BANK OF ALBANIA

THE ROLE OF EXCHANGE RATE IN AN IT FRAMEWORK, WHAT DO WE DO?

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CONTENTS

ABSTRACT

This paper analyses the relationship between exchange rate and inflation in Albania. The first aim is to investigate the impact of exchange rate changes on domestic consumer prices and secondly throw some light on the importance of currency movements on the conduct of monetary policy. The findings could be useful to policymakers at the central bank before adopting a full-fledged inflation targeting regime.

I. INTRODUCTION

While Albania commits itself to the exploration of inflation targeting as the next possible regime of monetary policy, we are trying to understand in details the elements of this regime, investigate the relationship and estimate the impact of economic variables on inflation and the course of monetary policy. At the same time it is important to understand the implication of this regime on the other policy variables as well. Among these policy variables the exchange rate is a very important one, with direct effect on inflation and/or inflation expectations. Therefore, the investigation of the relationship between the two is essential in the success of the new regime. Albanian authorities need to understand the role of exchange rate in the price behaviour and in the mean time design a clear exchange rate policy that deals with foreign currencies flows without intervening with inflation targeting framework.

This research strives to modestly discuss two major issues relating to central bank policy in the inflation targeting. First we want to investigate what is the status of the exchange rate pass-through to inflation and second, comment on how does monetary policy react to changes in the exchange rate. These are two important issues that relate to the pressures that developments in the exchange markets can have on inflation and inflation expectations and on the way that monetary authorities choose to address these pressures. We find that exchange rate has been an important determinant of inflation developments serving in the same time as a shock absorber. Our results also show that the strength of this channel of monetary transmission is reduced during the low and stable inflation period. Surprisingly our results show that monetary policy has responded vigorously to exchange rate changes. This result is puzzling and calls for future research and intensive communication.

The attitude toward inflation stabilization and exchange rate has changed considerably especially during this last decade. In the early 90s many economists argued that developing and transition economies must adopt hard peg regimes as a credible tool of stabilization. Fear of floating, as described in Calvo (1999), and Calvo and Reinhart (2002), provides a strong argument in

favour of such regimes. However, many of successful stories of early 90s developed into currency crises later during the decade or in early 2000's, adding to the troubles of inflation and showing that this sort of stabilization might be only short lived. Therefore, in a growing number of cases, economies have tried to address stabilization issues by adopting inflation targeting as the remaining choice (previously monetary targeting has been the model, which has been later replaced by exchange rate targeting). Moreover they have pared such regime with a free floating exchange rate regime.

This new regime puts forward important policy questions with regard to exchange rate research. Inflation targeting in its final objective does not change much from other regimes of monetary policy that seek stabilization of the economy by focusing on the price stability, since all regimes adopt price stability as the ultimate goal of their policy. In essence the difference emerges in the choice of the intermediate target, as it changes from exchange rate to money and later to inflation expectations respectively in the exchange rate, monetary and inflation targeting.

In the later case all other variables become important informative variables rather than intermediate goal or policy goals to be achieved. As expected inflation becomes the focus of monetary policy, the central bank renounces its control on money, since it chooses interest rate as the operational tool of monetary policy and exchange rate as "inflation targeting necessary requires nominal exchange rate flexibility" (Mishkin and Savastano 2001). In such circumstances it is important to know how fluctuations on nominal exchange rate will affect expectations and the final target of the monetary policy. Does this new setup have the capacity to develop in an increasing spiral of price instability and depreciation? Economists have tried to answer such questions focusing on the exchange rate pass-through. They have found that this important channel of monetary transmission has reduced substantially after the introduction of inflation targeting. While the link between final objective and exchange rate movements might have lessened, authorities can not completely neglect exchange rate developments.

Given the understanding that choice of the final target is not affected by nominal exchange rate fluctuations, the next logical question is how large of a depreciation/appreciation or fluctuation can be tolerated in the economy? From a central bank point of view, the exchange rate pass-through can introduce itself in three major channels:

1. the effects of the nominal exchange rate changes on real exchange rate changes and inflation pressures that might develop;
2. the effects of the real exchange rate changes on the external position of a country;
3. the collateral effects of nominal exchange rate changes on the balance sheets and aggregate economic activity.

It is obvious that in spite of reduced exchange rate pass-through to inflation, sustained appreciation/depreciation will have impact if not on inflation expectations on other important economic indicators, such as competitiveness, and long-run financial stability with finite effects on the achievement of the monetary policy goal in the long run. Over all, even if nominal exchange rate developments do not exert pressures on inflation expectations, it might depress overall competitiveness, with related effects on output and foreign sector flows. Moreover in the case of small opened economies exchange rate shocks, fluctuations or sudden depreciation might increase the risk of financial crisis and financial stability as discussed by Mishkin (1996).

