Responding to Domestic and Global Shocks: Exchange Rate Policy in Vietnam, 2007-2009

Abstract

The paper presents an analysis of exchange rate policy in Vietnam during 2007-09 when the country faced a series of domestic and global shocks. Although Vietnam initially experienced appreciation pressure amid buoyant capital inflows, in early 2008, it faced a sudden reversal as signs of developing domestic vulnerabilities became evident. The downward pressure on the exchange rate then intensified with the onset of the global financial crisis in the fall of 2008. In these environments, the Vietnamese authorities used various exchange rate policy measures to influence developments in the official and parallel foreign exchange markets. The paper documents a shift in Vietnam's de facto exchange rate regime, from a basket peg to a simple US dollar peg, when the domestic vulnerabilities became compounded by the evolving global crisis. The authorities also utilized additional policy measures, including devaluation of the official rate, widening of the trading band, market intervention, and interest rate actions to relieve pressure on the dong. An event study methodology reveals that upward adjustments in the base interest rate as well as dollar selling intervention were effective in stabilizing the exchange rate. Parallel market dynamics further indicate that intervention had immediate impact, while devaluation and widening of the band had considerable lags in their impact. All of these measures had the effect of reducing the parallel market premium.

Key words: exchange rate policy, foreign exchange market intervention, official exchange rate, trading band, parallel exchange rate, base interest rate, the global crisis, Vietnam.

JEL classification: F31, E52, C32

I. Introduction

The paper presents an analysis of exchange rate policy in Vietnam during 2007-09, when the country faced a series of domestic and global shocks. Although Vietnam initially experienced appreciation pressure amid buoyant capital inflows, in early 2008, the country faced a sudden reversal as signs of developing domestic vulnerabilities became evident. The downward pressure on the exchange rate then intensified with the onset of the global financial crisis in the fall of 2008. In these environments, the Vietnamese authorities used various exchange rate policy measures to influence developments in the official and parallel foreign exchange markets. The paper reviews the policy measures taken and assesses their effectiveness in relieving pressure on the exchange rate. A novel feature of our analysis is the application of a Kalman filter to the celebrated Frankel-Wei regression, in order to identify the timing of a shift in the de facto exchange rate regime. An event study (or news analysis) methodology is then used to assess the effectiveness of devaluation of the official exchange rate, widening of the trading band, foreign exchange market intervention, and interest rate actions in stabilizing the parallel exchange rate.

The paper contributes to the literature on exchange rate policy as a crisis management tool. Although various exchange rate policy measures have been taken in the past to respond to a currency crisis, there is a general lack of consensus in the literature on their effectiveness. For example, should a country under a managed float increase or reduce exchange rate flexibility when faced with downward pressure on the currency? Does raising interest rates help arrest a depreciating currency when there is a speculative attack? An especially large literature has emerged on the relationship between interest rates and exchange rates (e.g., Kim 2003, 2005; Evans and Lyons 2005; Caporale et al. 2005; and Fatum and Scholnick 2008). The case of Vietnam would be unique in this context as it is a semi-financially open economy. Though it controls capital flows tightly, it condones the existence of a parallel foreign exchange market. The very use of monetary policy instruments by the Vietnamese authorities to address pressure in the foreign exchange market is an indication of their recognition that they have little direct control over a substantial part of cross-border financial flows. The experience of Vietnam should therefore yield important implications for other developing countries that are at a similar stage of capital account openness.

There are three major findings. First, the paper verifies that the country's de facto regime switched from a managed float (in the form of a basket peg) to a simple dollar peg. The application of a Kalman filter algorithm to the conventional Frankel-Wei methodology further indicates that the shift took place in June 2008 when the State Bank of Vietnam carried out a number of exchange rate policy actions to stabilize the parallel exchange rate. Second, the paper utilizes an event study (or news analysis) methodology to show that dollar selling intervention and raising the base interest rates were effective in defending the dong when the country faced downward speculative pressure. Parallel

market dynamics, however, reveal that while intervention had immediate and significant impact on the parallel rate in a desired direction, devaluation and widening of the band had considerable lags in their impact. Finally, devaluation and intervention led to a significant reduction in the parallel market premium. All of these results are robust to the choice of event day or event windows.

The remainder of this paper is organized as follows. Section II reviews the major exchange rate policy related actions taken by the Vietnamese authorities during 2007-09, against the movements of the official and parallel exchange rates of the Vietnamese dong against the US dollar. Section III examines how the authorities may have shifted the country's de facto regime in response to the evolving crisis. Section IV assesses the impact of exchange rate policy actions, including devaluation of the official exchange rate, widening of the trading band, foreign exchange market intervention, and interest rate actions, in stabilizing the exchange rate. Section V presents a summary and a conclusion. Finally, Apendix 1 provide information on Vietnam's macroeconomic background during 2006-2009, Appendix II explains how net monthly interventions are estimated from published data, and Appendices III-V present the results of various robustness checks.

II. Exchange Rate Policy during 2007-09

Official and parallel exchange rates in Vietnam

The Vietnamese authorities used various exchange rate policy measures, including interest rate actions, in response to exchange rate developments during 2007-09 (see Table 1 for a summary of these measures). In reviewing the exchange rate developments during this period, however, one must first understand that Vietnam's foreign exchange market consists of official and parallel markets. The official market covers the official rate announced by the State Bank of Vietnam (SBV) and the inter-bank rate determined among commercial banks licensed to do foreign exchange business. Since 25 February 1999, the SBV has followed the practice of announcing on each working day an official US dollar exchange rate of the dong, along with a trading band, on the basis of the average actual exchange rates of preceding days in the inter-bank market. The inter-bank market rate in turn is determined freely among the licensed banks, subject to the requirement that buying and selling rates remain within the ceilings and floors established around the official rate (Figure 1). In contrast, exchange rates in the parallel market are determined by demand and supply conditions, and are in principle not subject to regulation by the SBV.

The parallel market is illegal but has emerged in response to the tight control of foreign exchange transactions in the official market.[1] First, according to the Ordinance on Foreign Exchange, market participants in the official market are limited to commercial banks, credit institutions, and import-export companies. Although import-export companies have access to foreign exchange from commercial banks upon submission of required documents, foreign exchange may not be always

[1] According the Circular 33/NH-TT, dated 15th March 1989, foreign exchange transactions can only be carried out through authorized commercial banks and other organizations, and any transactions in the parallel market are illegal."

available and the required procedures are cumbersome. Second, the authorities impose tight controls on purchases of foreign exchange by individuals, even for current account transactions. The parallel market typically offers more attractive terms for buying foreign exchange, so that individuals and import-export companies that have legally acquired foreign exchange prefer to go to the parallel market, thus ensuring its viability as an alternative source of foreign exchange funding.

Responding to appreciation pressure, early 2007-early 2008

A series of market opening measures, symbolized most prominently by World Trade Organization (WTO) accession in January 2007, made Vietnam an attractive destination for foreign investors. Stock prices were rising in late 2006 and early 2007. Vietnam thus became a recipient not only of large foreign direct investment (FDI) inflows but also of significant equity inflows (see Appendix I for Vietnam's general macroeconomic background during 2006-2009). These clearly put appreciation pressure on the Vietnamese dong. From late 2007 to early 2008, the dong's inter-bank and parallel rates appreciated (from 16240 to 15820 dong per US dollar and from 16280 to 15600 dong per US dollar, respectively), though the official rate was kept around 16115 dong per US dollar (Figure 2). The relative abundance of US dollars meant that both the inter-bank and parallel exchange rates were below the official rate.

The SBV intervened in the inter-bank market to buy more than US$9 billion during 2007 to ease appreciation pressure on the dong (see Appendix II), with the result that the balance of foreign exchange reserves reached a record US$23.5 billion at the end of the year. At the same time, it attempted to sterilize the impact of intervention by selling Treasury bonds, and by increasing reserve requirements on dong deposits (from 5 to 10, and further to 11 percent) as well as on foreign currency deposits (from 8 to 10, and further to 11 percent). In March 2008, the central bank also sold 20, 300 billion dong in one-year "compulsory" Treasury bills (i.e., government bills commercial banks are "required" to purchase)[2] to 41 commercial banks at the coupon rate of 7.8 percent. Despite these efforts, total liquidity increased by 46 percent compared with 2006.

Responding to domestic disturbances, mid to late 2008

A new situation emerged in the middle of 2008, when it had become apparent that Vietnam faced several economic disturbances. First, the rate of inflation had reached at more than 28 percent (year on year) in August 2008, the highest level in 17 years. Second, equity and real estate prices had tumbled from the beginning of the year (the declines would amount to nearly 70 percent and 50 percent, respectively, from January to December). Third, market interest rates had risen substantially (e.g., from 7.5 percent in January to 19 percent in July for 3-month deposits). Finally, the trade balance had begun to record large deficits of US$14.21 billion in the first six months of 2008. As market participants saw lurking problems for the prospects of the Vietnamese economy, the dong began to depreciate from late May 2008, reaching a bottom of 16,522 per US dollar on 8 July in the inter-bank

[2] 41 commercial banks are required to purchase these bills at a coupon rate below the prevailing market rate.

market and 19,400 per US dollar on 19 Jun 2008 in the parallel market. Morgan Stanley, for example, stated on July 7, 2008: "Vietnam will fail to halt declines in their currency by using intervention because their economy is slowing and trade deficits widening."[3] Around the same time, some observers believed that Vietnam was facing a speculative attack on the currency.[4]

In response, on 19 June 2008, the SBV Governor stated that Vietnam had sufficient foreign exchange reserves of US$20.7 billion (equivalent to 15-16 weeks of imports), which he said would be augmented to more than US$ 22 billion in 2008. At the same time, the central bank introduced a package of measures to address the turbulence in the currency market, including: (i) readiness to sell US dollars directly to commercial banks; (ii) devaluation of the official exchange rate from 16,139 to 16,461 dong per US dollar on 11 June 2008; (iii) widening of the trading band from ±1 to ±2 percent on 26 June 2008; (iv) stricter controls on parallel market transactions to prevent speculation; (v) an immediate increase in the base interest rate from 8.75 to 12 percent and further to 14 percent in another 10 days; and (vi) an increase in the interest rate on compulsory T-bills from 7.8 to 13 percent. These measures appeared to have calming influence on the market. In late July 2008, the dong stabilized around 16,800 dong per US dollar in both the official and parallel markets.

