extremely short-term intra-day horizon (see also Lyons, 2001, p.246). When it comes to the still short-term daily movements, banks do not take noteworthy open positions at this horizon. Is there any other group possibly responsible for changing open positions that might influence exchange rate movements?

The microstructure research has indeed an answer to this important question. In a first approach, Evans and Lyons (2002) use data of daily aggregated order flows. They have shown for a four-month period that cumulating the order flow in the DEM/USD (and the YEN/USD) market over time produces a net demand curve that is clearly related with the exchange rate.[3] This indicates that net buying orders for a currency drive its value upwards. This finding has been confirmed by following the cumulated customer orders of a large US market maker over nearly a six years period (Lyons, 2001, pp.249ff.). Mende

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[2] This kind of studies covers comparatively short time-periods as they are very rich in information regarding single trades. Most microstructure studies use less disaggregated or less complete data.

[3] The order flow is defined as the "net of buyer-initiated and seller-initiated orders; it is a measure of net buying pressure" (Evans and Lyons, 2002, 171). In this study, just the direction of orders is measured whereas the amount is not taken into account.

and Menkhoff (2002) confirm the central role of customer order flow in the USD/EUR market for more disaggregated deal-by-deal data over a period of four months. Order flows are thus a powerful information when it comes to explaining short-term exchange rate changes (see also Evans, 2001).

Latest research indicates even more interesting information as the order flow is split into several groups in the market. Lyons (2001, pp.256ff.) finds for a case study environment that "financial institutions" (in particular fund managers) are the group whose changes in net position are closely related to the YEN/USD rate at shorter-term horizons (the same data are analyzed in more detail in Fan and Lyons, 2002). The financial institutions mentioned here are the same as the "other financial institutions" in the BIS (2002) study which the BIS details in particular as asset managers. We will stick to this latter intuitively understandable term of asset managers.

The state of knowledge regarding hypothesis 1 can thus be summarized as a partial rejection. Banks still dominate FX trading volume and they behave in a very short-term manner. However, the central part of hypothesis 1, that banks would speculate and thus move exchange rates, must be rejected by available evidence. It is not the banks (neither is it commercial customers) which "make" the market but the indication points towards asset managers to play the central role. It is thus most interesting to learn about the foundations of their decision making.

3.2 Do short-term horizons indicate non-fundamentalism?

The relation of short-term horizons in decision making and the use of non-fundamental information has some intuitive appeal but is not compelling. It could well be that short-term trading reflects changing evaluations which cover infinite horizons. It is the survey of Taylor and Allen (1992) on London chief dealers which provided systematic evidence for the first time. It is found that technical analysis dominates forecasting horizons up to a few days whereas fundamental analysis only dominates decision making for the long-term horizons. Moreover, the majority of participants made it clear that they focus on the shorter term. This finding has been replicated several times in the literature and can thus be regarded as well confirmed (see Menkhoff, 1997, for Germany, Lui and Mole, 1998, for Hong Kong, Cheung and Chinn, 2001, for the US, and Cheung, Chinn and Marsh, 2000, for the UK).

Additional evidence supporting the notion of non-fundamental factors in the shorter-term has been provided by studies examining the term structure of exchange rate expectations (see more in Taylor, 1995). An example is given in Frankel (1996) who reports that an exchange rate change over the last week has a systematic influence on the expectations regarding the following weeks and months. In particular, on one week and four weeks horizons FX professionals exhibit extrapolative expectations whereas the same persons expect the opposite movement over the following three to 12 months.

In a related attempt to measure relevant restrictions on the horizon of professionals Menkhoff (2001) compares different horizons and finds results inconsistent with unrestricted behavior. In particular, the required time seen for fundamentals to succeed in the foreign exchange market is often longer than the horizons of the same persons when taking open positions. Thus, professionals do not fully use their available knowledge on fundamentals. An interesting point for our discussion here is that this restriction does not only apply to dealers but also to the international fund managers being asked.

Finally, we show in Figure 3 the relative weight that dealers and fund managers give to the use of fundamentals (in relation to technical analysis and flow analysis) depending on their typical decision making horizon. Data come from a survey of German dealers and fund managers (Gehrig and Menkhoff, 2002). Again, those who are more short-term oriented do not regard fundamentals very highly whereas the importance of fundamentals increases with the time horizon. Interestingly, this relation holds for dealers and fund managers separately. Fund managers have longer horizons and related with this fact rely more strongly on fundamentals. However, even fund managers can not be regarded as trading purely on the basis of fundamentals as this kind of information just receives half of the weights as allocated by the group themselves.

