WORKING PAPER

MOTIVES AND
EFFECTIVENESS OF FOREX
INTERVENTIONS IN
ALBANIA

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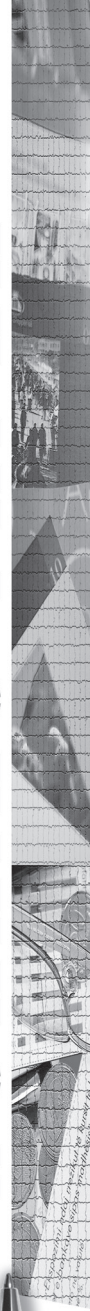
MOTIVES AND EFFECTIVENESS OF FOREX INTERVENTIONS IN ALBANIA

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ABSTRACT

In countries with floating exchange rates, central banks generally intervene to contain market volatility or put a stop to exchange rate overshooting, but not to influence the exchange rate trend. They also intervene to maintain international reserves against vulnerabilities in the external sector, or for mercantilist motivations. Using Probit and nonlinear testing models, this study tries to evaluate the Bank of Albania's reaction function to intervene during the 2000-14 period. Regarding the response to exchange rate deviations, the analysis has been extended to distinguish divergences from longer versus shorter time trends. The final aim of the study is to assess whether the central bank interventions have been effective in stabilizing the exchange rate by returning it towards an underlying direction and reducing undesired market volatility.

1. INTRODUCTION

The exchange rate is important in an open economy framework both, as a policy variable and for its impact on macro-financial variables. Therefore, apart from the conventional monetary policy instruments - like money and interest rate setting - central banks often conduct operations in the foreign exchange market as a useful tool in containing exchange rate shocks that may risk the macroeconomic objectives or financial stability. If forex interventions are effective in influencing exchange rate developments they can be used to signal future changes in the monetary policy stance. For that reason, a vast literature has focused on the foreign exchange market operations as an effective tool "…to control inflation or maintain internal balance; to maintain external balance and prevent resource misallocation or preserve competitiveness and boost growth; and to prevent or deal with disorderly markets or crises"[1].

Although the share of IMF member countries that abandoned the fixed exchange rate regimes after the Bretton Woods era had fallen to just 11 percent in 1999, the currency and banking crises in some countries would spread the "fear of floating" and instigate central banks to heavily use their foreign reserves to reduce the exchange rates variability (Calvo & Reinhart, 2000). The escalated globalization that affected international trade, financial flows and relative prices afterwards, led to the weakening of the exchange rate pass-through to prices and its decoupling with trade flows in many countries (Mauro et al., 2008). Nevertheless, the heightened capital flows to emerging economies caused hefty forex interventions by central banks in the run up to the global financial crisis and in the post-crisis period as well. Particularly in the latter period, the growing size of portfolio and short-term flows in emerging economies instilled high accumulation of international reserves – in 2013, they amounted to one-tenth of the US economy – as policymakers feared the extraordinary easing of monetary policies in advanced economies would build up risks in host countries and eventually jeopardize their financial systems. Therefore, in a world of high capital flows, floating exchange rates might not guarantee

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[1] *Bank for International Settlements (2005). "Foreign exchange market intervention in emerging markets: motives, techniques and implications," BIS Papers No 24.*

an autonomous monetary policy, thus challenging the validity of the Mundellian Trilemma (Rey, 2016; Aizenman et al, 2015).

Similar to many developing economies, Albania's stock of net foreign investments has more than doubled since the pre-crisis period. They increased from 27.7% of GDP in 2006 to 66.9% in 2014 (almost entirely in the form of FDI and non-portfolio investments). In spite of that, reserve assets only increased 2.6 percentage points to 22.0% of GDP in 2014. The accumulation of reserves appears to be in line with the growth of imported goods and services, and suggests the central bank has not intended to hoard large quantities of reserves against foreign liabilities for as long as the exchange market pressure[2] is deemed under control.

This behavior would classify the Bank of Albania as strictly following by the rules of a floating exchange rate regime. It only conducts occasional forex interventions with the intention to (i) maintain a certain level of international reserves, (ii) dampen undesired volatility, or (iii) influence the exchange rate towards a certain underlying level. Adequate international reserve levels are an important buffer against vulnerabilities to macroeconomic as well as financial sector shocks. They can also serve as an insurance to foreign investors, thereby softening the terms and conditions of loans borrowed abroad. Similarly, excessive short-term volatility or exchange rate divergences beyond a "fundamental" equilibrium worries for negative influence on prices and trade or put financial stability at risk. The adverse effects may be palpable in Albania, whose small open economy depends on imported goods and services and also has a considerable dollarization level of financial assets and liabilities. Although recent empirical evidence indicates a diminished relationship between exchange rate and prices and trade, yet financial dollarization and the reduced external short-term debt coverage by reserves should not be disregarded even under a free-floating regime.

During the most of the 2000-14 period, the BoA's decisions on maintaining an adequate stock of reserves has been established in

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[2] *Aizenman & Binici (2015) find that short-term portfolio flows and FDIs significantly affect exchange market pressure in EMEs, though that might not be considerable for OECD countries.*

agreement with the IMF mission and set at a level that is consistent with the monetary program. To meet this objective, the distribution of central bank operations have not been very regular, though they have often been concentrated during the height of the holiday seasons when Albanian emigrants return to the country or send considerable amounts of remittances. The seasonality of inflows and the subsequent U-shape of the exchange rate has pushed the Bank of Albania to combine its actions such as to meet the reserve objective and simultaneously stabilize the forex market. In an attempt to set up an analytical framework to guide the BoA's forex operations, Luçi (2007) argues that the fulfillment of international reserves objective ought to better be conducted according to certain transparent rules, and not to be combined with interventions that aim at stabilizing the exchange rate market. As combining both objectives is not an easy task, the finding of this paper about the effectiveness of central bank interventions should contribute in this discussion and help the central bank's decision making.

The purpose of this study is twofold. First, it tries to sort out the reaction function that has prompted the Bank of Albania to step in the foreign exchange market; and then it assesses the effectiveness of central bank objectives. In this regard, the discussion of stylized facts in Section 2 is followed by the estimation of two probability models in Section 3. Firstly, the Probit analysis evaluates the probability of BoA to respond to the exchange rate volatility, the current rate deviations from trend, and the inventory of foreign currency reserves. Secondly, the nonlinear modeling tries to find out whether the BoA's officials pay deeper attention to the nature of market developments, by distinguishing between small and transitory movements from large and persistent unsteadiness. Section 4 continues to evaluate the effectiveness of forex interventions within the autoregressive conditional heteroskedasticity GARCH (1,1) framework, as well as the event study methodology. The first is largely used as a sensible econometric procedure to deal with daily data; whereas the second might be considered as a more useful or accurate approach in analyzing irregular data series with often extensive idle periods of no interventions.

2. SOME STYLIZED FACTS

This section briefly discusses exchange rate developments in the past fifteen years and describes some statistical features of the Bank of Albania (BoA)'s interventions. The discussion is augmented with relevant analysis on the falling importance of exchange rate channel with regard to domestic inflation and external trade; the stability of lek relative to CESEE floating currencies during the global crisis; and the concern about financial dollarization.

Since the liberalization of prices and market reforms that started in early 1990s the Albanian lek has been allowed to float freely against all foreign currencies. During the first decade of transition, lek was generally perceived as being linked to the U.S. dollar, as a lot of economic transactions and private savings were denominated in the greenback currency. However, the introduction of euro in 2002 was welcomed by local importers and exporters. The new currency shared by the major trading partners as Italy, Greece and Germany meant lower transaction costs in the foreign exchange market and reduced exposure to exchange rate fluctuations. In addition, the subsequent fall of the US dollar in the international markets made it less attractive to be used as a store of value, therefore it was soon replaced by the European common currency.

