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EXCHANGE RATE PASS-THROUGH TO PRICES: VAR EVIDENCE FOR ALBANIA

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ABSTRACT

This study estimates exchange rate pass-through to prices in Albania using a Vector Autoregressive model from 2000Q1 to 2017 Q1 following Cholesky decomposition. We perform an Augmented Dickey-Fuller test and Phillips-Pherron test to ensure the stationarity of the variables and we estimate the impulse-response functions and the variance decomposition of import, producer, consumer prices and interest rate to oil price /exchange rate shocks. Impulse-response functions indicate an incomplete pass-through of exchange rate to prices and the highest response is of consumer prices and interest rates. Variance decomposition indicates that the variance of import prices is explained by growth rate, its shocks and oil prices shocks. The variance of producer prices is explained by its own shocks, real GDP rate and interest rate whilst consumer prices are explained by its innovations, GDP rate and exchange rate. In order to confirm our results, we order the interest rate before the exchange rate and the findings do not change from the previous results. We perform diagnostic tests for the presence of autocorrelation and the stability of our model and the results show that we fail to reject the null hypothesis for serial autocorrelation and all the roots lie within the companion matrix. However, there is evidence on non-normality in our VAR residuals, but this does not violate our analysis.

Contribution/Originality: We estimate the pass-through using recent data and we add producer prices in our VAR model, which to our best knowledge has not been captured in the existing pass-through literature for Albania.

1. INTRODUCTION

Republic of Albania has experienced significant structural changes in the past which featured the current state of the economy. Instead of recovering from the transition period, from communism to a free market economy, the Albanian economy went through pyramid schemes (Ponzi schemes), followed by the civil war of '97-98 which lead the country to total collapse. As a result the Albanian government had to deal with extreme financial , economic and social costs which brought instability and large masses of emigration. Vaughan-Whitehead (1999) defines that unemployement, collapse of industrial production, poverty and the inefficiency of the banking system brought the collapse of the "shining star". The ex-government was assisted by the international institutions in order to increase the revenues and in September 1997 the government agreed on an economic program supported by the IMF. Despite the interventions which were foreacasted to improve the overall performance, the engagement of the foreign institutions made the instability to go worst. The decree of 1997, after a formal meeting of ex-president

Berisha[1]and representatives of IMF and World Bank brought clashes among the government and the foreign administrator (Jarvis, 2000). These clashes increased the risk within the country and no matter the efforts, in such volatility, it was quite impossible to sell the assets left. Bojkov (2008) state that this was the the most dramatical historical event that Republic of Albania has faced. Indeed, ex-governor of Central Bank of Albania defines Albania as the best example in which international institutions failed to prevent the impact that economic shocks might have in the economy (Fullani, 2012). After more than two decades, Albanian economy still seems to be "hurt" due to traces marked from the past. In terms of development and competitiveness, Albania is often viewed as "late performers"[2]. Nevertheless economic policies done, the economic performance is low in terms of per capita income, direct investment or other indicators which refer to the economic growth. This gives evidence that only policy reforms are not enough for sustainable economic growth (Siegelbaum *et al.*, 2002).Whereas Albania's pre-crisis growth was among the highest in the Western Balkan region, post-crisis growth has decelerated to around the regional average (Cabezon *et al.*, 2016). Actually, Albania's growth momentum remained strong that reflected the revival in construction, the recovery in the labor market, the household credit and large energy-related FDI projects. Despite the surge of drought-induced electricity imports, the current account deficit narrowed supported by tourism and other services exports. (IMF, 2018). The economic growth for 2018 was 4.1 % which was underpinned by the employment, confidence and favorable financing conditions. Inflation reached at 1.6 %, employment has increased, and unemployment remained at the lowest levels. The budget balance resulted in surplus at the end of the first quarter of 2019 (due to the liquidity created by the issue of the Euro-bond) and the Ministry of Finance which has decreased the domestic borrowing (BOA, 2019).

Existing literature on the transition phase that Republic of Albania went through, try to capture the causes and their impact, but the way how the economy of a country works as a "chain" following up a "domino effect" makes the research tough to properly define the causes that wind up the collapse. Moreover, the data for the period 1990 - 2000 seem to be in vain. On one hand, there are efforts to estimate "the darkness period " that Albania has experienced but on the other hand, the reliability of a work which is based on data with a high volatility is in question. This study tries to estimate the exchange rate pass-through on prices in Albania from 2000Q1 to 2017Q1 which corresponds to the period of switching[3] the instruments of monetary policy followed by BOA[4] using a recursive vector autoregressive approach. We estimate the pass-through using recent data and we add producer prices in our VAR model, which to our best knowledge has not been captured in the existing "pass-through" literature for Albania. Impulse response functions indicate that the exchange rate pass through to prices in Albania is incomplete. Variance decomposition suggest that the fluctations to import prices is triggered by growth rate, its shocks and oil prices shocks whereas the variance of producer prices and consumer prices is explained by its own innovations. Additionally, exchange rate's innovations are "less aggressive" to import prices and producer prices then to consumer prices. The reminder of the paper is structured as follows: Section 2 explains the literature review.

[1]The costs for the foreign administrators were borne by the government, based on the grants and concessional loans from donors and World Bank. The new law for administrators appointment which was drafted as a decree was refused to be signed by ex-president Berisha. It brought one month delay until the newly elected parliament passed the law. Further delay , was on administrators appointment, and even after that the owners of pyramid schemes did not give up, challenging the courts and threating for violence Jarvis (2000).