Responding to the global financial crisis, late 2008 through 2009

Following the Lehman failure, the central bank intensified its efforts to further stabilize the foreign exchange market. On 6 November 2008, the SBV widened the trading band to ±3 percent, in what appeared to be a move toward greater exchange rate flexibility. On 25 December 2008, the central bank devalued the official rate, from 16,494 to 16,989 dong per US dollar, in an apparent attempt to shore up the economy against threats of the global recession. As stability was achieved, from 20 October 2008, the SBV aimed for a gradual reduction of the base interest rate in several steps, from 14 to 7 percent (see Table 1; Figure 3). Likewise, the SBV cut reserve requirements on dong denominated deposits in several steps, from 11 to 5 percent. These actions clearly indicated the authorities' intention to switch from monetary tightening (designed to stabilize the exchange rate) to monetary easing in order to help facilitate the country's recovery from the contractionary impact of the global crisis.

After experiencing relative stability during the first months of 2009, the dong began to depreciate sharply in late June. The parallel rate continued to depreciate and, in November 2009, reached a low of 19,800 dong per US dollar (see Figure 2). The sharp depreciation of the parallel exchange rate reflected several interrelated factors. First, there was a deficit in the trade balance deficit of US$10.5 billion during the first 10 months of the year. Second, because of the global economic crisis, Vietnam experienced a withdrawal of foreign investments and a decline in current transfers from overseas Vietnamese (*Viet Kieu*). Third, the balance of foreign exchange reserves declined gradually to a bottom of US$17,9 billion in November 2009 (from the peak of US$26.4 billion in

[3] http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aHON8OO56km4&refer=india
[4] See, for example, Chan and Packard, Moody's Economy.com- 13 June 2008. http://www.viet-studies.info/kinhte/VN_currency_criseS_TuPackard.pdf

March 2008). Fourth, in the last quarter of 2009, Vietnamese firms arbitraged, either legally or illegally, on the large difference that had emerged between domestic and foreign gold prices,[5] which led to an unexpected demand for US dollars. These developments created the expectation that the SBV would devalue the dong in the short run.

In response, on 25 November 2009, the SBV devalued the official exchange rate by 5.16 percent, from 17,034 to 17,961 dong per US dollar, and narrowed the trading band from ±5 to ±3 percent. In addition, the central bank increased the base interest rate from 7 to 8 percent and implemented a package of policy measures, including: (i) imposition of surrender requirements for seven state-owned corporations;[6] (ii) requirement that eight largest commercial banks sell foreign exchange (especially US dollars) to importers of essential goods used as inputs in domestic production, and to certain individuals who had a legitimate need; (iii) stricter control of foreign exchange transactions in the parallel markets; and (iv) fixing the official exchange rate at 17,941 dong per US dollar, from 12 December (the rate remained until 10 February 2010). Following the implementation of these measures, the parallel exchange rate appreciated somewhat through the end of 2009.

III. Identifying a Shift in Vietnam's De Facto Exchange Rate Regime, 2007-09

Was there a change in Vietnam's de facto exchange rate regime during the crisis? Although we can easily identify how they changed the official exchange rate or the width of the trading band just from official policy announcements or by looking at the data, we need a more rigorous statistical procedure in order to verify if there was any change in the way the authorities managed the exchange rate from day to day. One way to do this is to follow Frankel and Wei (1994, 2008), and to regress the exchange rate of the Vietnamese dong over those of major currencies that are considered important, all expressed in terms of a numeraire currency:

$$\Delta \log H_t = \alpha + \sum w(j)[\Delta \log X(j)_t] + u_t \qquad (1)$$

where: H_t is the exchange rate of the dong in terms of the numeraire at time *t*; $X(j)_t$ is the exchange rate of currency *j* in terms of the numeraire at time *t*; w(j) is the implicit weight of currency *j* in the determination of the dong exchange rate; and u_t is a disturbance term.

The currencies to be included in equation (1) are those of Vietnam's major partners in trade, finance, and investment based on the 2008 data, and include the US dollar (USD), the euro (EUR), the British pound (GBP), the Japanese yen (JPY), the Australian dollar (AUD), the Korean won (KRW), the Singapore dollar (SGD), the Chinese yuan (CNY), the Thai baht (THB), and the Malaysian ringgit (MLR). The SDR, the Swiss franc (CHF), the New Zealand dollar (NZD), and the GBP (when it is not included on the right hand side) are alternatively used as the numeraire currency (only the results

[5] The arbitrage involved purchasing gold in foreign markets and selling it in the domestic market at a higher price.

[6] The seven state-owned corporations included PetroVietnam, Vietnam National Coal-Mineral Industries Group, Vietnam National Chemical Group, Southern Airport Corporations, Vietnam Northern Food Corporation, Vietnam Southern Food Corporation, and Vietnam Machinery Erection Corporation. They were required to sell immediately 30 percent of the foreign currency term deposits they held (as of 31 December 2009), and the remaining 70 percent within the first two months of 2010.

based on SDR and CHF are reported in the text; those based on NZD and GBP are in Appendix II). Daily exchange rate data, for the period 1 January 2007-31 December 2009, come from the IMF's *International Financial Statistics* (only when the SDR is used as the numeraire), and the Pacific Exchange Rate Services of the Sauder School of Business, University of British Colombia.[7]

In view of the number of exchange rate policy measures taken during 2007-09, as outlined the previous section, it is reasonable to consider the possibility of a structural break (or structural breaks) in the relationship between the dong and other currencies. Thus, we employ the Kalman filter method to allow time-varying coefficients. The Kalman filter is an efficient recursive filter that estimates the state of a linear dynamic system from a series of noisy measurements; it provides the optimal estimator of a state vector at time *t*, based on information available at the time (Harvey 1989). The space state model for estimating the implicit currency weights is given by:

$$\begin{aligned}\Delta \log VND_t = \; & \alpha + \beta_{1,t}\Delta \log USD_t + \beta_{2,t}\Delta \log EUR_t + \beta_{3,t}\Delta \log GBP_t + \beta_{4,t}\Delta \log JPY_t + \\ & + \beta_{5,t}\Delta \log AUD_t + \beta_{6,t}\Delta \log KRW_t + \beta_{7,t}\Delta \log SGD_t + \beta_{8,t}\Delta \log CNY_t + \\ & + \beta_{9,t}\Delta \log THB_t + \beta_{10,t}\Delta \log MLR_t + + u_t \qquad (2)\end{aligned}$$

$$\beta_{1,t} = \beta_{1,t-1} + v_t \qquad (3)$$

where: Δ is a first difference operator; α is a fixed coefficient; $\beta_{j,t}$ is a vector of time-varying coefficients of the j^{th} currency *j* ; u_t is a scalar disturbance term; and v_t is a vector of disturbance terms. Equation (2) is a measurement (or signal) equation, while equation (3) represents a transition (or state) equation. The combination of these two equations gives a recursive system for estimating the implicit weights of the US dollar and other currencies.

Specifically, we estimate the following signal and state equations, in terms of SDR and CHF:

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dlogVND = c(1) + sv1*dlogUSD + sv2*dlogEUR + sv3*dlogGBP + sv4*dlogJPY +
        + sv5*dlogAUD + sv6*dlogKRW + sv7*dlogSGD + sv8*dlogCNY +
        + sv9*dlogTHB + sv10*dlogMLR + sv11                              (4)

        sv1 = sv1(-1)                                                    (5-1)
        sv2 = sv2(-1)                                                    (5-2)
        sv3 = sv3(-1)                                                    (5-3)
        sv4 = sv4(-1)                                                    (5-4)
        sv5 = sv5(-1)                                                    (5-5)
        sv6 = sv6(-1)                                                    (5-6)
        sv7 = sv7(-1)                                                    (5-7)
        sv8 = sv8(-1)                                                    (5-8)
        sv9 = sv9(-1)                                                    (5-9)
        sv10 = sv10(-1)                                                  (5-10)
        sv11 = c(3)*sv11(-1)  + [var = exp(c(2))]                        (5-11)
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[7] http://fx.sauder.ubc.ca/data.html

where equation (4) and equations (5-1)-(5-11), respectively, represent the signal and state equations.

The correlograms of the bilateral exchange rates between the dong and two numeraire currencies (abbreviated as VND/SDR and VND/CHF) show that the orders of the AR and MA models are 1 and 0, respectively (Table 2). The AR coefficient is parameterized in terms of c(3) (see equation 5-11), while there is no estimation for MA coefficient. It is found to be positive or negative depending on the numeraire, but it is insignificant with all level. Therefore, the Kalman filter is suitable for estimating the weight of the US dollar and other currencies in the basket of dong.

