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Deterring “Double-Play” Manipulation in Financial Crisis: Increasing Transaction Cost as a Regulatory Tool

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Rujing Meng^{††}

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I. Introduction

The 2008 worldwide financial crisis entered developing countries in the form of a currency crisis. The sudden cutback in lending by banks going through a credit crunch heightened the default risk of developing countries that relied on foreign debt to provide short-term financing and to sustain domestic growth. In 2008, it was estimated that net private capital inflows to emerging markets was US\$619 billion, down almost one-third from the 2007 level.¹ More than US\$20 billion flowed out of emerging market equities in the third quarter of 2008.² As foreign investors fled emerging markets, they converted assets held in local currencies into assets denominated in more “secure” currencies, such as the U.S. Dollar, Euro and Japanese Yen.³ This pullback exacerbated pressure on local currencies that were already weakened by soaring inflation as a result of years of over-exuberance in emerging market investment.⁴ The macro-economic environment in emerging markets was similar to that of Asian countries immediately before the outbreak of the Asian currency crisis just a decade ago. In September and October of 2008, the world witnessed massive moves in every major currency, and in some not so major ones, which economists interpreted as a prelude to a new episode of currency crisis of a severity unmatched by any previous crisis.⁵

¹ See *Capital Flows to Emerging Market Economies*, INST. INT'L FIN., Oct. 12, 2008, at 1, http://miha.ef.uni-lj.si/_dokumenti3plus2/191241/EMERGINGMARKETS.pdf.

² See *id.* at 3.

³ See, e.g., Mark Landler & Vikas Bajaj, *Some Currencies Plunge as Stocks Sink Worldwide*, N.Y. TIMES, Oct. 25, 2008, at A1.

⁴ On November 3, 2008, the Korean Won was 35% weaker against the U.S. Dollar than the exchange rate at the beginning of 2008. On October 29, 2008, the exchange rate between the Euro and the Hungarian Forint reached 1-284 from the rate of 1-230 in late July of 2008. On October 26, 2008, Ukraine currency fell to its historical low against the dollar at 6.01-1. See generally Yahoo! Finance, <http://finance.yahoo.com/currency-converter> (allowing the conversion of currencies on the given dates).

⁵ See, e.g., Paul Krugman, *The Conscience of a Liberal: The mother of all currency crises*, N.Y. TIMES BLOG, <http://krugman.blogs.nytimes.com/2008/10/26/the-mother-of-all-currency-crises> (Oct. 26, 2008, 10:37 EST)

(I've been reading reports from Stephen Jen, a former student of mine who's now the chief currency strategist at Morgan Stanley. He points out that since the fall of Lehman, we've been seeing clear signs of currency crises throughout

Some developing countries going through the crisis have established a currency board system,⁶ whereby the local currency is pegged to a more stable currency – typically the U.S. Dollar or the Euro – or a composite of currencies in order to maintain the stability of the local currency.⁷ One salient feature of the currency board is that domestic interest rates adjust automatically to pressures on the local currency. In late October 2008, Hungary raised its base interest rate by 3.0% to 11.5% (the highest increase since 2003) as a defensive move against speculative attacks on its plunging Forint.⁸ On November 28, 2008, Russia's central bank announced its decision to raise key interest rates to stem further devaluation of the Ruble.⁹ Interest rate hikes at times of economic recessions further hinder growth and inflict additional pressure on the local stock market.¹⁰ On the day of their respective interest rate increases, the Hungarian benchmark stock index BUX was down 3.4%¹¹ and the Russian 30-Stock Micex Index sank 2.8%.¹² This is a perfect setting for manipulators to carry out, on a large scale, a "double-play manipulation" strategy. They attack the weakening local currency and simultaneously park large short positions in the equity market, typically by utilizing the leverage effect of the index futures product, in anticipation of the negative

the world of emerging markets, including Eastern Europe. This time, it's not an Asian crisis or a Latin American crisis, it's a global crisis.)

⁶ See generally Mart Sörg & Vello Vensel, *Development of the Banking System Under the Estonian Currency Board*, 8 INT'L ADVANCES ECON. RES. 35, 35 (2002) (examining countries such as Bulgaria, Estonia, Hong Kong and Argentina that have established currency board systems).

⁷ See *id.* at 35-36.

⁸ See Vidya Ram, *Hungary Raises Rates To Defend Currency*, FORBES, Oct. 22, 2008, ¶ 2, available at http://www.forbes.com/2008/10/22/eastern-europe-downturn-markets-econ-cx_vr_1022markets18.html; Zoltan Simon, *Hungary Raises Rates, Sacrificing Growth to Protect Currency*, BLOOMBERG, Oct. 22, 2008, ¶ 6, <http://www.bloomberg.com/apps/news?pid=newsarchive&sid=ajzKRzwcQxkY>.

⁹ See Emma O'Brien & Maria Levitov, *Ruble Collapse Prompts Russia to Raise Interest Rates (Update1)*, BLOOMBERG, Nov. 28, 2008, ¶ 12, <http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aS9UcWrGGf0Y>.

¹⁰ See Jeff Faux, *The Next Recession*, ECON. POL'Y INST., Mar. 4, 2002, ¶¶ 16-19, http://www.epi.org/publications/entry/webfeatures_viewpoints_next_recession.

¹¹ See Simon, *supra* note 8.

¹² See Maria Levitov, *Russian Central Bank Raises Key Rates to Cap Prices (Update2)*, BLOOMBERG, Nov. 28, 2008, ¶ 14, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aFLez_uUrI6k.

stock market impact of increased interest rates. Double-play manipulation was believed to have been carried out a decade ago during the Asian currency crisis and exacerbated the pain for Asian countries going through major corrections in their economies.¹³

In order to deter such a manipulative scheme, and to alleviate the pressures that it inflicted on the local currency and the equity market, some Asian governments, in particular the Hong Kong Monetary Authority, took an unprecedented approach by intervening in both the currency market and the equity market. "We wish to send the very clear message to those manipulating our currency for this purpose that they may stand to lose money instead," said the Chief Executive of the Hong Kong Monetary Authority in explaining the motivation of the intervention to the Hong Kong public.¹⁴ During the two-week intervention period (August 14 to August 28, 1998), the Hong Kong government bought US\$12 billion to US\$15 billion (about 15.5% of Hong Kong's foreign reserves) worth of local stocks and long positions in the benchmark Hang Seng Index Futures.¹⁵ For the single day of August 28, 1998, when the August Hang Seng Index Futures contract was expiring, the government was forced to lay out approximately US\$9 billion.¹⁶ This action held the Hang Seng Index to a slight drop of 1.2% on a day when markets around the world plummeted.¹⁷

The high cost of intervention gives rise to the concern and criticism that equity market intervention is not sustainable and thus lacks credibility in the long run as an effective tool in combating double-play manipulations. "Even with its vast foreign exchange fund – worth roughly \$97 billion – most analysts said

¹³ See Joseph Yam, *Why We Intervened*, ASIAN WALL ST. J., Aug. 20, 1998, at 6, available at http://www.info.gov.hk/hkma/eng/speeches/speechs/joseph/speech_200898b.htm ("I have no doubt that there has been manipulation of our currency to engineer extreme conditions in the interbank market and high interest rates in order to reap profits from large short positions in stock index futures.").

¹⁴ *Id.*

¹⁵ See Mark Landler, *Hong Kong Shifts Gears, This Time Trying Reverse*, N.Y. TIMES, Sept. 1, 1998, at C1.

¹⁶ See G. Bruce Knecht, *Hong Kong Intervention Escalates; More Hinted*, WALL ST. J., Aug. 31, 1998, at A8.

¹⁷ *See id.*

Hong Kong could not afford a run-and-gun battle with traders for more than a few weeks. And experts are now focusing on how Hong Kong officials plan to extricate themselves from this standoff," wrote a commentator in the *New York Times* shortly after the Hong Kong intervention.¹⁸

In this paper, we seek to address this problem by exploring the feasibility of increasing temporarily (i.e., during the crisis period) the transaction cost on short positions in the equity market and using a transaction levy to sustain the continuation of the government's intervention. The selective imposition of higher transaction costs on short positions is justified on the ground that those who have inflicted the pain on the financial market are charged with the responsibility of paying for the consequences. Intervention sustained by the transaction levy also avoids the criticism that the government squanders its hard-earned tax dollars on stock market gambling. Moreover, the government's financial resources are positively linked to the magnitude of the short pressures in the market—the larger the short volumes, the bigger the government's coffer to support its market interventions.

Increasing transaction costs to deter undesirable financial market activities was advocated by Nobel Laureate James Tobin (and hence called the "Tobin Tax") in 1978. Professor Tobin calculated that a 0.5% tax (each way) on foreign exchange transactions would yield more than US\$1.5 trillion in annual revenue and would be a considerable deterrent to persons contemplating a quick round-trip trade to another currency.¹⁹ The Tobin Tax was urged for implementation during the Asian financial crisis,²⁰ and is currently a focal point of discussion again as the world's emerging economies are experiencing speculative attacks on their currencies.²¹

¹⁸ Landler, *supra* note 15, at C8.

