The Impacts of the Central Bank Foreign Exchange Auctions on the Parallel Market Exchange Rate in Myanmar

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Abstract
For transition from the multiple exchange rate system to a managed float, the Central Bank of Myanmar (CBM) instituted daily foreign exchange auctions in April 2012. This study examines the capacity of the CBM to stabilize exchange rates of the pervasive parallel market by means of auctions. First, a VAR model shows that the official rate did not Granger-cause the parallel rate. Second, a GARCH model indicates that CBM's net purchases of dollar did not reduce the conditional variance of parallel rate. These imply that the auction played only modest roles in stabilizing exchange rates.

Keywords: Myanmar; foreign exchange auction; intervention; parallel exchange rate; GARCH model
JEL codes: E65, F31, O24

1. Introduction

With the backdrop of its political and economic reforms, Myanmar (Burma) implemented foreign exchange policy reforms and moved to a managed floating regime from the *de facto* multiple exchange rate system in April 2012. Since then, the Central Bank of Myanmar (CBM) initiated daily foreign exchange auction with commercial banks, and has announced the daily reference exchange rate based on auction results.

The foreign exchange auctions are considered to be serving at least two functions. First, auctions allow the CBM to obtain a market exchange rate apart from the parallel market rates. Since the fixed exchange rate was abolished in the end of March 2012, this reference rate has been the official rate. Second, foreign exchange auctions are official intervention to the foreign exchange market. While the CBM does not have an explicit target of the exchange rate, its policy stance is considered to be aiming at smoothing exchange rate fluctuations (IMF, 2013).

Despite the reforms, the parallel foreign exchange market remains pervasive, and the parallel exchange rate has exhibited high volatility, which raises a question on capacity of the CBM to manage exchange rates. In the parallel market, the Myanmar kyat depreciated from around 820 kyat in per U.S. dollar from the start of auction in April 2012 to 1000 kyat in June 2013. This study addresses the question as to what extent the CBM intervention by means of foreign exchange auctions is effective in dampening fluctuations in the parallel exchange rates.

The empirical literature on the efficacy of official intervention in foreign exchange markets is scant due to lack of data on the amount of official intervention. The existing studies concentrate on the currencies of industrialized countries, including Australian dollar (Edison et al., 2006), and Deutsche Mark and Japanese Yen (Dominguez, 1998). Regarding foreign exchange auctions in Myanmar, the CBM announces the results of auctions and the reference rate; the CBM holds daily auctions and tenders (i.e., the CBM invites both bids and offers from commercial banks). Using the auction data, this study applies the methodology of the official intervention analysis (Dominguez, 1998; Edison et al., 2006) to examine the impact of foreign exchange auctions on the parallel exchange rate in Myanmar.

The remainder of the paper is organized as follows. Section 2 reviews the structure of the foreign exchange market in Myanmar, and illustrates the reasons why the parallel market persists even after the reforms from April 2012. Section 3 describes the structure of the foreign exchange auctions in Myanmar through comparison with those in other developing countries. It also contains the summary

of daily auctions in the period from April 2012 through July 2013. Sections 4 and 5 present empirical analyses by time series econometrics to examine the impacts of foreign exchange auctions on the prevalent parallel market exchange rate. First, in Section 4, using Granger-causality tests in a bi-variate vector autoregression (VAR) model of the parallel and Central Bank reference rates, we examine whether the Central Bank reference rate exerted influences on the parallel rate. Second, in Section 5, we estimate a uni-variate generalized autoregressive conditional heteroskedasticity (GARCH) model of the parallel exchange rate to evaluate how CBM intervention affected the level and variance of the parallel exchange rate. In Section 6, we summarize policy implications from the empirical analyses.

2. Structure of Foreign Exchange Market in Myanmar

2.1. Parallel Market

As a first step to analyze the impacts of foreign exchange auctions on the parallel market exchange rate, we illustrate the structure of foreign exchange market in Myanmar with a particular focus on the parallel market.

Until the move to a managed floating regime in April 2012, Myanmar had been formally in the fixed exchange rate regime where the kyat had been pegged to the special drawing right (SDR) of the International Monetary Fund (IMF) at 8.50847 kyat per SDR since 1977; the official rate had never been devalued for more than three decades. This official rate had been applied only to transactions in the public sector; for the private sector, there had been no allocation of foreign exchange nor surrender requirement on foreign exchange earners (Hori and Wong, 2013).

