Sustainability in Environment
ISSN 2470-637X (Print) ISSN 2470-6388 (Online)
Vol. 2, No. 3, 2017
www.scholink.org/ojs/index.php/se

Inputs Prices Shocks and Economic Growth: Comparative Analysis of the Effects of Oil and Cotton Prices Shocks in Burkina Faso

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Received: July 28, 2017 Accepted: August 10, 2017 Online Published: August 21, 2017

doi:10.22158/se.v2n3p315 URL: http://dx.doi.org/10.22158/se.v2n3p315

Abstract

This paper analyzes the effects of oil and cotton price shocks on Burkina Faso economic growth using a multivariate VAR model estimation. We have distinguished between the linear and nonlinear specification of oil and cotton price shocks in our study. For the nonlinear specification, we make the difference between prices increase and price decreases. We find that oil price shocks do not affect Burkina Faso's real GDP in both linear and nonlinear specification. However, we do find that cotton price shocks in linear and nonlinear model, Granger cause real GDP and final consumption. In addition, the study has shown that both positive and negative cotton price shocks affect positively the real GDP.

Keywords

VAR model, real GDP, Granger causality, linear and nonlinear price shocks

1. Introduction

The effect of raw materials' price on macroeconomic variables has been widely studied by economists. However, those studies have been done mostly in developed countries or in developing oil exporter countries. Thus, those studies are unusual for developing countries with less endowment in natural resources. Nevertheless, developing countries importers and exporters of raw materials can be concerned by those studies for knowing the global effect of import and export inputs price on their macroeconomic variables. Those countries are most concerned about this question since they are essentially price taker of those inputs. The effect of input price shock on macroeconomic variables in those countries may be different from the effects found in many developed countries. Theoretically, inputs' price such as oil and cotton price shocks can affect macroeconomic variables through many channels in function of the country context. For, an input-importer country an input price increase such as oil price, leads to a rise in production costs that induces firms to lower output (Rebeca & Marcelo, 2004) and inputs prices decrease will lead to a decrease in production cost and stimulate firm's production. On other hand, for an inputs exporter country, a rise of the raw materials price will stimulate the production of those materials and their prices decrease will have a negative effect on their production. In addition, input prices variation can also affect consumption through its positive relation with disposable income (Rebeca & Marcelo, 2004). Indeed, a variation of raw materials price such as cotton price will have a direct effect on producers' income and thus on their consumption. In economic literature, many studies have been for analyzing the effect of inputs' price shocks on certain macroeconomic variables. Domenico, Ken and Barbara (2015) varying the time series data frequency on Canada, they find the existence of a very short-term relationship between the country's major commodity daily price changes and the country nominal exchange rate. In addition, they find that the relation is robust when using contemporaneous commodity price shocks in their regression while the model predictive ability is ephemeral with lagged value of commodities price. This study supports the idea that for detecting predictive ability of commodity price on macroeconomic variable, data frequency is matter to consider. Studying the effect of primary commodity prices on the long-run growth of 24 primary commodities-based African economies, Solomon (2015) used Pooled Mean Group (PMG) heterogeneous panel. He shows a significant positive effect of primary commodity export prices on exporter countries economic growth. In addition, its study has shown that, this positive effect is inelastic. Many of other studies have analyzed the effect of only one specific input price variation effect on economic growth. Most of those studies have evaluated the effect of oil price on macroeconomic variables. William and Emmanuel (2015) used ARDL estimation applied on annually time series data for analyzing, the relationship between crude oil price and Ghana's economic growth. After controlled for the effect of fiscal policy in the relationship, they found negative relationship between crude oil price and economic growth in Ghana in long and short run. Muhammad (2013) in his study on oil price volatility on Pakistan's GDP, he used an OLS estimation on time series annual data. The study revealed unlikely to other previews studies an insignificant effect of oil price on Gross domestic production. Beside studies, which use commodities price in a linear regression, there is a group of studies, which use VAR models for examining the effect of price shock on economic growth. Mohd, Tan and Hafizah (2013) using Granger causality analysis, they have found that, agricultural sector and construction sector are both influenced by shocks on oil price in Malaysia. Rebeca and Marcelo (2004) used linear and non-linear model's specification for analyzing the effects of oil price shocks on six OECD's countries real GDP. They found that there is a non-linear impact of oil prices on real GDP. For instance, their study shows that oil price increase is found to have an impact on GDP growth of a larger magnitude than that of oil price decline, which is not statistically significant. As, we can see, most of studies are based on developed countries or on developing oil net export countries. There is a lack of studies on developing oil import countries. The principal innovation in this study is that, it based on developing country Burkina Faso which the particularity to be an input exporter country (cotton) and input importer country (mainly oil). The main objective of this study is then for analyzing the effect cotton and oil price on Burkina Faso's economic growth proxy by real GDP. The rest of the paper is organized as follow: In section II, we will make the background about the Burkina Faso economic growth and analyze the trend of inputs price in the period of study. In section III, we present the methodology of the study and in section IV, we expose the main findings of the study.

2. Overview of Burkina Faso Economic Growth and Inputs Price Tendency

2.1 Economic Growth in Burkina Faso

The last two decades have been marked by regular economic growth in Burkina Faso. Even though it was the same case in many African countries, Burkina Faso is one of low natural resource endowment countries that has been able to achieve high growth over a long period (IMF, 2014). In the period 1995-2015 gross domestic product has known, an annual average growth rate of 6%. This rate is bigger than the regional annual economic average growth rates, which are 3% and 2% respectively for WAEMU and the whole sub-Saharan Africa in the same period. Those good performances realized by the country can be explained by the improvement of macroeconomic management, stronger institutions, increased aid, and higher investment in human and physical capital (IMF, 2014). Despite, those performances, the country is frequently subject to the international economic fluctuations which are materialized by the shortage of aid and the inputs prices fluctuation. Economic growth was not stable during the period. It reached its maximum value in 1996 and realized the lowest average annual growth rate in 2000. The country economy is dominated by agriculture sector which employs about 80% of the active population. Cotton is the country's most important cash crop, while gold exports have gained importance in recent years. Cotton has been for long period the country first export product before the mining sector boom overlapped in those last years. The country's economic has affected by a combination of several factors, including exogenous shocks linked to the persistent fall in the price of raw materials, the socio-political crisis experienced by the country in 2014 and 2015 and the impact of the Ebola epidemic in the sub-region have resulted in a slowdown in the rate of economic growth. As we can see in Figure 1, the GDP growth of 4% was recorded in 2014 and 2015, significantly lower than the average of 6% registered over the previous decade. Burkina Faso economy is also vulnerable to changes in rainfall. In consequence, its economic and social development will, to some extent, be contingent on political stability within the country and sub-region, as well as its openness to international trade and export diversification. The country is also an importer of oil and depends entirely on oil import for the country consumption. In consequence, the country is subject to export prices shocks for cotton as well as import prices shocks for oil. So, the question we may ask is, what are the effects of export price shocks and import prices shocks on Burkina Faso economic growth? Does the effect of input price shocks depend of the nature of the inputs? In this study, we will try to answer those questions.

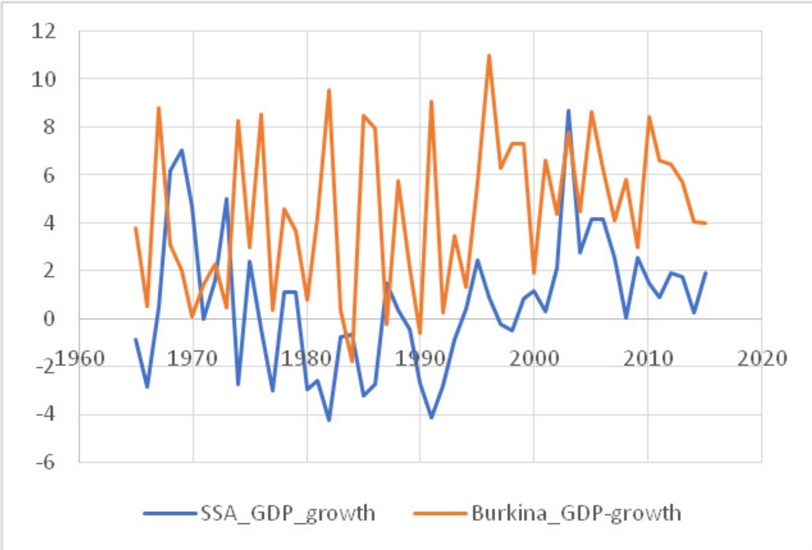

Figure 1. Burkina Faso Versus SSA GDP Growth

Source: constructed by author using WDI 2016.

2.1 International Inputs Prices Tendency and Economic Growth

Burkina Faso is belonging to African countries, which are lowly endowment in natural resources. The country does not have oil resource or diamond as many African countries. The main natural export product of the country is gold which knows a boom in the last decades. Besides gold, Burkina Faso is ranked first in term of cotton production in west Africa. Gold and cotton constitute the main export product of the country. Those products are however exported in raw forms partly due to the low level of industrialization to convert to semi-finished or finished products. This fact reduces the ad value of those products and decreases the contribution of those products to the national product. As a small economy and then price taker, the country is vulnerable to the shocks of the international inputs prices. The trend of the economic growth is then subject to those external price shocks. Cotton, crude oil, and gold prices have roughly known the same trend in the period 1965-2015. The tree inputs prices have known an increasing trend in this period. However, the tree inputs have not characterized by the same growth rate. Oil and gold have marked by the biggest increasing rate with an annual average growth rate respectively about 11% and 13% (IMF 2016). Cotton price has known the lowest increasing rate with about 4% of annual average rate. In this study we focus on oil price shocks and cotton price shocks because, the boom of gold industry is very recent.