¹⁹ See James Tobin, *A Proposal for International Monetary Reform*, 4 E. ECON. J., 153, 153-59 (1978).

²⁰ In 1997, Ignacio Ramonet, the editor-in-chief of the French publication *Le Monde Diplomatique*, renewed the debate around the Tobin tax with an editorial titled "Disarming the Markets". Ramonet proposed to create an association for the introduction of this tax. See Ignacio Ramonet, *Disarming the Markets*, LE MONDE DIPLOMATIQUE, Dec. 1, 1997, ¶ 11, available at <http://mondediplo.com/1997/12/leader>.

²¹ See, e.g., Paul Rogers, *A World in Flux: Crisis to Agency*, OPENDEMOCRACY NEWS ANALYSIS, Oct. 16, 2008, at 4, <http://www.opendemocracy.net/node/46530/pdf>

An important question associated with extending the Tobin Tax concept to the stock market is whether such a measure will be effective in the double-play manipulation setting by forcing manipulators to reduce short positions in both the currency and stock markets. The answer to this question is not immediately apparent given the lack of studies on manipulators' behaviors when facing such a regulatory measure. Our paper seeks to fill this void by setting up an optimal portfolio choice problem from the perspective of a double-play manipulator and examining how his optimal short positions change when he faces interventions and higher transaction costs.

This paper proceeds in the following order: Section II sets up a portfolio choice model as mentioned above and derives the conditions under which a double-play manipulator reduces short positions. Section III empirically tests for the existence of the conditions derived in Section II by studying historical events of increases in transaction costs at times of financial crisis or substantial downturns. Section IV states the conclusions of this study.

II. A Double-Play Manipulator's Portfolio Choice Problem

A. *The Model Setup*

A double-play manipulator implements a strategy of shorting the local currency and shorting the futures contract in the index of the local stock market.²² Let $(S_{s,t}, S_{f,t})$ be the manipulator's short positions in the currency and the stock index futures markets. The manipulator chooses his short positions at time t to maximize his expected terminal utility at time $t+1$. His utility function is given by $U = e^{-R_a W_{t+1}}$, where R_a is the risk aversion parameter and W_{t+1} is his terminal wealth at $t+1$. Let W_0 be the manipulator's

(describing the need for some version of the Tobin Tax to curb excesses of currency speculation).

²² It is more advantageous for the manipulator to short the index futures market due to the limited upfront capital requirement. In addition, some emerging countries prohibit short selling in the underlying stock market. See, e.g., ANCHADA CHAROENROOK & HAZEM DAOUK, FIN. MARKETS RES. CTR., THE WORLD PRICE OF SHORT SELLING, 34, 35 (October 2004), available at http://www.owen.vanderbilt.edu/fmrc/papers%20data/2004%20papers%20pdf/short_sale_Aida.pdf (providing examples of emerging countries prohibiting short selling).

initial endowment. The manipulator borrows the local currency at time t and sells it immediately in the spot currency market for U.S. dollars, which he then invests at the rate of $r_{us,t}$.

The government imposes a one-way transaction fee, payable at times of order execution, of $\tau\%$ on the value of short positions in the index futures contract. The government intervenes in the index futures market by taking long positions. Any revenue generated by trades executed at a given price level is used for intervention at the same price level. For example, if US\$100 is collected from trades executed at a price level of 900, the government will use up to US\$100 to long contracts at the price level of 900.

Let r_{t+1} be the local-currency interest rate at time $t+1$. Let $r_{t+1} \equiv r_{t+1}(S_{s,t}(\tau), O_r(\tau))$. In words, r_{t+1} is a function of the manipulator's short positions in the local currency, $S_{s,t}(\tau)$, and all other relevant factors captured by the variable $O_r(\tau)$. Both of these variables are influenced by the transaction fee τ . The currency market is deep and thus, under normal market conditions, positions of any single player have no palpable effects on the interest rate. However, a panic herding behavior occurs in times of currency crisis and makes it possible for trades of a single player to generate a market-wide response.²³

Let $vl_t(\tau)$ be the aggregate trading volume (i.e., the number of index futures contracts traded) during the period of t to $t+1$, after excluding the volume generated by the government intervention. Trading volume is influenced by the transaction fee τ . Let g_t be the number of index futures contracts that the government buys during its intervention in the period of t to $t+1$. The government intervenes at each traded price level, but the magnitude of its intervention at each level is limited to the transaction fee collected from trades executed at that price level. In addition, we assume that *on average* the government loses 20% on each trade, with contracts bought earlier during the period losing more and those bought toward the end of the period losing less.²⁴ Under these

²³ See, e.g., Ansgar Belke & Ralph Setzer, *Contagion, Herding and Exchange-rate Instability – A Survey*, INTERECONOMICS, 222, 225 (2004).

²⁴ This extremely cautious assumption is used in deriving the government's financial position as a result of its intervention activities in the downward moving futures market. The government's loss in the market constitutes a financial constraint on its continued intervention in the market. Given what had happened in Hong Kong in late August 1998

assumptions, $g_t = \nu l_t(\tau)\tau / (20 - \tau)$ (see Appendix A.1 for derivation).

Let F_t be the price of index futures contract at time t , and $E(F_{t+1})$ be the manipulator's expected price of the index futures contract at time $t+1$. The expected index futures price level is a function of the interest rate at time $t+1$ that is captured by the variable $r_{t+1}(S_{\$t}(\tau), O_r(\tau))$, the magnitude of the government's intervention that is captured by the variable $g_t(\tau)$, and all other factors that are captured by $O_f(\tau)$. These elements are, in turn, functions of the transaction fee τ . Thus $F_{t+1} \equiv F[r_{t+1}(S_{\$t}(\tau), O_r(\tau)), g_t(\tau), O_f(\tau)]$. Note that F_{t+1} is not set as a function of $S_{f,t}$, which represents the manipulator's short positions in the index futures market at time t , due to the depth of the index futures market and trading restrictions.²⁵

Let $\sigma_{F,t+1}^2$ be the variance of F_{t+1} and influenced by the transaction fee τ . Thus, $\sigma_{F,t+1}^2 \equiv \sigma_{F,t+1}^2(\tau)$.

B. A Double-Play Manipulator's Optimization of Terminal Utility

Costs associated with a double-play strategy are as follows:

First, there is the difference in the interest rates for the local currency and the U.S. Dollar. By shorting the local currency, the manipulator foregoes the local currency interest that is typically higher than the interest on an equivalent amount of the U.S. Dollar. His cost is $S_{\$,t}(r_t - r_{US,t})$, where r_t is the interest rate on the local currency and $r_{US,t}$ is the interest rate on the U.S. Dollar.

Second, the manipulator pays a transaction fee on short positions in index futures in the amount of $VF_t S_{f,t} \tau\%$, where V is the value assigned to one index point by the futures exchange. The manipulator borrows the entire amount of the cost and pays

(the real life incident of government's futures market intervention to deter double-play manipulation in financial crisis), an average loss of 20% during the intervention period is a conservative and worst-case-scenario assumption about the government's financial loss.

²⁵ For example, Hong Kong Exchange has a 10,000 position delta limit for Hang Seng Index Futures Contracts, Mini-Hang Seng Index Futures and Mini-Hang Seng Index Options in all contract months. See HONG KONG EXCHANGE, RULES, REGULATIONS AND PROCEDURES OF H.K. FUTURES EXCH., CONTRACT SPECIFICATIONS FOR MINI-HANG SENG CHINA ENTERPRISES INDEX (HSCEI) FUTURES 1 (2009), available at <http://www.hkex.com.hk/rule/dervrule/SIF-CS.pdf>.

back $VF_t S_{f,t} \tau \%(1+r_t)$ at time $t+1$.

At time $t+1$, the manipulator unwinds the short positions in index futures. There is no transaction fee imposed on long positions, so his transaction cost for the unwinding is zero. His gain or loss is captured by $(F_t - F_{t+1})VS_{f,t}$, i.e., the change in the index futures price multiplied by the value of each index point and the size of his short positions. The manipulator's terminal wealth at time $t+1$ from trading in both the currency market and the index futures market is

$$W_{t+1} = (W_0 - VF_t S_{f,t} \tau \%(1+r_t)) + (F_t - F_{t+1})VS_{f,t} - S_{s,t}(r_t - r_{t,US}).$$

The manipulator has a utility function given by $-e^{R_a(W_{t+1})}$, which is expected to have the value at time $t+1$ equal to $\exp\{[R_a(W_0 - VF_t S_{f,t} \tau \%(1+r_t)) + (F_t - E(F_{t+1}))VS_{f,t} - S_{s,t}(r_t - r_{t,US})] - \frac{1}{2}R_a^2 S_{f,t}^2 V^2 \sigma_{f,t+1}^2\}$. (See Appendix A.2 for derivation). The manipulator sets his short positions in the currency and the index futures markets $(S_{f,t}, S_{s,t})$ at time t to maximize the value of this expected utility.