In summary, available evidence is quite sufficient on the dominance of technical analysis over shorter horizons for FX dealers. Complementary evidence also supports the notion of a limited influence of fundamentals on short-term horizons as extrapolative expectations and restricted horizons exist. The evidence on the important group of international fund managers is thin but in line – although to a somewhat lesser degree – with the findings for dealers. Hypothesis 2 is thus supported by the presented evidence.

3.3 Does a Tobin tax reduce excessive exchange rate volatility?

The influence of heavy short-term non-fundamental trading on exchange rates can not be expected to stabilize the market. The best thing that could happen is uncoordinated behavior of these people so that many deals cancel each other out. It is, however, more probable that at least some of this trading takes place by participants either reacting to the same signals or to each other. Survey evidence (Gehrig and Menkhoff, 2002) as well as a careful investigation of customer orders (Osler, 2002) supports this view. The consequence will be that volatility increases in comparison with a market where trading refers only to fundamental news. Frankel (1996) has put this idea in a simple model.

He distinguishes two groups in the market, investors and speculators. Investors behave long-term oriented and trade only on deviations of the exchange rate from its fundamental equilibrium value. Speculators, by contrast, behave short-term oriented and buy a currency that is already (slightly) overvalued, i.e. they increase exchange rate bubbles. The total demand for the home currency is thus given by:

$d = w f_i ?(s-s_e) - (1-w) f_s d(s-s_e)$,

where w gives the share of investors in the market, $s-s_e$ gives the deviation of the actual exchange rate from its equilibrium value (in price notation), ? and d represent the strength of expected adjustments towards equilibrium or away from it respectively and f notes the elasticity of demand of the groups. Assume that $s > s_e$ then investors will buy the home currency in order to depreciate the rate, whereas speculators will sell. This simple model does not give any answer on exchange rate dynamics as the decisive parameters are exogenous. One could imagine that the weight of investors increases the clearer the wrong valuation becomes and that they behave more confidently under such circumstances, that is f_i increases. The model is designed to show the gain from a Tobin tax. The tax comes in as an instrument to strengthen the demand of long-term investors, expressed here as an increase of f_i relative to f_s after introduction of the Tobin tax. Under these assumptions, a tax could indeed reduce exchange rate volatility.

Research in finance has shown, however, a counterbalancing effect. The introduction of a Tobin tax has the same effect as an increase in spreads. This will obviously reduce liquidity and less liquid markets tend to be more volatile as idiosyncratic shocks more often disturb orderly market conditions (e.g. Habermeier and Kirilenko, 2002, Hau,

2002). This point has been made in the UNDP volume too (see ul Haq et al., 1996). Transaction costs have been reduced further since then and – even more important – the consideration of disaggregation of the market had not been sufficient in the light of most recent research.

To demonstrate the possible effect of a Tobin tax we have ordered all USD/EUR transactions of a median bank according to the estimated spread and calculated the same for interbank transactions only. Figure 4 shows that virtually all trades are settled with less than 100 pips, i.e. approximately 1% spread. It is more interesting that 99% of interbank dealing operates with less than 0.1% spread and still 96% of interbank trading takes place with a spread below 0.05%. This implies that even a Tobin tax as low as 0.1%, that is the preferred rate following the expert meeting in 1995, is above the highest realized spreads in the interbank market. When applying the elasticity calculations suggested by Campbell and Froot (1994) to our case, the interbank market would shrink by more then 80% with a Tobin of 0.1% and an assumed elasticity of only -1.[4] Consequently, the existing market structure could not easily exist further with this tax rate, liquidity would go down very markedly and volatility increase.

It is therefore unclear which of the inconsistent effects might dominate: would a Tobin tax strengthen fundamental speculation to an extent that it overcompensated a rise in volatility being caused by declining liquidity? There is no clear answer on hypothesis 3. To circumvent this conflict it has emerged as an objective of the discussion in the 1990s that the existing market structure should be kept. Is there any way out of this problem?

3.4 Can any tax rate satisfy the guidance and the liquidity objective?

The competing objectives of guidance and liquidity that have governed the more recent Tobin tax discussion have led proponents to a clear reaction. Sorting the Tobin tax proposals by their date of issue reveals that the suggested rates have become lower and lower over time with a new minimum suggested recently. In a study by Spahn (2002) on behalf of the German Federal Ministry for Economic Cooperation and Development a normal rate of 0.02% for an interbank transaction is preferred (0.01% on each participating bank per deal).