Under this fixed exchange rate regime, the parallel foreign exchange market was developed where private exporters and importers traded foreign exchange competitively. The foreign exchange regulation restricted private exporters to depositing their formal export earnings at state banks in foreign currency deposit (FCD) accounts. Nonetheless, domestic account transfers of FCDs were tolerated, which enabled private exporters and importers to trade FCDs in bilateral negotiation. Sometimes brokers acted as middlemen and their quoted prices of FCDs (i.e., parallel exchange rates) were widely circulated in the private sector.[1] In addition to FCDs, informally held foreign exchange has been traded in the parallel market.

2.2. Foreign Exchange Auctions

As the move to the managed floating, the CBM instituted foreign exchange auctions in April 2012. Participants are limited to authorized dealer banks and state banks. The CBM granted dealer licenses to 11 private commercial banks in November 2011.[2] In the past, foreign exchange dealing had been monopolized by three state banks. The CBM also began issuing money changer licenses to non-bank firms in December 2012, but these money changer are not permitted to participate in the auctions.

The CBM calls sealed- bids and offers from authorized dealer banks in daily auctions and tenders. Authorized dealer banks submit their price and quantity bids (offers) to the CBM. The bid (offer) quantity must be within the amount of deposits that authorized dealer banks maintain with the CBM. The CBM sets the cut-off rate of exchange rate, and accepts the bids (offers) above (below) the cut-off rate. In the terminology of auction, it is discriminatory auction where bidders (offerors) are awarded at their bid (offer) prices.[3]

The CBM announces to the public the cut-off rates of daily auctions as the Central Bank reference rate. The CBM uses the reference rate to regulate exchange rates in the retail market. The buying and selling rates at authorized dealer banks are restricted within the band of $\pm$ 0.8 per cent of the reference rate. The CBM renews the reference rate daily based on the result of auction and tender.

[1] Major brokers disseminate their quotes by the short message service (SMS) of mobile phones.
[2] Foreign exchange dealing had been monopolized by the state banks in the past.
[3] For explanation of auction terminology, see Feldman and Mehra (1993).

The auction serves as a policy instrument for the CBM to obtain a market exchange rate in its managed floating regime.

Despite the start of daily auctions, the parallel market of foreign exchange remains large and active. Domestic account transfer of FCDs is still tolerated, which allows private exporters and importers to trade FCDs directly and negotiate the price (exchange rate). Their negotiated prices of foreign exchange form parallel market exchange rates, and they are not necessarily constrained by the Central Bank reference rate band.

In August 2013, the CBM instituted the interbank market of foreign exchange; previously, banks were not permitted to trade foreign exchange among them. The foreign exchange interbank market is expected to replace foreign exchange auctions in the future.

3. Characteristics of Foreign Exchange Auctions in Myanmar

3.1 Foreign Exchange Auctions in Other Countries

Until the foreign exchange interbank market was instituted in August 2013, foreign exchange auctions had been the only *de jure* foreign exchange market in Myanmar. According to the IMF's survey of the foreign exchange market organization in developing and transition economies summarized by Canales-Kriljenko (2004), the case that the foreign exchange market was constituted of solely an auction market was only 2 per cent of the surveyed economies in 2001. The majority (57 per cent) of the surveyed economies had the market organization of only a dealer market (an interbank market), followed by the case of coexistence of both auction and dealer markets (32%).[4] As for Myanmar, the policy change in August 2013 led to the *de jure* coexistence of auction and dealer markets.

Regarding foreign exchange auctions in developing countries, the flow of foreign exchange in auctions is usually uni-directional from the central bank to commercial banks (Quirk et al., 1987; Aron and Elbadawi, 1994). It is common that auctions are combined with the surrender requirement on export earnings to the central bank. By the surrender requirement, foreign exchange is put together at the central bank, and auction re-allocates it from the central bank to the economy through participating commercial banks. Furthermore, when exporters are forced to surrender their export earnings at unfavorable official exchange rate, it spurs foreign exchange earners to the black market.[5]

As for foreign exchange auctions in Myanmar, the flows of foreign exchange are bi-directional between the CBM and authorized dealer banks. The CBM can absorb foreign exchange from the parallel market as well as release it via authorized dealer banks.

