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Would a Financial Transaction Tax Affect Financial Market Activity?
Insights from Futures Markets

by George H. K. Wang and Jot Yau

Executive Summary

In the wake of the recent financial crisis, several commentators have suggested a transaction tax on financial markets. The potential consequences of such a tax could be hazardous to the financial markets affected as well as to the economy. In this paper, we review the relevant theoretical and empirical literature and apply our findings to estimate the possible impact of a transaction tax on U.S. futures market activity as well as its utility as potential tax revenue.

We find that the impact of a transaction tax on market activity (trading volume, bid-ask spread, and price volatility) will determine the potential of such a tax as a source of government revenue. We also find that the current estimated elasticity of trading volume with respect to a transaction tax in the U.S. futures markets is much higher than those reported in the extant literature and those used by the government in such computation. We show that a transaction tax on futures trading will not only fail to generate the expected tax revenue, it will likely drive business away from U.S. exchanges and toward untaxed foreign markets.

A review of the literature and estimates contained here indicates that there is an inverse relationship between transaction cost (bid-ask spread) and trading volume; to the extent that a transaction tax increases costs, trading volumes will likely fall. There is also a positive relationship between transaction cost and price volatility, suggesting that the imposition of a transaction tax could actually increase financial market fragility, increasing the likelihood of a financial crisis rather than reducing it. Perversely, the imposition of a financial transaction tax could have results that are exactly the opposite of those hoped for by its proponents.

George H. K. Wang is research professor of finance at the School of Management, George Mason University, and former deputy chief economist at the U.S. Commodity Futures Trading Commission. Jot Yau is Dr. Khalil Dibee Endowed Chair in Finance at the Albers School of Business and Economics, Seattle University.

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Introduction

The financial crisis of 2007–2008 has raised many concerns and questions about financial regulation and policymaking. One of the more popular proposals in the wake of the crisis has been to impose financial transaction taxes (FTTs).[1] For example, the Republic of Korea pushed for an international levy on bank transactions at the G-20 meeting in 2010, while the International Monetary Fund had presented its own bank-tax proposal at the same meeting.[2] The European Union (EU) has also considered various FTTs, though a proposal for a bank transaction tax was rejected by the EU in 2010.[3] In September 2011 the European Commission proposed a new plan for a pan-EU Tobin tax taking effect in 2014. It had the backing of France and Germany but outright opposition from Britain.[4] Proponents of the financial transaction tax suggest that it can be used effectively as a means to curb excessive financial market volatility, stabilize the markets, and raise revenues for various purposes.

Financial transaction and securities transaction tax (STT) proposals have been brought up for consideration by several American administrations and Congresses.[5] During the fiscal year 1990 budget negotiations, the Bush administration proposed a broad-based 0.5 percent tax on transactions in stocks, bonds, and exchange-traded derivatives.[6] In 1993 the Clinton administration proposed a fixed 14-cent tax on transactions in futures and options on futures.[7] The Obama administration has proposed a user fee in the 2012 federal budget on all futures trading to fund the U.S. Commodities Futures Trading Commission, while 28 members of the House of Representatives have co-sponsored legislation that would impose a transaction tax on regulated futures transactions. The proposed tax is 0.02 percent of the notional amount of each futures transaction, to be charged to each party of the transaction, with a projected revenue of hundreds of billions of dollars per year.[8]

FTTs have a long history in various forms, dating from Great Britain's 1694 stamp duty[9] to recent Tobin taxes on currency transactions and the latest rejection of a proposed bank tax in Europe.[10] In 1978 James Tobin first proposed a tax on foreign exchange transactions. It aimed to curb excessive speculative volatility as exchange rates freely fluctuated after the collapse of the Bretton Woods Agreement, which had established a fixed exchange rate system featuring many other countries pegging their currencies to the U.S. dollar.[11]

FTTs have come under severe criticism by legislators, regulators, and the public—especially the financial services industry and investors—because the effects of the taxes are so wide-ranging. Those who oppose FTTs argue that a tax on securities transactions would increase price volatility, reduce market liquidity (trading volume), and decrease price efficiency, thus increasing the cost of capital and lowering security values.[12] In addition, an STT could drive trading in some securities to overseas markets not burdened by tax. Thus, the tax may affect the relative competitiveness of taxing countries in global financial markets and would naturally be of particular concern for the U.S. futures industry.[13] Some pundits warn that FTTs are easily avoidable and likely to drive financial activity underground, beyond regulatory oversight.[14] FTT proponents argue that FTTs would increase government revenues that could be used for various purposes, including funding regulatory agencies (e.g., the U.S. Commodity Futures Trading Commission or Securities Exchange Commission), pay back the bailout money to the government, fund a country's future budget, or extract a larger contribution from the financial sectors toward funding public goods.[15]

Transaction tax rates vary with the type of financial instruments in question (e.g., equities are typically taxed at higher rates than debt instruments or derivatives), the location of trade (i.e., on- or off-exchange, on domestic or foreign markets), and the status of the buyer or seller (domestic or foreign resident, market maker, or general trader). As

financial markets have become more globalized with advances in information and trading technologies, exchanges can now attract more business by lowering trading costs. For example, countries such as Sweden and Finland removed all STTs, while others such as Australia, Japan, the United Kingdom, and Taiwan lowered their tax rates. John Campbell and Kenneth Froot in 1994 referred to this shift in taxation as an important function of STTs, that they "reveal the nature and scope of powerful underlying changes in international capital markets, and offer a glimpse into a future in which government policy not so much disciplines, but is instead disciplined by, competition in modern capital markets."[16] That STTs are not commonplace in most countries lends credence to the hypothesis that implementing an STT will have a negative impact on a given market's relative competitiveness.

Before one can properly evaluate the pros and cons of a transaction tax on financial markets, one needs to know what potential impact an increase in transaction cost would have on trading volume, market liquidity, price volatility, potential revenue, and the general welfare of market participants.

The objective of this paper is to review the relevant literature on the theoretical rationale for a financial transaction tax as well as empirical evidence that measures outcomes from the imposition of such a tax. In this review, we concentrate on STTs because (1) this type of transaction tax has been proposed in Europe, and a proposal is still under consideration in the United States, and (2) STTs are the most common FTT that has been applied in other parts of the world, allowing us to analyze the impact of the tax on trading volume, volatility, and price efficiency.[17]

The rest of the paper is organized as follows. In the following section, we review the theoretical arguments for and against a FTT. Specifically, we review the literature on the analysis of the imposition of a FTT on trading activities (measured in terms of trading volume) and price volatility. Next, we review the empirical evidence on the imposition of an FTT/STT with regard to trading volume, price volatility, pricing efficiency, and estimated revenue. Following that, we discuss a methodology for estimating potential transaction tax revenue with an example illustrating the application for estimating potential tax revenues that can be raised from U.S. futures markets. Finally, we present our conclusion.

What Does Theory Say about the FTT?

The theoretical arguments for an FTT are based on rational economic theories, which assume participants in the markets are all rational, having complete information about future prospects. Participants make decisions based on the maximization of their utility functions given the assumed (costless) complete information they have. Transaction costs in financial transactions, including all kinds of taxes and levies charged by the authorities, are considered by traders as they optimize their welfare in these models. However, with different assumptions on the rationality and composition of market participants and the degree of market efficiency, arguments for and against the FTT both have reasonable theoretical appeal.

Extant literature presents myriad theoretical arguments in support of and against a transaction tax. The arguments all address the following basic questions: (1) Does the FTT reduce price volatility? (2) Does the FTT reduce trading volume and market liquidity? (3) Does the FTT affect cost of capital and stock prices? Also, does the FTT cause corporate management to emphasize long-term or short-term results relatively more? (4) Will the FTT cause trading to shift to overseas untaxed markets and make domestic markets less competitive? (5) Will the FTT raise substantial tax revenue?

