How Does the Capital Gains Tax Affect the Relationship between Stock Price Index and Exchange Rate in Taiwan?

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Abstract

This paper investigates how the passage of capital gains tax affects the relationship between stock prices and exchange rates in Taiwan. The results find a unidirectional causality from exchange rates to stock prices and a negative relationship between them in both the periods before and after the capital gains tax. The long-run cointegration relationship between stock prices and exchange rates in the pre-capital gains tax period no longer exists in the post-capital gains tax period. This paper proposes a "fund market hypothesis" to explain these results.

Keywords: Stock prices; exchange rates; capital gains tax; Granger causality test; cointegration; Taiwan.

JEL Classification: F31, F38, H26.

I.   Introduction

In 2012, when Ma, Ying-Jeou once again won Taiwan's presidential election and renewed his term of office, his government officials immediately advocated levies of the capital gains tax and the rich tax for the goals of fair taxation and fiscal soundness. The Executive Yuan soon set up a working group on fiscal consolidation in March 2012 responsible for discussing and developing viable options for amending the income taxation. The amendments to the Income Tax Act and the Income Basic Tax Act for the capital gains tax (a levy on domestic investors' net profits from the sale of securities) and the rich tax (raising the maximum marginal tax rate of individual income tax to 45% and reducing the dividend tax deduction ratio to 50%) were passed in July 2012 and May 2014, respectively.

The capital gains tax and the rich tax opened the prelude to unfair competition between foreign and domestic investors in Taiwan's securities market. The real tax burden on domestic investors is almost the double of that on foreign investors after the implementation of the new tax system, forcing powerful domestic investors either to transform themselves into foreign investors or to divert their funds to overseas markets to avoid the tax. As a result, the share of foreign investors in the Taiwan stock market has been rising steadily since then (see Figure 1), and the impact of foreign investors on this market has increased significantly. This paper is interested in exploring whether the passage of the amendments to income tax acts, which causes the unfair competition between foreign and domestic investors in the securities market, changes the interaction between stock prices and exchange rates in Taiwan.

The good market hypothesis (international trading effect) formulates that for exporters, the appreciation of domestic currency has an adverse effect on their sales and therefore decreases their earnings and stock prices; for importers, on the other hand, the effect is the opposite (Aggarwal, 1981; Dornbusch and Fisher, 1980; Kim, 2003). Thus, the hypothesis predicts that in an export-oriented country using the direct quotation to quote foreign exchange prices (the value of a unit of foreign currency in the national currency), such as Taiwan, the stock

price may have a positive relationship with the exchange rate and their causal relationship may be a unidirectional one running from exchange rates to stock prices. However, the asset market hypothesis (portfolio balance effect) stands for a negative correlation between stock prices and exchange rates whose causal relationship would be a reverse unidirectional one from stock prices to exchange rates (Bahmani-Oskooee and Sohrabian, 1992; Frankel, 1983).
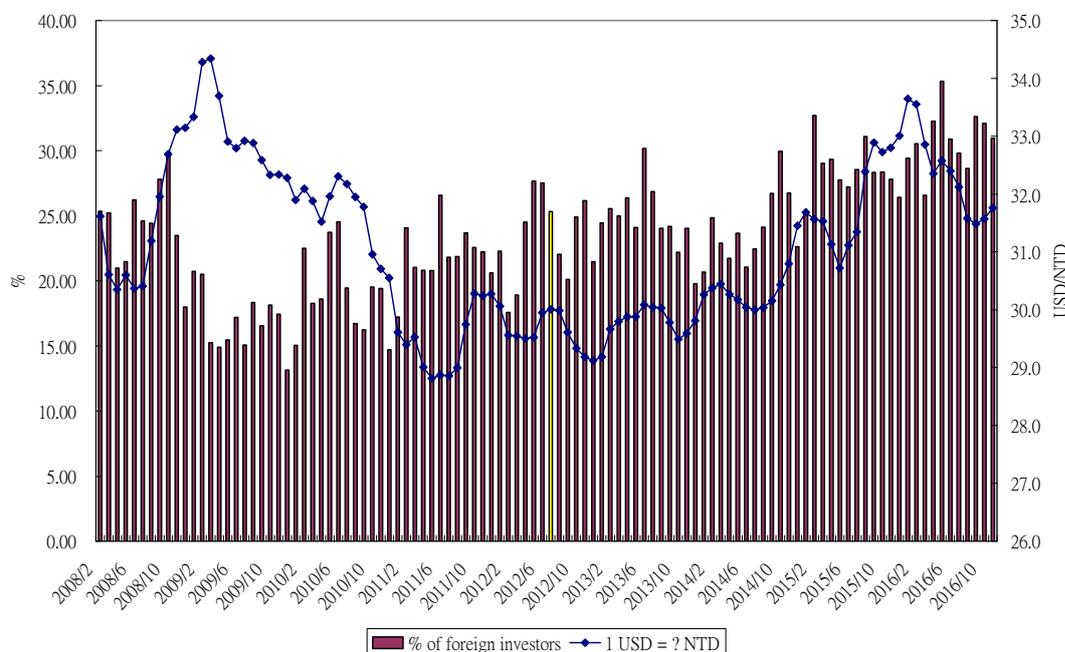