Furthermore, it is peculiar to Myanmar that there is no surrender requirement on foreign exchange earnings of the private sector. The absence of the surrender requirement is one of the reasons for the prevalence of the parallel market. As private exporters and importers trade FCDs in negotiated transactions, the formal auction market stands side by side with the informal market of FCDs. Nonetheless, the surrender requirement does not necessarily get rid of the prevalent parallel market; on the contrary, it may encourage the parallel market depending on the official exchange rate applied to exporters.

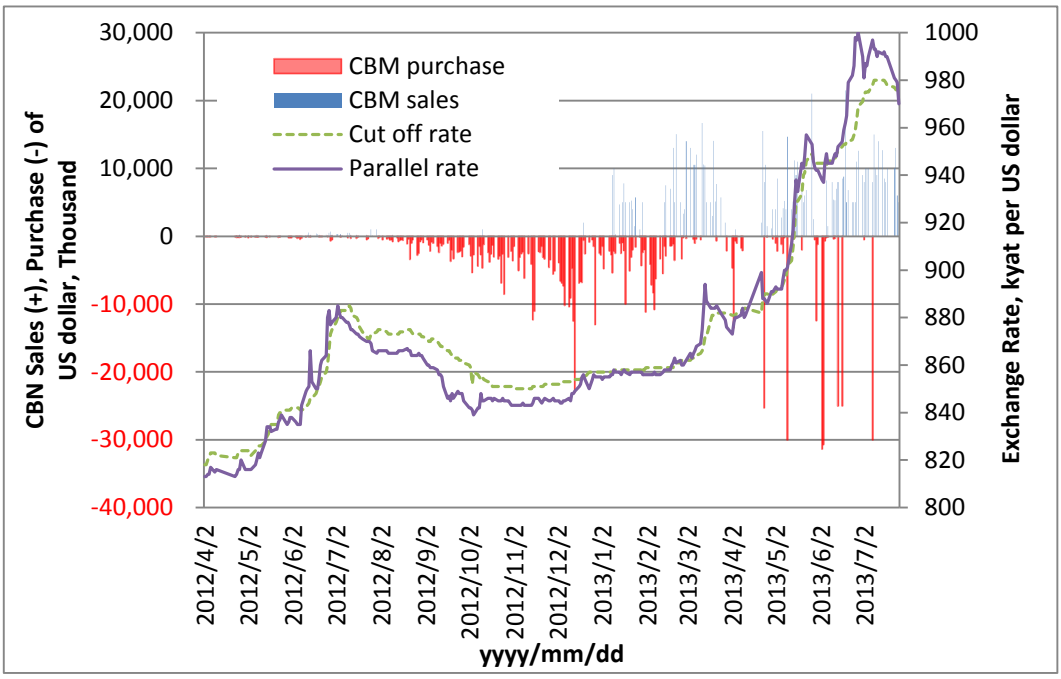
3.2. Myanmar's Foreign Exchange Auctions in Figures

The data on daily auction transactions and exchange rates reveal the behavior of the CBM and participating commercial banks. In Figure 1 and Table 1, we summarize the auction and exchange rate data for the period from the start of the auction on April 2, 2012 up to July 26, 2013.

[4] The rest of the surveyed countries (9 per cent) had no auction market nor dealer markets.

[5] Grosse (1994) describes the structure of Jamaica's foreign exchange market where formal foreign exchange auction market coexisted with the prevailing parallel market. Kiguel and O'Connell (1995) provide a general account of how parallel exchange market emerges in developing countries.

Figure 1: Summary of Foreign Exchange Auctions and Trends of Exchange Rates



Sources: Central Bank of Myanmar and the parallel market survey.