[2]The group is composed of Moldova, Azerbaijan, Kyrgyz Republic and Albania.

[3] At the end of 2000, Bank of Albania entered in another phase as the banks were not responding to the decrease of the rate settled by BOA. The entire operational framework was redesigned and it was decided that the rate of the repurchase (reverse) agreements with one week maturity will be used as the benchmark policy rate. The instruments used by the Central Bank of Albania to implement its monetary policy are: Open market operations, standing facilities, minimum reserve requirements and monetary implementation framework. www.bankofalbania.org.

[4] Bank of Albania.

Section 3 represents the methodology, estimation and results in section 4, section 5 robustness check and section 6, concluding remarks.

2. LITERATURE REVIEW

Existing literature states that the exchange pass-through to prices in the economy of a country depends on the structural factors of the international trade such as: substitution of good to the exchange rate (Corsetti and Dedola, 2002) or price setting[5] (Burstein *et al.*, 2005).

Dornbusch (1987) and Krugman (1987) proposed price-setting to the market, defining the market as oligoplostic, in which the firms change the marging according to changes of exchange rate. Indeed, this is a natural reaction towards maintaining the market share (Hooper and Mann, 1989); (Kasa, 1992); (Froot and Klemperer, 1989) or temporary currency misalignments (Marston, 1991).

McCarthy (1999) studied the impact of exchange rate changes and import prices of 6 OECD countries on consumer and producer prices using a vector autoregressive approach (VAR). The results indicate that exchange rate movements have negligble impact on consumer prices.

Muço *et al.* (2001) focused on the monetary policy transmission mechanism in Albania and indicate a modest correlation between money supply and inflation, but a strong link between exchange rate and inflation. The findings reveal the non causality between inflation and M3 growth while the political dummy impacts positively money growth and inflation. Choudri and Hakura (2001) focused on exchange rate pass-through to different prices in non-US G-7 countries using a vector autoregressive model which is composed of seven endogenous variables and two exogenous variables. Results reveal that the best fitting model incorporates: sticky prices, sticky wages, distribution costs and a combination of local and producer currency pricing.

Leigh and Rossi (2002) estimate the exchange rate pass-through on prices in Turkey and they find that the impact of exchange rate is felt over one year, but mostly is felt in the first four months.According to the results, the pass-through to wholesole prices is more pronounced than to consumer prices and the estimated pass-through is larger than the one estimated for other emerging countries. Muco *et al.* (2004) examine the transition from direct instruments to indirect instruments of monetary policy in Albania. The authors indicate a weak link between money supply and inflation up to mid-2000 while the switch from direct to indirect instruments of monetary control increase the predictability of transmission link from money supply to inflation. Peeters (2004) focused into the details of the monetary policy transmission mechanism in Albania and tests the hypothesis that the exchange rate is the most important channel in the monetary policy process. The findings show that there are strong shifts in the monetary policy transmission channel and the exchange rate is loosing is strength towards credit channel and wage channel. Luci and Ibrahimi (2005) estimated the impact of monetary policy changes on the volume of new deposits and credits and importance of commercial banks characteristics on this transmision process. The results indicate that credit supply was not affected by changes in monetary policy and that there were no significant differences among individual banks. The results also show that the effectiveness of the credit channel in Albania is modest due to cash transactions, undeveloped interbank market, preference of banks to lend in foreign currency and low penetration of credit services in the economy. Istrefi and Semi (2007) estimate the extend and the speed of exchange pass-through to consumer prices in Albania using a vector autoregressive approach. The findings show that exchange rate pass-through is almost complete within a year but in decline.

Kolasi *et al.* (2007) estimate how monetary policy impacts aggregate output, headline and core inflation. The findings indicate that the exchange rate channel is weak and the money and expectations channel play the most important role within the transmission mechanism in Albania.

[5] It depends on the country and the exchange rate volatility.

Agolli and Mancellari (2011) estimates the effect of fiscal policy on Gross Domestic Product, Prices and Interest Rates in Albania. The study reveals that a tax cut stimulus has the highest cumulative GDP multiplier and the interest rates do not respond significantly to fiscal spending shocks, but they increase after a tax cut.

Shijaku (2015) examine the transmission mechanism of monetary policy in Albania using a Bayesian VAR approach from 2002M01 -2014M2 to address the effects of the monetary policy shock due to interest rate and possible balance sheet policy changes. The results show a high impact on prices, bank lending and real money stock from policy rate whereas the liquidity effect impact exchange rate, output and the conditions of financial markets.

This study is similar to Istrefi and Semi (2007) and there are three main gaps that this study fills. First, we estimate our model using recent data (quarterly) in order to avoid the noise. Secondly, we order the reaction of monetary policy last in order to allow for the monetary policy to react contemporaneously to all shocks in the system. Thirdly, we include producer price index which to our best knowledge has not been captured before in the existing literature of exchange rate pass-through for Albania.

3. METHODOLOGY

In a Vector Autoregressive model, the dependent variable is regressed on its own lags and lags of the variables which are included in the model. General framework of a VAR model is defined in Equation 1:

$$y_t = c + \sum_{i=1}^{w} \beta_i y_{t-i} + u_t \quad (1)$$

Where $\mathbf{y}_t$ denotes a vector of endogenous variables which are :oil price, real gdp rate, real effective exchange rate, import prices, producer price index, consumer prices and repo rate, t denotes time which in our study is quarterly, c is a vector of constant terms, β_i are $n_x n$ matrices of coefficients, w is the maximum lag length in the model, u_t refers to the error term with a normal distribution with mean 0 and variance that equals σ^2.

