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### **FINANCIAL TRANSACTION TAX: SMALL IS BEAUTIFUL**

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## **Abstract**

The case for taxing financial transactions merely to raise more revenues from the financial sector is not particularly strong. Better alternatives to tax the financial sector are likely to be available. However, a tax on financial transactions could be justified in order to limit socially undesirable transactions when more direct means of doing so are unavailable for political or practical reasons. Some financial transactions are indeed likely to do more harm than good, especially when they contribute to the systemic risk of the financial system. However, such a financial transaction tax should be very small, much smaller than the negative externalities in question, because it is a blunt instrument that also drives out socially useful transactions. There is a case for taxing over-the-counter derivative transactions at a somewhat higher rate than exchange-based derivative transactions. More targeted remedies to drive out socially undesirable transactions should be sought in parallel, which would allow, after their implementation, to reduce or even phase out financial transaction taxes.

Keywords: Transaction tax, Tobin tax, financial transactions, global financial crisis, financial regulation

JEL codes: H20, D62, G10, F30.

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## **EXECUTIVE SUMMARY**

### **Background**

The volume of financial transactions has grown very rapidly in the past decade reaching about 70 times world GDP. The crisis has dented but not reversed this growth while greatly increasing the public support for taxing financial transactions.

### **Aim**

The key question of this paper is: Should financial transactions be taxed?

The case for a tax on financial transactions simply to raise more revenue from the financial sector to pay for the cost of the crisis is not particularly strong. Better alternatives to tax the financial sector are likely to be available.

However, the case for a tax on financial transactions in order to limit negative externalities of financial transactions is stronger. Some financial transactions are indeed likely to do more harm than good, especially when they contribute to the systemic risk of the financial system. To the extent that more direct means of curbing harmful transactions are presently unavailable, the introduction of a financial transaction tax should be considered.

However, such a financial transaction tax should be very small, much smaller than the negative externalities in question, because it is a blunt instrument that also drives out socially useful transactions. At the same time, there is a case for taxing over-the-counter derivative transactions at a somewhat higher rate than exchange-based derivative transactions. Countries that currently levy relatively substantial transactions taxes on specific segments of the market may wish to harmonise and therefore lower their rates to a globally agreed level.

More targeted remedies to drive out socially undesirable transactions should be sought in parallel. As targeted remedies are implemented, financial transaction taxes should be reduced or even phased out. Thereby, the financial transaction tax could provide the financial industry with an incentive to embrace such targeted remedies even as the memory of the financial crisis fades.

## 1. INTRODUCTION

Financial transaction taxes, just like other taxes, essentially do two things: first, they raise revenue and, second, they reduce the activity that is being taxed. The reason that financial transaction taxes are rapidly gaining political traction is that they would appear attractive on both counts in the current post-crisis situation.

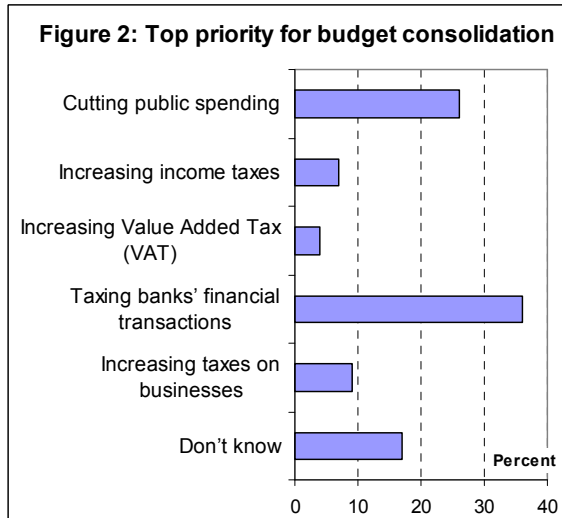
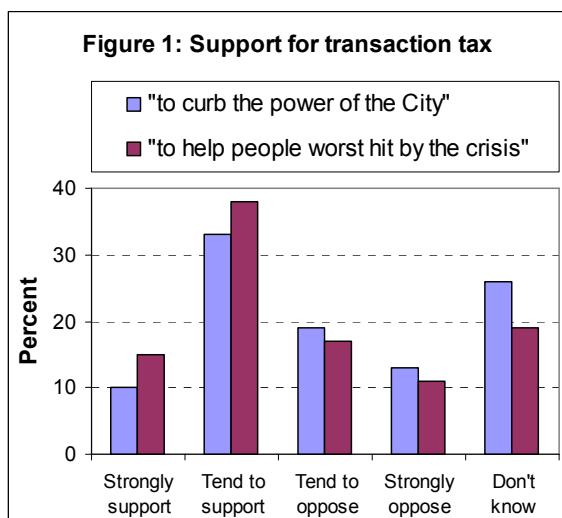
Revenue raising: Faced with greatly increased debt levels, governments are keen to raise additional revenues, if possible from the financial sector, which has contributed to the current global economic and financial crisis and had to be bailed out. The political idea here is to make those who caused the crisis foot at least part of the bill.

Reducing the taxed activity: As a result of the crisis, confidence in the efficiency of financial markets has weakened. Experts and the general public are questioning the social usefulness of the rapid growth in financial transaction volumes observed in the past few years. Hence, many no longer regard the prospect of a financial transaction tax somewhat reducing transaction volumes as a great concern, and some explicitly welcome the prospect, regarding financial transactions at the current level as positively harmful.

According to a recent UK poll (see Box 1), public support for financial transaction taxes is indeed increasing. And, at the recent EU summit in December 2009, European leaders explicitly encouraged the IMF to consider the introduction of a global financial transaction tax.<sup>1</sup>

### Box 1: A recent UK opinion poll on financial transaction taxes

In early November 2009, Oxfam commissioned a YouGov poll on the support for financial transaction taxes in the UK, a few weeks after Gordon Brown had called for the globally coordinated introduction of such taxes. Figure 1 gives the support level for financial transaction taxes, and Figure 2 gives the support for different measures to consolidate the UK budget, including taxes on financial transactions.



<sup>1</sup> "The European Council emphasises the importance of renewing the economic and social contract between financial institutions and the society they serve and of ensuring that the public benefits in good times and is protected from risk. The European Council encourages the IMF to consider the full range of options including insurance fees, resolution funds, contingent capital arrangements and a global financial transaction levy in its review." Conclusions of the European Council (10-11 December 2009), paragraph 15.

But despite these endorsements, the question remains whether financial transaction taxes really make sense. Intellectually, the idea to introduce financial transaction taxes goes back to John Maynard Keynes (1936) and James Tobin. In 1972, the latter proposed introducing a tax specifically on international foreign-exchange transactions that would act like soft capital controls by throwing “grains of sand in the wheels of the market” (Tobin 1974), thereby enhancing the policy space for national fiscal and monetary policy.

But today, only a limited number of countries are using financial transaction taxes, including the UK. Perhaps the critics are right in arguing that the negative side effects of financial transaction taxes simply outweigh any benefits such taxes might entail? After presenting some basic facts about the current volume of financial transactions and the international experience with transaction taxes in section 2, we explore this key question in some detail in section 3 of this paper. Section 4 concludes and provides some policy recommendations.

## **2. SOME FACTS: FINANCIAL TRANSACTIONS AND FINANCIAL TRANSACTION TAXES**

Before we enter into the arguments for and against financial transaction taxes in more detail, it is helpful to look at the amount of financial transactions and the impact of the crisis on trading and open derivative positions. To this end, we report available aggregate data on the evolution of financial-transaction volumes and briefly discuss the experience with financial transaction taxes in a number of countries.