Figure 1 the share of foreign investors in total trading value versus the exchange rate of US dollar against the new Taiwan dollar, February 2008 to November 2016

To empirically test the hypotheses above, Granger et al. (2000) use daily data of seven East-Asian countries for the period 1986-1997 and find a unidirectional causality from stock prices to exchange rates in Taiwan, which is in line with the argument of the portfolio balance effect. Pan et al. (2007) examine the linkages between stock prices and exchange rates using daily data of seven Asian countries from 1988 to 1998 and find that during the Asian financial crisis period no long-run equilibrium relationship between exchange rates and stock prices exists for all the seven countries. For Taiwan, no significant causal relationship from exchange rates to stock prices has been found before the 1997 Asian financial crisis, yet during the financial crisis period, a causal relationship from exchange rates to stock prices exists. Yau and Nieh (2009), on the other hand, use monthly data of Taiwan from 1991 to 2008 and find evidence of a long-run positive relationship running from exchange rates to stock prices, which supports the international trading effect. Tsai (2012) uses monthly data of six Asian countries from 1992 to 2009 and finds that the negative relationship between stock prices and exchange rates is more obvious when exchange rates are extremely high or low.

Like previous empirical studies, this paper sets a pre- and post-event scenario to observe the changes in the relationship between stock prices and exchange rates, thereby testing the related hypotheses. Since the event in this study is the amendment to income tax acts causing the unfair competition between foreign and domestic investors and the increasing impact of foreign investors on Taiwan's stock market, this paper proposes a new "fund market hypothesis" to formulate the relationship between stock prices and exchange rates. This hypothesis argues that when the influence of foreign investors rises to a certain extent and can manipulate the stock market, the inflow of foreign funds would lead to the appreciation

of domestic currency and the rise of stock prices, and then contribute to the formation of a negative relationship between stock prices and exchange rates and to a causality from exchange rates to stock prices, which can be called "foreign investors effect". Table 1 provides a comparison of this new hypothesis with the previous hypotheses in predicting the relationship between exchange rates and stock prices. To test this new hypothesis as well as the previous ones, this paper estimates the relationship between stock prices and exchange rates in Taiwan after the passage of the capital gains tax and compares the results with those in the previous period, during which the taxes faced by domestic and foreign investors are more equal.

Table 1: A comparison of the predictions of the three hypotheses regarding the exchange rate-stock price relationship

Hypothesis	Contemporary relationship	Causal relationship
Good market hypothesis	positive	Exchange rate → stock price
Asset market hypothesis	negative	Stock price → exchange rate
Fund market hypothesis	negative	Exchange rate → stock price

The remainder of this paper is organized as follows. Section II describes the data and variables. Section III contains the methodology and the empirical results. And Section IV summarizes the most important conclusions of this paper.

II.   Data and Variables

This paper uses daily data from February 21, 2008 to November 30, 2016 to examine the relationship between stock prices and exchange rates in Taiwan. Using the time point of the passage of levying tax on capital gains as the dividing point, this study divides the whole data period into the period before capital gains tax (February 21, 2008 to June 29, 2012) and the period after capital gains tax (July 2, 2012 to November 30, 2016) to investigate how the capital gains tax affects the relationship between stock prices and exchange rates in Taiwan and to test the various hypotheses for explaining the relationship. Here I use the Taiwan Stock Exchange Capitalization Weighted Stock Index (TAIEX) as the stock price variable and the exchange rate of US dollar against the new Taiwan dollar as the exchange rate variable and gather these data from the Taiwan Economic Journal (TEJ) database and the Central Bank of the Republic of China. Table 2 presents the descriptive statistics of the TAIEX and the USD/NTD exchange rate for the periods before and after the capital gains tax.