C. *The Effect of Higher Transaction Fee τ on the Manipulator's Optimal Choice of Short Positions*

A double-play manipulator's optimal choice of short positions in the currency and the index futures markets must satisfy the conditions given by equations (1) and (2) in Appendix A.2 (the "first order conditions"). We would like to see how his optimal choices change in response to an increase in the transaction fee τ . Based on the Implicit Function Theorem,²⁶ we take derivatives with regard to the transaction fee τ on both sides of the first order conditions and obtain equations (3) and (4) in Appendix A.3 (See Appendix A.3 for derivation). We prove in Appendix A.4 that an increase in the transaction fee τ results in the manipulator lowering short positions in both the currency market and the index futures market if A and B in these equations are both positive.

Components of A are shown in Appendix A.3. The first two components capture the effect of an increase in the transaction fee τ on the expected price of the index futures contract through the operation of factors other than the manipulator's currency market

²⁶ The Theorem allows one to take derivatives on an unspecified function with regard to any of its variables.

short position and the government's index futures market intervention. In other words, an increase in the transaction fee τ causes changes in these factors, which in turn causes change in the index futures price. The third component of A, $\frac{\partial E(F_{t+1})}{\partial g_t} \frac{\partial g_t}{\partial \tau}$, is the change in the index futures price given the increase in the transaction fee τ through the government's intervention. In other words, an increase in the transaction fee permits the government to intervene in a bigger magnitude and results in, as experience suggests, a positive movement in the index futures price if the higher transaction fee does not desiccate trading volume.²⁷ The function $\partial \sigma_{f,t+1}^2 / \partial \tau$ of the last component captures changes in the volatility of the index futures price at time $t+1$ as a result of an increase in the transaction fee τ . It is straightforward to see that A is positive if components one, two, three and five (component four is necessarily positive) are non-negative. That is, A is positive if the increase in transaction cost does not lead to lower price (not taking into account the government's intervention and the manipulator's short positions), lower trading volume and lower price volatility.

The components of B are also shown in Appendix A.3. The combination of the first two components captures the price effect of an increase in the transaction fee τ that is attributable to factors other than the government's intervention. The third component captures the price effect of changes in the transaction fee that is attributable to the government's intervention. This component is positive because an increase in the transaction fee strengthens the government's intervention, which in turn has a positive impact on the index futures price. In addition, the factor $\partial r_{t+1} / \partial S_{s,t}$ in this component is positive, as established by well-recognized financial market experience,²⁸ since it reflects how the manipulator's short positions in the local currency affect the local interest rate. Thus, if the increase in the transaction fee has a non-negative effect on the index futures price (not considering the price effect of the government's intervention and the manipulator's short positions in the index futures market), B is positive.

In sum, a double-play manipulator will optimize by reducing short positions in both the currency and the index futures markets

²⁷ See *infra* pp. 112-13.

²⁸ See *supra* p. 104 and accompanying notes.

if the increase in the transaction cost does not result in lower price, volatility, and volume in the index futures market.

III. Empirical Testing for the Impact of Increasing Transaction Fee on the Volatility, Price, and Volume of the Index Futures Market

A. Identification of Events

Since manipulators adjust their trading strategies to the higher transaction fee τ depending on how τ affects the index futures price, volatility, and volume, we proceed to identify events of increases in transaction costs in the recent past when the market was subject to substantial and persistent downward pressures, and analyze the effect of these events on volatility, price, and volume. Events were identified from news releases covering the period from January 1, 1991 to December 1, 2008, and were filtered to exclude those for which data was unavailable²⁹ and those that occurred during multiple event periods,³⁰ such that it is difficult to segregate the effect of the increase in transaction costs from the effect of other simultaneously occurring events. We also included events causing increases in transaction costs that occurred in the stock market rather than the index futures market because the two markets are closely linked by index arbitrage activities. These events were also included because the volatility, price, and volume effects in the underlying stock market are good indicators of what the effects would have been had the increase occurred in the index futures market.

²⁹ For example, we have excluded the event on March 15, 2001, when the Bombay Stock Exchange increased the initial margin on SENSEX futures contracts from 9% to 14%. India's SENSEX stood at 3666.20 on March 15, 2001, a near 20% decline from the 4372.60 level just a month before. For a description of the event, see Sangita Shah, *BSE Steps up Initial Futures Margin to 14 Percent*, Mar. 17, 2001, ¶ 1, <http://www.rediff.com/money/2001/mar/17bse.htm>.

³⁰ For example, on September 1, 1998, the Hong Kong Futures Exchange imposed a 150% margin surcharge on position-holders who had accumulated more than 10,000 contracts. Starting from August 31, 1998, the exchange also required members to report any open account holding 250 contracts or more and identify the beneficial owner of each reportable position. Previously, the reporting level had been 500 contracts and position-holders remained anonymous. For discussion of this event, see Bayani Cruz, Stephen Seawright & Dennis Ng, *Short Selling to be Curbed*, THE STANDARD, Sept. 1, 1998, ¶ 7, available at http://www.thestandard.com.hk/archive_news_search_resu.asp?d_str=19980901&page=13 (follow “Short-selling to be curbed” hyperlink).

The following events are included in our sample: (1) *Japan*: On January 31, 1991, the Tokyo Stock Exchange raised margins on index futures contracts from 15% to 20%.³¹ The Nikkei 225 Index dropped 35% from 32,891 on May 28, 1990 to 23,157 on January 28, 1991.³² (2) *Poland*: On December 6, 1994, after the Warsaw Stock Exchange had been experiencing a downhill slide for 10 months, Poland announced a 0.2% sales tax to be imposed on stock market transactions starting January 2, 1995.³³ (3) *Australia*: On October 24, 1997 (in the midst of the Asian financial crisis), the Sydney Futures Exchange raised the initial margin payable on its Share Price Index Futures Contract from AU\$2,500 to AU\$3,000 per contract.³⁴ (4) *Hong Kong*: On August 21, 1997, the initial margin on Hang Seng Index Futures was raised from HK\$50,000 to HK\$55,000.³⁵ (5) *Hong Kong*: On September 4, 2007, the initial margin on Hang Seng Index Futures was increased again from HK\$55,000 to HK\$60,000.³⁶ (6) *Hong Kong*: On October 24, 1997, the initial margin on Hang Seng Index Futures was increased from HK\$70,000 to HK\$75,000.³⁷ (7) *Hong Kong*: On November 4, 1997, the initial margin on Hang Seng Index Futures was increased from HK\$75,000 to HK\$90,000.³⁸ (8) *India*: On June 18, 2001, the National Stock Exchange of India raised existing margins on ALBM³⁹ from 17.5% to 40%.⁴⁰ India's SENSEX index stood at 3,353 on June 18, 2001, a decline of 30% since the high of 4,392 on February 5,

³¹ See *Margins on Stock-Index and Options Trading to Rise*, JAPAN ECON. NEWSWIRE, Jan. 30, 1991, ¶ 2.

³² See Yahoo! Finance, <http://finance.yahoo.com/q/hp?s=%5EN225&a=04&b=28&c=1990&d=00&e=28&f=1991&g=d&z=66&y=132> (last visited Oct. 21, 2009).

³³ See *Finance Minister Says Transaction Tax at WSE a Sure Thing*, PAP NEWS WIRE, Dec. 5, 1994, ¶ 1.

³⁴ See *SFE Makes Margin Calls on Contracts*, AAP NEWSFEED, Oct. 28, 1997, ¶ 2.

³⁵ See Enoch Yiu, *Futures Exchange Lifts Margins to Guard Against Sharp Market Moves*, SOUTH CHINA MORNING POST, Sep. 3, 1997, at 1.

³⁶ *Id.*

³⁷ See Enoch Yiu, *Futures Margins Up in Market Dive*, SOUTH CHINA MORNING POST, Oct. 28, 1997, at 2.

³⁸ See Rodney Diola, *HKFE Plans to Increase Margin Limit*, THE STANDARD, Oct. 31, 1997, ¶ 2, available at http://www.thestandard.com.hk/news_detail.asp?pp_cat=%&art_id=58497&sid=%&con_type=1&d_str=19971031&sear_year=1997.

³⁹ Automated Lending and Borrowing Mechanism

⁴⁰ See *Stocks - BSE Opens 45.4 pts down*, ASIA PULSE, June 18, 2001.

