Economics Department Working Paper Series

No. 16-2010

The Tobin Tax
A Review of the Evidence

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Abstract: The debate about the Tobin Tax, and other financial transaction taxes (FTT), gives rise to strong views both for and against. Unfortunately, little of this debate is based on the now considerable body of evidence about the impact of such taxes. This review attempts to synthesise what we know from the available theoretical and empirical literature about the impact of FTTs on volatility in financial markets. We also review the literature on how a Tobin Tax might be implemented, the amount of revenue that it might realistically produce, and the likely incidence of the tax. We conclude that, contrary to what is often assumed, a Tobin Tax is feasible and, if appropriately designed, could make a significant contribution to revenue without causing major distortions. However, it would be unlikely to reduce market volatility and could even increase it.

JEL Classification: G15, G18, H22, H27

Key Words: Tobin tax, financial transaction taxes, volatility, revenue, incidence, feasibility

[°] The corresponding author. We are grateful for the participants of a Centre for the Study of Financial Innovation workshop for useful comments and suggestions. Stacey Townsend has provided excellent administrative support. We gratefully acknowledge financial support from DFID for the research undertaken in this paper.

1. Introduction

In 1972, in the Janeway Lectures at Princeton, James Tobin suggested that it might be a good idea to impose a currency transactions tax in order to enhance the efficacy of macroeconomic policy (Tobin 1974). He reiterated this view in his presidential address to the Eastern Economic Association in 1978 (Tobin 1978). The proposal did not get a good reception. As Tobin wrote 'it did not make much of a ripple' (Tobin in Ul-Haq *et al*, 1996). However, over the subsequent 30 years, every time there has been some form of financial or currency crisis, there is renewed discussion about whether the implementation of a Tobin Tax might be an appropriate policy response. The Tobin Tax is an emotive issue. On the one hand such a tax is, as Tobin himself put it, 'anathema to Central Bankers'; many economists share an instinctive dislike for taxing transactions and oppose the tax for this reason; bankers and other participants in financial markets often regard it as unworkable or naïve. On the other hand, campaigning groups, politicians and economists frequently raise the issue of the Tobin Tax (and other similar financial transaction taxes), in reaction to major financial crises, due to its purported ability to stabilise markets. High volatility in the markets can be economically damaging, due to its negative impact on investment, and so if a Tobin Tax actually did stabilize markets this could be a significant benefit. Moreover, the fiscal difficulties created by the current crisis have led to renewed calls for the imposition of such a tax, both to boost tax revenues and as a means of extracting a larger contribution from the financial sector to fund a wide range of national and international public goods.[1]

Despite the long-standing debate on the issue, the arguments aired by both proponents and opponents of the tax are often rather poorly grounded in evidence. This is surprising, because there is now a voluminous literature on the Tobin Tax. This includes extensive theoretical work, examining whether Tobin and Tobin-like taxes would stabilise markets in principle, simulations which explore how simple agents acting according to specified set of rules would react to the imposition of such a tax, as well as empirical work examining the actual impact upon markets and revenue when similar such taxes have been imposed in various countries. In addition, there is a comprehensive literature on potential ways in which such a tax might be implemented and the pitfalls, difficulties and possibilities associated with these differing modalities. In short, there is a great deal that we already know about the pros and cons of Tobin and Tobin-like taxes.

The aim of this paper is to lay out, in a disinterested fashion, the evidence currently available. Specifically we will attempt to review the evidence on four key questions:

(1) What is the impact of financial transaction taxes on volatility?
We will review the results arising from the main theoretical models that have been developed, as well as the findings from computational simulations. We then describe the findings from the empirical literature associated with similar kinds of transaction costs and taxes.

(2) Is a Financial Transaction Tax feasible?
A key concern running through the debate is whether it is actually feasible to implement such taxes in a way that would prevent significant avoidance. Three key questions arise here. First, what instruments should be taxed (and would market actors simply be able to substitute non-taxed instruments for taxed ones to avoid the tax). Second, at what point in the payment system (i.e. trading, clearing or settlement) and on what resource (e.g. registration, brokerage) should the tax be imposed? Third, what should the scope of the tax be? i.e. should it cover domestic assets or also foreign assets; domestic market actors or also foreign actors; transactions taking place in the domestic market or also those taking place abroad? Related to this, is the issue of whether market actors can circumvent the tax by migrating their business, or at least their trades, to untaxed centres,

[1] The current Robin Hood Tax campaign (www.robinhoodtax.org) is the most recent embodiment of such a campaign focused on the revenue benefits of such a tax.

and, whether it would therefore be necessary to get agreement among all, or a large number of key countries for the tax to be effective.

(3) How much money would a FTT collect?
The answer to this question is clearly determined by the answers to the feasibility questions above. We outline the large range of estimates in the literature of the revenue that would be collected and attempt to explain how the figures produced depend on the coverage of instruments, actors and countries and the rates applied. We also examine the existing estimates of the elasticity of trade volume with respect to the tax and the effect that this has on the revenue figures obtained. Finally, we conduct a meta-analysis of the revenue collection potential using the median estimates from the literature.

(4) What would be the incidence of the Tobin Tax?
Unfortunately, the analytical and empirical literature on the incidence of a Tobin Tax is rather sparse. Nonetheless, we examine the merits of the various positions taken and attempt to come to a reasoned judgment about the likely incidence of the tax.

Given the range of terms used to describe financial transaction taxes, it is useful to define the scope of our review. We are interested in financial transaction taxes which affect the inter-bank or wholesale market. We do not consider non-financial transaction taxes (e.g. taxes on the exchange or trade in goods or services); nor do we explore non-transaction taxes on financial assets (e.g. capital gains tax). Moreover, we are only interested in financial transaction taxes that affect the inter-bank or wholesale market – as a result we do not consider transaction taxes that are oriented to the retail market e.g. bank debit taxes. Even with these restrictions, our definition is broad, covering taxes on the exchange of the entire range of financial securities, including bonds, shares, and foreign exchange as well as the spot, forward, and futures and options markets for these assets. When referring to this full range of transaction taxes we use the term Financial Transaction Taxes (FTT). When referring only to transaction taxes on foreign exchange we will use the term Tobin Tax, since Tobin's original idea only related to the taxation of foreign exchange transactions. However, we broaden Tobin's original concept to include all forms of transaction tax on the foreign exchange market, including forward, futures and options, not merely those pertaining to the spot market.

2. The Impact of FTTs on Volatility

Tobin's original proposal was focused on reducing the volatility of markets. His reasoning, and that used subsequently in much of the debate, was that very short-term transactions are more likely to be destabilising than long-term transactions based on market fundamentals. A tax on each transaction represents a much higher tax rate for short term than for long term investments, hence discouraging the former. If indeed short term transactions induce more volatility than long term trades, the tax should reduce overall market volatility.

The assumptions underlying this reasoning have been subject to comprehensive scrutiny in both the theoretical and empirical literature. We start by briefly reviewing the traditional theoretical work on the topic in the tradition of Keynes and Friedman. The opposing views about the impact of speculation on volatility arising from the traditional literature gave rise to a closer focus in theoretical models on the microstructure of these markets and the characteristics of traders (Frankel and Rose, 1994). These models depart from traditional assumptions of fully rational agents. Rather market actors are assumed to have bounded rationality, making decisions according to 'rules of thumb' which may not necessarily be optimal. In addition, these Heterogenous Agent Models (HAM) take into account the fact that market actors may have different interests, capabilities, and access to funding. A further group of models adopt the HAM approach but allow interaction between the various agents in ways that can affect aggregate variables (Westerhoff, 2003, Westerhoff and Dieci, 2006, Hanke, 2006).

A second group of theoretical studies focus on zero intelligence atomistic models based on percolation theory (Cont and Bouchaud, 2000). These models reproduce excess volatility and fat tails in the distribution of returns, through herding behaviour in the population of traders (e.g. Ehrestein *et al*, 2005; Mannaro *et al*, 2008). This class of models, though neglecting any notion of optimising behaviour, has the virtue of taking into account the discrete nature of traders, whereas in the heterogeneous agent approach only the effect of the aggregate demand of different types of traders matters (Bianconi et al, 2009).

Finally, we review game theoretical approaches to modeling the impact of Tobin like taxes on volatility (Bianconi *et al*, 2009; Kaiser *et al*, 2007). All three of these approaches are better than traditional models in reproducing the 'stylized facts' of real financial markets (Cont, 2001) such as excess volatility, the fat tailed distribution of returns and volatility clustering.

After reviewing the theoretical literature, we turn to the empirical literature. Since a Tobin Tax, as originally envisaged has never been implemented, the empirical evidence of the impact of a transaction tax in the foreign exchange market is much more sparse than the theoretical literature. However, numerous countries have implemented a variety of financial transaction taxes (see IMF (2010) for a recent review). We therefore draw on the empirical literature assessing the impact of these taxes on volatility. We conclude with an overall assessment of the evidence about the impact of FTTs on volatility from both the theoretical and empirical literature.

2.1 Theoretical Models

Traditional theoretical models

As noted above, both Keynes' and Tobin's original proposal for a financial transaction tax was based upon the assumption that short-term trades are likely to be more destabilising to financial markets than longer term trades. Indeed this is the underlying rationale behind the arguments of a very large number papers supporting financial transaction taxes. However, this view was famously challenged by Friedman (1953), who argued that speculation cannot in general be destabilising since, if it were, the actors involved would lose money:

> 'People who argue that speculation is generally destabilizing seldom realize that this is largely equivalent to saying that speculators lose money, since speculation can be destabilizing in general only if speculators on the average sell when the currency is low in price and buy when it is high' (Milton Friedman, 1953, p.175)

This strand of the literature therefore argues that speculative opportunities occur when the market is inefficient, and that rational arbitrage trading on unexploited profit opportunities is effective in clearing markets and stabilising prices, bringing them down to their fundamental values (Fama, 1965).

How might a transactions tax affect market efficiency and the volume of trade? Noussair *et al* (1998) uses a continuous double auction model[2] to show that, despite the imposition of a small fixed transaction tax[3], prices are still driven towards their equilibrium level, although with reductions in market efficiency and turnover. Similarly, Hanke *et al* (2010) simulates two continuous double auction markets, denoted LEFT and RIGHT, on which a foreign currency (Taler) can be traded for the home currency (Gulden). They analyse the effect of the imposition of a transaction tax (0.5 per cent of the transaction value) on one and then on both markets. In

[2] The continuous double action is the most widely used method of price formation in modern financial markets: "double" because traders can submit orders to both buy and sell; and "continuous", because they can submit orders at any time. Orders can be of two different types: limit or market orders. Limit orders are orders where the offered price does not match the ask price, so they do not result in an immediate transaction. Market orders match the ask price and therefore result in an immediate transaction.

[3] The tax was= 50 Yen (200 Yen= 1 French franc). This tax was charged to any agent who submitted an offer to buy or sell to the market.

order to examine the persistence of the impacts, they also consider a scenario where the tax is abolished again, after its introduction. Where the tax is imposed only on one market, they find that volatility in the taxed market decreases when the market is large and liquid, but increases when the market is small and illiquid. Moreover, volatility on the untaxed market is reduced significantly as a consequence of an increase in liquidity as traders shift to the untaxed market. If a Tobin tax is introduced simultaneously on both markets, overall trading volume is reduced and price volatility remains unchanged. Finally, they argue that the effects of a Tobin tax, once introduced on a market, cannot be completely undone by abolishing the tax later on, since the pre–tax level of trading activity would not be restored.

Beyond traditional theoretical approaches

Traditional models of financial markets tend to assume optimising agents with rational expectations about future events (i.e. that forecasts are perfectly consistent with the realisation of the events so that agents do not make consistent mistakes.) However, such models do not explain many of the characteristics that are observed in real financial markets such as excess liquidity (i.e. excessive trading activity due to speculative trade), excess price volatility, fat tailed distributions of returns (i.e. a much higher probability of very large positive and negative changes) and volatility clustering (i.e. switches between periods of high and low volatility).

To try and account for these, a new generation of theoretical models looked at the 'microstructure' of financial markets. These models typically assume that market actors are not perfectly rational, but rather apply rules-of-thumb when making decisions to buy or sell, based on whatever information they have at their disposal. They also assume that there are different types of market actors. As a result these models are known as Heterogenous Agent Models.

Heterogeneous Agent Models[4]

Models which assume rational traders with complete information face a fundamental difficulty because theory would suggest that, in these circumstances, there should be no trade. This is because a trader with superior private information about an asset should not be able to benefit from his information, because other rational traders, seeing the first trader trying to buy, would anticipate that he must have positive information about the asset and will therefore not be willing to sell the asset to him (Milgrom and Stokey, 1982). Heterogenous Agent Models (HAMs) attempt to find a solution to this problem by assuming that traders are different from one another, and that they are boundedly rational.[5] Agents do not have complete information about the market because gathering the necessary information is very costly, and because it is not always clear what the 'correct fundamentals' are (Keynes, 1936). As a result they use a range of rules-of-thumb to set their strategies.