All central banks face the same issues when trying to answer the following questions: why do we intervene to protect economy from seasonal fluctuations and speculative attacks? What is a country to do when real appreciation feed into decreased competitiveness? How to react in the case of considerable capital inflows? If intervention is considered should it be sterilized? What are the effects of such sterilization? To summarize, should exchange rate movements become a concern of monetary policy and how to deal with it without interfering with inflation targeting?

Edwards (2007) organizes such discussion in three mayor policy issues related to the inflation targeting and exchange rate

regime. He examines the exchange rate pass-through to changes in domestic prices; the impact of inflation targeting on the volatility of exchange rate, and finally the role of exchange rate in the policy rule of an inflation targeting central bank. Empirical research in the first two topics has found that introduction of inflation targeting regime reduces the exchange rate pass-through. Research in the exchange rate volatility has found increase in volatility after paring IT with free floating regime. Meantime many authors find that despite adopting inflation targeting, the monetary policy in many central banks responds to changes in exchange rates. We intend to follow Edwards (2007) and his methodology to discuss the first and the last of the above topics in the case of Albania. The volatility of exchange rate does not constitute an important research topic at the moment, since the Albanian lek has continuously strengthened and reduced its seasonal fluctuations.

Section II of the paper provides a brief discussion of the Albanian monetary and exchange rate policy and developments; section three deals with the exchange rate pass-through; section four will discuss the role of exchange rate in the new setup of monetary policy and section five will conclude with summary and conclusions.

II. ALBANIAN EXPERIENCE

Albania adopted a floating exchange rate as the best solution for and automatic mechanism to cure its large and growing trade and current account deficits in the early stages of transition and adjust to capital flows. This choice was also constrained by the lack of foreign exchange reserves. At the same time this regime provided room for an independent monetary policy, which relied on quantitative monetary targets and direct instruments of monetary control. In such role its moves have been a good predictor of expected inflation development. Intervention policy was designed such as to protect the foreign exchange market from speculative attacks and/or sudden short lived fluctuations due to particular seasonal developments related to flows of remittances; build up necessary level of foreign reserves; and intervene in the case that the level of exchange rate

is not supported by economic fundamentals. These rules clearly stated that the Bank of Albania will not intervene in the foreign exchange market to protect any equilibrium foreign exchange rate or revert its trend. However, despite the clear exchange rate policy the operational setup relied more on discretion rather than rule. The time, size and the direction of intervention reflected the Bank of Albania opinion about foreign exchange market developments[1]. It should be mentioned that none of these market interventions were used for fundamental reasons.

Frequently during this period devaluations feed into inflation, and inflation expectations feed into further devaluation. Tanku (2006) finds that there exist a strong substitution effect and demand for money is very responsive to exchange rate changes. The argument for such behaviour originates at the fear that a drastic depreciation might feed to inflation expectations and vice versa. This fear is supported by the fact that Albania is a small open economy that imports a considerable amount of its consumption from the rest of the world, which makes Albanian economy subject to fluctuations in the world commodity markets and exchange rates. Moreover Albanian financial markets are underdeveloped and shallow, with extremely limited investment opportunities. These conditions make foreign currencies a good investment to hedge against domestic fluctuations in prices and output, which is a typical phenomenon for developing countries as described by Bahmani and Tanku (2007). Indeed, exchange rate developments reflected the political social and expectations mood of the Albanian society. In such role its moves have been a good predictor of expected inflation development. This conclusion is supported by several authors who have studied the transmission mechanism for Albania[2]. Therefore, Bank of Albania Annual Reports and Monetary Policy Declarations report that small short-lived foreign exchange interventions were used to restore confidence in the economy and stabilize expectations in this environment. This setup resulted successful in stabilizing inflation and supported a sustained growth during the first decade of transition.

The free floating regime serves well for the same purposes today as well. However, after the sharp devaluations of 1998 and

introduction of the new monetary policy setup in 2000 that relies on indirect instruments to achieve a preannounced inflation target, the strong relationship between exchange rates and inflation is vanishing to the naked eye. Since early 2000 exchange rate has appreciated continuously in face of relatively low positive inflation. Such weakening of the exchange rate channel is observed in the works of Petters (2005) and Istrefi and Semi (2007). For the Bank of Albania, it is important to understand whether these developments are reflecting any particular expectations for expected scenarios, and /or a random pattern of behaviour and how have these recent developments affected the pass-through of exchange rate to inflation. The important thing here is to understand the implication that exchange rate developments could bear on price developments in our economy.

III. EXCHANGE RATE PASS-THROUGH TO INFLATION AND THE SHOCK ABSORBER EFFECT ON THE ALBANIAN ECONOMY.

This part attempts to investigate the exchange rate pass-through to domestic prices and the role of exchange rate as a shock absorber. This becomes an important topic for monetary policy, especially for an IT central bank, since in the case of a powerful pass-through, exchange rate changes will exert pressures on domestic prices and might require authorities response to offset such inflationary consequences of exchange rate changes. In addition a powerful exchange rate pass-through might even call for an exchange rate stability program rather than an IT regime.