2001.⁴¹

B. Volatility Effect

The effectiveness of using higher transaction costs to supplement government intervention and deter double-play manipulation depends on the absence of any negative impact of such measures on volatility, price, and volume. Although a number of papers have examined the volatility impact of imposing higher transaction costs, their studies have not focused on markets in times of financial crisis or in substantial downturns.⁴²

In the analysis of the volatility effect of our sample events, we use daily $\ln(\text{high price}) - \ln(\text{low price})$ as a proxy for volatility. Where the daily high or low prices are not available, we use the "Modified Levine Statistics" as substitute.⁴³ We define *Event Day* as the day on which an increase in transaction costs first becomes effective. Our method is to compare the pre-event volatility with the volatility on the *Event Day* and during the period shortly after

⁴¹ See *Stocks - BSE Closes 19.83 Points Down*, ASIA PULSE, June 18, 2001.

⁴² David A. Hsieh & Merton H. Miller, *Margin Regulation and Stock Market Volatility*, 45 J. OF FIN. 3, 3-90 (1990). The authors used daily data to test for signs of short-term or impact relations between twenty-two historical changes in margin requirements and the immediately subsequent changes in volatility. They found an absence of strong and consistent impact effects of margins changes on volatility. See also Steven R. Umlauf, *Transaction Taxes and the Behavior of the Swedish Stock Market*, 33 J. OF FIN. ECON. 227, 227-40 (1993). The author used the Swedish stock market data from the 1980s and showed that the introduction of, or an increase in Swedish tax, led to an increase in volatility of stock prices. See also Charles M. Jones & Paul J. Seguin, *Transaction Costs and Price Volatility: Evidence from Commission Deregulation*, 87 AM. ECON. REV. 728, 728-37 (1997). The paper has shown that the reduction in the commission portion of the transaction costs in 1975 led to a decrease in the volatility of stock prices and an increase in trading volume. See also Ian Domowitz, Jack Glen & Ananth Madhavan, *Liquidity, Volatility and Equity Trading Costs Across Countries and Over Time*, 4 INT'L FIN. 221, 221-55 (2001). The paper analyzed data of the average trading costs as a percentage of trade value for active portfolio managers in forty-two countries and found that transaction costs do not have a significant impact on the standard deviations of returns.

⁴³ See Howard Levene, *Robust Tests for Equality of Variances*, in CONTRIBUTIONS TO PROBABILITY AND STATISTICS 278, 278-80 (Ingram Olkin ed., 1960). Suppose there are G groups of data, indexed $i = 1, 2, 3 \dots G$. Each group contains n observations. Let σ_i^2 be the variance of the i^{th} group. The null hypothesis is $\sigma_1^2 = \sigma_2^2$. Let x^{ij} be the j^{th} observation in the i^{th} group. The Levine Statistic is computed as follows:

$$W = \left[\frac{\sum_i n_i (z_i - \hat{z})^2 / (G-1)}{\sum_i \sum_j (z_{ij} - z_i)^2 / \sum_i (n_i - 1)} \right], \text{ where}$$

$$z_{ij} = |x_{ij} - \bar{x}_i|, \quad \bar{x}_i = \sum_j x_{ij} / n_i, \quad \hat{z} = \sum_i \sum_j z_{ij} / \sum_i n_i$$

the *Event Day*. Specifically, we bootstrap the distribution for the pre-*Event* average volatility from observations for the five-day period prior to the *Event Day*. We then examine the standings of the *Event Day* volatility and the average volatility for the five post-*Event Days* in this distribution. In addition, we use the Wilcoxon Rank Sum Test⁴⁴ to compare the volatility levels for the five-day period before and the five-day period after the *Event Day*. We pay attention to events in which both the *Event Day* volatility and the post-*Event* average volatility were significantly lower than the pre-*Event* volatility. Lower *Event Day* volatility but higher or unchanged post-*Event* average volatility indicates that any declination in volatility is transitory and unlikely to continue beyond the *Event Day* or shortly thereafter. Lower post-*Event* average volatility but higher or unchanged *Event Day* volatility indicates that the declination in post-*Event* volatility is likely caused by factors other than the increase in transaction cost.

Table 1 reports the average volatility before and after the *Event Day* as well as the volatility on the *Event Day*. Among the eight events included in our study, only Event #2 (the imposition of a 0.2% sales tax on stocks traded on the Warsaw Stock Exchange on January 2, 1995) shows a volatility decline on both the *Event Day* and the five-day period after the *Event Day*. Events #5 and #7 (Hong Kong's imposition of a higher initial margin on Hang Seng Index Futures on September 4 and November 4, 2007, respectively) have lower post-*Event* average volatility. However, the volatility on the *Event Day* is actually higher or unchanged.

Table 1
Volatility Before and After Imposition of Higher Transaction Cost

This table reports, for the relevant index futures contract or the stock market index, daily volatility on the *Event Day*, the average daily volatility during the 5-day period prior to the *Event Day*, and the average daily volatility during the 5-day period after the *Event Day*. Volatility is proxied by daily $\ln(\text{high price}) - \ln(\text{low price})$. Where daily high and low prices are unavailable, daily volatility is calculated by using the Modified Levene Statistics described in Footnote 45.

⁴⁴ See generally David Anderson et al., INTRODUCTION TO STATISTICS 406, 406-10 (Bradley Schiller ed., West Publishing Co. 1981) (describing the "Wilcoxon Rank Sum Test").

	Event	Pre-Event Average	Event Day	Post-Event Average
1	Japan, January 31, 1991, initial margins on Nikkei 225 Futures was raised from 15% to 20%.	0.01	0.02	0.02
2	Poland, January 2, 1995, 0.2% tax on sales of stocks on Warsaw Stock Exchange	1.80	1.03	0.22
3	Australia, October 24, 1997, SFE raised initial margin on All Ordinary Index Futures from A\$2,500 to A\$3,000.	0.01	0.02	0.05
4	Hong Kong, August 21, 1997, HangSeng Index Futures initial margin was increased from HK\$50,000 to HK\$55,000	0.02	0.03	0.02
5	Hong Kong, September 4, 1997, HangSeng Index Futures initial margin was increased from HK\$55,000 to HK\$60,000	0.02	0.02	0.01
6	Hong Kong, October 24, 1997, HangSeng Index Futures initial margin was increased from HK\$70,000 to HK\$75,000.	0.07	0.11	0.10
7	Hong Kong, November 4, 1997, HangSeng Index Futures initial margin was increased from HK\$75,000 to HK\$90,000.	0.09	0.09	0.05
8	India, June 18, 2001, National Stock Exchange increased margins on the ALBM session from 17.5% to 40%.	0.01	0.02	0.02

Table 2 reports the standing of the *Event Day* volatility and the post-*Event* average volatility in the bootstrapped distribution of the pre-*Event* average volatility. If the imposition of a higher transaction cost results in lower volatility, we should see that the *Event Day* volatility and the post-*Event* average volatility stand within 5% or 10% of the distribution on the lower end. This occurs only in Event #2. For Event #7, although the post-*Event* average volatility is significantly lower than the pre-*Event* volatility at the 5% significance level (with a distribution standing of 0%), the *Event Day* volatility has a distribution standing at 44%, suggesting the insignificance of its difference from the pre-*Event* level. These results are confirmed by the Wilcoxon Rank Sum Test results listed in Table 2. In sum, the above evidence strongly suggests that an increase in transaction costs does not lead to volatility declines in markets that are going through major corrections.

Table 2
The Volatility Effect of Increasing Transaction Cost in Bear Markets

This table reports the standing of the *Event Day* volatility and post-*Event* average daily volatility in the distribution bootstrapped from the daily volatilities in the 5-day period prior to the *Event Day*. The table also reports the result of the Wilcoxon Rank Sum Test used to compare the daily volatilities 5 days before and 5 days after the *Event Day*. Significant lower post-event volatility is noted.

	Event	Distribution Percentile		Wilcoxon Rank Sum
		Event Day Volatility	Post-Event Volatility	<i>p</i> Value
1	Japan, January 31, 1991, initial margins on Nikkei 225 Futures was raised from 15% to 20%.	100%	100%	0.01
2	Poland, January 2, 1995, 0.2% tax on sales of stocks on Warsaw Stock Exchange.	19%	1%**	0.03**
3	Australia, October 24, 1997, SFE raised initial margin on All Ordinary Index Futures from A\$2,500 to A\$3,000.	100%	100%	0.01
4	Hong Kong, August 21, 1997, HangSeng Index Futures initial margin was increased from HK\$50,000 to HK\$55,000.	99%	61%	0.5
5	Hong Kong, September 4, 1997, HangSeng Index Futures initial margin was increased from HK\$55,000 to HK\$60,000.	31%	19%	0.42
6	Hong Kong, October 24, 1997, HangSeng Index Futures initial margin was increased from HK\$70,000 to HK\$75,000.	99%	94%	0.1
7	Hong Kong, November 4, 1997, HangSeng Index Futures initial margin was increased from HK\$75,000 to HK\$90,000.	44%	0%**	0.07*
8	India, June 18, 2001, National Stock Exchange increased margins on the ALBM session from 17.5%	100%	94%	0.15

to 40%.

