Technical Trading Rules and Trading Signals in the Black Market for Foreign Exchange in Sudan

Onour, Ibrahim

University of Khartoum

2 January 2018

Technical Trading Rules and Trading Signals in the Black Market for Foreign Exchange in Sudan

Ibrahim A. Onour
School of Management Studies
University of Khartoum
onour@uofk.edu

Technical Trading Rules and Trading Signals in the Black Market for Foreign Exchange in Sudan

Ibrahim A. Onour
School of Management Studies
University of Khartoum
onour@uofk.edu

Abstract

This paper aims to assess the level of departure of the actual black market rate from its real level. Our finding indicate divergence of the actual black market rate from the real level, ranging from 7% in October 2016 to about 38% in November 2017. This result imply 38% of the foreign exchange price in the black market rate in November 2017 was due to manipulative trading strategies exerted by a few powerful traders in the market. The study concludes that in the very short term to curb increasing depreciation of the domestic currency rate in the black market, it is essential to control domestic liquidity expansion, and raise the cost (risk) of dealing in the black market by imposing higher penalty cost on dealers in this market.

Kewwords: Black market, Foreign exchange, Technical trading, Volatility, Sudan.

1- Introduction:

Growing activities of black market for foreign exchange in some developing countries in the past few decades have attracted the attention of policy makers' as well as academicions. It become obvious to many economist in recent years that effective foreign exchange policy should take into account the link between the black market for foreign exchange and the rest of the economy, if viable economic planning is to set forth. Here in Sudan, Since seperation of oil rich South Sudan from the rest of

country in July 2011, and loss of about 75% of oil revenue , the black market rate premium over the official rate expanded rapidly due increasing demand for hard currencies. To control speculative effects on foreign exchange tradings, the the Central bank of Sudan decided to tighten control on exchange bureaux by enforcing additional restrictions on foreign exchange sales and oftenly cracking down on black marketeers for foreign exchange.

To understand the operational mechanism of imperfect market it is essential to decompose the effect of fundamental factors from the effect of nonfundamental speculative strategies on pricing. In competitive efficient market asset prices change only in response to change in fundamental variables. When a trader purchase foreign currency solely for its expected payoff due to future change in fundamentals, the foreign exchane is said to be driven mainly by fundamentals. However, if the market is dominated by non-fundamental speculative motives, the currency price diverge from its fundamental real value. Thus, systematic divergence of the price from its fundamental value is an indication of bubble. Blanchard and Watson, 1982, refer to such type of bubbles as self-fulfilling expectations that push the currency price towards expected price level, which is unrelated to change in the fundamentals of the price. The expanding gap between black market rate and the official exchange rate in the past few years became a major concern for the authorities in Sudan. Some basic questions we would like to answer in this paper includes: Is the black market rate for foreign exchange in Sudan is a free exchange rate that reflect change in fundamental macroeconomic variables? What are the major factors that nurture the black market foreign currencies in recent years? and finally, what is the best predictor of the black market rate?

To answer the first question we assessed profitability of technical trading rules, to see if speculative trading rules can gain significant profit to currency dealers.To answer the second and third questions we investigated the association between high powered money and change in black market prices.

The remaining part of the paper is structured as follows. Section two highlights literature review. Section three illustrates technical trading rules and shows how simple trading rules can attract significant gains to traders. The final section concludes the study.

2-Literiture review

Studying volatility in asset markets in general can help controlling asset markets irregularities and detecting volatility boundaries (Bollerslev et al., 2003). The increasing sensitivity of major economic indicators in underdevolpoed economies to volatility in black market for foreign exchange highlights the importance of modeling volatility in these markets. The literature on black market for foreign exchange takes two approaches: the first approach adapt specification of determinants of black market rate premium. A partial list of articles in this tradition includes Dornbusch et al. (1983), Fishelson (1988), Culbertson (1989), Phylaktis (1992), and Shachmurove (1999). The second approach focuses on the impact of black market rate volatility on macroeconomic indicators. Musila and Al-Zyoud (2012) following the latter approach assess the relationship between black market volatility and volume of international trade in sub-Saharan African countries and indicate that reducing volatility in the black market rate increase (though insignificant) international trade flow to these countries. But findings by

Makochekanwa (2007) show the black market rate has significant impact on hyperinflation in Zimbabwe, during 1999 -2006.