Drawing samples form recent history of inflation targeting countries, resent research shows that exchange rate pass-through reduces substantially after the adoption of IT. Campa and Goldberg (2002) research for OECD countries, and Gagnon and Ihring (2004) conclude that the weakening of exchange rate channel is related to changes in the monetary policy and adoption of IT. The common argument behind such findings is that IT provides a good

anchor on expectations and reduces inflation and its volatility, breaking in this process the supposedly strong link to exchange rate that exists in the pre IT period due to the reasons described above. This in turn increases the credibility of the regime and generates better anchored expectations, in a continuous process that in each repeated step contributes to the reduction of the pass-through as discussed by Taylor (2000).

Most authors have addressed these issues focusing on the pass-through effect on the aggregated data of CPI based inflation. This method, however, neglects the fact that there is a balancing effect embodied in the exchange rate mechanism, which through adjustments in the real exchange rate should address at least part of the inflationary pressures, by adjusting the spending behaviour and via substitution effects that might take place in the real economy, when certain tradable goods become more expensive due to depreciating local currency or higher foreign prices. Edwards (2007) argues that reduction of the exchange rate pass-through in tradable prices relative to non-tradable prices is not a development to cheer about, since it might stop the substitution and lead to increase in the price of non-tradable goods. Therefore, the reduction of the exchange rate pass-through is a positive development when it does not prevent it (exchange rate) from playing its role as a shock absorber. When such role is played exchange rate changes will not exert pressure on non-taxable prices and inflation expectations reflected in labour contract negotiations. To summarize "… a nominal exchange rate depreciation will have to generate an increase in real exchange rate, which in itself will generate the expenditure switch effect" Eduards (2006)[3].

In light of this discussion we first investigate the pass-through effect on headline inflation and then try to estimate the impact on tradable and non-tradable goods separately and use this information to asses the shock absorber effect of exchange rates. To estimate the response of domestic prices to exchange rate movements we follow Edwards (2007) and use a simple econometric model in a way that enables us to capture the short- and long-run effects:

$$\Delta \ln p_t = a + b \cdot \Delta \ln p_{t-1} + c \cdot \Delta \ln p^*_{t-l} + d \cdot \Delta \ln neer_{t-l} + e \cdot DOBJ * \Delta \ln p_{t-1} + f \cdot DOBJ * \Delta \ln neer_{t-l} + u_t \quad (1)$$

Where:

Δ denotes a change in variables;
t is the current quarter
l shows the number of lags (up to four lags were tried);
p is the domestic consumer/ tradable/ non-tradable[4] price;
p^* represents foreign CPI[5] prices;
neer is the nominal effective exchange rate[6] of lek against currencies of the five major trading partners;
DOBJ is a dummy variable that takes the value of 1 during the period the BoA sets its objective to keep inflation rates within the range of 2 to 4 percent, and zero otherwise;
u is the error term.

Theoretically, all explanatory variables are expected to have a positive relationship with the domestic prices. Parameter *b* in front of the past inflation is intended to measure any partial adjustment of domestic inflation to the explanatory variables. The direct pass-through effects of foreign prices and exchange rate to inflation are captured by parameters *c* and *d*, respectively.

An increase in consumer prices abroad or a depreciation of the lek exchange rates should lead to higher domestic inflation. The more the economy relies on imported finished and intermediate goods and services, the more sensitive domestic prices would be to movements in the exchange rates and producers-currency prices.

Parameter *d* in Equation 1 indicates the short-run elasticity of domestic prices with respect to the nominal effective exchange rate of lek. The long-run pass-through, in our empirical model, can be figured by the ratio of *d* to one minus parameter *b* [*d* / (1-*b*)].

The analysis of price sensitivity has been extended by including two interactive terms at the end of the model specification. The multiplication of past inflation and the exchange rate with the dummy variable *DOBJ* provide us with insights on whether the

central bank's commitment to maintain inflation between 2 to 4 percent has reduced inflation inertia and, secondly, lowered the size of long-run pass-through during this period. In this case, the long-run post-commitment effects are computed as $(d+f) / (1-b-e)$.

The model was estimated for the period from 1995Q1 to 2007Q2, using the ordinary least squares method. Unit root tests indicated that the series in levels were non-stationary. To avoid the problem of spurious regression all variables in log levels were transformed in first differences to achieve stationarity. A maximum of four lags were first used for each variable in a parsimonious modelling, and later the statistically insignificant coefficients were gradually dropped till the best fitting model was realized. Also, a dummy variable is added to take into account the structural break of the series in 1997 financial turmoil.

III.1 ESTIMATION RESULTS

The main objective of the paper is to estimate the relationship between exchange rate changes and developments in domestic prices. Therefore, Table 1 only displays the short-run and long-run exchange rate pass-through coefficients. Next, to further examine the role of the exchange rate as a shock absorber the response of total consumer prices is compared to the effects on tradable and non-tradable subcategories of inflation. Finally, the results demonstrate whether the short-run and long-run pass-through has changed after the Bank of Albania's objectives became more inflationary-focused in late 2000.