3.1. Data

We estimate a seven variable VAR model[6] and the variables are ordered as followed: oil prices (OIL)[7], real gross domestic product rate (GDP) , real effective exchange rate (REER), import prices (IMP) [8], producer price index (PPI), consumer prices (CPI) and repo rate (REPO). Oil prices, gross domestic product and repo rate are intended to capture the movements in the economy. Table 1, gives a description of the mean and the standard deviation of our variables at levels and at first difference.[9]

Table-1. Descriptive statistics.

Variable	Levels		First difference	
	Mean	Std. dev.	Mean	Std. dev.
OIL	8.757044	0.357647	0.001296	0.174294
GDP	1.331383	0.599325	0.008772	0.186191
REER	5.01999	0.05138	0.00146	0.016402
IMP	4.848742	0.18475	0.004392	0.035268
PPI	4.554521	0.11086	0.004632	0.031726
CPI	0.192271	0.766542	0.017157	1.164191
REPO	1.439882	0.7547	0.01083	1.161329

[6] The work and the ordering of the variables is consistent with the work of McCarthy (1999) who used an eight variables model and the work Leigh and Rossi (2002) who used five variables in the model.

[7] We use Benchmark crude oil price, converted into Albanian ALL by multiplying by the ALL/dollar exchange rate.

[8] Import price denominated in euro is calculated based on the price index/unit values of export to main partners.

[9] As our main focus is on prices, we report only the levels of import prices, producer prices and consumer prices which are available at Figure 3 (appendix).

We conduct the analysis using quarterly data in order to avoid the noise in our data series. Time series variables spanning from 2000Q1-2017Q1 was taken from sources like the WDI[10], BOA[11], IMF[12], and INSTAT[13]. The model is specified as follows:

$$\Delta\pi_t^{oil} = E_{t-1}[\pi_t^{oil}] + \varepsilon_t^{s} \quad (2)$$

$$\Delta gdp_t = E_{t-1}[\Delta y_t] + \rho_1 \varepsilon_t^{s} + \varepsilon_t^{d} \quad (3)$$

$$\Delta REER_t = E_{t-1}[\Delta e_t] + \varphi_1 \varepsilon_t^{s} + \varphi_2 \varepsilon_t^{d} + \varepsilon_t^{REER} \quad (4)$$

$$\Delta IMP_t^{nf} = E_{t-1}[CPI_t^{nf}] + \psi_1 \varepsilon_t^{s} + \psi_2 \varepsilon_t^{d} + \psi_3 \varepsilon_t^{REER} + \varepsilon_t^{IMP\,nf} \quad (5)$$

$$\Delta PPI_t = E_{t-1}[PPI_t] + \eta_1 \varepsilon_t^{s} + \eta_2 \varepsilon_t^{d} + \eta_3 \varepsilon_t^{REER} + \eta_4 \varepsilon_t^{IMP\,nf} + \varepsilon_t^{PPI} \quad (6)$$

$$\Delta CPI_t = E_{t-1}[CPI_t] + \alpha_1 \varepsilon_t^{s} + \alpha_2 \varepsilon_t^{d} + \alpha_3 \varepsilon_t^{REER} + \alpha_4 \varepsilon_t^{IMP\,nf} + \alpha_5 \varepsilon_t^{PPI} + \varepsilon_t^{CPI} \quad (7)$$

$$\Delta REPO_t = E_{t-1}[\Delta i_t] + \delta_1 \varepsilon_t^{s} + \delta_2 \varepsilon_t^{d} + \delta_3 \varepsilon_t^{REER} + \delta_4 \varepsilon_t^{IMP\,nf} + \delta_5 \varepsilon_t^{PPI} + \delta_6 \varepsilon_t^{CPI} + \varepsilon_t^{REPO} \quad (8)$$

Equations 2-8 define a VAR model for each variable in our model, indicating that each variable is regressed on its own lags and the lags of other variables in the model. E_{t-1} is the expectation operator of the variable whilst ε_t is the shock for every variable. All variables are in first log difference except CPI inflation and estimate a recursive VAR model using STATA based on Cholesky identification scheme which means that the identified shocks affect the variables ordered afterwards, but do not impact the variables ordered before them. Hence, we order first the most exogenous variable, which is oil price. Next, we order growth rate and exchange rate with the implicit assumption of a contemporaneous effect of demand shock on exchange rate while exchange rate will affect growth rate with a certain time lag. We order price variables such as import prices, producer price and consumer price. The last variable that is ordered is interest rate which allows the monetary policy to respond to all shocks in the system. The ordering is defined above:

$$\Delta\pi_t^{oil} \rightarrow \Delta gdp_t \rightarrow \Delta REER_t \rightarrow \Delta IMP_t^{nf} \rightarrow \Delta PPI_t \rightarrow \Delta CPI_t \rightarrow \Delta REPO_t$$

4. ESTIMATION AND RESULTS

We perform diagnostic tests to check for serial autocorrelation and the results show that the errors are not serially correlated; Jarque-Bera results reveal that jointly in the errors in the VAR system are not normally distributed. [14]However, the violence of normality assumption does not affect our estimation. Lütkepohl (2005) Figure 4 shows that our VAR system satisfies the stability condition that all the roots lie inside the unit root circle (Appendix). Non-stationary of the variables might lead to spurious results therefore, we perform standard unit root test following (Granger and Newfol, 1974); (Phillips, 1986); (Dickey and Fuller, 1979); (Dickey and Fuller, 1981).