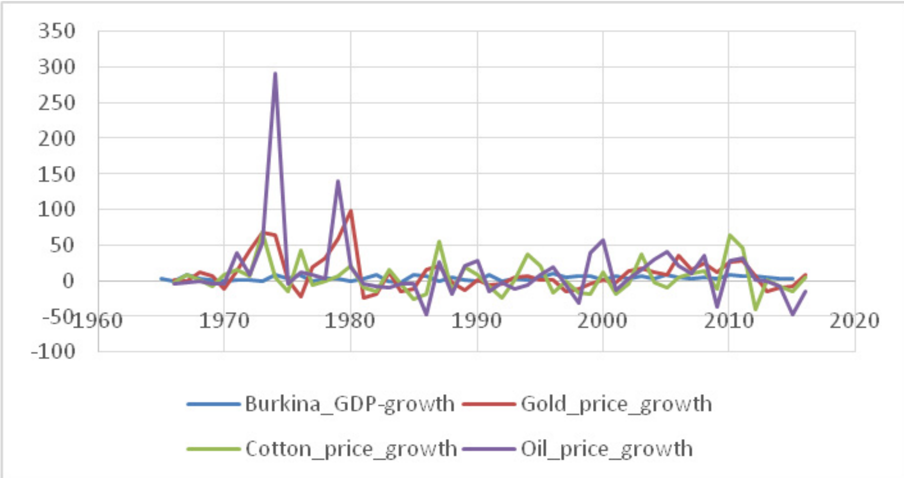

Figure 2. Inputs Prices Variation and GDP Growth Rate

Source: constructed by author using WDI 2016.

3. Methodology of the Study

3.1 Estimating Framework

In the literature, many econometric models have been used for analyzing the effect of inputs price on economic growth. Linear model specification (Muhammad, 2013), Pooled Mean Group (PMG) heterogeneous panel data (Solomon, 2015) and VAR model (Rebeca & Marcelo, 2004) have been widely used in literature. In this study, we follow Rebeca and Marcelo (2004) to specify two VAR(p) models. The models are defining as follow:

$$\text{Model1}: Y_t = \beta_0 + \sum_{i=1}^{p} \beta_i Y_{t-i} + \varepsilon_t,$$

$$\text{Model2}: X_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i X_{t-i} + \mu_t,$$

Whereas,

- In model 1, Y_t is a (n×1) vector of endogenous variables, β_0 is a (n×1) constants vector of the VAR(p) and β_i is the matrix of autoregressive coefficients for i=1, 2, …, p and ε_t is the matrix of errors terms. The endogenous variables include the following variablesinclude, real GDP (*GDP*), inflation rate (*infla*), trade deficit (*Trade_defi*), final consumption, real oil price (*p_oil*).
- In model 2, X_t is a (n×1) vector of endogenous variables, α_0 is a (n×1) constants vector of the VAR(p) and α_i is the matrix of autoregressive coefficients for i=1, 2, …, p and μ_t is the matrix of errors terms. The endogenous variables include the following variables in model 2 include, real GDP (*GDP*), inflation rate (*infla*), trade deficit (*Trade_defi*), final consumption, real cotton price (*pcotton_vari*).

In the two models, the variable real GDP, real oil price, and real cotton price are variables of interest in this study. We also include some variables for capturing the channel by which the inputs prices shocks can affect the economic growth.

3.2 Data

For this study, we collected data from the World Bank (World Development Indicators, 2016) and IMF database. Annually data have been collected for all the variables of the model. In the literature, there is an issue about the specification of oil price. Indeed, in economic literature there is a linear specification of oil price (Mohd, Tan, Hafizah, & Muhammad, 2013) and non-linear specification (Rebeca & Marcelo, 2004; Mohammad & Gunther, 2009). In this study, we use both the linear specification and non-linear specification for oil price and cotton price in our VAR model. Many non-linear oil price specifications have been proposed in the literature. Among those non-linear specification, Mork (1989) suggests allowing asymmetric responses to oil price increase and oil price decrease. He defined two variables for oil price variation. Two variables have been defined for price increase and price decrease. Lee, Ni and Ratti (1995) argue "that an oil price change is likely to have greater impact on real GNP in an environment where oil prices have been sTable, than in an environment where oil price movement has been frequent and erratic". Then, they used a univariate GARCH error process to model oil price, which allowed them, to compute the unexpected component and conditional variance of real oil price. Hamilton (1996) also, considered the increase of oil price as measure of prices shock. However, unlikely to Mork (1989), Hamilton (1996) defined a net price increase which compares, the price of oil each quarter with the maximum value observed during the preceding four quarters. The oil price in then defined as follow:

$$NOPI_t = \max\{0, p_t - max(p_{t-1}, p_{t-2}, p_{t-3}, p_{t-4})\}$$

In this article, we use a linear specification and non-linear specification of oil price and cotton price. For the nonlinear specification of price shocks, we follow (Mork, 1989), by specifying prices increase and prices decrease as separate two variables.

3.3 VAR Models Estimating

VAR parameters can be estimated by many estimation methods. Among these estimation methods, there is the OLS estimation method, which consist to estimate the VAR equations by OLS. For a stationary VAR(p), OLS estimator is unbiased and consistent. The VAR(p), can be also estimated by the maximum likelihood. However, maximum likelihood estimator is only asymptotically unbiased. In this paper OLS method is use for estimating our two VAR(p) models. While estimating VAR model, there is an issue of whether the variables in a VAR need to be stationary (WALTER, 2015). However, some authors (Sims, 1980; Watson, 1994) are opposed to the data differencing. For them, the goal of VAR model estimation is not for determining the model parameters but for identifying the nature of relationship between the variables. Thus, in this study, we use unrestricted VAR estimation. The following step have been followed for studying the effects of prices shocks: After estimating the VAR models, we examine the causal relationships between the variables by doing Johnsen causality test. Thereafter, we plot the impulse response functions for analyzing the dynamics relationships between different variables. Finally, the variance decomposition is analyzed for measuring the contribution of inputs price shocks on the economic variables innovations.

4. Presentation of Empirical Results

In this part of the paper, we present the empirical finding of the study. After estimated, the two models, we have carried out for each model, the Granger causality test, the impulses responses function and variance decomposition. However, before estimated the models, we have analyzed the stochastic propriety of our series by doing stationarity tests.

4.1 Effect of Oil Price Shocks on Economic Growth

4.1.1 VAR Estimation

The stationarity tests have shown that the series have different integration order. Inflation, oil price variation, are zero order integrated. On other hands, log_GDP, trade deficit, and log_final_consumption, are order 1 integrated. Thus, the series cannot present co-integration relationships. We then use unrestricted Var model for estimating this first model. The Table 1 and Table 2 respectively the results of VAR estimation for oil price symmetric shocks and asymmetric shocks.

After estimating VAR model, we carry out the Wald test for testing the significance of oil price coefficients in GDP equation. The results of this test have shown that all of oil price coefficients are jointly no-significant in GDP equation for both symmetric and asymmetric estimation. In other words, oil price shocks do not have direct effect on Burkina Faso GDP. In addition, for examining indirect effect of oil price on GDP, we carry out the Wald test for other equations of the model. The results of this show that oil price is only significant for in inflation equation for the symmetric model. That means, the only indirect effect of oil price on Burkina Faso's GDP is through its effects on inflation. In conclusion, we can say oil price shocks do not have direct effect on Burkina Faso GDP. The only way that oil price shocks can affect Burkina Faso's economy, is indirectly through inflation.

Table 1. VAR Output for Linear Specification of Oil Price Shocks

VARIABLES	(1) log_gdp	(2) inflation	(3) log_final_cons	(4) trade_deficit	(5) poil_vari
L.log_gdp	**0.522****	-114.361	0.635*	-1.625e+09	-1.543
	[0.193]	[106.283]	[0.304]	[1.750e+09]	[2.299]
L2.log_gdp	0.332+	-93.404	0.063	-2.905e+09+	2.100
	[0.186]	[102.324]	[0.293]	[1.685e+09]	[2.213]
L3.log_gdp	0.382+	**242.374***	-0.376	4.104e+09*	-0.044
	[0.200]	[110.045]	[0.315]	[1.812e+09]	[2.380]
L.inflation	0.000	0.014	0.000	2816879.272	0.000
	[0.000]	[0.134]	[0.000]	[2209439.201]	[0.003]
L2.inflation	0.000	0.237+	0.001*	-3885525.700+	0.004
	[0.000]	[0.124]	[0.000]	[2038432.667]	[0.003]
L3.inflation	0.000	0.035	0.000	780,561.725	-0.004
	[0.000]	[0.137]	[0.000]	[2256045.621]	[0.003]