Figure 1 Exchange rate performance and net FC purchases

Source: Bank of Albania.
*The exchange rate is expressed as leks per unit of foreign currency. The forex market staff analyzers at BoA usually report on a basket of two currencies, the euro and the US dollar, weighted as 90% and 10% respecetively.
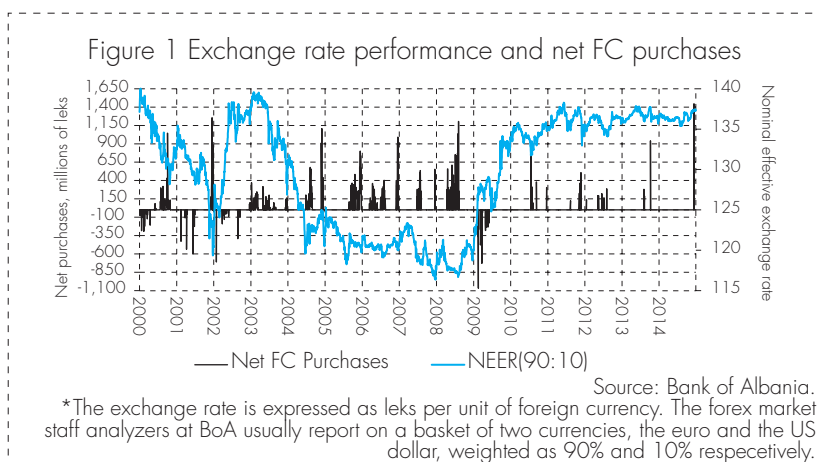
Figure 1 plots the daily effective exchange rate and net foreign currency purchases from 2000 to 2014. It appears that the Albanian lek fluctuated substantially in the early years of the sample. The stabilization policies in the aftermath of 1997 collapse of pyramid schemes were yielding their fruits, as labor productivity and foreign direct investment were growing rapidly. However, the economy was still struggling to recover an impaired public confidence and implement urging structural reforms. Therefore, the considerable appreciation of the lek against euro and the US dollar in the first two years was quickly reversed around the sudden run on bank deposits in March and April 2002.

Twelve months later, the Albanian currency started over its appreciation trend and was perceived as fairly stable for about six years, helped by a positive and relatively sustainable macroeconomic environment. For instance, one euro averaged about Lek140 in the first half of 2003; it dropped to almost Lek124 in July 2004 and moved upward and downward of that level by 3.4 percent until December 2008. Over this same period, the US dollar price was halved, costing as much as 134 leks in January 2003 and as little as 76 leks in July 2008.

The global crisis then ended the favorable years for the domestic currency. Lek was hit in January 2009, it gradually lost most of its previous gains until mid-2011, and fluctuated around that level thereafter. Nevertheless, lek losses were contained if compared to other free-floating currencies in the region. Since October 2008, which corresponds with the start of common journey of the CESEE floating currencies, most exchange rates appeared 12 to 18 percent weaker against euro in December 2014 – the Albanian lek was somewhere in the middle (14%) – while the Turkish lira and Serbian dinar had lost more than 40 percent (please see Figure 2). Moreover, lek was obviously the most stable currency in terms of volatility; in the last five years or so its coefficient of variation is less than 1, whereas that of other currencies varies from 3 to 13 times higher than the lek's.
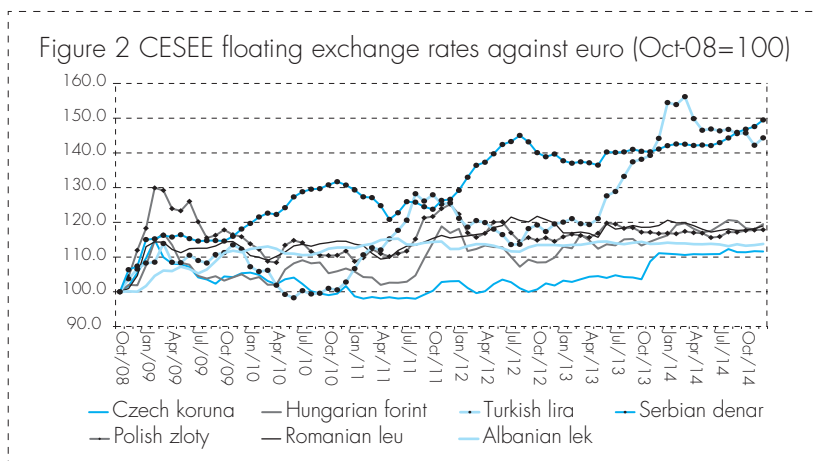
Figure 2 CESEE floating exchange rates against euro (Oct-08=100)

Legend: — Czech koruna — Hungarian forint — Turkish lira — Serbian denar — Polish zloty — Romanian leu — Albanian lek

Table 1 Features of intervention activities by the Bank of Albania, January 1,2000 – December 31, 2014

|	Days of interventions	Mean	Median	St.Dev.	Max	Min
		2000-2014				
FX Purchases	377	221.90	152.52	229.26	1444.98	1.30
FX Sales	68	192.27	132.30	199.56	1067.03	0.01
FX Interventions	445	217.37	149.30	225.02	1444.98	0.01
Intv/Reserves (%)	445	0.16	0.11	0.16	1.30	0.00
		2000-2002				
FX Purchases	70	155.32	72.29	235.92	1254.92	7.57
FX Sales	44	141.01	74.40	165.33	710.00	0.01
FX Interventions	114	149.79	72.31	210.80	1254.92	0.01
Intv/Reserves (%)		0.17	0.09	0.23	1.30	0.00
		2003-2008				
FX Purchases	285	228.49	164.35	214.22	1205.25	1.30
FX Sales	0	-	-	-	-	-
FX Interventions	285	228.49	164.35	214.22	1205.25	1.30
Intv/Reserves (%)	285	0.16	0.12	0.14	0.87	0.00
		2009-2014				
FX Purchases	22	348.38	223.96	324.77	1444.98	94.99
FX Sales	24	286.26	221.54	225.09	1067.03	39.27
FX Interventions	46	315.97	223.96	275.86	1444.98	39.27
Intv/Reserves (%)	46	0.13	0.10	0.11	0.48	0.02

Source: author's calculations

Turning to exchange rate interventions, the bars displayed in Figure 1 indicate the Bank of Albania has not been very active

in the FX market. During 2000-14, it has intervened on a total of 445 days (or 11.4% of the whole period) with an average amount of 217.37 million leks and a bit higher than average standard deviation. Purchases of foreign currencies accounted for nearly 85% of the intervention days. They were conducted more frequently during the 2000-08 period, and less often after the global financial meltdown. On the other hand, the frequency of FX sales operations is very low (conducted in only 68 days) and concentrated in the course of 2000-02 exchange rate oscillations and later on to defend the domestic currency against the negative external shocks in 2009. In addition, Table 1 shows the average amount of purchase transactions is somewhat higher than that of sales, particularly in the 2009-14 period (Lek348.4m-Lek286.3m), while their difference with respect to standard deviation is more pronounced (esp. if the zero sales 2003-08 period is excluded).