Table 3 provides the final values of the state vectors sv1, sv2,…, sv10 or $\beta_{i,t}$ ($i = \overline{1,10}$) in the notations of equations (2) and (3) (sv11, a vector of residuals, is not presented in this table). These estimates indicate that, with the SDR used as the numeraire, the final value of the weight of the US dollar, at 0.992, is significant at the one percent level of significance. The results do no change materially with the Swiss franc used as the numeraire: it is 1.05 and statistically significant at the same significance level. In contrast, the final values of the weights of all the other currencies are small and for the most part statistically not significant. These results suggest that the Vietnamese authorities made a shift in the country's de facto exchange rate regime from a managed float (in the form of a basket peg) to a simple dollar peg during the course of 2007-09.

But when was the shift made? Figure 4 depicts the evolution of the weight of the US dollar when the SDR or the Swiss franc is alternatively used as the numeraire.[8] Over the period January 2007-December 2009, the US dollar's weight rose gradually; it rose from less than 70 percent before July 2007 (when the subprime crisis occurred) to over 99 percent (or even beyond when the Swiss franc is used) at the end of the period. The gradual rise in the weight of the US dollar in the first half of 2008 coincided with the devaluation of the official exchange rate and the widening of the band (see Table 1). The hardening of the de facto US dollar peg towards the end of 2009, moreover, coincided with the number of exchange rate policy actions taken to stabilize the parallel exchange rate. Against the background of visible exchange rate policy actions, there was thus a shift in the way the exchange rate was managed from day to day.

How was the evolving weight of the US dollar reflected in market volatility?[9] Daily data show that volatility, measured as daily percentage changes, was extremely low throughout the period in the official market; the exchange rate changed substantially only three times (11 June 2008, 25 December 2008, and 26 November 2009) when the official rate was devalued (Figure 5). In some sense, this is not surprising. After all, the authorities had tight control over official foreign exchange transactions. A more interesting result concerns the parallel market, where we observe different phases of exchange rate volatility over the period. Initially, volatility was low. Then, from May to July 2008, volatility fluctuated between 2 and 5 percent on either side. From then on, volatility remained for the

[8] These results do not change when the New Zealand dollar or the Bristish pound is used as the numeraire currency (see Appendix III).

[9] In a country like Vietnam where foreign exchange transactions are tightly controlled, it is difficult to make a clear conceptual distinction between market volatility and exchange rate flexibility. Thus, daily percentage changes in the exchange rate can be interpreted alternatively as a measure of volatility or as a measure of flexibility.

most part below 2 percent on either side. This reduction in volatility (despite the widening of the trading band) corresponded to the identified shift to a more conventional US dollar peg as the crisis intensified.

IV. Assessing the Effectiveness of Exchange Rate Policy Actions

How effective were the series of exchange rate policy actions (as summarized in Table 1) in stabilizing the parallel exchange rate in a desired direction? To address this question, we employ below an event study (news analysis) methodology. While it is straightforward to identify the timing of most policy measures (including devaluation, widening of the band, and interest rate actions), the same does not hold for foreign exchange market intervention. In Vietnam, the authorities do not disclosure when and how much they intervene in the market. We have verified, however, that each announcement by the SBV of its willingness to intervene was followed by a change in the balance of foreign exchange reserves for that month in the corresponding direction. All in all, as summarized in Table 1, the SBV devalued the official rate three times, widened the trading band six times, announced their intention to intervene six times, and changed the base interest rate 10 times , during 2007-09.

We define below "an event" as a period of days around the announcement of a policy measure. In particular, an event typically consists of (i) pre-event days, (ii) the event day; and (iii) post-event days. When there was a lapse of time between the announcement date and the effective date, we assume that the first date was more relevant because the impact of an anticipated event should have already been reflected in the parallel exchange rate, if the market was efficient at all. Thus, we use the first date as the event day, though we use the second date as a robustness check. We set the length of an event alternatively as 20 working days (4 weeks) or 30 working days (6 weeks) around the event day[10].

We characterize it as "a success" when an exchange rate policy action is identified to influence the exchange rate in an intended manner (Fatum and Hutchison 2003a, 2003b). There are two criteria of success: (i) whether the change during post-event days is in the same direction as the policy measure—the "direction" criterion; and (ii) whether the news is associated with a smoothing of the exchange rate movement—the "smoothing" criterion. According to these criteria, news analysis would consider the following cases to be a success (the reverse will hold for an exchange rate policy action of opposite nature):

- Direction criterion: if devaluation, widening of the band, foreign exchange selling intervention, or an increase in the base interest rate leads to an appreciation of the dong ($\Delta s_{i+} < 0$) and a fall in the parallel market premium ($\Delta PRE_{i+} < 0$) in the post-event window; and
- Smoothing criterion: if devaluation, widening of the band, foreign exchange selling intervention, or an increase in the base interest rate leads to smaller exchange rate volatility

[10] We also used 40 working days as a robustness check.

($\Delta s_{i+} < \Delta s_{i-}$) and greater stability in the parallel market premium ($\Delta PRE_{i+} < \Delta PRE_{i-}$) from pre-event to post-event windows,

where: Δs_{i+} and Δs_{i-} are changes in the exchange rate during the post-event and pre-event windows, respectively; PRE is a parallel market premium, defined as a percentage differential between the average parallel rate and the official rate; and ΔPRE_{i+} and ΔPRE_{i-} are changes in the parallel market premium during the post-event and pre-event windows, respectively.

The non-parametric sign test of Mackinlay (1997) is employed to assess the effectiveness of exchange rate policy actions. This statistic examines whether the "direction" of the parallel exchange rate change following an exchange rate policy action (e.g. from depreciation during the pre-event window to appreciation during the post-event window), or "smoothing" of the parallel exchange rate change following an exchange rate policy action (e.g. smaller depreciation) is random or systematic. A significant sign test indicates that the observed number of successes is not a random finding attributable to the equal probability of appreciation or depreciation (Fatum and Hutchison 2003a, 2003b). Table 4 summarizes the null and alternatives hypotheses of the non-parametric sign test for the event study.

First, we assess the effectiveness of (i) devaluation of the official rate and (ii) widening of the trading band on the parallel exchange rate. As the parallel exchange rate, we consider four series: (i) the buying rate, (ii) the selling rate, (iii) the average rate, and (iv) the parallel market premium.[11] A non-parametric sign test applied to parallel exchange market data shows that these policy actions were not successful in stabilizing the parallel exchange rate for a 20-day event window although they were more successful for a longer (30-day) window (Table 5). With respect to the parallel market premium, the literature generally suggests an important role of expectations. Donrbusch et al (1983) and Phylaktis (1996), for example, find that the parallel market premium rises with an expectation of depreciation but falls toward zero when the official rate is actually devalued (see also Pozo and Wheeler 1999; Diamandis 2005). Our finding indicating that the premium declined when devaluation was announced is consistent with this conventional wisdom.

Second, we follow the same procedure to assess the effectiveness of foreign exchange market intervention. The non-parametric sign test indicates that, in contrast to the effectiveness of the other exchange rate policy measures, foreign exchange market intervention was effective in stabilizing the parallel exchange rate for both event windows, and on the basis of both criteria (Table 6). Although actual intervention operations remained undisclosed, it appears that an announcement by the SBV of its readiness to intervene sent the market a strong signal of its commitment to achieving exchange rate stability. These findings are consistent with those of Fatum and Hutchison (2003a, 2003b) and Kim (2003, 2005).[12] The news of intervention, moreover, had a similar impact on the parallel market

[11] Daily data are obtained from the Bank for Foreign Trade of Vietnam.

[12] Fatum and Hutchison (2003a, 2003b), utilizing an event study framework, found strong evidence that sterilized intervention systemically influenced the US dollar exchange rates of the deutsche mark (during September 1, 1985-December 31, 1995) and the Japanese yen (during April 1,1991-December 31, 2000). Likewise, Kim (2003, 2005) applied a structural

premium.

Finally, we assess the effectiveness of interest rate actions, using the base interest rate.[13] As we earlier noted, the SBV both raised and lowered the base interest rate during 2007-09 in order to address pressure in the foreign exchange market (see Table 1). Applying the same methodology, we find that an increase in the base interest rate led to a significant appreciation of the dong on the basis of both criteria (Table 7), consistent with the conventional view that monetary tightening leads to a nominal exchange rate appreciation during a crisis (Eichenbaum and Evans 1995; Caporale et al. 2005; Kim 2005). In contrast, a cut in the base interest rate did not seem to have the intended effect on the parallel exchange rate. This asymmetric response of the parallel exchange rate to monetary easing and tightening is robust with respect to whether the event window is 20 days or 30 days, or whether the announcement date or the effective date is used.

V. Concluding Remarks

The paper has reviewed how the Vietnamese authorities used exchange rate policy to respond to domestic and global shocks affecting the country during 2007-09, and assessed the effectiveness of some of the policy actions in relieving pressure in the parallel foreign exchange market. An application of a Kalman filter algorithm to the conventional Frankel-Wei regression identified a shift in Vietnam's de facto exchange rate regime, from managed float (in the form of a basket peg) to a simple US dollar peg, further identifying that the shift took place in June 2008 when the State Bank of Vietnam (SBV) introduced a number of exchange rate policy actions to stabilize the parallel exchange rate. An event study (or news analysis) methodology was then used to assess the effectiveness of devaluation, changes in the width of the trading band, market intervention, and changes in the base interest rate in helping to stabilize the parallel exchange rate. For the most part, exchange rate policy actions had expected impact on the parallel exchange rate. In particular, they all contributed to a significant reduction in the parallel market premium. Parallel market dynamics, however, revealed that while intervention had immediate and significant impact on the parallel exchange rate in a desired direction, devaluation and widening of the band had considerable lags in their impact.