L.log_final_cons	0.125	14.959	0.420+	2.791e+09*	0.426
	[0.138]	[76.185]	[0.218]	[1.254e+09]	[1.648]
L2.log_final_cons	**-0.286***	113.459	0.006	-1.733e+09	-0.954
	[0.134]	[73.902]	[0.211]	[1.217e+09]	[1.599]
L3.log_final_cons	-0.053	**-175.109***	0.227	-6.135e+08	0.080
	[0.129]	[70.954]	[0.203]	[1.168e+09]	[1.535]
L.trade_deficit	0.000+	-0.000	-0.000	1.461**	0.000
	[0.000]	[0.000]	[0.000]	[0.127]	[0.000]
L2.trade_deficit	-0.000	0.000	0.000	-1.159**	0.000
	[0.000]	[0.000]	[0.000]	[0.183]	[0.000]
L3.trade_deficit	0.000	-0.000+	0.000	0.729**	-0.000
	[0.000]	[0.000]	[0.000]	[0.151]	[0.000]
L.poil_vari	-0.002	**16.336***	0.033+	-1.439e+08	0.004
	[0.013]	[6.929]	[0.020]	[1.141e+08]	[0.150]
L2.poil_vari	0.012	-6.416	0.018	-1.013e+08	-0.070
	[0.014]	[7.444]	[0.021]	[1.226e+08]	[0.161]
L3.poil_vari	0.011	10.280	0.034	-1.100e+08	0.117
	[0.013]	[7.205]	[0.021]	[1.186e+08]	[0.156]
Constant	-0.171	119.843	0.256	-1.422e+08	-0.511
	[0.241]	[132.508]	[0.379]	[2.181e+09]	[2.866]
Observations	48	48	48	48	48
Standard errors in brackets					

** p<0.01, * p<0.05, + p<0.1.

Table 2. Effects of Symmetric Oil Price Shocks on Economic Growth

VARIABLES	(1) log_gdp	(2) inflation	(3) log_final_cons	(4) trade_deficit	(5) poil_increase	(6) poil_decrease
L.log_gdp	**0.531****	-20.272	0.788**	-2.040e+09	-0.430	-1.388
	[0.184]	[106.037]	[0.291]	[1.672e+09]	[2.720]	[1.087]
L2.log_gdp	0.328+	-134.014	-0.012	-2.897e+09+	1.234	0.947
	[0.176]	[101.521]	[0.279]	[1.601e+09]	[2.604]	[1.041]
L3.log_gdp	0.352+	203.198+	-0.480	4.595e+09**	-0.175	0.375
	[0.196]	[113.047]	[0.310]	[1.783e+09]	[2.900]	[1.159]
L.inflation	0.000	-0.081	0.000	2945758.506	-0.003	0.000
	[0.000]	[0.133]	[0.000]	[2099756.159]	[0.003]	[0.001]
L2. inflation	0.000	0.282*	0.001**	-4672142.328*	0.004	0.003*
	[0.000]	[0.124]	[0.000]	[1951407.372]	[0.003]	[0.001]

L3. inflation	0.000	0.167	0.000	935,796.827	-0.002	-0.001
	[0.000]	[0.137]	[0.000]	[2157610.920]	[0.004]	[0.001]
L.log_final_cons	0.181	-69.451	0.492*	2.792e+09*	-3.004	0.919
	[0.131]	[75.710]	[0.208]	[1.194e+09]	[1.942]	[0.776]
L2.log_final_cons	**-0.344***	**193.463***	-0.137	-2.106e+09+	1.858	0.121
	[0.136]	[78.335]	[0.215]	[1.235e+09]	[2.010]	[0.803]
L3.log_final_cons	-0.021	**-189.959***	0.324	-3.152e+08	0.355	-0.762
	[0.129]	[74.338]	[0.204]	[1.172e+09]	[1.907]	[0.762]
L.trade_deficit	**0.000***	-0.000	0.000	1.425**	-0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.126]	[0.000]	[0.000]
L2.trade_deficit	-0.000	0.000	-0.000	-1.112**	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.186]	[0.000]	[0.000]
L3.trade_deficit	0.000	-0.000+	0.000	0.728**	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.156]	[0.000]	[0.000]
L.poil_increase	-0.011	0.617	-0.017	-7.130e+07	-0.062	0.089
	[0.010]	[5.559]	[0.015]	[87671339.411]	[0.143]	[0.057]
L2.poil_increase	0.000	-5.969	0.001	19925844.844	-0.089	0.071
	[0.009]	[5.227]	[0.014]	[82438420.349]	[0.134]	[0.054]
L3.poil_increase	0.015+	8.860+	0.020	-6.539e+07	0.219	0.098+
	[0.009]	[5.216]	[0.014]	[82263832.470]	[0.134]	[0.053]
L.poil_decrease	0.024	14.764	**0.107***	-3.930e+08	-0.496	-0.241
	[0.027]	[15.836]	[0.043]	[2.498e+08]	[0.406]	[0.162]
L2.poil_decrease	-0.003	19.204	-0.032	-4.081e+08	0.077	-0.022
	[0.029]	[16.501]	[0.045]	[2.602e+08]	[0.423]	[0.169]
L3.poil_decrease	-0.004	-14.247	-0.019	1.010e+08	0.130	-0.045
	[0.028]	[16.080]	[0.044]	[2.536e+08]	[0.413]	[0.165]
Constant	-0.228	165.681	0.234	-2.335e+08	1.679	-2.029
	[0.244]	[140.455]	[0.386]	[2.215e+09]	[3.603]	[1.440]
Observations	48	48	48	48	48	48
Standard errors in brackets						

** p<0.01, * p<0.05, + p<0.1

4.2 Granger Causality Test

We say variable x_t Granger causes a variable y_t, if knowing the variable x_t, we can predict the variable y_t. The results of Granger causality test are presented in Tables 3 and 4 for linear and nonlinear specification. We then test if a given oil price variable granger causes all the remaining variables. This test shows that, we reject the null hypothesis at 5% for symmetric model. In other words, oil price Granger-causes the remaining variables in the symmetric and asymmetric specification. In addition, a given oil price shocks does not Granger-causes GDP, as found above with the VAR coefficients. As, Burkina Faso is essentially a price taker country, we do not look for knowing if the remaining variable are also Granger-causes the remaining variables. To conclude, the results show that oil price does not Granger-causes economic variables in Burkina Faso.

Table 3. Granger Causality Test in Linear Model of Oil Price

Equation	Excluded	chi2	df	Prob > chi2
log_gdp	inflation	6.1478	3	0.105
log_gdp	log_final_cons	7.6384	3	0.054
log_gdp	trade_deficit	.	0	.
log_gdp	poil_vari	1.4646	3	0.69
log_gdp	ALL	19.945	9	0.018
inflation	log_gdp	4.8703	3	0.182
inflation	log_final_cons	6.5796	3	0.087
inflation	trade_deficit	4.2178	3	0.239
inflation	poil_vari	8.1529	3	0.043
inflation	ALL	24.99	12	0.015
log_final_cons	log_gdp	10.893	3	0.012
log_final_cons	inflation	5.6757	3	0.128
log_final_cons	trade_deficit	.	.	.
log_final_cons	poil_vari	5.6757	3	0.107
log_final_cons	ALL	6.0952	12	0
trade_deficit	log_gdp	6.983	3	0.072
trade_deficit	inflation	5.9226	3	0.115
trade_deficit	log_final_cons	5.0564	3	0.168
trade_deficit	poil_vari	3.1117	3	0.375
	ALL	24.21 12	12	0.019

Table 4. Granger Causality Test in Nonlinear Model of Oil Price

Equation	Excluded	chi2	df	Prob > chi2
log_gdp	inflation	7.3647	3	0.061
log_gdp	log_final_cons	9.3486	3	0.025
log_gdp	trade_deficit	.	0	.
log_gdp	poil_increase	4.7397	3	0.192
log_gdp	poil_decrease	0.82566	3	0.843

log_gdp	ALL	25.463	12	0.013
inflation	log_gdp	4.2994	3	0.231
inflation	log_final_cons	8.9718	3	0.030
inflation	trade_deficit	3.0565	3	0.383
Inflation	poil_increase	4.878	3	0.181
inflation	poil_decrease	3.1959	3	0.362
inflation	ALL	23.982	15	0.065
log_final_cons	log_gdp	13.267	3	0.004
log_final_cons	inflation	8.6298	3	0.035
log_final_cons	trade_deficit	.	0	.
log_final_cons	poil_increase	3.6658	3	0.300
log_final_cons	poil_decrease	6.8826	3	0.076
log_final_cons	ALL	36.686	12	0.000
trade_deficit	log_gdp	8.4919	3	0.037
trade_deficit	inflation	8.8482	3	0.031
trade_deficit	log_final_cons	5.9289	3	0.115
trade_deficit	poil_increase	1.3122	3	0.726
trade_deficit	poil_decrease	5.0042	3	0.171
trade_deficit	ALL	29.591	15	0.013

4.3 Impulses Responses Functions

The VAR model written in Vector Moving Average representation (VMA), can be used to compute the impulse responses function of variables to oil price shocks. The VMA representation is an essential feature of Sims's (1980) methodology in that it allows you to trace out the time path of the various shocks on the variables contained in the VAR system (WALTER, 2015). Our VAR model for oil price can be represented in VMA form as follow:

$$Y_t = \mu + \sum_{i}^{\infty} \beta_i \varepsilon_t$$

Whereas μ is the mean of the process and β_0 is the identity matrix. The coefficients β_i are used for estimating the effects of error shocks on the endogenous variables Y_t. In addition, the coefficients of the impulse response functions are used to compute the accumulated effects of shocks. We then compute the orthogonal zed impulse response function of the remaining variables to one standard error variation of oil price for linear specification and non-linear specification oil price. To do so, we chose Cholesky decomposition that impose to order the variables in specific order. This order imposes that the first variable in the ordering is not contemporaneously affected by shocks to the remaining variables, but shocks to the first variable do affect the other variables in the system; the second variable affects contemporaneously the other variables (except for the first one), but it is not contemporaneously affected by them; and so on. In our case the order (*poil_vari, log_gdp, trade_deficit, inflation, log_final_cons*) for the linear specification and (*poil_increasepoil_decreaselog_gdptrade_deficit inflation log_final_cons*) for nonlinear model.

