

Partners' Diversification and Exposure of African Countries to International Crises: The Case of Kenya

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Abstract

The objective of this paper is to characterize the exposure of Kenyan's income to international income, monetary and price shocks. The results suggest that the partners' diversification permits them to resist to international shocks. In fact, Chinese conjuncture tends to be less exposed to OECD countries' income and inflation shocks. Also, income in this country more depends on domestic investment and household consumption, in comparison to the exposure to OECD country shocks. In this context, we observe that the exposure of Kenyan income to OECD shocks regresses when the dependence to Chinese conjuncture progresses.

Key Words: international crises, coupling and decoupling, economic conjuncture, African, developed and Chinese economies, SVAR

African countries essentially produce and export the raw materials toward advanced economies (Madeley, 2003) and import the finished goods for the household consumption. In these conditions, they are exposed to economic fluctuations of the trade partners and world prices of raw materials. For instance, Berman and Martin (2012) study the exposure of external trade of Sub-Saharan African countries to international financial crises and document that an industrial international crisis would have a big impact on their economies because they export the raw materials. However, they analyze the impacts of the international price fluctuations and the world demand on exports and imports of African countries. They conclude at the exposure, without measuring the effect on domestic income. In a first step, Assoumou Ella and Bastidon Gilles (2015) develop a model for measuring the fluctuations of domestic income in African countries caused by the impacts of the international shocks on their external trade. In the second step, Assoumou Ella (2014) extends this model with the inclusion of the external real and financial exchanges. However, the two analyses consider a world composed from two countries, while in the recent years the increase of Chinese investments in Africa and the development of the trade exchanges between African countries and China are observed (Hugon, 2012).

Also in many recent studies, it is argued that economic cycles of Asian emerging countries are not synchronized with the cycles in developed economies. Using a GVAR model, Déés and Vansteenkiste (2007) argue that the Chinese growth is relatively immune to world economic shocks. Lambert and Chavy-Martin (2008) confirm this result. In fact, using a correlation matrix of the economic growths and a FSVAR model inspired to Stock and Watson (2005), they document that the Chinese growth depends on domestic household consumption, investment and regional integration.

In this context, the exchanges of African countries with China can lead them to be less exposed to shocks of the developed countries. However, there is no consensus about the decoupling assumption in the literature. Kim et al. (2009), for example, argue that economic interdependencies are still strong between emerging Asian economies and developed countries, despite the increase of the Asian regional trade.

Taking into account the above, the objective of this paper is to develop a model of the exposure of an African country to shocks of a developed country, according the cases of coupling or decoupling economic conjunctures of developed and emerging countries. In theoretical model, we aim to measure the level of the exposure of an African country's income and real exchange rate to income, prices and monetary shocks in the developed country, and the index of the world prices of raw materials exported by the African country. However, for the data availability, we limit empirical model on the verification of the coupling-decoupling assumption and the exposure of developing country's income to international income and inflation shocks taking into account Chinese conjuncture. The ultimate objective is to verify whether the dependence of a developing country towards Chinese economy increases in the recent years and whether the exposure to international shocks decreases. Thereby, are the intensification of exchanges between Africa and China a solution for African countries to resist to shocks of the developed economies?

The paper is organized as following: the formalization of the theoretical model is subject of Section 2. In the Section 3, we proceed at the empirical verification using Kenyan economy.

Theoretical Model

We formalize the exposure of an African country's income to international shocks basing our analysis on the "locomotive" theory that argues that the fluctuations observed in economy impact the other economies through external trade (Frankel and Rose, 1998; Baxter and Kouparitsas, 2004) and financial liquidity flows (Kose et al. 2003; Imbs, 2004). The standard approach generally inspired by classical and neoclassical models use the production functions in order to study the determinants of output. Based on factors of production (capital, labor, technology ...), they describe a world composed of firms with idealist assumptions like "pure and perfect competition", while they are not always the case in real economy. Also, the output in African countries is essentially the fact of staffing raw material (Madeley, 2003), and not factors of production. In this context, we do not analyze the determinants of output in terms of factors of production, but the fluctuations of the value of this output according to the variations of international demand. Thereby, the analysis is based on the value (quantity*price) and the exchange flows. Inspired to Assoumou Ella (2014), the objective is to measure the fluctuations of income flows in African countries caused by the fluctuations of a developed country's income flows, the international prices and monetary shocks. This is analyzed taking into account the demand of goods and services and financial flows provided by China to see if the value of output flow in African countries is more (or less) exposed to the preceding international shocks, according to the increase of their dependence to Chinese economy. In this context, we retain the following assumptions:

H1: the world is composed of three countries: a developed country (A), a developing country (B) and an emerging country (C). Based on the “locomotive” theory, we can argue that the trade and the financial liquidity flows exist and they conduce to the interdependencies between these three countries. However, we limit our area on the study of the dependence of the developing country to shocks of the developed country, taking into account the presence (or not) of decoupling economic conjunctures of emerging and developed countries. (B) has the characteristics of the African economies. It exports the raw materials towards (A) and (C), and imports finished products from these two countries.

H2: the economy of (B) is composed of two sectors: one exposed to external exchanges and the other depending on the domestic variables (health, domestic investment, public expenditure...).

H3: GDP in (B) is significantly explained by external trade variables (Ayhan Kose & Riezman, 2001; Dutta & Ahmed, 2004; Thurlow, 2007; Mbabazi et al. 2008; Fernandez Puente et al. 2009), international tourism arrivals (Eugenio-Martin et al. 2004; Mitchell & Ashley, 2007; Fayissa et al. 2008; Olayinka Idowu, 2009), migrant transfers (Jongwanich, 2007; Ajayi et al. 2009; Garcia-Fuentes & Kenedy, 2009; Fayissa & Nsiah, 2010), external debt (Kwasi Fosou, 1996; Clements et al. 2003; Pattilo et al. 2011), foreign aid (Burnside & Dollar, 2000; Almeida & Fernandes, 2008; Schiff & Wang, 2008; Herzer & Morrissey, 2010), Foreign Direct Investment and other private financial flows (Carkovic & Levine, 2005; Ayanwale, 2007; Sukar et al. 2007; Magnus Frimpong & Fosu Oteng-Abayie, 2008; De Vita & Kyaw, 2009; Brambila-Macias et al. 2011).

H4: the income, price and monetary shocks of (A), the income shocks of (C) and the prices of the raw materials shocks impact the external variables of (B) enumerated in H3 (Thomas & Gosse, 2001; Naudé & Saayman, 2005; Adams & Richard, 2008; Aslan et al. 2009; Cali & Dell’Erba, 2009; Dabla-Norris et al. 2010; Jan Singh et al. 2011; Berman & Martin, 2012; Assoumou Ella & Bastidon Gilles, 2015).

H5: The trade exchanges are made in the currency of the developed country that is the international currency.

Using H2 and H3, we formalize the value of the income flow of (B) as following:

$$Y_t = X_t^{\alpha_0} \times Z_t^{\beta} \quad (1)$$

With $\alpha_0 \in]-\infty; +\infty[$ and $\beta \in]0; +\infty[$

Y represents the value of income flow, X the vector of the value of foreign variable flows enumerated in H3, Z the vector of the value of domestic variable flows enumerated in H2, α_0 the elasticity of Y with respect to X , β the elasticity of Y with respect to Z and t , the time. $\alpha_0 \in]-\infty; +\infty[$: in the empirical recent literature review concerning the effects of the variables included in the vector X on the domestic income in developing countries, it is demonstrated that the relationship can be positive or negative. In the case of the imports, for example, they have a

positive effect on the domestic income if they are the imports of capital goods for domestic investment (Ugur, 2008; Cetintas & Barisik, 2009), and the effect is negative concerning the imports of consumption goods (Fernandez Puente et al. 2009; Ullah et al. 2009). In the case of migrant transfers, the effect on the domestic income is ambiguous. There is a positive relationship between these two variables (Wooddruff & Zenteno, 2004; Yang, 2005; Rapoport & Docquier, 2005). The effect can be negative, taking into account the levels of education of the migrants (Stark & Levhari, 1982; Ahlburg, 1991; Chami et al. 2005; Amuedo-Dorantes & Pozo, 2004). $\beta \in]-\infty; +\infty[$ because education and health have a positive effect on income in African countries and the bad quality of the institutions and the public infrastructures negatively affect income.