** Significantly lower at 5% level.

* Significantly lower at 10% level.

C. Price Effect

Existing research on the price effect of an increase in transaction costs has drawn mixed conclusions. Barclay, Kandel and Marx have found that the changes in the "bid-ask spread" (a proxy for transaction costs) do not have any significant impact on stocks' returns.⁴⁵ However, Domowitz, Glen and Madhavan have found that transaction costs have a negative impact on the annual returns of stocks traded in some countries.⁴⁶ Again, these studies have not focused on the price effect in financial crisis or substantial bear markets.

We take a similar approach to our analysis of the volatility effect discussed in Section III(B) above by (1) comparing *returns*, defined as the difference in log settlement prices between two consecutive trading days, of the *Event Day* with the average daily returns for the five-day period immediately before the *Event Day*; (2) comparing settlement prices on the *Event Day* with the average settlement prices for the five-day period immediately before the *Event Day*; and (3) comparing the average post-*Event* settlement prices with the average pre-*Event* settlement prices.

⁴⁵ Michael J. Barclay, Eugene Kandel & Leslie M. Marx, *The Effects of Transaction Costs on Stock Prices and Trading Volume*, 7 J. OF FIN. INTERMEDIATION 130, 130-50 (1998).

⁴⁶ Domowitz et al., *supra* note 42, at 241-44.

Table 3
Daily Returns Before and After Imposition of Higher Transaction Cost

This table reports, for the relevant index futures contract or the stock market index, the daily return on the *Event Day*, the average daily return for the 5-day period before the *Event Day*, and the average daily return for the 5-day period after the *Event Day*. Daily return is defined as $\ln(\text{close price for the day}) - \ln(\text{close price for the previous day})$.

	Event	Pre-Event Average	Event Day	Post-Event Average
1	Japan, January 31, 1991, initial margins on Nikkei 225 Futures was raised from 15% to 20%.	0.003	-0.010	0.003
2	Poland, January 2, 1995, 0.2% tax on sales of stocks on Warsaw Stock Exchange.	0.0001	0.026	0.0005
3	Australia, October 24, 1997, SFE raised initial margin on All Ordinary Index Futures from A\$2,500 to A\$3,000.	0.002	-0.032	-0.015
4	Hong Kong, August 21, 1997, HangSeng Index Futures initial margin was increased from HK\$50,000 to HK\$55,000.	-0.007	-0.016	-0.006
5	Hong Kong, September 4, 1997, HangSeng Index Futures initial margin was increased from HK\$55,000 to HK\$60,000.	-0.008	-0.040	-0.001
6	Hong Kong, October 24, 1997, HangSeng Index Futures initial margin was increased from HK\$70,000 to HK\$75,000.	-0.051	0.059	-0.010
7	Hong Kong, November 4, 1997, HangSeng Index Futures initial margin was increased from HK\$75,000 to HK\$90,000.	0.022	-0.062	-0.028
8	India, June 18, 2001, National Stock Exchange increased margins on the ALBM session from 17.5% to 40%.	-0.007	-0.006	0.001

Table 3 reports the average daily returns before and after the *Event Day* as well as the daily return on the *Event Day*. Events #3, #5 and #7 have both a lower *Event Day* return and a lower average post-*Event* return, while Events #1 and #4 have a lower *Event Day*

return but a higher or unchanged post-*Event* return. Table 4 reports the average settlement prices before and after the *Event Day* as well as the settlement price on the *Event Day*. Events #1, #3, #4, #6 and #8 all have lower *Event Day* settlement prices and post-*Event* average settlement prices, although the differences from the pre-*Event* level in Events #1 and #3 appear nominal.

Table 4
Settlement Price Before and After Imposition of Higher Transaction Cost

This table reports, for the relevant index futures contract or the stock market index, the settlement price on the *Event Day*, the average settlement price for the 5-day period before the *Event Day* and the average settlement price for the 5-day period after the *Event Day*.

	Event	Pre-Event Average	Event Day	Post-Event Average
1	Japan, January 31, 1991, initial margins on Nikkei 225 Futures was raised from 15% to 20%.	23,824	23,570	23,808
2	Poland, January 2, 1995, 0.2% tax on sales of stocks on Warsaw Stock Exchange.	36	37	38
3	Australia, October 24, 1997, SFE raised initial margin on All Ordinary Index Futures from A\$2,500 to A\$3,000.	2,651	2,594	2,492
4	Hong Kong, August 21, 1997, HangSeng Index Futures initial margin was increased from HK\$50,000 to HK\$55,000.	16,000	15,725	15,576
5	Hong Kong, September 4, 1997, HangSeng Index Futures initial margin was increased from HK\$55,000 to HK\$60,000.	14,159	14,300	14,782
6	Hong Kong, October 24, 1997, HangSeng Index Futures initial margin was increased from HK\$70,000 to HK\$75,000.	12,198	11,240	10,248
7	Hong Kong, November 4, 1997, HangSeng Index Futures initial margin was increased from HK\$75,000 to HK\$90,000.	10,352	10,710	10,368
8	India, June 18, 2001, National Stock Exchange increased margins on the ALBM session	3,467	3,353	3,392

from 17.5% to 40%.

Whether or not the differences from the pre-*Event* level are statistically significant is reported in Table 5. At the 10% significance level, only Event #3 has a significantly lower return and settlement price on the *Event Day* as well as for the five-day period after the *Event Day*. This is evidenced by the low standings of the *Event Day* and post-*Event* numbers in the distribution of the pre-*Event* average returns and settlement prices (1%, 0% and 1% for the *Event Day* return, settlement price and post-*Event* average settlement price, respectively). Event #8 has a significantly lower *Event Day* settlement price and average post-settlement price, but its *Event Day* return is indifferent from the pre-*Event* average. This suggests that the lower *Event Day* and post-*Event* settlement price are likely due to a temporary declining time trend in settlement prices rather than the increase in transaction costs, since any significant impact of the higher cost would have been reflected in the *Event Day* return. Events #1, #5 and #7 have significantly low *Event Day* returns, but their post-*Event* average settlement prices are statistically indifferent from the pre-*Event* averages, suggesting that any price impact of an increase in transaction costs does not last beyond the first day of its imposition. Events #4 and #6 have significantly lower post-*Event* average settlement prices but higher or unchanged *Event Day* returns and settlement prices. This suggests that the lower post-*Event* average price is unrelated to the increase in transaction costs, whose impact, if any, is expected to be more prominent on the first day of its imposition. In sum, there is no compelling evidence to suggest that an increase in transaction costs in a substantial bear market has any long-lasting negative price impact.

Table 5
The Price Effect of Increasing Transaction Cost in Bear Markets

This table reports (1) the standing of the *Event Day* return in the distribution bootstrapped from the daily returns in the 5-day period prior to the *Event Day*, (2) the standing of the *Event Day* settlement price in the distribution bootstrapped from the settlement prices in the 5-day period prior to the *Event Day*, (3) the standing of the post-event average settlement prices in the distribution bootstrapped from settlement

prices for the 5-day period prior to the *Event Day*, and (4) the result of the Wilcoxon Rank Sum Test used to compare the settlement prices 5 days before and 5 days after the *Event Day*. Significant lower *Event Day* and post-*Event* return and settlement price are noted.

	Event	Distribution Percentile			Wilcoxon
		Event- Day Return	Event- Day Price	Post-Event Average Price	Rank Sum <i>p</i> Value
1	Japan, January 31, 1991, initial margins on Nikkei 225 Futures was raised from 15% to 20%.	0%**	0%**	26%	0.34
2	Poland, January 2, 1995, 0.2% tax on sales of stocks on Warsaw Stock Exchange.	100%	100%	100%	0.01
3	Australia, October 24, 1997, SFE raised initial margin on All Ordinary Index Futures from A\$2,500 to A\$3,000.	1%**	0%**	1%**	0.01**
4	Hong Kong, August 21, 1997, HangSeng Index Futures initial margin was increased from HK\$50,000 to HK\$55,000.	20%	2%	0%**	0.02**
5	Hong Kong, September 4, 1997, HangSeng Index Futures initial margin was increased from HK\$55,000 to HK\$60,000.	9%*	73%	99%	0.07
6	Hong Kong, October 24, 1997, HangSeng Index Futures initial margin was increased from HK\$70,000 to HK\$75,000.	100%	2%	0%**	0.02**
7	Hong Kong, November 4, 1997, HangSeng Index Futures initial	8%*	77%	48%	0.34

	margin increased HK\$75,000 to HK\$90,000.	was from to				
8	India, June 18, 2001, National Stock Exchange increased margins on the ALBM session from 17.5% to 40%.		58%	0%**	0%**	0.05**

** Significantly lower at 5% level.

* Significantly lower at 10% level.