Interestingly, the parallel exchange rate displayed asymmetric responses to monetary tightening and easing. Although the parallel rate appreciated significantly when the base interest rate was raised, it hardly responded to a cut in the base interest rate. It is possible that this asymmetric behavior of the parallel exchange rate reflects the corresponding asymmetry in the way the parallel market is organized: inflows of funds into the parallel market are curtailed immediately when the official interest rate is raised, whereas a pick up in inflows is not immediate after the official interest rate is lowered, given the costs of transferring funds between the parallel and official markets. The

VAR model to the US and Canada to find that foreign exchange intervention had substantial effect on the trade-weighted exchange rate of the US dollar against the currencies of other major industrial countries.

[13] The SBV uses the base interest rate as an instrument of monetary policy, not unlike the Federal funds rate in the Untied States. It is determined on the basis of inter-bank interest rates, interest rates on open market operations, average deposit rates at commercial banks, as well as the supply and demand conditions in the money market. The base interest rate serves as a benchmark for determining commercial bank lending rates.

apparent effectiveness of the interest rate defense of the dong may also to some extent have been enhanced by the thinness of the market, where the costs of speculation are high to begin with.

Another important aspect of the Vietnamese experience concerns the June 2008 package, in which the authorities implemented two seemingly contradictory measures: they shifted to a de facto US dollar peg, while widening the trading band. This combination seemed to work in calming the market, possibly because the authorities thereby succeeded in demonstrating a greater commitment to defending the dong while eliminating the possibility of a one-way bet. The result was smaller exchange rate volatility in the parallel market, despite the fact that the authorities allowed greater exchange rate flexibility in the inter-bank market. This experience of Vietnam seems to yield an important insight into how market participants respond to exchange rate policy actions, and provide a potential lesson for other developing countries that may face a similar speculative attack on their currency.

Table 1. Exchange Rate Policy Related Announcements, 2007-2009

	Policy measure	Announcement date	Effective date
Change in the official exchange rate (dong per US dollar)			
1	Devalued by 2 percent (from 16134 to 16461)	11 Jun 2008	11 Jun 2008
2	Devalued by 2.9 percent (from 16494 to 16989)	25 Dec 2008	25 Dec 2008
3	Devalued by 5.16 percent (from 17034 to 17961)	25 Nov 2009	26 Nov 2009
Change in the width of the trading band (on either side of the official rate)			
1	Widened to 0.75 percent (from 0.5 percent previously)	24 Dec 2007	24 Dec 2007
2	Widened to 1 percent	7 Mar 2008	10 Mar 2008
3	Widened to 2 percent	26 Jun 2008	27 Jun 2008
4	Widened to 3 percent	6 Nov 2008	7 Nov 2008
5	Widened to 5 percent	24 Mar 2009	25 Mar 2009
6	Narrowed to 3 percent	25 Nov 2009	26 Nov 2009
Market intervention (an estimated amount of net intervention during the month of announcement in parentheses) 1/			
1	Announcement of willingness to sell foreign exchange (an estimated US$1.698 billion sold during the month)	27 May 2008	n.a.
2	Announcement of willingness to sell foreign exchange (an estimated US$1.336 billion sold during the month)	26 June 2008	n.a.
3	Announcement of williness to buy foreign exchange (an estimated US$1.46 billion bought during the month)	12 Sep 2008	n.a.
4	Announcement of willingness to sell foreign exchange (an estimated US$153 million sold during the month)	16 May 2009	n.a.
5	Announcement of willingness to sell foreign exchange (an estimated US$1.18 billion sold during the month)	10 July 2009	n.a.
6	Announcement of willingness to sell foreign exchange (an estimated US$925.6 million sold during the month)	25 Nov 2009	n.a.
Change in the base interest rate			
1	Raised to 8.75 percent (from 8.25 percent)	30 Jan 2008	1 Feb 2008
2	Raised to 12 percent	30 May 2008	2 Jun 2008
3	Raised to 14 percent	10 Jun 2008	11 Jun 2008
4	Lowered to 13 percent	20 Oct 2008	21 Oct 2008
5	Lowered to 12 percent	3 Nov 2008	5 Nov 2008
6	Lowered to 11 percent	20 Nov 2008	21 Nov 2008
7	Lowered to 10 percent	3 Dec 2008	5 Dec 2008
8	Lowered to 8.5 percent	19 Dec 2008	22 Dec 2008
9	Lowered to 7 percent	23 Jan 2009	1 Feb 2009
10	Raised to 8 percent	25 Nov 2009	26 Nov 2009

Sources: The State Bank of Vietnam; IMF, *International Financial Statistics.*

Note: 1/ The amount of net intervention is calculated as a change in the balance of foreign exchange, adjusted for estimated interest income on the average balance. The US Treasury bill rate is used as the interest rate. See Appendix II for more details.

Table 2. Correlograms of Log(SDR/VND) and Log(CHF/VND)

	Log(SDR/VND)				Log(CHF/VND)			
	AC	**PAC**	**Q-Stat**	**Prob**	**AC**	**PAC**	**Q-Stat**	**Prob**
1	0.986	0.986	671.41	0.000	0.991	0.991	715.60	0.000
2	0.974	0.040	1327.1	0.000	0.982	0.021	1419.6	0.000
3	0.962	0.016	1968.1	0.000	0.973	0.008	2112.3	0.000
4	0.951	0.010	2594.9	0.000	0.964	-0.047	2792.8	0.000
5	0.938	-0.056	3205.9	0.000	0.956	0.035	3462.2	0.000
6	0.925	-0.023	3800.8	0.000	0.948	0.029	4121.4	0.000
7	0.912	-0.021	4379.5	0.000	0.938	-0.077	4768.6	0.000
8	0.900	0.051	4944.2	0.000	0.929	-0.029	5403.3	0.000
9	0.887	-0.062	5493.0	0.000	0.919	0.016	6026.3	0.000
10	0.873	-0.006	6026.1	0.000	0.909	-0.071	6635.8	0.000
11	0.860	-0.000	6544.0	0.000	0.900	0.074	7234.1	0.000
12	0.846	-0.043	7046.0	0.000	0.890	-0.035	7820.6	0.000
13	0.832	-0.006	7532.3	0.000	0.880	-0.040	8394.4	0.000
14	0.818	0.001	8003.3	0.000	0.869	-0.021	8955.5	0.000
15	0.804	-0.028	8458.6	0.000	0.859	0.012	9504.3	0.000
16	0.789	-0.044	8897.6	0.000	0.850	0.036	10042.	0.000
17	0.773	-0.032	9319.8	0.000	0.840	-0.012	10568.	0.000
18	0.757	-0.006	9725.7	0.000	0.830	-0.033	11082.	0.000
19	0.742	-0.001	10116.	0.000	0.819	-0.049	11583.	0.000
20	0.726	-0.026	10490.	0.000	0.808	0.005	12072.	0.000
21	0.710	0.005	10849.	0.000	0.798	0.021	12550.	0.000
22	0.695	0.005	11193.	0.000	0.789	0.066	13017.	0.000
23	0.686	0.204	11528.	0.000	0.780	-0.014	13475.	0.000
24	0.677	0.038	11855.	0.000	0.771	-0.013	13922.	0.000
25	0.668	0.027	12174.	0.000	0.764	0.120	14361.	0.000
26	0.660	0.021	12485.	0.000	0.757	0.047	14794.	0.000
27	0.651	-0.020	12790.	0.000	0.750	-0.036	15220.	0.000
28	0.642	-0.041	13086.	0.000	0.744	0.019	15639.	0.000
29	0.633	-0.017	13375.	0.000	0.738	0.004	16052.	0.000
30	0.625	0.045	13657.	0.000	0.732	0.008	16458.	0.000

Table 3. Final State Estimates

	Numeraire: SDR			Numeraire: CHF		
	Coeffcients	**Root MSE**	**P-value**	**Coeffcients**	**Root MSE**	**P-value**
USD	0.992***	0.146706	0.0000	1.05***	0.098	0.0000
EUR	0.019	0.056643	0.7389	0.011	0.04	0.7697
GBP	0.036	0.026241	0.1665	0.033**	0.017	0.0470
JPY	-0.037	0.023776	0.1112	0.001	0.017	0.9137
AUD	-0.006	0.019294	0.7417	0.005	0.013	0.7134
KRW	-0.032	0.013989	0.0204	-0.02	0.01	0.0369
SGD	0.115	0.072073	0.1099	0.012	0.047	0.7946
CNY	0.123	0.135102	0.3612	-0.115	0.101	0.2542
THB	0.037	0.050791	0.4605	0.011	0.015	0.4673
MLR	-0.137	0.056137	0.0146	0.059*	0.033	0.0726

Note: ***, **, * indicates that the coefficient is significant at 1 percent, 5 percent and 10 percent, respectively.