Table 1 Short-run and Long-run Exchange Rate Pass-through, 1995q1:2007q3

	Short-run Pass-through		Long-run Pass-through	
	Pre-OBJ	Post-OBJ	Pre-OBJ	Post-OBJ
Total CPI prices	0.3376	-0.1995	0.5310	-0.2133
Tradable Prices	0.3561	0.0053	0.6614	0.0062
Non-tradable Prices	0.1859	-0.1544	0.2072	-0.1601
Note: The coefficients are based on the results in Table A1 in the Appendix.				

As it is shown, the exchange rate movements used to have a moderate influence on all price indices during the pre-objective period. The response of domestic prices was between one-third and half of the magnitude of exchange rate percentage changes. Also, the strength of the impact appears to have previously gained momentum in the long rather than the short run. This is especially true for the case of tradable and total consumer prices, whose long-run coefficients are nearly two times larger than those of the short-run. Comparison of coefficients for tradable and non-tradable prices supports the hypothesis that exchange rate has acted as a shock absorber.

On the other hand, the results evidence a dramatic decline in the pass-through after the Bank of Albania became more attentive to modest inflation rates. From 2001 to mid-2007 the annual growth rates of consumer prices have averaged around three percent. At the same time, the exchange rate has stabilized and gradually appreciated by fourteen percent against a basket of currencies, hence causing a notable fall in the slope of exchange rate pass-through. While tradable prices seem to hardly react to exchange rate movements, consumer prices and non-tradable prices show a meaningless response, both in the short and long run as well. The large decline and change in sign of the pass-through parameters suggest that domestic market may in recent years be characterized by "local currency pricing," where small fluctuations in the value of lek are not associated with price developments.

The estimates in Table A1 indicate sizeable inflation inertia during the period of soaring prices (as shown by the coefficient of dlog P_{-1}). More than one-third of previous inflation would persist in the current rise of consumer and tradable prices (0.36 and 0.46, respectively). In case of non-tradable the price continuation is much smaller and diminutive. Nevertheless, the parameters of the interaction term (DOBJ*dlog P_{-1}) almost offset the inflation inertia, highlighting a significant minimization of inflation persistence during the post-objective period. Results suggest that the pass-through and persistence have reduced after the introduction of the new policy objective in late 2000.

IV. EXCHANGE RATE POLICY UNDER INFLATION TARGETING

The exchange rate issue and its pass-through to inflation have policy implications that extend well beyond inflation. Inflation targeting central banks focus their attention only on expected inflation and use monetary policy to steer these expectations toward some desired level within a predetermined period in time. The final goal is to keep prices under control. Under this setup, monetary policy rule requires that central bank adjusts its policy rate so that inflation objective is achieved. This is done by incorporating all possible information available to the central bank. Meaning that despite incorporating information in the decision making with regard to developments in the other variables, exchange rate included, monetary policy does not consider the effects of chosen policy on these variables.

However, in the theoretical literature optimal policy is described as the policy, which minimizes the loss function of the central bank. This function is a weighted combination of the output gap and inflation deviation from its desired level (its objective in the case of inflation targeting) with a much heavier weight on the inflation component especially in the case of inflation targeting[7]. Exchange rate has the potential to affect both components of such function[8]. Just to give an example that fits well with current and likely expected developments Albanian economy: assume that due to some relatively large interest rate differential a small open economy is experiencing a sustained appreciation of its currency. At the same time authorities find out that inflation expectations have increased beyond inflation objective. In these circumstances authorities decide to increase the base rate to correct expectations. The rate increase results successful with regard to inflation but at the same time increases further the interest rate differential encouraging additional flows of foreign currency and further appreciation. Such appreciation/depreciation as discussed by Mishkin (2001), might not only affect output gap or inflation deviation, but also affect the balance-sheets of the private sector and could jeopardize the financial stability of the economy. Therefore, central bank must pay some attention to exchange rate movements, but how much?

Should such attention be as large as to include exchange rate in the Taylor rule? In other words, should central bank respond to changes in exchange rates? If yes, which rate, the nominal or the real one?

The question becomes more complicated when exchange rate interventions are also designed as a policy tool for the achievement of other secondary objectives of the monetary policy like increasing international reserves, smoothing short term fluctuations that rise due to particular characteristics of a small open economy and adjusting exchange rate when it moves away from the fundamentals. How could such policies cope with inflation targeting?