D. Volume Effect

The effectiveness of using higher transaction costs to support government intervention and deter double-play manipulation depends on the absence of any negative impact of such higher costs on trading volume. Barclay, Kandel and Marx use the “bid-ask spread” as proxy for transaction costs and show that changes in the spread are negatively correlated with trading volume for NYSE and NASDAQ stocks.⁴⁷ Jones and Seguin have found that a reduction in the transaction costs leads to an increase in trading volume.⁴⁸ However, none of the existing studies focus on the volume effect of imposing higher transaction costs when the market is subject to persistent downward pressures. In addition, the results of these studies also appear inconsistent with the prevailing views of market participants.⁴⁹

In this paper, we examine the volume effect by (1) comparing the absolute trading volume on the *Event Day* with the average volume for the five-day period immediately before the *Event Day*; (2) comparing the daily percentage change in *trading volume*, defined as the percentage difference in the trading volumes between two consecutive trading days, on the *Event Day* with the

⁴⁷ Barclay et al., *supra* note 45, at 132.

⁴⁸ Jones & Seguin, *supra* note 42.

⁴⁹ For example, Steve Chan, the Chief Operating Officer of the Hong Kong Futures Exchange, said in response to the question of whether increasing the initial margin on Hang Seng Index Future would cause reduction in trading volume: “We have recorded more turnover since we raised the margin in August [1997]. I believe turnover is related to investors' need for hedging and not to the margin level. Futures exchange lifts margins to guard against sharp market moves.” Yiu, *supra* note 37.

average daily percentage change in the *trading volume* for the five-day period immediately before the *Event Day*; and (3) comparing the average post-*Event* daily *trading volume* with the pre-*Event* average daily *trading volume*. A conclusion that higher transaction costs lead to a lower *trading volume* that is non-transitory in nature should be supported by consistent evidence in all of the above measures.

Table 6 reports the absolute *trading volume* on the *Event Day* and the average *volume* before and after the *Event Day*. Only two *Event Days*, #5 and #7, show a reduced *trading volume* for both the *Event Day* and the post-*Event* period.

Table 6
Daily Trading Volume Before and After
Imposition of Higher Transaction Cost

This table reports, for the relevant index futures contract or the stock market index, the trading volume on the *Event Day*, the average daily trading volume for the 5-day period before the *Event Day* and the average daily trading volume for the 5-day period after the *Event Day*.

	Event	Pre-Event Average	Event Day	Post-Event Average
1	Japan, January 31, 1991, initial margins on Nikkei 225 Futures was raised from 15% to 20%.	60,349	56,733	70,805
2	Poland, January 2, 1995, 0.2% tax on sales of stocks on Warsaw Stock Exchange.	441	541	570
3	Australia, October 24, 1997, SFE raised initial margin on All Ordinary Index Futures from A\$2,500 to A\$3,000.	911	2,053	1,984
4	Hong Kong, August 21, 1997, HangSeng Index Futures initial margin was increased from HK\$50,000 to HK\$55,000.	31,650	41,188	39,884
5	Hong Kong, September 4, 1997, HangSeng Index Futures initial margin was increased from HK\$55,000 to HK\$60,000.	40,317	32,803	26,480
6	Hong Kong, October 24, 1997, HangSeng Index Futures initial margin was increased from HK\$70,000 to HK\$75,000.	53,290	54,817	54,227

7	Hong Kong, November 4, 1997, HangSeng Index Futures initial margin was increased from HK\$75,000 to HK\$90,000.	45,608	32,251	28,911
8	India, June 18, 2001, National Stock Exchange increased margins on the ALBM session from 17.5% to 40%.	20,588,716	21,516,460	20,042,796

Table 7 reports the daily percentage change in *trading volume* on the *Event Day* and the average percentage change before and after the *Event Day*. Although six out of eight events show a lower value for this measure on the *Event Day* relative to the pre-*Event* average, the difference is statistically significant at a 10% level in only three out of eight events, as shown in Table 8. Even among the three events that tested significantly, only Event #5 shows notably lower *trading volume* in all three measures of change (i.e., *Event Day* percentage change in *trading volume* relative to the pre-*Event* average, *Event Day* *trading volume* relative to the pre-*Event* average, and post-*Event* average *trading volume* relative to the pre-*Event* average). In Event #6, although the percentage change in *trading volume* on the *Event Day* is significantly lower, absolute *trading volume* is actually higher than the pre-*Event* average. This is also the case with Event #8. For Event #7, although the *Event Day* absolute *trading volume* and the post-*Event* average show significant declines from the pre-*Event* level, the *Event Day* percentage change is actually significantly higher than the pre-*Event* level. Thus, any reduction in the absolute *trading volume* on the *Event Day*, as well as during the post-*Event* period, is likely due to the existence of a temporary declining time trend in *trading volume* rather than the imposition of a higher transaction cost.

Table 7
Percentage Change in Daily Trading Volume Before and After Imposition of Higher Transaction Cost

This table reports, for the relevant index futures contract or the stock market index, the daily percentage change in trading volume on the *Event Day*, the average daily percentage change in trading volume for the 5-day period before the *Event Day*, and the average daily percentage change in trading volume for the 5-day period after the *Event Day*. Daily percentage change in trading volume is defined as (daily trading volume - daily trading volume on the previous day)/daily trading volume on the

previous day.

	Event	Pre-Event Average	Event Day	Post-Event Average
1	Japan, January 31, 1991, initial margins on Nikkei 225 Futures was raised from 15% to 20%.	-0.6%	-3.8%	10.2%
2	Poland, January 2, 1995, 0.2% tax on sales of stocks on Warsaw Stock Exchange	12.1%	-12.6%	-3.8%
3	Australia, October 24, 1997, SFE raised initial margin on All Ordinary Index Futures from A\$2,500 to A\$3,000.	10.5%	194.1%	37.6%
4	Hong Kong, August 21, 1997, HangSeng Index Futures initial margin was increased from HK\$50,000 to HK\$55,000.	14.6%	7.3%	1.5%
5	Hong Kong, September 4, 1997, HangSeng Index Futures initial margin was increased from HK\$55,000 to HK\$60,000.	4.2%	-25.8%	-11.5%
6	Hong Kong, October 24, 1997, HangSeng Index Futures initial margin was increased from HK\$70,000 to HK\$75,000.	23.9%	-34.3%	-9.2%
7	Hong Kong, November 4, 1997, HangSeng Index Futures initial margin was increased from HK\$75,000 to HK\$90,000.	-5.2%	23.6%	2.5%
8	India, June 18, 2001, National Stock Exchange increased margins on the ALBM session from 17.5% to 40%.	-0.1%	-10.9%	-2.2%

Table 8
The Volume Effect of Increasing Transaction Cost in Bear Markets

This table reports (1) the standing of the *Event Day* percentage change in trading volume in the distribution bootstrapped from the daily percentage change in trading volume in the 5-day period prior to the *Event Day*, (2) the standing of the *Event Day* trading volume in the distribution bootstrapped from the daily trading volume in the 5-day period prior to the *Event Day*, (3) the standing of the post-event average daily

trading volume in the distribution bootstrapped from the daily trading volume for the 5-day period prior to the *Event Day*, and (4) the result of the Wilcoxon Rank Sum Test used to compare the daily trading volumes 5 days before and 5 days after the *Event Day*. Significant lower *Event Day* and post-*Event* daily trading volume and lower *Event Day* percentage in trading volume are noted.

	Event	Distribution Percentile			Wilcoxon
		Event-Day Volume Change	Event-Day Volume	Post-Event Average Volume	Rank Sum <i>p</i> Value
1	Japan, January 31, 1991, initial margins on Nikkei 225 Futures was raised from 15% to 20%.	29%	12%	100%	0.07
2	Poland, January 2, 1995, 0.2% tax on sales of stocks on Warsaw Stock Exchange.	19%	97%	99%	0.11
3	Australia, October 24, 1997, SFE raised initial margin on All Ordinary Index Futures from A\$2,500 to A\$3,000.	100%	100%	100%	0.01
4	Hong Kong, August 21, 1997, HangSeng Index Futures initial margin was increased from HK\$50,000 to HK\$55,000.	26%	99%	98%	0.11
5	Hong Kong, September 4, 1997, HangSeng Index Futures initial margin was increased from HK\$55,000 to HK\$60,000.	0%**	0%**	0%**	0.01**
6	Hong Kong, October 24, 1997, HangSeng Index Futures initial margin was increased from HK\$70,000 to HK\$75,000.	0%**	58%	53%	0.42
7	Hong Kong, November 4, 1997, HangSeng Index Futures initial margin was	97%	6%*	1%**	0.07*

	increased from HK\$75,000 to HK\$90,000.				
8	India, June 18, 2001, National Stock Exchange increased margins on the ALBM session from 17.5% to 40%.	8%*	82%	29%	0.5

** Significantly lower
at 5% level.

* Significantly lower
at 10% level.