Table 4: Null and Alternative Hypotheses of the Non-parametric Sign Test

	"Direction" criterion	**"Smoothing" criterion**
Devaluation of the official rate, widening of the trading band, and foreign exchange selling intervention.	**Ho**: Change in the parallel exchange rate (or the parallel market premium) in post-event days = 0 **Ha**: Change in the parallel exchange rate (or the parallel market premium) in post-event days < 0	**Ho**: Comparison of changes in the parallel exchange rate (or the parallel market premium) from post-event days to pre-event days = 0 **Ha**: Comparison of changes in the parallel exchange rate (or the parallel market premium) from post-event days to pre-event days < 0
An increase in the base interst rate	**Ho**: Change in the parallel exchange rate (or the parallel market premium) in post-event days = 0 **Ha**: Change in the parallel exchange rate (or the parallel market premium) in post-event days < 0	**Ho**: Comparison of changes in the parallel exchange rate (or the parallel market premium) from post-event days to pre-event days = 0 **Ha**: Comparison of changes in the parallel exchange rate (or the parallel market premium) from post-event days to pre-event days < 0
A cut in the base interest rate	**Ho**: Change in the parallel exchange rate (or the parallel market premium) in post-event days = 0 **Ha**: Change in the parallel exchange rate (or the parallel market premium) in post-event days > 0	**Ho**: Comparison of changes in the parallel exchange rate (or the parallel market premium) from post-event days to pre-event days = 0 **Ha**: Comparison of changes in the parallel exchange rate (or the parallel market premium) from post-event days to pre-event days > 0

Table 5. Non-parametric Sign Test of the Effectiveness of Changes in the Width of the Trading Band and the Official Exchange Rate

Event window	Type of exchange rate	Devaluation of the official exchange rate				Widening of the trading band			
		Direction criterion $\Delta s_{i+} < 0$		Smoothing criterion $\Delta s_{i+} < \Delta s_{i-}$		Direction criterion $\Delta s_{i+} < 0$		Smoothing criterion $\Delta s_{i+} < \Delta s_{i-}$	
		"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/
20-day windows	Buying rate at Hanoi	22/50	0.8389	57/101	0.1162	37/77	0.6756	77/149	0.3716
	Selling rate at Hanoi	27/49	0.2841	58/96	0.0260**	41/76	0.2833	79/150	0.2839
	Average rate at Hanoi	25/54	0.7517	60/106	0.1032	42/83	0.5000	84/161	0.3182
	Parallel market premium	29/60	0.6506	65/119	0.1797	57/97	0.0519*	118/197	0.0033***
30-day windows	Buying rate at Hanoi	38/76	0.5456	91/152	0.0092***	61/115	0.2880	114/212	0.1515
	Selling rate at Hanoi	43/75	0.1240	91/147	0.0024***	66/112	0.0361**	117/211	0.0648*
	Average rate at Hanoi	41/80	0.4555	93/158	0.0157**	68/124	0.1616	123/227	0.1161
	Parallel market premium	49/90	0.2304	102/179	0.0363**	84/141	0.0141**	165/285	0.0045***

Notes: 1/ Number of "successful" days over total days in an event window.

(2) Based on a binomial probability distribution with the probability of an individual success of 50 percent.

***, **, * indicate that the policy measure is successful at the 1, 5, and 10 percent levels, respectively

Table 6. Non-parametric Sign Test of the Effectiveness of Foreign Exchange Market Intervention

Event window	Type of exchange rate	Foreign exchange selling intervention			
		Direction criterion $\Delta s_{i+} < 0$		Smoothing criterion $\Delta s_{i+} < \Delta s_{i-}$	
		Successful days 1/	P-value 2/	Successful days 1/	P-value 2/
20-day windows	Buying rate at Hanoi	45/80	0.1572	98/152	0.0002***
	Selling rate at Hanoi	48/74	0.007***	99/145	0.0000***
	Average rate at Hanoi	48/84	0.1149	103/160	0.0002***
	Parallel market premium	54/91	0.0465**	111/178	0.0006***
30-day windows	Buying rate at Hanoi	62/106	0.0491**	131/203	0.0000***
	Selling rate at Hanoi	65/99	0.0012***	132/197	0.0000***
	Average rate at Hanoi	65/111	0.0435**	136/214	0.0000***
	Parallel market premium	73/120	0.0110**	149/236	0.0000***

Notes: (1) Number of "successful" days over total days in an event window.

(2) Based on a binomial probability distribution with the probability of an individual success of 50 percent.

***, **, * indicate that the policy measure is successful at the 1, 5, and 10 percent levels of significance, respectively

Table 7. Non-parametric Sign Test of the Effectiveness of Interest Rate Actions

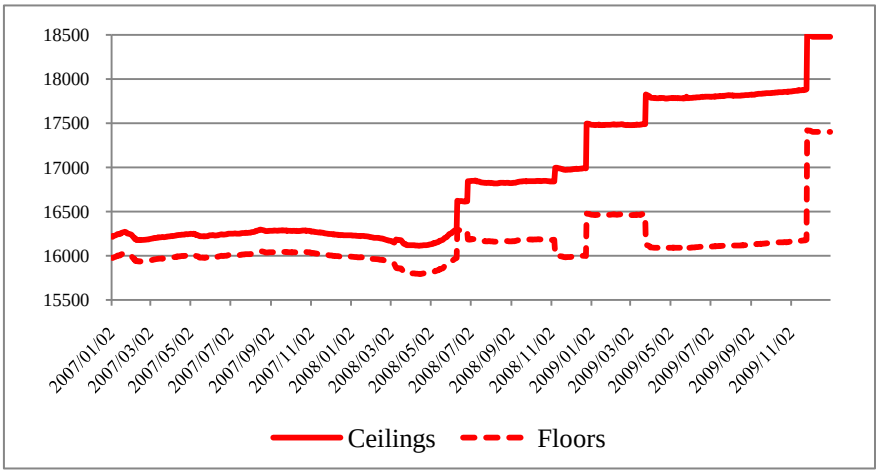
Event window	Type of exchange rate	A rise in the base interest rate				A cut in the base interest rate			
		Direction criterion $\Delta s_{i+} < 0$		Smoothing criterion $\Delta s_{i+} < \Delta s_{i-}$		Direction criterion $\Delta s_{i+} > 0$		Smoothing criterion $\Delta s_{i+} > \Delta s_{i-}$	
		Successful days 1/	P-value 2/	Successful days 1/	P-value 2/	Successful days 1/	P-value 2/	Successful days 1/	P-value 2/
20-day windows	Buying rate at Hanoi	28/51	0.2879	61/100	0.0176**	26/42	0.0821*	44/80	0.2170
	Selling rate at Hanoi	35/53	0.0135**	62/97	0.004***	23/41	0.2664	41/78	0.3672
	Average rate at Hanoi	35/53	0.0135**	67/102	0.001***	26/45	0.1856	46/85	0.2577
	Parallel market premium	30/63	0.6927	66/125	0.2958	28/52	0.3389	54/103	0.3468
30-day windows	Buying rate at Hanoi	46/81	0.1332	95/152	0.0013***	31/49	0.0427**	51/93	0.2035
	Selling rate at Hanoi	53/82	0.0053***	95/149	0.0005***	26/47	0.2800	46/91	0.5000
	Average rate at Hanoi	50/86	0.0803*	99/160	0.0017***	30/52	0.1659	52/49	0.3439
	Parallel market premium	48/93	0.4179	103/185	0.0706*	45/93	0.6607	82/185	0.9472

Notes: (1) Number of “successful” days over total days in an event window.

(2) Based on a binomial probability distribution with the probability of an individual success of 50 percent.

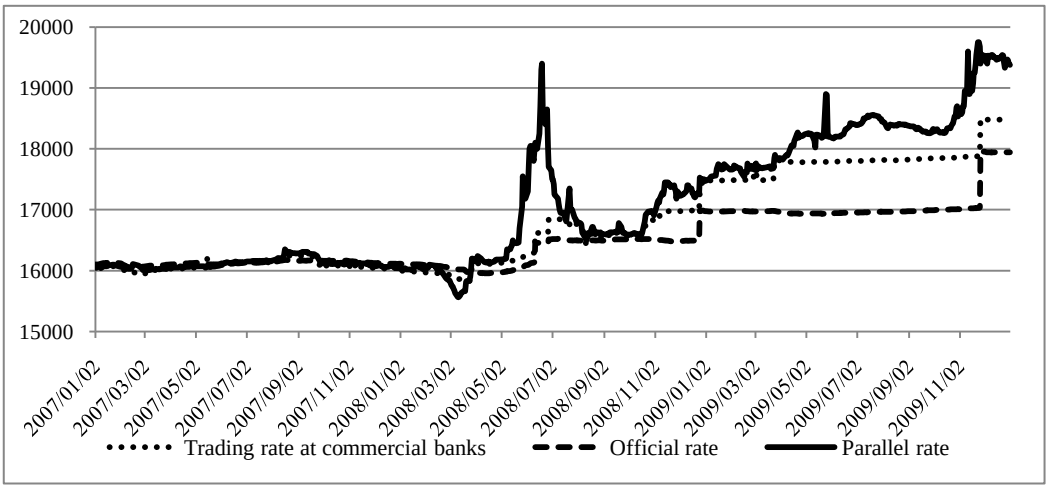
***, **, * indicate that the interest rate action is successful at the 1, 5, and 10 percent levels of significance, respectively

Figure 1. Official Ceilings and Floors in the Inter-bank Market,
January 2007-December 2009 (Dong per US dollar)



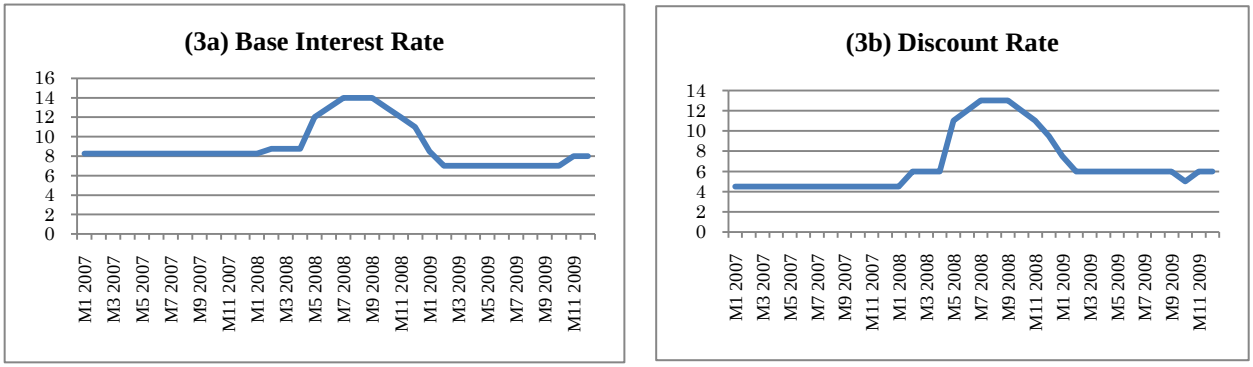
Sources: The State Bank of Vietnam; authors' calculation.