Ball (1999) considers such concerns and incorporates real exchange rate as an explanatory variable in the aggregate demand and supply equations where exchange rate is determined as a function of interest rate and a stochastic error. The implication of such innovation in the demand and supply equation is that the Taylor rule for optimal policy setting will also be modified by taking explicit account of exchange rate in the setting of the monetary policy instrument. In this respect the new rule does not conflict inflation targeting, it just states that monetary policy considers real exchange rate fluctuations as well as the impact of exchange rate interventions on interest rate. Like Ball, Svensson (2000), also argues that including exchange rate in the Taylor rule is likely to produce more stable macroeconomic outcomes. Both authors propose optimal values for exchange rate coefficients, which are however subject to change due to model specification and parameter changes; therefore, such rules are not practically robust.

Other authors like Mishkin and Schmidt-Hebbel (2001), Taylor (2001) and Mishkin and Savastano (2001), argue that in a well specified model the effects of exchange rate are indirectly included in the policy rule (loss function as well) through its effects on output gap and inflation. Therefore, responding to exchange changes might add instability to monetary policy and undermine its performance. In general this dispute remains unresolved, since the exchange rate issue is not fully addressed in the inflation targeting literature. Most of the literature focuses in the closed economy monetary models and does not provide comparative analysis of the welfare effects or

macroeconomic performance when exchange rate is incorporated in the monetary policy rule[9].

Therefore, the best possible answer for this discussion might come from empirical investigation due to country specific factors. Mohanty and Klau 2005, have investigated the hypothesis that exchange rate belongs to the monetary reaction function of 13 emerging and transition economies. Their results shows that the exchange rate coefficients result significant in 11 of the 13, indicating that these central banks consider exchange rate developments in the design and implementation of monetary policy. What is the status of monetary policy with regard to exchange rate developments in Albania? To answer this question, we aim to investigate the Taylor rule for an open economy using Albanian data.

IV.1 TAYLOR RULE AND THE EXCHANGE RATE OF LEK

In this section we intend to investigate whether exchange rate has affected the Bank of Albanian' monetary policy decision making. To estimate the interest rate policy reaction function in an open economy, many authors[10] have employed the Taylor rule that includes the effects of exchange rate movements in addition to inflation and output gap. In our analysis, we have used a slightly modified specification form of the Mohanty and Klau's (2004) version of the Taylor rule. The modification consists in the introduction of the nominal effective exchange rate, rather than the real one, with the argument that Bank of Albania's foreign exchange policy aims to tame speculative attacks and sudden fluctuations on the nominal exchange rate. Therefore, we estimate the following equation:

$$i_t = a + b \cdot i_{t-1} + c \cdot \pi_t + d \cdot y_t + e \cdot \Delta \log neer_t + f \cdot \Delta \log neer_{t-1} + u_t \quad (2)$$

where

i_t is the central bank's policy rate at quarter t;
π represents the annual CPI inflation rate;
y is the output gap; *neer* is the nominal effective exchange rate of lek (an increase indicates depreciation of the lek value);

Δlog is the first difference operator of variables in natural logarithms;

a is a constant,

b, c, d, e and f are the slope coefficients to be estimated;

u is the error term.

The parameters a, b and d are expected to be positive and greater than zero. For the monetary policy stance to be non-accommodating, the long-run relationship between inflation and the interest rate should be greater than one [i.e., $c / (1-b) > 1$]. The coefficient e is also expected to be positive, indicating the need for the central bank to tighten its monetary policy in response to the lek depreciation. However, the inclusion of the lagged exchange rate changes as an explanatory variable allows for more dynamic effects than just reacting to current lek fluctuations. The exchange rate very often exhibits mean reverting[11] movements; therefore, parameter f needs not be positive. If it is negative but smaller in absolute value than e, it will offset some of the interest rate reaction in the next period.

On the other hand, the role of the exchange rate in the Taylor rule would be insignificant, if the sum of coefficients e and f is equal to, or slightly different from zero. In that case, it will resemble a closed economy monetary policy rule, where exchange rate developments are neglected (Taylor, 2001).

The model has been estimated using the least square[12] method for the period 1997q1:2006q4. To check for robustness properties in Equation (2), another equation has been estimated by replacing the annual inflation and the exchange rate changes in (2) with the deviations from their respective trends. For simplicity, we will here on refer to the simple Eq. (2) as the baseline model and its alternative as the gap model.

IV.2 EMPIRICAL RESULTS OF THE BASELINE MODEL

The output gap is measured as the percent deviation of actual real GDP from its potential trend, where the latter is obtained by

using the Hodrick-Prescott filter. The repo rate was used as an indicator of the Bank of Albania's policy rate. However, because the data for this instrument start from mid-2000, the series has been extrapolated before that time with the 3-month deposit rates, which has a high correlation of nearly 90 percent with the repo rate. The lek effective exchange rate is calculated as a basket of currencies weighted according to their respective trade weights of the five major trading partners.

The empirical findings of the baseline model are displayed in Table A2. The high R^2 indicates that our open-economy Taylor rule explains fairly well the interest rate setting behaviour of the Bank of Albania. All the coefficients are statistically significant and show the expected sign.