Table 1. Summary of Foreign Exchange Auctions and Trends of Exchange Rates

	Number of Working Days	Number of Auctions where CBM		Auction Amount (USD, Thousand)			Monthly Average Exchange Rate (kyat per US dollar)		
		sold USD	purchased USD	CBM sales	CBM purchase	CBM sales (net)	(A) Cut-off Rate	(B) Parallel Rate	Gap (A) - (B)
April 2012	13	6	13	510	978	-468	822	815	6
May 2012	22	5	12	710	1,570	-860	832	829	3
June 2012	21	11	15	3,530	3,190	340	850	855	-4
July 2012	21	16	8	4,970	2,150	2,820	878	874	4
August 2012	22	1	22	200	19,730	-19,530	874	865	8
September 2012	20	0	20	0	35,270	-35,270	866	852	14
October 2012	21	1	21	1,000	69,400	-68,400	853	844	9
November 2012	20	0	20	0	85,660	-85,660	851	844	7
December 2012	20	1	20	2,000	136,510	-134,510	854	850	5
January 2013	22	14	21	69,230	61,100	8,130	858	856	1
February 2013	19	9	16	64,830	72,080	-7,250	860	859	1
March 2013	19	16	7	145,320	5,500	139,820	872	877	-4
April 2013	15	8	9	43,650	49,500	-5,850	885	884	1
May 2013	21	18	12	131,804	55,450	76,354	921	925	-4
June 2013	20	17	9	132,600	113,800	18,800	952	962	-10
July 2013 (till 26 July)	18	18	2	176,200	30,500	145,700	977	987	-10
Total	314	141	227	776,554	742,388	34,166			

Sources: Central Bank of Myanmar and the parallel market survey.

Several observations can be made from the figure and table. First, the turnover of auctions has been increasing. In the initial four months from April 2012 through July 2012, a monthly average of the CBM's net sales of foreign exchange in the absolute value terms was just USD 1.1 million, whereas an average for April 2013 through July 2013 was USD 61.7 million. Second, in the first nine months from the start of auctions CBM's dollar purchases were dominant, whereas CBM's dollar sales were dominant from May 2013 through July 2013. On the other hand, it is considered that CBM's dollar purchases since May 2013 include the transfer of foreign exchange from state banks to the CBM for accumulation of the official reserves.[6] Third, when the gap between the prevalent parallel exchange rate and the reference rate is small, CBM's dollar purchases and sales were mixed as in January and February 2013.

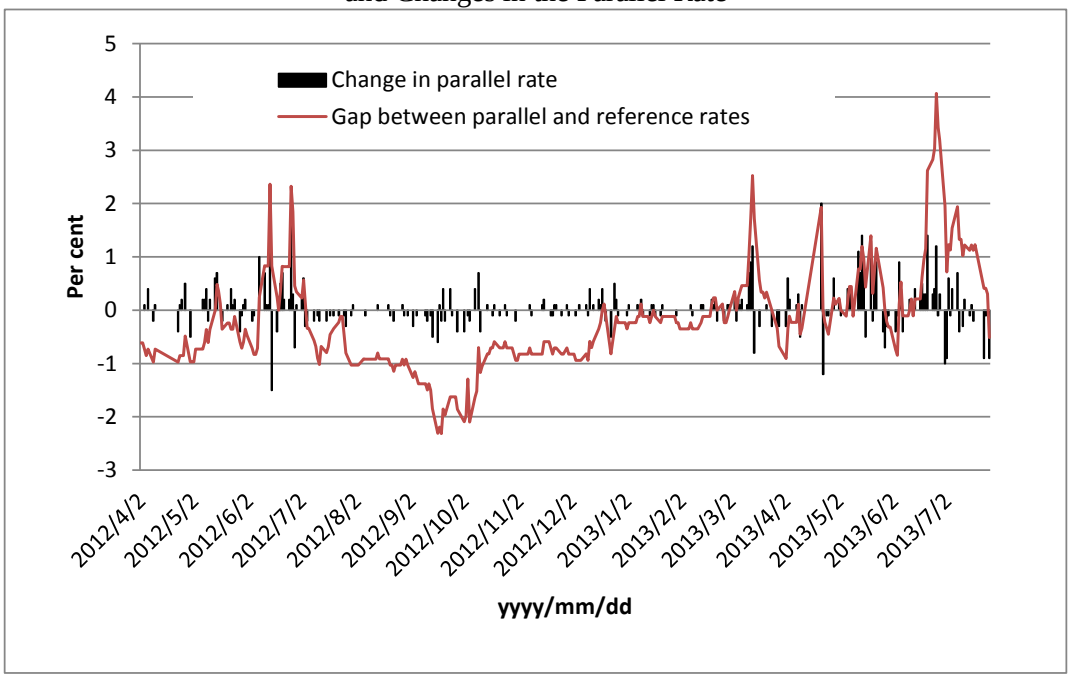
[6] Interviews with senior officials of the Central Bank of Myanmar in August 2013.