Then, based on H1, H4 and H5, we formalize the dependence of the value of trade and financial variable flows of the vector X , to value of income flows, price and monetary variables of (A), controlled of the dependence to the value of income flow of (C):

$$X_t = e_{1t} \times e_{3t} \times \dot{Y}_{1t}^{\varphi_0} \times \dot{p}_t^{\rho_0} \times \dot{r}_t^{\tau_0} \times p_{pt}^{\sigma_0} \times \dot{Y}_{2t}^a \quad (2)$$

With $\varphi_0 \in]0; +\infty[$, $\rho_0 \in]-\infty; +\infty[$, $\tau_0 \in]-\infty; +\infty[$, $\sigma_0 \in]-\infty; +\infty[$ and $a \in]0; +\infty[$

\dot{Y}_1 represents the value of income flow of (A), \dot{p} the inflation in (A), \dot{r} the central bank's director interest rate in (A), p_p the index of the world prices of the raw materials exported by (B) whose the formalization takes into account the weight of each commodity exported in its economy, \dot{Y}_2 the value of income flow of (C), φ_0 the elasticity of X with respect to \dot{Y}_1 , ρ_0 the elasticity of X with respect to \dot{p} , τ_0 the elasticity of X with respect to \dot{r} , σ_0 the elasticity of X with respect to p_p and a the elasticity of X with respect to \dot{Y}_2 . We multiply X by e_1 and e_3 (the nominal exchange rate between (B) and (A), (B) and (C)) for the conversion in money of (B). $\varphi_0 \in]0; +\infty[$ and $a \in]0; +\infty[$: income flows of (A) and (C) have a positive effect on foreign variables of (B). $\rho_0 \in]-\infty; +\infty[$: the effect of inflation in (A) on some external variable flows of (B) can be positive or negative. In the case of the migrant transfers, for example, inflation in (A) decreases the purchasing power of the migrants, and therefore their transfers. $\tau_0 \in]-\infty; +\infty[$: the effect of monetary policy in (A) on the external variables of (B) can be positive or negative. An expansive monetary policy that increases income and the demand, for example, can decrease the exports of (A) towards (B). On the other hand, this monetary policy can increase the migrant transfers. $\sigma_0 \in]-\infty; +\infty[$: the effect of the prices of the raw materials on the external variable flows can be positive or negative. For instance, a decrease in this index can reduce the value of the exports of (B) and increase the level of the migrant transfers, for example.

In the assumption of coupling economic conjunctures of (A) and (C), we can write the value of income flow in (C) with the part exposed to the value of income flow, price and monetary shocks of (A) and the part depending on other variables (domestic household consumption, investment, regional trade...) as following:

$$\dot{Y}_{2t} = e_{2t} \times \dot{Y}_{1t}^b \times \dot{p}_t^c \times \dot{r}_t^d \times \dot{Z}_t^f \quad (3)$$

With: e_2 the nominal exchange rate between (C) and (A) for the conversion in the currency of (C), b the elasticity of \dot{Y}_2 with respect to \dot{Y}_1 , c the elasticity of \dot{Y}_2 with respect to \dot{p} and d the elasticity of \dot{Y}_2 with respect to \dot{r} , \dot{Z} the vector of the others determinants of income in (C) and f the elasticity of \dot{Y}_2 with respect to \dot{Z} .

In replacing (3) in (2), we have:

$$X_t = e_{1t} \times e_{2t}^a \times e_{3t} \times \dot{Y}_{1t}^{(\varphi_0+a \times b)} \times \dot{p}_t^{(\rho_0+a \times c)} \times \dot{r}_t^{(\tau_0+a \times d)} \times p_{pt}^{\sigma_0} \times \dot{Z}_t^{f \times a} \quad (4)$$

According to (4), in the situation of coupling economic conjunctures between (A) and (C), the external variables of (B) can be formalized taking into account their dependence on economic conjuncture of (A) measured by φ_0, ρ_0 and τ_0 , the vector \dot{Z} measured by $(f \times a)$, the dependence of \dot{Y}_2 to economic conjuncture of (A) measured by $a \times b, a \times c$ and $a \times d$, and also their dependence on index of the prices of the raw materials measured by σ_0 .

Using the equations (1) and (4), we can measure the level of the exposure of the value of income flow in (B) to shocks of (A) and the raw material prices index through exports, imports, international tourism, migrant transfers, Aid, external debt, FDI and other external private financial flows in the situation where the economic conjunctures of (A) and (C) are coupled.

$$Y_t = e_{1t}^{\alpha_0} \times e_{2t}^{a \times \alpha_0} \times e_{3t}^{\alpha_0} \times \dot{Y}_{1t}^{(\varphi_1+\varphi_2)} \times \dot{p}_t^{(\rho_1+\rho_2)} \times \dot{r}_t^{(\tau_1+\tau_2)} \times p_{pt}^{\sigma_1} \times \dot{Z}_t^{a_2} \times Z_t^\beta \quad (5)$$

With: $\varphi_1 = \varphi_0 \times \alpha_0$, $\rho_1 = \rho_0 \times \alpha_0$, $\tau_1 = \tau_0 \times \alpha_0$, $\sigma_1 = \sigma_0 \times \alpha_0$, $\varphi_2 = a \times b \times \alpha_0$, $\rho_2 = a \times c \times \alpha_0$, $\tau_2 = a \times d \times \alpha_0$, $a_2 = f \times a \times \alpha_0$

According to (5), if the economic conjunctures of (A) and (C) are coupled, the value of income flow of (B) is exposed to the value of income flow shocks of (A) by φ_1 directly and by φ_2 through the income flow of (C), inflation shocks by ρ_1 directly and by ρ_2 indirectly, monetary shocks by τ_0 directly and by τ_2 indirectly, the other determinants of the income flow in (C) by a_2 and the raw material shocks by σ_1 , through the external flows enumerated in X . In the case of the decoupling economic conjunctures of (A) and (C), we replace (2) in (1) and the equation (5) becomes:

$$Y_t = e_{1t}^{\alpha_0} \times e_{3t}^{\alpha_0} \times \dot{Y}_{1t}^{\varphi_1} \times \dot{p}_t^{\rho_1} \times \dot{r}_t^{\tau_1} \times p_{pt}^{\sigma_1} \times \dot{Y}_{2t}^{a_1} \times Z_t^\beta \quad (6)$$

With $a_1 = a \times \alpha_0$

In the period of the crisis in (A), the dependence of income flow in (B) to income flow of (C) and the vector Z permits the developing country to resist to the contagion of the crisis. This conclusion is in favor of the partners' diversification in Africa. Taking into account the fact that the Chinese economy tends to be decoupling with the developed economies because its growth depends on domestic household consumption, investment and regional integration (Déés and Vansteenkiste, 2007 and Lambert and Chavy-Martin, 2008), we recommend that African countries increase their exchanges with China. Thereby, they will be less exposed to international shocks.