Table 2: Descriptive statistics of the TAIEX and the USD/NTD exchange rate

Period	Pre-capital gains tax		Post-capital gains tax	
Variable	TAIEX	USD/NTD	TAIEX	USD/NTD
Mean	7398.567	31.211	8538.664	30.886
Median	7600.870	31.132	8544.050	30.406
Maximum	9295.200	35.174	9973.120	33.838
Minimum	4089.930	28.632	6970.690	29.039
Std. Dev,	1228.935	1.522	667.417	1.242
Skewness	-1.029	0.164	-0.160	0.538
Kurtosis	3.503	2.046	2.210	2.133
Observation	1089	1089	1089	1089

I also compute log returns for the TAIEX (TX) and the USD/NTD exchange rate (ER) using following equations where $r_{TX,t}$ and $r_{ER,t}$ are the log returns at day t for the TAIEX and the USD/NTD exchange rate, respectively:

$$r_{TX,t} = \log \frac{TX_t}{TX_{t-1}} \times 100\% \qquad (1)$$

$$r_{ER,t} = \log \frac{ER_t}{ER_{t-1}} \times 100\% \qquad (2)$$

III.   Methodology and Empirical Results
III.1 Short-run causal relationship between stock prices and exchange rates
Following previous literature (e.g. Agrawal et al., 2010; Hatemi-Irandoust, 2002; Smyth and Nandha, 2003; Tsagkanos and Siriopoulos, 2013), I use Granger causality test to examine the short-run causal relationship between stock prices and exchange rates. However, this test requires that all data series involved are stationary. Otherwise, the test-statistics would have non-standard distributions and the inference from F-statistic might be spurious (Kollias et al., 2010). Therefore, I first use Augmented Dickey-Fuller (ADF) unit root test to check the stationarity of the two series (TAIEX and USD/NTD exchange rate). Table 3 presents the results of ADF unit root test, which show that in both the pre- and post-capital gains tax periods, the two series are non-stationary but their log return series are stationary. Accordingly, the Granger causality test is applied to the log returns of the two series to examine the short-run causal relationship between stock prices and exchange rates (Table 4).

Table 3: Augmented Dickey-Fuller unit root test

Null hypothesis	t-Statistic	Prob.
Pre-capital gains tax period		
TAIEX has a unit root	-0.4648	0.5141
Log return of TAIEX has a unit root	-30.5803	0.0000
USD/NTD has a unit root	-0.5400	0.4831
Log return of USD/NTD has a unit root	-29.8545	0.0000
Post-capital gains tax period		
TAIEX has a unit root	-2.0235	0.2768
Log return of TAIEX has a unit root	-31.4211	0.0000
USD/NTD has a unit root	-0.9890	0.7590
Log return of USD/NTD has a unit root	-31.9148	0.0000

The results of Granger causality test in Table 4 show that, in both the pre- and post-capital gains tax periods, only a unidirectional causality from exchange rates to stock prices exists, which is consistent with the predictions of the good market and the fund market hypotheses. Such relationship is more significant in the post-capital gains tax period, indicating that after the passage of levying tax on capital gains, the foreign investors does enhance their influence over Taiwan's stock market and that the fund market hypothesis may explain the relationship better.

Table 4: Granger causality test

Null hypothesis	F-Statistic	Prob.
Pre-capital gains tax period		
Log return of USD/NTD does not Granger Cause Log return of TAIEX	9.4525	0.0022
Log return of TAIEX does not Granger Cause Log return of USD/NTD	1.7129	0.1909
Post-capital gains tax period		
Log return of USD/NTD does not Granger Cause Log return of TAIEX	14.6228	0.0001
Log return of TAIEX does not Granger Cause Log return of USD/NTD	0.5275	0.4678

Note: Lags to be included in the test are decided by Akaike information criterion.

III.2 Contemporaneous relationship between stock prices and exchange rates

Using log returns of the USD/NTD exchange rate and the TAIEX as independent and dependent variables, respectively, this paper further constructs the following regression equation to examine the contemporaneous relationship between stock prices and exchanger rates.

$$r_{TX,t} = \alpha + \beta \times r_{ER,t} + \varepsilon_t \qquad (3)$$

Intercept α and coefficient β are parameters of the regression. Table 5 reports the regression results and shows that whether in the pre- or post-capital gains tax periods, stock prices are significantly and negatively correlated to exchange rates. The results do not meet the prediction of the good market hypothesis but support the argument of the new "fund market hypothesis" when the causal relationship is running from exchange rates to stock prices.