In sum, only one out of eight events shows a significantly lower *Event Day* percentage change in *trading volume*, the *Event Day* absolute *trading volume* and post-*Event* average *trading volume*. This result is inconsistent with the hypothesis that increasing transaction costs has the tendency to reduce trading volume.

IV. Conclusion

This paper proposes a solution to the dilemma that financial market regulators in developing economies face when their currency board system is subject to attacks by the so-called double-play manipulation strategy typically implemented at times of financial crisis. Interventions in equity markets may be required to break the self-fulfilling prophecy of the double-play manipulation, but the intervention demands an enormous capital resource that is typically beyond the budgetary limit and financial means of most governments in developing economies. We believe the solution lies in raising transaction costs on short sellers and supplementing the intervention with the revenue generated by such additional levy. Such a measure can only claim to be effective if it results in the alleviation of short pressures in the currency and/or stock markets. We set up a portfolio choice problem from the perspective of a double-play manipulator and examined how his optimal choice for short positions in both markets changes when facing such a regulatory measure. We find that the manipulator will be prompted to reduce his short positions in both the currency and the equity markets if the higher transaction costs do not lower volatility, reduce trading volume, and plunge the price. Our empirical study of eight historical events of regulators increasing transaction costs at times of financial crisis or substantial price

corrections suggests that these market conditions do not typically follow the imposition of higher costs. Our study has shown the viability of using higher transaction costs as a regulatory tool in combating double-play manipulations that exacerbate the pain suffered by developing economies going through difficult corrections. How such a tool is best implemented in different markets naturally depends on the geopolitical and economic environment of each individual country. A currency board system that is essential for the political and economic stability of developing economies has been, and will continue to be, a lucrative prey for financial sharks eyeing a long line of currency and stock market kills when a temporary dislocation exists between the pegged currencies. It is imperative for regulators to establish defense plans in preparation for future double-play attacks. We hope our study helps in this regard.

Appendix A: Derivation of Key Formulas

1. $g_t = vl_t(\tau) \frac{\tau}{20-\tau}$, where g_t = the number of futures

contracts that the government buys during the period of t to $t+1$, $vl_t(\tau)$ = trading volume (i.e., number of contracts traded) during the period t to $t+1$, not including the volume generated by the government's intervention. To see this:

Step 1 – Assumptions

We assume that the government is exempt from the initial margin requirement and other transaction costs but its positions are marked-to-market at the end of each period. Relaxation of this assumption does not change the results of our analysis because (1) initial margin deposits are insubstantial as they are merely opportunity costs of capital – the costs being the difference in interest accrued to margins deposited with the exchange and the returns that otherwise could be earned had they not been deposited with the futures exchange; and (2) the transaction costs, mainly in forms of stamp duties and exchange fees, etc., constitute a small percentage of the value of a trade.

Step 2

Let V = dollar (in local currency) value per index point. The transaction fees paid by the short positions executed at the index price level P_i are equal to $vl_{P_i}(\tau)P_iV\tau\%$. Since there is no upfront cost for the government to long positions in index futures, the government can use all revenues collected for payment of its marked-to-market obligations if the index futures price further declines. Let N_1 be the number of long contracts that the government can hold at the price level P_i with the transaction fee levies. Under the assumption that the government loses an average 20% on its long positions at $t+1$, the government's marked-to-market obligation for each long contract is $20\%P_iV$.

$$\text{Thus, } N_1 = \frac{vl_{P_i}(\tau)P_iV\tau\%}{20\%P_iV} = \frac{vl_{P_i}(\tau)\tau\%}{0.2}.$$

Step 3

Given the imbalance between short and long orders at times of crisis, we assume that the government's long orders are matched immediately with short orders. Short positions provide the government with revenues in the form of transaction fees against which the government is able to hold

additional $N_2 = \frac{\nu l_{P_i}(\tau)\tau\%}{0.2^2}$ long contracts at the index price

level P_i . This process goes on. Thus, at each price level P_i , the number of long contracts that the government can hold is equal to the following under the assumption that $0\% < \tau\% < 20\%$:

$$\begin{aligned} & \frac{\nu l_{P_i}(\tau)\tau\%}{0.2} + \frac{\nu l_{P_i}(\tau)\tau\%^2}{0.2^2} + \frac{\nu l_{P_i}(\tau)\tau\%^3}{0.2^3} + \dots \\ &= \frac{\nu l_{P_i}(\tau)\tau\%}{0.2} \left(1 + \frac{\tau\%}{0.2} + \frac{\tau\%^2}{0.2^2} + \frac{\tau\%^3}{0.2^3} + \dots \right) \\ &= \frac{\nu l_{P_i}(\tau)\tau\%}{0.2} \left(\frac{1}{1 - \frac{\tau\%}{0.2}} \right) = \frac{\nu l_{P_i}(\tau)\tau\%}{0.2 - \tau\%} \end{aligned}$$

Step 4

Adding the government's long positions at each price level gives:

$$\begin{aligned} g_t &= \frac{\nu l_{P_1}(\tau)\tau\%}{0.2 - \tau\%} + \frac{\nu l_{P_2}(\tau)\tau\%}{0.2 - \tau\%} + \frac{\nu l_{P_3}(\tau)\tau\%}{0.2 - \tau\%} + \dots \\ &= \frac{\tau\%}{0.2 - \tau\%} [\nu l_{P_1}(\tau) + \nu l_{P_2}(\tau) + \nu l_{P_3}(\tau) + \dots] \\ &= \frac{\tau\%}{0.2 - \tau\%} \nu l_t(\tau) = \nu l_t(\tau) \frac{\tau}{20 - \tau} \end{aligned}$$

2. The Objective Function and the First Order Conditions

The original objective function is:

$$\begin{aligned}
 & \text{Max}_{S_{s,t}, S_{f,t}} E \left\{ -\exp \left(-Ra \left[(W_0 - S_{f,t} F_t V \tau \%) (1 + r_t) + (F_t - F_{t+1}) S_{f,t} V - S_{s,t} (r_t - r_{t,us}) \right] \right) \right\} \\
 & \therefore E(e^{x\theta}) = e^{\theta E(x) + \frac{1}{2} Ra^2 \theta^2 \sigma^2} \\
 & \therefore E(e^{-RaW_{t+1}}) = e^{-RaE(W_{t+1}) + \frac{1}{2} Ra^2 \text{Var}(W_{t+1})} \\
 & \therefore E(W_{t+1}) = (W_0 - S_{f,t} F_t V \tau \%) (1 + r_t) \\
 & \quad + (F_t - E(F_{t+1})) S_{f,t} V - S_{s,t} (r_t - r_{t,us}) \\
 & \text{Var}(W_{t+1}) = \text{Var}(F_{t+1}) S_{f,t}^2 V^2 = \sigma_{f,t+1}^2 S_{f,t}^2 V^2, \\
 & \text{where } \sigma_{f,t+1}^2 = \sigma_{f,t+1}^2(\tau) = \text{Var}(F_{t+1})
 \end{aligned}$$

In addition,

$$\begin{aligned}
 & \therefore \text{Max} \left\{ -e^{-RaW_{t+1}} \right\} = \text{Min} \left\{ e^{-RaW_{t+1}} \right\} \\
 & = \text{Min} \left\{ e^{-RaE(W_{t+1}) + \frac{1}{2} Ra^2 \text{Var}(W_{t+1})} \right\} \\
 & = \text{Max} \left\{ e^{RaE(W_{t+1}) - \frac{1}{2} Ra^2 \text{Var}(W_{t+1})} \right\}
 \end{aligned}$$

Thus, the objective function can be written as:

$$\text{Max}_{S_{s,t}, S_{f,t}} e^{Ra \left[(W_0 - S_{f,t} F_t V \tau \%) (1 + r_t) + (F_t - E(F_{t+1})) S_{f,t} V - S_{s,t} (r_t - r_{t,us}) \right] - \frac{1}{2} Ra^2 S_{f,t}^2 V^2 \sigma_{f,t+1}^2}$$

Let

$$L = e^{Ra \left[(W_0 - S_{f,t} F_t V \tau \%) (1 + r_t) + (F_t - E(F_{t+1})) S_{f,t} V - S_{s,t} (r_t - r_{t,us}) \right] - \frac{1}{2} Ra^2 S_{f,t}^2 V^2 \sigma_{f,t+1}^2}$$

, the first order conditions are given by:

$$\frac{\partial L}{\partial S_{f,t}} \Rightarrow F_t - E(F_{t+1}) - F_t \tau \%(1 + r_t) - Ra S_{f,t} V \sigma_{f,t+1}^2 = 0 \tag{1}$$

$$\frac{\partial L}{\partial S_{s,t}} \Rightarrow -S_{s,t} V \frac{\partial E(F_{t+1})}{\partial S_{s,t}} - (r_t - r_{t,us}) = 0 \tag{2}$$