Also we can use the equations (5) and (6) for measuring the imported inflation from (A) to (B). Knowing that $e_{r1t} = e_{1t} \times \left(\frac{\dot{p}_t}{p_t}\right)$, with e_{r1} and p , the real exchange rate and inflation in (B) ($e_{1t} = e_{r1t} \times \left(\frac{p_t}{\dot{p}_t}\right)$), we replace e_{r1t} with its value in (5) and (6) and we apply the logarithm:

$$\begin{aligned} \log(e_{r1t}) = & \frac{1}{\alpha_0} \log Y_t - \frac{\varphi_1 + \varphi_2}{\alpha_0} \log(\dot{Y}_{1t}) + \frac{\{\alpha_0 - (\rho_1 + \rho_2)\}}{\alpha_0} \log(\dot{p}_t) - \frac{(\tau_1 + \tau_2)}{\alpha_0} \log(\dot{r}_t) - \\ & \frac{\sigma_1}{\alpha_0} \log(p_{pt}) - \frac{\alpha_2}{\alpha_0} \dot{Z}_t - \frac{\beta}{\alpha_0} \log(Z_t) - \log(p_t) - a \log(e_{2t}) - \log(e_{3t}) \end{aligned} \quad (7)$$

In the case when the cycles of the economic conjunctures of (A) and (C) are synchronized, an increase in \dot{Y}_{1t} appreciates e_{r1t} by φ_1 directly, and through the dependence between the incomes of (A) and (C) by φ_2 indirectly (and conversely for a decrease in \dot{Y}_{1t}). The global effect is $\frac{\varphi_1 + \varphi_2}{\alpha_0}$. An increase in \dot{p}_t has two effects on e_{r1t} : a positive effect that is in conformity with the formula of the real exchange rate, and a negative effect that characterizes the imported inflation measured by $\rho_1 + \rho_2$. ρ_1 represents the direct effect and ρ_2 the indirect effect (and conversely for a decrease of \dot{p}_t). The global effect is $\frac{\{\alpha_0 - (\rho_1 + \rho_2)\}}{\alpha_0}$. An expansive monetary policy in (A) appreciates the real exchange rate of (B). A decrease of \dot{r} has a positive effect on the demand and investment in (A), and therefore \dot{Y}_1 . It increases the demand of the raw materials (the exports of (B)) according to the stocks of the firms, and their prices. The firms in (A) and (C) increase the prices of the finished products to respond to the surplus of the demand in (A) and (B) (the demand in (B) increases with the value of the exports) and the increase of the prices of raw materials. Thereby, this leads to imported inflation in (B) by the imports channel (See H1). The devaluation of the currency in (A) appreciates the real exchange rate of (B), because it leads to imported inflation like the expansive monetary policy. More \dot{Z} impacts the income of (C), more the real exchange rate of (B) can resist to shocks of (A), according to the intensity of the relationship between Y and \dot{Z} measured by $\frac{\alpha_2}{\alpha_0}$, and conversely.

In case when the cycles of the economic conjunctures of (A) and (C) are not synchronized, the equation (7) becomes:

$$\begin{aligned} \log(e_{r1t}) = & \frac{1}{\alpha_0} \log Y_t - \frac{\varphi_1}{\alpha_0} \log(\dot{Y}_{1t}) + \frac{(\alpha_0 - \rho_1)}{\alpha_0} \log(\dot{p}_t) - \frac{\tau_1}{\alpha_0} \log(\dot{r}_t) - \frac{\sigma_1}{\alpha_0} \log(p_{pt}) - \\ & \frac{\alpha_1}{\alpha_0} \log(\dot{Y}_{2t}) - \frac{\beta}{\alpha_0} \log(Z_t) - \log(p_t) - \log(e_{3t}) \end{aligned} \quad (8)$$

The exposure of the real exchange rate of (B) to shocks in (A) is mitigated by the dependence of its economy to income of (C) and the vector Z .

Empirical Verification: The Case of Kenya

The objective of this section is to do an empirical verification of theoretical model in Kenyan economy. We limit the investigation on the exposure of GDP in Kenya to international

income and inflation shocks. According to Hugon (2012) African countries diversify their external exchanges in the recent years with the increase of Chinese investments and the development of the trade exchanges with this country. Also, according to Déés and Vansteenkiste (2007) and Lambert and Chavy-Martin (2008), economic cycles of Asian Emerging countries tend not to be synchronized with the cycles in developed economies, because Asian growth is essentially determined by the domestic household consumption and investment. In this context, we do two estimations with two periods of study: 1960-2006 and 1960-2012. The second period includes the recent international crisis. The objective is to view if taking into account the recent years decreases the exposure of Chinese economy to international shocks, increases the dependence of Kenya economy to Chinese economy, and therefore decreases the exposure of Kenya economy to international shocks. For doing this, we use correlation matrix of conjuncture variable cycles and a SVAR model.

Correlation Matrix of Conjuncture Variable Cycles

Table 1

Correlation Matrix of Conjuncture Variable Cycles; end 2006

gdpoecd	infoecd	hcchina	invchina	gdpchina	gkenya	xkenya	invkenya	mkenya	imkenya	infkenya	gdpkenya	
gdpoecd	1.0000											
infoecd	-0.2276	1.0000										
hcchina	0.9416	-0.4079	1.0000									
invchina	0.9646	-0.3418	0.9806	1.0000								
gdpchina	0.9524	-0.4005	0.9975	0.9902	1.0000							
gkenya	0.9661	-0.0542	0.8958	0.9283	0.9080	1.0000						
xkenya	0.9799	-0.1097	0.9181	0.9482	0.9315	0.9839	1.0000					
invkenya	0.9524	-0.0064	0.8639	0.9088	0.8786	0.9888	0.9719	1.0000				
mkenya	0.9753	-0.1148	0.9224	0.9523	0.9356	0.9899	0.9941	0.9800	1.0000			
imkenya	-0.9090	-0.0991	-0.7742	-0.8281	-0.7909	-0.9518	-0.9274	-0.9567	-0.9220	1.0000		
infkenya	0.4524	0.2658	0.2726	0.3494	0.2964	0.3991	0.4604	0.4213	0.4101	-0.4868	1.0000	
gdpkenya	0.9822	-0.1358	0.9256	0.9513	0.9372	0.9944	0.9904	0.9807	0.9951	-0.9324	0.3948	1.0000

Table 2

Correlation Matrix of Conjuncture Variable Cycles; end 2012

gdpoecd	infoecd	hcchina	invchina	gdpchina	gkenya	xkenya	invkenya	mkenya	imkenya	infkenya	gdpkenya	
gdpoecd	1.0000											
infoecd	-0.3410	1.0000										
hcchina	0.9249	-0.5063	1.0000									
invchina	0.9494	-0.4614	0.9882	1.0000								
gdpchina	0.9335	-0.5017	0.9985	0.9938	1.0000							
gkenya	0.9703	-0.2272	0.9183	0.9435	0.9267	1.0000						
xkenya	0.9741	-0.2804	0.9432	0.9642	0.9518	0.9870	1.0000					
invkenya	0.9588	-0.1958	0.9016	0.9334	0.9113	0.9919	0.9796	1.0000				
mkenya	0.9678	-0.2888	0.9487	0.9686	0.9570	0.9898	0.9959	0.9843	1.0000			
imkenya	-0.9246	0.1114	-0.8440	-0.8797	-0.8543	-0.9639	-0.9472	-0.9680	-0.9433	1.0000		
infkenya	0.4178	0.2506	0.2333	0.2949	0.2516	0.3570	0.3975	0.3736	0.3555	-0.4227	1.0000	
gdpkenya	0.9800	-0.2964	0.9420	0.9622	0.9499	0.9956	0.9927	0.9864	0.9951	-0.9506	0.3507	1.0000

Domestic income in (B) used in the theoretical model is approximated by real GDP in Kenya (*gdpkenya*), income in (A) (international income) by real OECD GDP (*gdpoecd*), world price by the harmonized inflation in OECD countries (*infoecd*), household consumption in China (*hcchina*), investment in China (*invchina*) and real GDP of China (*gdpchina*). Also, we have the following domestic variables: public expenditure (*gkenya*), exports (*xkenya*), investment (*invkenya*), imports (*mkenya*), infantile mortality (*imkenya*) and inflation (*infkenya*). The correlations of real GDP OECD cycles with household consumption, investment and real GDP in China are 94%, 96% and 95% in the first period. They become 92%, 94% and 93% in the second period. Thereby, the correlation of the cycles decreases in the three cases. The correlation of the cycles between GDP, household consumption and investment in China are 99.7% and 99% in the first period, 99.8% and 99.4% in the second period. Contrary to the cycle correlations with real GDP OECD, we observe an increase in the second period. Also, the cycles of Chinese GDP are most correlated by the two domestic variables in comparison with the correlation with GDP OCDE. In case of Kenya, its GDP cycles are correlated with GDP OECD by 98.22% in the first period, and 98% in the second period. They become 93% in the first period and 95% in the second period, concerning the correlation with Chinese GDP. In this context, we observe a small decrease in the cycle correlations with the conjuncture of OCDE countries and an increase in the correlation with the Chinese cycles. We deduce that there are cycle synchronizations between OECD and Chinese conjunctures, but its intensity decreases. Also, confirming literature, the intensity of the cycle correlations between investment, household consumption and GDP in China increases. The conjuncture cycle correlations between Kenya and OECD decrease. They increase with China.