[4] Assuming a minimal tax rate of 0.01% would still result in a volume decline by a third.

In the light of our above discussion the Tobin tax proponents have adjusted first to declining transaction costs and second to the fire from the finance community regarding the liquidity concern. There is no question that new proposals take market microstructure insights seriously. The problem is, however, that this move to satisfy one concern does in the meantime clearly hurt the original main concern. Reading the analyses carefully, there was never any hope that a Tobin tax could shelter currencies against major speculative attacks. The purpose was more modest to limit unwanted effects from "normal" speculative activities.

It is obvious and conceded by Spahn (2002) that low rates such as 0.02% will not impact speculative activity very much if at all. This is accepted as a price of keeping the market liquid. What has not been considered so far is, however, that banks do not seem to be the right focus when talking about exchange rate speculation. It is asset managers who matter and their horizon is clearly longer than that of FX dealers. Moreover, their horizon is definitely too long to be impacted by tax rates of below 0.1%. Microstructure research thus reveals an illusionary character of the proposals with ever declining tax rates: even if the minimum rates might impact FX dealers' decisions which is questionable, the logic of the Tobin tax shows that minimum rates can not influence the comparatively longer-term asset managers' calculus.

Summing up, it looks as if that there is no way out of the competing objectives discussed here and hypothesis 4 thus seems to be not supported: a low rate does not curb speculation and a high rate destroys the existing market structure. What are possible policy alternatives under these circumstances?

4. Policy conclusions

Considering the guidance and the liquidity objective only and leaving other objectives of a Tobin tax aside, the original concept of a uniform proportional tax rate does not reach its goals. Microstructure research has not only strengthened the case of Tobin tax opponents in highlighting the economic benefit of risk allocation in foreign exchange markets and the possible costs of a transaction tax in this respect. Latest research has moreover shattered hopes that there will be any rate able to satisfy the two competing objectives discussed here. Available evidence thus suggests that the Tobin tax concept

may have worked in a world with speculating banks and higher transactions costs but that it does not work anymore.

This finding leaves three alternative strategies open: first, one could follow the income-generating impetus of many proponents and just accept that a minimum rate can not guide foreign exchange markets; but why then tax FX transactions? Second, one may stick to Tobin's original concern and assess guidance as the overall priority and thus risk the unknown outcome of a tax-induced change in market structure; is this experiment worth it? It may be speculated that both alternatives do not suffice for what Tobin had in mind. So, Tobin (1996) may offer a third alternative by changing the basis of assessment away from transactions towards open positions. Whatever a serious analysis of this idea may reveal, the original Tobin tax concept is unconvincing in the light of recent microstructure research in foreign exchange.

References

Arestis, Philip and Malcolm Sawyer, 1997. How many cheers for the Tobin transactions tax?. *Cambridge Journal of Economics* 21, 753-768.

Bank for International Settlements, 2002. *Triennial central bank survey, foreign exchange and derivatives market activity in 2001*. Basel.

Bjønnes, Geir Høidal and Dagfinn Rime, 2001. FX trading … LIVE! Dealer behavior and trading systems in foreign exchange markets. Working paper, Stockholm Institute for Financial Research.

Campbell, John Y. and Kenneth A. Froot, 1994. International experiences with securities transaction taxes, in: Jeffrey Frankel (ed.), *The internationalization of equity markets*, Chicago: University of Chicago Press, 277-308.

Cheung, Yin-Wong and Menzie D. Chinn, 2001. Currency traders and exchange rate dynamics: a survey of the US market. *Journal of International Money and Finance* 20, 439-471.

Cheung, Yin-Wong, Menzie D. Chinn and Ian W. Marsh, 2000. How do UK-based foreign exchange dealers think their market operates?. *NBER Working Paper*, No.7524.

Eichengreen, Barry, 1996. The Tobin tax: What have we learned?, in: ul Haq et al. (eds.), 1996, 273-287.

Eichengreen, Barry, James Tobin and Charles Wyplosz, 1995. Two cases for throwing sand in the wheels of international finance. *Economic Journal* 105, 162-172.

Evans, Martin D.D., 2001. FX trading and exchange rate dynamics. *Journal of Finance*, forthcoming [NBER Working paper 8116].

Evans, Martin D.D. and Richard K. Lyons, 2002. Order flow and exchange rate dynamics. *Journal of Political Economy* 110, 170-180.