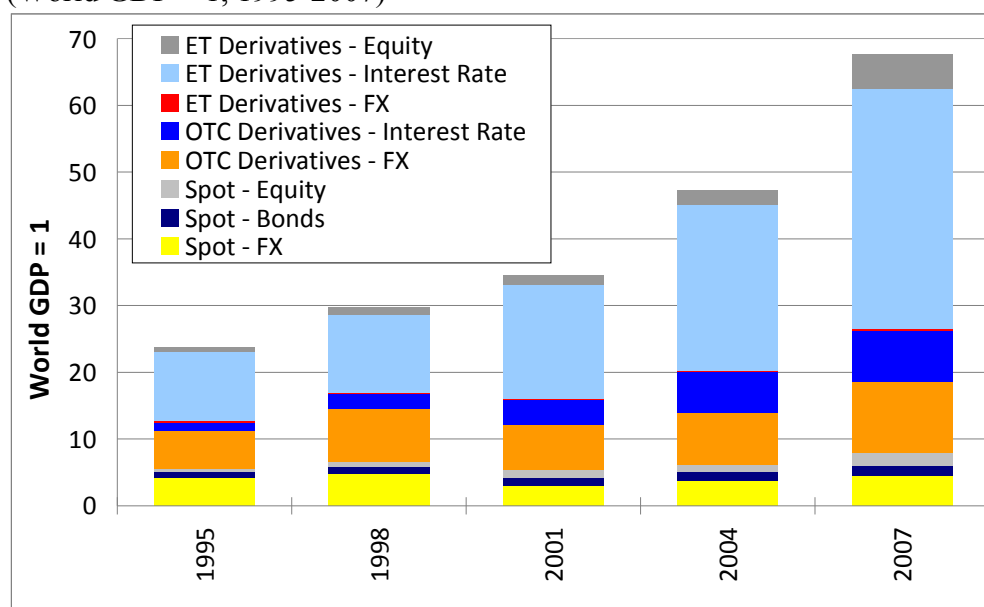
### **2.1. Financial transaction volumes**

Financial transaction volumes have increased dramatically in recent years. Figure 3 presents data on annual turnover for the main spot and derivatives markets as a ratio of world GDP.<sup>2</sup> In 2007, total turnover amounted to almost 70 times world GDP. The lion’s share of transactions, 88 percent in 2007, is accounted for by derivatives trading, of which trading related to fixed-income securities features prominently. Spot transactions only amount to about 12 percent of all transactions.

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<sup>2</sup> Unfortunately data on turnover and open positions are not fully comparable across various markets and hence Figure 3 should be interpreted with some caution.

**Figure 3: Annual turnover on main financial markets**  
(World GDP = 1, 1995-2007)

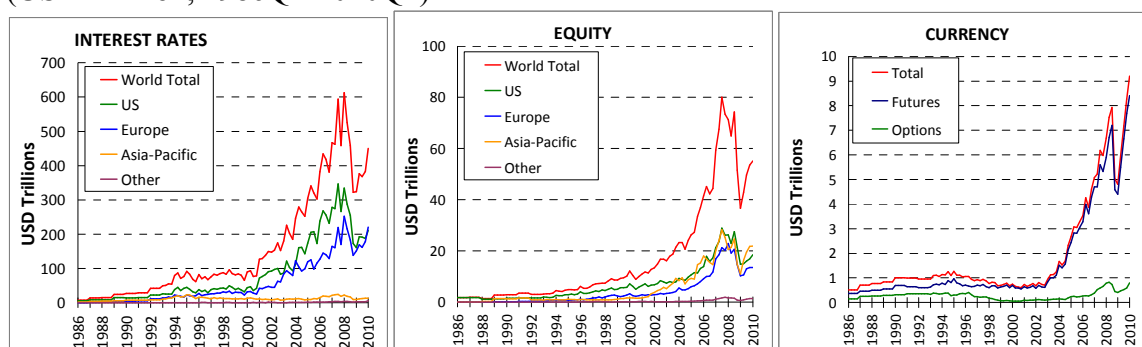


Source: BIS, WFE, IMF.

**Note.** ET=exchange traded; OTC=over the counter; OTC derivatives turnover data and spot-currency turnover data are based on the BIS triennial survey conducted in April of every third year. We multiplied by 250 the April daily average value to get an estimate of annual turnover. Turnover data for commodity markets is not available.

Higher-quality data is available at quarterly intervals for exchange-traded derivatives (excluding commodity markets). Figure 4 presents turnover data (in US dollars) for the three main types of derivatives broken down by geographic region where available. The key observation from the figure is that there was an explosion of trading activity starting in the early 2000s. The crisis shrunk trading activity by almost one half: turnover in 2009Q1 was 53 percent of turnover in 2008Q1. By 2010Q1 trading had rebounded somewhat to 75 percent of the peak level of 2008Q1, which is still several times more than the market activity levels before 2000.

**Figure 4: Quarterly turnover in exchange-traded derivatives**  
(USD Trillion, 1986Q1-2010Q1)



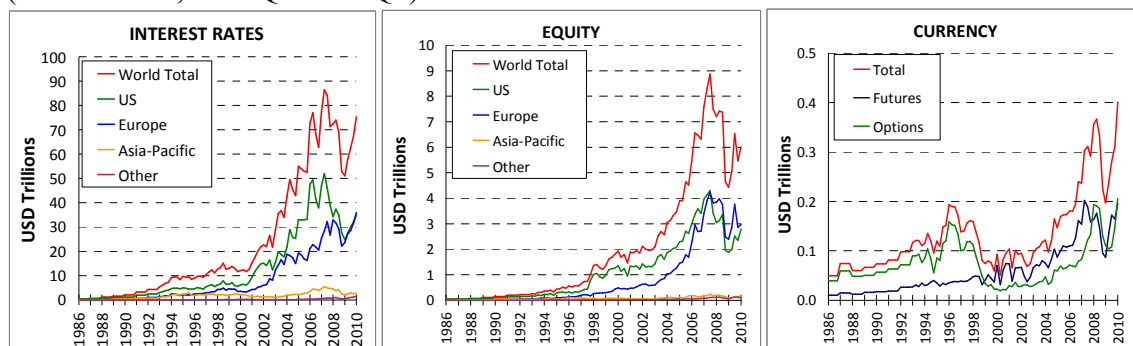
Source: BIS.

**Note.** Quarterly data is available only since 1993 and hence one quarter of annual values are shown at each quarter before

In addition to the turnover data, we also provide an overview of the stock of open positions for derivative contracts. Figure 5 shows net open positions at quarterly intervals for exchange-traded derivatives, whereas data for over-the-counter derivatives is only available on a gross basis (Figure 6). Open positions move broadly in line with the changes in turnover. The

explosion in open positions since the early 2000s, the crisis-related sharp drop and the partial rebound after the first quarter of 2009 are clearly discernible.

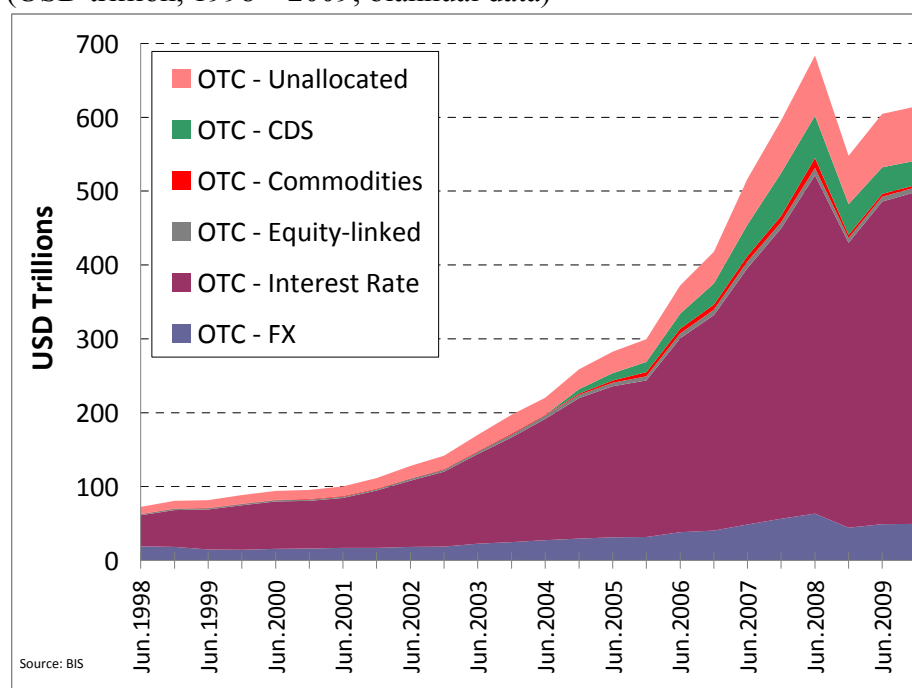
**Figure 5: Net open positions for exchange-traded derivatives**  
(USD trillion, 1986Q1-2010Q1)