Caporale and Cerrato (2008) investigate the long-run relationship between black market and official exchange rates in a number of Asian emerging economies to show weak evidence of long-run equilibrium relationship between the two market rates. In study of exchange markets in India and Sri Lanka, Emran and Shilipi (2010) show black market rates are weak indicators of equilibrium exchange rate. Jayaratnam (2003) investigates the impact of black market premium on FDI to show that reduction in black market premium has little impact on FDI flows in a number of developing countries.

3: Technical Trading Rules and Trading Signals

In recent years more research results unveiled the predictive power of technical trading rules in emerging stock markets. A number of research studies (Besseminder and Chan, 1995; Ratner and Leal 1999; Ito 1999; Kho 1996; Levich and Thomas,1993), indicated that trading rules showed significant predictive power of profits in a number of Asian markets including Malaysia, Thailand, and Taiwan, but less predictive in more developed markets of Hong Kong and Japan. In a more comprehensive study including Indonesia, Mexico, Taiwan, Canada, and U.S., stock markets, Ito (1999) found trading rules captures quite strongly trading patterns (buy and sell signals) in all these markets with exception of the U.S., stock markets. Similar conclusion supporting relevance of trading rules analysis in Latin America stock markets concluded by Ratner and Leal (1999).

Since efficient market hypothesis imply, prices in efficient markets reflect all available information to the extent that excess returns generated

from any additional information cannot exceed transaction costs of trading on that stock (Fama and Blume 1966), then evidence of profit generation in stock or currency market using past price behavior entails indication of market inefficiency. Thus, investigation of technical trading analysis may have important implications on a market regulations, in addition to its benefit to investors with respect to availability of potential opportunities.

In the following we investigate whether technical analysis can be exploited to predict significant profit returns in the black market.

3.1. Simple Technical Rules:

Technical trading rules assume price change follow predictable patterns that can be exploited for trading strategies. While there are different specifications of trading rules, the most simple and more often employed by practitioners are the variable length moving average (VMA), and the trading-range break. To explain these two rules, let s_{it} $(t = 1,2.....T)$ be the ith daily stock price index, so that its return can be computed as: $r_{it} = \ln(s_{it}) - \ln(s_{i(t-1)})$. A buy and sell orders prescribed based on:

$$\begin{array}{ll} \textit{Buy if} & S_t \geq \frac{1}{n}\sum_{i=0}^{n-1} S_{t-i} \\ \textit{Sell if} & S_t < \frac{1}{n}\sum_{i=0}^{n-1} S_{t-i} \end{array},$$

where s_t is the stock price at time t.

Alternatively, to compute the variable moving average rule, a short-period moving average (SMA) and a long-period moving average (LMA) rules need to be computed, so that n is set equal to the number of trading days in a week (i.e., n = 3) for SMA, and n>10, for LMA. In this case a buy order can be signaled when $SMA_{it} > LMA_{it}$, by an amount larger than pre-specified band level; and a sell order when $SMA_{it} < LMA_{it}$ by an

amount lower than the band. The trading-range break signals buy order when the price rises above its last local maximum (the resistance level), and a sell order when the price sink below its last local minimum (the support level).

The t-test statistics for the buys (sells) are defined as:

$$\frac{\mu_r - \mu}{\left[\frac{\sigma_r^{\ 2}}{N_r} + \frac{\sigma^2}{N}\right]^{0.5}}$$

where $\mu_r, \sigma_r^{\ 2}, N_r$ are the mean return, estimated variance, and the number of buy (sell) days; μ and N are the population mean and number of observations.