Extant literature presents myriad theoretical arguments in support of and against a transaction tax.

Reduced Excess Speculation and Price Volatility

Proponents of an FTT have suggested

that a transaction tax may reduce speculative trading and excess market volatility. They believe short-term speculative trading is the source of excess volatility, so by imposing a transaction tax, short-term speculative trading and price volatility will be reduced.

The argument rests on the assumption that there is a positive relationship between short-term speculation and excess price volatility. To FTT proponents, there appear to be two types of traders in a financial market: value investors and noise traders. Value investors, also known as fundamentalists, purchase stocks on the basis of comparison of security price with estimates of fundamental values. That is, they buy stocks when market price is below the fundamental value and sell stocks when market price is above the fundamental value. This value-based trading is assumed to reduce stock price volatility by pushing stock prices back toward estimates of the worth of the company. Conversely, short-term noise traders act on the basis of past price movements or the results of technical analysis of stock market data itself. They purchase stocks when market prices rise and sell the stocks when they fall. This type of trading, based on positive feedbacks from market prices, is assumed to destabilize markets because it often drives market price away from estimates of fundamental values and thus creates excess price volatility. Value investors who trade on the basis of market price deviations from the fundamental values are long-term investors and have no need to trade frequently. On the other hand, short-term speculative traders do need to trade frequently because their strategy is to follow recent past price behavior. Because the trading frequency of short term traders is much greater than that of long-term investors, the imposition of a transaction tax will increase the trading cost for short-term speculative traders but will have less impact on the trading cost of long-term value investors. As a result, a transaction tax will curb the frequency of short-term speculative trading and thus, theoretically, curb excess volatility.

Keynes proposed a securities transaction tax as a means of mitigating the predominance of speculation in the stock market during the Great Depression.

This line of argument for a transaction tax can be attributed to John Maynard Keynes. In light of excessive speculation and volatility during the Great Depression, Keynes proposed a securities transaction tax as a means of mitigating the predominance of speculation in the stock market during the Great Depression.[18] Witnessing excess volatility in the foreign exchange markets after the dissolution of the Bretton Woods Agreement, James Tobin proposed an international transfer tax on currencies in 1978. Keynes's and Tobin's proposals, although made decades apart, were based on the same assumption that short-term trades are likely to be more destabilizing to financial markets than longer-term trades.[19] In subsequent work, Tobin stated that a financial transaction tax is "fundamental valuation efficient" since it lowers excess volatility. [20]

In 1953, however, Milton Friedman argued that speculation cannot be destabilizing in general; if it were, the participants would lose money.[21] Other advocates of the Efficient Market Hypothesis argue that speculators—by rationally arbitraging the unexploited profit opportunities when a market becomes inefficient—help to clear markets, stabilize prices, and bring the assets and securities back to their fundamental values.[22] This suggests that the impact of a transaction tax on price volatility may hinge on whether markets are dominated by speculators, arbitrageurs, or long-term investors. In other words, any FTT's success is dependent upon the composition of traders in the market.

Joseph Stiglitz suggests that a desirable FTT should not impede the functioning of the capital market as an allocator of scarce resources. As such, an FTT based on the value of the transaction (e.g., a turnover tax on trades) should be broad-based in order to avoid the frequent introduction of unnecessary distortions, set at a low rate, and be equitable. Stiglitz further suggests that a sufficiently small transaction tax (~ 0.5 percent to 1 percent) is negligible and would not affect exchange efficiency, but would have different impacts on the welfare of different groups of

traders. He asserts that the uninformed traders are hardly likely to be affected by a tax at a moderate rate of less than 1 percent. Likewise, the informed traders (insiders) would not be discouraged from trading with that amount of transaction tax. This is because they operate more often on long-term bases for valuation and thus are unlikely to have their behavior greatly affected.[23]

Stiglitz posits that the turnover tax primarily affects short-term market participants—noise traders and speculators—who buy and sell within the trading day and within days or weeks. As such, a transaction tax may represent a significant fraction of the returns they hope to achieve on each transaction. He argues that the large number of noise traders and liquidity providers (those who trade with the noise traders) bear the lion's share of the transaction tax and may actually experience a welfare gain from impeding these exchanges. There may be greater volatility if the FTT is too big (barring arbitrage trades), but this is unlikely if the tax is small. Based on this logic, Stiglitz establishes that the upper bound on the volatility increase will not be greater than that without the transaction tax. He therefore believes that if the tax is small, there will be significant reduction in volatility as noise traders drop out of the market. Thus, he argues that such a tax may actually be beneficial because it discourages short-term speculative trading. The tax won't affect the long-term investors too much because a transaction tax, on average, has the property of automatically phasing itself out for long-term investments; that is, as a proportion of returns, it becomes negligible as the holding period increases. Thus, the tax will not have a significant effect on long-term investors. He suggests this feature makes a turnover tax more desirable than a capital gains tax because a capital gains tax subsidizes noise traders and penalizes arbitrageurs, leading to increased price volatility. Lawrence Summers and Victoria Summers also agree that a securities transactions tax improves the efficiency of financial markets by crowding out market participants that behave irrationally or that waste too many resources for this speculative zero-sum game.[24]

Short-term technical traders are not necessarily amateurs or low-volume traders. Portfolio managers, for example, are often evaluated on the basis of quarterly performance. Thus, portfolio managers are incentivized to maximize performance in the near term. This leads them to give short-term prospects a disproportionate weight in determining stock purchases. As a consequence, corporate managers are forced to slight long-term investment in favor of delivering short-term earnings.

Proponents of transaction taxes argue that they will discourage short-term trading and reduce the number of speculative short-term traders due to higher trading costs in the markets. More market participants would, theoretically, look beyond quarterly earnings reports and short-run prospects, resulting in more stable prices. In this model, corporate managers would pursue more long-term investment projects.

Reduced Cost of Capital

Stock markets allow firms to raise new capital from shareholders by way of exchange. Thus, a transaction tax that impedes the exchange function of the stock market might interfere with the capital raising function of the market, ironically forcing management and investors to focus on short-term returns rather than long-term concerns.[25] Stiglitz argues that this potential impact is negligible for a small transfer tax and, to the contrary, would enhance the capital-raising function of the stock market if the tax reduces stock market volatility.[26] Reducing market volatility will make it easier for firms to raise equity capital at a lower cost, thus increasing efficiency. If true, management would focus their orientation toward a longer-term strategy.[27]

Increased Tax Revenue

Transaction tax proponents suggest that the revenue potential of a transaction tax is formidable.[28] The Congressional Budget

Proponents of transaction taxes argue that they will discourage short-term trading.

A small fixed transaction cost significantly reduces trading volume.

Office (CBO), in its publication *Reducing the Deficit: Spending and Revenue Options*, estimated the revenue from a broadly based 0.5 percent securities transaction tax to be about $12 billion per year based on a five-year average. Based on the same tax rate used by the CBO, Summers and Summers suggest a similar figure, estimating government revenues of at least $10 billion a year.[29] Another estimate indicates that revenue from a securities transaction tax could be as large as $70–$100 billion per year.[30] Outside the United States, it was estimated that a securities transaction tax in Japan would bring in $12 billion a year.[31] The European Commission in a June 2011 budget proposal calculated that a financial transaction tax would contribute €50 billion per year to the European budget, or €350 billion over a seven-year period.[32]

Effects on Trading Volume, Market Liquidity, and Information Efficiency

Some literature suggests that there is a negative relationship between trading volume and trading costs. Increases in trading costs lower the profitability of trading, leading traders to trade less frequently or extend their hold period in order to minimize their trading costs over time. As trading volume is reduced, traders will take more time to offset their trades and face a larger price impact of a given trade, thus diminishing market liquidity as well. When the market is illiquid, information will be more slowly incorporated into equity or futures prices, impairing overall market efficiency.