**Source:** BIS.

**Note.** Quarterly data is available only since 1993 and hence the end-of-year values are shown at each quarter before.

**Figure 6: Gross open positions of over-the-counter derivatives**  
(USD trillion, 1998 – 2009; biannual data)



**Source:** BIS.

**Note.** Values shown are notional amounts outstanding.

One important question for our purposes is the nature of transactions behind the observed explosion in activity, and to some extent also the reasons for the observed sharp drop in response to the crisis. The development of market infrastructure, and especially improvements in information technologies – which substantially decreased transaction costs - and parallel financial innovation creating a large variety of derivatives products were certainly



prerequisites for the observed developments. But it is unlikely that these factors alone fully explain the huge explosion in trading as shown in eg Figure 4.<sup>3</sup>

There are basically two views regarding the nature of the explosion in transactions from about 2000 to 2008. One view is that lower transaction costs simply enabled markets to process information much more efficiently and in real time thereby greatly increasing activity levels. Short-term speculation and the parallel increase in the liquidity made markets much more efficient than before. The other view is that a rather large share of the additional trading activity is the consequence of anomalies in financial markets. Some call it ‘excessive short term speculation’, others draw attention to flawed incentives<sup>4</sup>, partly due to implicit government insurance, while others argue that the excessively low interest-rate policy of major developed countries since about 2000 has fuelled the expansion of money and credit with subsequent asset-price booms that further fuelled trading activity.

What is clear is that the pace of expansion of trading activity significantly outperformed the pace of expansion in economic activity, which is clearly evident from Figure 3 relating financial-market turnover to GDP. But GDP is a flow concept, and it would have been informative to relate transactions to the stock of financial assets. Unfortunately there exist no readily available global statistics on this, but available evidence suggests that that annual turnover amounts to twentyfold or more the stock of financial assets. For example, the bulk, ie 64 percent, of financial transactions in 2007 were derivatives related to fixed-income products. According to BIS data, the total notional amounts outstanding of all international and domestic debt securities (of financial institutions, corporate issuers and governments), plus money-market instruments, were 27 trillion US dollars in 1995 and 80 trillion in 2007 world wide. Derivatives trading related to fixed-income securities amounted to 345 trillion in 1995 and 2403 trillion in 2007. Hedging and distribution of interest-rate risk may not be related solely to fixed-income securities, but also to credit. There are no readily available statistics on world credit, but its stock may be between 100 percent and 200 percent of world GDP, which was 55 trillion in 2007. Adding the stock of credit to the stock of fixed-income securities, the resulting sum is still a tiny fraction of the 2840 trillion fixed-income related annual derivatives trading. Furthermore, the bulk of fixed-income derivatives trading (1981 trillion out of 2403 trillion in 2007) was conducted on organised exchanges, and hence the ‘hot-potato’ effect often argued for dealership markets, such as the foreign-exchange market, may not be able to explain the huge rise in transactions.

Obviously, fixed-income derivatives are related not just to the underlying fixed-income security and credit, but also to hedging other activities. For example, the hedging of future foreign-currency risks also has an interest rate dimension that can be addressed with interest-rates swaps. Interest-rate swaps are also the ideal means to pursue “long duration” investment strategies by insurance companies and others. Various interest-rate derivatives are also used

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<sup>3</sup> It is difficult to measure transaction costs, not least because different investors face different transaction costs even from the same financial intermediary. Appendix 2 of Darvas (2009) presents transaction-costs data on the inter-dealer currency market for major currencies and reports that costs halved from the 1980s to the 2000s in the case of several currency pairs.

<sup>4</sup> In 2002, ie well before the crisis, Warren Buffett, who is one of the most successful investors in history and in 2008 was ranked by Forbes as the richest person in the world, has raised serious concerns about the incentives of market participants working with derivatives and specifically warned about the explosion in derivatives: “*The derivatives genie is now well out of the bottle, and these instruments will almost certainly multiply in variety and number until some event makes their toxicity clear. Central banks and governments have so far found no effective way to control, or even monitor, the risks posed by these contracts. In my view, derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal.*”

to hedge asset-backed securities and, as their duration can change easily, it may be needed to change the hedging positions frequently. While these and other hedging activities are generally essential to manage risk, the huge gap between turnover and the outstanding stock of assets still presents a puzzle.

Overall, lower transaction costs and financial innovation have clearly helped markets to be more efficient at helping actors follow through their economic incentives, thereby leading to massive increases in financial-transaction volumes. However, what is less clear is the extent to which the relevant actors were all acting in accordance with sound incentives, which ultimately determines the extent to which this increase in transactions was accompanied by a real increase in economic efficiency.

## 2.2. Financial transaction taxes: international experiences

Many countries have applied financial transaction taxes in the past and a limited number of countries continue to apply financial transaction taxes today. These taxes are primarily levied on spot share trading, but in a few countries other types of transactions, including derivatives, are taxed as well<sup>5</sup>. The best-known example is the UK's stamp duty: it is a 0.5 percent tax on the value of spot transactions in shares of UK companies. The tax rate on share trading is 1 percent in Ireland, 0.5 percent in Korea, while tax rates between 0.15 and 0.3 percent are applied in Australia, Switzerland, Greece, Hong Kong, India and Taiwan.<sup>6</sup> The Taiwanese transaction tax is rather broad and covers various kinds of securities, including bonds and futures contracts (see Box 2). The revenue generated from the tax can be substantial, with data for the UK, Ireland, Taiwan and South Africa provided in Table 1.

### **Box 2: Financial transaction tax rates and bases in Taiwan**

Taiwan provides an interesting example, because it has FTTs on both spot and derivatives markets.

#### ***Securities transaction tax:***

0.3% for shares or share certificates embodying the right to shares issued by companies.

0.1% for corporate bonds and other securities approved by the government (note: the Taiwanese government has recently suspended the tax on bond transactions until the end of 2016).

#### ***Futures transaction tax:***

Different rates apply depending on type of contract:

- between 0.0000125% and 0.06% per transaction on the value of stock index futures contracts,
- between 0.0000125% and 0.00025% per transaction on the value of contracts for interest rates,
- between 0.1% and 0.6% per transaction for options based on premium paid,
- between 0.0000125% and 0.06% per transaction on the value for other futures contracts

<sup>5</sup> See, for example, Table 1 in Pollin, Baker and Schaberg 2003, and Table A1 in Schulmeister, Schratzenstaller and Picek, 2008

<sup>6</sup> France also had a tax rate between 0.15 and 0.30 percent with a maximum of 610 euros for each transaction, but it was abolished on 1 January 2008.

The collection cost of FTTs is generally very low due to the electronic execution and settlement of trades. In the UK, for example, the collection costs for all kinds of stamp duties (including on property) cost 0.21 pence per pound raised in the fiscal year 2008/2009, while the average for all taxes amounted to 1.10 pence (HM Revenue & Customs Autumn Performance Report 2009). But the collection costs for stamp duty on share transactions is likely to be substantially lower still since the number given above includes collection costs for stamp duty on property, typically more expensive to collect (Bond, Hawkins and Klemm 2005).