Empirical Model Specification: a SVAR

The SVAR model used in this study is inspired by Parnisari (2002). The theoretical model developed in section 2, has the variables of a real economy. The utilization of VAR models for estimating these types of models has been popularized by Diebold (1998) who introduces the VAR models in economic literature in the 80s. Thereby, under stationary condition, it is possible to apply the Wold theorem and to present a vector y_t , like equations (5) and (6), in the form of a Vector Moving Average (VMA). In this context, we suppose that Kenyan economy is described by a VAR (p) with the polynomial form:

$$\emptyset(L)y_t = c + \varepsilon_t \quad (9)$$

With y_t the vector of n endogeneous variables with $(n \times 1)$ dimensions, t the time, p the number of the retards, c the constant with $(n \times 1)$ dimensions, L the operator of retards ($L^n y_t = y_{t-n}$), \emptyset the matrix of retard polynomials ($\emptyset(L) = I_n - \emptyset_1 L - \emptyset_2 L^2 - \dots - \emptyset_p L^p$), with I_n an identity matrix with $(n \times n)$ dimensions, $\emptyset_1, \dots, \emptyset_p$ the matrix of the coefficients with $(n \times n)$ dimensions, ε_t a vector of innovations with $(n \times 1)$ dimensions, $(E(\varepsilon_t) = 0, E(\varepsilon_t \varepsilon_t') = \Omega, \text{ and } E(\varepsilon_t \varepsilon_s') = 0$ for all $t \neq s$).

According to (9), the variance-covariance matrix of the vector of innovations ε_t can contain non-zero values outside of its diagonal. This implies that, even if the dynamic evolution of the

variables of y_t is very well estimated by the autoregressive structure of the polynomial $\phi(L)$, the residual innovations can be correlated there between. The Structural Vector Autoregressive Models (SVAR) were developed for resolving this problem. They transform the correlated innovation series of the vector ε_t in a vector of orthogonal (independent) structural shocks that we name e_t , and, that can economically be interpreted. For understanding the logic and the notations of SVAR (p) developed in this paper and the effect on the structure of the model after the transformation of the ε_t in a vector of independent shocks named e_t , it is necessary to proceed at some developments that can be seen in Hamilton (1994) and Stier (2001). Thereby, taking into account the above, the equation (9), by deleting the constant, can be written in VAR (p) Moving Average:

$$y_t = C(L)\varepsilon_t \quad (10)$$

With $C(L) = \phi(L)^{-1}$

The VAR (p) representation, by deleting the constant, of the dynamic structural model associated at the equation (9) is:

$$B(L)y_t = e_t \quad (11)$$

With a variance-covariance matrix for e_t and normalized at I_n , that is to say $E(e_t e_t') = I_n$. The VMA (p) with the structural shocks associated at the equation (11) is:

$$y_t = A(L)e_t \quad (12)$$

With $A(L) = B(L)^{-1}$ where A_j is a matrix ($n \times n$) that must be identified. The elements a_{ni} measure the effects of the i^{th} structural shock contained in e_t after j periods on the n^{th} variable.

In equalizing the equations (10) and (12), we have:

$$A(L)e_t = C(L)\varepsilon_t \quad (13)$$

Thereby, we connect the estimated residuals and the structural shocks.

Knowing that “C” is an identity matrix, after estimating the matrix A, the structural residuals can be deducted of those observed. The transformed model, having more parameters to estimate than the VAR of reduced form that is estimable, we impose restrictions for identifying the matrix A. More econometric softwares use the model named “AB” for the short term restrictions and “C” for those of the long term. In this context, for choosing the restrictions adapted in our model, we base on (Blanchard and Quah, 1989). They use short term restrictions for the demand shocks and long term restrictions for the production shocks. Our model is based on the fluctuations of the activities and the demand shocks that are short term phenomena. Thereby, we estimate them using short term SVAR and Cholesky’s decomposition. According to Sims (1980), the Cholesky’s decomposition is a method of identification of the response functions in a VAR model; therefore,

this method is a SVAR. In this context, we impose exclusion restrictions on the variables that are not significant in the matrix A for respecting the just identification.

Also, it is important to specify that we use data of conjuncture. In this context, one can pose the question of the utilization of the VAR of raw data (non-stationary data) or those corrected of the seasonal variations. For the correction of the seasonal variations, we added in equation (9) with the constant, a vector of determinist variables that we name (D_t), containing the constant, the seasonal variables, a trend and others intervention variables:

$$y_t = \phi(L)y_t + \psi D_t + \varepsilon_t \quad (14)$$

The matrix ψ has the coefficients associated with constant vector, seasonal influences, determinist trend... Because, if y_t has the variables with the seasonal profiles, a part of this seasonality will be in ε_t , except in the presence of seasonal cointegration between the variables of the vector y_t . However, in the literature, there are the papers that use the variables corrected of seasonality (Pétursson and Slok, 2001) and those with the variables with seasonality (Brüggemann, 2001). According to Maravall (1994), the series corrected of seasonality are estimated, and not the observations. In these conditions, they depend on the value estimated by statistical technics; the confidence interval for example. Also, it is necessary to use more assumptions like the orthogonality of unobserved components (seasonality, trend...). That is to say that the seasonal fluctuations are independent from all the others fluctuations affecting an economic variable, while this is not always the case in the facts. Also, the smoothing of the auto-correlated functions of raw data by the correction of seasonality is impacted by the method of correction of seasonality used.

Data Characteristics

We calculate the elasticities using SVAR model, under stationary condition and Wold theorem. The macroeconomic data are expressed in the U.S. dollars and come from the World Bank database (the web site database ("African Development indicators")) and the OECD ("StatExtracts"). The variables are in logarithm for the interpretation in terms of elasticities. ADF and FPhillips-Perron tests are used to study the stationarity of the series for being in accordance with the assumption of the empirical specification (stationary condition for using Wold theorem) (See tables C1 and C2 in Appendix C.) We remove the aberrant values of the variables and we replace them by the reasonable values using linear interpolation. In applying the models, the Akaike Information Criterion (AIC) is used to determine the optimal lag length. After the estimations, the residual autocorrelation test (LM test) and collinearity test (Wald test) are performed, and the stability of the models is also checked.

Knowing that the order of apparition of the variables in the SVAR is capital for the final results, we base our intuition on economic theory to do this. In this context, we have the following classification:

$$Y_t = \begin{pmatrix} gdpoecd, infoecd, hcchina, invchina, gdpchina, gkenya, \\ xkenya, invkenya, mkenya, imkenya, infkenya, gdpkenya \end{pmatrix} \quad (15)$$

According to (15), real GDP of Kenya is impacted by external and domestic variables. Real GDP of China is influenced by real GDP of OECD, harmonized inflation in OECD, household consumption and investment in China.