Fan, Mintao and Richard K. Lyons, 2002. Customer trades and extreme events in foreign exchange, in: Paul Mizen (ed.), Festschrift for Charles Goodhart, London: Edward Elgar.

Frankel, Jeffrey A., 1996. How well do markets work: might a Tobin tax help?, in: Ul Haq et al. (eds.), 1996, 41-81.

Frankel, Jeffrey A. and Andrew Rose, 1995. Empirical research on nominal exchange rates, in: Gene Grossmann and Kenneth Rogoff (eds.), *Handbook of International Economics*, Vol.III, Amsterdam et al.: North-Holland, 1689-1729.

Gehrig, Thomas and Lukas Menkhoff, 2002. The use of flow analysis in foreign exchange: exploratory evidence. *Journal of International Money and Finance*, forthcoming.

Habermeier, Karl and Andrei A. Kirilenko, 2002. Securities transaction taxes and financial markets. Paper presented at the Third Annual IMF Research Conference, November.

Hau, Harald, 2002. The role of transaction costs for financial volatility: Evidence from the Paris bourse. Working paper, INSEAD.

Keynes, John Maynard, 1936. *The general theory on employment, interest, and money*. New York, London: HBJ Book (reprint).

Lui, Yu-Hon and David Mole, 1998. The use of fundamental and technical analysis by foreign exchange dealers: Hong Kong evidence. *Journal of International Money and Finance* 17, 535-545.

Lyons, Richard K., 1995. Tests of microstructural hypotheses in the foreign exchange market. *Journal of Financial Economics* 39, 321-351.

Lyons, Richard K., 2001. *The microstructure approach to exchange rates*. Cambridge: MIT Press.

Lyons, Richard K., 2001a. New perspective on FX markets: order-flow analysis. *International Finance* 4, 303-320.

Mende, Alexander and Lukas Menkhoff, 2002. Different counterparties, different foreign exchange trading? Evidence from a median bank. Discussion paper, University of Hannover, forthcoming.

Menkhoff, Lukas, 1997. Examining the use of technical currency analysis. *International Journal of Finance and Economics* 2, 307-318.

Menkhoff, Lukas, 2001. Short-term horizons in foreign exchange? Survey evidence from dealers and fund managers. *Kyklos* 54, 27-47.

Neely, Christopher and Lucio Sarno, 2002. How well do monetary fundamentals forecast exchange rates?, *Federal Reserve Bank of St. Louis Review* , 51-74.

Osler, Carol, 2002. Currency orders and exchange-rate dynamics: An explanation for the predictive success of technical analysis. *Journal of Finance*, forthcoming.

Reisen, Helmut, 2002. Tobin tax: could it work?. *OECD Observer* No.231/232, March.

Rogoff, Kenneth, 2002. Dornbusch's overshooting model after twenty-five years. IMF Mundell-Fleming Lecture, *IMF Working Paper* WP/02/39.

Sarno, Lucio and Mark P. Taylor, 2001. *The microstructure of the foreign-exchange market*. Princeton Studies in International Economics No.89, Princeton University.

Spahn, Paul Bernd, 2002. On the feasibility of a tax on foreign exchange transactions, report to the Federal Ministry for Economic Cooperation and Development, Bonn.

Taylor, Mark P., 1995. Exchange rate economics. *Journal of Economic Literature* 33, 13-47.

Taylor, Mark P. and Helen Allen, 1992. The use of technical analysis in the foreign exchange market. *Journal of International Money and Finance* 11, 304-314.

Tobin, James, 1978. A proposal for international monetary reform. *Eastern Economic Journal* 4, 153-159.

Tobin, James, 1984. On the efficiency of the financial system. *Lloyds Bank Review* No.153, 1-15.