Andrew Lo, Harry Mamaysky, and Jiang Wang proposed a dynamic equilibrium model of asset prices and trading volume. It shows that a small fixed transaction cost significantly reduces trading volume.[33] Even Stiglitz, a supporter of the transaction tax, agrees that a sizable transaction cost can reduce trading, thinning market liquidity if the buy and sell sides are symmetric, although "for widely traded stocks, on both theoretical and empirical grounds, it is hard to believe that this effect [larger bid-ask spread due to a transaction tax] would be significant."[34]

Franklin Edwards argues that transaction taxes increase trading costs, making U.S. futures markets less competitive because of the impact on price efficiency and on the cost of hedging. He argues that a tax-induced reduction in trading may decrease informational efficiency by discouraging "information" trades by informed speculators and hedgers. He admits that it is not easy to determine the impact on price efficiency because the tax also discourages noise trading.[35]

Evidence from a pair of studies suggests that reducing the transaction tax in the Taiwan futures market greatly improved the efficiencies of price execution[36] and price discovery.[37] Likewise, a study by Shinhua Liu examined the impact of a 1989 change in tax rates on securities in Japan. Liu found significant decreases in estimates of the first auto-correlations in returns for Japanese stocks listed in Japan, but no changes for Japanese stocks dually listed in the United States as American Depository Receipts (ADRs), which were not subject to the tax law change. Liu also found a lower price basis between the ADRs and their underlying Japanese stocks, concluding that these results are consistent with the hypothesis that a reduction in transaction costs (transaction tax) improves the efficiency of the price discovery process.[38]

FTTs Do Not Necessarily Reduce Price Volatility

Donald Kiefer argued that a transaction tax can theoretically increase or decrease volatility.[39] Paul Kupiec demonstrated that a transaction tax has ambiguous effects on price volatility in a general equilibrium model framework. In the context of his model, he shows that a transaction tax can reduce the price volatility of risky assets.[40] However, the reduction in price volatility is accompanied by a fall of the taxed asset's price, while conversely the volatility of risky asset returns will increase with the transaction tax. Thus, the net effect of a transaction tax on price volatility could be to increase it, decrease it, or leave

it unchanged, depending on other factors in the scenario.

In a general equilibrium model, Frank Song and Junxi Zhang examined the effects of a transaction tax on a set of noise traders and the resulting market volatility. They showed that a transaction tax may not only discourage the trading activity of noise traders but also discourage rational and stabilizing value investors from trading.[41] The net effect of a transaction tax on volatility depends on the change of trader composition that results from the implementation of the tax. They referred to this as the "trader composition effect."[42] Furthermore, a transaction tax may decrease trading volume and increase the bid-ask spread. This potential effect of a transaction tax on liquidity is labeled as the "liquidity effect." The net impact of a transaction tax could decrease or increase market price volatility. The final results depend on the relative magnitude and interaction of the trader composition and liquidity effects.

Paolo Pellizzari and Frank Westerhoff analyzed the effect of a transaction tax on market price volatility in a number of computational experiments. They showed that the effectiveness of transaction taxes depends on the types of trading markets: specifically, they compared a continuous double-auction market versus a dealership market. In a continuous double auction market, the imposition of a transaction tax is not likely to reduce market volatility since a reduction in market liquidity amplifies the average price impact of a given trade order. Liquidity is endogenously generated in this type of market. Their model predicts that in a dealership market, a transaction tax may reduce market volatility because abundant liquidity is exogenously provided, prompting specialists and some traders to retreat from the market, causing volume to decline.[43]

Kang Shi and Juanyi Xu examined the impact of a transaction tax on foreign currency transactions, which was designed to limit the impact of noise traders in order to reduce volatility.[44] They also believe exchange rate volatility is caused by changes in the relative share of noise traders and fundamentalists. In their general equilibrium model, Shi and Xu analyzed entry costs for both informed and noise traders after an introduction of a transaction tax. The model assumed informed traders' unconditional expectation of excess return depends on the ratio of noise entrants to informed entrants, but this does not influence noise traders' expectations. An increase in the noise component increases market volatility. In analyzing three equilibria with different entry costs to the market, their major finding was that the imposition of a Tobin tax did not reduce volatility and may, in fact, increase it, depending on the ratio of noise to informed entrants. An increase in market volatility was also an important assumption for the impact of a transaction tax, demonstrated in models assuming stochastic interaction between agents, who are assumed not to be able to influence aggregate variables.[45] In these models, exchange rate volatility will be low if the market is dominated by fundamentalists and will be high if the market is dominated by noise traders. These models reflect the stylized facts of financial markets, most notably, "volatility clustering"—in which the exchange rate switches irregularly between phases of high and low volatility.

Overall, the implications of theoretical models on the price volatility effects of an FTT are mixed. Conclusions about the impact of a transaction tax on price volatility depend on the assumptions of the theoretical models and assumed mechanisms of information transmission. We will examine some of these in section III.

Increased Costs of Capital and of Hedging

Trading costs affect stock prices because trading costs reduce the expected return of stocks. Investors demand higher expected return when paying increased costs.

Yakov Amihud and Haim Mendelson found that the expected rate of return on equities (i.e., the cost of equity) is an increas-

The net effect of a transaction tax on volatility depends on the change of trader composition.

The imposition of transaction taxes will increase the trading costs on stocks, and thus investors will demand a higher expected return commensurate with the added cost.

ing concave function of the bid-ask spread, a proxy measure of liquidity.[46] Since other transaction costs of equity trading (e.g., the brokerage fee) are positively related to the bid-ask spread, the estimates obtained by Amihud and Mendelson imply that, for a given increase in the bid-ask spread, expected returns increase at a larger amount as the equity issue becomes more liquid. Likewise, a securities tax that is analogous to a bigger bid-ask spread will raise the expected return of equity (i.e., the cost of capital). Later studies have also documented two similar results: (1) The greater the liquidity of a given stock, the lower its expected return,[47] and (2) lower trading costs are associated with lower expected return of the stock.[48]

In 2002 Amihud investigated the effects of changing overall market liquidity on stock prices over the period from 1963 to 1996. He observed that a decline in market liquidity was accompanied by a significant decline in stock prices and subsequent increase in expected return (i.e., the cost of capital).[49] Previous studies clearly indicate that the imposition of transaction taxes will increase the trading costs on stocks, and thus investors will demand a higher expected return commensurate with the added cost. As a consequence, firms' cost of equity would rise and their stock prices will decrease.

Franklin Edwards argued that a declining trading volume due to a transaction tax would likely increase the risk premiums that hedgers would have to pay to speculators who provide liquidity. This makes futures less efficient risk management instruments and thus the FTT undermines one of the primary economic functions of futures markets.[50]

Migration of Trading and Relative Competitiveness

Previous literature on transaction taxes shed light on the potential adverse effects of FTTs on the international competitiveness of the U.S. financial services industry. While Summers and Summers did not believe a transaction tax would cripple U.S. equities trading in 1989, they admitted that a transaction tax could have damaging impacts on the industry as evidenced in the demise of the Sweden Options and Futures Exchange following implementation of a tax on options.[51]

Joseph Grundfest and John Shoven suggest that an STT would cause distortions in the financial markets and could cause many investors—particularly institutions—to shift their equity trading away from organized domestic exchanges toward foreign countries. They believe even a small STT can have major adverse consequences for the value of instruments subject to the tax and for the cost of capital in the U.S. economy. They also criticize the CBO's static model because it does not consider the STT's effect on trading volume or market prices, nor does it consider the possibility of substitution away from taxable instruments and transactions. Thus, they contend, the CBO overstates the actual tax revenue that can be collected.[52]

Franklin Edwards has argued that even a very small transaction tax would be sufficient to drive all U.S. futures trading to untaxed overseas markets.[53] He considered a tax of 0.5 percent on the value of the contract to be prohibitively high as a percentage of total transaction cost on trading as compared to stocks.[54] Should a lower rate be set on futures trading vis-à-vis stocks, the difference in the transaction tax may cause traders to pursue transactions that bear a lower tax. Substitution may take place domestically or across international borders. This is why Stiglitz suggested in 1989 that transaction tax rates should be uniform within the United States on substitutable assets.[55]

Edwards also pointed out that a critical feature of futures markets across the globe is low transaction costs. "If U.S. markets were to have higher trading costs . . . it would be a relatively simple matter for trading to shift to foreign markets."[56] The shift will take place because: (1) there are restrictions that require foreign exchanges to trade the same contract in order to compete for the same business (e.g., TAIFEX and Nikkei 225

indexes were traded on the Singapore Exchange) and commodity futures are traded all over the world; and (2) there are no restrictions on Americans shifting their trading to foreign exchanges. This has been the main reason why the futures industry opposes a transaction tax on futures trading.