These facts suggest the Bank of Albania has been similarly attentive to exchange rate volatility. Whether on a depreciating or appreciating trend, the central bank would intervene to contain exchange rate overshooting or smooth its volatility, but not to influence its direction. Furthermore, the higher statistical properties of purchase transactions as compared to sales imply that BoA has been more inclined to replenish and maintain an adequate level of international reserves, rather than allowing them to deplete at all costs. A visual inspection of the data supports this notion, since the recurrence of BoA's active days is higher during the more volatile
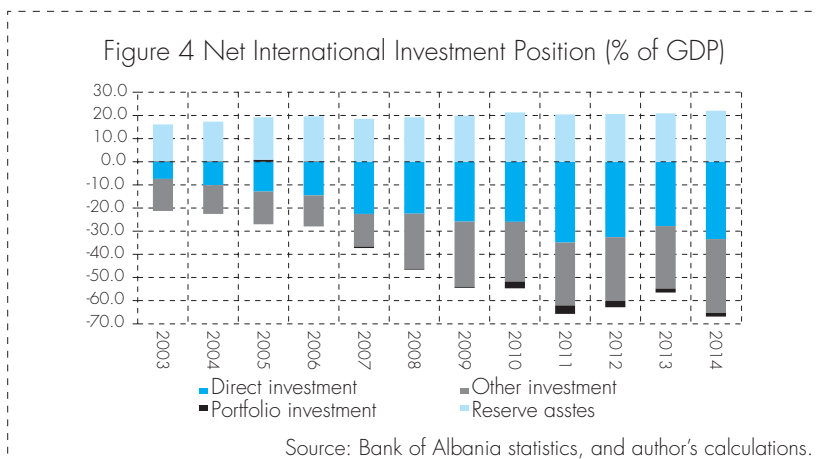

Figure 3 Imports and External Short-term Coverage by Foreign Reserves

Source: Bank of Albania statistics, and author's calculations.

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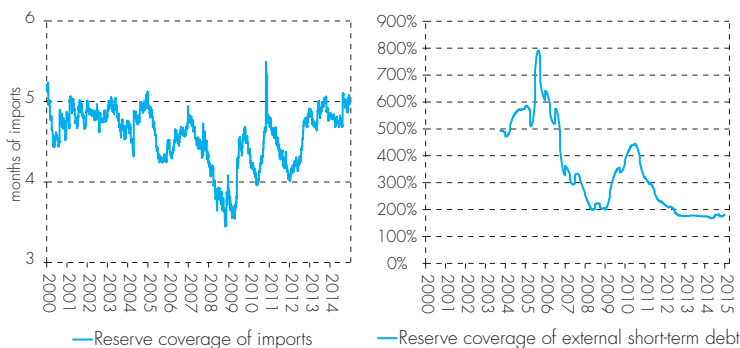
2000-09 period, while it becomes more infrequent in the subsequent years when exchange rate changes are relatively steady and less volatile; import coverage is at historical highs over and above 4 months[3]; while the ratio of foreign reserves to external short-term debt (at 176% in the fourth quarter of 2014) stands well above the IMF recommended benchmarks (see Figure 3).

Indeed, the relative stability of lek in recent years is admirable, as it does not owe to the absence of nominal or real shocks. The domestic currency has been little affected by favoring, though volatile, net foreign investments. The stock of net foreign liabilities in the form of FDI and non-portfolio investments increased significantly from 36.7 percent of GDP in 2007 to 65.3 in 2014 (Figure 4). Yet, the exchange rate against euro depreciated in the early years of the global crisis and showed a low variability afterwards. Similarly, the Albanian currency has resisted pressures from negative factors, such as falling private transfers and the relatively large current account deficit (Figure 5); the narrowing gap of policy rates between Albania and euro area – the difference was above 4 percent in 2010 and nearly 2 percent at the end of 2014; and shocks in the FX market resulting from the ECB's quantitative easing programs and the ongoing debt crisis in the neighboring Greece.

Figure 4 Net International Investment Position (% of GDP)

Direct investment   Other investment
Portfolio investment   Reserve asstes

Source: Bank of Albania statistics, and author's calculations.

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[3] For several decades, IMF has generally recommended an adequacy level of reserves at 3 months of imports; whereas developing countries like Albania with limited access to international capital markets have to maintain an additional month of imported goods and services (Luçi, 2007).

Figure 5 Current Account Balance (% of GDP)

Legend: Current Account — Balance of Trade — Balance of Transfers
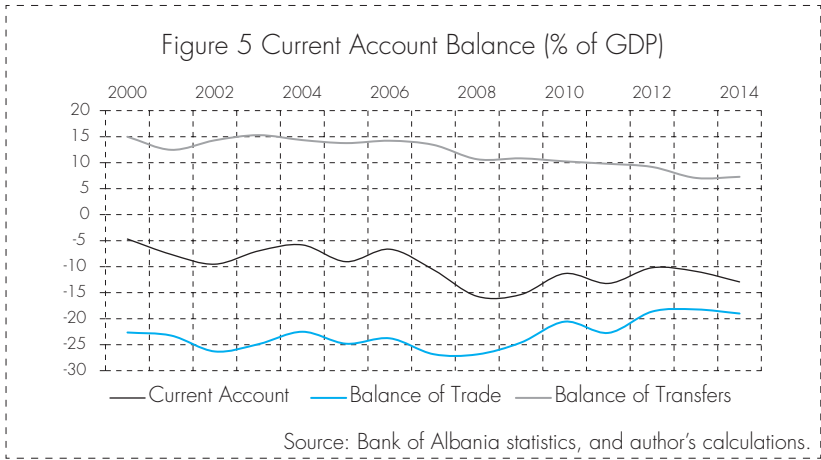
In spite of these macro-financial developments, the rarer actions of the central bank after the global financial crisis can be comprehensible. Primarily, the exchange rate performance and foreign reserve levels have been satisfactory, while there is a growing evidence that exchange rate pass-through to inflation has faded away and its role is evaluated as more of a shock absorber rather than being much able to influence Albania's external competitiveness (Tanku et al., 2007). On the other hand, what might be worrying attention in this respect is the level of financial dollarization in Albania, which continues to remain substantially above desired levels despite modest inflation rates for a decade and a half. Dollarization of bank deposits increased from 30 to 50 percent in the years 2005 to 2015, whereas dollarization of bank loans has gradually reduced to 57 percent. Nevertheless, the Bank of Albania seems attentive to the exchange rate exposure as it has continuously opted for adequate international reserves for precautionary purposes during the recent financial stress.

3. DETERMINANTS OF INTERVENTIONS

The main reasons behind central bank interventions in the foreign exchange market are trend corrections, volatility smoothing, exchange rate overshooting, profitability, and international reserve level (Kim & Sheen, 2002). The latter can be conducted for precautionary purposes and for competitiveness motives (Malloy, 2013). In the case of Albania, the central bank does not aim at altering the exchange rate direction, unless authorities deem it misaligned. Because it has adopted a free-floating regime, such an intervention would send mixed signals to the market on the stated objectives and thus undermine the central bank credibility.

Furthermore, the motives of interventions are often not mutually exclusive. Central banks that rely more on discretionary strategies rather than intervention rules can combine more than one objective to intervene in the market at a given point in time. The Bank of Albania, for instance, does not use any rule for 'regular' interventions to reach a certain target of international reserves, therefore its purchases of foreign currencies have been frequently undertaken during the height of holiday seasons to smooth volatility or exchange rate misalignment.

This section employs two methods to sort out the reaction function that has prompted the monetary authority in Albania to buy or sell currencies in the foreign exchange market. The Probit method initially estimates the likelihood of an intervention given the forex market conditions and current account vulnerabilities. Then, a nonlinear estimation is used to distinguish between small and transitory movements from large and persistent instabilities.

3.1 PROBIT ANALYSIS

The Bank of Albania (BoA) has officially stated that it has no intention to influence the value of the domestic currency. It mainly intervenes to smooth undesired fluctuations, adjust the exchange rate towards an underlying level, as well as maintain an adequate

level of foreign currency reserves[4]. To determine whether the central bank's actions are consistent with its objectives, we can employ a Probit estimation method that models the probability of an intervention event in the following form:

$$INTV_t = \alpha_C + \alpha_{ERDEV} \ ERDEV_t + \alpha_H \ H_t + \alpha_{RM} \ RM_t \qquad (1)$$

where *INTV* is a binary choice dummy variable that takes the value of one if there is a foreign exchange (purchase or sale) intervention at time *t*, and zero otherwise; $ERDEV_t$ is exchange rate overshooting proxied by the current exchange rate deviation of from its trend (in percent); *H* is the lek exchange rate volatility approximated by the conditional variance of the daily changes generated from the GARCH(1,1) model in Section 4.1; *RM* indicates the level of foreign currency reserves in months of imports (the monthly data were interpolated into daily frequency).