HAMs in financial markets typically assume the existence of at least two different types of traders: 'fundamentalists', who base their expectations about future asset prices and their trading strategies on market fundamentals and economic factors, such as market dividends, earnings, macroeconomic growth, exchange rates, etc; and 'chartists' or 'noise traders' who base expectations and trading strategies on historical patterns. The latter employ a variety of 'technical trading rules' based on moving averages – buying when the short run moving average crosses the long run moving average from below and selling when the opposite occurs (Schulmeister, 2009). In such a set up, the volatility of the market is driven by the share of market traders that are noise traders (who increase volatility) relative to the share that are fundamentalists (who reduce it).

[4] See Hommes (2006) for a comprehensive review of this class of models.

[5] Formalised by Herbert Simon in 1957, the concept of bounded rationality argues that agents are not fully rational, i.e. they neither know everything about the other agents in the market nor about market characteristics. Moreover, they form expectations based upon observable quantities and adapt their forecasting rule as additional observations become available. Adaptive learning may converge to a rational expectations equilibrium or it may converge to an "approximate rational expectations equilibrium", where there is at least some degree of consistency between expectations and realisations. There is also an extensive literature in psychology describing how behaviour under uncertainty can be driven by heuristics and biases (Kahneman and Tversky, 1973).

De Long *et al*. (1990a and 1990b) formalised such a model in which fundamentalists are called 'sophisticated traders' and the chartists are 'noise traders'. The noise traders use signals from technical analysis, economic consultants and stock brokers to set their portfolio, irrationally (in the model) believing that these sources contain correct information. Sophisticated traders exploit this misperception, buying when noise traders depress prices and selling when prices are inflated. Thus sophisticated traders pursue a contrarian strategy, pushing prices towards their fundamental values. One advantage of these models is that they give more realistic outcomes in terms of the stylised facts of these markets, such as excess volatility (De Grauwe and Grimaldi, 2006).

Frankel and Froot (1990a and 1990b) apply such a model to the exchange rate markets, and extend it by adding another agent: the portfolio managers. As before, chartists use moving averages to trade, taking only the past exchange rate into account, but it is the portfolio managers who actually buy and sell foreign assets. They form their expectations as a weighted average of the forecasts of fundamentalists and chartists, adapting the weight over time in the direction that would have yielded a perfect forecast (Hommes, 2006). Simulation of this model shows that exchange rates may exhibit temporary bubbles during which the weight that portfolio managers place on the forecasts of fundamentalists is negative, inducing (in this model) an increase in the exchange rate. However, when the exchange rate goes too far away from its fundamental value, portfolio managers increase the weight given to fundamentalists thereby accelerating a depreciation. Frankel and Froot (1990a and 1990b) therefore show that, when the behavior of portfolio managers is driven by bounded rationality, it is possible for exchange rate markets to exhibit significant temporary deviations from market fundamentals.

Haberer (2004) describes the effect of a transaction tax in a perfectly efficient market and in an inefficient market – where efficiency is defined as the ability of the market to incorporate news. The efficient market is composed by fully rational agents with complete information about the structure of the model and the behaviour of relevant fundamentals. In this market, all market participants are homogenous and new information causes the price to change towards a new equilibrium through an approximation path[6]. Greater liquidity in this market helps prices to reach the new equilibrium and reduces volatility. The inefficient market, by contrast, is composed by heterogeneous participants (fundamentalists, who do not contribute to excess volatility; and chartists, who do) with different expectations and forecasting techniques. In this market, higher liquidity due to speculation increases volatility. Taking the two markets together, Haberer therefore suggests that there may be a U shaped relationship between liquidity and excess volatility. At low levels of market volume, greater liquidity reduces excess volatility. However, after a certain point, the confusion caused by speculation creates a positive relationship between liquidity and excess volatility. This suggests that a transaction tax in a low liquidity market would increase volatility, but in highly liquid markets such a tax may reduce volatility by reducing the incentives for speculative trading.

Shi and Xu (2009), augmenting Jeanne and Rose's (2002) study on the effect of a transaction tax on 'noise trading', analysed the effect on a Tobin tax on exchange rate volatility. Again, the idea is that exchange rate volatility is caused by changes in the relative share of fundamentalist and noise traders. A transaction tax might reduce exchange rate volatility by reducing the number of noise traders. They analysed entry costs for both informed (fundamentalists) and noise (chartists) traders after the introduction of a transaction tax in a general equilibrium model. A key assumption is that informed traders' unconditional expectation of excess return depends on the 'noise component' i.e. the ratio of noise entrants to informed entrants, but that this does not influence noise traders' expectations. An increase in the noise component increases market volatility. It also changes the risk premium and the gross benefit of

[6] There is not an instantaneous jump to the new equilibrium because agents are not perfectly aware of other's expectations in this model.

entry, but in a different way for informed and noise traders because of the asymmetry in their expectations.

Shi and Xu (2009) find that, when the entry decisions of all traders are endogenous, three equilibria are possible. In the first equilibrium, the noise component is one i.e. there are the same number of noise and informed entrants, so all traders form their expectations in the same way. As a result, an increase in entry costs due to a transaction tax leads them leave the market in pairs. The 'asymmetric expectation effect' therefore disappears and the gross benefits of entry are only affected by market depth (i.e. the sum of informed and noise traders). Hence a transaction tax only reduces market depth and does not affect volatility, since it does not influence the composition of traders. The second equilibrium occurs when the noise component is different from one. If entry costs are increased due to the tax, the asymmetry in expectations causes a larger reduction in the gross benefits of entry for informed traders' than for noise traders'. This, in turn, affects the composition of traders, increasing the noise component and, thereby, volatility. The third equilibrium occurs when the entry cost is sufficiently high to prevent the entry of noise traders. In this case, the introduction or increase of a transaction tax has no effect on volatility. Thus a Tobin tax will have an effect on volatility only if there are entry costs and if its imposition changes the share of noise traders in the market. Moreover, in Shi and Xu's model, the imposition of a Tobin tax does not reduce volatility, but may increase it depending on the ratio of noise to informed entrants.

The models described above assume stochastic interaction between agents, who are assumed not to be able to influence aggregate variables. This assumption is questioned by HAM interaction models, which support the idea that even weak interactions between individuals can lead to large movements in aggregate variables. Follmer (1974) considers an exchange economy with random preferences based on a probability law which depends on the agents' environment. Using results on interacting particle systems from physics, he shows that even short range interactions may propagate through the economy and lead to aggregate uncertainty causing a breakdown of price equilibria (Hommes, 2006).

Kirman (1991) formalised a 'local interaction model' comprising two sub–models: a model of opinion formation through a stochastic model of recruitment and an equilibrium model of the foreign exchange rate. The model of opinion formation argues that there is individual behavioural asymmetry when facing symmetric events.[7] Applied to financial markets, Kirman assumes that agents have to form opinions about the next period price of a risky asset, and they can choose between an optimistic and a pessimistic view. The fractions of fundamentalists and chartists in the market are thus derived from the stochastic model of recruitment and then used in foreign exchange rate model. Their expectations are influenced by random meetings with other agents. Agents have to decide to invest on two different assets: a safe asset, namely domestic currency, paying a fixed interest rate ; and a risky asset in the form of foreign currency paying an uncertain dividend. As usual, the equilibrium exchange rate is found where the aggregate demand for currency equals aggregate supply. If the market is dominated by fundamentalists, the exchange rate is stable and is pushed towards its fundamental value, causing low volatility. If noise traders dominate the market, the exchange rate is either driven by a stable but near unit root process, or by an unstable process when chartists think that the movement in the exchange rate will be greater than the risk free asset return, leading to high volatility. In this way, local interaction models capture one of the most important stylised facts of financial markets, namely volatility clustering, in which the exchange rate switches irregularly between phases of high and low volatility.

[7] This idea originated from a puzzle observed in biology where ants, having to choose between two identical food sources, do not simply choose randomly. Rather the majority of them chose one source, but their preferences for which source change over time.

Lux and Marchesi (1999, 2000) also attempt to derive a model capable of explaining the stylised facts of financial markets (asset prices follow a unit root process; asset returns are unpredictable with almost no autocorrelation; return distribution has fat tail; volatility clustering) which traditional fully rational models are not able to address. They analyse the probability of traders switching from chartist to fundamentalist trading strategies as well as from an optimistic chartist strategy to a pessimistic one and vice versa. The equilibrium price is derived based on the composition of traders in the market and a market opinion index, which captures the average opinion among chartists. Volatility arises through the interaction of, and switching between, fundamentalist and chartist trading strategies. Periods of high volatility are associated with an increase in the number of chartists in a market with a balanced distribution of pessimistic and optimistic views.

Another set of models have looked at the implications of imposing Tobin taxes on volatility when there is more than one market (e.g. London and New York). Westerhoff (2003) and Westerhoff and Dieci (2006) developed a simulation model of heterogeneous interactive agents in which rational agents apply technical and fundamental analyses for trading in two different markets. The technical analysis is based on past price trends, whereas fundamental analysis predicts a convergence towards fundamentals. The agents have several options, which are chosen depending on their relative fitness, where the fitness is given as a weighted average of current and past profits. Their model shows that even the imposition of a low tax rate of 0.25 percent in one market reduces distortions and volatility in the taxed market, whereas the untaxed market experiences stronger bubbles and crashes and higher volatility than before. Their model therefore supports Tobin's hypothesis that imposing a tax will reduce volatility. Moreover, they conclude that 'there is no reason for regulators of a market not to impose such a tax – at least the own market will benefit', because 'if the agents have to pay a uniform levy in both markets, chartism declines in favor of fundamentalism in both markets and thus both markets display lower price fluctuations and deviations from fundamentals'. This also suggests that regulators in the untaxed, more volatile market may see it in their interests to also impose the tax in order to compete for investors with a longer term horizon.

Zero intelligence agent models

Another approach to modeling the behaviour of financial markets is through the use of 'zero intelligence' (ZI) models – so called because they assume that market traders in the aggregate, behave probabilistically rather than being driven by any intelligent maximising behaviour. Agents in these models place orders to buy and sell at random depending on the current price. Only the institutions (e.g. the auction process) in these models have some kind of intelligence since they let prices converge to equilibria. The idea behind this approach is that modeling market behaviour using minimally intelligent agents provides a good benchmark of the effect of the market institutions, since it shows what sorts of behaviour arise purely because of these institutions and not due to any intelligent or strategic behaviour on the part of the agents. It may well be that market institutions shape agents behaviour so much that some properties of their behaviour depend more on the structure of these institutions than on any rationality on their part.[8]

ZI models are therefore much simpler than models assuming full rationality because they do not try to derive the properties of the market from assumptions of utility maximising rational individual agents. Rather, the ZI models study the flow of liquidity in and out the market and its interaction with price formation. Interestingly, ZI models and models based on the rationality paradigm can give rise to quite different explanations for volatility. For example Hasbrouck and Saar (2002), using a rational optimising model, find a positive link between the ratio of market and limit orders and volatility. They explain that this is because, when prices are more volatile, market orders become more attractive to risk averse rational agents (because, unlike limit orders, they entail an immediate transaction) and so the fraction of market orders increases. However, Farmer *et al*. (2004), using a ZI model, show that the same relationship can be explained without

[8] Indeed, Gode and Sunder(1993) claim that if students in an economics classroom are replaced in an experiment by zero intelligence agents with a budget constraint, the behavioural results are almost the same!

any rational optimising behavior. They show that a ZI model can exhibit a positive relationship between volatility and the ratio of market and limit orders due to the reduction of liquidity induced by the increase in market orders (since market traders are liquidity demanders), and that it is this reduction in liquidity that increases volatility.

Ehrestein *et al* (2005) used a ZI model to evaluate the impact of a Tobin tax on volatility, market distortions and government revenue, varying the size of the tax from 0 to 1 per cent. In this model, the introduction of a Tobin tax also brings about a reduction in volatility, as long as the tax rate is not so high as to significantly reduce market liquidity.

However, Mannaro *et al* (2008) using a similar approach obtains a different result. They use a multi-agent simulation model to analyze the effects of introducing a transaction tax on one, and then on two related stock markets. The market consists of four kinds of traders (Raberto *et al*., 2003): Random traders, who trade at random; Fundamentalists, who pursue the 'fundamental' value; and Chartists, who are either Momentum traders (following the market trend) or Contrarian traders (who go against the market trend). Each trader is modeled as an autonomous agent, with a limited stock portfolio and cash. When there are two stock markets, at each simulation step the trader decides in which market to operate by evaluating an attraction function for both markets. Mannaro *et al* find that the imposition of a tax in a single market of between 0.1per cent and 0.5 per cent of transaction costs increases price volatility, as long as there are noise traders in the market. When there are two markets, volatility is higher as traders switch from one market to the other to try and reduce their risk. In this case, the taxed market is generally more volatile than the untaxed one because the tax reduces trading volume and market liquidity.

Game theoretical approaches

Finally, it is possible to use game theory to assess the impact of a Tobin Tax on volatility. Kaiser *et al*. (2007) describe a game theoretical approach applied to an asset market both with and without the introduction of a Tobin tax. The game was set up with two steps. In the first step, agents define their bid and ask prices. Market prices are then created, with the ask price as the lowest stated by agents and bid price as the highest. In step 2, each agent decides whether to buy or sell or to refrain from trade. When a tax is introduced, it is paid by the agent who initiates the trade and is a percentage of the bid or ask price. In addition, the tax's height was varied to analyse the elasticity of volatility with respect to the tax. In the final period the assets each agent holds are converted into money.