John Campbell and Kenneth Froot explained that investors in Sweden moved equity trading offshore and fixed income trading to untaxed local substitutes in response to the country's imposition of an STT. In the United Kingdom, the stamp duty STT stimulated trading in untaxed substitute assets and seemed to reduce total trading volume to some degree. They concluded that if an STT is aimed at reducing overall trading volume or raising revenue, most likely it won't achieve its goal because investors would move trading to offshore markets or untaxed assets. They believe the British type of STT would be more workable for the United States than the Swedish type.[57]

What Does the Empirical Evidence Say about the FTT?

There are ample empirical studies on the impact of FTTs on various aspects of financial market quality, including trading volume, volatility, liquidity, and price discovery. In general, the literature can be placed into two groups. The first group of studies has used direct ex post tests on the impact of transaction taxes on market quality in countries where actual direct taxes, whether STTs or Tobin taxes, had been charged on financial transactions.

The second group of studies has used ex ante analysis of the impact of a transaction tax on the quality of financial markets where there have been no actual STT or Tobin taxes. The studies use different measures and proxies of transaction costs (e.g., changes in bid-ask spreads, brokerage commission, and tick size[58]) but not necessarily the actual transaction tax. Some caveats are in order here. First, although test results on the hypothesized impact of a transaction tax are useful in explaining its possible impact, the actual impact may differ in practice. An explicit tax charged on a transaction may not be perceived as an implicit transaction cost embedded in the bid-ask spread or a reduction in brokerage fee. Second, despite controlling for variables that could affect the empirical results, the results obtained from foreign countries where market environments are different may vary considerably when and if an FTT is applied to U.S. markets. Third, because most studies are done in securities and foreign exchange markets and very few in futures markets, observers should recognize the limits of similarities between the results and implications obtained from those markets and what would happen if they were applied to a futures market.

Effects on Trading Volume and Market Liquidity

One major argument against transaction taxes is that a transaction tax would increase trading cost, which would reduce trading volume and market liquidity. A narrowly based transaction tax would provide a strong incentive for traders to migrate to an alternative domestic instrument or to untaxed foreign markets that have lower costs. Furthermore, a reduction in trading volume would increase trading costs (e.g., a wider bid-ask spread) and decrease market liquidity. Market and price efficiency would be impaired when market liquidity deteriorated.

Several studies provide estimates of the elasticity of trading volume in equity markets. In 1976 Thomas Epps estimated the share transaction cost turnover elasticity to be about -0.26 in U.S. equity markets,[59] whereas Patricia Jackson and Gus O'Donnell estimated the transaction cost turnover elasticity of equities traded in London to be -0.70 nine years later.[60] Put simply, previous studies find that transaction costs and trading volume have a negative relationship. Likewise, empirical studies find that the

Investors in Sweden moved equity trading offshore and fixed income trading to untaxed local substitutes.

SST had a negative effect on local trading. For example, Steven Umlauf documented in 1993 that 60 percent of the trading volume of the 11 most actively traded Swedish share classes, amounting to 30 percent of the total trading volume, shifted to the London stock exchange when the Swedish transaction tax on equity increased from 1 percent to 2 percent in 1986.[61] Two econometric studies on equity turnover, one in the United Kingdom[62] and one in Sweden,[63] found that the long-run elasticity of turnover with respect to overall transactions costs is in the range of -1 and -1.7. Their best estimate is -1 (i.e., for each reduction or removal of 1 percent round trip transaction tax (or 0.5 percent on buy and 0.5 on sell), trading volume would increase by 100 percent.[64]

Taking into consideration the margins of substitution, Campbell and Froot estimated the elasticity of trading volume after changes in transaction taxes in Sweden and found evidence that foreign investors tended to move toward more trading abroad and domestic investors became less likely to engage in any trading at all. They reported that when the SST was in place from 1988–91, the fraction of trading taking place in Stockholm was much lower for unrestricted shares. This is corroborated by further evidence that commissions paid by large U.S. institutional investors when trading Swedish equities remained constant but the share of their taxes paid fell from 68 percent in 1987 to 13 percent by 1990. That is, foreign investors such as U.S. institutions (and their brokers) were increasingly able to evade the tax by eliminating the use of Swedish brokers when trading in Sweden or by exchanging Swedish securities in London and New York. They reported that by 1990, 50 percent of trading volume was shifted to the London equity exchange. The authors also found that the Swedish tax shifted fixed-income trading activity from income-securities and futures markets to untaxed markets such as variable-rate notes, corporate loans, and forward rate agreements. They contended that the Swedish tax had only a marginal effect on the volume of trade in Swedish equities by foreign institutions. There is little evidence that total trading volume in Swedish stocks responded strongly to changes in taxation of trades in Stockholm. This lends additional support to the view that international investors easily evaded Swedish turnover taxes. They find that the transaction tax had a larger impact on local fixed-income trading volume than on stocks. Campbell and Froot offer several observations: (1) The effect of the tax seems to be quite large; (2) much of the volume decline in futures occurred in anticipation of the tax; (3) these effects ran in reverse once the tax was removed in April 1990. In short, the turnover tax in fixed income securities raised little revenue since substitution toward other Swedish domestic securities was easy, with little need for migration abroad given the existence of less costly domestic substitutes.

Sixty percent of the trading volume of the 11 most actively traded Swedish share classes shifted to the London stock exchange when the Swedish transaction tax on equity increased.

Campbell and Froot proposed two principles that might be used to rationalize transaction tax rates across securities. The first principle is that the transactions that give rise to the same pattern of payoffs should pay the same tax, though they admit that it is conceptually impossible to apply this principle consistently. The second principle is that transactions that use the same resources should pay the same tax. For example, they point out that Sweden used to tax domestic brokerage services, whereas the United Kingdom taxes registration (i.e., the stamp duty).

Previous evidence of STT impacts in equity markets shows that a transaction tax reduces trading volume and market liquidity. For highly elastic instruments, substitution will take place, driving some or all trading to overseas markets where the tax rates are lower, or out of the market entirely.

Likewise, previous studies in futures markets demonstrated a statistically significant negative relationship between trading volume and trading costs in U.S., Taiwanese, and Indian futures markets.[65] For example, Johan Bjursell, George Wang, and Jot Yau examined the relations among trading volume,

bid-ask spread, and price volatility in 11 U.S. futures markets from 2005 to 2010. They found that a transaction tax would have the same effect as a wider bid-ask spread, reducing trading volume, increasing price volatility, and generating a modest amount of tax revenue.[66]

Robert Aliber, Bhagwan Chowdhry, and Shu Yan studied the impact of a small transaction cost (averaged around 0.05 percent) on the trading volume and price volatility of four currency futures traded on the Chicago Mercantile Exchange (CME) over the period of 1977–1999. They found that an increase of 0.02 percent in transaction costs leads to a reduction in trading volume as well as an increase of volatility of 0.5 percentage points.[67]

Robin Chou and George Wang found that before Taiwan cut the tax on the Taiwan Index (TIX) futures trading by 50 percent in 2000, futures trading volume was smaller than that in the Singapore futures exchange. However, since July 2002, the trading volume for TIX exceeded that of the same contract on the Singapore futures exchange.[68] This evidence indicates that lower transaction costs change the relative competitiveness of exchanges and significant migration of trade may take place because of lower trading costs.