In the Figure 3, we present the orthogonalized impulse responses function and cumulative impulse response function to one standard variation of oil price in the linear specification. We can see that the log GDP responds positively to one standard deviation innovation in oil price. The corresponding accumulated impulse response shows a positive and increasing response of log GDP to oil price shocks specification model. For inflation, an oil price shocks result to a negative response for the first years and positive responses after the third year and the corresponding accumulated responses are strictly negative through years. On other side, an oil price shocks results to a negative response for the log of final consumption and the trade deficit respectively for the first six years and first years and to positive responses latter. In addition, their corresponding accumulated responses are strictly negative over years for trade deficit and final consumption, which last after eight years for final consumption and become positive.

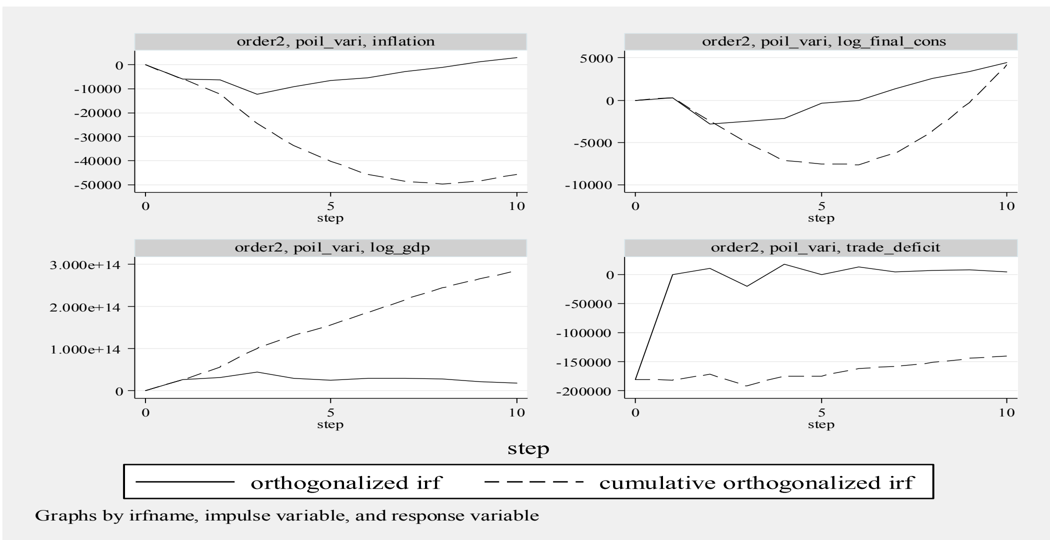

Figure 3. Impulse Response Function of Shocks to Linear Measure of Oil Price

Source: constructed by author using WDI 2016.

The Figure 4 presents theorthogonalized impulse responses functions and accumulated impulses responses to shocks in nonlinear (increase) specification of oil price. In those Figures, we can see that an oil price increase results to an ins Table impulse responses function of log GDP which are positive and negative through the years. In other hands, log GDP accumulated impulse responses is positive to a one standard deviation of oil price increase. This sign is counterintuitive for Burkina Faso, which is essentially an oil import country. But as we have seen with VAR estimation an oil price increase is not significant for Burkina Faso GDP growth. For the other variables, i.e., inflation, log final consumption and trade deficit, an oil price increase results to an accumulated negative impulse response for inflation, log of final consumption and trade deficit.

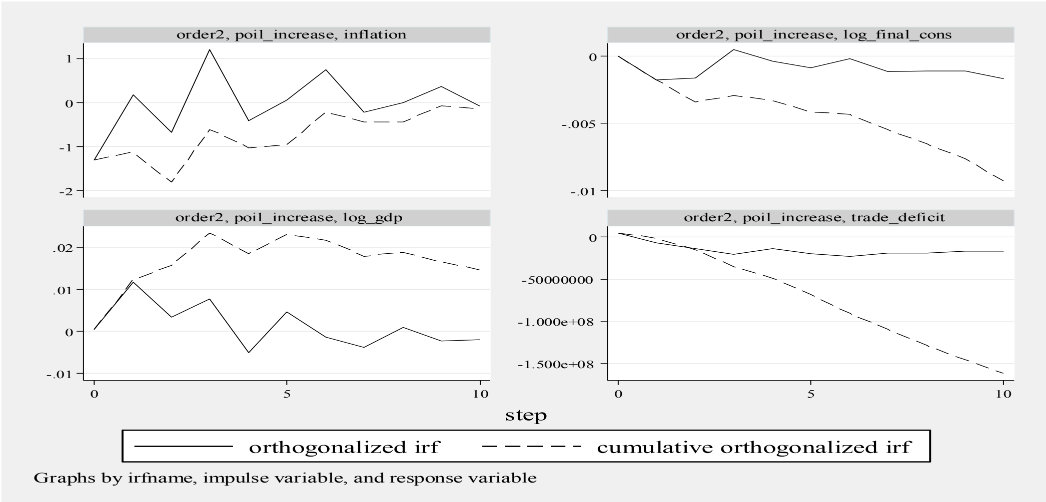

Figure 4. Impulse Response Function of Shocks to Nonlinear Measure of Oil Price (Oil Price Increase)

Source: constructed by author using WDI 2016.

Figure 5, contain respectively the impulses response functions and the accumulated impulse response functions for an oil price decrease. We can see from that Figure that an oil price decrease results by a positive and negative impulses response for log-GDP with a dominance of positive impulse responses. In addition, the accumulated impulse response function of log-GDP is positive through years. For other macroeconomic variables in our model, an oil price decrease results to positive impulses response trade deficit and negative impulses response for log final consumption through the years. Their corresponding cumulative impulse responses are also positive. On other hands, an oil price decrease results to a nons Table positive and negative impulse responses for inflation. The cumulative orthogonalized impulse response has the same trend.

In sum, we can see that variables respond differently for linear and nonlinear oil price shocks specification. The responses are also different for an oil price increase and an oil price decrease.

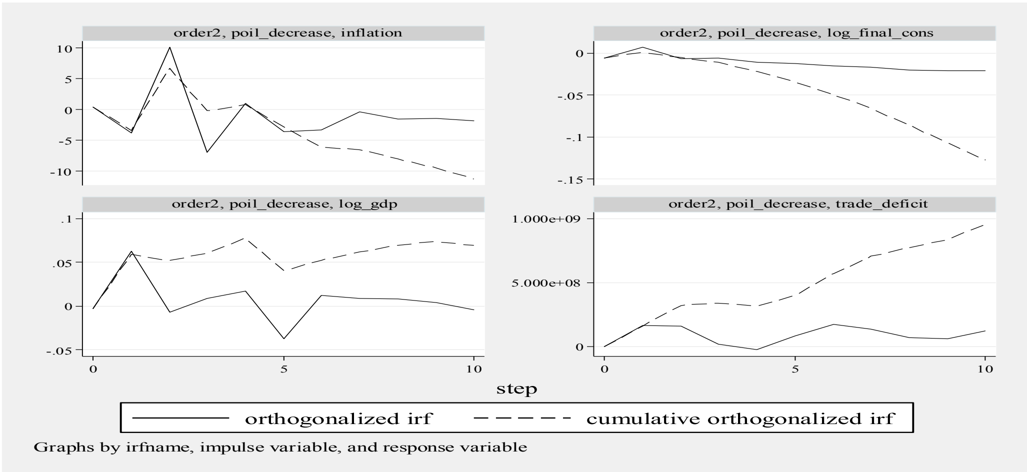

Figure 5. Impulse Response Function of Shocks to Nonlinear Measure of Oil Price (Oil Price Decrease)

Source: constructed by author using WDI 2016.

4.4 Variance Decomposition

For completing our analysis, we have done the variance decomposition for the macroeconomic variables in our model. We focus here on the interpretation of the results of the real GDP for the linear and nonlinear specification. The results in Table 5 confirm the no significance of oil price shocks effect on real GDP. Indeed, at the first year the contribution of oil price shocks to real GDP innovation is almost 0% and this contribution increases for reaching its maximum value of 4.89% at the fifth year. For the other variables in the linear specification, at the first year the contribution of oil price to their shocks' explanation is ranked from 0% to 4.89 which is very low. At the fifth year, that contribution increased and is ranked from 9.4% to 19.1% of variables' shocks.

The variance decomposition for the nonlinear specification is presented in Table 6. We find that the results are different from those found with the linear specification. Indeed, at the first year, the oil price's decrease alone contributes to 10.4% to real GDP innovation. At the fifth year, oil price decrease and oil price increase contribute respectively for 6.73% and 5.44% to real GDP innovations. For other variables, the results show that at the first year, oil price decrease has more contribution to final consumption's shocks and less contributes to trade deficit. On other hands, oil price increase more contributes to inflation's shocks and less contributes to trade deficit shock at the first year.