**Table 1: Revenues from financial transaction taxes in four countries (2001-2009)**

	UK		Ireland		Taiwan		South Africa	
	in GBP bn	% of total tax revenues	in EUR bn	% of total tax revenues	in USD bn	% of total tax revenues	in USD bn	% of total tax revenues
<b>2001</b>	2.9	0.9	0.35	1.2	1.9	5.2	0.4	1.6
<b>2002</b>	2.6	0.8	0.30	1.0	2.3	6.5	0.4	1.6
<b>2003</b>	2.6	0.7	0.26	0.8	2.2	5.9	0.6	1.6
<b>2004</b>	2.7	0.7	0.26	0.7	2.8	6.7	1.0	2.1
<b>2005</b>	3.5	0.9	0.32	0.8	2.3	4.8	1.3	2.4
<b>2006</b>	3.8	0.9	0.41	0.9	2.9	5.9	1.5	2.5
<b>2007</b>	4.2	0.9	0.61	1.3	4.1	7.8	1.4	1.9
<b>2008</b>	3.2	0.7	0.42	1.0	3.0	5.5	1.4	1.9
<b>2009</b>	<i>n.a.</i>	<i>n.a.</i>	0.21	0.6	3.3	7.2	<i>n.a.</i>	<i>n.a.</i>

**Sources:** HM Revenue & Customs, Revenue Irish Tax & Customs, Ministry of Finance (ROC), South Africa Revenue Services, IFS.

**Note.** UK data refer to fiscal year.

At the same time, it should be noted that transaction taxes have not been equally successful in collecting revenues everywhere. For example, when Sweden introduced a financial transaction tax in the mid-eighties, the revenues were disappointing, not least because the tax was easily avoided as financial dealings were moved abroad. The extent to which this is possible depends crucially on the specific design of the financial transaction tax. The UK stamp duty, for example, essentially buys legal certainty. Only once the tax is paid has the transfer of ownership been officially stamped. Of course, in the UK case it is still possible to sell a share to a counterparty abroad so that it leaves the UK system and can thereafter change hands without being subject to the UK's stamp duty. However, a transaction that exits the system in that way is in effect charged at 3 times the normal stamp duty, thereby to some extent inoculating the system against geographic relocation of transactions.

### 3. SHOULD FINANCIAL TRANSACTIONS BE TAXED?

The evidence presented in the previous section shows that financial transactions have indeed exploded in a considerable number of countries and suggests that taxing financial transaction remains possible in a global financial market, although the practical experience with taxing derivatives - the most rapidly growing segment of financial transactions - is limited.

Against this background we can now turn to the key policy question of this paper: should financial transactions be taxed?

From a public-finance perspective, taxes should essentially be collected for either of two reasons that are not mutually exclusive: to collect revenues for public expenditures and to discourage activities that are deemed to have negative side effects not properly taken into account by market participants. Taxes levied at least in part for the latter motive of ‘internalising negative externalities’ are called Pigou taxes after Artur Cecil Pigou, a British economist who proposed such taxes to correct market failures.

In the following, we will argue that the case for a financial transaction tax purely on the grounds of raising revenues is relatively weak, while the case for a financial transaction tax as a Pigou tax is more convincing.

### **3.1. Revenue-raising taxation**

From a pure revenue-raising perspective, the case for a financial transaction tax is not particularly strong. The reason is that a large part of financial transactions should be regarded as ‘intermediate production’, not final consumption. Interest rates swaps, for example, can be a useful hedging tool in the production process but are not normally enjoyed as final consumer products.

Generally, financial markets are supposed to allocate two key factors of production, capital and risk, to the production process. To the extent that they do so efficiently, taxation of such intermediate steps of production should typically be avoided as it is prone to distort production efficiency (Diamond and Mirlees 1971).<sup>7</sup>

But how does this observation square with the three key arguments often used to support the revenue-raising rationale of taxing financial transactions? : (1) the financial sector is undertaxed compared to other sectors and the transaction tax would remedy this problem; (2) the transaction tax should raise revenues from the financial sector, amounting in effect to an ‘insurance fee’ for the systemic risk created by the financial sector; (3) the revenue collected could be used for global purposes given otherwise scarce resources, such as to fund development assistance or global public goods like climate change. In our view, none of these three arguments are built on sufficiently solid ground.

#### ***3.1.1. Undertaxation of the financial sector***

It is true that the financial sector is difficult to tax. In part this is the case because financial-sector organisations may find it comparatively easy to shift profits internationally. Another important factor is that the financial sector is essentially exempt from value added taxation. The absence of VAT on financial products is, perhaps ironically, attributable to technical difficulties in appropriately measuring the value added in financial-sector products. As a result, the use of financial services by private households, for example the borrowing of money as a mortgage, is currently VAT exempt, contrary to, say, the renting of a car which is subject to VAT. However, to address such problems it may be preferable, in view of the distortive nature of transaction taxes (see above) to increase taxation of the financial industry directly. This could be achieved through an enhanced regime for taxing profits, dividends and bonuses and through steps to at least partially include the financial sector in the VAT regime.<sup>8</sup> One would thereby avoid the problem of taxing intermediate production. Also, one would not

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<sup>7</sup> If, however, financial markets are allocating capital and risk inefficiently to start with, then the Diamond-Mirlees result does not apply as discussed in the subsequent section on Pigou taxation.

<sup>8</sup> Huzinga (2002) makes a concrete proposal on how to introduce VAT for financial-sector services purchased by private households.

have to worry about an important unknown, namely the incidence of financial transaction taxes. At this stage, we still do not have a very good idea which part of the financial transaction taxes would end up being paid by the financial sector – its shareholders, managers and employees – and which part would end up being paid by the rest of society.

### **3.1.2. *Insurance fee***

If such a fee is to be raised, then it should of course be collected in the way that causes the least distortion. However, because of the finding by Diamond and Mirlees cited above, it is indeed questionable whether from a purely revenue-raising perspective the transaction tax would be the best way to collect such fees. And viable alternatives should exist, as explained in the previous paragraph.

### **3.1.3. *Raising revenues for development assistance or global public goods***

Regarding the idea to raise revenues for development assistance or global public goods through transaction taxes, we are also somewhat sceptical. The public finance perspective simply offers little support for such goals. The reason is that earmarking of revenues of a particular tax for specific purposes risks the misallocation of public funds: either too much or too little money might be spent on the specific purpose chosen just because the revenues from the tax in question were lower or higher than the optimum level of spending. In order to avoid such misallocation, tax revenues should by default be used to fund the general budget so that the expenditure allocation can be optimised on the basis of the overall tax resources that are available, including those resources spent on global concerns. What is more, it should be noted that revenues from financial transaction taxes would be very unevenly distributed geographically, with the lion's share accruing to a limited number of financial centres. Within the EU, tax revenues would be extremely concentrated in the UK and Germany, where over 97 percent of EU spot and derivative transactions are currently taking place (see eg Schulmeister et al 2008). This makes it particularly unlikely that the UK or Germany would agree to fund worthwhile international activities in proportion to transaction tax revenues.

In summary, we are somewhat sceptical at the suggestion that financial transaction taxes should be introduced with the primary objective of raising revenue.

## **3.2. *Pigou taxation***

By contrast, we do see some merit in the case for a small financial transaction tax as a Pigou tax if financial transactions indeed cause negative external effects that need to be internalised.

To start with, it may be worth re-stating the well-known case for a Pigou tax in the case of a negative externality like environmental pollution. Without Pigou taxes on the polluting activity, too much polluting would occur. Banning polluting activities altogether typically does not make sense since zero pollution would make the world very clean but also very poor. What we typically want is simply to lower pollution so that the marginal benefit of the activity equals the marginal pollution cost. To achieve this, regulation might sometimes be an alternative to Pigou taxation, but it has two disadvantages. First, it would mean foregoing the revenues of the Pigou taxes, revenues that would then have to be raised through other taxes that cause undesirable distortions. Second, regulators would often be faced with the difficult administrative choice about who should be polluting and by how much. To avoid that problem, the state could of course sell pollution certificates, but in many ways that would be the exact economic equivalent of a Pigou tax.

Next, the question arises whether financial transactions may actually be accompanied by negative externalities, in which case a Pigou tax would help. In parallel, we explore reasons why a Pigou tax would hurt.