[10] World Development Indicator.

[11] Bank of Albania.

[12] International Monetary Fund.

[13] Institute of Statistics www.instat.com.

[14] The results are not shown for brevity purposes, but are available upon request.

Table 2, shows the Augmented Dickey-Fuller test and Phillips-Pherron test for the stationarity of the variables. We perform the test at first difference when the variables are not stationary at levels and we include PP test as ADF can be biased if the sample size estimated is too small or if there is any presence of structural breaks.

4.1. Unit Root Test

Table-2. Unit root test for 2000-2017.

Variable	ADF				PP			
	I(0)	Prob.	I(1)	Prob.	I(0)	Prob.	I(1)	Prob.
LOIL	2.046	2.920	5.869	3.566***	7.602	13.412	44.014	19.116***
LGDP	1.478	2.916	5.617	3.558***	3.912	13.444	67.026	19.206***
LREER	1.898	2.916	5.673	3.558***	4.885	13.444	67.1741	19.206***
LIMP	1.330	2.916	5.752	3.558***	2.014	13.444	67.233	19.206***
LPPI	2.283	2.916	6.403	3.558***	4.387	13.444.	63.704	19.206***
CPI	12.405	3.556**	11.06	3.558***	51.739	19.224***	67.018	19.026***
LREPO	3.9173.562***.		12.972	3.563 ***	91.872	19.152***	109.525	19.1344***

Note: *, **, *** refer to 10%, 5 % and 1% level of significance.

4.2. Lag Order Selection Criteria

Before we estimate our VAR model, we define the number of the optimal lags. Table 3 defines that our decision for the number of lags is based on Akaike Information Criterion, Likelihood Ratio Criterion and Final Prediction Error Criterion which indicate that the number of lags used in our VAR system is five.

Table-3. Var lag order selection criterion.

Lag	LogL	LR	FPE	AIC	HQIC	SBIC
0	466.513	NA	5.0e-17	-17.6736	-17.5729*	-17.4109*
1	497.143	61.259	1.0e-16	-16.967	-16.1614	-14.8657
2	521.912	49.54	2.90E-16	-16.0351	-14.5246	-12.0951
3	613.574	183.32	7.4e-17	-17.6759	-15.4605	-11.8972
4	726.031	224.91	1.2e-17	-20.1166	-17.1962	-12.4992

Note: *, **, *** refer to 10 %, 5 % and 1 % level of significance.

The empirical results will be based on impulse impulse-response functions and variance decomposition.

4.3. Impulse Responses

Orthogonalized impulse-response functions indicate the effect of oil price exchange rate shocks on price volatility and interest rate. The shade indicates the confidence bond whereas the line indicates the response of our variables to oil price/exchange rate shocks.[15] Figure 1 indicates positive impact of import prices and producer prices and negative impact of consumer prices and interest rates to oil price shocks. The highest fluctuations are obvious on consumer prices, it shows indeed the adjustment of household consumption to oil price effects and the influence goes ahead even after one year. In the first quarter consumer prices decrease with 2.8 per cent and increase in the second quarter by 2.4 per cent.

[15] Other impulse functions are not reported as the main focus is the impact of the exchange rate shocks on domestic prices but are available upon request. For accuracy, impulse-response functions except of the graphs are based on impulse-response tables which are not included in the paper for brevity purposes.