3. The Implicit Function Theorem and the Gramer's Rule

Taking derivative on both sides of first order conditions with regard to transaction fee τ produces the following conditions:

$$\begin{aligned}
 0 &= \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \left(\frac{\partial r_{t+1}}{\partial S_{s,t}} \frac{\partial S_{s,t}}{\partial \tau} + \frac{\partial r_{t+1}}{\partial O_r} \frac{\partial O_r}{\partial \tau} \right) + \frac{\partial E(F_{t+1})}{\partial g_t} \frac{\partial g_t}{\partial \tau} + \frac{\partial E(F_{t+1})}{\partial O_f} \frac{\partial O_f}{\partial \tau} + \frac{1}{100} F_t(1+r_t) \\
 &+ RaV\sigma_{f,t+1}^2 \frac{\partial S_{f,t}}{\partial \tau} + RaVS_{f,t} \frac{\partial \sigma_{f,t+1}^2}{\partial \tau} \\
 0 &= \frac{\partial S_{f,t}}{\partial \tau} \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}} + S_{f,t} \frac{\partial r_{t+1}}{\partial S_{s,t}} \left[\frac{\partial^2 E(F_{t+1})}{\partial r_{t+1}^2} \left(\frac{\partial r_{t+1}}{\partial S_{s,t}} \frac{\partial S_{s,t}}{\partial \tau} + \frac{\partial r_{t+1}}{\partial O_r} \frac{\partial O_r}{\partial \tau} \right) \right] \\
 &+ S_{f,t} \frac{\partial r_{t+1}}{\partial S_{s,t}} \frac{\partial^2 E(F_{t+1})}{\partial r_{t+1} \partial g_t} \frac{\partial g_t}{\partial \tau} + S_{f,t} \frac{\partial r_{t+1}}{\partial S_{s,t}} \frac{\partial^2 E(F_{t+1})}{\partial r_{t+1} \partial O_f} \frac{\partial O_f}{\partial \tau} \\
 &+ S_{f,t} \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \left(\frac{\partial^2 r_{t+1}}{\partial S_{s,t}^2} \frac{\partial S_{s,t}}{\partial \tau} + \frac{\partial^2 r_{t+1}}{\partial S_{s,t} \partial O_r} \frac{\partial O_r}{\partial \tau} \right)
 \end{aligned}$$

The above can be expressed in a matrix form as follows:

$$\begin{aligned}
 &\begin{bmatrix} -RaV\sigma_{f,t+1}^2 & -\frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}} \\ -\frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}} & -S_{f,t} \left(\frac{\partial r_{t+1}}{\partial S_{s,t}} \right)^2 \frac{\partial^2 E(F_{t+1})}{\partial r_{t+1}^2} - S_{f,t} \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial^2 r_{t+1}}{\partial S_{s,t}^2} \end{bmatrix} \begin{bmatrix} \frac{\partial S_{f,t}}{\partial \tau} \\ \frac{\partial S_{s,t}}{\partial \tau} \end{bmatrix} \\
 &=
 \end{aligned}$$

$$\left[\begin{array}{l} \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial O_r} \frac{\partial O_r}{\partial \tau} + \frac{\partial E(F_{t+1})}{\partial O_f} \frac{\partial O_f}{\partial \tau} + \frac{\partial E(F_{t+1})}{\partial g_t} \frac{\partial g_t}{\partial \tau} \\ + \frac{1}{100} F_t(1+r_t) + RaVS_{f,t} \frac{\partial \sigma_{f,t+1}^2}{\partial \tau} = A \\ S_{f,t} \frac{\partial r_{t+1}}{\partial S_{s,t}} \left(\frac{\partial^2 E(F_{t+1})}{\partial r_{t+1}^2} \frac{\partial r_{t+1}}{\partial O_r} \frac{\partial O_r}{\partial \tau} + \frac{\partial^2 E(F_{t+1})}{\partial r_{t+1} \partial O_f} \frac{\partial O_f}{\partial \tau} \right) \\ + S_{f,t} \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial^2 r_{t+1}}{\partial S_{s,t} \partial O_r} \frac{\partial O_r}{\partial \tau} + S_{f,t} \frac{\partial r_{t+1}}{\partial S_{s,t}} \frac{\partial^2 E(F_{t+1})}{\partial r_{t+1} \partial g_t} \frac{\partial g_t}{\partial \tau} = B \end{array} \right]$$

Let

$M \equiv$

$$\left[\begin{array}{cc} -RaV\sigma_{f,t+1}^2 & -\frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}} \\ -\frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}} & -S_{f,t} \left(\frac{\partial r_{t+1}}{\partial S_{s,t}} \right)^2 \frac{\partial^2 E(F_{t+1})}{\partial r_{t+1}^2} - S_{f,t} \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial^2 r_{t+1}}{\partial S_{s,t}^2} \end{array} \right]$$

$$\equiv \begin{bmatrix} M_{11} & M_{12} \\ M_{21} & M_{22} \end{bmatrix}$$

The above system of equations can be solved by using the Gramer's Rule:

$$\frac{\partial S_{f,t}}{\partial \tau} = \frac{\begin{vmatrix} A & M_{12} \\ B & M_{22} \end{vmatrix}}{\det|M|} = \frac{AM_{22} - BM_{12}}{\det|M|} \quad (3)$$

$$\frac{\partial S_{s,t}}{\partial \tau} = \frac{\begin{vmatrix} M_{11} & A \\ M_{21} & B \end{vmatrix}}{\det|M|} = \frac{BM_{11} - AM_{21}}{\det|M|} \quad (4)$$

4. Proof that the signs of $\frac{\partial S_{f,t}}{\partial \tau}$ and $\frac{\partial S_{s,t}}{\partial \tau}$ depend on the signs of A and B.

The elements of matrix M are second order derivatives of the objective function with regard to $S_{f,t}$ and $S_{s,t}$. To see this:

$$\therefore \frac{\partial L}{\partial S_{f,t}} = V(F_t - E(F_{t+1})) - F_t V \tau \%(1 + r_t) - Ra S_{f,t} V \sigma_{f,t+1}^2$$

$$\therefore \frac{\partial^2 L}{\partial S_{f,t}^2} = -V \frac{\partial E(F_{t+1})}{\partial S_{f,t}} - Ra V \sigma_{f,t+1}^2 = -Ra V \sigma_{f,t+1}^2,$$

because $\frac{\partial E(F_{t+1})}{\partial S_{f,t}} = 0$ by assumption

$$\therefore \frac{\partial L}{\partial S_{s,t}} = -S_{f,t} V \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}} - (r_t - r_{t,us}) = 0$$

$$\therefore \frac{\partial^2 L}{\partial S_{s,t}^2} = -S_{f,t} V \frac{\partial^2 E(F_{t+1})}{\partial r_{t+1}^2} \left(\frac{\partial r_{t+1}}{\partial S_{s,t}}\right)^2 - S_{f,t} V \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial^2 r_{t+1}}{\partial S_{s,t}^2}$$

$$\frac{\partial^2 L}{\partial S_{f,t} \partial S_{s,t}} = -V \frac{\partial E(F_{t+1})}{\partial S_{s,t}} = -V \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}}$$

$$\frac{\partial^2 L}{\partial S_{s,t} \partial S_{f,t}} = -V \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}} - S_{f,t} V \frac{\partial \left(\frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}} \right)}{\partial S_{f,t}}$$

\therefore By assumption,

$$E(F_{t+1}) = E[f(r_{t+1}(S_{s,t}(\tau), O_r(\tau)), g_r(\tau), O_f(\tau))]$$

$$\therefore \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \text{ and } \frac{\partial r_{t+1}}{\partial S_{s,t}} \text{ are not functions of } S_{f,t}.$$

Therefore, $\frac{\partial \left(\frac{\partial E(F_{t+1})}{\partial r_{t+1}} \right)}{\partial S_{f,t}} = 0$ and

$$\frac{\partial^2 L}{\partial S_{s,t} \partial S_{f,t}} = -V \frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}}$$

By second order necessary conditions,

$$M_{22} \leq 0 \text{ and } M_{11} \leq 0$$

$$M_{11} * M_{22} - M_{12} * M_{21} = \det|M| \geq 0$$

By well-recognized financial market experience, attacks on the local currency lead to higher local currency interest rate, thus

$$\frac{\partial r_{t+1}}{\partial S_{s,t}} > 0.$$

By well-recognized financial market experience, an increase in local currency interest rate leads to lower local stock prices, thus

$$\frac{\partial E(F_{t+1})}{\partial r_{t+1}} < 0.$$

$$\text{Thus, } M_{12} = M_{21} = -\frac{\partial E(F_{t+1})}{\partial r_{t+1}} \frac{\partial r_{t+1}}{\partial S_{s,t}} > 0.$$

$$\text{Thus, if } A \geq 0 \text{ and } B \geq 0, \frac{\partial S_{f,t}}{\partial \tau} < 0 \text{ and } \frac{\partial S_{s,t}}{\partial \tau} < 0.$$