### **3.2.1. *Excessive incentives to be faster than others***

One fairly solid argument why there may be too much investment in financial market infrastructure was developed by Stiglitz (1988). It is based on the observation that it will always pay to have new information faster than other market participants and then to trade on it. This provides a powerful private incentive heavily to invest in being – perhaps just a millisecond – faster. This is very much the reality in financial centres today, with heavy infrastructure investments in very fast ‘high-frequency trading’ by major market players<sup>9</sup>.

While many private investments in information gathering and processing for private gain also serve the general public by making markets better at absorbing information, it is plausible that these ‘arms-race incentives’ may produce ‘too much of a good thing’. An illustrative example for such over-investment might be a recent USD 1.3 billion project to lay an optical cable through the Arctic Sea between the financial centers in London and Tokyo. The cable would cut latency times for data transmission from 140 to 88 milliseconds which appears to be the principal selling point for the financial sector.<sup>10</sup>

A financial transaction tax could help to reduce such over-incentives to invest in being fastest by discouraging very short-term speculation that exploits minor information advantages. While this overinvestment is likely to be only a tiny fraction of GDP, it may not be an entirely negligible part of investment of the financial service industry.

### **3.2.2. *Regulation and financial-sector fragility***

A powerful argument in favour of transaction taxes would of course emerge if very low transaction costs could be linked to the kind of financial sector instability we have just been through. Krugman (2009) gives an example of such a link: part of the fragility of the financial sector observed during the present crisis was due to the heavy reliance on short-term arrangements and, more broadly, excessive systemically relevant leverage. For example, the financial sector relied to a large extent on rather short-term financing for its funding needs (interbank market, commercial paper). When the market for this short-term funding broke down, the situation immediately became systemically relevant and public intervention was needed. A financial transaction tax might have helped somewhat to discourage such short-term arrangements. However, as pointed out by Zingales (2009), a tax on short-term debt would be a better instrument to tackle this particular concern.

But behind this particular example there might be a more general observation on the interplay between financial-sector regulation and financial-market efficiency. If financial-sector regulation is sufficiently light to allow substantial financial innovation, the chances are that it will be periodically outsmarted by the financial industry, at a cost to the general public. And it is at least plausible that very low transaction costs facilitate the thorough exploitation of even relatively minor regulatory shortcomings. Put differently: transporting tomato ketchup in a leaky (regulatory) bucket may not be a big problem, but transporting water is another matter.

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<sup>9</sup> ‘Stock Traders Find Speed Pays, in Milliseconds’, New York Times, 23 July 2009.

<sup>10</sup> ‘Global warming opens Arctic for Tokyo-London undersea cable’, Associated Press, 21 January 2010.

Hopefully, the now obvious and gaping holes in our regulatory bucket are being mended in the aftermath of the crisis. This should include a more thorough treatment of the problem of systemic risk as we currently understand it and the externalities implied by it. Some highly problematic practices or products might even have to be banned. However, historical experience suggests that such regulatory improvements are usually successful at preventing a repeat crisis, they are unlikely to be flawless as witnessed by new types of crisis that emerge.

Aspects of regulation which we may consider too small to be important today may suddenly matter a great deal as markets become ever-more efficient and find new ways to exploit regulatory loopholes. Therefore, transaction taxes may be justified given the uncertainties about future regulatory problems. And they might, from time to time, even be able to give regulators a little more time to think about the holes to be plugged.

In a sense, this argument is just a variant of the well-known insight that if there is one inefficiency in your system – in this case imperfect regulation – then more efficiency in the rest of the system could be a bad thing. However, it need not be. In sum, this particular argument in favour of a financial transaction tax is potentially very important, but it is also somewhat fragile. But it is probably fair to say that the crisis has shifted the burden of proof somewhat. Before the crisis many people felt that regulatory imperfections were not an essential part of the picture. This certainly has changed and there are few signs of regulatory hubris re-emerging arguing that new regulation will deal with any such problems once and for all.

### **3.2.3. *Taxation versus controls***

Possibly of lesser relevance for the current debate but of interest anyway may be the original proposal for a financial transaction tax on currency trades by Tobin (1974, 1978). His was in essence a proposal in the context of the ‘holy trinity’ of monetary independence, fixed exchange rates and capital mobility. His proposed tax would essentially have acted like a soft form of capital controls, thereby increasing the autonomy of the national government and central bank to manage the business cycle without destabilising the exchange rate. While the underlying problem is of course still relevant today for a number of countries, it may be hard to justify the introduction of a universal transaction tax on that basis. However, what remains is the insight that transaction taxes may often be an attractive policy when administrative zero-one choices are inappropriate, as may be the case with many problems in the financial markets.

### **3.2.4. *Transaction costs and volatility***

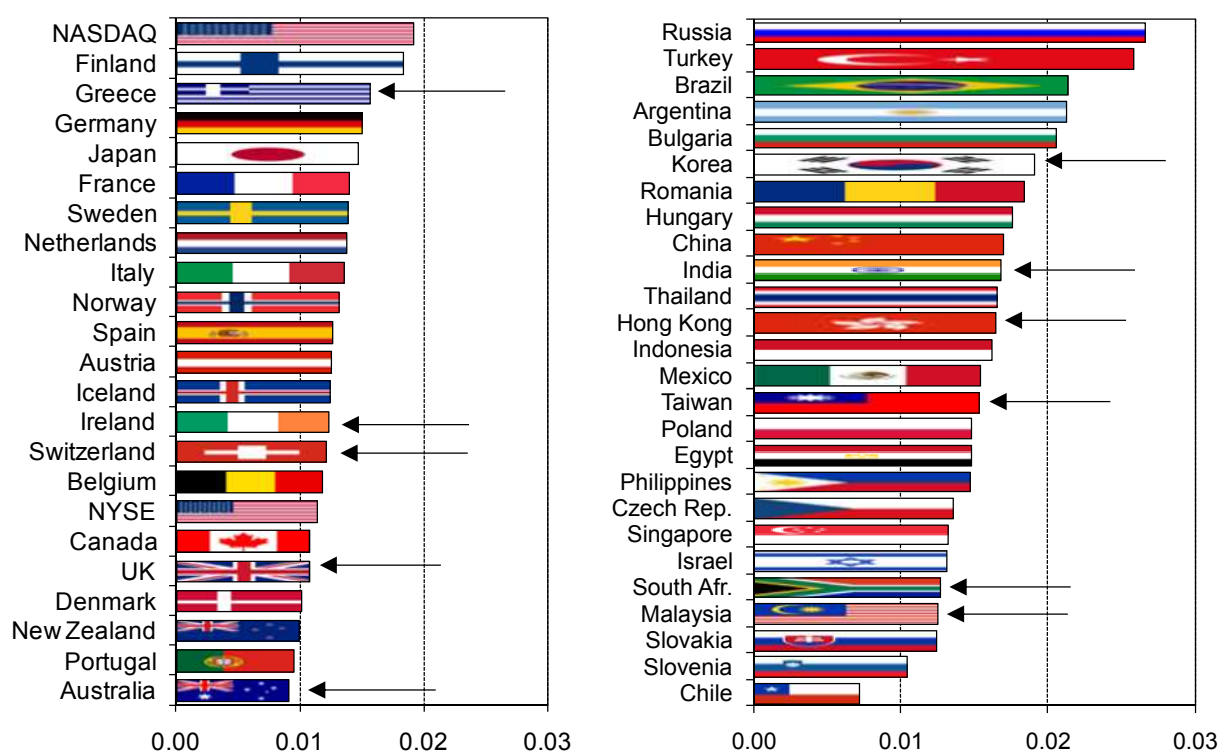
One much-discussed question is whether lower financial transaction costs lead to lower or higher price volatility in markets. However, the brief review of the literature we present in the following is inconclusive. Therefore, we would be hesitant to use a possible link between financial transaction costs and volatility either as a strong argument for or against financial transaction taxes at this stage.