Fourth, transactions in auctions tended to concentrate in either side of CBM's selling or buying. When the reference rate was higher than the parallel rate by a large margin as in September 2012, transactions concentrated in CBM's purchase of foreign exchange. Out of 20 working days in September 2012, the CBM purchased dollar every day, and never sold dollar. Similarly, when the reference rate was lower than the parallel rate by a large margin as in July 2013, transactions concentrated in CBM's dollar sales.

Among the above-mentioned four observations, the fourth has a controversial implication. In principle, foreign exchange auctions are to provide a facility for authorized dealer banks to adjust their foreign exchange positions. In reality, it is conjectured that the auctions provided these banks an exclusive opportunity to arbitrage between the auction and parallel markets since participation in auctions was limited to them. Arbitrage activities of banks themselves were reasonable, and in some cases they might have added to stability of exchange rates. However, it incurred on the CBM a great expense; in two months from June to July 2013, USD 308.8 million flew out from the official reserves of the CBM, which amounted to 6.7 per cent of the gross official reserves.[7]

Turning to the movements of the parallel and Central Bank reference rates, the data cast doubt on the efficacy of the CBM to manage exchange rates. Figure 2 summarizes the gap between the parallel and reference rates in percentage and the daily change in the parallel rate. The line graph refers to the gap between the parallel and reference rates, and the bar graph refers to the change in the parallel rate. The gap between the parallel and reference rates was mostly less than 2 per cent. The gap sometimes got wider than 2 per cent when the parallel exchange rate showed abrupt changes. These as a whole imply that the CBM set the reference rate by following the parallel rate in order to maintain the gap within a small margin.

Figure 2: The Gap between the Parallel and Reference Rates, and Changes in the Parallel Rate



Sources: Central Bank of Myanmar and the parallel market survey.

Notes: Change in parallel rate is calculated as $(lnPARA_t - lnPARA_{t-1})$, where $lnPARA_t$ is the parallel rate on date t in logarithm. Gaps between parallel and reference rates are calculated as $(PARA_t - CBM_t)/PARA_t$, where CBM_t is the reference rate.

[7] According to the estimate of IMF (2013: 28), the figure on the gross official reserves as of end of March 2013 is USD 4,599 million.

4. Relationship between Central Bank Reference Rate and Parallel Rate

To evaluate impacts of foreign exchange auctions on the parallel market exchange rate, we first examine the relationship between the Central Bank reference rate and the prevalent parallel rate. For the parallel rate, we use the informal broker selling price of U.S. dollar banknote in the parallel market.[8] If foreign exchange auctions exert influences on the parallel market, a rise in the reference rate would be accompanied by a rise in the parallel rate. We examine the relationship of the two rates by Granger-causality tests.

The sample period of daily exchange rates spans from April 2, 2012 to July 26, 2013. The total number of observations is 314. We use variables in logarithms, and denote the reference rate and the parallel rate as *lnCBM* and *lnPARA*, respectively.

First, we examine stationarity of the two time series with the Augmented Dickey-Fuller test. The test statistics indicate that both *lnCBM* and *lnPARA* are non-stationary in their levels but stationary in their first difference at the 1% significance level. Thus, we judge they are I(1) variables. Second, we test if two variables are co-integrated in their levels. The Maximum Eigenvalue test indicates that the null hypothesis of no co-integration cannot be rejected at the 5% significance level.[9]

Accordingly, we estimate a bi-variate vector autoregression (VAR) model of exchange rates in their first difference as below;

$$\Delta lnCBM_t = \alpha_1 + A_{11}(L)\Delta lnCBM_{t-1} + A_{12}(L)\Delta lnPARA_{t-1} + \varepsilon_{1t}, \quad (1)$$

$$\Delta lnPARA_t = \alpha_2 + A_{21}(L)\Delta lnCBM_{t-1} + A_{22}(L)\Delta lnPARA_{t-1} + \varepsilon_{2t}, \quad (2)$$

where A_{ij} are the polynomials in the lag operator L. ε_{1t} and ε_{2t} are independently distributed disturbance terms. We test the null hypothesis that $A_{21}(L) = 0$. Rejecting the null hypothesis implies that the CBM could exert influences on the parallel market exchange rate. As to the empirical model, the lag length is pared down to 3 from 20 by the Akaike Information Criterion (AIC). The model diagnostic tests indicate that the null hypothesis of no serial correlation of residuals up to the lag order of five cannot be rejected at least at the 10% significance level by the Lagrange multiplier tests.