In summary, evidence in extant futures literature is consistent with the anti-tax hypothesis that increasing trading costs through a transaction tax would reduce trading volume and market liquidity, and increase price inefficiency of taxed financial instruments.

Effects on Price Volatility

The empirical studies of transaction taxes' impact on price volatility can be classified into two groups. The first group of papers that examine the relationship between price volatility and trading costs does not find any definitive pattern or relationship, whereas the second group of papers finds evidence of either an increase or a decrease in volatility. Putting them together, empirical results are inconclusive.

The first group of literature includes the work of Harold Mulherin, who examined the relationship between trading costs in the New York Stock Exchange and the daily volatility of the Dow Jones Industrial Average returns from 1897 to 1987. He concluded that the imposition of a transaction tax may not necessarily reduce volatility.[69] Likewise, Charles Jones and Paul Seguin used the elimination of the minimal brokerage commissions in the U.S. stock market in 1975 as a proxy for a one-time reduction in the transaction tax. They found that volatility fell the year after the abolishment of the minimum commission rates in NYSE and AMEX markets, but the decline in volatility was also observed in the NASDAQ market.[70]

Using the cross-sectional data of 23 countries for the period up to, during, and after the October market crash (1987–1989), Richard Roll found no significant evidence that volatility is negatively related to transaction taxes.[71] In other words, transaction taxes do not necessarily cause volatility to decrease across countries, and it is questionable whether transaction taxes should be used with confidence as an effective policy instrument. Shing-yang Hu analyzed numerous changes in STT rates in Hong Kong, Japan, Korea, and Taiwan during the period 1975–1994 but concluded that, on average, a change in STT rates had no effect on volatility and market turnover.[72]

In one study, Ragnar Lindgren and Anders Westlund found no significant effect of an STT on price volatility of Swedish stocks, but in later work they found a weak positive relationship between STT and price volatility.[73] Steven Umlauf examined the impact of increasing the transaction tax on market price volatility. He reported several interesting results: (1) there was no significant difference in volatility across the three tax regimes (i.e., before 1984 [0 percent], 1984–1986 [1 percent], after 1986 [2 percent]);[74] (2) there was a statistically significant increase in daily volatility of returns, which was higher during the 2 percent tax regime than in other regimes, but there was no sys-

Transaction taxes do not necessarily cause volatility to decrease.

tematic relationship between transaction tax regimes and volatility;[75] and (3) the volatility of London-traded shares of 11 companies was lower than the volatility of these companies' Stockholm-traded classes.[76] Robin Chou and George Wang found that there were no significant changes in the daily price volatility of Taiwan index futures after the tax reduction.[77]

Among studies that belong to the second group, Shinhua Liu and Zhen Zhu studied the deregulation of fixed brokerage commissions and the removal of an STT in Japan in October 1999, and found results contrary to those of Jones and Seguin. They found that the reduction in transaction costs (in which an STT was included) increased volatility in the Tokyo Stock Exchange.[78] Liu and Zhu offered a possible explanation for contradictory results: commission rates were drastically reduced in Japan, whereas they were not in the United States. Hendrik Bessembinder found that larger tick sizes were associated with higher transaction costs and also with higher volatility.[79] Bessembinder and Subhrendu Rath found that stocks that had moved from NASDAQ to NYSE, where trading costs were lower, saw a reduction in volatility.[80] Harald Hau also found a positive relationship between transaction costs and price volatility in the French stock market, where significant volatility increases were observed when there was an increase in the cost of trading stocks due to an increase in the tick size.[81]

Franklin Edwards examined the relation between trading volume and volatility for 16 U.S. commodity markets during 1989 and found no significant relationship between the two.[82] He concluded that even if a transaction tax were to succeed in reducing speculative or short-term trading in futures markets, there was no evidence that it would reduce price volatility in either futures or the underlying spot markets. Based on the three-equation structural model used by George Wang and Jot Yau in a 2000 study, Bjursell, Wang, and Yau examined the relations among volatility, bid-ask spread, and trading volume for selected U.S. futures contracts. Pravakar Sahoo and Rajiv Kumar analyzed the relations for five most traded commodity futures contracts in India. These studies showed that there is a significantly positive relation between price volatility and bid-ask spread (transaction costs) for each futures contract examined.[83]

Robert Aliber, Bhagwan Chowdhry, and Shu Yan studied the impact of a small transaction cost (averaged around 0.05 percent) on four currency futures traded on CME in the period of 1977–1999 on their trading volume and price volatility. They found that an increase of 0.02 percent in transaction costs on the four currency futures traded on CME leads to an increase of volatility of 0.5 percent points, coupled with a decline in asset prices due to the decline in the demand because of higher transaction costs.[84] Markku Lanne and Timo Vesala found larger transaction costs impact on foreign exchange rate volatility between 1992–1993.[85] Badi Baltagi, Dong Li, and Qi Li investigated the effect of an increase in the stamp tax on price volatility in the two Chinese stock exchanges using an event study methodology. They found market price volatility significantly increased after the increase in the stamp tax rate.[86]

Most of the previous empirical evidence does not support the use of a transaction tax as an effective regulatory policy tool to reduce market price volatility.

Overall, most of the previous empirical evidence does not support the use of a transaction tax as an effective regulatory policy tool to reduce market price volatility.

Effects on Information Efficiency and Price Discovery

Robin Chou and Jie-Haun Lee provided interesting empirical evidence of the effect of a transaction tax cut on the price efficiency of the Taiwan Futures Exchange (TAIFEX) and the Singapore Stock Exchange (SGX).[87] They demonstrated that after the tax reduction in 1986, the TAIFEX assumed a leading role over the SGX in the price discovery process for index futures contracts. They showed that a reduction in the transaction tax greatly improves the efficiency of price execution. Wen-Liang Hsieh also noted that the information advantage of the SGX di-

minished as the TAIFEX lowered its transaction tax.[88] Badi Baltagi, Dong Li, and Qi Li found that volatility shocks were not quickly incorporated into stock prices in the Shanghai and Shenzhen exchanges once China had increased its STT from 0.3 percent to 0.5 percent in July 1997, suggesting that the increase adversely affected the price discovery function of the stock market.[89] In contrast, Shinhua Liu showed a reduction in the first-order autocorrelation of Japanese stock prices after the STT reduction in 1989, implying an improvement in the efficiency of the price discovery process.