The probability of a purchase (sale) intervention should increase (decrease) if actual exchange rate substantially appreciates (depreciates) from its perceived trend. A downward (upward) movement in the exchange rate basket[5] indicates strengthening (weakening) of the Albanian lek; therefore, coefficient *a*ERDEV is expected to have a negative (positive) sign. Another point of interest is to find out which of the exchange rate deviation draws more attention from the central bank. Are divergences from the longer, or shorter time trends more imperative that increase the likelihood of an intervention? For that reason, the analysis has been extended to evaluate the response probability to exchange rate deviations separately from its 1-week, 2-week, 1-month, 3-month and 6-month moving average.

Next, higher market volatility should increase the likelihood of the central bank response to calm the market. Thus, parameter *a*H before exchange rate volatility should have a plus sign to indicate a positive relationship with both, purchase and sale actions. Lastly,

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[4] *A paraphrase of Article 4 in the Regulation "On the procedures of the Bank of Albania's interventions in the domestic foreign exchange market", approved on January 16, 2012.*
[5] *The exchange rate is expressed as Albanian lek per unit of foreign currency. The forex market staff analyzers at BoA usually report on a basket of two currencies, the euro and the US dollar, weighted as 90% and 10% respecetively.*

the import cover ratio RM is included in the equation as a proxy for the reserve adequacy indicator. As the BoA needs to maintain an adequate level of FX reserves for precautionary reasons, a fall in the ratio of reserves to imports would raise the possibility of purchase intervention, and vice versa. Hence, coefficient a_{RM} is expected to have a negative (positive) sign with purchase (sale) interventions.

The estimated results for the likelihood of purchase and sale interventions from January 1, 2000 to December 31, 2014 are presented in Table 2. A quick look at the signs of coefficients reveals that the Bank of Albania has been keen on the exchange rate deviations from its trend, rather than volatility of its level. Whether on the appreciation or depreciation side, movements away from certain levels raise the likelihood that BoA will "lean against the wind" to stop or smooth further exchange rate divergences. However, the likelihood of such actions appears to decrease if market volatility amplifies. The sign and statistical significance of parameters before conditional volatility suggest that BoA was likely to withdraw from the market in case of lek depreciations, and perhaps freer to act against rising volatility during appreciations.

Comparing the deviations from longer versus shorter time trends, it seems that BoA devotes similar care to all states of "equilibrium". The coefficients that measure the reaction to exchange rate overshooting are statistically significant and have the expected sign. Their magnitude is also similar for all downward deviations. Whereas the short-term coefficients for upward overshooting are higher – 0.84 for the deviation from the last week compared to 0.18 for the deviation from the past six months – suggesting a larger response to depreciations from recent market levels.

Last but not least, the inclusion of international reserves as an explanatory variable provides some important implications. A reduction in the reserve coverage of imports appears to definitely influence the decision of policymakers to buy foreign currencies in the market. The coefficient estimates for this variable is negative as expected and at around 95 percent level of confidence in all equations. On the other hand, higher ratios of reserves to imports have not instilled the central bank to sell foreign currencies. The

estimated likelihood is statistically insignificant and has the opposite sign in almost all regressions.

Table 2 Probit Estimation Results for Intervention Probability during 01/01/2000 31/12/2014

	FC Purchase Interventions									
	ERDEV 1w		ERDEV 2w		ERDEV 1m		ERDEV 3m		ERDEV 6m	
c	-0.6497	*	-0.6425	*	-0.6114	*	-0.4279		-0.0290	
	0.07		0.07		0.09		0.26		0.94	
erdev	-0.2434	**	-0.3343	***	-0.3314	***	-0.3017	***	-0.2615	***
	0.01		0.00		0.00		0.00		0.00	
volatility	0.0057		0.0035		0.0005		-0.0074		-0.0107	**
	0.18		0.42		0.92		0.13		0.03	
rm	-0.1530	*	-0.1533	*	-0.1584	**	-0.1972	**	-0.2882	***
	0.05		0.05		0.05		0.02		0.00	
LogL	-1234.3		-1224.5		-1211.6		-1170.1		-1143.4	
Obs with Dep=0 3536			Total obs 3913							
Obs with Dep=1 377										

	FC Sale Interventions									
	ERDEV 1w		ERDEV 2w		ERDEV 1m		ERDEV 3m		ERDEV 6m	
c	-1.2384	**	-1.3448	**	-1.5908	***	-2.0179	***	-2.2772	***
	0.03		0.02		0.00		0.00		0.00	
erdev	0.8409	***	0.6311	***	0.5428	***	0.2645	***	0.1780	***
	0.00		0.00		0.00		0.00		0.00	
volatility	-0.0306	*	-0.0361	**	-0.0433	**	-0.0234		-0.0159	
	0.05		0.03		0.01		0.14		0.30	
rm	-0.1597		-0.1324		-0.0771		-0.0110		0.0360	
	0.20		0.29		0.54		0.93		0.78	
LogL	-329.6		-326.0		-318.1		-316.5		-316.4	
Obs with Dep=0 3845			Total obs 3913							
Obs with Dep=1 68										

Note: p-values are in italics; green color indicates coefficient does not have the expected sign.

Equation:where INTV is a dummy equal to 1 if there is a purchase/sale intervention and zero otherwise; ERDEV is exchange rate deviation from its 1-week, 2-week, 1-month, 3-month and 6-month moving average (in %); H is the volatility measure of exchange rate; RM is the ratio of foreign currency reserves to imports.

These results are consistent with the BoA's statement that interventions aim at achieving a reserve adequacy level, which is often decided in accordance with the "Memorandum of Economic and Financial Policies" and "Technical Memorandum of Understanding" with the IMF. To achieve that objective, the central

bank would be ready to purchase foreign currencies, but hold back from selling them. Because decisions are not rule based, FX purchases are usually undertaken at the height of holiday seasons, in order to combine the reserve objective with the "leaning against the wind" policies.

3.2 TESTING FOR NONLINEARITY IN THE INTERVENTION REACTION FUNCTION

Equation (1) measures a linear reaction of the central bank's purchase or sale interventions. Moderate deviations and/or volatility of the exchange rate might incite actions by the monetary authority to correct the disorderliness in the market. However, the empirical literature shows that at times of large divergences and high volatility with plenty of current news going on central banks may rather stay out of the market until exchange rate shows a clearer direction and trading volume returns to normal levels. Following Kim and Sheen (2002), I estimate another equation to test for nonlinearity in the Bank of Albania's reaction to market disturbances:

$$INTV_t = a_{INTV} INTV_{t-I} + (b_{DEV} DEV_t + b_{SUC} SUC_t + b_{SIZE} SIZE_t) \times | ERDEV_t | +$$
$$+ (c_{DS} DS_t + c_{HSIZE} DS_t \times HSIZE_t) \times H_t + (d_{RM} + d_{RMSIZE} RMSIZE) \times RM_t + v_t \quad (2)$$

where

$INTV_t =$ net purchase intervention by the Bank of Albania, in millions of leks.

$ERDEV_t =$ effective exchange rate deviation from its 1w, 2w, 1m, 3m and 6m moving average, in percent.

$DEV_t =$ deviation dummy variable equal to 1 (-1) if ERDEVt is negative, i.e. appreciating (positive, i.e. depreciating) and zero otherwise.

$SUC_t =$ successive dummy variable equal to 1 (-1) if ERDEVt is negative, i.e. appreciating (positive, i.e. depreciating) for five consecutive days (i.e. t-4 to t) and zero otherwise.