It appears that the central bank has been cautious and slow to adjust its policy rate during the sample period. The lagged coefficient of the repo rate is roughly 0.8, indicating smooth movements in the monetary policy indicator. This view finds support in the small short-run and long-run inflation coefficients as exhibited in Table 2. The weak response of repo rates to inflation points to an accommodating monetary policy stance towards price pressures, particularly during the period of high inflation rates in the 1990s.

Table 2 Short-run and Long-run Reaction of the Baseline Model, 1997q1:2006q4

	Inflation	Output gap	NEER
Short-run	0.0994	0.1519	0.3673
Long-run	0.4942	0.7555	1.8272
Note: the coefficients are based on results in Table A2 in the Appendix.			

The sustained stabilization of the Albanian macroeconomic indicators after the 1997 financial turmoil appears to have reduced the need for strict monetary policy measures in response to demand shocks. The gradual improvement in the budget deficit as reflected in its decreasing ratio to nominal GDP has called for a less active role of the central bank. Therefore, the magnitude of policy rate changes has been smaller than deviations from potential output.

The results reveal a strong long-run relationship between base interest rate and exchange rate developments. An increment by 2 percentage points in the depreciation (appreciation) rate of lek has prompted the Bank of Albania to push up (down) interest rates by 73 bp and 3.65 pp in the short and long run, respectively. The coefficients are statistically significant and positive both in the current as well as the previous period changes, demonstrating a high degree of the persistence of exchange rate shocks and thus magnifying the response of the central bank's policy rate.

To check whether the results above are robust or not, the baseline model was re-specified by replacing the inflation rate and the exchange rate changes with their deviation from the respective HP trend[13]. The new estimates reinforce the previous findings with regard to the expected sign and magnitude of the parameters (Table A3 in the appendix). The current and lagged exchange rate changes maintain their influence on the policy rate decision-taking. This suggests that developments in the value of lek are very important and closely followed by the policymakers and reject the idea of excluding it from the monetary policy rule.

IV.3 TESTING FOR NONLINEARITY AND ASYMMETRY IN THE BOA'S REACTION FUNCTION

Equation (2) measures a linear reaction of the monetary policy actions to inflation, demand shocks and exchange rate fluctuations. This implies that the Bank of Albania would treat economic shocks in a similar manner, regardless of the magnitude and the actual performance. For that reason, it would be of importance to check whether domestic monetary policy has followed a nonlinear reaction to positive versus negative departures from trend, as well as an asymmetric response to larger versus smaller variations.

Here we are interested to test for nonlinearity in the response of the central bank in connection with inflation and the exchange rate only. First equation (2) has been re-estimated by including two slope dummies that check whether policymakers take similar measures for inflation and exchange rate departures from trend. The dummy

variables take the value of one for negative variations and zero otherwise. Also, to test for different responses to larger vs. smaller shocks equation (2) is augmented with two variables consisting of squared deviations of inflation and exchange rate changes. In each case the overall reaction to annual inflation and exchange rate movements is obtained by summing up the slope dummy or squared deviation coefficients with their respective parameters.

Hypothetically, negative and significant coefficients suggest a weaker reaction of interest rates to a fall in inflation and exchange rate appreciation below trend values. This interpretation applies to the magnitude of the deviations as well. However, the closer these coefficients are to zero, the more unmoved are policymakers to either side deviations or the magnitude of these shocks.

The estimated results are shown in Table A4 and A5 in the appendix. It appears that the Bank of Albania reacts similarly to inflation values above and below the trend. The slope dummy coefficient with respect to inflation is statistically highly insignificant; hence a zero response due to the sign cannot be rejected. On the other hand, the response to exchange rate changes is significantly reduced during appreciation as opposed to depreciation periods. Altogether, the interest rate response declines by around 37 bp to only 8.8 bp (Table A4).

In terms of the shocks' size, inflation rates are again paid due attention by policymakers, without making any difference between large and small deviations. The corresponding parameter is meagre and statistically insignificant. However, larger exchange rate deviations seem to magnify the monetary policy action.

V. CONCLUSIONS

Central Bank of Albania has committed its resources to the study of potential alternative regimes of monetary policy. Important part of this research is focused on the study of exchange rate and its powerful monetary transmission model. Most importantly, the Bank

of Albania is interested in the exchange rate effects on inflation and financial stability. Recent economic trends of mating inflation targeting stabilization regimes with free floating exchange rate, has revived the discussion of the appropriate exchange rate regime. At the same time this new policy setup is posing challenging questions for monetary authorities. The introduction of inflation targeting features in the monetary policy of the Bank of Albania has produced stable and low inflation and has coincided with a prolonged period of gradual and persistent appreciation in the domestic currency. Despite desirable monetary outcomes, these developments put forward important policy questions, which deal with the role of exchange rate in the new monetary policy, its objective, potential destabilizing effects of exchange rate developments and policy response to these developments.