Effects on Potential Tax Revenue

Transaction tax proponents argue that the revenue potential of a transaction tax is formidable.[90] The U.S. Congressional Budget Office estimates the revenue from a broad-based 0.5 percent securities transaction tax to be about $12 billion per year over five years.[91] Based on the same tax rate used by the CBO, Lawrence Summers and Victoria Summers provided a similar estimate of at least $10 billion a year.[92] Robert Pollin, Dean Baker, and Marc Schaberg suggested that revenue from an STT could be as large as $70–$100 billion per year.[93] Outside of the United States, a Japanese STT was estimated to bring in $12 billion a year in the late 1990s,[94] and the European Commission expected an FTT to provide €50 billion per year over a seven-year period as recently as 2011.[95]

Edwards doubts that a tax on futures transactions would potentially generate significant tax revenue. He argues that the elasticity of trading volume in futures markets is much more than that of equities because close substitutes are easily available in international futures markets, due to the growth in trading and information technologies.[96] Thus, he contends that the CBO overestimated the revenue from the STT because the elasticity of demand (-0.26) used in the estimate was based on an assumption of no suitable international substitutes. Given a more elastic trading volume in futures, Edwards argues that a transaction tax of the magnitude of 0.5 percent would probably eliminate all futures trading in the United States, driving all of those transactions overseas. Of course, no revenue would be collected in that case. According to his conservative estimate, only negligible revenue (~ $287 million) could be raised from futures trading even if the lowest tax rate (0.0001 percent) and a low demand elasticity (-0.26) were assumed.[97] He also computed estimated potential tax revenue with a range of assumed elasticities (from -1 to -20) and concluded that a transaction tax on futures trading would not generate substantial revenue.[98]

George Wang, Jot Yau, and Tony Baptiste provided the first empirical estimates of the elasticity of trading volume for several U.S. futures contracts. They documented that estimates of trading volume elasticity with respect to trading costs were in the range of -0.116 to -2.72, which were less than the elasticities (-5 to -20) used by Edwards, but higher than the elasticity of -0.26 used in the CBO report.[99] Bjursell, Wang, and Yau provided empirical estimates of the elasticity volume for 11 U.S. futures for the years 2005–2010 in a three-equation structural model.[100] They estimated the potential post-tax trading volume and tax revenue with updated cost estimates of trading volume elasticity under alternative tax rates. For a 0.02 percent tax rate, they found that the trading volume for six futures (S&P 500, E-mini S&P 500, 10-year T-Note, British pound, soybeans, and gold) would be totally eliminated, resulting in zero post-tax revenue from these six futures.[101] They concluded that a sizable transaction tax could have significant adverse impacts on market quality and would not raise substantial revenue for the government as suggested in other studies. Moreover, the tax could potentially hurt the international competitiveness of U.S. futures markets. A study on Indian futures trading also concluded that implementation of a transaction tax would not bring in substantial tax revenue.[102]

Chou and Wang found that the 50 per-

A sizable transaction tax could have significant adverse impacts on market quality.

Trading volume may precipitously decline in response to increased tax-induced trading costs.

cent reduction in the TAIFEX transaction tax rate reduced tax revenue, but the proportional decrease in the tax revenue (30 percent) was less than the 50 percent reduction in the tax rate. Interestingly, tax revenue increased in the second and third year after the tax reduction when compared to the year before the tax reduction.[103] This suggests that tax reduction has no permanent negative impact on tax revenue.

Finally, some of the literature suggests that the burden of transaction taxes on market participants depends on the availability of no-tax substitutes for their instruments. For instance, the elasticity of financial and metals futures are much higher than those of agriculture futures. Thus, the traders of agriculture futures would have a larger tax burden relative to traders of financial futures.[104] A transaction tax would raise the relative cost of hedgers using agriculture futures to hedge against their underlying asset price risk.

In sum, the review presented above suggests the following:

1. There is an inverse relationship between transaction cost (bid-ask spread) and trading volume;
2. There is a positive relationship that may or may not be statistically significant between transaction cost and price volatility;
3. There is a positive relationship between trading volume and price volatility;
4. Relationships among trading volume, bid-ask spread, and price volatility are jointly determined;
5. Demand for U.S. futures trading is very sensitive (i.e., very elastic) with a strong substitution effect between domestic and untaxed overseas markets; and
6. Although estimated potential tax revenue is formidable in the equities markets, tax revenue raised by a transaction tax in the U.S. futures markets would not be as much as many would believe because the demand for U.S. futures is found to be very elastic.

Estimation of Potential Transaction Tax Revenue

One major argument for implementing a transaction tax in security and futures markets is to raise substantial tax revenue for the government. However, proponents of the transaction tax often employ a naïve method to calculate transaction tax revenue, multiplying the tax fee by current aggregate trading volume in the given markets assuming a static model.[105] In other words, their models assume the imposition of a tax will not affect the trading volume in the market. This assumption can vastly overestimate the potential tax revenue because it does not take into account the relation between transaction costs and trading volume (see no. 1, above). Trading volume may precipitously decline in response to increased tax-induced trading costs.

William Schwert and Paul Seguin presented a model to estimate tax revenues that accounts for the impact of the transaction tax on trading volume and price volatility.[106] They assumed a flat tax rate, τ, for all financial transactions. Revenues can be estimated as follows:

$R = \tau (P + \Delta P) (Q + \Delta Q) + \Delta OR$, where R is the revenue, P the volume-weighted average price level, Q the quantity of transactions, ΔP and ΔQ the change in P and Q, respectively, and ΔOR the change in other government revenues associated with the tax. The magnitude of the decline in trading volume (ΔQ) depends on the elasticity of trading volume, which requires estimation with respect to the percentage increase in trading costs due to the transaction tax for each financial instrument (see no. 5, above). Likewise, the impact of the transaction tax on prices (ΔP) needs to be estimated. More importantly, previous studies have shown that the elasticity of demand in the futures market is not likely to be the same as that in the equities market.[107] As such, the potential revenue that can be raised from a transaction tax in these two markets can be substantially different depending on the differing elasticities (see no. 6, above).

It can be inferred that the estimation of the elasticity of trading volume is critical to the accurate estimation of the potential tax revenue. Previous studies found a strong and significant positive relation between trading volume/liquidity and price volatility (see no. 2, above), and an inverse relation between transaction costs and trading volume/liquidity (see no. 1, above). The empirical relation between price volatility and transaction costs depends on how transaction costs affect trading volume, which, in turn, affects the price volatility as theory suggested. Model specifications of these previous studies, however, are incomplete because trading volume is assumed to be a function of transaction costs and/or price per share only.[108] Likewise, one study found that trading volume was not only a function of volatility, but also one of open interest, interest rates, exchange rates, and other variables in futures markets.[109] Unfortunately, it does not include any measure of transaction costs (such as the bid-ask spread) or transaction taxes/fees as an explanatory variable in the model. In other words, the estimation of the relationship between trading volume and other explanatory variables is done separately instead of jointly in a structural model (i.e., ignoring no. 4, above).

In light of the deficiencies in the empirical estimation of the relation of trading volume and price volatility, and the relation of bid-ask spread and price volatility, Wang, Yau, and Baptiste proposed a two-equation structural model to examine the relations between trading volume and transaction costs in seven financial, agricultural, and metals futures.[110] By estimating the elasticities in a simultaneous-equation system, they explicitly formalize the jointly determined relationship between trading volume and bid-ask spread. Their study confirms that trading volume and bid-ask spread are jointly determined in the U.S. futures markets. It also shows that the differences in the estimates for four U.S. futures markets underestimate the elasticities and overestimate the potential tax revenues in these markets. Thus, in estimating the elasticity of trading volume for the purpose of estimating the potential tax revenue, one needs to have a model that allows relevant variables to be jointly determined in estimating the parameters of the model. However, in Wang, Yau, and Baptiste's model, price volatility was omitted. It is imperative to estimate the elasticity of trading volume with respect to the transaction tax (bid-ask spread) in a structural model that jointly determines the relationships between price volatility, bid-ask spread, and trading volume.[111] In 2000 George Wang and Jot Yau proposed a three-equation structural model that allows trading volume and price volatility to be jointly determined together with transaction costs in the estimation of tax revenues, which has been used in other studies discussed above.[112]

In 2011, Bjursell, Wang, and Yau provided updated estimates of the trading volume elasticity to bid-ask spread on the 11 selected U.S. futures based on Wang and Yau's methodology.[113]

In Table 1, the estimates of the elasticity of trading volume with respect to transaction costs (proxied by the bid-ask spread) for 11 U.S. futures are presented. The estimates range from -2.6 (E-mini S&P 500 index futures) to -0.81 (heating oil), suggesting that the trading volume of a futures contract will decline if transaction costs increase, as by the imposition of an FTT. For example, the elasticity of -0.81 for the S&P 500 index futures indicates that the trading volume for these futures will decrease 0.81 percent for each one percent increase in the bid-ask spread or financial transaction tax. The lower-end of the corresponding interval estimates with a 95 percent confidence level are all greater than one, except for 30-year T-bond (-0.972) and heating oil (-0.923) futures. These results suggest that the elasticity of trading volume with respect to transaction costs had been very high during the period 2005–2010 for most futures examined. Bjursell, Wang, and Yau pointed out the important implication that an increase in the bid-ask spread due to a new transaction tax would substantially re-

The empirical relation between price volatility and transaction costs depends on how transaction costs affect trading volume.