Using this framework Kaiser *et al* (2007) carried out experiments on 96 subjects, mostly students from the University of Bonn. They analysed 6 sessions for the taxed scenario and 6 sessions for the untaxed one, each session lasting two hours. In general they found that the Tobin Tax reduced volatility, relative to the untaxed market.[9] However, a tax rate above 2 percent increases volatility drastically in their experiment, although the statistical evidence is not strong enough to give a definitive conclusion on this.

The Grand Canonical Minority Game model has also been used to analyse the effect of the imposition of a Tobin Tax in the exchange rate market.[10] It is a stylised representation of the financial markets, which are depicted as an ecology of different types of agent, speculators and institutional traders, interacting in an 'information food chain' (Bianconi *et al*,2009). As in previous models, it captures the interplay between commercial traders and financial speculators, with the latter group assumed to be responsible for both excess volatility and market efficiency. There are two types of agents. The first is commercial traders. They trade no matter what, so that the imposition of a tax cannot affect their choice. The second type of agent is financial speculators, who trade only if the perceived market profit exceeds a given threshold. The speculators' keep scores of the success of their previous strategies and adapt them accordingly.

[9] Unlike most studies, they measure variance as the absolute difference between prices and their mean.
[10] See Challet et al (2006) for a review of grand canonical minority game models.

The main objective of each agent is to be in the minority, i.e. to place a bid which has the opposite sign of the aggregate bid of all agents.

Bianconi *et al*. (2009) analyze the impact of the imposition of a Tobin tax on the volatility of the exchange rate in a GCMG model. The first effect of the tax is to increase the profit threshold for speculators, discouraging them from trading. More generally, the effect of the tax depends on how close the market is to a critical zone of information efficiency. If it is far from this zone, the tax has mild effect on volatility and information efficiency. If the market is within the critical zone and volatility is high, only a sufficiently large tax will have an impact on volatility. Moreover, the impact on volatility is found to be very dependent of the market size. Since volatility decreases with the size of market, the effect of a Tobin tax is much stronger in a small market than a bigger one. Finally, in a market in which the composition of agents is evolving, a tax can reduce volatility only if the change in the composition of agents is slow.

As the above discussion makes clear, there are a wide range of theoretical models with different assumptions and different results. Table 1 provides a summary of the conclusions from the key theoretical papers on the topic. Most, but not all, studies conclude that a small Tobin tax would reduce volatility, but many models also suggest that great care should be taken in choosing the size of the tax since, if it is too large, the reductions in market trading and liquidity could result in an increase rather than a reduction in volatility.

Table 1: Results from Theoretical and Simulation Models

AUTHOR(S)	IMPACT OF TOBIN TAX ON VOLATILITY
Hanke (2006)	Increase or decrease depending on market size
Shi and Xu (2009)	Increase or decrease depending on the effect on the number of noise traders
Westerhoff (2003) and Westerhoff and Dieci (2006)	Decrease
Ehrenstein (2002, 2005)	Decrease, as long as the tax rate is not too high to affect the liquidity
Mannaro *et al*. (2008)	Decrease, but only in presence of noise traders in the market
Kaiser *et al*. (2007)	Decrease
Bianconi *et al*. (2009)	Decrease but depending on market size

2.2 Empirical evidence

Theoretical models, and their associated simulations, are helpful in thinking through the pathways through which a Tobin Tax might affect volatility, but we cannot be sure that real financial markets will necessarily behave in the way that these models predict. It is therefore helpful to look at empirical evidence about the impact of such taxes. Unfortunately, there are relatively few such empirical studies, in part, because a Tobin Tax has not yet been imposed. However, other similar taxes have been imposed in various countries and so it is possible to learn from these experiences. Moreover, there is a literature on the relationship between transaction costs and volatility. In so far as taxes increase transaction costs, this literature can shed light on the possible effect of a Tobin Tax.

Most of the studies examining the link between transaction costs and volatility find a positive relationship between the two – that is higher transaction costs are associated with more, rather than less volatility. For example, Mulherin (1990) examines trading costs in the NYSE and relates these to the daily volatility of the Dow Jones returns over the 91 years from 1897 to 1987. He concludes that although the imposition of a transaction tax can be expected to be followed by lower trading volume, a corresponding decline in volatility is not an obvious result.

Other studies on stock markets give similar results. For example, Jones and Seguin (1997) show that the abolition of mandated minimal commission rates in the U.S in 1975 decreased transaction costs in the NYSE and the AMEX markets and that market volatility fell in the year following the deregulation. However, the same volatility decrease, although less pronounced, was also registered for the Nasdaq market (which had not had such regulation), suggesting that an overall reduction in volatility over time may have had a stronger influence on the result than the reduction in transaction costs.

Liu and Zhu (2009), following Jones and Seguin's approach, study the effect of the commissions deregulation which occurred in October 1999 in the Japanese market. These were part of the "Big Bang" reforms in which STT were abolished and the fixed brokerage commission deregulated. The main aim of the reform was to reduce transaction costs, blamed for the economic stagnation and the poor performance of the Japanese equity market during the 1990s. In contrast to Jones and Seguin, they find support for the idea that the reduction in transaction costs increased volatility in the Tokyo Stock Exchange.[11] Since there was no section of the Japanese market exempt from the reforms, they compare a treatment group, TOPIX (a value weighted stock price index covering the Tokyo Stock Exchange (TSE) First Section) and its three subgroups, with four control portfolios: ADR, which is used as the benchmark control portfolio, and three equity indices respectively for Asia (AEJ), Pacific (PEJ) and Asia/Pacific (APEJ).[12] The control portfolios are strongly linked to the treated portfolio, but are not affected by the commission deregulation. Liu and Zhu's results show that volatility for TOPIX increased by 32% after the deregulation, relative to the control portfolios.

Bessembinder and Rath (2002) analyze stocks moving from the Nasdaq market to the NYSE. They find strong evidence that the newly NYSE listed stocks reduce both trading costs and the standard deviation of daily returns. But NYSE listings may simultaneously alter market structure or investor composition which may affect volatility. Hence the cross-market comparison is inconclusive because the volatility change could result from a stock listing effect rather than a transaction cost effect.

Studies of tick size[13] changes tend to give the same result. Larger tick sizes are associated with higher transaction costs and also with higher volatility (Bessembinder, 2000). Similarly, Hau (2006), studying French stock finds that a larger tick size increases transaction costs by 20 per cent and that this increase in transaction costs generates an increase in volatility of about 30 per cent. However, it is not clear whether the types of transaction costs introduced by tick size changes would act in the same way as a transactions tax.

Studies of foreign exchange markets also suggest that higher transaction costs are associated with greater volatility. Aliber *et al*. (2003) look at transaction costs, volatility and trading volume using futures prices of four currencies (the British Pound, the Deutsche Mark, the Japanese Yen and the Swiss Franc) traded on the Chicago Mercantile exchange for the period of 1977–1999.

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[11] The authors identify the following reasons for the different effects in the US and Japan : 1) the commission deregulation in Japan drastically reduced the commission rates on individual trading, while the opposite was true for the deregulation in the U.S.; 2)online retail stock trading, which was unavailable at the time of the U.S. deregulation, has further fuelled individual trading following the Japanese deregulation.

[12] Japan was excluded from all of the three control indices.

[13] The tick size is the minimum price change allowed in the trading system. This can depend on the value of the stock, with higher valued shares having larger tick sizes.

Average transaction costs are tiny - in the range of $36 to $51 for a foreign currency trade valued at $100,000 (i.e. around 0.05 percent). Across the 4 currencies, the average volatility is 11.025 percent.[14] They find that an increase of 0.02 percent in transaction costs leads to an increase of volatility of 0.5 percentage points, as well as a reduction in trading volume.

Lanne and Vesala (2010) confirm this finding with both daily and intradaily data on Deutsche Mark – Dollar and Yen – Dollar exchange rates from 1992 to 1993. They include money – market headline news on the Reuters AAMM screen to control for the endogeneity problems caused by changes in fundamental volatility. Following Andersen and Bollerslev (1998) they compute volatility as a measure of daily realised variance summing the squared 5 minute returns over each trading day. Realised variance is regressed on transaction costs and a set of control variables. They estimate both a daily and intradaily equations, because transaction costs can vary in the course of a day. The results show that both in the daily and intradaily regressions the effect of transaction cost on volatility is positive and significant. An increase of 0.01 per cent in transaction costs raises the variance of the Deutsche Mark by 1.16 per cent relative to its average; the increase for the Yen is 1.21 per cent, over four times larger than the increase calculated by Aliber *et al*. The difference in findings from Aliber *et al* is due to their use of better controls for endogeneity, as well as their use of higher frequency data.

Turning to the few studies of actual transaction taxes, we find a similar story. Roll (1989) analyzed the impact of the imposition of a transaction tax on volatility in 23 equity markets around the world, in three periods before and after the international equity market crash on October 1987. He found that transaction taxes are inversely but insignificantly related to volatility both before and after the crash. Also, Hu (1998) who describes 14 changes in STTs rates that occurred in Hong Kong, Japan, Korea, and Taiwan during the period 1975–1994, concludes that, on average, a change in STT rates had no effect on volatility.

Similarly, Sweden introduced a 1 per cent round trip tax on equity transactions in 1984, which was increased to 2 per cent in 1986. Umlauf (1993) compares weekly and daily returns variance of the Swedish All share equity index under the no tax, 1 per cent and 2 per cent tax regimes. He finds no significant difference in the weekly variance across the three tax regimes.[15] There is, however, a statistically significant increase in the daily variance of returns which is higher during the 2 per cent tax regime than in the other regimes (regardless of whether the 1987 crash is included or not). Umlauf also attempts to control for time time varying fundamental volatility, by normalising the returns variance by the NYSE[16] and FTSE variances, but finds no systematic relationship between tax regime and volatility.

Since the stock of some Swedish firms were also traded in London, Umlauf also attempts to assess the impact of the tax by calculating the ratio of the volatility of London- and Swedish-traded share classes. If this ratio diminishes with the imposition of the tax, it would suggest that transaction taxes increase volatility. He show that this ratio falls or remains stable across the different tax regimes for 9 out of 11 companies for daily data and 5 out of 11 for weekly data. The average reduction was about 6 per cent on a daily basis and 2 per cent on a weekly basis, supporting the idea that the imposition (and increase) of the transaction tax increased volatility in the taxed market. Umlauf also notes that the tax gave rise to huge market diversion from the Swedish to the London stock market. It was estimated that, in 1986, 30 per cent of Swedish trading was diverted to London; by 1990 the migrated volume had grown up to 50 per cent (Campbell and Froot 1994).

Saporta and Kan (1997) undertake a similar piece of analysis on the impact of the imposition of UK Stamp Duty on the FTSE – All share equity index returns from 1969 to 1996. Unsurprisingly, they find that the increase in stamp duty rate from 1 per cent to 2 per cent in 1974

[14] They measure volatility as the standard deviation of daily returns on the closest maturing futures contract.
[15] If the period of the 1987 crash, which occurred at the end of the period studied, is excluded.
[16] NYSE: New York Stock Exchange. FTSE: London Stock Exchange FT All – share index.

caused a significant (-3.3 per cent) fall in the index, whilst its reduction from 2 per cent to 1 per cent in 1984 and then to 0.5 per cent in 1986 caused a small increase. To disentangle the effect of the securities transaction tax on volatility, they compared the variance of returns on the stock of 4 companies listed on the London Stock Exchange, which are subject to the stamp duty, with the returns variance of their corresponding US-listed American Depositary Receipts (ADR), which are not subject to stamp duty. Using univariate GARCH and ARMA models with different specifications to control for serial correlation and leptokurtotic distribution of financial time series, their findings show no significant effect of UK Stamp duty imposition on the volatility of equity prices.

More recently, Phylaktis and Aristidou (2007) describe the effect of a STT increase and reduction in the Athens Stock Exchange (ASE). First introduced in 1998 at 0.3%, it was increased in 1999 to 0.6% and then reduced after two years to its original rate. Phylaktis and Aristidou use the All Share Index as well as the FTSE/ASE 20 Index, which covers the top 20 shares, to test whether the transaction tax had a greater impact on the volatility of the most actively traded stocks. Unlike previous studies, they control for the possibility that transaction taxes might have a different effect on volatility during bull and bear periods.[17] They also test test whether negative shocks (bad news) raise volatility more than the positive ones (good news), which might induce future stock volatility to vary inversely with the stock price.

Their results show that the transaction tax has no effect on volatility for both the All share index and the FTSE/ASE 20. The STT decreases volatility in bull periods and increases it in bear periods for FTSE/ASE 20. Phylaktis and Aristidou (2007) argue that the STT reduces volatility in "bull periods" because investors are less affected by transaction taxes in highly liquid markets, and instead buy stocks in anticipation that the market will continue to rise. They suggest that the reverse effect during bear periods is because investors become more price sensitive to the additional cost of the transaction tax. Finally, negative innovations (bad news) are found to increase volatility by 1.09-1.13 times more than positive innovations (good news).