In Table 6, we present Variance decomposition for log GDP in the nonlinear specification (oil price decrease). We can see from this Table that in short term, i.e., third year, GDP contributes for 80.97% to its own innovations. Inflation is second contributor to GDP innovation with 7.24% followed by oil price decrease, which contributes for 5.18% to GDP innovations. On other hand, in short term trade deficit and final consumption contribute respectively for 4.80% and 1.79% to GDP innovations. In long run (seventh year), GDP contributes for 46.61% to its own innovation. Besides, trade deficit is the first contributor to GDP's innovations with 25.1% of contribution, followed respectively by inflation oil price decrease, and final consumption. In addition, the contribution of price decrease is lower in long run.

To conclude in this part, Burkina Faso shocks in economic growth captured by fluctuation in log real GDP is not so dependent of oil price shocks in short and long run term. Oil price contribution to GDP innovation is low in the three model and in short and run.

4.5 Effect of Cotton Price Shocks on Economic Growth

In this part, we investigate the effects of cotton price on Burkina Faso's economic growth. Cotton is indeed, the second export product of Burkina Faso and we expect that cotton price shocks will have more effect than oil price shocks. Bellow, we have successively estimated our VAR model and thereafter, we carry out the Granger causality test, the impulse responses functions and variance decomposition.

4.5.1 VAR Model Estimation

We estimate an unrestricted VAR for our model 2. After the VAR estimation, we do many different test such us significance tests, Wald test, normality test and autocorrelation test. Firstly, normality test and autocorrelation show us that our two VAR models do not suffer from nonnormality and autocorrelation problems. Secondly, we carry out Wald test on cotton price for GDP equation. The results of this test show that we cannot reject the null hypothesis for the linear specification but we reject for nonlinear specification. In other words, the cotton price coefficients are jointly equal zero in the linear specification but jointly different from zero in the nonlinear model. In Tables 7 and 8 are presented the results of the two VAR estimation. Individual coefficients significance tests have shown that in the linear model only the second lag of cotton price is significantly different from zero at 5% significance level in the linear model. Unlikely in the nonlinear model, the first three lags of price increase and the third and fourth lag of price decrease are all significant at 5% of significance level. This means that the effects of cotton price shocks on Burkina Faso's GDP varies according to the type of specification. Below, we complete this analysis by doing the Granger causality test.

Table 7. VAR Estimation Output for Linear Specification of Cotton Price

VARIABLES	(1) log_gdp	(2) inflation	(3) log_final_cons	(4) trade_deficit	(5) var_pcotton
L.log_gdp	0.436*	13.935	0.768*	-2.587e+09	-0.514
	[0.181]	[102.999]	[0.299]	[1.591e+09]	[1.481]
L2.log_gdp	0.355*	-178.475+	-0.021	-2.640e+09+	0.365
	[0.173]	[98.204]	[0.285]	[1.517e+09]	[1.412]
L3.log_gdp	0.386*	227.047*	-0.410	4.650e+09**	0.473
	[0.190]	[107.803]	[0.313]	[1.665e+09]	[1.550]
L.inflation	0.000	-0.028	-0.000	4314779.918*	0.001

	[0.000]	[0.128]	[0.000]	[1980430.366]	[0.002]
L2. inflation	0.000	0.362**	0.001**	-5916649.156**	-0.001
	[0.000]	[0.122]	[0.000]	[1883748.613]	[0.002]
L3. inflation	0.000+	0.081	0.000	-82,006.518	-0.001
	[0.000]	[0.128]	[0.000]	[1979110.309]	[0.002]
L.log_final_cons	0.194	-50.540	0.339	3.538e+09**	0.151
	[0.127]	[72.283]	[0.210]	[1.116e+09]	[1.039]
L2.log_final_cons	-0.259*	176.539*	0.182	-2.833e+09**	-0.728
	[0.123]	[70.094]	[0.204]	[1.083e+09]	[1.008]
L3.log_final_cons	-0.076	-210.396**	0.110	-3.921e+07	0.216
	[0.119]	[67.578]	[0.196]	[1.044e+09]	[0.972]
L.trade_deficit	0.000*	-0.000+	-0.000	1.582**	0.000
	[0.000]	[0.000]	[0.000]	[0.124]	[0.000]
L2. trade_deficit	-0.000	0.000**	0.000	-1.237**	-0.000
	[0.000]	[0.000]	[0.000]	[0.182]	[0.000]
L3. trade_deficit	0.000	-0.000*	0.000	0.679**	0.000
	[0.000]	[0.000]	[0.000]	[0.152]	[0.000]
L.var_pcotton	0.018	12.770	0.016	59383105.690	-0.335*
	[0.020]	[11.094]	[0.032]	[1.714e+08]	[0.160]
L2.var_pcotton	**0.047***	-0.458	0.076*	-4.607e+08**	-0.465**
	[0.020]	[11.484]	[0.033]	[1.774e+08]	[0.165]
L3.var_pcotton	0.038+	-28.675*	-0.015	2.425e+08	0.071
	[0.020]	[11.609]	[0.034]	[1.793e+08]	[0.167]
Constant	-0.314	209.516	0.317	-7.770e+08	0.348
	[0.237]	[134.471]	[0.391]	[2.077e+09]	[1.933]
Observations	48	48	48	48	48
Standard errors in brackets					

** p<0.01, * p<0.05, + p<0.1.

Table 8. VAR Estimation Output for Nonlinear Specification of Cotton Price

VARIABLES	(1) log_gdp	(2) inflation	(3) log_final_cons	(4) trade_deficit	(5) pcotton_increase	(6) pcotton_decrease
L.log_gdp	0.143	34.298	0.255	-7.029e+08	-0.869	-0.688
	[0.203]	[124.528]	[0.337]	[1.878e+09]	[1.346]	[0.867]
L2.log_gdp	0.321+	-269.343*	0.013	-1.835e+09	0.592	-0.011

	[0.171]	[105.210]	[0.285]	[1.587e+09]	[1.137]	[0.733]
L3.log_gdp	0.289	279.411*	-0.700*	6.300e+09**	0.071	-0.007
	[0.183]	[112.068]	[0.304]	[1.690e+09]	[1.211]	[0.780]
L4.log_gdp	0.420+	28.108	0.825*	-3.898e+09+	0.525	0.700
	[0.245]	[150.580]	[0.408]	[2.271e+09]	[1.628]	[1.048]
L.inflation	-0.000	-0.011	-0.001	6619059.874**	0.000	0.002+
	[0.000]	[0.147]	[0.000]	[2213991.519]	[0.002]	[0.001]
L2. inflation	0.001*	0.330*	0.002**	-9857319.163**	0.000	0.002
	[0.000]	[0.142]	[0.000]	[2148248.149]	[0.002]	[0.001]
L3. inflation	0.001*	0.046	0.001	-1122420.955	-0.001	-0.002+
	[0.000]	[0.154]	[0.000]	[2320743.269]	[0.002]	[0.001]
L4. inflation	0.000*	-0.053	0.000	1190913.432	-0.002	-0.003**
	[0.000]	[0.133]	[0.000]	[2003199.063]	[0.001]	[0.001]
L.log_final_cons	0.174	-40.063	0.400+	3.092e+09*	0.444	-0.070
	[0.139]	[85.526]	[0.232]	[1.290e+09]	[0.924]	[0.595]
L2.log_final_cons	-0.074	196.218*	0.407+	-4.348e+09**	-0.525	1.250*
	[0.135]	[83.054]	[0.225]	[1.253e+09]	[0.898]	[0.578]
L3.log_final_cons	-0.000	-194.711*	0.211	-7.322e+08	-0.474	-1.290*
	[0.136]	[83.599]	[0.227]	[1.261e+09]	[0.904]	[0.582]
L4.log_final_cons	-0.187	-61.613	-0.395+	1.814e+09	0.163	0.185
	[0.125]	[76.564]	[0.208]	[1.155e+09]	[0.828]	[0.533]
L.trade_deficit	0.000	-0.000	-0.000*	1.682**	0.000	-0.000*
	[0.000]	[0.000]	[0.000]	[0.148]	[0.000]	[0.000]
L2.trade_deficit	0.000	0.000+	0.000+	-1.467**	-0.000	0.000*
	[0.000]	[0.000]	[0.000]	[0.256]	[0.000]	[0.000]
L3.trade_deficit	-0.000	-0.000	-0.000	0.715**	0.000	-0.000*
	[0.000]	[0.000]	[0.000]	[0.266]	[0.000]	[0.000]
L4.trade_deficit	0.000+	-0.000	0.000	-0.073	-0.000	0.000**
	[0.000]	[0.000]	[0.000]	[0.180]	[0.000]	[0.000]
L.pcotton_increase	**0.065***	7.362	0.129**	-3.813e+08	-0.409*	-0.071
	[0.027]	[16.463]	[0.045]	[2.483e+08]	[0.178]	[0.115]
L2.pcotton_increase	**0.109****	14.700	0.090+	-8.215e+08**	-0.282	-0.445**
	[0.032]	[19.522]	[0.053]	[2.944e+08]	[0.211]	[0.136]
L3.pcotton_increase	**0.065***	-29.552	0.006	-1.410e+08	-0.212	-0.279*