Table 1
Elasticity of Trading Volume with Respect to Transaction Costs in Selected U.S. Futures Markets

Contract	January 2005–December 2010 Elasticity Estimates[a]	January 1990–April 1994 Elasticity Estimates[b]
S&P500	-0.81	-0.78
E-mini S&P500	-2.60	
30-Year T-Bond	-0.87	
10-Year T-Note	-1.36	
British Pound	-0.97	
Wheat	-0.98	
Soybean	-1.66	
Copper	-1.44	
Gold	-2.02	-1.31
Crude Oil	-1.00	
Heating Oil	-0.80	
Deutschemark		-1.30
Silver		-0.90

Source: [a]C. Johan Bjursell, George H.K. Wang, and Jot Yau, "Transaction tax and market quality of U.S. futures market: An ex ante analysis," *Review of Futures Markets* (2012), forthcoming. [b]George H.K. Wang, and Jot Yau, "Trading volume, bid-ask spread, and price volatility in futures markets," *Journal of Futures Markets* 20, no. 10 (2000): 943–70.
Note: Numbers in parentheses denote standard errors for the corresponding point estimates.

duce trading volume and decrease liquidity for the U.S. futures exchanges. The elasticity used in the CBO's 1990 report, -0.26, estimated by Thomas Epps based on U.S. stock data, seriously understates current elasticity in the futures markets. Hence, the CBO overestimated the potential revenue of a transaction tax in futures markets.

The elasticity used in the CBO's 1990 report seriously understates current elasticity in the futures markets.

We use the following example to illustrate how Bjursell, Wang, and Yau computed the estimated tax revenue for S&P 500 index futures, using a transaction tax of 0.02 percent.[114]

First, we calculate the 0.02 percent transaction tax revenue on the S&P 500 futures transactions based on the notional value of the futures contract, or $283,981 as approximated by the average yearly price in 2010. The transaction tax revenue is then expressed as a percentage of the total fixed transaction costs (TFC), which is $14.8. Thus, for S&P 500 futures, the transaction tax revenue as a percentage of the total fixed transaction costs (TR%TC) is

$$\frac{\$283{,}981 * 0.0002}{\$14.8} = 3.837581 \text{ or } 383.7581\%$$

Second, the post-tax volume (PTV), i.e., the estimated trading volume after a transaction tax is imposed, is calculated based on the current elasticity of trading volume (TV) with respect to transaction costs/taxes (-0.81 for the S&P 500 futures, Table 1) and

the total trading volume (the number of contracts traded in 2010). Thus,

PTV = Total TV*[1 + (current elasticity of TV*(TR%TC/TFC))]
PTV =7,689,961*[1 + (-0.81*3.837581)]
= -16,213,825

Third, the change in trading volume (ΔTV) is computed to be equal to

ΔTV = PTV − TV
ΔTV = -16,213,825 – 7,689,961
= -23,903,786

This result shows that the trading volume of S&P 500 index futures is very sensitive to changes in transaction costs. Even a small transaction tax (e.g., 0.02 percent) is big enough to wipe out all S&P 500 index futures transactions, leaving no tax revenues to be collected by the government. This result suggests that the impact of a transaction tax on trading costs and trading volume can vary significantly with different types of futures since they have different degrees of trading volume elasticity.

Finally, the estimated potential tax revenues to be collected on various futures contracts is calculated based on the post tax volume (column 3, Table 2) estimated with the recent estimates of trading volume elasticity (from Table 1). Column 5 in Table 2 presents the estimates of the potential post-tax revenue for the eleven futures computed by Bjursell, Wang, and Yau with recent estimates of trading volume elasticity. The potential tax

Even a small transaction tax (e.g., 0.02 percent) is big enough to wipe out all S&P 500 index futures transactions, leaving no tax revenues to be collected by the government.

Table 2
Estimates of Post-Tax Revenue in Selected U.S. Futures Markets

(1) Contract	(2) Average Yearly Price (2010) ($)	(3) Post Tax Trading Volume	(4) Post Tax Revenue Naïve Method ($)[a]	(5) Post Tax Revenue Elasticity Adjusted ($)[b]
S&P 500	283,981	0	436,760,532	0
E-mini S&P 500	56,776	0	6,305,896,991	0
30-Year T-Bond	124,069	29,208,455	2,072,187,486	724,770,376
10-Year T-Note	121,174	0	7,118,223,079	0
British Pound	96,522	0	583,383,582	0
Wheat	29,512	14,747,726	136,289,676	87,048,101
Soybean	52,434	0	387,315,432	0
Copper	8,572	8,340,933	17,668,989	14,300,463
Gold	122,616	0	1,096,935,043	0
Crude Oil	79,621	0	2,685,649,749	0
Heating Oil	9,033	21,518,357	48,725,003	38,875,710
Total			**20,889,035,562**	**864,994,651**

Source: C. Johan Bjursell, George H.K. Wang, and Jot Yau, "Transaction Tax and Market Quality of U.S. Futures Market: An ex ante Analysis," *Review of Futures Markets* (2012), forthcoming.
Notes: [a]Estimated potential revenue under this method is computed as Trading volume 2010 x Average Yearly Price (2010) x Tax rate (0.02%). [b]Estimated potential revenue under this method is computed as: Post-tax trading volume x Average Yearly Price (2010) x Tax rate (0.02%).

revenues (PTR) collected from each futures contract is computed as follows:

PTR = PTV*Average Yearly Price (2010)* Tax rate (0.02%)

For comparison purposes, presented in column 4 in Table 2 are the post-tax revenues calculated by the naïve method, that is, assuming trading volume will stay the same and not be affected by the transaction tax. The tax revenue generated by the naïve method (column 4) is often used by proponents of transaction tax as the basis for arguing that transaction taxes would generate substantial revenue.[115] For the 0.02 percent tax rate, six futures (S&P 500, E-mini S&P 500, 10-year T-Note, British pound, soybean, and gold) would cease to be traded at all in U.S. markets, and would therefore generate zero tax revenue (column 5). The other five futures (30-year T-Bond, wheat, copper, crude oil, and heating oil), given their trading volume elasticity, generate tax revenues that are less than the corresponding estimated tax revenues from the naïve method.

The transaction tax revenue estimated by the pre-tax trading volume or with an unrealistically low elasticity can seriously overestimate the potential tax revenue.

There are three noteworthy findings from the study by Bjursell, Wang and Yau. First, the magnitude of the decline in the post-tax volume depends on the relative importance of the transaction tax to the total fixed cost and/or the elasticity of trading volume with respect to transaction costs on each future. For example, the post-tax trading volume of the S&P 500 index futures is reduced to zero when the transaction tax is 383.76 percent of the total fixed transaction cost with an elasticity of -0.81. In the soybean case, the elasticity is high (i.e., -1.66) but the post-tax trading volume still drops to zero even if the transaction tax is only 65.75 percent of the total fixed transaction cost.

Second, the impact of a transaction tax on transaction costs and trading volumes varies significantly with different types of futures. Third, the transaction tax revenue estimated by the pre-tax trading volume or with an unrealistically low elasticity can seriously overestimate the potential tax revenue.