Results

Based on table 3, we can view the origins of the impulses of GDP in short term in the first period. Thereby, we represent in equations (16) and (17) above, the causes of the impulses of Chinese GDP and Kenyan GDP. In short term, the perturbations of *gdpchina* are caused by their perturbations with an elasticity estimated at 0.017. They are also caused by *gdpcode* (0.071), *hcchina* (0.622) and *invchina* (0.247) perturbations. We observe that the elasticity of domestic variables are higher than the elasticity of *dgpoecd*. This situation is confirmed by the impulse response functions (See figure 1). In fact, an increase in *gdpoecd*, *hcchina* and *invchina* has initially a significant and positive effect on *gdpchina* respectively by 1.9%, 7.5% and 3%, and these effects disappear after four, two and three years. Concerning *gdpkenya*, its impulses are their origin by 0.02, OECD and Chinese conjuncture origins; with 0.358 and -0.064 for *gdpoecd* and *infoecd*, and 0.209 for *gdpchina*. They are also *gkenya*, *xkenya*, *invkenye*, *mkenya* and *infkenya* origins. *gdpcode* and *gdpchina* shocks have initially a positive effect on *gdpkenya* by 5.03% and 3.8% and the perturbations disappear after five and three years. The reaction to *infoecd* shocks is not significant (See figure 3).

Based on table 4, we have the origins of the impulses of GDP in the second period. Thereby, we represent in equations (18) and (19) above, the causes of the impulses of Chinese GDP and Kenyan GDP. In a short term, the perturbations of *gdpchina* are caused by their perturbations with an elasticity estimated at 0.019. They are also caused by *gdpcode* (0.091), *hcchina* (0.63) and *invchina* (0.24). As the first period, we observe that the elasticities of domestic variables are still higher than the elasticity of *dgpoecd*. This situation is still confirmed by the impulse response functions (See figure 2). In fact, an increase in *gdpoecd*, *hcchina* and *invchina* has initially a significant and positive effect on *gdpchina* respectively by 2.5%, 7.5% and 3%, and these effects disappear after five, two and three years (See figure 2). Concerning *gdpkenya*, its impulses are their origin by 0.025, OECD and Chinese conjuncture origins, with 0.321 and -0.05 for *gdpoecd* and *infoecd*, and 0.237 for *gdpchina*. They are also *gkenya*, *xkenya*, *invkenye*, *mkenya* and *infkenya* origins. Thereby, in comparison to the first period, we observe a decrease in exposure of *gdpkenya* to *gdpoecd* and *infoecd* by -0.037 and -0.014, and an increase in the exposure to *gdpchina* by 0.028. These results are confirmed by the impulse response functions. Now, *gdpcode* and *gdpchina* shocks have still initially a positive effect on *gdpkenya*, but by 5% and 3.9%, and the perturbations disappear after three and five years (See figure 4). Thereby, the duration of the reaction regresses of two years in the first case and progresses of two years in the second case.

Table 3

Results with end duration study in 2006 (* significant at 1%, ** significant at 5% and * significant at 10%)

1	0	0	0	0	0	0	0	0	0	0	0
-2***	1	0	0	0	0	0	0	0	0	0	0
0.55***	0.158***	1	0	0	0	0	0	0	0	0	0
0	0	-0.673***	1	0	0	0	0	0	0	0	0
-0.071***	0	-0.622***	-0.247***	1	0	0	0	0	0	0	0
-1.029***	0	1.531***	0.63***	-2.748***	1	0	0	0	0	0	0
-0.453***	-0.196***	0	0	0	-0.266***	1	0	0	0	0	0
0.731**	-0.259***	0	0	0	-0.931***	0	1	0	0	0	0
0.499***	-0.205***	1.292***	0.368***	-1.564***	-0.351***	0.567***	-0.135**	1	0	0	0
0	0	0	0	0	0	0	0	0	1	0	0
0	1.995***	1.068***	1.205***	-1.288***	1.958***	0	-1.47***	0	-1.669***	1	0
-0.358***	0.064***	0	0	-0.209***	-0.4***	-0.122***	-0.059**	-0.114***	0	0.003***	0
=											
0.045***	0	0	0	0	0	0	0	0	0	0	0
0	0.169***	0	0	0	0	0	0	0	0	0	0
0	0	0.086***	0	0	0	0	0	0	0	0	0
0	0	0	0.1***	0	0	0	0	0	0	0	0
0	0	0	0	0.017***	0	0	0	0	0	0	0
0	0	0	0	0	0.091***	0	0	0	0	0	0
0	0	0	0	0	0	0.079***	0	0	0	0	0
0	0	0	0	0	0	0	0.103***	0	0	0	0
0	0	0	0	0	0	0	0	0.055***	0	0	0
0	0	0	0	0	0	0	0	0	0.024***	0	0
0	0	0	0	0	0	0	0	0	0	3.473***	0
0	0	0	0	0	0	0	0	0	0	0	0.02***

$$\varepsilon_{gdpchina_t} = 0.017 \varepsilon_{gdpchina_t} + 0.071 \varepsilon_{gdpocde_t} + 0.622 \varepsilon_{hcchina_t} + 0.247 \varepsilon_{invchina_t} \quad (16)$$

$$\varepsilon_{gdpkenya_t} = 0.02 \varepsilon_{gdpkenya_t} + 0.358 \varepsilon_{gdpocde_t} - 0.064 \varepsilon_{infocde_t} + 0.209 \varepsilon_{gdpchina_t} + 0.4 \varepsilon_{gkenya_t} + 0.122 \varepsilon_{xkenya_t} + 0.059 \varepsilon_{invkenya_t} + 0.114 \varepsilon_{mkenya_t} - 0.003 \varepsilon_{infkenya_t} \quad (17)$$

Table 4

Results with end duration study in 2012 (* significant at 1%, ** significant at 5% and * significant at 10%)

$$\begin{bmatrix}
 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 -2.066^{***} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0.636^{***} & -0.109^{***} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & -0.666^{***} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 -0.091^{***} & 0 & -0.63^{***} & -0.24^{***} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 -1.193^{***} & 0 & 1.077^{***} & 0.399^{**} & -1.966^{***} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
 -0.319^{***} & -0.137^{***} & 0 & 0 & 0 & -0.251^{***} & 1 & 0 & 0 & 0 & 0 & 0 \\
 0.801^{***} & 0 & 1.039^{**} & 0 & 0 & -0.778^{***} & 0 & 1 & 0 & 0 & 0 & 0 \\
 0.553^{***} & -0.081^{***} & 0.886^{***} & 0.206^{**} & -1.028^{***} & -0.311^{***} & -0.602^{***} & -0.214^{***} & 1 & 0 & 0 & 0 \\
 -0.038^{**} & 0.005^{**} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
 0 & 0 & 1.664^{***} & 1.205^{***} & -1.958^{***} & 1.917^{***} & 0 & 0 & 0 & 0 & 1 & 0 \\
 -0.321^{***} & 0.05^{***} & 0 & 0 & -0.237^{***} & -0.509^{***} & -0.1^{***} & 0 & -0.102^{**} & 0 & 0 & 1
 \end{bmatrix}
 \begin{bmatrix}
 \varepsilon_{gdpocdt_t} \\
 \varepsilon_{infoecd_t} \\
 \varepsilon_{hcchina_t} \\
 \varepsilon_{invchina_t} \\
 \varepsilon_{gdpchina_t} \\
 \varepsilon_{gkenya_t} \\
 \varepsilon_{xkenya_t} \\
 \varepsilon_{invkenya_t} \\
 \varepsilon_{mkenya_t} \\
 \varepsilon_{imkenya_t} \\
 \varepsilon_{infkenya_t} \\
 \varepsilon_{gdpkenya_t}
 \end{bmatrix}
 =$$

$$\begin{bmatrix}
 0.047^{***} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0.296^{***} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0.086^{***} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0.104^{***} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0.019^{***} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0.101^{***} & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0.076^{***} & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.109^{***} & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.059^{***} & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.05^{***} & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 4.791^{***} & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.025^{***}
 \end{bmatrix}
 \begin{bmatrix}
 \varepsilon_{gdpocdt_t} \\
 \varepsilon_{infoecd_t} \\
 \varepsilon_{hcchina_t} \\
 \varepsilon_{invchina_t} \\
 \varepsilon_{gdpchina_t} \\
 \varepsilon_{gkenya_t} \\
 \varepsilon_{xkenya_t} \\
 \varepsilon_{invkenya_t} \\
 \varepsilon_{mkenya_t} \\
 \varepsilon_{imkenya_t} \\
 \varepsilon_{infkenya_t} \\
 \varepsilon_{gdpkenya_t}
 \end{bmatrix}$$

$$\varepsilon_{gdpchina_t} = 0.019\varepsilon_{gdpchina_t} + 0.091\varepsilon_{gdpocde_t} + 0.63\varepsilon_{hcchina_t} + 0.24\varepsilon_{invchina_t} \quad (18)$$