Advocates of financial transaction taxes suggest that by making short-horizon trading more costly compared to long-horizon trading, both short-run volatility (ie ‘noise’) and long-run volatility (ie persistent deviation from ‘fundamental equilibrium’) would lessen; see eg Summers and Summers (1989), Frankel (1996), Palley (2003) or Schulmeister (2009). On the other hand, there is also the opposite argument that financial transaction taxes, by reducing

liquidity, risk increasing the volatility of markets; see eg Mannaro, Marchesi and Stzu (2008). The empirical evidence on this appears inconclusive at this point. For example, Jones and Seguin (1997) show that the reduction in the commission portion of transaction costs in 1975 led to a decrease in volatility of stock prices in the US, but Liu and Zhu (2009) – by applying the same methodology as Jones and Seguin (1997) – find that a reduction of the commission in the Japanese equity markets has increased volatility. Hau (2006) finds a positive association between transaction costs and volatility in the French stock market, Baltagi, Li and Li (2006) for the Chinese stock market, and Aliber, Chowdhry and Yan (2004) for the foreign-exchange market. Yet there are also many papers claiming that transaction taxes (or transaction costs more generally) have no significant effect on volatility: Saportan and Kan (1997) support this finding for the UK equity market, Hu (1998) for stock markets in Hong Kong, Japan, Korea and Taiwan, and Chou and Wang (2006) for the Taiwanese futures markets.<sup>11</sup>

We close this discussion about a possible link between volatility and transaction costs with a simple comparison of stock-market volatility for countries with and without financial transaction taxes, see Figure 7, which at least does not offer evidence of a very strong cross-country link between volatility and the taxation of transactions.

**Figure 7: Daily stock market volatility, 1996-2009**



**Source:** Authors' calculations based on data from DataStream.

**Note.** For each year between 1996 and 2009 we calculated the standard deviation of daily percentage stock-price index changes and then calculated the average of these annual figures. Countries with current tax rates between 0.15 and 1.0 percent are indicated with arrows.

<sup>11</sup> FISCO (2006) also finds that the debate on the impact of transaction taxes on volatility is inconclusive, and discusses in detail several examples from the EU.

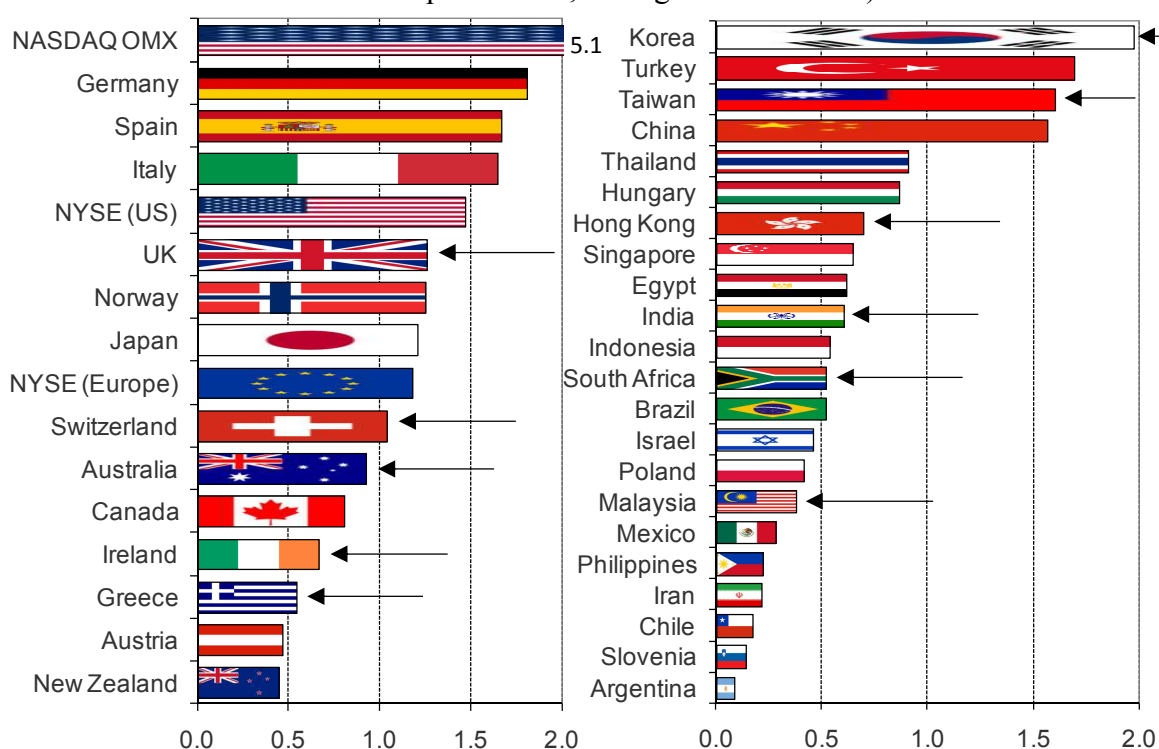


### 3.2.5. Trading volume

By contrast, what is fairly clear is that higher transaction costs will tend to reduce trading volume. Such a reduction in trading volume would also tend to go hand in hand with a reduction in market liquidity, which could be a major adverse consequence of a tax. What is less clear is how large this effect will be. Figure 8 shows the ratio of turnover to market capitalisation (a measure called ‘stock-market velocity’). It shows that countries with significant transaction taxes do not have exceptionally low stock-market velocities. This certainly suggests that the financial transaction tax itself is not the dominant determinant of trading activity, with other factors driving major cross-country differences. Those factors would include other sources of transaction cost, the size and frequency of shocks to these markets and the ways in which these shocks are absorbed.

**Figure 8: Stock-market velocity**

(Ratio of annual turnover to market capitalisation, average of 2003-2009)



Source: WFE.

**Note.** Velocity of NASDAQ is 5.1, but for better readability of the left-hand side panel, it has a 2.0 cut-off. Countries with current tax rates between 0.15 and 1.0 percent are indicated with arrows.

### 3.2.6. Increased cost of funding for the real economy

But probably the most obvious and direct argument against transaction taxes is that they would increase the cost of funding for the real economy via the stock market. While the precise extent to which this would occur remains unclear, there exists some literature studying this effect. For example, Umlauf (1993) finds that a one-percent tax on share trading in Sweden led to a fall in stock prices by 2.2 percent on announcement of the measure. According to that study, the cumulative fall in stock prices might even have been as high as 5 percent when the period prior to the announcement is taken into account. By contrast, Oxera (2007) calculates much more marked effects using a stylised model that seeks to estimate the net present value of future transaction tax obligations for UK-listed companies. On that basis,

the study suggests that the 0.5-percent tax in the UK would be depressing stock prices by as much as 8 to 12 percent<sup>12</sup>.

In a simple version of this simulation approach, the calculated impact depends essentially on the stock-market velocity, which varies considerably across different markets, as shown in Figure 8. For example, if the stock market-velocity is one, with each stock on average being turned over once per year, a 0.5-percent tax amounts to a financial burden of 0.5 percent of stock-market capitalisation per year. If this burden is repeated every year, and assuming an interest rate of, say, 4 percent, the net present value of the burden would amount to a towering 12.5 percent of the value of the stock.

Of course, with the much smaller tax rates that we suggest as more appropriate in the following, the burden would be proportionately smaller. For example, for a 0.01-percent tax rate, the net present value of the transaction tax burden - even for German stocks with a stock-market velocity of about 1.8 - would amount to a mere 0.45 percent.

### **3.3. Why a financial transaction tax should be small**

Given the possible advantages of taxing some and the disadvantages of taxing other transactions, the first-best solution would of course be to use targeted instruments to deal with any negative externalities, while leaving those with no externalities untouched. However, assuming for now that only a uniform transaction-tax instrument is available, the pros and cons discussed above raise the difficult question of how to manage the trade-off. In the transaction-tax debate, this trade-off is traditionally operated by simple assertion and counter-assertion, which tends not to be very illuminating.