Conclusion

In this paper, we reviewed the theoretical and empirical studies on the impact of a transaction tax.[116] Specifically, we reviewed the empirical evidence on the imposition of a FTT in futures markets with regard to trading volume, price volatility, pricing efficiency, and estimated revenue. We discussed a methodology for estimating the potential transaction tax revenue that can be raised from U.S. futures markets. The empirical model proposed by the authors and used in several previous studies accounts for the endogenous relationships among trading volume, bid-ask spread (transaction cost), and volatility.[117] We explained the estimation of the empirical elasticity of trading volume and post-tax adjusted trading volume using Bjursell, Wang, and Yau's estimates on 11 futures traded in the United States. We showed that current estimates of the elasticity of trading volume with respect to a transaction tax in U.S. futures markets are much higher than those reported in the extant literature and those used by the government in transaction tax revenue estimation. As such, a transaction tax would reduce trading volume significantly, may not reduce price volatility, and might only raise a modest amount of tax revenue, much smaller than expected. More importantly, results indicate that with such high estimates of trading volume elasticity, it is very likely that futures trading activities would be shifted to untaxed foreign markets should a transaction tax be imposed. We conclude that a transaction tax on futures trading will not only fail to generate the expected tax revenue, it will likely drive business away from U.S. exchanges and toward untaxed foreign markets.

Notes

We would like to thank Mark A. Calabria, director of financial regulation studies at the Cato Institute, for encouraging us to write this paper. The views expressed here do not necessarily reflect those of our current or former employers.

1. Financial transaction taxes (FTTs) can be classified into (1) securities transaction taxes (STT); (2) currency transaction taxes (CTT or Tobin tax); (3) capital levy or registration taxes; (4) bank transaction taxes (BTT); and (5) real estate transaction taxes. Thornton Matheson, "Taxing Financial Transactions: Issues and Evidence," International Monetary Fund working paper, WP11/54, 2011. The term "Tobin tax" originally referred to the tax on currency transactions (i.e., CTT). It is now used interchangeably with financial transaction taxes, as in this paper.

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3. Jason Zweig, "Flash Tax: Why Levies on High-Speed Trading Won't Work," *The Wall Street Journal*, September 3–4, 2011, p. B11.

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7. General Accounting Office, GGd-93-108-Futures Transaction Fee, p. 1.

8. Kathleen Cronin, "A Transaction Tax's *Unintended* Consequences," 2010, http://archive.opnmkts.com/regulatory/a-transaction-taxs-unintended-consequences/; E. Noll, "The Perils of a Financial Services Transaction Tax," 2010, http://www.rollcall.com/news/-42770-1.html.

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10. The European Commission rejected a proposal for a bank tax to pay for the bailout of failed European banks due to the 2007–2008 financial crisis.

11. James E. Tobin, "A Proposal for International Monetary Reform," *Eastern Economic Journal* 4, no. 3 (1978): 153–9.

12. For a review of arguments, see Schwert and Seguin, pp. 27–35; Paul H. Kupiec, Patricia A. White, and Gregory Duffee, "A Securities Transaction Tax: Beyond the Rhetoric," *Research in Financial Services Private and Public Policy* 5 (1993): 55–76; R. Glenn Hubbard, "Securities Transaction Taxes: Can They Raise Revenue?" MidAmerica Institute Research Project on Transaction Tax, July 1993; Summers and Summers; Steven R. Umlauf, "Transaction Taxes and the Behavior of the Swedish Stock Market," *Journal of Financial Economics* 33 (1993): 227–240; and Neil McCulloch and Grazia Pacillo, "The Tobin Tax–A Review of the Evidence," working paper, Institute of Development Studies, University of Sussex, 2010.

13. See Franklin R. Edwards, "Taxing Transactions in Futures Markets: Objectives and Effects," *Journal of Financial Services Research* 7 (1992): 75–91; and George H. K. Wang, Jot Yau, and Tony Baptiste, "Trading Volume and Transaction Costs in Futures Markets," *Journal of Futures Markets* 17, no. 7 (1997): 757–80.

14. "Charlemagne: The Seven-Yearly War," *Economist*, June 30, 2011.

15. Kiefer.

16. Campbell and Froot, p. 277.

17. Previous studies present summaries for various types of financial transaction taxes around the world over different time periods. See Robert Pollin, Dean Baker, and Marc Schaberg, "Securities Transaction Taxes for U.S. Financial Markets," *Eastern Economic Journal* 29, no. 4 (2003): 527–58; McCulloch and Pacillo; Schwert and Seguin; Roll; and Matheson.

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23. Joseph E. Stiglitz, "Using Tax Policy to Curb Speculative Short-Term Trading," *Journal of Financial Services Research* 3 (1989): 101–115.

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26. Stiglitz.

27. Sanford J. Grossman and Joseph E. Stiglitz, "Information and Competitive Price Systems," *American Economic Review* 66 (May 1976): 246–53; Sanford J. Grossman, and Joseph E. Stiglitz, "On the Impossibility of Informationally Efficient Markets," *American Economic Review* 70 (June 1980): 393–408. Grossman and Stiglitz showed that the stock market provides a mechanism through which information is aggregated from both uninformed and informed individuals in the market. They argued that stock prices play no informational role in a firm's investment decisionmaking and are not likely to play any major role in the firm's investment decision. They suggested that managers do not base their investment decisions on stock prices, although stock prices provide signals to investors that may be read by the managers in the same way. Summers and Summers make the same argument.

28. For examples, see Kiefer; Congressional Budget Office, *Reducing the Deficit: Spending and Revenue Options* (Washington: Government Printing Office, 1990); and Pollin, Baker, and Schaberg.

29. Summers and Summers.

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31. Roll.

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90. For summaries of the arguments, see Kiefer; Congressional Budget Office; Pollin, Baker, and Schaberg.

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92. Summers and Summers, p. 285.

93. The estimate was based on 1997 levels of market activity for stocks, bonds, and swaps, and the March 1999 level of market activity for futures and options. Pollin, Baker, and Schaberg, p. 528.

94. Stiglitz, p. 211. Summers and Summers suggested the same amount (p. 276).

95. Uppal, p. 5.

96. Edwards.

97. -0.26 was the elasticity used in Congressional Budget Office report. Edwards, p. 88.

98. Edwards, p. 88.

99. Wang, Yau, and Baptiste, p. 774.

100. Bjursell, Wang, and Yau.

101. Ibid, p. 27.

102. Sahoo and Kumar.

103. Chou and Wang, p. 1213.

104. See Wang, Yau, and Baptiste; and Bjursell, Wang, and Yau.

105. For example, the Congressional Budget Office report.

106. Schwert and Seguin.

107. For example, the -0.26 elasticity used in the Congressional Budget Office report and elasticities used by Edwards ranging from -1 to -20 in estimating the potential tax revenue.

108. For example, see Harold Demsetz, "The Cost of Transacting," *Quarterly Journal of Economics* 87 (1968): 33–53; and Epps. Similarly, Thomas George and Francis Longstaff found a negative relationship between transaction rate and bid-ask spread for the S&P 100 index options market and provided estimates of the transaction rate with respect to the bid-ask spread in a structural equation model. Thomas J. George and Francis A. Longstaff, "Bid-Ask Spreads and Trading Activity in the S&P 100 Index Options Market," *Journal of Financial and Quantitative Analysis* 28, no. 3 (1993): 281–397.

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111. Wang and Yau; Haberer.

112. Chou and Wang; Sahoo and Kumar.

113. Bjursell, Wang, and Yau.

114. The U.S. House of Representatives had proposed to impose a 0.02% tax on futures transactions; see Cronin; and Noll.

115. The Congressional Budget Office study also used an elasticity of -0.26 as the input to calculate the post-tax volume and potential tax revenue.

116. We did not review the literature on the practical/implementation issues of an STT nor did we review the literature on the incidence of such a tax.

117. Wang and Yau; Bjursell, Wang, and Yau; and Sahoo and Kumar.

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