(10)
(3.46)
(17.86)
(9.93)

$$\begin{aligned}
 \varepsilon_{gdpkenya_t} = & 0.025\varepsilon_{gdpkenya_t} + 0.321\varepsilon_{gdpocde_t} - 0.05\varepsilon_{infoecd_t} + 0.237\varepsilon_{gdpchina_t} \\
 & + 0.509\varepsilon_{gkenya_t} + 0.1\varepsilon_{xkenya_t} + 0.102\varepsilon_{mkenya_t}
 \end{aligned} \quad (19)$$

(10)
(2.96)
(-3.12)
(2.84)

(8.2)
(2.98)
(2)

Conclusion and Political Economic Implications

The development of a non-exposed sector to international shocks in African countries leads their economies to resist to external shocks (Assoumou Ella and Bastidon Gilles, 2015; Assoumou Ella, 2014). In this paper, we investigate the role of the partners' diversification in developing a model with three countries. Since several years, the developed countries were the buyers of the raw materials exported by the African countries (Madeley, 2003). Thereby, they are exposed to shocks in developed countries (Berman and Martin, 2012). However, in the recent years, the diversifications of the trade and financial partners in Africa, with the increase of the exchanges with China essentially are observed (Hugon, 2012). Also, the economic conjunctures of the developed countries and Asian emerging countries tend to be decoupled, because Asian growth is essentially determined by the domestic household consumption, investment and the regional integration (Dées and Vansteenkiste, 2007; Lambert and Chavy-Martin, 2008). However, there is no consensus in the literature concerning this assumption. In these conditions, we develop a theoretical model of the exposure of a developing country's income with the characteristics of the African economies to shocks of a developed country, according to two cases: coupling and decoupling economic conjunctures of developed and emerging countries. The results suggest that the partners' diversification permits the developing country to resist to shocks of developed country if the economic conjunctures of the developed and emerging countries are decoupled. We empirically verify this model in Kenyan country using a correlation matrix of cycles and a SVAR model. The results confirm that Chinese conjuncture tends to be less exposed to OECD countries' income and inflation shocks. Also, income in this country more depends on domestic investment and household consumption, in comparison to the dependence on OECD country shocks. Also, the exposure of Kenya income regresses and the dependence on Chinese conjuncture progresses, confirming theoretical results.

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Appendices

Appendix A: Impulse response functions; end 2006

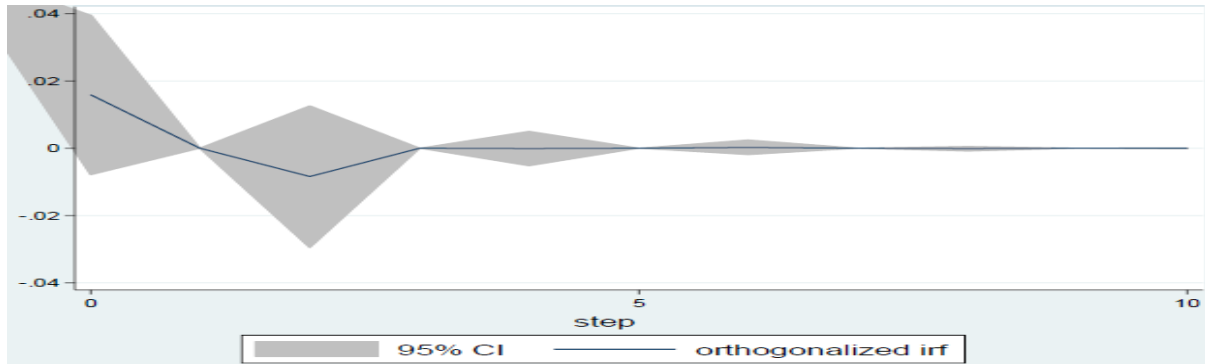


Figure A1: Graph by irfname: impulse variable (*gdpocde*) response variable (*gdpchina*)

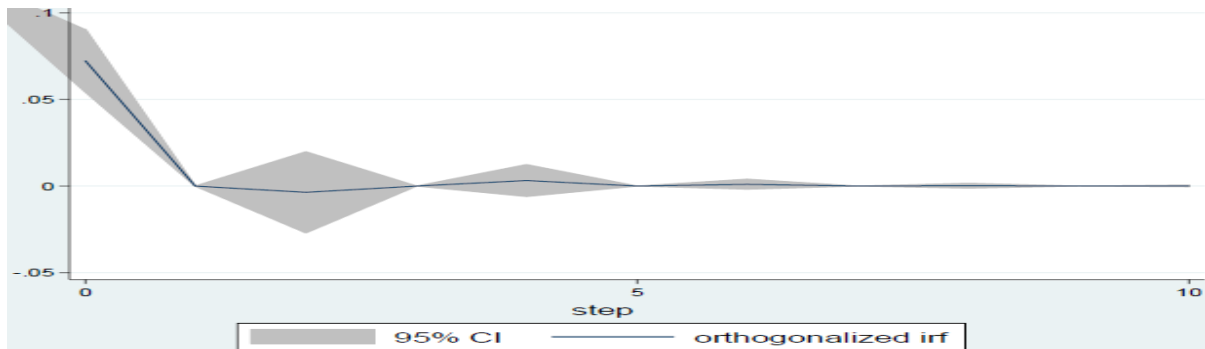


Figure A2: Graph by irfname: impulse variable (*hcchina*) response variable (*gdpchina*)

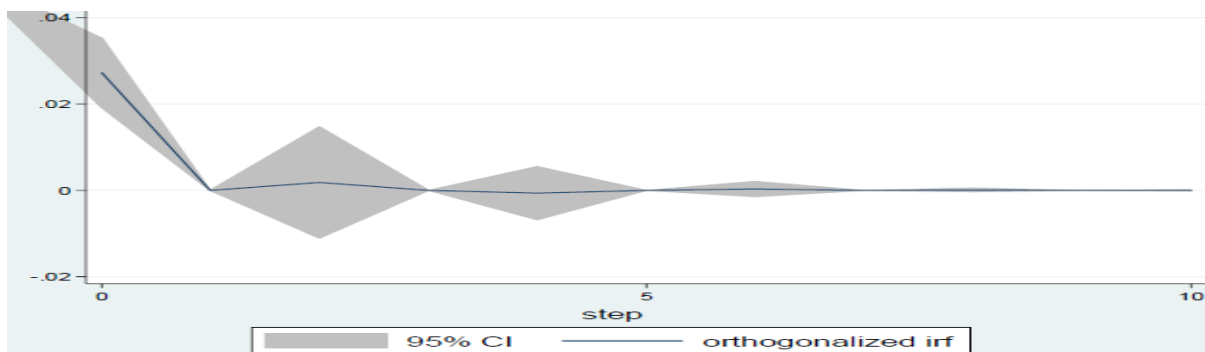


Figure A3: Graph by irfname: impulse variable (*invchina*) response variable (*gdpchina*)