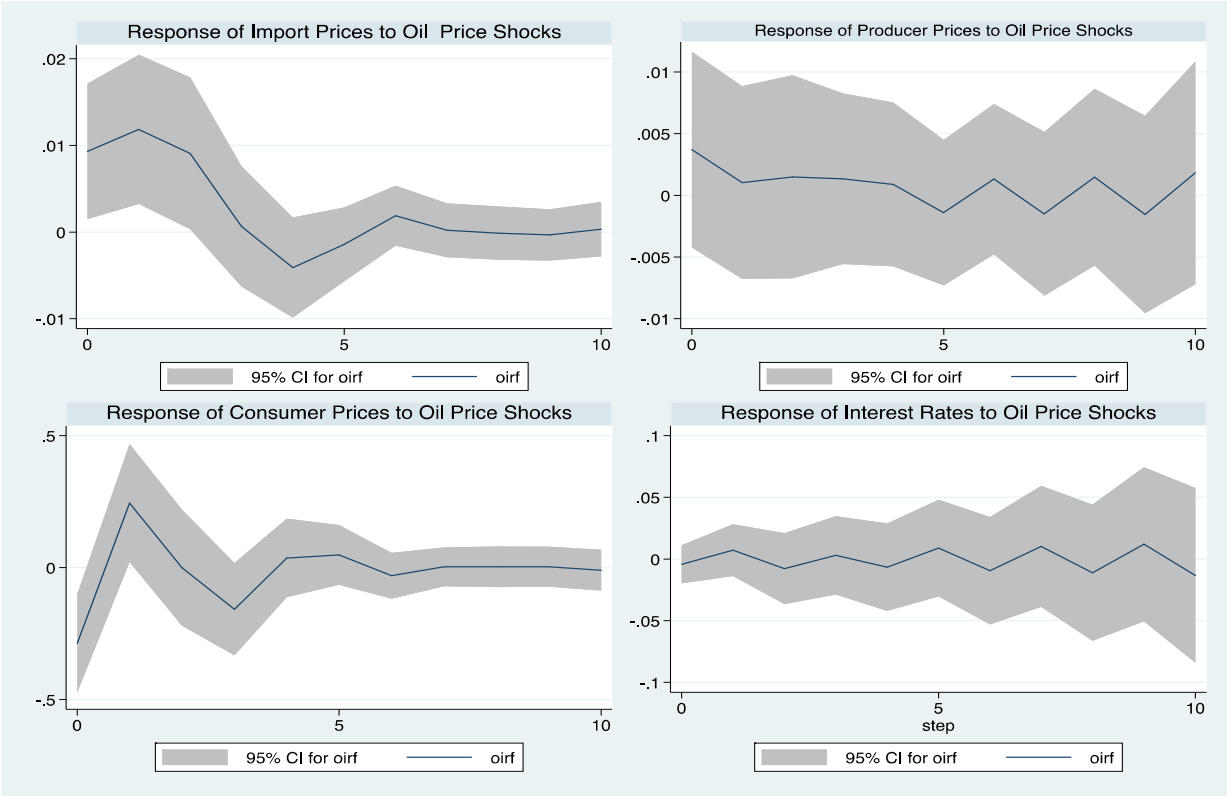

Figure-1. Response to oil price shocks.

Impulse-response functions of import, producer, consumer prices and interest rates to exchange rate shocks are shown at Figure 2 and indicate the highest volatility of consumer prices and interest rates. Import prices display a moderate effect, while producers increase the prices to exchange rate shocks by 2. 6 per cent in the first quarter to adjust their prices Consumer prices increase by 2 per cent in second quarter whilst interest rates decrease by 1.6 per cent in the second quarter. Impulse-response functions indicate an incomplete pass-through to prices in Albania.

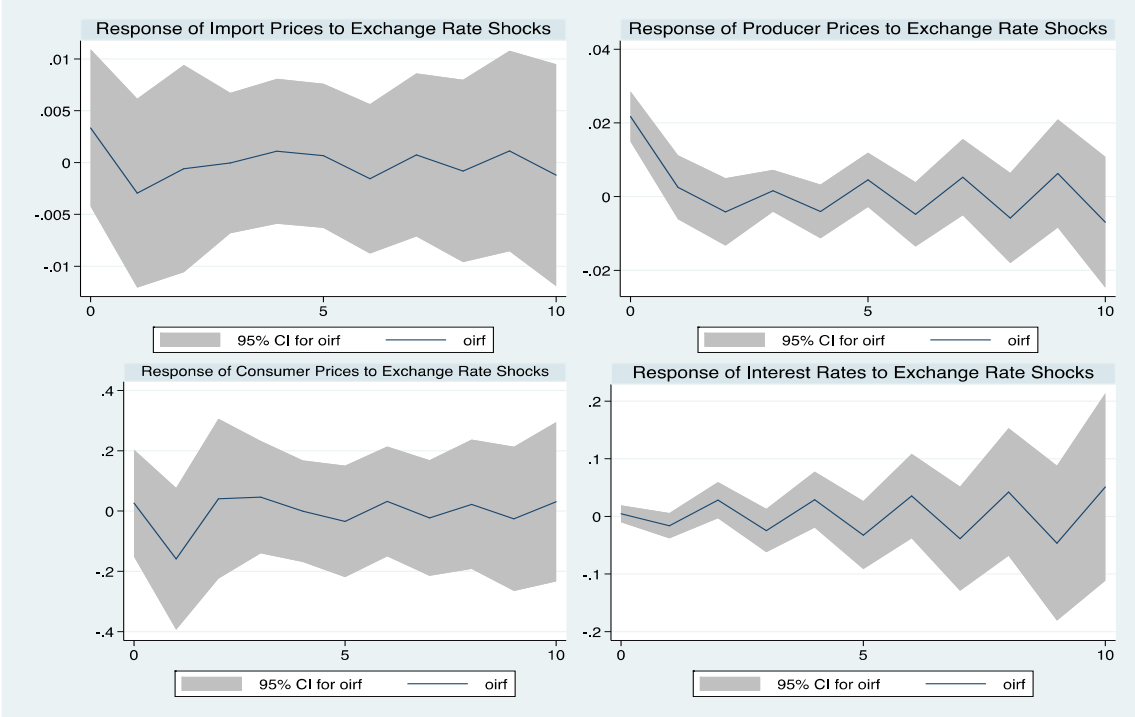

Figure-2. Response to exchange rate shocks.

4.4. Variance Decomposition

Variance decomposition helps to better understand the importance of exchange rate shocks in the behavior of our variables of interest, import prices, producer prices and consumer prices. Therefore, we decompose the variations of import prices, producer prices and consumer prices into the shocks to the endogenous variables in our VAR system.

The results of the variance decomposition for exchange rate are presented in Table 4 reveal that exchange rate movements accounts for a small proportion of the fluctuations in import and producer inflation. The variation of import prices is explained mainly by the shocks of growth rate and oil prices by 20.7 and 20.4 per cent. Its own shocks count for approximately 18.6 per cent at the end of the horizon period, exchange rate account for 6 .2 per cent. CPI and producer prices explain 5 and 13.8 per cent of import prices variance while interest rate 14.9 per cent. [16]

The results for variance decomposition of producer prices in Table 5 show its own innovations explain approximately 37 per cent in the 12 horizon period. Exchange rate shocks explain 8.4 per cent of the variance of producer prices, CPI only 2 per cent. Growth rate, interest rate and oil prices account for about 17.5 , 15.7 and 12.2 per cent of the variation. [17]