In this paper we have tried to tackle both problems: the status of the pass-through effect of exchange rate developments on domestic prices and assess the role of exchange rate in the design and conduct of monetary policy from a pure empirical analysis of available data.

We find that in general a considerable exchange rate pass-through exists. This pass-through is stronger in the prices of tradable goods, permitting exchange rate to act as a shock absorber. However, the power of the pass-through depends on choice period of investigation. Our results show that the pass-through of exchange rate to domestic prices weakens considerably during periods of low and stable inflation. The pass-through virtually disappears during the period that the BoA sets its inflation rate objective between 2 to 4 percent. However, it still indicates at least some substitution, while the pass-through of exchange rate to non-tradable prices breaks down.

This result matches well with the findings of similar research for other countries that have experienced similar changes. However, one must be careful with such interpretation, which is valid for periods of low and stable inflation. Such result might not continue to hold in periods of high inflation and volatile exchange rates.

In our investigation of the open economy Taylor rule shows that monetary policy is very responsive to changes in exchange rate shocks maybe more than to inflation innovations. This result came as a surprise since the operational policy framework is designed such that does not respond to shocks in the exchange rate. Such result could make sense in the case when exchange rate developments make a good predictor of inflation or inflation expectations. However, our previous results reveal that this is not the case. In this respect we find difficult to reconcile our results and believe that further research is needed until a reasonable explanation is found. Our tests show that authorities do not distinguish between inflation deviations above or below objective but have an intervention bias toward depreciation. The bias could result due to Bank of Albania's intervention policy, which calls for market intervention when temporary shocks affect the demand or supply in the foreign exchange market (with the purpose to reduce fluctuations). The nature of the shocks, which are almost always caused by large inflows of foreign currency due to remittances could provide a reasonable explanation for this result.

The most important implication of our result associates with the risk that the appearance of the exchange rate in the Taylor rule might mislead the public about the true objective of monetary policy and impair central bank credibility. Moreover, in the presence of a sluggish and highly seasonal concentration in foreign exchange market and an intervention regulation, which calls for market interventions that are not related to the final objective of price stability, we would like to properly address this issue by referring to Mishkin and Savastano (2001, pg. 439), who suggest that if a central bank needs for any reason to intervene in the foreign exchange market, it is important that it states publicly the nature of the intervention and shows that it is not intended or related in any case with the achievement of the inflation objective.

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APPENDIX

Table A1 Exchange rate pass-through to domestic prices, 1995q1:2007q2

	CPI	Tradable Prices	Non-tradable Prices
dlog P_{-1}	0.3643 (0.0001)	0.4615 (0.0000)	0.1028 (0.0005)
dlog P^*	0.8402[#)] (0.0014)	0.6708 (0.0500)	0.0618 (0.0009)
dlog NEER	0.3376 (0.0000)	0.3561 (0.0000)	0.1859 (0.6171)
DOBJ*dlog NEER	-0.5371 (0.0000)	-0.3508 (0.0359)	-0.3403 (0.0079)
DOBJ*dlog P_{-1}	-0.2998 (0.0364)	-0.3176 (0.0044)	-0.0675 (0.6788)
Adj. R^2	0.8673	0.8553	0.5371
LM test (Chi-square (4))	0.2063	0.0733	0.4037

Note: p-values in parentheses; p is the domestic price level; p^* is the foreign price index; neer is the effective exchange rate of lek; DOBJ is a dummy variable that take the value of 1 during the period the inflation objective is set within 2-4 percent and zero otherwise; dlog indicates a change in the log of variables.
[#)] The coefficient is for lag 3.

Table A2 Baseline model of the Taylor rule 1997Q1:2006Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.3384	0.3435	3.8960	0.0004
$REPO_{-1}$	0.7990	0.0546	14.6413	0.0000
INFL	0.0994	0.0356	2.7878	0.0086
GAP	0.1519	0.0520	2.9182	0.0062
dlog NEER	0.1158	0.0373	3.0970	0.0039
dlog $NEER_{-1}$	0.2515	0.0286	8.8008	0.0000
Adj. R^2	0.9841	Prob(F-statistic)		0.0000
S.E. of regression	0.8344	LM test (Chi-square (2))		0.0669

Table A3 Reaction of repo rate to trend deviations of inflation, output, and exchange rate 1997Q1:2006Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.5736	0.3338	1.7183	0.0948
$REPO_{-1}$	0.9125	0.0317	28.8318	0.0000

INFLDEV	0.0710	0.0314	2.2648	0.0300
GAP	0.1755	0.0608	2.8853	0.0067
dlogNEERDEV	0.1657	0.0356	4.6547	0.0000
$dlogNEERDEV_{-1}$	0.2621	0.0310	8.4544	0.0000
Adj. R^2	0.9812	F-statistic		407.7027
S.E. of regression	0.9065	Prob(F-statistic)		0.0000