Su (2010) analyses the impact of changes in STT rates in the Shanghai Stock Exchange (SHSE) and the Shenzhen Stock Exchange (SZSE), on trading volume, volatility of returns and market efficiency. Both exchanges list two types of shares, A and B shares, issued by Chinese companies. A STT on both purchase and sale of A shares was introduced in 1991 and modified 14 times between then and 2008. Their results suggest that both an increase and a decrease of the STT increases volatility. Moreover, although the evidence on market efficiency is mixed, the effect of the tax on trading volume is clear: an increase of the rate (on average by 133%) decreased trading volume (by 26%), whereas reducing the tax rate (on average by 50%) increased volume (by 105%). Su suggests that increasing the STT boosted volatility, because it reduced the frequency of transactions and the volume of trade, thereby shrinking liquidity and widened bid-ask spreads. However, reducing the STT also increased volatility. Su suggests that this is because trading volume may be a proxy for information flows. The decrease in transaction costs may therefore have increased noise trading inducing higher volatility.

It is important to note that the empirical literature, reviewed above suffers from a number of methodological weaknesses. First, studies use a range of different measures of volatility, making it hard to compare the results across studies. Second, it is important to control for market-wide changes in volatility, and, although several researchers attempt to do this, there is no agreed methodology for doing so. Finally, studies use different levels of data aggregation which again can give rise to differing results, but there seems little theoretical reason for using one level of aggregation over another.

[17] "A bull or a bear market is a period of consecutive monthly increases or decreases in stock prices whose horizon is perceived to last more than one month. That is, a period during which there are at least n consecutive monthly stock returns with the same algebraic sign. Because there is no widely accepted definition of a bull or a bear period, the horizon n of our analysis takes three possible values, n=3–5 months." (Phylaktis and Aristidou, 2007, p.1459)

Nonetheless, the overall conclusion from the empirical evidence is more one sided than the theoretical work. The balance of evidence would seem to suggest that there is a positive relationship between transaction costs and volatility, although the size of this effect varies across different studies. Whether a Tobin Tax would affect volatility in the same way as underlying market transaction costs is not clear. The Swedish experience of imposing a tax on equity transactions may have increased volatility, but the size of the tax was large; there is no evidence that UK Stamp Duty had any effect on volatility, although it clearly affected returns on equity.

3. **Is a Financial Transaction Tax feasible?**

Many of the arguments typically leveled against the introduction of financial transaction taxes are practical concerns related to the ability to implement such taxes in an effective fashion. There is now a substantial literature on these implementation issues. This literature addresses the two core implementation concerns of substitution (i.e. the potential for market actors to shift away from taxed instruments to untaxed instruments) and migration (i.e. the ability of market actors to shift their activities to untaxed locations). The literature has tackled the issue of substitution by exploring the question of which instruments should be taxed and at what rate. The issue of migration requires asking at what the point in the financial system the tax should be imposed, as well as whether multilateral cooperation is necessary in order to implement a successful tax. We explore each of these questions in turn below.

Which instruments to tax?

Tobin's original idea in 1972 was to tax spot transactions in the traditional foreign exchange markets. However, the problem with this approach is immediately obvious – there is little difference between a transaction in the spot market and the forward market. Hence if a tax was only to be imposed on the spot market, we would expect to see a large reduction in the volume of trade in that market and a corresponding increase in the market for close substitutes. Such a tax might still be valuable if such a change in the structure of the market were to bring about a reduction in volatility (see the discussion in section 2), but it would be almost certain to reduce substantially the revenue from the tax.

As a result of this, Kenen (1996) argues that, if a tax on spot transactions is implemented, short-term forward contracts would have to be taxed as well, because of the high substitutability between the two instruments (see also Tobin 1996). However, since swap contracts are composed of a combined spot and forward transactions, this would suggest that they should also be taxed, although as one transaction.[18] Similarly, it would then be necessary to include interest rate swaps**.** Pollin (2003) argues that swap transactions can be considered as equivalent to the transfer of ownership of an asset. The main difference is that the parties exchange claims on the income stream on two separate assets, instead of exchanging the assets themselves. He therefore suggests taxing the value of the underlying asset each year until the asset's maturity.

If swaps are included in the tax base, what about futures? Here, there is more dissent in the literature. Kenen (1996) suggests taxing these on the notional value of the contract when written and traded, leaving the collection to the point of trade. Similarly Pollin (2003) suggests taxing the notional value of the underlying assets of a future contract, following the Japanese approach, in order to make the size of the tax proportional to the size of transaction. However, others cast doubt on the feasibility of taxing futures. Stephany Griffith-Jones (1996) argues that, since the changes in the cash flows in futures contracts relate not to the nominal value but to contract's value, a relatively small tax on the nominal value could completely destroy the futures markets. Instead she advocates either applying a 'pre-contract' tax to reduce distortions on investors' decisions between cash markets or future trading; not taxing futures at all, following

[18] However, if this is the case then synthetic swap contracts, which are composed of spot and forward contracts but with two different counterparties, will be taxed twice.

the UK stamp duty example, which exempt futures and options unless they are exercised; or taxing options at a lower rate.

If future contracts are taxed, this naturally raises the question as to whether options should be taxed too. However, options are particularly difficult to include since they may never be exercised in the spot or forward markets. Moreover, if they were taxed, substitution with synthetic options and more complex contracts would seem very probable. On the other hand, if exempted, options could crowd out forward and future markets. Stiglitz (1989) therefore suggests including options, but taxing them at half the tax rate applied to the underlying assets. Alternatively, Pollin (2003) suggests taxing the premium paid for the option, i.e. the price paid for acquiring the option. The rationale here is that taxing the premium taxes the asset actually traded with option contracts (i.e. the right to acquire another asset). Moreover, unlike the strike price, the premium incorporates the markets' evaluation of the option itself, including the time limits to exercise the option and the difference between the strike price, the market price of the underlying asset at the time of the purchase and the price history of the underlying asset.

Whether the omission of futures and options would have a significant impact upon the revenue raised from a FTT depends on the extent to which they are used by importers and exporters for hedging, or whether their use is predominantly to profit from speculation on exchange rate changes without actual delivery of the currencies. If the former predominates, futures and options will translate into eventual spot market transactions which would be taxed, but this would not be the case if the primary motive for the use of such instruments is speculative (Kenen, 1996). Similarly, Eichengreen and Wyplosz (1996) suggest that it is only necessary to tax spot transactions, since, when a foreign currency asset is sold to a non financial customer, the bank finds itself with an open position in that currency. Risk management practices dictate closing that position by buying the same amount of currency from another bank. If the bank cannot find this currency in other banks, it will buy it from the spot markets. Thus they argue that authorities can affect the entire chain by taxing only the spot market.

Finally, if the FTT is applied beyond the foreign exchange market, the question arises as to whether it should include bonds. Pollin (2003), for example, includes in all government debt (federal, state and municipal in the case of the USA), in order to minimise any distortionary effects on the tax across the markets. On the other hand, several commentators point to the common practice of excluding transactions in government bonds from taxation in order not to raise the costs of government borrowing.

Notwithstanding this, the general consensus in the literature is that the tax base for a FTT should be broad, including equities, bonds, futures, options and interest rate swaps. For example, Baker *et al*. (2009) argue for full coverage in the traditional and non traditional market. Schulmeister (2009) deepens this coverage to include also over the counter (OTC) derivatives, including interest rate-, foreign exchange-, equity-, commodity-, and credit related derivatives, as well as credit default swaps (CDS). On the other hand, Jetin (2009) does not include exchange or OTC derivatives in his currency transaction tax's design.

Should the tax rate be uniform for all instruments?

If a FTT is to cover more than one instrument, the question naturally arises as to whether all instruments should be subject to the same tax rate. Campbell and Froot (1993) suggest that the optimal tax should abide by two principles:

1. transactions which give rise to the same patterns of payoffs should pay the same;
2. transactions which use the same resources should pay the same tax.

The aim of the first principle is to avoid substitution between different instruments. However, in practice, Campbell and Froot argue that it is extremely difficult to implement. As is well known, derivatives deliver payoffs which can be replicated through trading the underlying assets. Thus the payoff pattern obtained by purchasing and holding an option can be replicated by undertaking a dynamic trading strategy in the underlying asset and vice versa. However, once a transaction

tax is imposed, some payoff patterns will be cheaper to achieve with derivatives and others will be cheaper to achieve with the underlying assets. Transaction taxes will generally not be able to equate the tax burden from trading the two instruments (Campbell and Froot, 1993).

Campbell and Froot's second principle of transaction taxes requires equating the tax burden across assets as a fraction of total transaction costs, so that transactions with the same resource costs would be taxed at the same rate. There are three ways in which this principle can be implemented: taxing the transaction directly, taxing the notional amount invested at a lower rate for assets with lower transaction costs and, finally, taking into account not only direct 'resource costs' but also indirect ones, such as negative externalities in the financial markets including excessive volatility of asset prices, higher risk premia and excessive or misallocated investment in speculative activities.

The detailed elaboration of securities transaction taxes for the US financial market elaborated by Pollin *et al* (2003) adopted a similar set of principles. They suggest that the tax rate has to be smaller, or at least in the same range, as the transaction costs for each instrument. Based upon a set of estimates of market transaction costs for different instruments, they suggest applying:

- 50 basis points[19] for equities
- 1 basis point for bonds per each year until bond's maturity
- 2 basis points of the notional value of underlying asset for futures
- 50 basis points of the premium paid for options
- 2 basis points per each year until maturity of the swap agreement for interest rate swaps.

We adopt a similarly differentiated approach in our own revenue estimates (see Section 4). Moreover, a recent report on financial transaction taxes prepared for the European Parliament (Darvas and von Weizsäcker, Bruegel, 2010) suggests that higher tax rates should be imposed for over-the-counter derivative transactions than exchange-based derivative transactions, on the grounds that OTC transactions are less transparent and subject to greater systemic risks. Thus it is argued that differential tax rates could complement the ongoing legislative actions to encourage centralised clearing for derivatives.

Should taxation be National or Market based?

A further implementation issue concerns whether the tax is collected on a National basis or a Market basis. The former implies that financial institutions pay the proceeds of the tax from all their dealing sites across the world to the country in which they are headquartered. By contrast, collection on a Market basis means that governments would collect the tax on transactions of all players within their country, whether domestic or foreign.

Kenen (1996) argues that, although the National basis is ideal - because it would discourage migration of transactions to tax free sites - it suffers from four important disadvantages:

1. It creates an extra burden for banks because they have to consolidate data from all of their dealing sites and send them to their headquarters
2. it would create an incentive to enforce laws on data confidentiality in order to create tax free locations by preventing banks from sending data to their head offices
3. it would favour those banks whose home countries do not impose the tax. These banks would end up having a comparative advantage both at home and abroad
4. it would disfavour large financial centres, such as UK, where the market is bigger than the total transactions by British banks.

Conversely, collection on a market basis has the advantage that it does not create a competitive disadvantage for institutions from the home country; but it does encourage the creation of tax free locations and the migration of dealing sites to these places. Offshore migration has been addressed by Summers and Summers (1989), in their discussion of the design

[19] 1 percent = 100 basis points.

of a securities transaction excise tax (STET) in the USA. They argue that the problem could be solved through two strategies:

1. harmonisation of the STET structure and enforcement among countries that are financial centres and
2. imposition of the tax on transactions occurring outside the United States but involving U.S. persons as principals, on a residency, rather than a situs, basis.

They also suggest partial exemption of transactions by foreigners within the USA to avoid any negative effect on the competitiveness of the U.S. market for foreign participants.

By contrast, Pollin (2003) proposes applying a U.S. STET to all traders in U.S. financial markets, both domestic and foreign residents. In addition, Pollin argues that the tax should be applied to the foreign transactions of U.S. nationals and corporations as well as to trades of U.S. securities by foreigners in non U.S. markets.

In conclusion, there is no firm consensus on whether a national or market basis is preferable for implementation. Indeed many possible permutations are possible depending on the nationality of the asset being traded (e.g. a US or a UK security); the nationality of the trading parties; and the market in which the trade takes place. Unilateral imposition of a tax on a national basis, disadvantages home country financial institutions relative to their competitors. However, unilateral imposition of a market basis tax, encourages both domestic and foreign firms to migrate elsewhere. This suggests that Market basis implementation would require the agreement of, at least, the major financial centres. Implementation on a national basis, however, could be undertaken unilaterally, but may entail a significant political cost.

At what point in the system?

Another practical concern about the implementation of a FTT is the issue of where within the financial system the tax would actually be imposed. Kenen (1996) describes the steps and locations of transactions in the wholesale foreign exchange market. The first step is in the dealing sites where the deal is struck between two counterparties. The two dealers can be located in the same or different markets. They define the quantities, the place of booking and the place of settlement of the agreement. The second step is in the booking sites - each dealer will book the deal in an office of his or her bank. The last step is in the settlement sites, in which the bank balances are transferred between the banks. An exchange between two currencies entails two settlement sites. Kenen (1996) argued that the tax can only be applied at dealing sites. The possibility of moving banks' booking offices offshore prevents the use of the booking site. Moreover, because many transactions are netted before they are settled, he argues that it is not possible to separate out the subset of interbank transfers that arise from foreign exchange trades, making levying the tax on the settlement sites impossible.