Figure 2. The Vietnamese Dong Exchange Rates in Official and Parallel Markets,
January 2007-December 2009 (Dong per US Dollar)



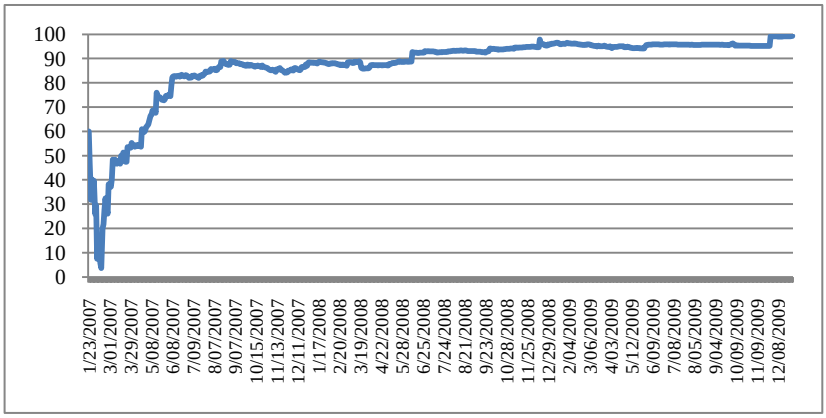
Sources: www.sbv.gov.vn; www.vietcombank.com.vn

Figure 3. Monthly Official Interest Rates, January 2007-December 2009 (In percent)



Source: The State Bank of Vietnam

Figure 4. The Evolving Weight of the US Dollar,
January 2007-December 2009 (In percent)
(a) SDR as the numeraire currency



(b) Swiss franc as the numeraire currency

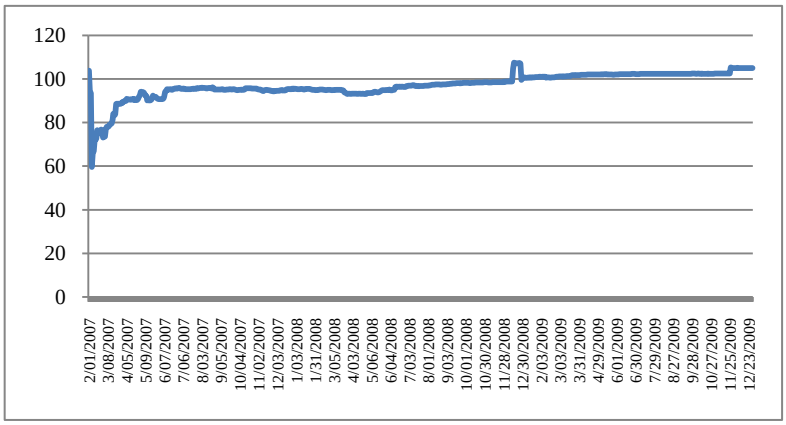
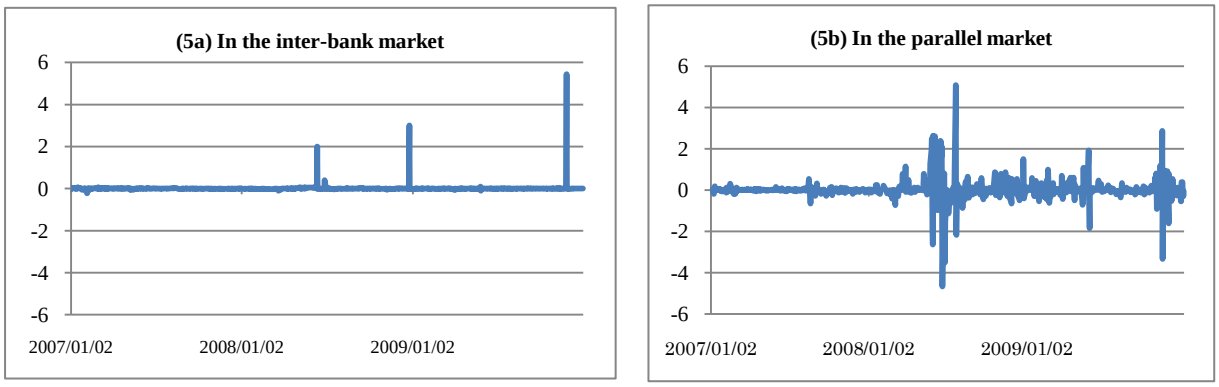


Figure 5. Exchange Rate Volatility in the Inter-bank and Parallel Markets,
January 2007-December 2009 (In daily percentage changes)



Sources: The State Bank of Vietnam; authors' calculations

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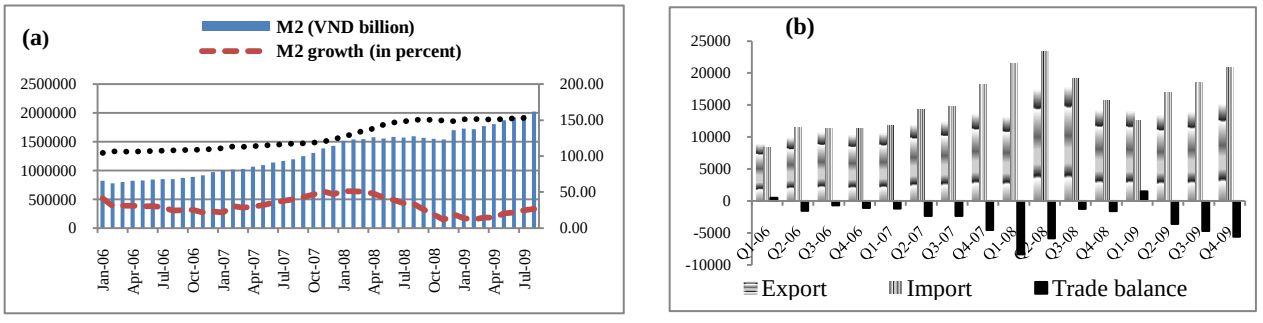
Appendix I

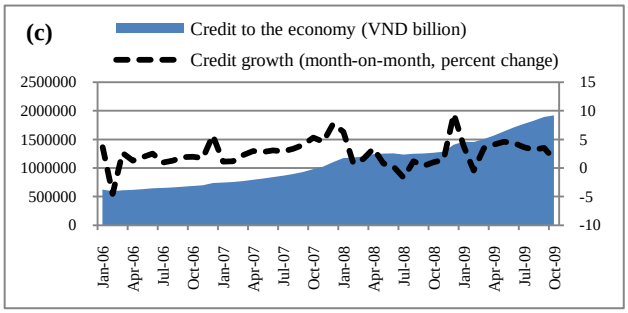
Vietnam's Macroeconomic Background, 2006-2009

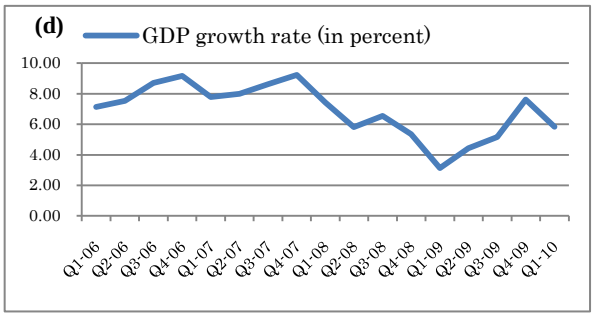
In addition to negative impacts of the global financial-economic crisis, the Vietnam's own crisis has caused severe economic turbulences. After obtaining a record of 9.24 percent in the last quarter of 2007, GDP growth rate fell down to 7.43 percent (Quarter 1, 2008), 5.35 percent (Quarter 4, 2008), and dropped to the bottom of 3.12 percent (Quarter 1, 2009). In order to help the country overcome the global and domestic shocks, Vietnamese authorities launched the stimulus package of VND143,000 billion (equivalent to US$8 billion or 10 percent of GDP) in the second quarter of 2009 which aimed to support growth, ensure social security, and accelerate poverty reduction. It includes some main components such as: (i) 4-percentage-point interest-rate subsidy on new dong-denominated short-term bank loans; (ii) new credit-guarantee scheme to support commercial bank lending to small and medium-sized enterprises; (iii) a series of stimulus measures targeting the rural economy including interest-free loans for purchases of farm equipment and subsidized loans for fertilizer and other agricultural inputs; (iv) tax breaks for enterprises and individuals; (v) reduction in import tariffs on goods used as inputs in domestic production, and a rise in export tariffs on natural resources and import tariffs on some domestically-produced goods; and (vi) the largest component – infrastructure and development projects. Thanks to these solutions, GDP growth rate increased gradually from the bottom to 4.42 percent in the second quarter, 5.17 percent in the third quarter, and 7.63 percent in the fourth.