Table 2 summarizes the results of the Granger causality tests. The null hypothesis that Δ*lnCBM* does not Granger-cause Δ*lnPARA* cannot be rejected at the 10% significance level. On the other hand, the null hypothesis that Δ*lnPARA* does not Granger-cause Δ*lnCBM* can be rejected at the 1% significance level.

Table 2: Granger Causality between the Reference Rate and the Parallel Rate

Null Hypothesis	Δ*lnCBM* does not Granger-causes Δ*lnPARA*	Δ*lnPARA* does not Granger-causes Δ*lnCBM*
Test Statistics ($\chi^2(3)$)	3.66970	71.0746
P-value that null hypothesis holds	0.2994	0.0000

Source: Author's calculation.

We can interpret the results in three ways. First, whether the CBM had capacity to manage the parallel rate by foreign exchange auctions or not, the CBM followed the parallel exchange rate rather than guiding it.

Second, there might be high transaction costs that segmented the auction market from the parallel market, so that changes in the reference rate did not transmit to the parallel rate. For example, when firms and individuals purchase foreign exchange from banks for the amount above USD 10,000, they are required to present the evidence document which specifies the usage of foreign exchange. Such procedure produces costs, which would in turn segment two markets. Should this be the case, the

[8] There are various rates in the parallel market. Another rate is the price of FCDs.

[9] For evaluation of co-integration relationship, we include 20 lags of Δ*lnCBM* and Δ*lnPARA*, where Δ refers to first difference.

capacity of the CBM to manage the parallel rate would be weakened. However, this simple analysis cannot verify whether market segmentation existed or not.

Third, it is possible that the volume of foreign exchange auctions was small relative to the size of the parallel market, so that the reference rate did not influence the parallel rate. The volume of foreign trade gives a yardstick to estimate the size of the parallel market. Based on IMF (2013), monthly averages of imports and exports in 2012/13 were USD 1,035.7 million and USD 857.3 million, respectively. In contrast, CBM's largest monthly purchases were USD 136.5 million in December 2012, and the largest monthly sales were USD176.2 million in July 2013. Thus, the volume of the auctions is relatively modest. In the subsequent analysis with regard to the effect of auctions on the volatility of the parallel rate, we explicitly take into account the volume of auctions.

5. The Effect of Foreign Exchange Auctions on the Volatility of the Parallel Rate

In general, the rational of central bank intervention in the foreign exchange market is to dampen the volatility of exchange rate movements. In this section, we evaluate how foreign exchange auctions exerted impacts on the volatility of the parallel rate.

Figure 2 in Section 3 depicts the log change in the parallel rate. As is common for financial variables, large changes of the parallel rate were followed by large changes as in June 2012 and May-June 2013, and small changes by small changes as in the period from November 2012 to January 2013. The Box-Pierce *Q*-statistics for serial correlation reveal that the null hypothesis of no serial correlation is rejected at 1% significance level for the squared log change, whereas it is not rejected for the un-squared data for up to 36-order at 10% significance level. These indicate that the variance of changes in the parallel rate exhibits conditional heteroskedasticity.

Following Baillie and Bollerslev (1989), Dominguez (1998), and Edison et al. (2006), we examine the characteristics of the innovations of the log change in the parallel rate with a generalized autoregressive conditional heteroskedasticity (GARCH) model. In the model, we add the net sales of foreign exchange in daily auctions both in the conditional mean and conditional variance equations. The econometric model sheds lights on how the intervention variables are related with the conditional mean and conditional variance of the parallel exchange rate.

The specification of the GARCH (1, 1) model is as follows;

$$\Delta lnPARA_t = \varphi_0 + \varphi_1 INT_t + \varepsilon_t, \quad (3)$$

$$\sigma_t^2 = \delta_0 + \delta_1 |INT_t| + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2, \quad (4)$$

Equation (3) represents the conditional mean of log change in the parallel rate. INT_t refers to CBM's net sales of the U.S. dollars in thousands in the auction, and its negative value indicates net purchase.[10] ε_t is the disturbance term. Equation (4) represents the conditional variance of log change in the parallel rate, and $\varepsilon_t \sim N(0, \sigma_t^2)$. ε_{t-1}^2 is the ARCH term, and σ_{t-1}^2 is the GARCH term. We add CBM's net sales in absolute value terms, $|INT_t|$, into the conditional variance equation.