However, foreign exchange markets have changed considerably since Kenen's 1996 contribution, with a strong shift towards centralisation, formalisation and regulation of settlement sites. As a result the primary practical objection that Kenen raises to applying the tax at settlement no longer applies, since gross transactions can be now be effectively isolated. All financial and foreign exchange settlement systems, whether on- or off- shore, require an account with the central bank that issues the currency in which the gross transaction is denominated. Moreover, the Continuous Linked Settlement Bank, launched in 2002, now settles more than half of all foreign exchange transactions, eliminating settlement risk[20]. The remainder is processed through national Real Time Gross Settlements. Both of these systems allow a one-to-one correspondence between foreign exchange payments and their originating trades (Payment-

[20] Settlement risk is also called "Herstatt Risk". On 26th June 1974 at 15:30 CET, the German authorities closed Bankhaus Herstatt, a middle-sized bank with a large FX business. Prior to the closure, however, a number of Herstatt's counterparty banks had irrevocably paid Deutsche marks into Herstatt but, as US financial markets had just opened, had not yet received their dollar payments in return. This failure triggered a ripple effect through global payment and settlement systems, particularly in New York. Ultimately, this fed into New York's multilateral netting system, which over the next three days, saw net payments going through the system decline by 60% (BIS 2002) (as reported by Spratt, 2005).

versus-Payment (PvP) for exchanges of bank balances; Delivery-versus-Payment (DvP) for exchanges of securities) Moreover, the messaging and netting system, SWIFT, is more or less universally adopted so that Central Banks can enforce the tax on offshore netting systems and on derivatives such as Contracts for Difference (CfD) (Schmidt, 2008). As a result, Schmidt (1999, 2008) and Spratt (2005, 2006) argue that the tax can be levied at the settlement sites, because they are now formal, organised and centralised.

Schmidt and Spratt also argue that levying the tax at settlement sites would considerably reduce concerns about tax avoidance because the global settlement systems provide an electronic track of every transaction, including options and other derivatives. Moreover, avoiding the tax by moving away from the use of centralised global systems such as CLS would be extremely expensive and probably ineffective. Spratt (2005, 2006) estimates that the net benefit from participation in the CLS for Sterling or Euro transactions is $17.94 billion annually.[21] He calculates that this is more than 17 times (for UK sterling) and around 8 times (for Euro) the tax payment that would be incurred through a 0.5 basis point levy on single currency transactions. Furthermore, even if banks did set up an alternative settlement system, it would have to be acceptable to central banks and compatible with Basel II and anti money-laundering regulations.[22] To comply with these regulations it would have to have very similar features to CLS and national RTGS systems. If these regulations were to require the implementation of the tax, it would not be possible to avoid the tax through establishing a new settlement centre. Applying the tax at the point of settlement also has the advantage that it would avoid discriminating between on and off exchange trading. HM Treasury (2009), for example, argue that a financial transaction tax would have to be 'non discriminatory' between on and off exchange trading, to avoid diversion to off exchange.

Thus the existing literature appears to support the idea that it is technically feasible to implement a FTT. Indeed, the recent report by the IMF on the implementation of a global bank tax (IMF, 2010), which argues against the implementation of a FTT[23], nonetheless explicitly acknowledges that it would now be technically feasible to implement such a tax.

Do all countries have to act together?

Almost all recent policy announcements argue that any global system of taxation (whether a Bank Tax or a FTT or anything else) would have to be implemented by all countries (see for example IMF (2010) and HM treasury (2009)). Again the underlying rationale is that, were a country not to participate it might be possible for payments to be routed through that country in order to avoid the tax. However, the recent literature outlined above suggests that, contrary to popular belief, it might be possible for a single country to act alone. Spratt (2005) and (2006), for example, suggests that a Tobin like tax of 0.005 per cent could be unilaterally levied either in the UK sterling market or the Euro market without significant problems of evasion and avoidance, due to the concentration of national and international payment and settlement systems such as CLS, Clearing House Automated Payment System (CHAPS, UK) and Trans-European Automated Real Gross settlement Express Transfer (TARGET, EU). Similarly Schmidt (2008) suggests that it would be relatively straightforward to apply a Currency Transaction Tax (also of 0.5 basis points) to only the US Dollar, Euro, UK Pound and Yen.

Baker (2000) also argues that it would be possible to impose a similar tax unilaterally in the US market. He recognises that unilateral action is not the best outcome, since it opens up the possibility of evasion. Moreover, he argues that a tax levied only on the US markets will have very little impact on the dynamics of global markets and, that the revenue collected would be commensurately smaller if other countries did not participate. However, akin to some of the two market theoretical models described above, he argues that implementation of such a tax by the US

[21] The benefit is the sum of efficiency gains, operating cost gains, and net funding requirement gains.
[22] Current negotiations on Basel III will, if anything, tighten this constraint.
[23] The IMF's rejection of a FTT is on the grounds that it does not help to address systemic risk, which was the remit that they were given by the G20.

would induce a shift in the political dynamics of the relevant interests groups because financial actors in the taxed regions will pressure their governments to press other countries to implement the tax.

Table 2: Securities Transaction Taxes around the world

Country	Stocks	Corp Bods	Govt Bonds	Futures	Detail
Argentina	0.60%	0.60%	0.60%	0.60%	Tax of 0.6 on all financial transactions approved by legislature March 2000
Australia	0.3%	0.15%	-	-	Reduced twice in 1990s: currently 0.15% each for buyer and seller
Austria	0.15%	0.15%	-	-	Present
Belgium	0.17	0.07%	0.07%	-	Present
Brazil	0.3% [0.38%]	0.3% [0.38%]	0.3% [0.38%]	-	Tax on FX from 2% to 0.5% in 1999. Tax on stocks increased and bonds reduced 1999
Chile	18% V	18% V	-	-	Present
China	0.5% or 0.8%	[0.1%]	0	-	Tax on bonds eliminated 2001.Higher rate on stock exchanges applies to Shanghai
Colomia	1.5%	1.5%	1.5%	-	Introduced 2000
Denmark	[0.5%]	[0.5%]	-	-	Reduced in 1995, 1998. Abolished 1999
Ecuador	[0.1%]	[1.0%]	-	-	Tax on stocks introduced 1999, abolished 2001. Tax on Bonds introduced 1999
Finland	1.6%	-	-	-	Introduced 1997, applies only to trades on HEX electronic exchange
France	0.15%	See note		-	Present. Sources ambiguous as to whether tax applies to bonds
Germany	[0.5%]	0.4%	0.2%	-	Removed 1991
Greece	0.6%	0.6%	-	-	Imposed 1998, doubled 1999
Guatemala	3%	3%	See note		Present' Source ambiguous as to whether tax applies to government bonds
Hong Kong	0.3% + $5 SF	[0.1%]	[0.1%]	-	Tax on stocks reduced from 0.6% in 1993. Tax on bonds eliminated 1999. $5 stamp fee
India	0.5%	0.5%	-	-	Present
Indonesia	0.14% +10%V*	0.03%	0.03%	-	*VAT on commissions. Introduced 1995
Ireland	1.0%	-	-	-	Present
Italy	[1.12%]	-	-	-	Stamp duties eliminated 1998
Japan	[0.1%], [0.3%]	[0.08%], [0.16%]	-	-	Renewed 1999
Malaysia	0.5%	0.5%	0.015% [0.03%]	0.0005%	Present
Morocco	0.14% +7% V	7% V	7% V	-	Present
Netherlands	[0.12]	[0.12]	0	-	1970-1990
Pakistan	0.15%	0.15%	-	-	Present
Peru	[0.1%], 0.08% + 18% V	[0.1%], 0.08% + 18 V	[0.1%], 0.08%	-	Present
Philippines	[0.5%] + 10% V	-	-	-	VAT present
Portugal	[0.08%]	[0.04%]	[0.008%]	-	Removed 1996
Russia	0.08%† - 8% V	-	-	-	†0.8% on secondary offerings. Present
Singapore	0.05% + 3% V	-	-	-	Reduced 1994, eliminated 1998. VAT present
South Korea	0.3% [0.45%]	0.3% [0.45%]	-	-	Reduced 1995
Sweden	[1%]	-	-	-	Removed1991
Switzerland	0.15%	0.15%	0.15%	-	Present 0.3% on foreign securities. 1% new issues
Taiwan	0.3% [0.6%]	0.1%	-	0.05%	Reduced 1993
UK	0.5%	-	-	-	Present
Venezuela	0.5% [1%]	-	-	-	Reduced May 2000
Zimbabwe	0.45%V	-	-	-	Present

Source: Spratt (2006) (See also Pollin 2005)

Notwithstanding these views, the general consensus in the literature is that, for currency transaction taxes, an international (or at least plurilateral) agreement would be preferable to unilateral action. This is in marked contrast to transaction taxes on equities and some other securities which have already been implemented unilaterally by a large number of countries – see Table 2.

4. How much money would a FTT collect?

Although this was not Tobin's original intention, one of the principle motivations of those proposing the tax is to raise substantial revenue. A huge number of different revenue estimates have been calculated in the literature leading to considerable confusion as to the likely revenue from the implementation of such a tax. The reason for these differences is the different assumptions which are made by authors regarding the base of the tax, the tax rate, and the extent to which the volume of trade would be reduced by the introduction of the tax. In order to try and estimate how much money a Tobin Tax would collect, we have compiled all of the papers that we have been able to find that provide a detailed calculation of the revenue from a Tobin or Tobin-like Tax. The findings are summarised in Table 3, for literature providing estimates which assume worldwide application of the tax; and Table 4 for estimates of revenue from the application of the tax to single markets or groupings of countries.

Perhaps the most striking characteristic of Table 3 and Table 4 is the huge range of revenue estimates, from US$ 10 billion per year from Kapoor (2004) to US$ 376 billion per year from Tax Research LLP (2010). In part the differences reflect the huge growth in the foreign exchange market since the early 1990s and the resulting large differences in the base of the tax. Kapoor, using data from 2001 has a daily tax base of spot, outright forwards and swaps of US$ 1200 billion – Schmidt (2008) uses exactly the same tax base, but in 2007 this had rised to US$ 3227 billion. Moreover, there are also different views about the composition of the base. Whilst most studies include spot, outright forward and swaps in their base, some also include futures and options; the large estimate from Tax Research LLP (2010) reflects their inclusion of the bond and equity markets as well forex.

Far larger variation, however, can be found in the choice of tax rates to impose. These vary from 0.25 per cent proposed by D'Orville and Najman (1995) and even 1 per cent at the top end of the range estimated by the Belgian and Finnish Ministries of Finance (2001), to the more common 0.005 per cent proposed by Schmidt (2008), Kapoor (2004) and the Tax Research LLP (2010). Over time there has been a tendency for proposed tax rates to fall as transaction costs have also been reduced.

Revenue estimates from the unilateral or regional application of a Tobin Tax are commensurately smaller given the smaller tax base. Most work has been done on the application of the Tax in the EU (Belgian Ministry of finance, 2001; Spahn 2002; Jetin and Denys, 2005; Schulmeister *et al* 2008). However, calculations have also been done for the large individual currencies (Spratt 2005; Schmidt, 2008) as well as for individual countries such as France (French Ministry of Finance, 2000) and the USA (Baker *et al*, 2009). Again the range of estimates is wide, depending primarily on the tax rates assumed, although there is a tendency in these studies to assume small tax rates of around 0.01 per cent or 0.02 per cent.

There have been a wide range of attempts to take into account the likely reduction in trade volume as a result of the imposition of the tax. This takes two forms. Several studies (Felix and Sau, 1996; Frankel 1996; French Ministry of Finance 2000; Belgian Ministry of Finance 2001; Nissanke 2004; Jetin and Denys 2005) either provide exemptions from the tax for some groups, and/or assume a degree of evasion of the tax, typically between 15-25 per cent. More commonly, studies tend to assume a reduction in volume or an elasticity of volume with respect to transaction costs (although with some notable exeptions e.g. Spahn 1995, Kennen 1996, Kapoor 2004). The size of the reduction or the elasticity is often chosen arbitrarily, and the values therefore vary enormously – in one study from 4.7 per cent to 99.7 per cent (Belgian Ministry of Finance, 2001).

Similarly estimates of elasticities range from 0.12 (Nissanke, 2004) to 1.5 (French Ministry of Finance, 2000), with a mean of 0.535.