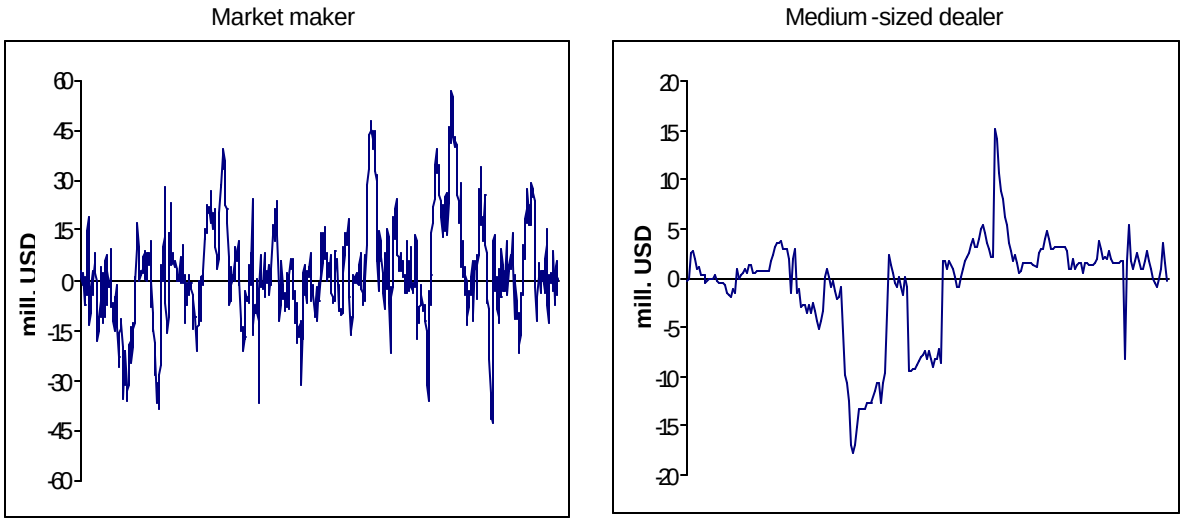
Tobin, James, 1996. Prologue. in: ul-Haq et al. (eds.), 1996, ix-xviii.

Ul Haq, Mahbub, Inge Kaul and Isabelle Grunberg (eds.),1996. *The Tobin tax: coping with financial volatility*. Oxford et al.: Oxford University Press.

Wahl, Peter and Peter Waldow, 2001. Currency transaction tax – a concept with a future. WEED (world economy, ecology & development) working paper, Bonn.

Yao, Jian M., 1998. Market making in the interbank foreign exchange market. Working paper S-98-3, Stern School of Business, New York University.

Figure 1. Foreign exchange inventory of a market maker and a medium-sized dealer



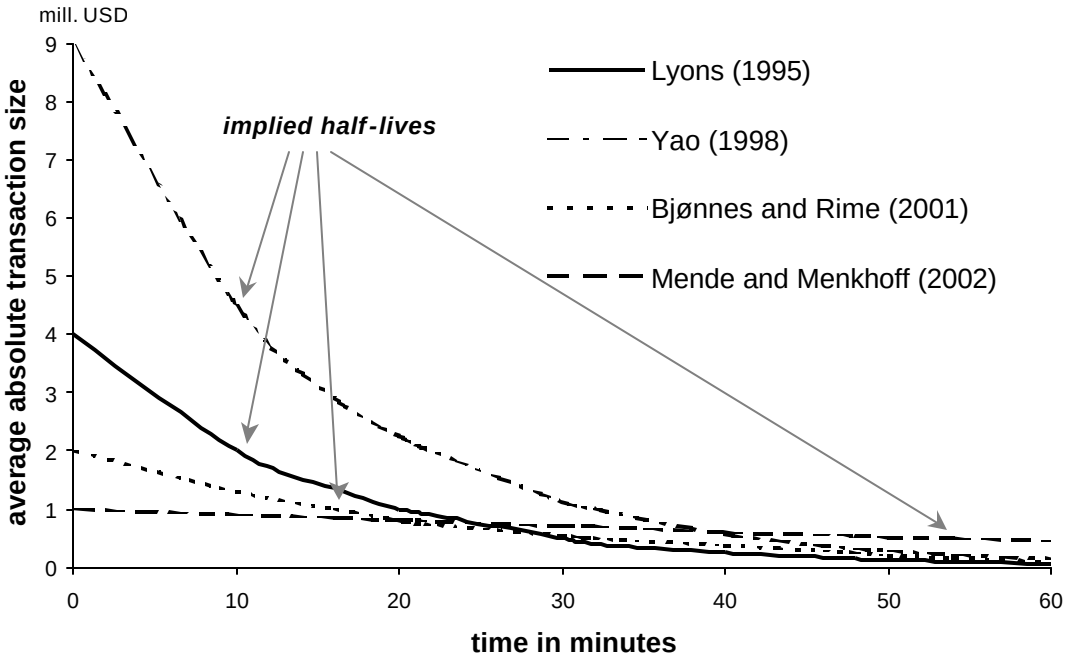
Plot of a market maker's inventory in millions of USD at the time of each incoming order during the sample week, 08/03/92 – 08/07/92.