	[0.031]	[18.713]	[0.051]	[2.822e+08]	[0.202]	[0.130]
L4.pcotton_increase	-0.021	2.808	-0.004	2.589e+08	-0.106	0.151
	[0.022]	[13.645]	[0.037]	[2.058e+08]	[0.147]	[0.095]
L.pcotton_decrease	-0.066+	24.349	-0.150**	5.385e+08+	-0.941**	-0.285+
	[0.034]	[20.961]	[0.057]	[3.161e+08]	[0.227]	[0.146]
L2.pcotton_decrease	0.066	-13.184	0.208**	-5.593e+08	-0.658*	0.069
	[0.042]	[26.052]	[0.071]	[3.929e+08]	[0.282]	[0.181]
L3.pcotton_decrease	**0.135****	15.129	0.055	-1.153e+08	-0.105	-0.292
	[0.046]	[28.438]	[0.077]	[4.289e+08]	[0.307]	[0.198]
L4.pcotton_decrease	**0.171****	-11.416	0.060	-8.429e+08	-0.145	-0.547*
	[0.060]	[36.940]	[0.100]	[5.571e+08]	[0.399]	[0.257]
Constant	-0.763**	265.184+	-0.120	2.876e+09	0.743	-0.655
	[0.260]	[159.724]	[0.433]	[2.409e+09]	[1.726]	[1.112]
Observations	47	47	47	47	47	47
Standard errors in brackets						

** p<0.01, * p<0.05, + p<0.1.

4.5.2 Granger Causality Test

The results of Granger causality test are presenting in Tables 7 and 8 respectively for linear and nonlinear model. In the two specifications, we test for if a given cotton price Granger causes the remaining variables in the system. The results of this test show that cotton price Granger causes inflation a trade deficit in the linear specification. On other hands, in the nonlinear specification, cotton price Granger cause GDP (price increase and decrease) and final consumption (price decrease). Those results have confirmed the importance role of cotton in Burkina Faso's economic growth.

Table 9. Granger Causality Test in Linear Model

Equation	Excluded	chi2	df	Prob > chi2
log_gdp	inflation	7.3184	3	0.062
log_gdp	log_final_cons	6.8715	3	0.076
log_gdp	trade_deficit			.
log_gdp	var_pcotton	6.7872	3	0.079
log_gdp	ALL	27.256	9	0.001
inflation	log_gdp	7.038	3	0.071
inflation	log_final_cons	12.475	3	0.006
inflation	trade_deficit	7.5984	3	0.055

inflation	var_pcotton	10.536	3	0.015
inflation	ALL	28.087	9	0.005
log_final_cons	log_gdp	12.718	3	0.005
log_final_cons	inflation	11.191	3	0.011
log_final_cons	trade_deficit	.	3	.
log_final_cons	var_pcotton	6.6834	3	0.083
log_final_cons	ALL	32.036	9	0
trade_deficit	log_gdp	10.396	3	0.015
trade_deficit	inflation	14.377	3	0.002
trade_deficit	log_final_cons	11.618	3	0.009
trade_deficit	var_pcotton	12.535	3	0.006
trade_deficit	ALL	37.522	9	0.000

Table 10. Granger Causality Test in Nonlinear Model

Equation	Excluded	chi2	df	Prob > chi2
log_gdp	inflation	21.062	4	0
log_gdp	log_final_cons	3.5895	4	0.464
log_gdp	trade_deficit	0	4	.
log_gdp	pcotton_increase	14.767	4	0.005
log_gdp	pcotton_decrease	20.785	4	0
log_gdp	ALL	49.553	16	0
inflation	log_gdp	12.278	4	0.015
inflation	log_final_cons	10.821	4	0.029
inflation	trade_deficit	6.2266	4	0.183
inflation	pcotton_increase	4.9242	4	0.295
inflation	pcotton_decrease	2.4902	4	0.646
inflation	ALL	41.258	20	0.003
log_final_cons	log_gdp	16.548	4	0.002
log_final_cons	inflation	25.852	4	0
log_final_cons	trade_deficit	.	0	.
log_final_cons	pcotton_increase	9.2105	4	0.056
log_final_cons	pcotton_decrease	14.764	4	0.005
log_final_cons	ALL	60.074	16	0
trade_deficit	log_gdp	15.063	4	0.005
trade_deficit	inflation	26.149	4	0
trade_deficit	log_final_cons	17.307	4	0.002

trade_deficit	pcotton_increase	9.1208	4	0.058
trade_deficit	pcotton_decrease	7.597	4	0.108
trade_deficit	ALL	54.776	20	0

4.5.3 Impulse Responses Functions

In this subsection, we examine the impulses responses function of our variables to linear and nonlinear cotton price shocks. The Figures 6-8 represent the responses of the variables to cotton price shocks. In Figure 6 we can see the or thogonalized responses and cumulative responses of macroeconomic variables to on standard innovation of cotton price for the linear specification of cotton price shocks. The responses of log GDP to cotton price shocks is negative through the ten years and indicate a negative effect of cotton shocks on economic growth in this specification. For other variables, a cotton price shocks results to cumulative positive responses in this linear specification.

The nonlinear cotton price shocks are presented in Figures 7 and 8. Figure 7 presents the response of economic variables to cotton price increase. In this case, log GDP responds negatively to cotton price increase for the first two years and after the second years those negative responses last and become positive for about six years. Then we can see that log GDP responses in this specification are different from those found with the linear specification. For the other variables cotton price increase results to positive responses for final consumption and negative responses for trade deficit. The inflation responses are very ins Table through the years and go from positive to negative response through the ten years.

Figure 8 presents the responses of variables to cotton price decrease. In this Figure, we can see that log GDP's responses are from the responses found with cotton price increase. In this case, a cotton price increase results to positive and negative responses of GDP with a dominance of positive response in the ten years. On other hands, a cotton price decrease results to negative response of inflation and final consumption. For trade deficit, a cotton price decrease results to positive and responses which alternate through the years.

In sum, economic variables respond differently for cotton price increase and cotton price decrease. That is very logic result because as cotton export country, a cotton price increase is perceived like an income increase for the country and cotton price decrease as income shift.

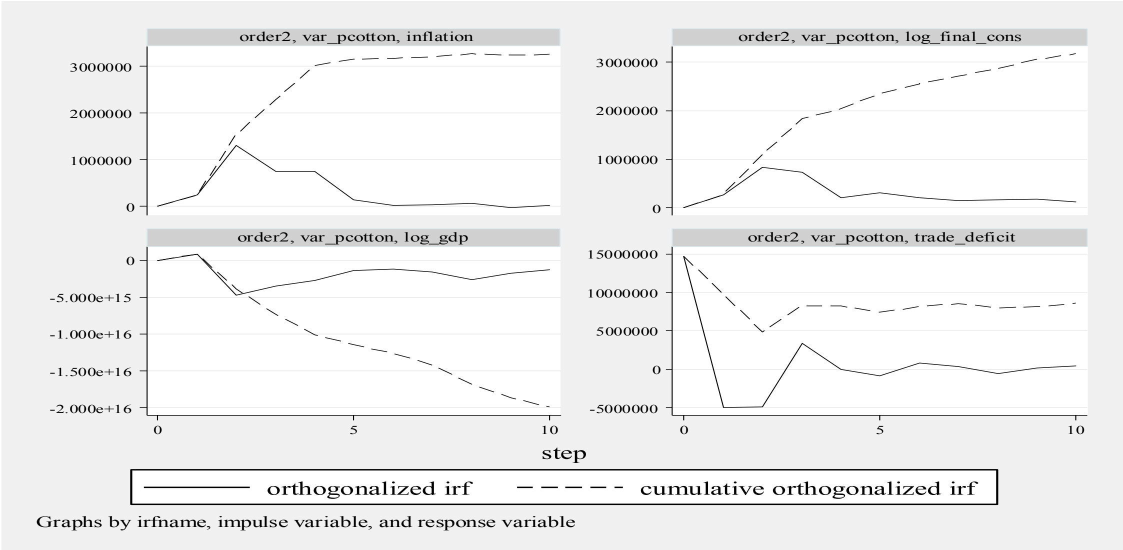

Figure 6. Impulse Response Function of Shocks to Linear Measure of Cotton Price

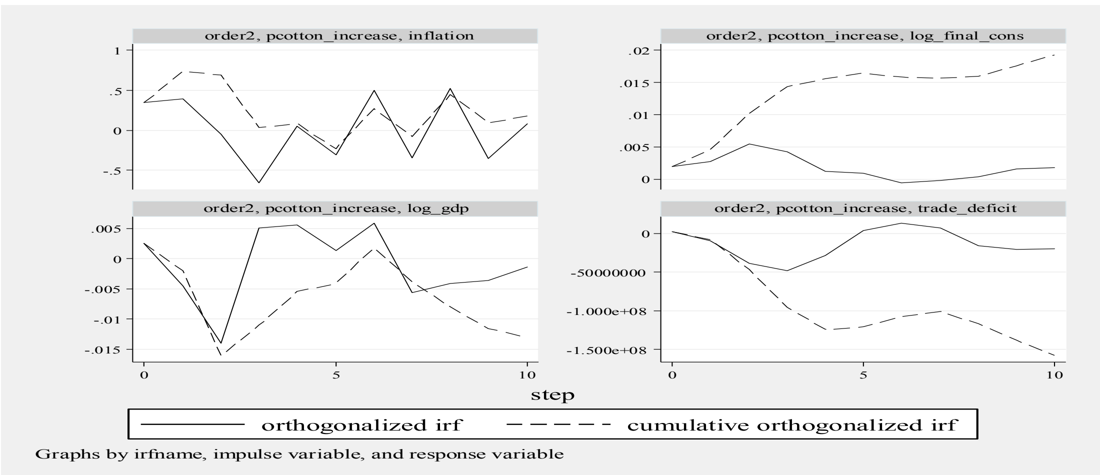

Figure 7. Impulse Response Function of Shocks to Nonlinear Measure of Cotton Price (Increase)