Table 3: Estimated revenues from worldwide application of a Tobin Tax

Author(s)	Year tax base	Geographical coverage	Tax Base (US$ bn) DAILY	Base description		Trading days per annum	Tax rate	Exempted official trading	Fiscal evasion	Pre-Tax Transaction costs	Elasticity	Reduction of volume
D'Orville and Najman (1995)	1992	Worldwide	293	Forex	Spot, outright forward, swaps, futures and options*	240	0.25%					20%
D'Orville and Najman (1995)	1992	Worldwide	293	Forex	Spot, outright forward, swaps, futures and options*	240	0.10%					20%
Spahn (1995)	1995	Worldwide	1000*	Forex	All Spot and derivatives	250	0.02%					none
Felix and Sau (1996)	1992	Worldwide	576	Forex	Spot, outright forward, swaps, futures and options	250	0.25%	10%.	25%	0.75 1.25%*	0.75*	
Kenen(1996)	1992	Worldwide	880	Forex	Spot, outright forward, swaps, futures and options	240	0,05%					
Frankel(1996)	1995	Worldwide	1230	Forex	Spot, outright forward, swaps*	240	0.10%	20%		0.1%*	0.32*	20%
French Ministry of finance (2000)*	1998	Worldwide	1500	Forex	Spot, outright forward, swaps		0.01% to 0.2%		20%	0.02 and 0.05%	0.5 1 1.5	67% (central estimate)
Belgian Ministry of finance (2001)	1998	Worldwide	1500	Forex	Spot, outright forward, swaps	250	0.01% to 1%	from 15% (if tax 0.01%) to 25% (if tax 1%)		0.1% (non financial sector), 0.05% (other financial institutions), 0.02% (interbanking sector)	0.5 (non financial sector), 1 (other financial institutions), 1.5 (interbanking sector)	4.7% to 99.7%*

Finnish Ministry of Finance (2001)	1998	Worldwide	1442	Forex	Spot, outright forward, swaps	240	0.01%; 0.25%; 1%			0.1% (non financial sector), 0.05% (other financial institutions), 0.02% (interbanking sector)*	0.5 (non financial customers); 1 (financial customers); 1.5 (banks)	
UN (General Assembly, 2003)	2001	Worldwide	1200	Forex	Spot, outright forward, swaps		0.1%					50%
Nissanke (2004)	2001	Worldwide	1173	Forex	Spot, outright forward, swaps		0,01 - 0,02%*	8%	2%	0,01 to 0,02%	0,12 to 0,23	5% (0,01% tax rate) 15% (0.02% tax rate)
Kapoor (2004)	2001	Worldwide	1200	Forex	Spot, outright forward, swaps		0.005%					none
Bruno Jetin and Lieven Denys (2005)*	2004	Worldwide	1900	Forex	Spot, outright forward, swaps	250	0.1% (preferred scenario)		16%	0.10%	1	67%
	2004	Worldwide	1900	Forex	Spot, outright forward, swaps	250	0.02%(intermediate scenario)		15.2%	0.02%	1	67%
	2004	Worldwide	1900	Forex	Spot, outright forward, swaps	250	0.01 - 0.02% (minimal scenario)		15.1% (0.01% tax rate) to 15.2% (0.02% tax rate)	0.02%	0.5	29% (if tax rate 0.01%) 42% (if tax rate 0.02%)*
*alternative formula (following the Belgian and Finnish report of 2000)**	2004	Worldwide	1900	Forex	Spot, outright forward, swaps	250	from 0.01% to 1%		15.1% (0.01% tax rate) to 25% (1% tax rate)	0.1% (non financial sector), 0.05% (other financial institutions), 0.02% (interbanking sector)*	0.5 (non financial sector), 1 (other financial institutions), 1.5 (interbanking sector)	4.7% to 99.7%*
Schulmeister et al (2008)	2006	Worldwide	3637	Forex	All Spot and derivatives (exchange and OTC)	250	0.01%; 0.05%; 0.1%					15 - 35%; 50 - 75%; 65 - 85% (according to the tax rate)
Schmidt (2008)	2007	Worldwide (major currencies)*	3,227	Forex	Spot, outright forward, swaps	240	0.005%					14%

Tax Research LLP (2010)	2007-08	Worldwide	16440*	All markets*	All Spot and derivatives (exchange and OTC)	250	0.5% (equity) 0,005% (others)					25%

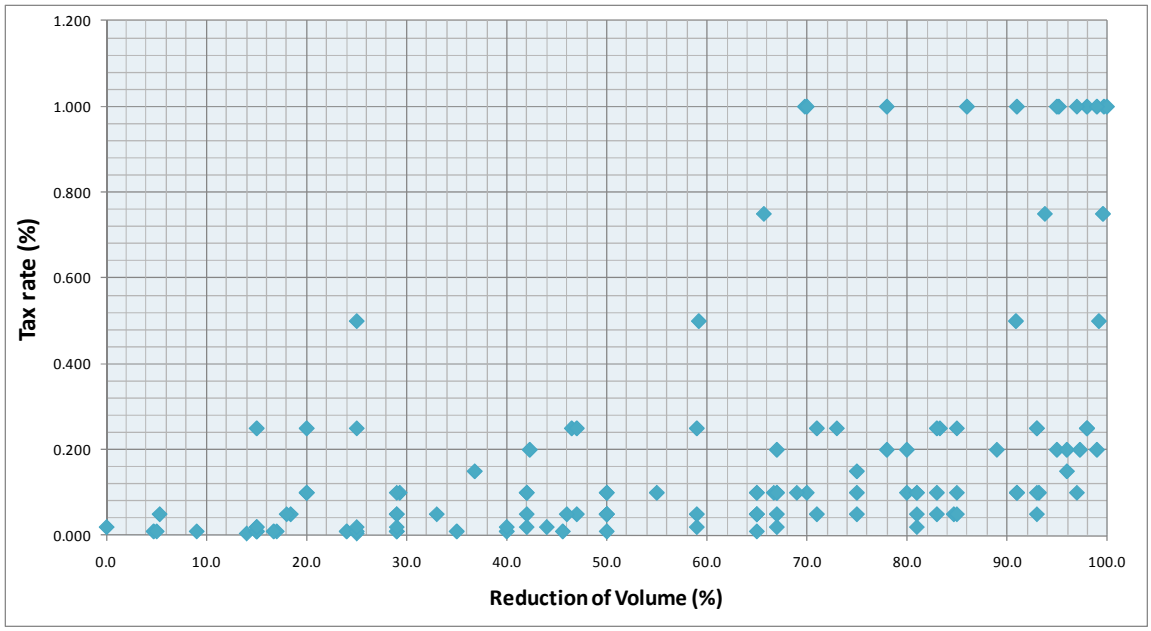
Table 4: Estimated revenues from unilateral and regional application of a Tobin Tax

Author(s)	Year tax base	Geographical coverage	Tax Base (US$ bn) DAILY	Base description		Trading days per annum	Tax rate	Exempted official trading	Fiscal evasion	Pre-Tax Transaction costs	Elasticity	Reduction of volume	Total Annual Revenue (US$ bn)
French Ministry of finance (2000)*	1998	France	36 (bn Euro)	Forex	Spot, outright forward, swaps	250	0.01% to 0.2%			0.02 and 0.05%	0.5; 1; 1.5	67%	**2** (bn Euro central estimate)*
	1998	EU 15	525 (bn Euro)	Forex	Spot, outright forward, swaps	250	0.01% to 0.2%			0.02 and 0.05%	0.5; 1; 1.6	67%	**22** (bn Euro central estimate)*
Belgian Ministry of finance (2001)	1998	EU 15	772.5	Forex	Spot, outright forward, swaps	250	0.01% to 1%	from 20.2% (if tax 0.01%) to 35% (if tax 1%)		0.1% (non financial sector), 0.05% (other financial institutions), 0.02% (interbanking sector)	0.55 (non financial sector), 1.1 (other financial institutions), 1.75 (interbanking sector)	5.1% to 99.9%*	**9** (0,01% tax rate) **39** (1% tax rate)
Spahn (2002)	2001	EU and Switzerland (including UK)	367.6	Forex (Euro leg)	Spot, outright forward, swaps	250	0,01 0,02%*						**9.193** (uniform 0.01%) **14.585** (non uniform 0.02%)
Bruno Jetin and Lieven Denys (2005)*	2004	EU	659	Forex	Spot, outright forward, swaps	250	0.1% (preferred scenario)		16%	0.10%	1	67%	**38**
	2004	EU	659	Forex	Spot, outright forward, swaps	250	0.02%(intermediate scenario)		15.2%	0.02%	1	67%	**8**
	2004	EU	659	Forex	Spot, outright forward, swaps	250	0.01 - 0.02% (minimal scenario)		15.1% (0.01% tax rate) to 15.2% (0.02% tax rate)	0.02%	0.5	29% (if tax rate 0.01%) 42% (if tax rate 0.02%)*	**8** (if tax rate 0.01%) **13** (if tax rate 0.02%)*
alternative formula (following the Belgian and Finnish report of 2001)*	2004	EU	659	Forex	Spot, outright forward, swaps	250	from 0.01% to 1%		15.1% (0.01% tax rate) to 25% (1% tax rate)	0.1% (non financial sector), 0.05% (other financial institutions), 0.02% (interbanking sector)*	0.5 (non financial sector), 1 (other financial institutions), 1.5 (interbanking sector)	4.7% to 99.7%*	**8.4** (if tax rate 0.01%) **55.3** (if tax rate 1%)*

Spratt (2005)	2004	EU leg	348	Forex	All Spot and derivatives (exchange and OTC)	260	0.005%					2.50%	**4.4**
Spratt (2005)	2004	Sterling leg	160	Forex	All Spot and derivatives (exchange and OTC)	260	0.005%					2.50%	**2.07**
Schulmeister *et al* (2008)	2006	EU	2060	Forex	All Spot and derivatives (exchange and OTC)	250	0.01%; 0.05%; 0.1%					15 to 35%; 50 to 75%; 65 to 85% (according to the tax rate)	**29 to 38; 36 to 95; 48 to 143**
Schmidt (2008)	2007	Dollar	2,770	Forex	Spot, outright forward, swaps	240	0.005%			*		14%	**28.38**
	2007	Euro	1,188	Forex		240	0.005%					14%	**12.29**
	2007	Sterling and Yen	2,055	Forex		240	0.005%					14%	**21.24**
	2007	Yen	530	Forex		240	0.005%					14%	**5.59**
	2007	Sterling	462	Forex		240	0.005%					14%	**4.98**
Baker *et al* (2009)*	2008	USA	2604.407	All the markets	Spot, outright forward, swaps		0.5% (equity, options) 0.02% (bonds, futures and forwards) 0.01% (Forex, swaps)*					0% 25% 50%	**353.8 265.3 176.9 (according to the volume reduction)**

Given the bewildering range of estimates it is useful to try and abstract away from the issue of the tax base and focus on the assumptions about the tax rate and the extent of reduction resulting from the tax. Figure 1 plots the assumptions about the tax rate and amount of reduction for all of the studies of the worldwide market.

Figure 1: Tax Rates and Volume Reduction Assumptions



A clear pattern emerges from Figure 1. First, most studies assume tax rates of under 0.2 per cent, with many assuming a tax rate of 0.1 per cent or much less. Second, there is a huge range of assumptions about the likely reduction in volume, ranging from the negligible to almost total elimination of the market. There is a slight tendency for higher tax rates to be associated with larger reductions in volume, but for the most part, Figure 1 reveals the uncertainty of the studies about the extent of reduction that would take place for any given tax rate.

Empirical Estimates of Transaction Costs

Calculating the impact of a tax increase on the volume of trade requires some assessment of the size of the initial transaction costs in order to know what percentage increase in transaction costs would be caused by the tax. Again, studies assume a very wide range of values for transaction costs, from 1.25 per cent of the value of the transaction (Felix and Sau, 1996) to 0.01 per cent (Nissanke, 2004), although more recent studies tend to employ values at the lower end of this scale.

Surprisingly, very few studies take their assumed values for transaction costs and elasticities from empirical estimates of these figures. Table 5 shows the estimates of transaction costs in forex markets from Aliber *et al* (2003). They criticise traditional approaches to the estimation of transaction costs in forex markets, which use bid-ask spreads and triangular arbitrage to calculate costs, because they focus entirely on measuring the transaction costs faced by commercial customers of banks, ignoring the fact that 90-95 per cent of forex transactions occur between banks themselves. To avoid using bid-ask spread quotes, Aliber *et al*. draw on the prices of foreign currency futures, since future contracts are traded on a well organised exchange with a well defined price. They exploit deviations from interest parity type relationships to measure the transaction costs of the marginal investors (usually large commercial banks), which are likely to capture the minimum level of overall transaction costs.