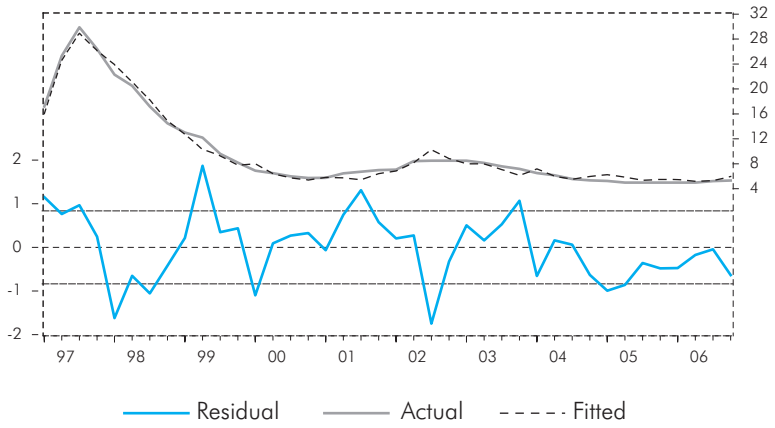
Table A4 Repo reaction to positive vs. negative shocks of inflation and exchange rate
Sample (adjusted): 1997Q1 2006Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.0642	0.2469	4.3095	0.0002
$REPO_{-1}$	0.7821	0.0408	19.1273	0.0000
INFL	0.0569	0.0282	2.0136	0.0528
GAP	0.0211	0.0444	0.4755	0.6377
dlog NEER	0.3062	0.0418	7.3098	0.0000
dlog $NEER_{-1}$	0.1488	0.0347	4.2866	0.0002
INFL*D1	-0.0199	0.0561	-0.3554	0.7246
dlogNEER*D2	-0.4869	0.0799	-6.0869	0.0000
$dlogNEER_{-1}$*D2	0.1195	0.0449	2.6616	0.0122
Adj. R^2	0.992047	F-statistic		609.1203
S.E. of regression	0.589321	Prob(F-statistic)		0.000000

Table A5 Repo reaction to larger v smaller shocks
Sample (adjusted): 1997Q1 2006Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.1933	0.2006	5.9479	0.0000
$REPO_{-1}$	0.7735	0.0307	25.189	0.0000
INFL	0.0481	0.0251	1.9156	0.0647
GAP	-0.0302	0.0377	-0.8023	0.4285
dlog NEER	-0.0044	0.0338	-0.1310	0.8966
dlog $NEER_{-1}$	0.0829	0.0276	2.9943	0.0054
INFLDEV^2	-0.0017	0.0013	-1.2790	0.2104
dlogNEERDEV^2	0.0162	0.0024	6.5564	0.0000
$dlogNEERDEV_{-1}$^2	0.0134	0.0024	5.5996	0.0000
Adj. R^2	0.9950	F-statistic		981.8886
S.E. of regression	0.4647	Prob(F-statistic)		0.0000

Chart A1 Actual, Fitted and Residual Chart of the Baseline Model



ENDNOTES

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The views in this paper are of the authors and do not necessarily reflect those of the Bank of Albania.
[1] The Bank of Albania has frequently intervened in the market, buying foreign currencies twice a year during June-August period and December, to smooth exchange rate volatility in response to large inflows of remittances.
[2] See Muco et al 2004 and Peeters 2005.
[3] Please see Edwards (2006) for a detailed explanation on the issue.
[4] The series of tradable and nontradable prices were provided by Çeliku (2003).
[5] Authors' calculation. The foreign price index consists of the consumer prices from China, Germany, Greece, Italy and Turkey (based on import weights); the series are taken from Ecowin.
[6] The NEER is trade weighed; exchange rates are expressed as Albanian leks per unit of foreign currencies; therefore, a rise of the NEER index denotes a depreciation of the lek.
[7] The argument that explains why output gap belongs to the loss function of an IT central bank is given by Mishkin and Savastano (2001, pg 431), who conclude that "setting a positive goal for inflation at 2 or 3 % rather than 0% is at the same time showing that authorities do care about economic growth".
[8] Edwards (2007) provides a brief but good discussion of this issue incorporated in the description of the theoretic work on the topic based on the Taylor rule and the central bank's loss function. See the paper for a good selective review on the literature
[9] Eduards 2007 provides a comprehensive review of the literature on the topic.
[10] See for example Ball (1999), Svensson (2000), Taylor (2001), Mohanty and Klau (2004).
[11] As Mohanty and Klau (2004) have illustrated, the exchange rate shocks that are not caused by fiscal and/or monetary policies are assumed to be temporary; hence, mean reverting.
[12] Mohanty and Klau 2005 use OLS as well.
[13] In another attempt, the inflation gap was tried by measuring the inflation divergence from the annual objective rate, instead of its deviation from the HP trend. The outcome was quite similar and did not change the overall interpretation. At the end, it was decided to keep the inflation gap from a trend, because it showed a better statistical significance.

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