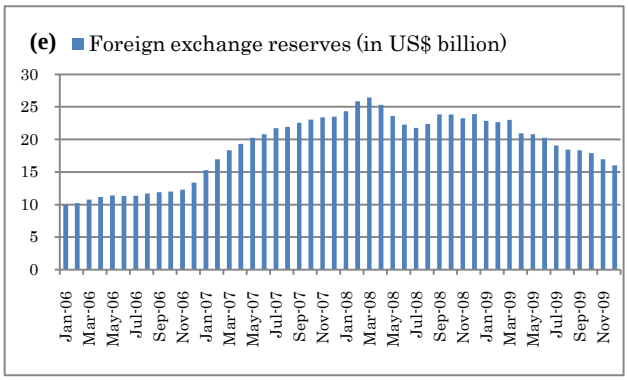
On the other hand, consumer price index (CPI) shows an opposite picture to GDP growth rate. Rapid credit growth, partly sterilized intervention, combined with higher public sector spending and a surge in energy and food prices led to the inflation rate of more than 28 percent (year on year) in August 2008, and of 23 percent (year on year) at the end of 2008. However, by tightly controlling credit growth and money supply, monthly inflation still increased in 2009 but at a minor rate that led to the inflation rate of 6.88 percent at the end of 2009, the lowest rate in recent 6 years .

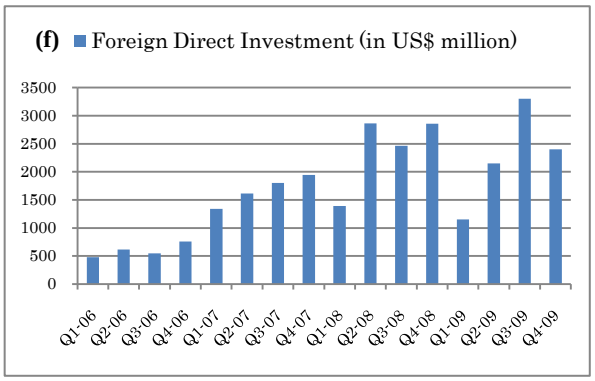
Appendix Figure I-1. Principal Macroeconomic Indices in Vietnam, 2006-2009





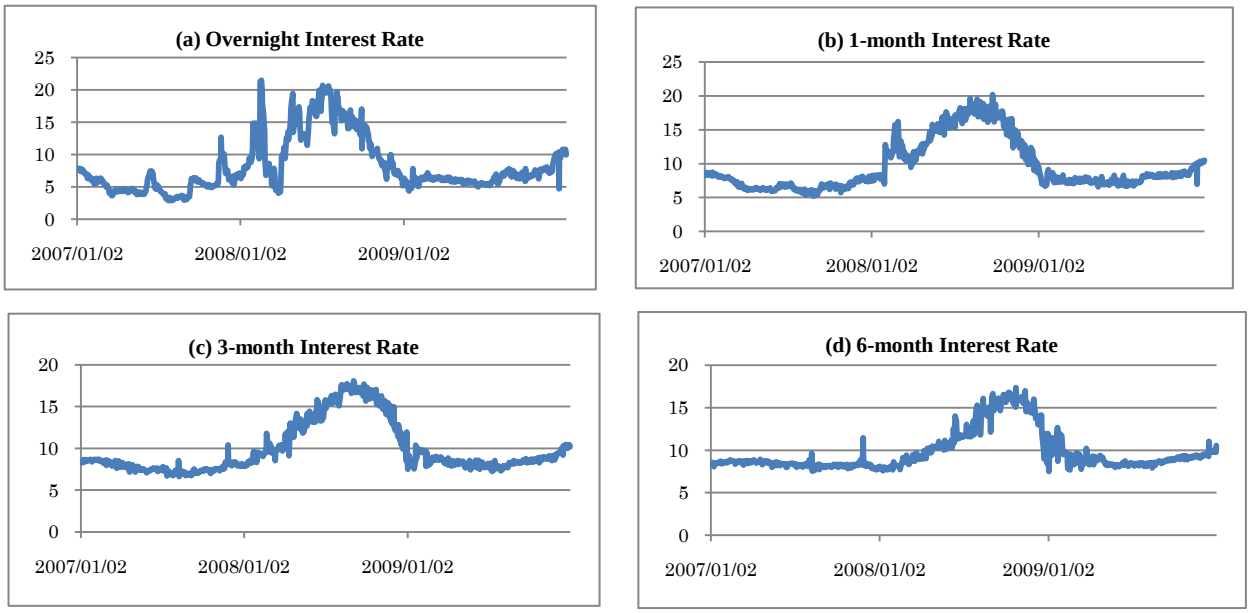






Source: The SBV, General Statistics Office of Vietnam, IMF's International Financial Statistics.

Appendix Figure I-2. Daily Inter-bank Interest Rates, 1 January 2007-31 December 2009 (In percent)



Source: The State Bank of Vietnam

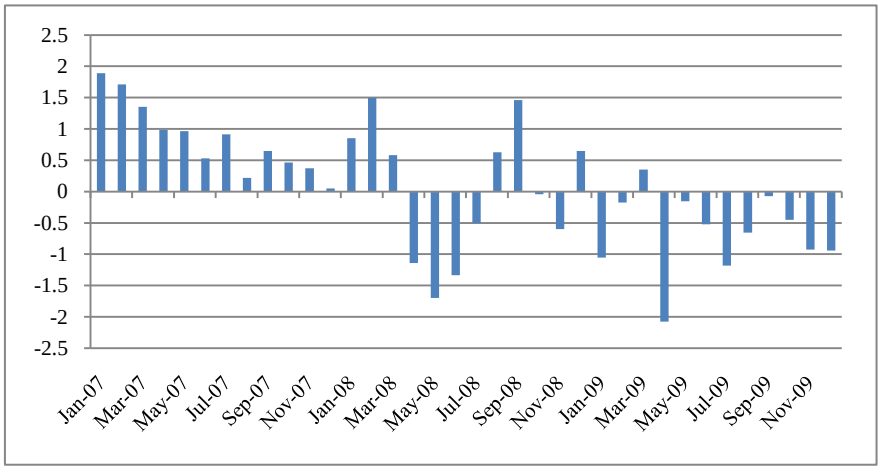
Appendix II

Because the Vietnamese authorities do not disclose the amount of intervention, the amount of net monthly intervention has been estimated from the published data, as a change in the balance of foreign exchange reserves, adjusted for estimated interest income on the average balance, as follows:

$$\text{Intervention} = \text{Reserves}_t\left(1 + \frac{\text{TBill}_{US,t}}{12}\right) - \text{Reserves}_{t-1}(1 + \frac{\text{TBill}_{US,t-1}}{12})$$

where Reserves_t and Reserves_{t-1} are the balance of foreign exchange reserves at the end of month and month *t-1*, respectively; $\text{TBill}_{US,t}$ and $\text{TBill}_{US,t-1}$ are US Treasury bill rate for month *t* and month *t-1*, respectively (the US Treasury bill rate is used as a proxy for the interest rate on Vietnamese foreign exchange reserves). Data on foreign exchange reserves and the US Treasury bill rate are obtained from the IMF's *International Financial Statistics*. The estimated monthly net interventions during 2007-09 are depicted in Appendix Figure II-1..

Appendix Figure II-1. Net Monthly Foreign Exchange Market Interventions in Vietnam, January 2007-December 2009 (In billions of US dollars)



Source: IMF, *International Financial Statistics*

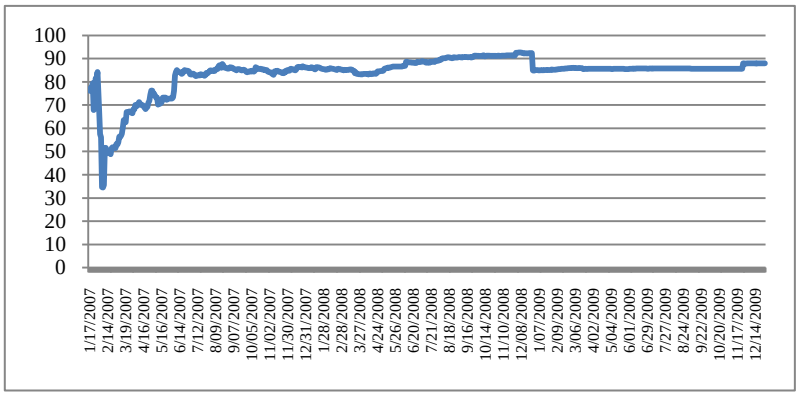
Appendix III

Robustness Check I

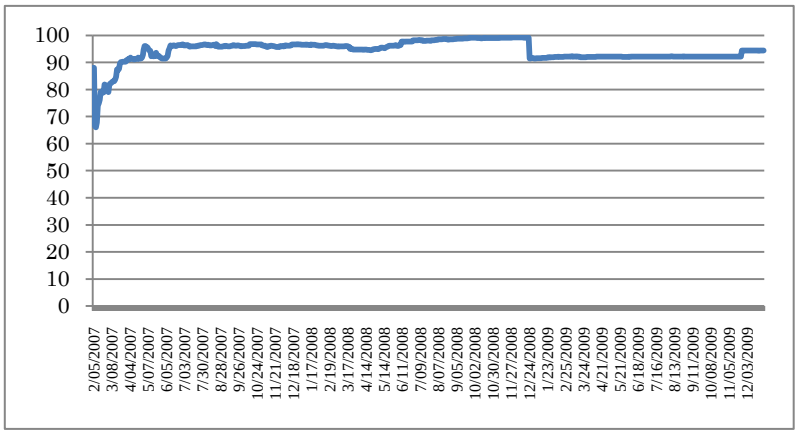
In order to check the robustness of the results based on the SDR and CHF, the same Kalman filter methodology was applied to the data, with the British pound (when it is not included on the right hand side of the equation (2)) and the New Zealand dollar as alternative numeraire currencies. The evolving weights of the US dollar are depicted in Appendix Figure III-1. The pattern sof the evolution of the US dollar weight, as depicted here, show a striking resemblance to those depicted in Figure 4 of the text (here, the weight of the dollar reaches the final values of 0.95 and 0.88). These results confirm the robustness of the results reported in the text