Table 5: Empirical Estimates of Transaction Costs in the Foreign Exchange Market

Author(s)	Description	Year	Pre-tax Transaction costs (% of the trade value)
Aliber (2003) *using Roll (1984)'s formula.*	British Pound	1977-1988	**0.046**
		1988-1999	**0.024**
		1977-1999	**0.036**
	Deutsche Mark	1977-1988	**0.056**
		1988-1999	**0.018**
		1977-1999	**0.041**
	Japanes Yen	1977-1988	**0.06**
		1988-1999	**0.041**
		1977-1999	**0.051**
	Swiss Franc	1977-1988	**0.056**
		1988-1999	**0.035**
		1977-1999	**0.047**
Aliber (2003)***	British Pound	1977-1988	**0.059**
		1988-1999	**0.023**
		1977-1999	**0.043**
	Deutsche Mark	1977-1988	**0.048**
		1988-1999	**0.021**
		1977-1999	**0.038**
	Japanes Yen	1977-1988	**0.065**
		1988-1999	**0.019**
		1977-1999	**0.051**
	Swiss Franc	1977-1988	**0.06**
		1988-1999	**0.023**
		1977-1999	**0.047**
Felix and Sau (1996)	Forex		0.6 1.25
Frankel(1996)	Forex		0.10
French Ministry of finance (2000)*	Forex		0.02 and 0.05
Belgian Ministry of finance (2001)	Forex		0.1 (non financial sector), 0.05 (other financial institutions), 0.02 (interbanking sector)
Finnish Ministry of Finance (2001)	Forex		0.1 (non financial sector), 0.05 (other financial institutions), 0.02 (interbanking sector)*
Nissanke (2004)	Forex		0,01 to 0,02
Jetin and Denys (2005)*	Forex		0.10
	Forex		0.02
	Forex		0.02
*alternative formula (following the Belgian and Finnish report of 2000)**	Forex		0.1 (non financial sector), 0.05 (other financial institutions), 0.02 (interbanking sector)*
Median estimation			**0.0465**

Empirical estimates of transaction costs in other markets also exist. Table 6 shows the transaction costs reported by Pollin *et al* (2003) for equity, futures, OTC and bond markets. Pollin *et al*. (2003) report three different estimates of equity transaction costs. The first set of estimates, expressed as percentage of trade value, is from Stoll (1993), who estimates 'trading costs in the large.' i.e. costs derived from aggregate revenues of securities firms, as opposed to 'trading costs in the small' where one tries to examine the impact of individual trades. The second is taken from the work of Keim and Madhavan (1998) who develop one version of a 'trading costs in the small' transaction cost estimate, for both the exchanges and Nasdaq. These measure both 'implicit' and 'explicit' trade costs for institutional equity trades, on a per trade basis. The main explicit trade cost is the commission paid to the broker for execution. The implicit trading costs include: bid-ask spreads, the price impacts of large trades on markets, and the opportunity costs associated with missed trading opportunities.

The third set of estimates is by Reiss and Werner (1996) who develop a new measure of transaction costs, the 'adjusted apparent spread', which enables them to track discounting patterns on larger trades relative to the touch spread on smaller trades. Using data from the London open electronic quotation system, SEAQ, the UK equivalent to Nasdaq, they define the apparent spread as the difference between the transaction price and the quoted ask. This provides an upper bound on transaction costs because SEAQ's best execution would guarantee a reverse purchase execution at or within the ask.

For transaction costs in options, Diltz and Swidler (1993) estimated observed transaction costs for 10 actively traded Chicago Board Options Exchange (CBOE) call options for the calendar year 1988. The analysis was restricted to the nearest-to-the-money calls, to mitigate potential biases resulting from combining the near-to-the-money options with the distinct in- and out-of-the money markets. Similarly, Locke and Venkatesh (1997) use data from six months of trading in 12 futures contracts on the Chicago Mercantile Exchange in 1992. They calculate a direct measure of per contract transaction costs equal to the difference between the average purchase price and the average sale price for all futures customers, with prices weighted by transaction size (see also Wang *et al*, 1997). Finally, transaction costs in the bond market have been estimated by Hong and Warga (1998) both for bonds traded at the NYSE Automated Bond System (ABS) and the over-the-counter dealer market between March 1995 and February 1997.

Table 6: Empirical Estimates of Transaction Costs in Other Markets

Pollin, Baker *et al* (2003)					
	Description			Pre - transaction costs (% of trade value)	Median values
US equity market	Average one-sided costs (Stoll, 1993)	Exchanges	1980	**0.689**	**0.487**
			1990	**0.285**	
	One-sided costs on Buyer Initiated Institutional Trades (Keim & Madhavan, 1998)	Exchanges	1998	**1.78 - 0.31**	**1.045**
				0.31 - 0.90	**0.605**
		NASDAQ	1998	**2.85 - 0.24**	**1.545**
				0.76 - 1.80	**1.28**
UK SEAQ Market	Median One-Sided "Adjusted Apparent Spread" (Reiss & Werner, 1996)	FTSE-100 Size Class	1996	**0.71**	**0.71**
		Medium-Size Class		**1.31**	**1.31**
		Smaller-Size class		**2.28**	**2.28**
Median estimation (equity)					**1.1625**
Options	Mean Transaction Costs for 10 actively traded firms (Diltz and Swidler, 1993)	Shorter-term options	1988	**4.9-21.3** (% of call option premium)	**14.6 (mean)**
		Longer-term options		**3.1-12.7** (% of call option premium)	**8.2 (mean)**
Futures	12 futures contracts on the Chicago Mercantile Exchange (average TC: low-high estimates) (Locke & Venkatesh, 1997)	CME	1992 (6 months)	**0.0184 - 0.0589**	**0.03865**
OTC	US equity market (Stoll, 1993)		1980	**1.528**	**1.528**
			1990	**0.761**	**0.761**
Bond	(Hong & Warga, 1998)	NYSE & Dealer market transactions	1995 - 1997	**0.13 - 0.2**	**0.165**

Sources: Average one-sided costs for US equity are from Stoll (1993), as are the OTC results on US equity; one-sided costs on buyer initiated institutional trades are from Keim and Madhavan (1998); UK SEAQ results are from Reiss and Werner (1996); Futures results are from Locke and Venkatesh (1997); Bond results are from Hong and Warga (1998).

Overall, the size of transaction costs clearly varies with the market (transaction costs for equity are higher than those for forex), the size-class of the trades (small trades cost more), whether the trades take place on an exchange or OTC (the latter are more expensive), and the time period during which the trade takes place (transaction costs have declined over time). Table 5 shows that the median transaction cost for foreign exchange markets is around 0.05 per cent of the transaction

value. Transactions in futures markets are of a similar order of magnitude. By contrast, costs on equities (Table 6) can be over 1 per cent, even for some exchange traded stock. These large differences are the reason that Pollin *et al* (2003) suggest that the size of any financial transaction tax should be tailored to the size of the underlying transaction costs in each market to try and ensure a more uniform percentage increase in transaction costs from such a tax.

Empirical Estimates of Elasticities

The literature also has some estimates of the elasticity of the volume of trade in the foreign exchange market with respect to transaction costs. A recent study by Bismans and Damette (2008) estimates this elasticity using individual time series data, as well as with a Seemingly Unrelated Regressions Estimation (SURE) framework to account for the possibility of a relationship between exchange parities because traders react the same way to news for different currency pairs. In addition they estimate an overall elasticity using a fixed-effect panel approach (Table 7). Individual time series estimates are higher (mean 0.56) than SURE estimates (mean 0.23), whilst the panel estimate is of the same order of magnitude as the individual time series estimates. It is notable that these estimates are substantially lower than some of the elasticities used in the revenue estimates reported in Table 3 and Table 4 above.

Table 7: Empirical Estimates of Elasticity of Forex Volume with respect to Transaction Costs

Method	Period	Currencies	**Elasticity (-)**
Time series analysis: single series separately	24/11/2004 to 25/11/04	EUR/USD	**0.61**
	24/11/2004 to 25/11/04	GBP/USD	**0.55**
	24/11/2004 to 25/11/04	CAD/USD	**0.3**
	24/11/2004 to 25/11/04	JPY/USD	**0.79**
Time series analysis: system of 4 equations (SURE)*	24/11/2004 to 25/11/04	EUR/USD	**0.33**
	24/11/2004 to 25/11/04	GBP/USD	**0.36**
	24/11/2004 to 25/11/04	CAD/USD	**0.23**
	24/11/2004 to 25/11/04	JPY/USD	**0.008**
Panel: Fixed Effect	24/11/2004 to 25/11/04	EUR/USD; GBP/USD; CAD/USD; JPY/USD	**0.606**

Source: Bismans and Damette (2008)

A number of studies have also calculated volume elasticities for transaction costs in the equity market (

Table 8). These show relatively small short-run elasticities of around 0.58. However Jackson and O'Donnell (1985) and Lindgren and Westland (1990) calculate long-run elasticities over 1.

Table 8: Empirical Estimates of Elasticity of Equity Volume with respect to Transaction Costs

Author(s)	Market		Elasticity	**Median Values**
Schwert and Seguin (1993)	US security market		0.25-1.35	**0.8**
Li Zhang	Equity	Shangai stock exchange market	0.58	**0.58**
Li Zhang	Equity	Shenzhen stock exchange market	0.49	**0.49**
Jackson and O'Donnell (1985)	Equity	UK	0.9-1.65	**1.275**
Lindgren and Westlund (1990)	Equity	Sweden (1970-88)	0.85-1.35	**1.1**
Median				**0.8**
Median estimations (without Long Run)				**0.58**

A composite estimate of revenue from a Financial Transaction Tax

Rather than producing yet another estimate of the revenue from the Tobin Tax, we attempt to provide a central estimate adopting the best practice from all the existing studies. We draw the latest data on the size of each of the financial markets (including equity, derivative, forex and OTC markets) and assume 250 trading days.[24] We use the median of the available empirical estimates of the size of the transaction costs in each market and then adjust the tax rate so that it represents either a 10 per cent, 20 per cent, or 50 per cent increase in the transaction costs of trading in that market. Having no evidence on the extent of fiscal evasion, we use 20 per cent which is the median figure used in other simulations. Similarly, we use the median elasticity of volume with respect to transaction costs in each market found from empirical studies.[25] To calculate the revenue we use a modified version of the formula from Jetin and Denys (2005).[26]

$$R = 250 \times \tau \times V \times (1 - ev) \times \left(1 + \frac{\tau}{k}\right)^{\varepsilon}$$

[24] The average across all financial markets is 248, but larger markets tend to have more trading days, so for simplicity we assume 250.
[25] Since we have no empirical estimates of the transaction cost elasticity of volume for the OTC markets, we assume that these are the median of the largest values from the empirical studies of equity markets.
[26] Jetin and Denys use a two-sided tax because they focus on the forex market. We tax each transaction only once.

where R is the annual revenue, 250 is the number of business days per year, τ is the tax rate, V is the market turnover before tax, ev is fiscal evasion, k is the pre-tax transaction costs, and ε is the volume elasticity. The results are shown in
Table 9.

We find that using empirically derived estimates of transaction costs and elasticities gives larger estimates of revenue than many previous studies, suggesting that previous simulations have been overly cautious in constructing their revenue estimates. Applying a 0.005 per cent tax to the foreign exchange market alone might raise around US$ 26 billion per year worldwide. Including the other markets, the revenue raised could reach over US$ 150 billion, even if the OTC market is excluded, and well over US$ 400 billion if it is included. Of course we cannot be sure that a real tax would raise this sort of revenue. The key weakness is that we have no empirical estimate of fiscal evasion – if evasion were to be 80 per cent rather than 20 per cent, clearly the figures would be much smaller. At the same time, the empirical estimates that we have for transaction costs and elasticities suggest that, even if the tax was restricted to a single market, such as the foreign exchange market, large sums of revenue might be raised. Moreover, the revenue potential for the UK is also significant – around $11 billion (£7.7 billion) from a 0.005 per cent tax applied only to the foreign exchange market. Like all revenue estimates in this area, these results should be treated with considerable caution. At the same time, the existing evidence does support the view that quite small proportionate increases in existing levels of transaction costs could yield quite large sums of revenue.

Table 9: Composite Estimate of Worldwide Revenue from the imposition of Financial Transaction Taxes

Source: Calculation based on the data reported by IFSL and BIS (2009-10)

MARKET	World ($ bn)	UK ($bn)	Business days (average)	TAX RATE %	Transaction Cost (pre-tax average) %	FISCAL EVASION (average) %	ELASTICITY OF VOLUME (average)	TO ANN REVE W ($
	456	18.24	250	*0.116*	1.163	20	0.58	1
Equity market	456	18.24	250	*0.233*	1.163	20	0.58	1
	456	18.24	250	*0.581*	1.163	20	0.58	4
	4933	1335	250	*0.004*	0.039	20	1.5	
Derivative	4933	1335	250	*0.008*	0.039	20	1.5	
	4933	1335	250	*0.019*	0.039	20	1.5	1
	2914	1269	250	*0.005*	0.047	20	0.606	
Forex	2914	1269	250	*0.009*	0.047	20	0.606	
	2914	1269	250	*0.023*	0.047	20	0.606	1
	2544	1094	250	*0.076*	0.761	20	1.5	3
OTC	2544	1094	250	*0.152*	0.761	20	1.5	5
	2544	1094	250	*0.381*	0.761	20	1.5	1
Total						**With OTC**	Tax rate 10% TC	**4**
							Tax rate 20% TC	**8**
							Tax rate 50% TC	**1**
						Without OTC	Tax rate 10% TC	**1**
							Tax rate 20% TC	**2**
							Tax rate 50% TC	**6**

5. What would be the incidence of the Tobin Tax?

One of the most prominent claims made by proponents of a Tobin Tax, is that the incidence of the tax would be extremely progressive, primarily affecting wealthy institutions and individuals (Tax Research LLP 2010, Kapoor 2010). However, such analyses make the common error of confusing who would actually pay the tax with the issue of where the incidence of tax would lie. By the same token, opponents of the tax have been quick to argue that that incidence would lie entirely on end users, but generally provide no basis for this claim.