Table 5: Contemporaneous regression analysis

Period	α	β	$Adj. R^2$
Pre-capital gains tax period	-0.0220 (-0.5444)	-2.5783 (-17.7540)***	0.2242
Post-capital gains tax period	0.0286 (1.2312)	-1.2721 (-13.0513)***	0.1348

Note: Those in parentheses are *t*-statistics of the coefficients. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

I also use quantile regression approach to estimate the above regression equation and to observe the relationships between stock prices and exchange rates across different quantiles of the dependent variable (log return of the TAIEX). Figure 2 exhibits the estimation results for the pre- and post-capital gains tax periods. The results show that in the pre-capital gains tax period, the negative relationship between stock prices and exchange rates is stronger in lower quantiles, and that the relationship seems asymmetric for the extrema sets of quantiles (0.1 vs. 0.9 and 0.2 vs. 0.8). In the post-capital gains tax period, this negative relationship between stock prices and exchange rates turns into more stable and symmetric, an outcome may be interpreted as the formation or normalization of the foreign investor's effect.
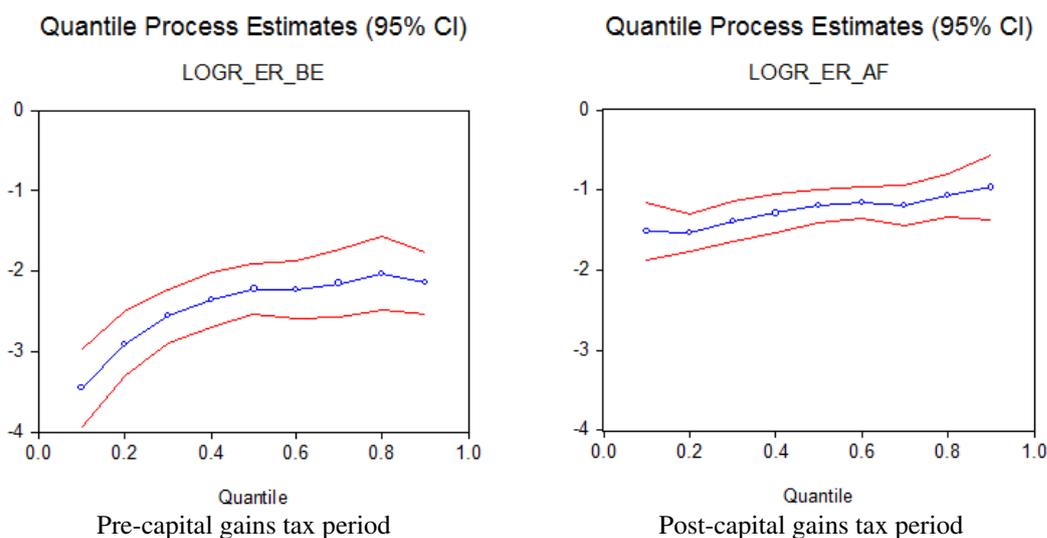

Pre-capital gains tax period   Post-capital gains tax period

Figure 2 slope (β) estimates across different quantiles of the log returns of the TAIEX

III.3 Long-run equilibrium relationship between stock prices and exchange rates

Nelson and Plosser (1982) indicate that the differencing of time series data may lead to the loss of important long-term information in the data itself. Engle and Granger (1987) propose the concept of cointegration to solve the above problems. In a model with an intercept term but no deterministic trend, the results of Johansen cointegration tests show that a cointegration relationship between stock prices and exchange rates exists in the pre-capital gains tax period (Table 6). However, in the post-capital gains tax period, this long-run relationship disappears (Table 7).

Table 6: Johansen cointegration test for the pre-capital gains tax period

Hypothesized No. of CE(s)	Eigenvalue	Test Statistic	0.05 Critical Value	Prob.
Unrestricted Cointegration Rank Test (Trace)				
None	0.0146	21.8748	20.2618	0.0297
At most 1	0.0054	5.8851	9.1645	0.1998
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
None	0.0146	15.9898	15.8921	0.0483
At most 1	0.0054	5.8851	9.1645	0.1998

Note: "CE" stands for cointegration equation. "Prob." displays MacKinnon-Haug-Michelis (1999) *p*-values.

