Globalization and Exchange Rate Pass Through: Evidence from Zambia

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Abstract

This study examines the impact of globalisation on the exchange rate pass through in Zambia. We study the influence of Chinese imports, regional and multilateral globalization on exchange rate pass through to consumer prices in Zambia between 2006 and 2017. We employ a combination of the pricing to market model and vector error correction model (VECM) to achieve the objective. The results from the study show that Chinese presence and multilateral globalisation have a positive effect on the exchange rate pass through to consumer prices in both the short and long run. However, the effect of Chinese presence on the exchange rate pass through is greater than that of multilateral globalisation. This is both in the short and long run. On the other hand, regional globalization has a negative effect on the exchange rate pass through to consumer prices in both the short and long run. This could be because regional globalization may be characterized by cross border trade in local currencies in the region. This might have a diminishing effect on exchange rate pass through to prices in Zambia. This signals to policy makers that there could be need to pursue regional integration policies.

Keywords: Exchange rate pass through, globalization, regional trade, Chinese presence, Zambia, VECM

JEL Classification Codes: E31, F31, F62

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1.0 Introduction

In the recent past, the impact of globalization on the exchange rate pass through has received considerable attention by both researchers and policy makers (Villavicencio and Mignon, 2017). There is an intense debate on the impact of globalisation on the exchange rate pass through (Benigno and Faia, 2016; Ozkhan and Erden, 2015). There are two strands of literature, each giving plausible opposite outcomes. One end of the globalisation literature claims that globalisation is expected to positively impact the exchange rate pass through (Benigno and Faia, 2016). The other end concludes that globalization can produce a negative effect on the exchange rate pass through. This ambiguity entails that the debate on the impact of globalization on the exchange rate pass through is not yet settled (Benigno and Faia, 2016).

The first strand of the globalisation literature contends that multilateral globalisation, proxied by trade openness, can be expected to have a positive effect on the exchange rate pass through. This is because the more trade has been liberalized in an economy, the larger the quantities of imports that enter the domestic economy. This means that exchange rate fluctuations impact a wider category of goods. This is especially so, if imported goods account for a bigger percentage of total goods purchased in the domestic economy. This may cause the overall price index in the domestic economy to be more responsive or sensitive to external factors such as changes in the exchange rate (Villavicencio and Mignon, 2017). Therefore, the more open an economy is, the easier it can transmit external shocks to the domestic variables through exchange rate movements. This means that the more open an economy is, the greater the degree of exchange rate pass through. In addition, the New open economy theory argues that a larger share of imports in total output means a lower substitution between foreign and domestic goods. This implies that exchange rate movements, easily pass through to domestic prices (Dornbusch, 1987; Menon, 1995; and Camp and Goldberg, 2002; Camp and Goldberg, 2005).

Villavicencio and Mignon (2017) examined whether multilateral and regional globalization matter for the exchange rate pass through in three core Eurozone countries. The study showed that globalization indicators, such as trade openness and lower tariffs, pushed up the exchange rate pass through in some sectors. However, their study did show that regional globalization, defined as the share of intra-EU imports in total imports, reduces the exchange rate pass through. Their finding also showed that the exchange rate pass through is complete when the globalization indicator, namely the EU trade, is controlled for. Benigno and Faia (2016) applied the Dornbusch (1987) oligopolistic model to analyse the extent to which globalisation affects the exchange rate pass through. They defined globalisation as the number of foreign products in each destination market. Their finding did show that globalisation increases the exchange rate pass through (Benigno and Faia, 2016).

The second strand has argued that multilateral globalization, measured by trade openness, may lead to higher international competition among multinational firms. This may result in pricing to market behaviour among exporters. This might reduce the exchange rate pass through (Ozkhan

and Erden, 2015). Their argument is that, foreign exporters may want to preserve their market share in the face of international competition in the export market. Therefore, exporters are not likely to pass exchange rate movements to prices which are likely to negatively affect their market share or international competiveness. This may reduce the exchange rate pass through to prices. (Ozkan and Erden, 2015; Benigno and Faia, 2016). To prove their argument, Ozkhan and Erden (2015) analysed the determinants of the exchange rate pass through for a group of countries. These were classified as developed, developing and less developed countries. Their findings showed that for all groups of countries, the coefficient of the globalization variable was negative and significant. This implied that trade integration has a negative effect on the exchange rate pass through. Gust, Leduc and Vigfusson, (2010) in their empirical study showed that the entry of foreign exporters in the domestic market raises the exchange rate pass through. However, when trade costs are reduced because of trade integration, the exchange rate pass through reduces.