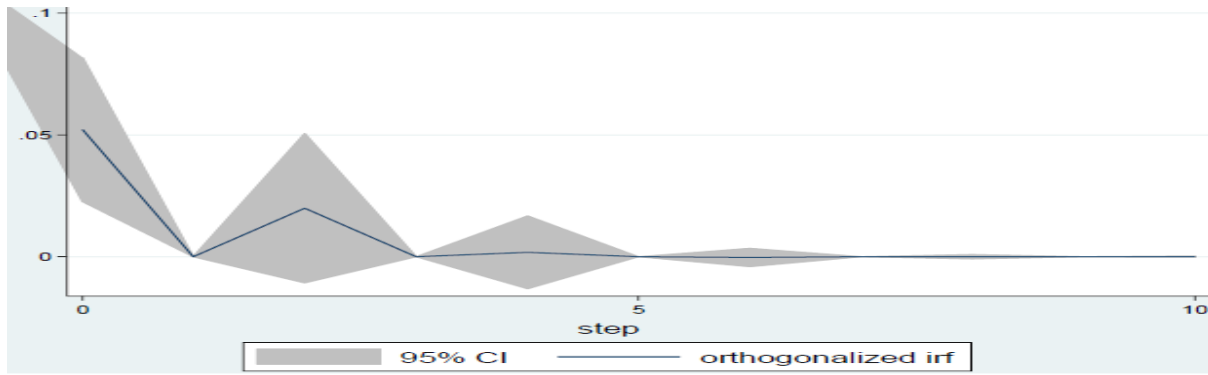


Figure A4: Graph by irfname: impulse variable (*gdpcde*) response variable (*gdpkenya*)

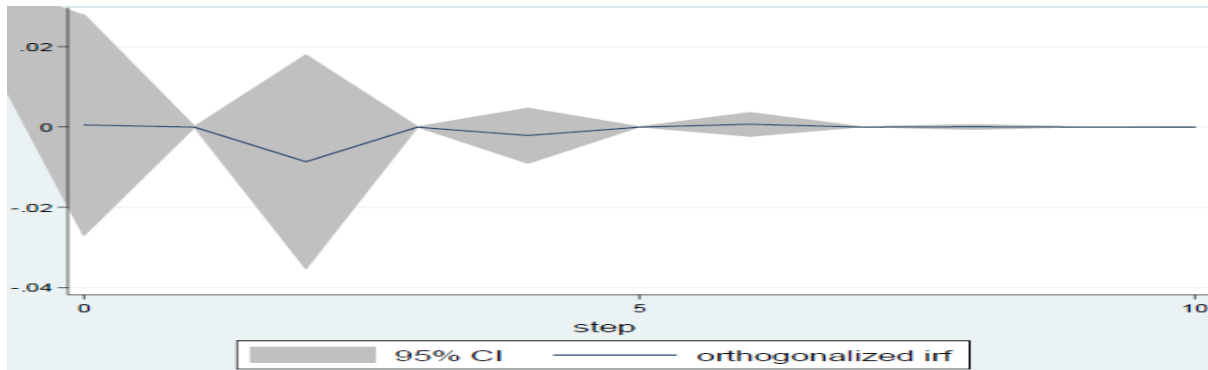


Figure A5: Graph by irfname: impulse variable (*infocde*) response variable (*gdpkenya*)

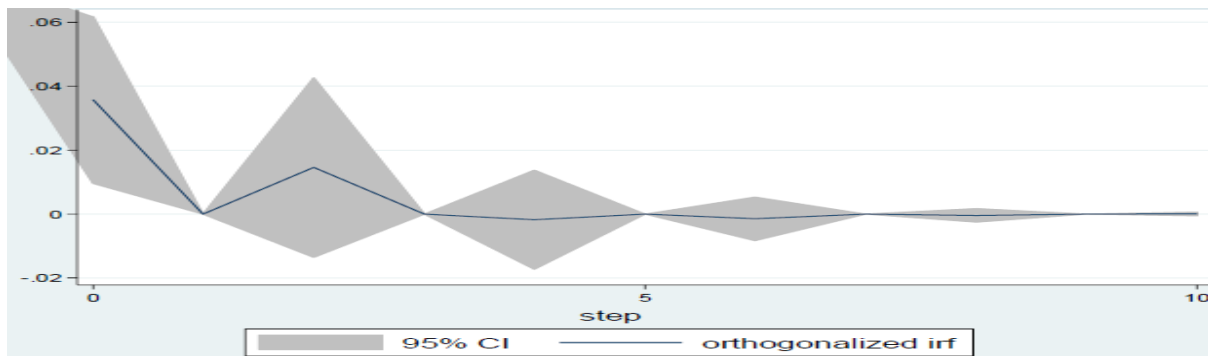


Figure A6: Graph by irfname: impulse variable (*gdpchina*) response variable (*gdpkenya*)

Appendix B: Impulse response functions; end 2012

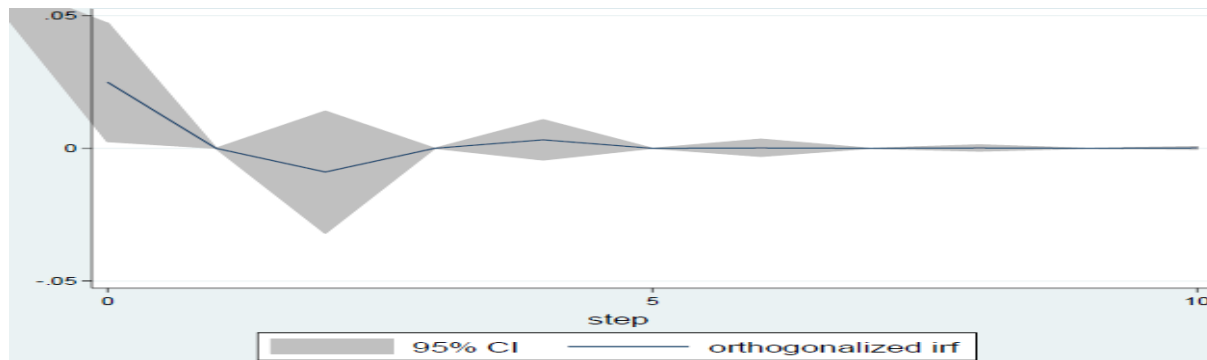


Figure B1: Graph by irfname: impulse variable (*gdpocde*) response variable (*gdpchina*)

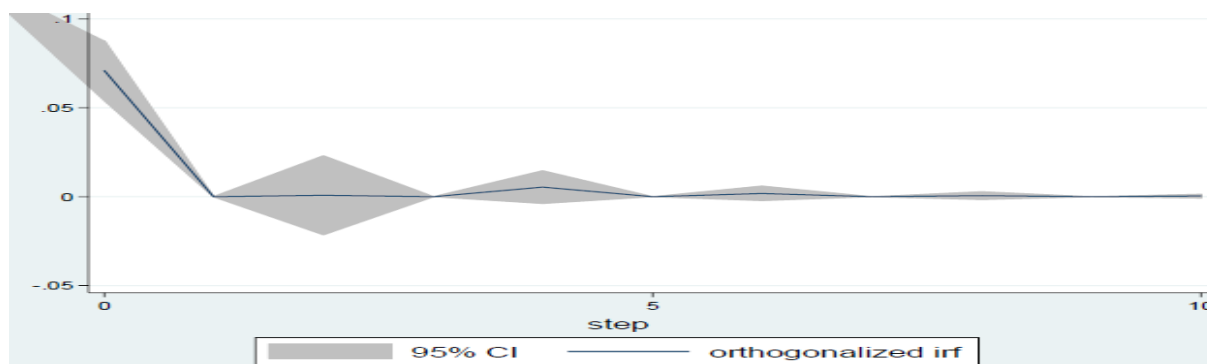


Figure B2: Graph by irfname: impulse variable (*hcchina*) response variable (*gdpchina*)