Table 7: Johansen cointegration test for the post-capital gains tax period

Hypothesized No. of CE(s)	Eigenvalue	Test Statistic	0.05 Critical Value	Prob.
Unrestricted Cointegration Rank Test (Trace)				
None	0.0058	8.6091	20.2618	0.7721
At most 1	0.0021	2.2403	9.1645	0.7296
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
None	0.0058	6.3688	15.8921	0.7455
At most 1	0.0021	2.2403	9.1645	0.7296

Note: "CE" stands for cointegration equation. "Prob." displays MacKinnon-Haug-Michelis (1999) *p*-values.

The estimated cointegration equation for the pre-capital gains tax period is as follows:

$$TX_{t-1} = 22735.23 - 496.49 \times ER_{t-1}$$

The long-run equilibrium relationship that includes error correction (*ec*) term can also be expressed as follows:

$$ec_{t-1} = TX_{t-1} + 496.49 \times ER_{t-1} - 22735.23$$

The corresponding vector error correction model (VECM) is as follows:

$$\Delta TX_t = -0.0025 \times ec_{t-1} + 0.0272 \times \Delta TX_{t-1} + 0.0001 \times \Delta TX_{t-2} - 107.69 \times \Delta ER_{t-1}^{***} - 43.99 \times \Delta ER_{t-2}$$

$$\Delta EX_t = -0.00000965 \times ec_{t-1}^{***} + 0.0000448 \times \Delta TX_{t-1} - 0.0000196 \times \Delta TX_{t-2} + 0.1137 \times \Delta ER_{t-1}^{***} + 0.0225 \times \Delta ER_{t-2}$$

where the superscript, ***, denotes significance at 1% level.

The above results confirm the negative relationship between stock prices and exchange rates in the pre-capital gains tax period and indicate that only the fund market hypothesis can explain such a negative relationship with a unidirectional causality from exchanges rates to stock prices. Even in the pre-capital gains tax period, the relationship between stock prices and exchange rates has displayed a type that the fund market hypothesis advocates. The results also show that when the relationship deviates from the long-run equilibrium, the error

correction from exchange rates is much more significant, and that short-term fluctuations in the exchange rate (ΔER_{t-1}) can explain the short-term changes in the TAIEX (ΔTX_t). Moreover, the disappearance of the cointegration relationship between stock prices and exchange rates in the post-capital gains tax period demonstrates that the passage of the capital gains tax and the rich tax does affect the original equilibrium relationship between stock prices and exchange rates in Taiwan and may lead to increased influence of foreign investors over the Taiwan stock market.

IV.   Conclusion

The amendments to the Income Tax Act and the Income Basic Tax Act for the capital gains tax and the rich tax were passed in July 2012 and May 2014, respectively, and opened the prelude to unfair competition between foreign and domestic investors in Taiwan's securities market. This paper investigates how these tax amendments affect the relationship between stock prices and exchange rates in Taiwan.

Two competing hypotheses, the good market hypothesis and the asset market hypothesis, are often used to explain the stock-price and exchange-rate relationship. This paper proposes a new "fund market hypothesis" to explain the stock-price and exchange-rate relationship in a securities market where the influence of foreign investors has risen to a certain extent and can manipulate the stock market.

Using daily data and dividing the whole data period (February 21, 2008 to November 30, 2016) into the pre- and post-capital gains tax periods, this paper applies Granger causality test, contemporaneous regression analysis and cointegration analysis to examine the short-run and long-run relationships between stock prices and exchange rates in Taiwan. The results show that in both the pre and post-capital gains tax periods, only a unidirectional causality from exchange rates to stock prices exists. The causal relationship is strengthened in the post-capital gains tax period indicating that the passage of the amendments to income tax acts and thereby the unfair competition between foreign and domestic investors in the securities market do enhance the influence of foreign investors. Stock prices are significantly and negatively related to exchange rates, and this negative relationship is asymmetric in pre-capital gains tax period yet turns into more stable and symmetric in the post-capital gains tax period. This negative relationship between stock prices and exchanges rates with causality from exchange rates to stock prices meets the expectation of the fund market hypothesis.

The results also show that a cointegration relationship between stock prices and exchange rates is present in the pre-capital gains tax period yet disappears in the post-capital gains tax period, indicating that the passage of the capital gains tax and the rich tax does affect the original equilibrium relationship between stock prices and exchange rates in Taiwan. All the above results demonstrate that the passage of the capital gains tax does lead to increased influence of foreign investors on Taiwan's stock market. Since then, the action of foreign investors has gradually and profoundly manipulated the ups and downs of the stock market.

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