$SIZE_t =$ size dummy variable equal to 1 (-1) if ERDEVt is negative,

	i.e. appreciating (positive, i.e. depreciating) and larger than 2 percent.
$H_t =$	volatility of lek proxied by its conditional variance generated from the GARCH(1,1) model in Section 4.1.
$DS_t =$	dummy variable equal to 1 (-1) one if the daily exchange rate change is negative, i.e. appreciating (positive, i.e. depreciating), and zero otherwise.
$HSIZE_t =$	dummy equal to one if the size of volatility is above its period average and zero otherwise.
$RM_t =$	ratio of foreign currency reserves to imports. Monthly data were interpolated into daily frequency.
$RMSIZE_t =$	dummy equal to one if the ratio of FC reserves to imports is above its period average of 4.5 months and zero otherwise.

If the central bank believes that persistent intervention increases its effectiveness, it is expected that the purchase of foreign currency be followed by similar actions in the consecutive days. In that case, the coefficient in front of the lagged dependent variable should be positive and significant.

The other explanatory variables are basically employed from the Probit model; however, the innovative specification in Eq.(2) is intended to check whether actions of the central bank are determined by the nature of market disorders.

Downward/upward exchange rate departures from its trend accompanied with high volatility in that direction should invite an intervention purchase/sale of foreign currency. Therefore, coefficients b_{DEV} and c_{DS} should be positive. In addition, if the downward wander of lek continues for several subsequent days it may bolster the central bank's decision to intervene in the market. Hence, coefficient b_{SUC} is likely to be positive, too. However, on days of large deviations and relatively high volatility it may make sense for the monetary authority to wait until winds are settled and become more predictable. Therefore, the link between the dependent variable and the magnitude of exchange rate deviations and volatility is ambiguous.

The final coefficients d_{RM} and d_{RMSIZE} capture the central bank response to the international reserve floor (proxied by the ratio of foreign currency reserves to imports). A higher import cover ratio should reduce the possibility of net FC purchases, especially if it that is deemed much higher than the target agreed. Hence, negative coefficients are expected.

Table 3 reports the estimated coefficients for the nonlinear response model. Again, separate equations have been estimated for the central bank's reaction to exchange rate deviations from the 1-week, 2-week, 1-month, 3-month and 6-month moving average.

Table 3 Nonlinear Reaction Model for Interventions during 01/01/2000 31/14/2014

Equation: $INTV_t = a_{INTV}INTV_{t-n} + (b_{DEV}DEV_t + b_{SUC}SUC_t + b_{SIZE}SIZE_t) \times |ERDEV_t| + (c_{DS}DS_t + c_{HSIZE}DS \times HSIZE_t) \times H_t + (dRM + d_{RMSIZE}RMSIZE_t) \times RM_t + u_t$

	ERDEV 1W		ERDEV 2W		ERDEV 1M		ERDEV 3M		ERDEV 6M	
	Coef	Prob	Coef	Prob	Coef	Prob	Coef	Prob	Coef	Prob
a_{INTV+1}	0.23 ***	0.00	0.23 ***	0.00	0.23 ***	0.00	0.23 ***	0.00	0.23 ***	0.00
a_{INTV+2}	0.10 ***	0.00	0.10 ***	0.00	0.10 ***	0.00	0.10 ***	0.00	0.10 ***	0.00
a_{INTV+3}	0.18 ***	0.00	0.18 ***	0.00	0.18 ***	0.00	0.18 ***	0.00	0.18 ***	0.00
a_{INTV+4}	0.17 ***	0.00	0.17 ***	0.00	0.16 ***	0.00	0.16 ***	0.00	0.16 ***	0.00
b_{DEV}	4.78	0.53	13.71 **	0.02	5.88	0.50	18.00 **	0.04	8.03	0.50
b_{SUC}	24.10 **	0.02	-1.89	0.76	-2.48	0.78	-16.23 *	0.07	-6.89	0.56
b_{SIZE}	-1.75	0.92	-2.15	0.87	14.03 ***	0.01	4.28 *	0.08	2.67	0.19
c_{DS}	1.07 ***	0.00	1.02 ***	0.01	1.22 ***	0.00	1.21 ***	0.00	1.25 ***	0.00
c_{HSIZE}	-1.35 ***	0.00	-1.32 ***	0.00	-1.42 ***	0.00	-1.39 ***	0.00	-1.41 ***	0.00
d_{RM}	2.06 ***	0.00	2.08 ***	0.00	2.16 ***	0.00	2.20 ***	0.00	2.29 ***	0.00
d_{RMSIZE}	-1.08	0.12	-1.14	0.10	-1.21 *	0.08	-1.20 *	0.08	-1.37 **	0.05
LogL	-23155		-23157		-23153		-23153		-23155	

*Note: asterisks *, ** and *** indicate significance at 10, 5 and 1 percent*

It appears that purchase/sale interventions have usually been followed by same moves on the next days. Coefficients a_{INTV+n} are positive and statistically significant in all equations, implying that BoA may consider persistent actions to be more effective than isolated interventions on both, exchange rate movements and volatility (as indicated in the results in Table 4).

Coefficient b_{DEV}, which captures the average response to exchange rate deviations, is overall positive, suggesting that exchange rate

overshooting activate the warning signal at the central bank. This could be particularly plausible for deviations from the 2-week and 3-month moving average, where b_{DEV} are statistically significant. Furthermore, successive exchange rate deviations in the same direction might catch the eye of CB officials in the very short term, as indicated by the positive sign and statistical significance of b_{SUC}; its negative sign in the rest of equations suggests consecutive deviations might not cause a real concern. On the contrary, central bank actions seem to be encouraged on days of large overshooting, at least for the mid to longer term. The exchange rate deviation by more than 2 percent from the past month(s) appears to be on the center of BoA's attention, as evidenced by the positive size coefficient b_{SIZE}.

The results support, also, the CB official statements of taking actions against exchange rate fluctuations. The positive coefficient c_{DS} indicates that Bank of Albania has constantly responded to undesired volatility. However, as it is expected, very high fluctuations would hold off the central bank to step in the market. The negative parameter c_{HSIZE} largely offsets the average effects of volatility on purchase/sale interventions, suggesting that BoA has been very cautious when dealing with exchange rate oscillations.

The overall effects of exchange rate overshooting and volatility remain on the whole positive and statistically significant – particularly in case of deviations from 3-month moving average – as indicated by the sum of their respective slope parameters in all equations. These findings support the results from the Probit analysis, suggesting that "leaning against the wind" interventions by BoA is still a determining policy in our sample period but it is retracted in a tumultuous market.

Finally, the overall relationship between the stock of foreign currency reserves to imports and net purchase interventions is shown positive, contradicting our prior expectations. Nevertheless, the estimated negative coefficient d_{RMSIZE} for magnitude in all equations indicates that interventions intended to satisfy the target and not to accumulate indefinite reserves. This might also explain the puzzle of getting negative coefficients for the FC sale interventions in the Probit estimations.

4. ASSESSING THE EFFECTIVENESS OF INTERVENTIONS

The previous section aimed at understanding the factors that determine the Bank of Albania's interventions in the foreign exchange market. The findings suggest that the central bank has indeed intervened to smooth the exchange rate volatility and prevent its overshooting. A point of interest is, then, to find out how successful the forex market operations have been. For that purpose, this section investigates the effectiveness of central bank interventions by using two different methodologies, the econometric approach and the event study analysis.

4.1 ECONOMETRIC INVESTIGATION

Autoregressive conditional heteroskedasticity (ARCH) models are widely used in the literature for testing the effectiveness of interventions simultaneously on both the mean and the volatility of the daily exchange rate. Various models were estimated, including the generalized ARCH (GARCH), GARCH in the mean, Exponential GARCH, and Component GARCH. Differently from the standard GARCH, the other alternatives help to determine whether daily FX returns depend on the market volatility (GARCH-M), test for asymmetric shocks effects on the conditional volatility (EGARCH), and whether interventions have differing effects on the short-term, as compared to the long-term volatility.