The parameters of interest are φ_1 which measures the impacts of foreign exchange auctions on the level of the parallel rate, and δ_1 which measures the impact of auctions on the variance of the change in parallel rate. We expect $\varphi_1 < 0$ as CBM's net sales of the U.S. dollars would lead to appreciation of the kyat vis-à-vis the U.S. dollar. Regarding the impacts of foreign exchange auctions on the volatility of the parallel rate, if the CBM intervention in the foreign exchange market would dampen the fluctuations in the parallel rate, the sign of δ_1 would be negative.

We estimate GARCH (1, 1) model for the sub-period of September 2012 through July 2013 as well as the whole sample period. The sub-period of September 2012 through July 2013 covers the period where the volume of auction increased. Table 3 reports the results of estimations. The Box-Pierce *Q*-statistic tests for high-order serial correlation indicate that the null hypothesis of no serial correlation in squared standardized residuals cannot be rejected. These model diagnostic tests indicate

[10] The results of the auctions are announced to the market around 10:00AM, whereas the parallel market rates are usually quoted around 11:00AM. Therefore, it is appropriate to incorporate the intervention variable of the same day into the conditional mean and variance equations.

that the GARCH models correct the heteroskedasticity. As to the conditional mean equation, φ_1 is not significant. Moreover, the coefficient on the intervention variable in the conditional variance equation, δ_1, is positive and significant for the sub-period of September 2012 through July 2013. These imply that the CBM intervention was associated with higher volatility of the parallel rate.

Table 3. Results for conditional mean and conditional variance equations of GARCH model

	April 2012-July 2013		September 2012-July 2013	
	Coeff.	p-value	Coeff.	p-value
Mean equation				
C	0.000111	0.271	0.000185	0.120
INTx10000	0.000039	0.821	0.000121	0.632
Variance Equation				
C	0.0000001	0.373	-0.0000002	0.000
RESID(-1)^2	0.309342	0.000	0.216022	0.000
GARCH(-1)	0.786324	0.000	0.836426	0.000
INTx10000	0.0000001	0.816	0.000001	0.000
log L	1,375.52		950.82	
Q(20)	24.681	0.214	18.449	0.558
Q^2(20)	9.918	0.970	16.291	0.698

Source: Author's calculation.

Notes: *log L* is the value of the log likelihood function. Q(20) and Q^2(20) denote the Box-Pierce *Q*-statistic with 20 lags for the standardized residuals and squared standardized residuals. The p-value for *Q*-statistic is the probability that the null hypothesis of no serial correlations of the standardized residuals (squared standardized residuals) is accepted.

The results should not be interpreted as that the CBM intervention raised the volatility of the parallel rate. On the contrary, the causality might run in the other way around that the CBM intervened more in the market when the parallel rate showed abrupt changes. In other words, the CBM stance is considered to have been "leaning against the wind". Furthermore, while the CBM intervention in the foreign exchange market is positively associated with the conditional variance, its impact in terms of the coefficient δ_1 is quite modest. Such a result is similar to Edison et al. (2006).

6. Conclusion

For the transition from the *de facto* multiple exchange rate system to a managed floating, the Central Bank of Myanmar instituted daily foreign exchange auction in April 2012. The auctions have two functions; one is to provide the CBM a market-determined exchange rate apart from the parallel rate, and the other is a policy instrument to intervene in the foreign exchange market.

Using the daily data of auctions and exchange rates for the period from the start of the auction in April 2012 to July 2013, this study examines to what extent foreign exchange auctions had impacts on the parallel exchange rate. If auctions have impacts, the CBM can use them to dampen fluctuations in the parallel rate. First, the bi-variate VAR of exchange rates indicates that the official reference rate did not Granger-cause the parallel rate, whereas the parallel rate did the reference rate. This suggests that the CBM followed the parallel rate. Second, the GARCH model incorporating intervention variables indicates that the CBM's net sales of the U.S. dollar did not reduce the conditional variance of parallel rate changes.

Thus, the function of the auctions as a means of intervention was modest, whereas they incurred substantial costs on the CBM in terms of erosion of the official foreign reserves. The CBM might need to re-consider the means of intervention. In this regard, the CBM has already instituted a foreign exchange interbank market. The interbank market is encouraged to replace the auctions in the future.

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