The effect of exchange shocks on CPI fluctations in Table 6 is more "aggressive" then for import and producer prices. CPI inflation variation is explained by the exchange rate shock about 14.6 per cent , import prices and producer prices for about 11.7 per cent. Its own innovations explain about 59 per cent in the first quarter, falling to 21.2 per cent in the last quarter. [18]

5. ROBUSTNESS CHECK

We followed the work of Choudri and Hakura (2001) and we re-estimate our model ordering the interest rate before the exchange rate. This means that exchange rate volatility can influence the monetary policy and the interest rate can impact the money market; this might reduce the pressure on the national currency and making investments more attractive. We follow the ordering of the variables below:

$$\Delta\pi_t^{otl} \rightarrow \Delta gdp_t \rightarrow \Delta REPO_t \rightarrow \Delta REER_t \rightarrow \Delta IMP_t^{nf} \rightarrow \Delta PPI_t \rightarrow \Delta CPI_t$$

We estimate our VAR model again and results do not differ from the previous results.[19]

6. CONCLUDING REMARK

We use a VAR model from 2000Q1 to 2017Q1 to estimate the exchange rate pass-through on prices for Albania. Based on impulse-response functions and variance decomposition of the pass-through of import prices, producer prices, consumer prices and interest rates we conclude:

There is a positive impact of oil price shocks to import prices and producer prices and a negative effect to consumer prices and interest rates. Consumer prices and interest rates have the highest volatility even when there is a shock to exchange rate. Hence, we conclude that there is a incomplete pass-through in Albania.The results indeed, show how sensitive is household consumption to oil price/exchange rate shocks and the interest rate. The impact on interest rate is modest in the first quarter indicating that the speed of adjustment of monetary policy rate to shocks is too low when the shock happens and it takes time to the economy to adjust to the shock. The response of import prices and producer prices is modest reflecting the nature of our economy as price takers. On one hand,

[16] Table 4 Appendix

[17] Table 5 Appendix

[18] Table 6 Appendix

[19] The results are not shown for brevity purposes, but available upon request.

the response of consumer prices is higher as import prices include a higher share of tradable goods which is tough to adjust them to the shocks in the economy. On the other hand, it shows that producers do not have the power to fully adjust their prices directly to impulses of oil prices and/or exchange rate.

Variance decomposition shows that the variables are explained by their own innovations. Import prices are mainly explained growth rate and oil prices at the end of the horizon period whereas its own innovations count 18. 6 per cent. Consumer prices and interest rate explain 13.8 and 14.9 per cent. Producer prices innovation count 32.5 per cent while growth rate and interest rate explain 17.5 and 15.7 per cent respectively. Consumer prices are explained by its own innovations by 21.2 per cent and growth rate by 20.6 per cent whilst exchange rate explaines 14.6 per cent.

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APPENDIX

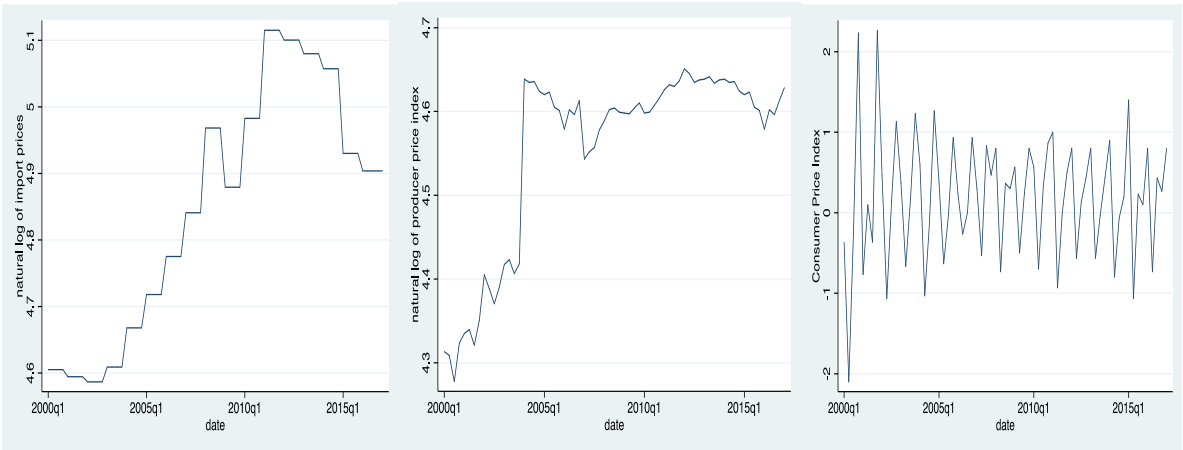

Figure-3. Time series at levels.

Table-4. Variance decomposition of import prices.