The standard GARCH model was eventually preferred, since it provided better forecasts for the conditional variance, ht, while most of the other models resulted in statistically insignificant coefficients for GARCH-M, EGARCH, and ARCH and GARCH in the CGARCH model. Therefore, the following analysis will refer to the GARCH model to estimate the central bank's ability to control exchange rate changes and volatility. The generalized specification for the mean and the conditional variance equations is given by:

$$(3)\ dlogER_t = m_C + m_{ER}dlogER_H + m_{i\cdot i\ast}(i_t \cdot i_t\ast) + (m_{INTV} + m_{INTVSUCI}SUCI + m_{INTVLSI}LSI) \times INTV_{t-1} + m_DD_i + e_t$$

$$(4)\ h_t = v_C + v_{i\cdot i\ast}(i_t \cdot i_t\ast) + (v_{INTV} + v_{INTVSUCI}SUCI + v_{INTVLSI}LSI) \times |INTV_{t-1}| + m_DD_i + v_e e_{t-1} + v_h h_{t-1}$$

where $dlogER_H$ is the log difference of a composite exchange rate index that includes the euro currency (90%) and the US dollar (10%). $INTV_{t-1}$ represents the Bank of Albania's intervention proxied by net daily purchases of foreign currencies at the previous day (expressed in millions of Albanian leks). LSIt is a large size dummy variable equal to one if the absolute amount of intervention is greater than the average interventions during the sample period, and zero otherwise. $SUCI_t$ is a successive dummy variable that equals one if intervention at day t is preceded by intervention in the same direction *at day t-1 and t-2, and zero otherwise. The interest rate differential i - i** is the difference between the overnight rate in Albania and the Eonia interbank rate. Di indicates day-of-the-week dummies from Monday to Thursday. Finally, e_{t-1} and h_{t-1} in the variance equation correspond to the ARCH and the conditional variance GARCH terms of the $dlogER_t$.

Equations (3) and (4) measure the impact of interventions on the conditional mean and variance of daily exchange rate changes, respectively. Interventions enter the equations with a lag, to avoid any simultaneous bias arising between interventions and exchange rate changes at time *t* (Baillie & Osternberg, 1997). The dummy variables are intended to capture any differential effects of particularly large as well as successive interventions. The central bank actions may be more effective if the interventions are large enough to preserve the "equilibrium" exchange rate and also if carried out over a number of days. Such actions might be regarded as more credible to market participants than an undersized and/or isolated entry into the market.

Table 4 GARCH(1,1) Estimated Effects of Net Purchase Interventions

Sample period from 1/01/2000 to 31/12/2014

Mean Eq.: $dlogER_t = mC + m_{ER}dlogER_H + m_{i\text{-}i^*,t}(i_t - i_t^*) + (m_{INTV} + m_{INTVSUCI}SUCI + m_{INTVLSI}LSI) \times INTV_{t-1} + m_D D_{-t} + e_t$

Variance Eq.: $h_t = v_C + v_{i\text{-}i^*,t}(i_t - i_t^*) + (v_{INTV} + v_{INTVSUCI}SUCI + v_{INTVLSI}LSI) \times INTV_{t-1} + m_D D_{-t} + v_e e_{t-1} + v_h h_{t-1}$

	Core model			Extended model		
	Coef.	p-value		Coef.	p-value	
Mean equation						
m_C	-9.3E-05	0.39		-7.1E-05	0.59	
$m_{ER,t\text{-}1}$	1.4E-01	0.00	***	1.4E-01	0.00	***
$m_{ER,t\text{-}2}$	-5.8E-02	0.01	***	-5.9E-02	0.03	**
$m_{ER,t\text{-}3}$	-6.7E-02	0.00	***	-6.7E-02	0.01	**
$m_{ER,t\text{-}4}$	3.8E-02	0.05	*	3.7E-02	0.13	
$m_{i\text{-}i^*,t}$	3.0E-03	0.29		2.7E-03	0.47	
$m_{INTV,t\text{-}1}$	7.4E-07	0.00	***	-2.3E-06	0.30	
$m_{INTVSUCI}$				4.8E-07	0.47	
$m_{INTVLSI}$				2.7E-06	0.23	
Variance equation						
v_C	3.1E-06	0.00	***	3.5E-06	0.00	***
$v_{ARCH,t\text{-}1}$	1.5E-01	0.00	***	1.5E-01	0.00	***
$v_{GARCH,t\text{-}1}$	6.0E-01	0.00	***	6.0E-01	0.00	***
$v_{i\text{-}i^*,t}$	-3.9E-05	0.00	***	-2.5E-05	0.00	***
$v_{INTV,t\text{-}1}$	-3.5E-09	0.00	***	-1.9E-09	0.62	
$v_{INTVSUCI}$				-1.7E-09	0.21	
$v_{INTVLSI}$				-1.5E-09	0.69	
Aggregated intervention effects on:						
Direction	7.4E-07		***	8.4E-07		
Volatility	-3.5E-09		***	-5.0E-09		

Note: p-value asterisks *, ** and *** indicate statistical significance at 10, 5 and 1 percent.

Table 4 displays the estimated effects of net purchase interventions during the 2000-14 period. It shows the results of a core equation and an extended model with disaggregated effects. The positive parameter m_{INTV} in the mean equation gives the impression that the central bank has been able to influence the exchange rate to return towards an underlying trend. An increase in purchase (sale) interventions has led to the depreciation (appreciation) of the domestic currency. The aggregated effects including the slope coefficients of large and continual interventions in the extended model are still positive, confirming the results in the core model.

Nevertheless, the disaggregation of intervention effects in the extended model indicates that it is the successive and/or large size intervention that ensures it to be effective – as shown by the positive $m_{INTVSUCI}$ and $m_{INTVLSI}$; otherwise average (timid and isolated) actions may not be successful.

The central bank has been able to reduce market volatility, too. Again, the negative sign in all disaggregated slope parameters suggest that sizable interventions and those carried out over a number of days would increase the effectiveness and dampen the exchange rate volatility. The estimated results, thus, suggest that to fully satisfy the market-calming objective the Bank of Albania's operations need to be aggressive in their magnitude and recurring events as well.

4.2 EVENT STUDY APPROACH

The Bank of Albania has intervened in the foreign exchange market at irregular patterns, where idle periods of no interventions varied from a couple of weeks to several months or even a year. As a result, time series econometric methods may not accurately estimate the link between interventions and the exchange rate, since the latter might be considerably volatile during times of inactivity (Fatum, 2000). For that reason, some authors have reverted to the event study approach from the finance literature in order to assess the effectiveness of central bank interventions.

The event study methodology analyses and compares the behavior of variables before and after a certain event occurs. The inspected period is referred to as the event window and includes the pre-event days, the event day(s), and the post-event days. The length of pre-, and post-event periods ought to be defined such that there is no overlapping between them. A short distance between intervention events would make it difficult to interpret the response of exchange rates to intervention operations, since they may not capture a "normal" no intervention performance of the exchange rate (Fatum, 2000).

Foreign exchange interventions are viewed as successful if the subsequent changes in the exchange rate move in the same direction with the central bank intervention (for instance, purchases of foreign currencies should be associated with increases in its market price (Frankel, 1994)), or at least the magnitude of these movements is reduced afterwards (Humpage, 1996). The first condition, where the direction of the exchange rate is changed after the central bank operation is known in the literature as the "reversal" criterion, or "leaning against the wind", which is formally expressed as follows:

Leaning against the wind policy (a.k.a. "direction" criterion)
Purchase of foreign currencies $\{INTV_t > 0, \Delta NEER_{t-} < 0 \text{ and } \Delta NEER_{t+} > 0\}$
Sale of foreign currencies $\{INTV_t < 0, \Delta NEER_{t-} > 0 \text{ and } \Delta NEER_{t+} < 0\}$

where $INTV_t$ is the amount of central bank interventions during event t, and $\Delta NEER_{t-,+}$ indicates the change in the exchange rate basket in the pre-event $t-$ and post-event $t+$ periods.