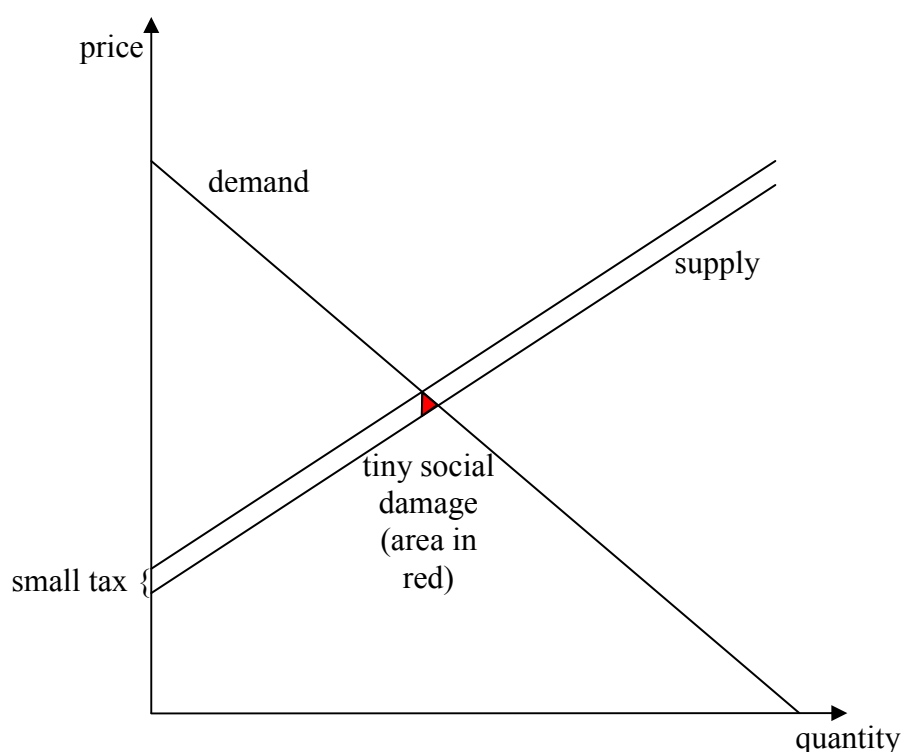
Instead, we offer in the following a fairly robust *a-priori* argument for why the optimal financial transaction tax should be small – much smaller than the externalities in question – but not zero.

The reason for this lies in the geometry of the welfare losses and gains caused by the tax. In Figure 9a, the welfare loss induced by such a small tax  $t$  is depicted for all those transactions which do not imply a negative externality. This welfare loss, represented by the red area, increases and decreases in proportion to the square of the small tax  $t$ . The reason is that one side of this triangle is equal to the small tax  $t$  itself. And the height of the triangle, viewed from that side, varies with the price elasticity of demand, which is also proportional to  $t$ .

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<sup>12</sup> In support of this approach, Bond, Hawkins and Klemm (2005) find empirically that more heavily traded stocks tended to be impacted more by a change in transaction tax in the UK, though the magnitude of the estimated effect is rather small.

**Figure 9a: Welfare effect of a small tax in the absence of an externality**

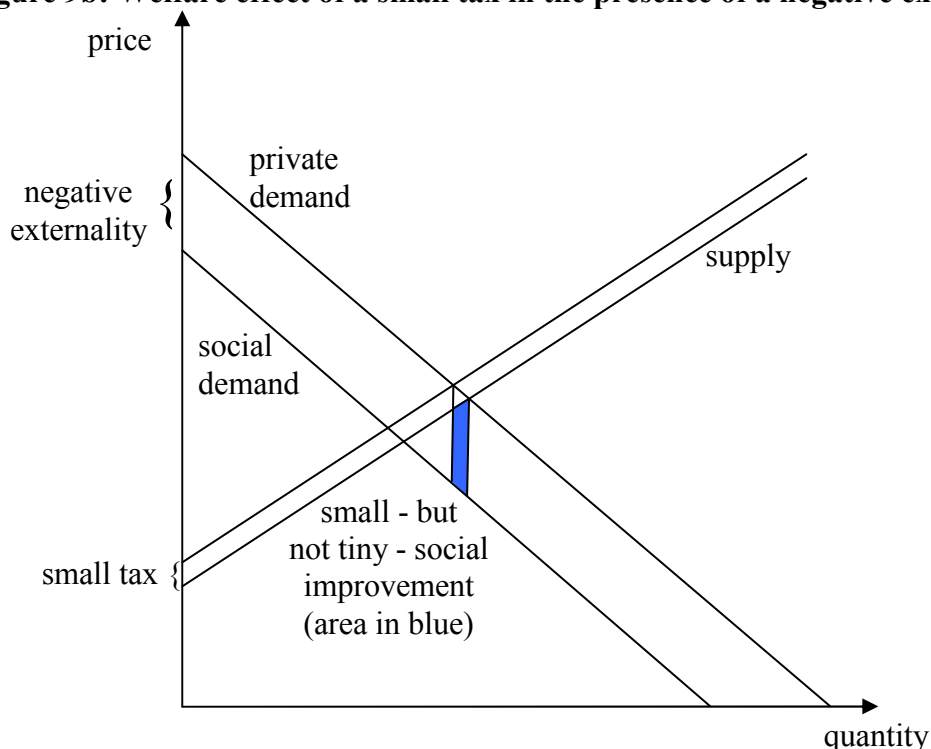


By contrast, the positive welfare effect of a small transaction tax where a negative externality is present is depicted as the blue area of Figure 9b. To understand this figure, it should first be noted that the externality is depicted here as diminishing social demand for the good. The quantity chosen by the market is defined by the point where supply equals private demand. By contrast, the socially optimal quantity is substantially lower, defined by the point where supply equals social demand. At the original market outcome, the marginal damage done to welfare is exactly equal to the size of the negative externality which is represented by the maximum height of the blue area. In our calculation we can take it to be constant for small  $t$ .<sup>13</sup> At the same time, the width of the blue area is the variation in the quantity demanded in response to the small tax  $t$ , which is again proportionate to the price elasticity of  $t$  and therefore proportionate to  $t$ . As a result, the overall size of the blue area varies in proportion to  $t$  for small tax rates.

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<sup>13</sup> To be precise, the average height decreases as  $t$  increases, but this simply adds a negative term in  $t$  squared to the first order term in  $t$  in the formula for the blue area. This term in  $t$  squared can then be neglected for small  $t$  for the remainder of the argument.

**Figure 9b: Welfare effect of a small tax in the presence of a negative externality**



With this, we can now show that it is always possible to pick a small but non-zero tax which is sufficiently small for the welfare benefits of the tax to exceed the welfare costs. Formally, we look for the range of taxes where the blue area is bigger than the red area.

$$\text{Blue area} > \text{Red area}$$

$$\text{Constant}_{\text{Blue}} t > \text{Constant}_{\text{Red}} t^2$$

$$\frac{\text{Constant}_{\text{Blue}}}{\text{Constant}_{\text{Red}}} > t > 0$$

Of course, the scale of the drawings in Figure 9a and 9b might in reality be very different, for example if there were only very few transactions that carried a negative externality but very many carrying a positive one. However, such a difference in scales would merely influence the constants above and call for an even smaller  $t$ , but the basic result would be unaltered. Within this very basic framework – which can be generalised further - we therefore find that a range of positive but small financial transaction taxes will always exist that would lead to a welfare improvement<sup>14</sup>.

The intuition for this finding is that a very small tax will only prevent very marginally useful ‘good’ transactions while at the same time driving out ‘intra-marginally’ and therefore significantly ‘bad’ transactions. Therefore, the welfare gain from driving out these bad

<sup>14</sup> The most important hidden assumption underlying this result is that financial transactions either exert a negative externality or no externality at all. Logically, there also exists the possibility for financial transactions to imply a positive externality. Obviously, when both positive and negative externalities are present, little can be said about the sign of the tax. However, at least at this stage transactions with positive externalities do not feature prominently in the transaction-tax debate.

transactions will initially dominate. Using an analogous argument it can also be seen why it would not be optimal to fully internalise the externality by setting the Pigou tax at the level of the negative externality. The reason for this is that when the Pigou tax is already close to the level of the negative externality, further increases will only drive out marginally ‘bad’ transactions while driving out significantly useful ‘good transactions’.