Appendix Figure III-1. The Evolving Weight of the US Dollar With GBP and NZD as Alternative Numeraire Currencies. (In percent)

(a) British pound



(b) New Zealand dollar



Appendix IV

Robustness Check II

Announcement Date versus Effective Date-(20-day windows)

Appendix Table IV-1. Non-parametric Sign Test of the Effectiveness of Changes in the Width of the Trading Band and the Official Exchange Rate

Length of event window	Type of exchange rate	Devaluation of the official exchange rate				Widening of the trading band			
		"Direction" criterion $\Delta s_{i+} < 0$		"Smoothing" criterion $\Delta s_{i+} < \Delta s_{i-}$		"Direction" criterion $\Delta s_{i+} < 0$		"Smoothing" criterion $\Delta s_{i+} < \Delta s_{i-}$	
		"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/
Announcement date	Buying rate at Hanoi	22/50	0.8389	57/101	0.1162	37/77	0.6756	77/149	0.3716
	Selling rate at Hanoi	27/49	0.2841	58/96	0.0260**	41/76	0.2833	79/150	0.2839
	Average rate at Hanoi	25/54	0.7517	60/106	0.1032	42/83	0.5000	84/161	0.3182
	Parallel market premium	29/60	0.6506	65/119	0.1797	57/97	0.0519*	118/197	0.0033***
Effective date	Buying rate at Hanoi	21/50	0.8987	55/101	0.2131	37/76	0.6345	77/148	0.3406
	Selling rate at Hanoi	26/49	0.3877	56/96	0.0627*	41/75	0.2443	78/149	0.3116
	Average rate at Hanoi	24/54	0.8296	58/106	0.1911	42/82	0.4561	83/160	0.3464
	Parallel market premium	28/60	0.7405	63/119	0.2912	59/97	0.0209**	121/197	0.0008***

Notes: (1) Number of "successful" days over total days in an event window.

(2) Based on a binomial probability distribution with the probability of an individual success of 50 percent.

***, **, * indicate that the policy measure is successful at 1 percent, 5 percent, and 10 percent significant level, respectively

Appendix Table IV-2. Non-parametric Sign Test of the Effectiveness of Interest Rate Actions

Length of event window	Type of exchange rate	A rise in the base interest rate				A cut in the base interest rate			
		"Direction" criterion $\Delta s_{i+} < 0$		"Smoothing" criterion $\Delta s_{i+} < \Delta s_{i-}$		"Direction" criterion $\Delta s_{i+} > 0$		"Smoothing" criterion $\Delta s_{i+} > \Delta s_{i-}$	
		"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/
Announcement date	Buying rate at Hanoi	28/51	0.2879	61/100	0.0176**	26/42	0.0821*	44/80	0.2170
	Selling rate at Hanoi	35/53	0.0135**	62/97	0.004***	23/41	0.2664	41/78	0.3672
	Average rate at Hanoi	35/53	0.0135**	67/102	0.001***	26/45	0.1856	46/85	0.2577
	Parallel market premium	30/63	0.6927	66/125	0.2958	28/52	0.3389	54/103	0.3468
Effective date	Buying rate at Hanoi	30/53	0.2051	61/101	0.0230**	28/45	0.0676*	45/81	0.1871
	Selling rate at Hanoi	37/54	0.0045***	64/98	0.0016***	23/43	0.3804	41/80	0.4555
	Average rate at Hanoi	34/57	0.0924*	64/104	0.0118**	26/47	0.2800	46/87	0.3341
	Parallel market premium (3)	27/63	0.8963	62/125	0.5709	29/53	0.2916	55/104	0.3121

Notes: (1) Number of "successful" days over total days in an event window.

(2) Based on a binomial probability distribution with the probability of an individual success of 50 percent.

***, **, * indicate that the interest action is successful at 1 percent, 5 percent, and 10 percent significant level, respectively

Appendix V

Robustness Check III

20-day Windows versus 40-day Window

Appendix Table V-1. Non-parametric Sign Test of the Effectiveness of Changes in the Width of the Trading Band and the Official Exchange Rate

Length of event window	Type of exchange rate	Widening of the trading band				Devaluation of the official exchange rate			
		"Direction" criterion $\Delta s_{i+} < 0$		"Smoothing" criterion $\Delta s_{i+} < \Delta s_{i-}$		"Direction" criterion $\Delta s_{i+} < 0$		"Smoothing" criterion $\Delta s_{i+} < \Delta s_{i-}$	
		"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/
20-day windows	Buying rate at Hanoi	22/50	0.8389	57/101	0.1162	37/77	0.6756	77/149	0.3716
	Selling rate at Hanoi	27/49	0.2841	58/96	0.0260**	41/76	0.2833	79/150	0.2839
	Average rate at Hanoi	25/54	0.7517	60/106	0.1032	42/83	0.5000	84/161	0.3182
	Parallel market premium	29/60	0.6506	65/119	0.1797	57/97	0.0519*	118/197	0.0033***
40-day windows	Buying rate at Hanoi	52/96	0.2376	123/198	0.0004***	72/143	0.5000	142/267	0.1637
	Selling rate at Hanoi	57/93	0.0188**	122/193	0.0001***	77/136	0.0723*	145/263	0.0544*
	Average rate at Hanoi	55/100	0.1841	124/206	0.0021***	80/153	0.3139	153/285	0.1180
	Parallel market premium	63/111	0.0918*	135/230	0.0050***	104/178	0.0147**	202/359	0.0100***

Notes: (1) Number of "successful" days over total days in an event window.

(2) Based on a binomial probability distribution with the probability of an individual success of 50 percent.

***, **, * indicate that the policy measure is successful at 1 percent, 5 percent, and 10 percent significant level, respectively

Appendix Table V-2. Non-parametric Sign Test of the Effectiveness of Foreign Exchange Market Intervention

Length of event window	Type of exchange rate	Foreign exchange selling intervention			
		"Direction" criterion $\Delta s_{i+} < 0$		"Smoothing" criterion $\Delta s_{i+} < \Delta s_{i-}$	
		"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/
20-day windows	Buying rate at Hanoi	45/80	0.1572	98/152	0.0002***
	Selling rate at Hanoi	48/74	0.007***	99/145	0.0000***
	Average rate at Hanoi	48/84	0.1149	103/160	0.0002***
	Parallel market premium	54/91	0.0465**	111/178	0.0006***
40-day windows	Buying rate at Hanoi	71/121	0.0343**	155/242	0.0000***
	Selling rate at Hanoi	74/113	0.0006***	156/236	0.0000***
	Average rate at Hanoi	75/127	0.0252**	161/255	0.0000***
	Parallel market premium	86/140	0.0043***	177/284	0.0000***

Notes: (1) Number of "successful" days over total days in an event window.

(2) Based on a binomial probability distribution with the probability of an individual success of 50 percent.

***, **, * indicate that the policy measure is successful at 1 percent, 5 percent, and 10 percent significant level, respectively

Appendix Table V-3. Non-parametric Sign Test of the Effectiveness of Interest Rate Actions

Length of event window	Type of exchange rate	A rise in the base interest rate				A cut in the base interest rate			
		"Direction" criterion $\Delta s_{i+} < 0$		"Smoothing" criterion $\Delta s_{i+} < \Delta s_{i-}$		"Direction" criterion $\Delta s_{i+} > 0$		"Smoothing" criterion $\Delta s_{i+} > \Delta s_{i-}$	
		"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/	"Successful" days 1/	P-value 2/
20-day windows	Buying rate at Hanoi	28/51	0.2879	61/100	0.0176**	26/42	0.0821*	44/80	0.2170
	Selling rate at Hanoi	35/53	0.0135**	62/97	0.004***	23/41	0.2664	41/78	0.3672
	Average rate at Hanoi	35/53	0.0135**	67/102	0.001***	26/45	0.1856	46/85	0.2577
	Parallel market premium	30/63	0.6927	66/125	0.2958	28/52	0.3389	54/103	0.3468
40-day windows	Buying rate at Hanoi	55/99	0.1574	112/189	0.0066***	35/55	0.0290**	59/105	0.1207
	Selling rate at Hanoi	62/96	0.0028***	112/182	0.0011***	31/54	0.1704	55/103	0.2773
	Average rate at Hanoi	59/103	0.0837*	116/197	0.0076***	35/59	0.0963*	61/112	0.1976
	Parallel market premium	64/112	0.0780*	131/232	0.0283**	41/72	0.1444	77/141	0.1561

Notes: (1) Number of "successful" days over total days in an event window.

(2) Based on a binomial probability distribution with the probability of an individual success of 50 percent.

***, **, * indicate that the interest rate action is successful at 1 percent, 5 percent, and 10 percent significant level, respectively