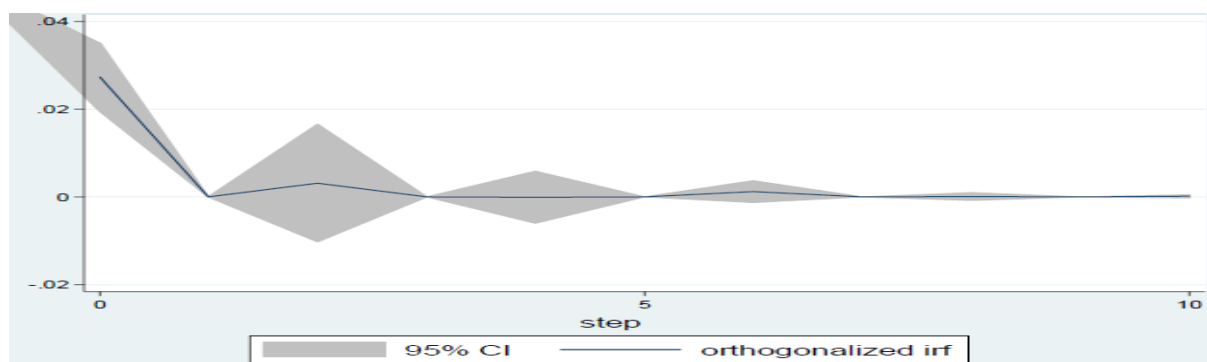


Figure B3: Graph by irfname: impulse variable (*invchina*) response variable (*gdpchina*)

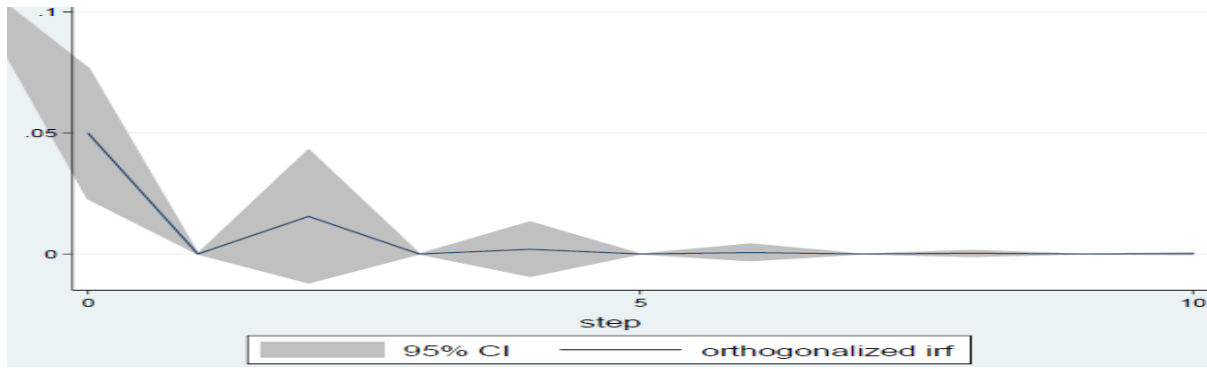


Figure B4: Graph by irfname: impulse variable (*gdpocde*) response variable (*gdpkenya*)

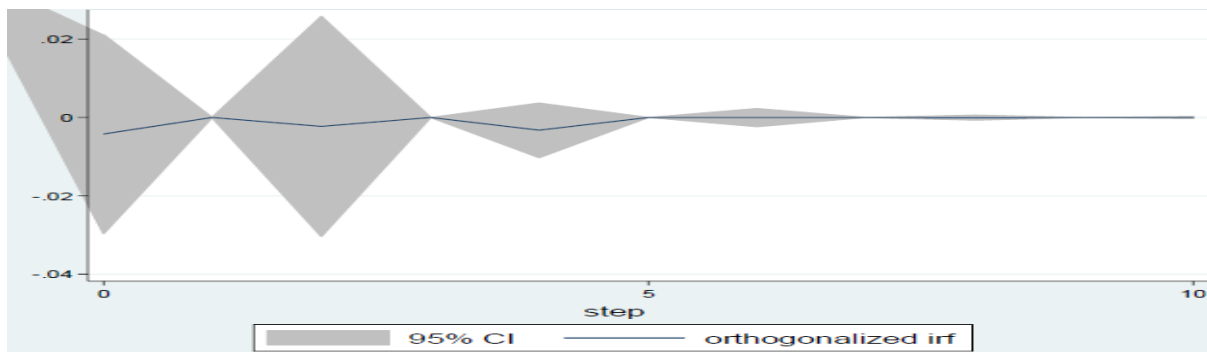


Figure B5: Graph by irfname: impulse variable (*infocde*) response variable (*gdpkenya*)

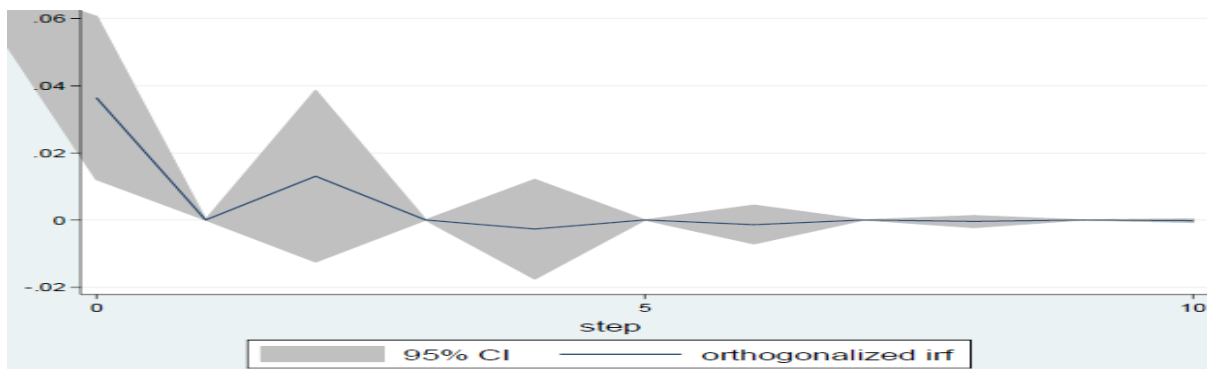


Figure B6: Graph by irfname: impulse variable (*gdpchina*) response variable (*gdpkenya*)

Appendix C: Unit Root Tests

Table C1

Unit Root Tests; end 2006

Variable	ADF		PP	
	Level	First Differences	Level	First Differences
log_gdpoecd	-2.353	-3.425**	-1.819	-3.396**
log_infoecd	-1.444	-6.078***	-1.554	-6.074***
log_hcchina	0.966	-6.985***	1.183	-6.89***
log_invchina	0.607	-6.52***	0.675	-7.35***
log_gdpchina	2.093	-5.979***	2.116	-6.021***
log_gkenya	-1.53	-4.984***	-1.445	-4.999***
log_xkenya	-0.741	-6.261***	-0.753	-6.293***
log_invkenya	-0.997	-6.972***	-0.973	-7.002***
log_mkenya	-0.457	-6.147***	-0.457	-6.128***
log_imkenya	-4.053***	-	-2.7**	-
infkenya	-3.03**	-	-2.988**	-
log_gdpkeny	-0.902	-4.88***	-0.891	-4.886***

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Note: ADF and PP denotes Augmented Dickey- Fuller and Phillips- Perron unit root tests respectively. (***), (**) and (*) denote significant at 1%, 5%, and 10% critical values respectively.

Table C2

Unit Root Tests; end 2012

Variable	ADF	First Differences	PP	First Differences
	Level		Level	
log_gdpoecd	-3.036**	-3.807***	-2.418	-3.753***
log_infoecd	-2.095	-8.945***	-1.924	-9.196***
log_hcchina	2.254	-6.747***	3.23	-6.768***
log_invchina	1.305	-6.856***	1.232	-7.543***
log_gdpchina	3.238	-5.902***	3.23	-5.896***
log_gkenya	-1.246	-5.386***	-1.189	-5.39***
log_xkenya	-0.305	-6.941***	-0.34	-6.968***
log_invkenya	-0.657	-7.366***	-0.623	-7.393***
log_mkenya	0.049	-6.596***	0.034	-6.583***
log_imkenya	-1.861	-5.52***	-1.371	-5.924***
infkenya	-3.626***	-	-3.577***	-
log_gdpkenya	-0.495	-5.172***	-0.542	-5.167***

Note: ADF and PP denotes Augmented Dickey- Fuller and Phillips- Perron unit root tests respectively. (***), (**) and (*) denote significant at 1%, 5%, and 10% critical values respectively.