And the t-test statistics for the buy-sell are defined as:

$$\frac{(\mu_b - \mu_s) - \mu}{\left[(\frac{\sigma_b^{\ 2}}{N_b} + \frac{\sigma_s^{\ 2}}{N_s}) + \frac{\sigma^2}{N}\right]^{0.5}}$$

where μ_b , μ_s , N_b *and* N_s are respectively the buy and sell mean returns and the number of days for the buys and sells. In the table the term (1,20,0.01) refer to the short period is one day, the long period is 20 days, and the band is 1%.

Results in table (1) indicate profitability of variable length moving avergae trading rule by currency traders. The findings in the table show positive profits can be gained if traders practice simple trading rule of buying at the low price levels and selling at higher prices in periods ranging from one day to three weeks . Such practice of buying and selling at different prices also supported by figure (1), which indicates the buying periods by the upward arrows , and the selling periods by the downward arrows. On the other hand, table (2) indicate trading rules in the black market for foreign exchange do not support a positive profit gains when support and resistence trading strategies are assumed.

In tables (3) and (4), we simulated a hypothetical example of three traders who are able to cordinate among themself as in the oligopoly models, under two senarios. The first senarion in table (3) shows sustainability of the cordinated tradings when traders have a fixed amount of domestic cuurency balance and trade a fixed amount of foreign currency among themselves (US$10). In such case the trading in FX is not sustainable even when they have a market power to set price at the levels they want. This can be indicated by the declining amount of foreign currency balance from US$ 33 in the initial period 1 to US$19 in the final period. However, under the second senario it is assumed that traders have the same fixed amount of foreign currency, but they have access to increasing domestic currency balance. In this case the trading of FX in the black market becomes sustainable, as their total balance in foreign exchange increase from US$44 in the initial period to about US$ 100 in the final period. These results imply as long as traders in black market for foreign exchange have access to increasing domestic currency, via smuggling activities or whatever, black market activities may not disappear even when foreign currency amounts traded in the black market for FX remained fixed.

Given that growth in domestic liquidity (money supply) is fundamental driver of change in black market rate (figure 2), to assess the size of over-pricing of the black market rate due to speculative trading of foreign exchange in the black market, we estimated the black market rate consistent with the growth in money supply (M2), and refer to it as realistic rate of the black market rate. As reported in table (5), the excess of the actual black market rate over the estimated rate indicates the size of over-pricing due to speculative trading activities in the black market. Results in table (5) show increasing divergence between the estimated and the actual rates. This imply that the size of over-price in the black

market increased from 7% in October 2016 to 38% in November 2017. This result shows the effect of speculative motives, as opposed to fundamental drivers, were more dominant in 2017, albeit in the last four months of 2017.

Table (1):Variable length moving average rule

	FX mean	Std.dev	Min/Max
[1, 15; 0.01]			
Buy-Sell	-0.86*	7.09	-8.0/8.2
t-stat	-51.23		
[1, 20; 0.01]			
Buy-Sell	-0.16*	7.14	-7.9/8.2
t-stat	-57.80		
[5, 15; 0.01]			
Buy-Sell	-1.44*	6.9	-8.0/8.2
t-stat	-46.43		
[5, 20; 0.01]			
Buy-Sell	-0.36*	7.13	-7.9/8.2
t-stat	-43.40		

*significant at 1% significance level.

Table (2): Trading Range Break (support & resistance)

	Fx mean	St.dev	Min/Max
Buy	7.8*	0.13	7.6/8.2
t-stat	31.5		
Sell	6.4*	0.18	6.0/6.7
t-stat	-18.7		
Buy-Sell	1.04*	7.13	-6.7/8.2
t-stat	-38.1		

*significant at 1% significance level.