Forecast horizon	Oil prices	GDP	Exchange rate	Import prices	Producer prices	Consumer prices	Interest rate
1	0.0199	0.54343	0.00164	0.4349	0	0	0
2	0.3132	0.38672	0.0046	0.2369	0.0014	0.0281	0.0288
3	0.2210	0.2782	0.0275	0.1940	0.0076	0.1935	0.0779
4	0.1900	0.2745	0.0245	0.2148	0.0068	0.1669	0.1222
5	0.1997	0.2538	0.0238	0.2351	0.0066	0.1556	0.1251
6	0.2089	0.2440	0.0257	0.2248	0.0135	0.1508	0.1320
7	0.2041	0.2399	0.0341	0.2196	0.0156	0.1493	0.1370
8	0.2095	0.2357	0.0369	0.2096	0.0163	0.1494	0.1323
9	0.2107	0.2346	0.0384	0.2246	0.0176	0.1440	0.1298
10	0.2106	0.2331	0.0384	0.2233	0.0174	0.1485	0.1283
11	0.2053	0.2277	0.0447	0.2177	0.0243	0.1438	0.1362
12	0.2011	0.2239	0.0442	0.2141	0.0256	0.1416	0.1402
13	0.2126	0.2217	0.0439	0.2152	0.0256	0.1404	0.1402
14	0.2150	0.2214	0.0441	0.2111	0.0260	0.1444	0.1377
15	0.2104	0.2159	0.0498	0.2054	0.0324	0.1445	0.1413
16	0.2149	0.2142	0.0497	0.2028	0.0329	0.1429	0.1423
17	0.2165	0.2127	0.0565	0.2015	0.0350	0.1419	0.1414
18	0.2177	0.2126	0.0511	0.2010	0.0348	0.1419	0.1406
19	0.2136	0.2115	0.0532	0.1977	0.0383	0.1393	0.1460
20	0.2113	0.2099	0.0549	0.1961	0.0415	0.1385	0.1474
21	0.2137	0.2091	0.0547	0.1953	0.0415	0.1379	0.1475
22	0.2128	0.2098	0.0556	0.1994	0.0413	0.1389	0.1469
23	0.2113	0.2094	0.0560	0.1929	0.0430	0.1409	0.1461
24	0.2107	0.2082	0.0571	0.1919	0.0456	0.1401	0.1461
25	0.2112	0.2064	0.0580	0.1906	0.0470	0.1392	0.1472
26	0.2105	0.2089	0.0584	0.1898	0.0468	0.1385	0.1468
27	0.2099	0.2102	0.0582	0.1890	0.0471	0.1390	0.1462
28	0.2089	0.2092	0.0588	0.1880	0.0489	0.1382	0.1477
29	0.2081	0.2083	0.0594	0.1878	0.0492	0.1378	0.1490
30	0.2071	0.2094	0.0602	0.1871	0.0490	0.1392	0.1488
31	0.2066	0.2091	0.0602	0.1871	0.0490	0.1392	0.1485
32	0.2059	0.2083	0.0607	0.1864	0.0499	0.1399	0.1497
33	0.2050	0.2079	0.0616	0.1864	0.0507	0.1387	0.1494
34	0.2046	0.2081	0.0621	0.1867	0.0505	0.1384	0.1492
35	0.2044	0.2079	0.0627	0.1866	0.0505	0.1384	0.1492
36	0.2049	0.2075	0.0627	0.1864	0.0506	0.1382	0.1493

Table-5. Variance decomposition of producer prices.

Forecast horizon	Oil prices	GDP	Exchange rate	Import prices	Producer prices	Consumer prices	Interest rate
1	0.1731	0.1482	0.0341	0.0364	0.6020	0	0
2	0.1247	0.1602	0.0564	0.1126	0.4764	0.0055	0.0637
3	0.1212	0.1558	0.0565	0.1188	0.4773	0.0068	0.0633
4	0.1168	0.1429	0.0658	0.1161	0.4657	0.0067	0.0856
5	0.1176	0.1415	0.0686	0.1143	0.4586	0.0079	0.0910
6	0.1241	0.1394	0.0853	0.1073	0.4303	0.0138	0.0994
7	0.1244	0.1387	0.0877	0.1031	0.4128	0.0162	0.1167
8	0.1233	0.1574	0.0847	0.1045	0.3924	0.0254	0.1120
9	0.1199	0.1603	0.0844	0.1062	0.3857	0.0260	0.1172
10	0.1211	0.1617	0.0851	0.1058	0.3836	0.0259	0.1166
11	0.1194	0.1612	0.0863	0.1041	0.3774	0.0269	0.1243
12	0.1212	0.1641	0.0849	0.1037	0.3699	0.0260	0.1294
13	0.1211	0.1669	0.0854	0.1027	0.3675	0.0274	0.1293
14	0.1199	0.1655	0.0844	0.1015	0.3632	0.0267	0.1340
15	0.1207	0.1675	0.0842	0.1039	0.3587	0.0255	0.1324
16	0.1205	0.1656	0.0859	0.1039	0.3538	0.0250	0.1380
17	0.1202	0.1703	0.0852	0.1031	0.3507	0.0248	0.1385

18	0.1249	0.1692	0.0844	0.1039	0.3477	0.0241	0.1374
19	0.1241	0.1675	0.0835	0.1041	0.3440	0.0235	0.1436
20	0.1232	0.1686	0.0856	0.1035	0.3422	0.0234	0.1438
21	0.1235	0.1684	0.0857	0.1031	0.3408	0.0230	0.1449
22	0.1239	0.1695	0.0851	0.1038	0.3383	0.0226	0.1453
23	0.1234	0.1697	0.0851	0.1036	0.3371	0.0224	0.1471
24	0.1232	0.1706	0.0857	0.1031	0.3363	0.0225	0.1468
25	0.1252	0.1702	0.0854	0.1032	0.3354	0.0222	0.1464
26	0.1248	0.1689	0.0853	0.1025	0.3331	0.0219	0.1512
27	0.1243	0.1726	0.0849	0.1022	0.3315	0.0218	0.1505
28	0.1243	0.1723	0.0848	0.1020	0.3315	0.0221	0.1503
29	0.1240	0.1723	0.0844	0.1018	0.3303	0.0217	0.1525
30	0.1236	0.1730	0.0847	0.1016	0.3296	0.0216	0.1529
31	0.1233	0.1739	0.0844	0.1013	0.3286	0.0215	0.1534
32	0.1236	0.1741	0.0842	0.1014	0.3282	0.0217	0.1534
33	0.1230	0.1736	0.0842	0.1009	0.3270	0.0214	0.1560
34	0.1226	0.1755	0.0840	0.1011	0.3262	0.0212	0.1555
35	0.1227	0.1753	0.0842	0.1010	0.3260	0.0212	0.1554
36	0.1223	0.1752	0.0841	0.1007	0.3253	0.0212	0.1570

Table-6. Variance decomposition of consumer prices.