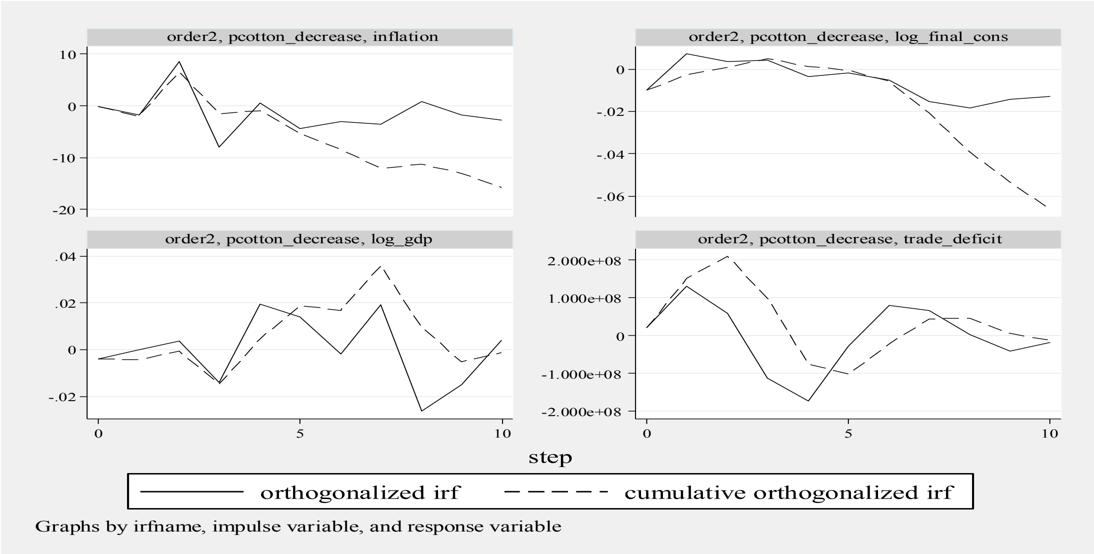

Figure 8. Impulse Response Function of Shocks to Nonlinear Measure of Cotton Price (Decrease)

4.5.4 Variance Decomposition

To complete our analysis, we do below the variance decomposition for our variables. We focus on the contribution of cotton price to the explanation of the other variables innovations. The Table 11 present the variance decomposition for variables in the linear specification model. The results presented in this Table show that for log GDP, at the first year, cotton price contribute to explanate its shocks for 5.84%. That contribution is increasing for the first year reach the maximum at the fifth year with 12.6%. That contribution is moderate and confirm the results of the Granger causality test which found that cotton price only Granger causes GDP at 10% of significance level. For the other variables in the linear specification, at first year cotton price has the highest contribution for final consumption (17%) and lowest contribution is to inflation shocks (1%). In long run say fifth year, the highest contribution of cotton price to economic variables innovation is realized for the log real GDP and the lowest contribution to trade deficit.

Table 12 presents the variance decomposition for economics variables for the nonlinear specification of cotton price. In this Table, we can see that the effect of price shocks on log real GDP is higher than the effect found in the linear specification. Indeed, at the first year, the cotton price decrease contributes for 26.5% to real GDP innovation and cotton price increase contributes for 9.91% to real GDP innovation. We note the cotton price increase reach a high contribution at the fourth year with 41% of contribution. In the all ten years, cotton price increase has seen on average to have higher contribution to real GDP shock than cotton price decrease. For other macroeconomic variables, as with the linear model specification, at first year we found that cotton price has highest contribution to final consumption and lowest contribution to inflation. In addition, we note that cotton price decrease contribution is ranked from 0.16% to 55.5% to economic variables shocks explanation and cotton price increase contribution is ranked from 0.5% to 41% over the years.

In sum those results confirm the Granger causality test results and the impulses response finding that the effect of cotton price shocks on economic variables are more visible with the nonlinear model which distinguish between positive and negative price shocks.

5. Conclusion

In this study, we have analyzed the effect of export and import inputs' price shocks on Burkina Faso economic growth using an unrestrictive VAR model. The main particularity of this study is that, it analyzes the effect of import input (oil) price shocks and the effect of export input (cotton) price shocks on net importer country economy. The real GDP has been used as economic growth indicator, and cotton price and oil price are the input price considered in this study. Empirical results have shown that, oil price shocks do not influence economic growth in Burkina Faso. Indeed, the Granger causality test on the linear and nonlinear models have shown that oil price shocks only Granger causes inflation in the linear oil price shocks specification. On other hands the results of the study show that cotton price shocks have a big effect on economic growth in Burkina Faso. In the linear cotton price shocks model, cotton price shocks Granger cause inflation and trade deficit. In the nonlinear model, cotton price increase and cotton price decrease both Granger cause the real GDP. In addition, cotton price decrease Granger causes final consumption in Burkina Faso. Those findings are logics, because cotton is the second export product of Burkina Faso and produced by most of population. The orthogonalize impulse response function and the variance decomposition have confirmed the Granger causality test results. This study shows that the effect of input price shocks depends of the importance of those product on the country economy.

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Appendix 1

Variance Decomposition of LOG_GDP for Nonlinear Model

Variance Decomposition of LOG_GDP:

Period	S.E.	LOG_GDP	POIL_DECREASE	POIL_INCREASE	LOG_FINAL_CONS	INFLATION	TRADE_DEFICIT
1	0.013204	89.14635	10.38703	0.466621	0.000000	0.000000	0.000000
2	0.015147	85.77896	8.878892	3.016158	1.156992	1.168681	0.000317
3	0.016533	76.93383	7.466194	5.522183	1.352132	3.443269	5.282388
4	0.017700	69.79501	6.653338	4.821824	1.325587	8.452586	8.951658
5	0.018784	62.45360	6.739374	5.442140	2.589881	10.56419	12.21081
6	0.020901	50.61429	5.799782	4.657505	2.826039	11.98243	24.11996
7	0.022807	42.81656	5.264281	4.012603	2.684483	11.89116	33.33092
8	0.024853	36.06180	4.758235	3.501496	3.301795	11.38938	40.98728
9	0.026917	30.74553	4.114299	3.168525	3.935426	10.27985	47.75637
10	0.029368	25.82903	3.905198	2.920073	4.275158	8.977900	54.09265

Variance Decomposition of LOG_FINAL_CONS:

Period	S.E.	LOG_GDP	POIL_DECREASE	POIL_INCREASE	LOG_FINAL_CONS	INFLATION	TRADE_DEFICIT
1	0.067439	42.87648	16.03438	0.671637	32.89315	0.529736	6.994617

2	0.072125	54.24797	10.72762	2.119214	25.18179	0.347899	7.375505
3	0.075480	51.84279	9.821633	3.681572	21.90841	6.387409	6.358179
4	0.078710	49.25498	9.225636	3.459228	22.27096	9.693376	6.095822
5	0.083367	44.75082	8.434625	3.164646	20.28846	15.32371	8.037732
6	0.085590	42.20655	8.011888	3.071513	19.26358	17.82477	9.621701
7	0.087188	39.27753	8.173090	3.373107	17.78772	19.01784	12.37071
8	0.091829	36.53603	7.646734	3.639144	17.34816	18.92435	15.90559
9	0.094786	33.56532	7.507546	3.500299	15.99357	18.62427	20.80899
10	0.095693	30.28420	6.921550	3.268288	14.88390	16.93530	27.70676

Variance Decomposition of INFLATION:

Period	S.E.	LOG_GDP	POIL_DECREASE	POIL_INCREASE	LOG_FINAL_CONS	INFLATION	TRADE_DEFICIT
1	0.188153	7.737586	9.562629	10.79124	0.000000	70.92864	0.979909
2	0.208581	10.66362	8.914642	9.496573	4.414163	65.60732	0.903688
3	0.211926	10.42368	8.343028	8.059172	11.88357	59.44247	1.848077
4	0.223386	15.50463	7.545712	9.767300	12.25924	53.11679	1.806314
5	0.225362	18.19140	6.512116	15.22392	10.63210	46.14504	3.295420
6	0.228635	19.40634	6.386213	15.11936	11.66218	43.93938	3.486531
7	0.230008	18.15614	6.929207	19.48365	10.95478	41.15224	3.323981
8	0.234605	17.56846	6.674247	18.77681	11.38739	40.75791	4.835181
9	0.236159	17.49214	6.765921	18.84261	11.33855	40.65514	4.905643
10	0.237016	17.60030	6.827098	19.50271	11.38837	39.85501	4.826507

Variance Decomposition of TRADE_DEFICIT:

Period	S.E.	LOG_GDP	POIL_DECREASE	POIL_INCREASE	LOG_FINAL_CONS	INFLATION	TRADE_DEFICIT
1	0.021094	11.25757	0.876499	0.633908	0.000000	0.000000	87.23202
2	0.026073	7.432936	0.627818	0.739251	5.944383	0.323794	84.93182
3	0.028655	9.593082	1.677853	2.323145	8.375602	1.313046	76.71727
4	0.029572	11.01811	1.864822	3.913083	7.650347	3.055013	72.49862
5	0.031025	10.54020	1.969274	5.413509	7.016347	3.621671	71.43900
6	0.031955	9.289108	2.965948	6.266021	6.258439	3.001813	72.21867
7	0.033255	8.242818	2.428817	8.306042	6.880319	2.452131	71.68987
8	0.034574	7.827053	2.444172	10.41849	7.683495	2.267524	69.35927
9	0.036340	7.795134	2.503320	11.88453	7.581881	2.586338	67.64879
10	0.038537	7.741339	2.440435	12.76985	7.428518	2.661356	66.95850

Cholesky Ordering: POIL_INCREASE POIL_DECREASE LOG_GDP TRADE_DEFICIT

INFLATION LOG_FINAL_CONS.