Fig(1): Buy and sell strategies (2016)

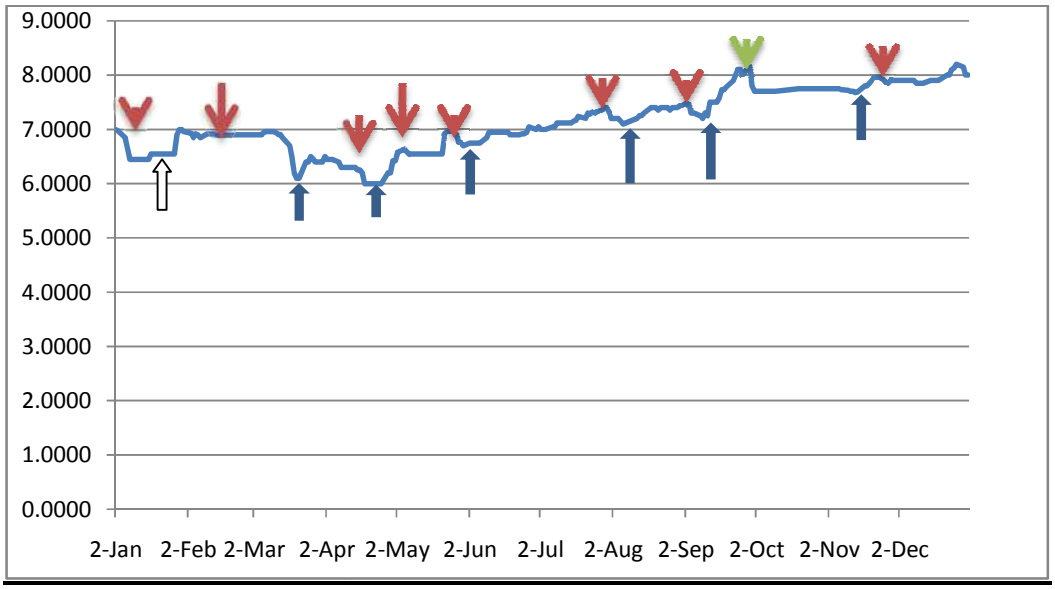

Table (3): Price setting and oligopolistic gains:
(Senario 1: restricted liquidity access)

Periods	FX Rate S£/ US$	**Trader 1** S£	US$	**Trader 2** S£	US$	**Trader 3** S£	US$	Total balance For the 3 traders in US$
1	20	--	10	220	--	240	--	33
2	22	220	--	--	10	240	--	30
3	24	220	--	240	--	--	10	29
4	30	-80	10	240	--	300	--	25
5	40	320	--	240	--	-100	10	21
6	50	320	--	-260	10	400	--	19

Table (4): Price setting and oligopolistic gains:
(Senario 2: sufficient liquidity access)

Periods	FX Rate S£/ US$	**Trader 1** S£	US$	**Trader 2** S£	US$	**Trader 3** S£	US$	Total balance For the 3 traders in US$
1	20	220	10	220	--	240	--	44
2	22	600	--	500	10	500	--	82
3	24	800	--	800	--	800	10	110
4	30	900	10	900	--	900	--	100
5	40	1020	--	1020	--	1020	10	86
6	50	1500	--	1500	10	1500	--	100