Forecast horizon	Oil prices	GDP	Exchange rate	Import prices	Producer prices	Consumer prices	Interest rate
1	0.0248	0.0255	0.3383	0.0029	0.0154	0.5930	0
2	0.1010	0.0551	0.3542	0.0025	0.0167	0.5166	0.0441
3	0.0148	0.0770	0.2979	0.0055	0.0225	0.4434	0.1387
4	0.0197	0.0956	0.2790	0.0124	0.0586	0.3965	0.1378
5	0.0281	0.1280	0.2627	0.0108	0.0565	0.3984	0.1151
6	0.0220	0.1496	0.2549	0.0118	0.0461	0.3903	0.1250
7	0.0198	0.1621	0.2243	0.0174	0.0651	0.3492	0.1618
8	0.0310	0.1545	0.2196	0.0165	0.0974	0.3226	0.1579
9	0.0345	0.1529	0.2130	0.0159	0.1062	0.3238	0.1534
10	0.0311	0.1740	0.2005	0.0195	0.1000	0.3183	0.1563
11	0.0320	0.1914	0.1849	0.0240	0.1124	0.2879	0.1671
12	0.0373	0.1824	0.1855	0.0241	0.1316	0.2771	0.1617
13	0.0368	0.1812	0.1826	0.0262	0.1361	0.2749	0.1618
14	0.0349	0.2009	0.1715	0.0350	0.1281	0.2674	0.1618
15	0.0334	0.2112	0.1648	0.0409	0.1338	0.2550	0.1606
16	0.0338	0..2062	0.1655	0.0414	0.1442	0.2509	0.1576
17	0.0337	0.2044	0.1632	0.0454	0.1456	0.2486	0.1587
18	0.0339	0.2247	0.1558	0.0550	0.1370	0.2413	0.1519
19	0.0332	0.2284	0.1521	0.0610	0.1399	0.2355	0.1495
20	0.0326	0.2257	0.1513	0.0630	0.1436	0.2347	0.1487
21	0.0355	0.2245	0.1493	0.0702	0.1417	0.2309	0.1477
22	0.0397	0.2340	0.1471	0.0783	0.1340	0.2269	0.1397
23	0.0405	0.2324	0.1458	0.0826	0.1351	0.2248	0.1385
24	0.0405	0.2304	0.1450	0.0847	0.1353	0.2259	0.1380
25	0.0438	0.2303	0.1432	0.0915	0.1329	0.2221	0.1359
26	0.0464	0.2307	0.1456	0.0960	0.1283	0.2197	0.1329
27	0.0478	0.2290	0.1447	0.0992	0.1279	0.2184	0.1326
28	0.0493	0.2259	0.1437	0.1023	0.1265	0.2212	0.1309
29	0.0522	0.2233	0.1430	0.1065	0.1245	0.2173	0.1327
30	0.0549	0.2194	0.1472	0.1083	0.1224	0.2161	0.1314
31	0.0571	0.2178	0.1462	0.1106	0.1216	0.2153	0.1310
32	0.0583	0.2154	0.1453	0.1128	0.1202	0.2174	0.1303
33	0.0596	0.2125	0.1456	0.1140	0.1193	0.2145	0.1341
34	0.0620	0.2096	0.1489	0.1150	0.1191	0.2126	0.1325
35	0.0646	0.2082	0.1478	0.1171	0.1183	0.2121	0.1315
36	0.0654	0.2068	0.1465	0.1172	0.1172	0.2127	0.1334

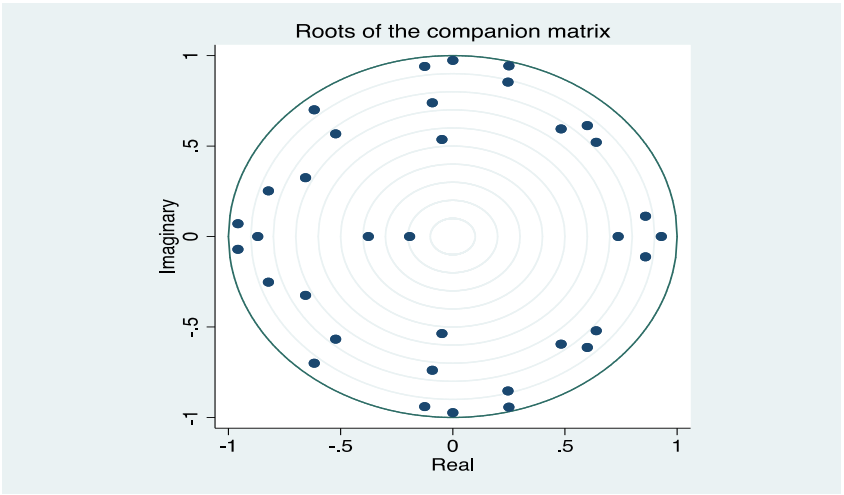

Figure-4. Roots of the companion matrix.