Source: Lyons (1995)

Plot of a medium-sized dealer's inventory in millions of USD at the time of each order during the sample week, 09/03/01 – 09/07/01.

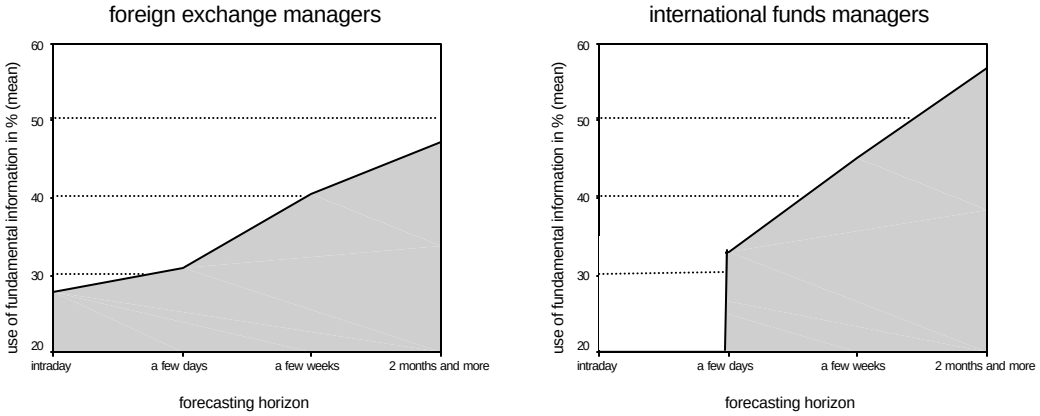
Source: Mende and Menkhoff (2002)

Figure 2. Reduction of open positions and implied half-lives



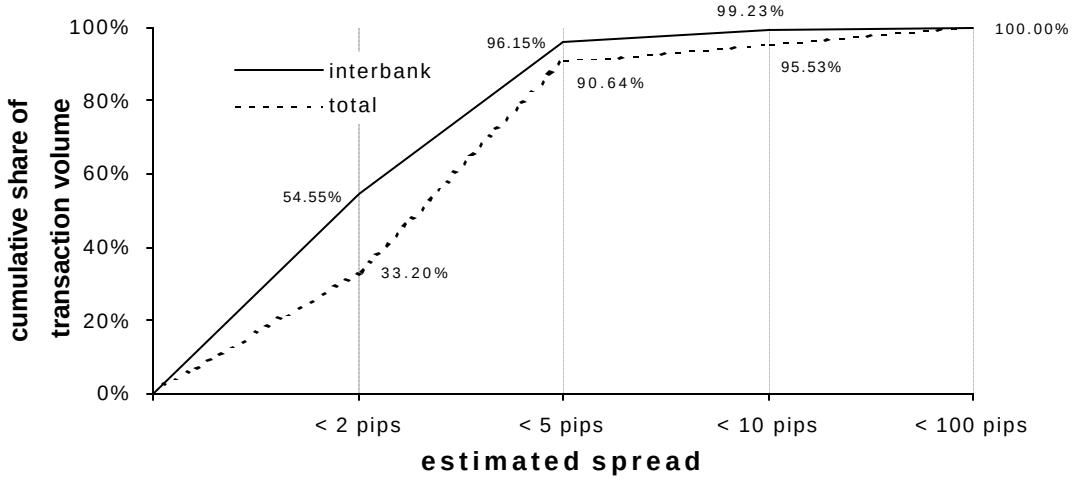
Note: This figure shows the behavior of four dealers from four different studies in a highly stylized way. The starting points are transactions of average size and the curved lines indicate the typical reduction of open positions over time. The half-lives of open positions resulting from typical behavior are marked.

Figure 3. The importance of fundamentals at typical forecasting horizons



Note: The data stem from a questionnaire survey conducted in Germany in 2001 with about 200 responses. One question asks for the forecasting horizon when deciding about open foreign exchange positions. The other question asks for the relative weight given to fundamentals, technical analysis and flows for typical decision making in foreign exchange.

Figure 4. The cumulated distribution of spreads



Note: The cumulated shares of transaction volume with an "estimated spread" of less than 2 pips, i.e. approximately 0.02%, less than 5 pips etc. are shown here for interbank trades and for total trades respectively. The "estimated spread" is calculated on the basis of the existing data set (Mende and Menkhoff, 2002).