Fig (2):Prediction of the black market rate

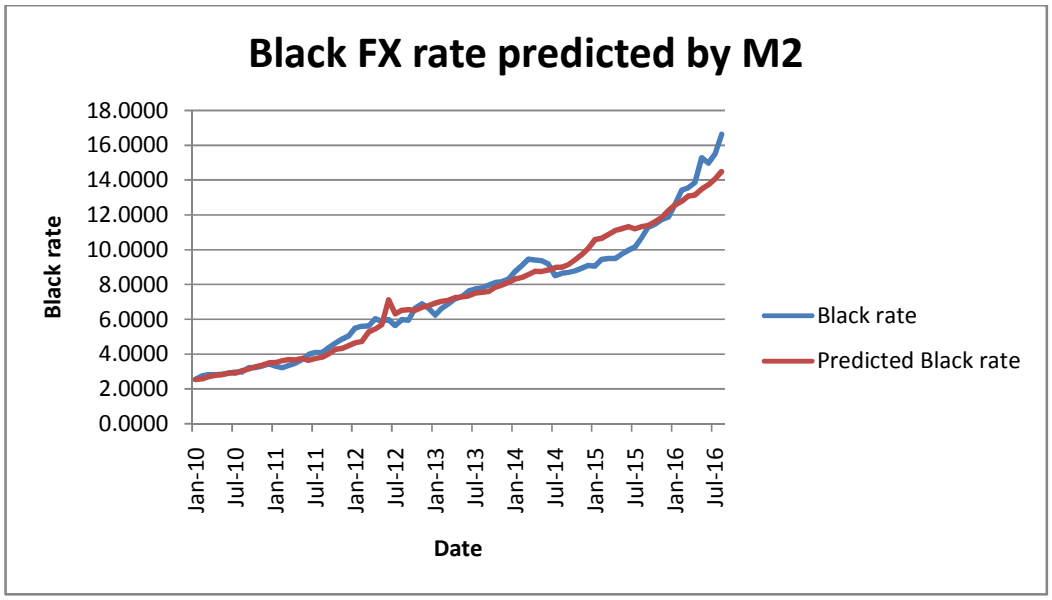

Table (5): Speculative trading effect

Date	Black FX Actual	Black FX (M2 based prediction)	Over-pricing (%)
Oct-16	15.49	14.47	7.02
Nov-16	16.63	14.30	16.26
Dec 16	16.98	14.51	17.05
Jan-17	17.50	14.64	19.52
Feb-17	17.67	14.81	19.31
Mar-17	17.89	15.02	19.08
Apr-17	18.40	15.24	20.75
May-17	18.90	15.46	22.29
Jun-17	19.41	15.67	23.84
Jul-17	19.69	15.89	23.89
Aug-17	19.98	16.11	23.99
Sep-17	20.12	16.34	23.15
Oct-17	21.89	16.56	32.17
Nov-17	23.23	16.79	38.37

4- Concluding Remarks:

The findings in this research indicate profitability of variable length moving avergae trading rule by currency traders when traders practice simple trading rule of buying at low price and selling at higher price in periods ranging from one day to three weeks . However, such trading rule cannot support a positive profit gains when resistence and support trading strategies are assumed. To investigate further trading signals we simulated a hypothetical example of three traders who are able to coordinate among themselves as oligopolist, under two senarios. The first senarion assume monetary authority control domestic liquidity so that traders cannot increase their balance of domestic currency. In such case it is indicated that trading in foreign currency in a black market is not sustainable, as the balance of foreign currency declines over time, even when traders enjoy a market power to set prices. However, under the second senario it is assumed that traders have the same fixed amount of foreign currency, but they have access to increase domestic currency balance, implying that monetary authorities unable to control domestic liquidity. In this case trading of foreign currency in the black market becomes sustainable, as traders foreign currency balance increases continously over time. These results imply as long as traders in black market for foreign exchange have access to increasing domestic currency, via gold smuggling, export under-invoicing, or import over-invoicing , then black market activities can not disappear if black market is controlled by a few powerful traders who set prices as oligopolist. Assuming growth in domestic liquidity (money supply) is fundamental driver of change in black market rate, we estimated the extent of over-price in the black market rate due to speculative trading of foreign exchange. Our results indicate the size of over-price in the black market

increased from 7% in October 2016 to 38% in November 2017, revealing expanding market power exerted by the black market traders in the last four months of 2017.

References

Bessembinder, H., & Chan, K. (1995). The profitability of technical trading rules in the Asian stock markets. *Pacific-Basin Finance Journal*, *3*(2-3), 257-284. DOI: 10.1016/0927-538X(95)00002-3

Culbertson, W.P. (1989), Empirical regularities in black markets for currency, World Development,17, No. 12, pp. 1907-1919.

Dornbusch, R.. et al. (1983), The black market for dollars in Brazil. Quarterly Journal of Economics,98, 25-40.

Fishelson, Gideon (1988), The black market for foreign exchange: An international comparison,Economics Letters 27, 1988, 67-71.

Gros D., "Dual Exchange Rate in the Presence of Incomplete Market Separation: Long-Ran Effectiveness and Implications for Monetary Policy" *IMF, WP/87/45*,1987

Jadgeep B., Vegh C., "Dual Exchange Markets Under Incomplet Separation: An Optimizing Model," *IMF Staff Papers*, Vol. 37, No.1 March 1990.