Interventions that reduce the exchange rate deviations but do not change its direction are referred to as "smoothing" exchange rate policies, expressed as:

Smoothing exchange rate policy {a.k.a. "smoothing" criterion}
FC Purchases $\{INTV_t > 0, \Delta NEER_{t-} < 0, \Delta NEER_{t+} < 0 \text{ and } \Delta NEER_{t+} > \Delta NEER_{t-}\}$
FC Sales $\{INTV_t < 0, \Delta NEER_{t-} > 0, \Delta NEER_{t+} > 0 \text{ and } \Delta NEER_{t+} < \Delta NEER_{t-}\}$

On the other hand, if interventions in the forex market are not intended to reverse or smooth the exchange rate direction but to support its ongoing trend, the central bank policies would be viewed as "leaning with the wind". In that case, purchases (sales) of foreign currency would lead to higher (lower) exchange rate changes in the post-event days while maintaining their direction of the pre-event period:

Leaning with the wind policy
FC Purchases $\{INTV_t > 0, \Delta NEER_{t-} > 0, \Delta NEER_{t+} > 0 \text{ and } \Delta NEER_{t+} > \Delta NEER_{t-}\}$
FC Sales $\{INTV_t < 0, \Delta NEER_{t-} < 0, \Delta NEER_{t+} < 0 \text{ and } \Delta NEER_{t+} < \Delta NEER_{t-}\}$

This section tries to assess the effectiveness of the Bank of Albania's interventions during the 2000-14 period, based on the event

study methodology. During these fifteen years, the central bank's operations were mostly aimed at purchasing foreign currencies, whereas sales operations were concentrated in the early years of the sample and in 2009. Also, attention was generally paid to the performance of a two-foreign currency basket composed of the euro (90%) and the US dollar (10%).

Table 5 The number of the identified intervention events from 2000 to 2014

Pre- and post-event days allowed	2-day	5-day	10-day	20-day
No. of intervention events	127	69	49	33

Table 5 reports the identified episodes based on maximum days of no intervention operations between two successive interventions. It seems that the number of the event windows is quite sensitive to the length of pre- and post-event period. Allowing for 10 working days of inactive operations we can identify 49 intervention events, which are 78 (20) events less than if two (five) idle days are chosen. Since the weekly meetings at the Bank of Albania focus more on the shorter, rather than longer-term forex market developments, the analysis below will mainly refer to the 69 event windows as the benchmark; also, the 49 episodes with 10 non-overlapping days will be discussed, so as to examine the exchange rate response in the post two-, five- and ten-day periods for different event definitions.

Figure 6 Number of days for 5 and 10 non-overlapping days episodes
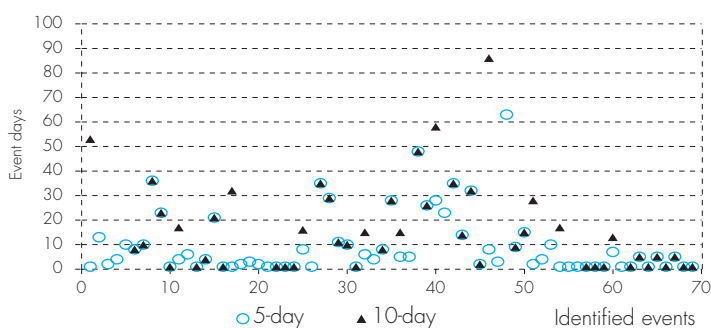
Source: Bank of Albania statistics, and author's calculations.

The features of both, the five and ten non-overlapping day event definitions are quite similar. While a third of the central bank operations were only carried out in a single day, more than a dozen of events occurred in a timespan that varied between 21 to 86 working days. Also, nine episodes were followed by idle periods of no intervention that extended from 5 to 14 months.

Based on the criteria of successfulness, policies of smoothing the exchange rate, leaning against, or with the wind have been successful in about 62 percent of the shorter episodes. The share of successful policies is pretty similar for the five- and two- business day periods (Table 6), of which "leaning against the wind" account for the majority (59.5%), followed by "smoothing the exchange rate" (23.8%), and "leaning with the wind" (16.7%). If the event window definition is changed such that to allow for a maximum of 10 days of idle interventions, the performance improves to 65, 73 and 69 percent for the 2, 5 and 10 business days, respectively[6].

Table 6 Identified events (max. 5 non-overlapping days) and intervention outcome

Identified events (max.5 days of idle interventions)	Total intervention (leks, mln)	Days of Inter- vention	Event days	Next episode (days away)	Type of Interven.	Intervention policy outcome	
						2 day	5 day
Jan 11, 2000	51	1	1	5	Sale	smooth	against
Jan 19 to Feb 4, 2000	686	7	13	5	Sale	-	-
Feb 14-15, 2000	419	2	2	5	Sale	with	-
Feb 23-28, 2000	266	2	4	8	Sale	against	against
Mar 10-23, 2000	251	4	10	10	Sale	-	with
Apr 7-18, 2000	215	4	8	30	Sale	against	against
May 31 to Jun 13, 2000	160	4	10	29	Purchase	-	-
Jul 25 to Sep 12, 2000	2502	27	36	13	Purchase	-	-
Oct 2 to Nov 1, 2000	2563	21	23	75	Purchase	against	with
Feb 15, 2001	428	1	1	27	Sale	-	with
Mar 27-30, 2001	203	4	4	7	Sale	with	-
Apr 11-18, 2001	595	2	6	38	Sale	-	-
Jun 12, 2001	601	1	1	9	Sale	-	-
Jun 26 to 29, 2001	520	3	4	113	Sale	with	with
Dec 6, 2001 to Jan 3, 2002	5379	14	21	17	Purchase	against	against
Jan 29, 2002	710	1	1	41	Sale	-	-
Mar 28, 2002	191	1	1	5	Sale	against	smooth

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[6] *Results are not shown here, they can be provided by the author on request.*

Identified events (max.5 days of idle interventions)	Total intervention (leks, mln)	Days of Inter-vention	Event days	Next episode (days away)	Type of Interven.	Intervention policy outcome	
						2 day	5 day
Apr 5-6, 2002	106	2	2	5	Sale	against	-
Apr 16-18, 2002	244	3	3	5	Sale	-	-
Apr 26-29, 2002	87	2	2	8	Sale	smooth	smooth
May 10, 2002	53	1	1	13	Sale	-	-
May 30, 2002	88	1	1	64	Sale	against	against
Aug 29, 2002	392	1	1	13	Sale	against	against
Sep 18, 2002	98	1	1	66	Sale	-	-
Dec 20-31, 2002	268	4	8	7	Purchase	-	-
Jan 10, 2003	370	1	1	10	Purchase	with	with
Jan 27 to Mar 14, 2003	3271	28	35	34	Purchase	with	with
May 2 to Jun 11, 2003	1381	14	29	13	Purchase	against	smooth
Jul 1-15, 2003	397	7	11	16	Purchase	against	smooth
Aug 7-20, 2003	351	7	10	11	Purchase	-	against
Sep 5, 2003	37	1	1	66	Purchase	against	against
Dec 9-16, 2003	183	2	6	5	Purchase	-	-
Dec 24-29, 2003	176	2	4	129	Purchase	against	against
Jun 28 to Jul 7, 2004	709	8	8	10	Purchase	-	with
Jul 22 to Aug 30, 2004	5880	27	28	62	Purchase	-	-
Nov 25 to Dec 1, 2004	2070	3	5	5	Purchase	-	-
Dec 9-15, 2004	1430	5	5	182	Purchase	-	-
Aug 29 to Nov 2, 2005	5586	27	48	11	Purchase	-	-
Nov 18 to Dec 23, 2005	7185	20	26	57	Purchase	-	against
Mar 15 to Apr 21, 2006	2332	18	28	7	Purchase	-	-
May 3 to Jun 2, 2006	1212	15	23	20	Purchase	against	against
Jul 3 to Aug 18, 2006	4431	25	35	76	Purchase	-	-
Dec 5-22, 2006	5281	9	14	130	Purchase	against	against
Jun 25 to Aug 7, 2007	4295	17	32	94	Purchase	against	-
Dec 18-19, 2007	890	2	2	84	Purchase	against	against
Apr 16-23, 2008	2137	5	8	6	Purchase	smooth	against
May 6-8, 2008	458	2	3	6	Purchase	smooth	-
May 19 to Aug 13, 2008	15057	40	63	129	Purchase	-	against
Feb 11-23, 2009	2931	7	9	12	Sale	against	against
Mar 12 to Apr 01, 2009	2046	7	15	19	Sale	against	against
Apr 29-30, 2009	465	2	2	5	Sale	with	smooth
May 8-13, 2009	738	4	4	7	Sale	against	against
May 25 to Jun 5, 2009	690	4	10	292	Sale	with	with
Jul 21, 2010	810	1	1	7	Purchase	against	against
Aug 2, 2010	312	1	1	7	Purchase	-	-
Aug 12, 2010	95	1	1	22	Purchase	-	with
Sep 14, 2010	381	1	1	70	Purchase	smooth	against
Dec 22, 2010	304	1	1	167	Purchase	smooth	against