Unfortunately, actual evidence on the incidence of a Tobin Tax is extremely sparse. The few studies that have mentioned the issue have tended to guess the likely incidence based upon the design of the tax. For example, the Landau report[27] (2004) argues that the economic impact of a Tobin tax in the forex market is uncertain. However, it claims that its incidence 'would probably fall entirely on end-customers, i.e. corporations with international operations and fund and asset managers engaged in reallocating portfolios internationally including hedge funds, which can occasionally play an important role in foreign exchange markets. The tax may be seen as an indirect means of reaching an elastic and highly mobile base; it would also penalize international portfolio diversification, with little economic justification. It would furthermore penalize those countries with very open markets, whose volume of foreign exchange transactions relative to GNP is fairly high.' (Landau report, 2004) However, the report presents no evidence or argument for why they believe that the incidence would fall entirely on end customers. A report by the UK Treasury (2009) shares the same concern, stating that 'it needs to be clearly ascertained that the incidence of the tax will not in practice fall on end users of financial services within the economy at large' – but again, no evidence is put forward about what the likely incidence might actually be or why.

Spahn (2002) analyses the incidence of a 'politically feasible Tobin tax' (PFTT) in the foreign exchange markets. He states that the effects of the PFTT would have three effects:

1. an increase of bid - ask spread
2. a reduction of the trading volume
3. an increase in length of the average maturity of foreign exchange transactions, because of the strong decline of spot transactions relative to outright forwards.

He argues that the initial incidence will be on wholesalers 'whose costs have been falling dramatically as a consequence of technological developments, although they remain in fierce competition among each other at a global scale, and they rely on high transactions volumes to remain profitable in view of minute profit margins, despite of [sic] cost decreases.' Moreover, Spahn suggests that wholesalers would try to shift the tax burden onto final consumers to maintain profitability - 'Since final customers have only 13.3 percent of the market[28], a tax of one basis point would quickly be transformed into 7.5 basis points onto the final customer' (Spahn, 2002).

However, Spahn (2002) argues that it is not clear to what extent it will be possible for the tax to be shifted to the end consumer. It will be the easiest in retail trading because demand is relatively price-inelastic and locally limited, which allows a degree of monopoly rents. Similarly it should be easier to pass on costs to small and medium-sized companies than to multinational firms. The latter have much more influence on foreign exchange traders given their higher trading volumes. Indeed, some multinational firms can run their own foreign exchange departments, which would intensify competition.

[27] This report was commissioned by President Chirac to explore alternative sources of finance for development. It consisted of a distinguished group of economists led by former Director for France at the European Bank for Reconstruction and Development (EBRD) and Minister Councillor in charge of financial affairs at the French Embassy in London. He is currently the second deputy governor of the Bank of France.

[28] The remainder is banks and other financial institutions.

Institutional portfolio investors and insurance companies tend to have a longer term perspective. Their behaviour is driven by institutional rules and their volume of trade is smaller than their stock of assets. As a result they are more in a position to take on the tax burden and shift it to their consumers over a long period of time. Investment funds, on the other hand, tend to concentrate on securities that are short-term market favorites and change their portfolio frequently. Spahn argues that 'If the change of securities denominated in different currencies is more costly through the tax than trading securities of one single currency, portfolio investors will focus on the latter and avoid foreign exchange trading as far as possible. It implies that shifting the tax burden onto this group of market participants is more difficult than for longer-term investors such as insurance companies'. Furthermore, tax avoidance, by focusing on the trade of securities in a single currency, will be easier for funds specializing in the securities of industrialised countries than for those specialising in the securities of developing and emerging economies, because the former can easily change their strategies due to more liquid and deep markets within the respective currency areas that do not necessitate frequent changes in currency positions.

Hillmann *et al* (2006) on the other hand, argues that 'most transactions in the FX markets are conducted between banks themselves or with other large players in the financial services industry. Transactions with individuals (for overseas travel for example) constitute less than 0.1 per cent of total transactions and trade-related transactions amount to less than 10 per cent. A significant proportion of the tax burden is thus likely to be borne at least initially by the financial services industry itself with some of the costs being passed on to trade related transactions. The financial services industry is disproportionately used by the richer segments of the society so the tax incidence is likely to be socially progressive and is unlikely to affect the majority of the population in any tangible way.' They therefore argue that the 'economic footprint' of the tax would, in the first instance, fall upon these large financial institutions that are members of the CLS Bank and the Real Time Gross Settlement systems (RTGS).

Hillmann *et al* (2006) also provide a rough calculation of the likely incidence of the tax on the corporate sector as follows:

> 'CLS Bank settles only around half of all FX transactions, which suggests a global figure of 68,000 sterling trades per day. Over a year, therefore, we can estimate the total number of sterling transactions to be of the order of 17.7 million. The impact of the Currency Transaction Development Levy [CTDL] of 0.005 per cent would be spread very widely internationally with tens of thousands of participants carrying out the 17.7 million transactions. The cost would be in the region of $117 per trade, on an average trade size of a little over $2 million. For corporations, however, the situation is clearly different. For example, the UK exports somewhere in the region of $380 billion worth of goods and services per year. Based on the profit margins of UK companies from 1990 to 2002, we assume an average margin of 10 per cent. Ten per cent of $380 billion is $38 billion, which we take as a rough estimate of the annual profit of the UK's export sector. The impact of the CTDL on UK corporates would be somewhere in the region of $115 million. Consequently, the impact on UK exporters would be just 0.3 per cent of their annual profits, which is very small when set against the many other factors that influence company profitability. For example, over the past ten years, UK companies' average profitability has fluctuated by up to 10 per cent per year. It is therefore clearly the case that when compared to the impact of changes to general business conditions, and movements in indicators such as interest rates and the sterling exchange rate, a CTDL of 0.005 per cent will have hardly any discernable impact. This analysis is also applicable to the impact of the CTDL on the euro and the krone. Consequently, we estimate that at least half of the impact of the CTDL will eventually be passed on by banks to their global clients in the form of a slightly higher spread. The impact of the CTDL would therefore be dispersed widely throughout the global financial system, and not fall disproportionately on any single institution.'

In summary, the incidence of a Tobin Tax is far from clear. On the one hand there is general agreement that wholesale traders, particularly those involved in short-term foreign exchange transactions would bear the initial cost of the tax. However, as Spahn points out, the final incidence will depend on the extent of competition in different segments of the financial sector. Most casual reasoning suggests that, in the long run, a significant proportion of the tax would end up being passed on to consumers in the form of lower returns or higher spreads. Even so, given that most households earn relatively little of their income in the form of returns to capital, it would seem likely that a Tobin Tax would be more progressive than several other forms of taxation. However, we currently have no credible estimates of what proportion of the tax would be passed on to consumer nor a clear sense of how it compares with the incidence of other forms of taxation.

6. Summary and Conclusions

To conclude, we return to the four questions which we set out at the beginning. On the issue of volatility, the evidence is mixed. Theoretical models predominantly conclude that a Tobin Tax would reduce volatility due to the changes it would induce into the composition of traders in the market. By reducing the share of noise traders, whose presence is usually assumed to be destabilising, a Tobin Tax might enhance market stability. However, this conclusion is by no means guaranteed, with some models arguing that the tax would reduce informed traders by more than uninformed traders, thereby increasing volatility. Similarly, concerns are raised by the impact of the tax on market liquidity and the resulting effect on volatility, particularly if the tax substantially increases the existing level of transactions costs in a particular market.

Empirical work tends to confirm these fears with the balance of evidence suggesting that there is a positive relationship between transaction costs and volatility. Of course, it is not certain that the imposition of a tax would affect volatility in the same way as transactions costs, but the few studies that exist of actual financial transaction taxes do not provide much grounds for optimism. In summary, we conclude that the Tobin Tax, and other financial transaction taxes based on the value of the transaction, would likely fail in their original purpose of providing greater stability to the market. On the other hand, the evidence does not suggest that a Tobin Tax would be highly destabilising either, at least, not at the low rates of taxation typically proposed; volatility may increase, but only by a relatively small amount. Moreover, it is possible that alternative designs for the Tobin Tax might have a more stabilising effect upon markets (see McCulloch 2010 for one proposal).

On the second question of whether the Tobin Tax and other financial transaction taxes are feasible, the literature points to a relatively clear conclusion. It is useful in answering this question to distinguish between securities transaction taxes on equity, bonds and related securities, and a Tobin Tax on the foreign exchange markets. It is obvious that securities transaction taxes are feasible – Table 2 shows that they have been successfully implemented in several countries already, including the UK. The principles for the design of such taxes have been well elaborated in the literature (notably in Pollin *et al* 2003 and Summers and Summers 1989) and instruments to discourage avoidance are already available.

For the Tobin Tax, the literature is less definitive. However, there is a clear sense that the significant shift towards centralisation in the foreign exchange market and the widespread use of common messaging and clearing systems means that a Tobin Tax could be successfully implemented. Although implementation problems still remain, the literature does provide a reasonable consensus about how such a tax should be designed. There is a clear preference to coverage of a broad range of instruments, including not only spot transactions, but also outright forwards, and swaps and potentially futures, options and other derivatives. The literature is also clear on the need to differentiate the tax rate by instrument and market to ensure that it corresponds to around the same percentage of transaction costs in each market.

Where disagreement still exists in the literature, it centres around whether the tax should be at the point of trade, which is still highly decentralised, or at the point of settlement (which is increasingly centralised). If it is applied at the point of trade, then the question arises of whether taxation should be based on the nationality of the trader or on the market in which they are operating. The literature contains persuasive arguments on both sides. Either way, most authors suggesting this approach concur that an international agreement would be necessary to ensure that countries did not disadvantage their nationals and to prevent migration to non-compliant jurisdictions. By contrast, those arguing for application at the point of settlement, provide persuasive evidence that this could enable implementation by individual countries or groups of countries (notably the EU), which might make this option more politically feasible. However, broader application would still be desirable to avoid currencies disadvantaging themselves relative to those not included.

The third question, on the revenue raising potential of financial transaction taxes, has generated a very large literature. It has also generated an enormously wide range of estimates of revenue potential, depending on the assumptions made about the base of the tax, tax rates and the extent to which the base would reduce as a result of the tax. Most notable, is the remarkable lack of consensus in the literature about the appropriate assumption for the elasticity of volume with respect to the tax. Fortunately, recent work has provided credible estimates of both the underlying transaction costs in different markets and the relevant elasticities. We construct a meta-estimate of revenue potential, by applying the central estimates for transaction costs and elasticities drawn from empirical studies to the most recent data on the size of the various markets.

Our results suggest that the revenue potential of a Tobin Tax is still significant, albeit smaller than proponents suggest. A Tobin Tax of 0.005 per cent applied only to spot, outright forward and swap foreign exchange markets could raise around $26 billion if applied globally, or US$ 11.1 billion (£7.7 billion) if only applied to the UK. If a financial transaction tax equivalent to 10 per cent of existing levels of transaction costs in each market was to be applied, across the board, to equity, forex and derivative markets (both on and off exchanges), the revenue potential could be as high as US$ 415 billion, or US$ 134.6 billion (£92.7 billion) if only applied in the UK. Of course, it is likely that long run elasticities will be larger than short run elasticities, as market actors find mechanisms of avoiding the tax. Certainly the existing literature suggests considerable care needs to be take in the design of the tax to minimise avoidance opportunities, and tax authorities would need to monitor avoidance and modify or supplement measures as appropriate (as exemplified by the UK's introduction of the Stamp Duty Reserve Tax to prevent avoidance of the UK Stamp Duty on share transactions). However, we do not find compelling evidence that these activities would be any more onerous or costly than the normal activities undertaken by tax authorities. We therefore conclude that, a Tobin Tax, could make a significant contribution to the revenues of countries that impose it.

Our final question concerns the incidence of the Tobin Tax. Again, we find the literature somewhat wanting on this topic. Several papers make strong assertions about the progressive nature of the tax, whilst others make equally strong assertions that the entire tax is likely to be passed on to consumers – rarely is evidence for either position presented. There is general agreement in the literature that the initial brunt of the tax would be borne by wholesale traders, particularly those involved in short-term foreign exchange transactions. Moreover, several papers point out that different kinds of institutions have very different levels of involvement in these transactions. In particular, banks and hedge funds are much more involved in short-term trading than insurance and pension funds and would therefore pay a larger share of tax. However, the final incidence depends on the extent to which these institutions can pass on the tax. This, in turn, depends on the extent of competition in different segments of the financial sector. It seems likely that, in the long run, a significant proportion of the tax would end up being passed on to consumers in the form of lower returns or higher spreads, but we currently have no credible estimates of what proportion that might be. Nonetheless, even assuming that the tax is ultimately passed on in the form of lower returns and a higher cost of capital, this is likely to have a disproportionately large

impact on the owners of capital. Since the distribution of capital is significantly more unequal than the distribution of income, it would seem likely that the incidence of the tax is no worse, and quite possibly significantly more progressive, than other forms of taxation.

Given the answers that we have been able to glean from the literature on our four questions, our overall conclusion is moderately positive. Although the literature is far from conclusion on many points, it seems clear that a Tobin Tax is implementable and could make a non-trivial contribution to revenue in the major financial economies. It seems unlikely to stabilise financial markets, but, if appropriate designed, unlikely to destabilise them either; and, although a multilateral agreement between the key economies is clearly preferable, it would not be impossible to implement unilaterally, at least for a major economy. The incidence of a Tobin Tax would not be as progressive as its proponents claim, but we have no reason to believe that it would be significantly worse than most alternatives, nor that it would be any more difficult to collect. In short, we conclude that, somewhat contrary to our initial instincts, the Tobin Tax may not be such a bad idea after all.

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