Kharas, H., and Pinto, B., "Exchange Rate Rules, Black Market Premia, and Fiscal Deficits: The Bolivian Hyperinflation," *Review of Economic Studies*, 56, July 1989, 435-47.

Kiguel, M., O'Connell, S., "Parallel Exchange Rate in Developing Countries." *The World Bank Research Observer*, Vol. 10, No.1, Feb. 1995, 21-52.

Lizondo, J. S., "Unification of Dual Exchange Market," *Journal of International Economics*, 22, Feb. 1987, 57-77.

Onour, I., and Cameron, N., "Parallel Market Premium and Real Official Exchange Rate Misalignment," *Journal of Economic Development,* Volume 22, Issue No.1, 1997, 25-41.

Onour, I., "Unification of Dual Foreign Exchange Markets" *Economics of Planning (Journal),*33, 171-184, 2000.

Rodriguez, C., "A Stylized Model of the Devaluation-Inflation Spiral" *IMF Staff Papers*, 25 , 1978, 76-89.

Gupta S., (May 1984) "Unrecorded trade at black exchange rates: Analysis, implications, and estimates" Aussenwirtschaft, 39, pp.75-90.

Caporale, Guglielmo Maria and Cerrato, Mario, Black Market and Official Exchange Rates: Long-Run Equilibrium and Short-Run Dynamics (November 2006). CESifo Working Paper No. 1851. Available at SSRN: https://ssrn.com/abstract=949425

Ito A., (1999) "Profits on technical trading rules and time-varying expected returns: evidence from pacific-basin equity markets. Pacific-Basin Finance Journal, 7(3-4), pp.283-330.

Kho, B-C., 1996, Time-varying risk premium, volatility, and technical trading rule profits: Evidence from foreign currency futures markets, *Journal of Financial Economics* 41, p249-290.

Levich, R. M., and L. R. Thomas, 1993, The significance of technical trading-rule profits in the foreign exchange market: A bootstrap approach, *Journal of International Money and Finance* 12, p451-474.

Fama, E., and M. Blume, 1966, Filter rules and stock market trading profits, *Journal of Business* 39, p226-241.

Musila J.; AL-Zoud H.; (2012) "Exchange rate volatility and international trade flows in sub-saharan Africa: empirical evidence" Journal of African Business, vol.13, 2012, issue 2, pp. 115-122.

Makochekanwa A.; (2007, July) "Zimbabwe's hyperinflation money demand model" University of Pretoria, department of economics, working paper series, 2007-12.

Jayaratnam A.; Mckinnon R.; How does the black market exchange premium affect foreign direct investment?" uploaded from: http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.197.6736

Ratner, Mitchell; Leal, Ricardo P C., (1999), *Tests of Technical Trading Strategies in the Emerging Equity Markets of Latin America and Asia*, Journal of Banking and Finance, Vol. 23 (12)., December 1999, p 1887-1905.

Shachmurove, Y. (1999), The premium in black foreign exchange markets: evidence from developing,countries. Journal of Policy Modeling Volume 21, Issue 1, January 1999, Pages 1-39.

Shahe Emran, M. and Shilpi, Forhad, Is Black Market Exchange Rate a Good Indicator of Equilibrium Exchange Rate? A Simple Test with Evidence from South

Asia (February 14, 2010). Available at SSRN: https://ssrn.com/abstract=1552885 or http://dx.doi.org/10.2139/ssrn.1552885

Phylaktis, K. (1992), The black market for dollars in Chile. Journal of Development Economics,Volume 37, Issues 1-2, November 1991, pp. 155-172.

Pinto B., "Black Market Premia, Exchange Rate Unification and Inflation In Sub-Saharan Africal" *World Bank Economic Review*, 3, Sep. 1989, 321-38.

------, "Black Markets for Foreign Exchange, Real Exchange Rates, and Inflation" *Journal of International Economics,"* 30, March 1991, 121-35.