It is worth noting that this logic in favour of a small Pigou tax on financial transactions applies irrespective of whether short-term or long-term transactions are more likely to carry a negative externality. To the extent that there are reasons to believe that short-term speculative transactions are more likely to imply a negative externality, the optimal small Pigou tax will be just a little higher.

#### **4. CONCLUSION**

In conclusion, we find that there is a case to be made in favour of a small Pigouvian financial transaction tax. However, it should be substantially smaller than the externalities in question. To address tax avoidance through financial innovation or geographic relocation, the full range of financial transactions – including derivatives – should be included and the introduction of the tax should be globally coordinated to the extent possible.

If such a globally coordinated, very small but broad-based financial transactions tax were to be implemented, countries that currently levy relatively substantial transactions taxes on specific segments of the market, in particular on stock transactions, may wish to harmonise and therefore lower their rates to the globally agreed level in order to minimise distortions.

However, we also find that such an optimal financial transaction tax can only be expected to very partially internalise any negative external effects. Therefore, more targeted remedies for the inefficiencies in question should in any event be sought in parallel to introduction of the tax. To the extent that such targeted remedies are available and implemented, any financial transaction tax might eventually be reduced or even phased out. In that sense, the financial transaction tax might provide the financial industry with an incentive to embrace such targeted remedies.

This political-economy observation somewhat defuses the difficult question whether a second-best or even third-best solution which is the financial transaction tax should be considered at all before all the more targeted measures have been exhausted. In fact, the financial transaction tax might stimulate interest in first-best regulation even as the memory of the financial crisis fades.

The targeted first-best measures will of course need to include better regulation and supervision of the financial industry. But they may also include more targeted tax incentives. For example, it may be possible to measure and to tax systemic risk directly, as suggested for example by Acharya et al. (2009). Such levies may, for example, be used to fund a financial-sector bailout mechanism, as is currently under discussion in Sweden and can be argued to be at the heart of the recent Obama proposal to tax large banks based on their leverage.

Even within a financial transaction tax system, differentiation in rates of tax is possible and could be a useful means to make the system more targeted and effective. In particular, one may wish to consider taxing over-the-counter derivative transactions at a somewhat higher

rate than exchange-based derivative transactions.<sup>15</sup> Substantively, this could be justified on account of the lesser transparency and greater systemic risks that over-the-counter transactions might entail. And such tax incentives could nicely complement the ongoing legislative action on both sides of the Atlantic to encourage centralised clearing for derivatives.

## REFERENCES

- Acharya, Viral, Lasse Pedersen, Thomas Philippon and Matthew Richardson (2009) 'Regulating Systemic Risk', Chapter 13 in 'Restoring Financial Stability: How to Repair a Failed System', eds. Viral Acharya and Matthew Richardson, John Wiley & Sons.
- Baltagi, Badi H., Dong Li, and Qi Li, 2006, 'Transaction Tax and Stock Market Behaviour - Evidence from an Emerging Market', *Empirical Economics* 31, 393–408.
- Bond, Steve, Mike Hawkins, and Alexander Klemm, 2005, 'Stamp Duty on Shares and its Effect on Share Prices', *FinanzArchiv* vol. 61 no. 3, 275-297.
- Buffett, Warren, 2002, 'Warren Buffett on Derivatives', edited excerpts from the Berkshire Hathaway annual report for 2002.
- Chou, Robin and George H.K. Wang, 2006 'Transaction Tax and Market Quality of the Taiwan Stock Index Futures', *The Journal of Futures Markets*, Vol. 26, No. 12, 1195–1216.
- Darvas, Zsolt, 2009, 'Leveraged carry trade portfolios', *Journal of Banking and Finance* Vol. 33, No. 5, 944-957.
- Diamond, Peter A. and James A. Mirrlees (1971) 'Optimal Taxation and Public Production I: Production Efficiency and II: Tax Rules', *American Economic Review* 61: 8–27 and 261–278.
- Frankel, Jeffrey A., 1996, 'How Well do Foreign Exchange Markets Function: Might a Tobin Tax Help?', in 'The Tobin Tax: Coping with Financial Volatility', Mahbub Ul Haq, Inga Kaul, and Isabelle Grunberg, eds., Oxford University Press, New York, 1996, 41-81.
- FISCO (2006) 'First Report: Fact-finding study on fiscal compliance procedures related to clearing and settlement within the EU', FISCO (The EU Clearing and Settlement Fiscal compliance Experts' Group), Brussels, [http://ec.europa.eu/internal\\_market/financial-markets/clearing/compliance\\_en.htm](http://ec.europa.eu/internal_market/financial-markets/clearing/compliance_en.htm)
- Hau, Harald, 2006 'The Role of Transaction Costs for Financial Volatility: Evidence from the Paris Bourse', *Journal of the European Economic Association* 4(4), 862-890.
- Hu, Shing-yang, 1998, 'The effects of the stock market transaction tax on the stock market - Experiences from Asian Markets', *Pacific-Basin Finance Journal* 6, 347–364.
- Huizinga, Harry, 2002, 'A European VAT on financial services?', *Economic Policy*, Vol. 17- Issue 35, 497 – 534.

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<sup>15</sup> Interestingly, some countries already apply different transaction tax rates for share trading on organised exchanges and elsewhere. Finland, Italy and Malta have taxes (in the range between 0.009 and 2 percent) on the transfer of securities, but securities traded on the stock exchange are exempt from tax. Greece has a 0.15 percent tax on shares listed on the stock exchange and a 5 percent tax on non-listed shares (see Table A1 in Schulmeister, Schratzenstaller and Picek, 2008).

- Jones, Charles M. and Paul J. Seguin, 1997, 'Transaction Costs and Price Volatility: Evidence from Commission Deregulation', *The American Economic Review*, Vol. 87, No. 4, 728-737.
- Keynes, John Maynard, 1936, 'The General Theory of Employment, Interest and Money', Cambridge University Press.
- Krugman, Paul, 2009, 'Taxing the speculators', *New York Times*, 26 November 2009.
- Mannaro, Katiuscia, Michele Marchesi and Alessio Setzu, 2008, 'Using an artificial financial market for assessing the impact of Tobin-like transaction taxes', *Journal of Economic Behavior & Organization* 67 (2008) 445–462.
- Oxera, 2007, 'Stamp Duty: Its Impact and the Benefits of its Abolition', Oxera, London.
- Palley, Thomas I., 2003, 'The Economic Case for the Tobin Tax', in: James Weaver, Randall Dodd and Jamie Baker (eds.) 'Debating the Tobin Tax. New Rules for Global Finance', New Rules for Global Finance Coalition: Washington, DC, p. 5-26.
- Pollin, Rober, Dean Baker and Marc Schaberg, 2003, 'Securities Transaction Taxes for US Financial Markets', *Eastern Economic Journal*, Vol. 29, No. 4, 527-558.
- Saporta, Victoria and Kamhon Kan, 1997, 'The Effects of Stamp Duty on the Level and Volatility of UK Equity Prices', Bank of England
- Schulmeister, Stephan, 2009, 'A General Financial Transaction Tax: A Short Cut of the Pros, the Cons and a Proposal', WIFO Working Paper No 344.
- Schulmeister, Stephan, Margit Schratzenstaller, and Oliver Picek, 2008, 'A General Financial Transaction Tax: Motives, Revenues, feasibility and Effects', WIFO.
- Summers, Lawrence. H., and Victoria P. Summers, 1989, 'When Financial Markets Work Too Well: A Cautious Case For a Securities Transaction Tax', *Journal of Financial Services Research*, 3.
- Tobin, James, 1974, 'The New Economics One Decade Older', Eliot Janeway Lectures 1972, Princeton, Princeton University Press
- Tobin, James, 1978, 'A Proposal for Monetary Reform', *Economic Journal*, Volume IV, No. 3-4, July/October 1978, pp. 153-159.
- Umlauf, Steven, 1993, 'Transaction Taxes and the Behaviour of the Swedish Stock Market', *Journal of Financial Economics* 33, 227-240.
- Zingales, Luigi, 2009, 'A tax on short-term debt would stabilise the system', *Financial Times*, 17 December 2009.

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