Identified events (max.5 days of idle interventions)	Total intervention (leks, mln)	Days of Inter-vention	Event days	Next episode (days away)	Type of Interven.	Intervention policy outcome	
						2 day	5 day
Aug 15, 2011	125	1	1	61	Purchase	against	against
Nov 09-17, 2011	811	3	7	5	Purchase	against	-
Nov 25, 2011	508	1	1	38	Purchase	smooth	-
Jan 19, 2012	138	1	1	80	Purchase	against	against
May 11-17, 2012	390	2	5	21	Purchase	against	against
Jun 18, 2012	222	1	1	11	Purchase	smooth	smooth
Jul 04-10, 2012	426	3	5	18	Purchase	smooth	against
Aug 06, 2012	288	1	1	260	Purchase	-	smooth
Aug 06-12, 2013	469	2	5	42	Purchase	against	against
Oct 10, 2013	941	1	1	304	Purchase	-	-
Dec 11, 2014	1445	1	1	78	Purchase	smooth	against
		"Leaning against the wind" policy (1)				25	27
		"Smoothing exchange rate" policy (2)				10	7
		"Leaning with the wind" (3)				7	9
		Ineffective forex interventions (4)				27	26
		No. of effective forex policies (1+2+3)				42	43
		Number of events				69	69

Looking at the shorter episodes, it turns out that the size of forex interventions used by the Bank of Albania has not been important in achieving its desired policy outcome. One would expect that larger purchases or sales of foreign currencies have more impact on the exchange rate developments. The results show, however, that average amount of successful interventions is much lower than the mean and median of the ineffective operations (Table 7). The median of the latter is about 30 to 40 percent higher, suggesting that the amount of interventions was typically not intended to influence the exchange rate level.

Table 7 Outcome of Intervention Episodes based on Size and Length

		2-day window		5-day window	
	Whole sample	Successful events	Ineffective events	Successful events	Ineffective events
Intervention size^), mean	1402	1051	1980	1415	1380
Intervention size^), median	465	458	601	426	598
Average event days	10	7	13	9	11
Average intervention days	6	5	9	6	7
^) in millions of Albanian leks.					

Similarly, it appears that effectiveness of foreign currency interventions did not depend on the number of successive days they were carried on. The results show that successful events have an average number of days (7 and 9, for the two- and five-day windows respectively) that is smaller than the average days of ineffective events (13 and 11, respectively). This is true so even if we refer to the average days of interventions within an event, implying that successive interventions have not necessarily brought about any desired outcome in the exchange rate behavior. At best, the effects have been satisfactory in either the next two, or the five days, but not consistently in both.

Redefining the episodes to allow for ten non-overlapping days provides similar results for the two- and five-day windows, but not for the ten days. In this case, the average size of successful interventions is Lek2076 mln vs. 1744 mln for ineffectual episodes (though the median remains smaller[7]), indicating that hefty interventions can become effective in the next couple of weeks. In the same vein, protracted events (and with more days of intervention on average) are shown to produce a stronger exchange rate response for the ten-day window, thus increasing the likelihood of successfulness.

Lastly, applying the same exercise on the exchange rate volatility yields similar results. It is found that central bank interventions were able to reduce exchange rate volatility (employed from the GARCH(1,1) equation estimated in the previous section) more often than not. Nevertheless, the impact was not equal for different post-event windows. Allowing for five- (ten-) day non-overlapping events, the share of successful episodes is evaluated as 74 (65) percent in the case of a 2-day post-event window, and it falls closer to 50 percent for the 5 or 10 days (Table 8). So, the degree or intensity of volatility has more often abated during shorter time windows, and that has been less sure for extended pre- and post-event intervals.

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[7] *Idem.*

Table 8 Exchange Rate Volatility and Intervention Events

	Whole sample	2-day window		5-day window		10-day window	
		Successful events	Ineffective events	Successful events	Ineffective events	Successful events	Ineffective events
69 identified events, with max. 5 days of idle interventions							
Intervention size, millions of leks							
Mean	1402	1539	1015	1278	1553		
Median	465	508	352	461	469		
Average days of…							
Interventions	6	6	7	6	7		
Event	10	10	9	9	10		
49 identified events, with max. 10 days of idle interventions							
Intervention size, millions of leks							
Mean	1974	2217	1517	2013	1900	1678	2258
Median	710	800	638	754	638	695	941
Average days of…							
Interventions	9	9	10	9	10	8	10
Event	16	16	16	16	16	13	19

Some of the reasons for the differing effects could be found with the size of interventions. The effectiveness of central bank actions to reduce market volatility in the shorter windows is positively linked to the amount of purchase/sale operations, where successful events record larger interventions. The size, however, has not mattered for lengthier (toward ten days) intervals, as larger interventions on average were not followed by effectual events. On the other hand, the number of sequential days of intervention has not been important in abating exchange rate volatility. Both, successful and ineffectual events count about the same average number of days for the two and five day post-event windows; while for the ten day window ineffectual events are lengthier and count even more transaction days.

5. CONCLUSION

Forex market interventions by the Bank of Albania appear to be mainly driven by the need to maintain an adequate level of international reserves, often agreed with the International Monetary Fund. Because there is no rule for a regular timing for hitting that target, foreign exchange interventions seem to be carried out in combination with the market-calming objectives, particularly during the height of holiday seasons when the lek exchange rate is shown to deviate from its underlying trend.

The Probit model results indicate that upward movements from a certain trend raise the probability that the central bank will intervene to stop further divergences of the lek exchange rate. Also, the results suggest that BoA generally pays similar attention to deviations from all states of "equilibrium" levels. The coefficients that measure the reaction to deviations from a couple of weeks to six months moving average are as expected and overall statistically significant. The nonlinear estimations largely confirm the empirical findings from the Probit method, adding that sizable (but not persistent) exchange rate deviations might draw more attention to CB officials.

Regarding the exchange rate volatility, the estimated parameters from the Probit model are in general positive, suggesting that BoA would act against undesired volatility. However, the asymmetric model results showed the CB interventions are highly influenced by the nature of market disorders. Very high fluctuations would make the central bank pause before stepping in the market and thus assess cautiously the intervention timing when dealing with exchange rate oscillations.

A central bank is judged to be effective if it is able to stabilize the foreign exchange market by slowing or reversing currency movements and dampening volatility. The GARCH model results and the event study analysis give us the impression that BoA's actions have weighted on the exchange rate to return to certain 'fundamental' levels. The findings discern also that substantial and continual interventions would increase the effectiveness in moving the exchange rate (particularly in the next couple of weeks) and

reducing market volatility (at least for the next few days). Therefore, in order to meet with its market-calming objective the central bank transactions in the foreign exchange market ought to be aggressive in their magnitude and recurring events as well.

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