Appendix 2

Variance Decomposition of LOG_GDP for Linear Model of Cotton Price

Variance Decomposition of LOG_GDP:

Period	S.E. PCOTTON_VARI	LOG_GDP	LOG_FINAL_CONS	INFLATION	TRADE_DEFICIT
1	0.0931525.847090	94.15291	0.000000	0.000000	0.000000
2	0.0991754.300601	90.47260	0.842763	0.211871	4.172162
3	0.10361610.23357	80.50475	1.054136	2.721948	5.485594
4	0.10700112.59815	67.58939	1.771400	10.26846	7.772603
5	0.10731311.26854	60.53177	2.847400	12.26649	13.08580
6	0.10769210.50101	52.81317	3.893837	13.49741	19.29457
7	0.1080049.715667	46.74526	5.692149	13.48982	24.35711
8	0.1081649.141108	41.61094	7.101793	12.98138	29.16477
9	0.1084618.836837	36.96147	8.959096	11.89273	33.34987
10	0.1084848.539238	32.50774	10.28626	10.60441	38.06236

Variance Decomposition of LOG_FINAL_CONS:

Period	S.E. PCOTTON_VARI	LOG_GDP	LOG_FINAL_CONS	INFLATION	TRADE_DEFICIT
1	0.01141017.27342	48.33593	34.39066	0.000000	0.000000
2	0.01346913.02578	61.81509	24.61488	0.009503	0.534748
3	0.01557411.42931	61.15252	20.02547	6.994780	0.397917
4	0.01787410.65172	57.43876	17.61450	13.15413	1.140881
5	0.0192809.949204	51.28210	15.11215	20.01125	3.645293
6	0.0210158.989548	47.30609	13.81447	23.76722	6.122670
7	0.0226618.378409	44.37717	13.16431	26.23817	7.841946
8	0.0241488.015936	42.19837	13.46749	27.19543	9.122773
9	0.0257487.771329	39.87507	13.98354	27.07480	11.29526
10	0.0275607.481009	37.55855	14.63747	25.99544	14.32753

Variance Decomposition of INFLATION:

Period	S.E. PCOTTON_VARI	LOG_GDP	LOG_FINAL_CONS	INFLATION	TRADE_DEFICIT
1	0.0188170.010482	1.907506	0.622252	97.45976	0.000000
2	0.0238453.525972	1.778843	0.611008	89.83929	4.244886
3	0.0276544.162150	3.854172	1.599524	84.56955	5.814599
4	0.0295689.201106	4.362691	6.830919	74.42951	5.175772
5	0.0319309.405360	6.047806	7.773762	71.43928	5.333794
6	0.0335938.954837	6.130886	9.030249	68.18713	7.696895

7	0.0347968.921642	6.035281	9.268126	67.87212	7.902833
8	0.0357509.040100	6.370481	9.242081	67.52114	7.826196
9	0.0367959.292606	6.413557	9.172987	67.01800	8.102846
10	0.0379139.102192	6.294991	9.223023	65.72419	9.655604

Variance Decomposition of TRADE_DEFICIT:

PeriodS.E.	PCOTTON_VARI	LOG_GDP	LOG_FINAL_CONS	INFLATION	TRADE_DEFICIT
1	6.4789293.240600	6.156173	7.089208	3.000969	80.51305
2	6.7487821.656574	4.077326	2.377139	0.967966	90.92099
3	7.2323852.355391	6.873102	1.861809	1.320773	87.58892
4	7.7530422.783337	8.500744	1.826789	1.840651	85.04848
5	7.9616022.827065	8.477165	1.969549	2.754104	83.97212
6	8.1594652.421583	7.670956	1.698968	3.359031	84.84946
7	8.2323822.011883	7.068642	1.433870	3.552545	85.93306
8	8.3049941.912053	7.232629	1.453395	3.615011	85.78691
9	8.3366802.074670	7.491607	1.458244	3.911255	85.06422
10	8.4265052.067847	7.410696	1.407718	4.157366	84.95637

Cholesky Ordering: PCOTTON_VARI LOG_GDP LOG_FINAL_CONS INFLATION TRADE_DEFICIT.

Appendix 2

Variance Decomposition of LOG_GDP for Linear Model of Cotton Price

Variance Decomposition of LOG_GDP:

Period	S.E.	LOG_GDP	PCOTTON_DECREASE	PCOTTON_INCREASE	TRADE_DEFICIT	LOG_FINAL_CONS	INFLATION
1	0.011618	63.57211	26.51055	9.917334	0.000000	0.000000	0.000000
2	0.013378	52.53037	25.50172	20.18444	0.110660	1.477394	0.195407
3	0.016840	36.92362	19.03510	38.50427	2.231098	1.107996	2.197914
4	0.019386	29.84775	14.95754	41.40049	2.275780	1.234940	10.28351
5	0.021277	25.43830	13.70932	35.10301	6.826321	1.026999	17.89605
6	0.023984	20.48246	12.07246	27.99580	11.90968	0.844745	26.69485
7	0.025356	18.68211	11.34477	25.20099	14.67552	0.759787	29.33682
8	0.026446	18.23056	11.67367	23.25409	15.28220	1.304587	30.25489
9	0.027545	17.69729	12.35985	21.43913	16.27775	2.366009	29.85997
10	0.029351	16.32167	12.67296	19.33614	21.13134	2.872857	27.66504

Variance Decomposition of TRADE_DEFICIT:

Period	S.E.	LOG_GDP	PCOTTON_D	PCOTTON_I	TRADE_DEF	LOG_FINAL_	INFLATION

			ECREASE	NCREASE	ICIT	CONS	
1	0.049626	0.077735	8.196817	0.059595	91.66585	0.000000	0.000000
2	0.057630	0.032025	3.177272	0.189701	89.71849	2.157082	4.725433
3	0.063884	0.286542	2.632220	6.056644	85.47782	1.990239	3.556536
4	0.067535	0.247992	2.510550	15.35669	75.74984	2.152658	3.982269
5	0.070431	0.271403	2.463993	18.43552	70.93266	3.494804	4.401619
6	0.072815	0.264691	2.383321	17.83954	71.33462	3.513098	4.664728
7	0.074401	0.289974	2.249617	16.70939	73.08337	3.286165	4.381480
8	0.076245	0.328049	2.050117	15.11288	74.68241	3.017130	4.809415
9	0.076895	0.312486	1.932165	14.32396	75.60886	2.738384	5.084149
10	0.077430	0.297536	2.045441	14.80028	75.28218	2.653837	4.920723

Variance Decomposition of LOG_FINAL_CONS:

			PCOTTON_D	PCOTTON_I	TRADE_DEF	LOG_FINAL_	
Period	S.E.	LOG_GDP	ECREASE	NCREASE	ICIT	CONS	INFLATION
1	0.077046	17.78547	55.60048	2.171849	0.906441	23.49756	0.038192
2	0.104745	17.01927	46.26879	14.19021	4.992104	15.58702	1.942618
3	0.106632	15.63771	36.44423	23.79175	4.236809	15.18575	4.703744
4	0.114962	12.28811	29.35613	29.82442	3.845517	14.18459	10.50122
5	0.115785	10.00771	23.64094	28.36059	5.430256	12.81664	19.74387
6	0.117093	8.604632	20.22746	24.26908	6.609577	11.43079	28.85847
7	0.119692	8.118543	18.90422	22.66103	6.929140	10.66176	32.72531
8	0.120728	7.682391	18.05592	22.38900	6.700361	10.15089	35.02143
9	0.121767	7.433721	17.88077	21.52193	6.633107	10.77308	35.75739
10	0.122187	7.201679	18.38228	20.81207	7.165940	11.22722	35.21081

Variance Decomposition of INFLATION:

			PCOTTON_D	PCOTTON_I	TRADE_DEF	LOG_FINAL_	
Period	S.E.	LOG_GDP	ECREASE	NCREASE	ICIT	CONS	INFLATION
1	1.08E+08	6.234723	0.161579	0.502707	6.024107	0.000000	87.07688
2	1.97E+08	5.756213	4.550964	0.753722	8.347907	0.255415	80.33578
3	2.28E+08	11.03669	5.746338	0.704775	6.929430	3.108002	72.47476
4	2.46E+08	15.36716	7.206504	2.119555	6.275363	3.983098	65.04832
5	2.54E+08	17.43201	9.041186	1.937681	9.195614	3.675024	58.71848
6	2.59E+08	16.90336	9.479138	2.507823	9.004790	4.785325	57.31956
7	2.74E+08	16.67556	9.130423	2.940726	10.08382	4.850221	56.31925
8	2.91E+08	16.32502	9.738678	3.492482	9.850123	5.559538	55.03416
9	3.05E+08	16.18185	9.867060	4.094599	9.794955	5.504141	54.55739

10	3.13E+08	16.10464	9.804357	4.386938	9.789923	5.501165	54.41297

Cholesky Ordering: PCOTTON_DECREASE PCOTTON_INCREASE LOG_GDP TRADE_DEFICIT INFLATION LOG_FINAL_CONS.