It can be concluded from the foregoing discussion that the debate on the direction of the impact of globalization on the exchange rate pass through is not yet settled. The empirical literature is divided on the direction of the effect of globalization on the exchange rate pass through. One side of the literature proposes a positive effect of globalization on the exchange rate pass through. The other side suggests a negative effect. On the other hand, the empirical literature on the effect of globalization on the exchange rate pass through is scarce. There is no such evidence for Zambia. This creates a motivation to estimate the impact of globalization on the exchange rate pass through to consumer prices in Zambia. We specifically want to investigate the impact of Chinese presence (imports from China), regional and multilateral globalization on the exchange rate pass through to consumer prices in Zambia.

In studying the impact of globalization on the exchange rate pass through, this study contributes to the current debate on whether the inclusion of globalization variables in the exchange rate pass through equation positively or negatively affects the exchange rate pass through to prices. The finding of this study is very important as a contribution to literature. This is because, it could give a signal that there could be need to adjust the exchange rate pass through models so as to include globalization variables. Finally, the three studies done by Benigno and Faia (2016), Villavicencio and Mignon (2017) and Ozkhan and Erden (2015) on the effect of globalization on the exchange rate pass through made use of the ordinary least squares (OLS) method of estimation for analysis. The current study differs and contributes to existing literature in that, it applies the vector error correction model (VECM) to analyse the short and long effects of globalization. In addition, in using the VECM, the current study accounts for possible endogeneity which are not accounted for in the earlier studies. This serves as a contribution to the exchange rate pass through literature.

The rest of the paper is organized as follows; section 2 looks at the theoretical framework and the method of analysis. Section 3 looks at the data and data sources. We discuss the estimation and results in section 4. We conclude the paper in section 5.

2.0 Theoretical Frameworks and Method

2.1. Pricing to Market Model

To investigate the impact of globalization on the exchange rate pass through to domestic consumer prices in Zambia, the study adopted the pricing to market model as the theoretical framework. The pricing to market model can be expressed as follows;

$$\Delta P = \tau + z\Delta E_t + \eta\Delta MC_t^F + \omega\Delta Y_t^d + \varphi\Delta P_t^d \quad (1)$$

Where E_t is nominal exchange rate; MC_t^F is foreign marginal cost and Y_t^d is demand pressure facing the exporter; the coefficients τ is the intercept; z is the coefficient of exchange rate pass through to consumer prices; η measures foreign cost; ω captures demand pressure in the importing economy facing the exporter and φ measures pricing to market. The proponents of the pricing to market model expressed in equation (1) say that ${P_t}^d$ and ${Y_t}^d$ measure the same thing, namely demand pressure. In empirical studies, one of them is normally left out (Pryzstupa and Wrobel, 2011).

The model we use for modelling the exchange rate pass through to domestic consumer prices in Zambia is abstracted from the theoretical model specified in equation (1). It can be expressed in log form as follows;

$$\Delta lncpi_t = \beta + \gamma\Delta lnexr_t + \rho\Delta lnoil_t + \pi\Delta lngap_t + \mu \quad (2)$$

Where $lncpi$ is the log of consumer price index which is the proxy for the general price level of the basket of goods and services; $lnexr$ is the log of nominal exchange rate. It is a measure of exchange rate pass through. $lnoil$ is the US Dollar price of crude oil. $lnoil$ measures foreign marginal cost. $lngap$ is output gap calculated as the difference between the actual and potential real Gross domestic product (GDP). Output gap measures demand pressure. It is calculated using HP filter. μ is the error term.

Since the objective of this study is to investigate specifically the impact of Chinese presence (Chinese imports in Zambia), regional globalization (regional integration) and multilateral globalization on the exchange rate pass through to consumer prices in Zambia, the following four models were estimated to meet the specific objectives.

$$\Delta lncpi_t = \beta + \gamma\Delta lnexr_t + \rho\Delta lnoil_t + \pi\Delta lngap_t + \pi\Delta lntbil_t + \mu \quad (3)$$

$$\Delta lncpi_t = \beta + \gamma\Delta lnexr_t + \rho\Delta lnoil_t + \pi\Delta lngap_t + \sigma\Delta lntbil_t + \tau\Delta lnchina_t + \mu \quad (4)$$

$$\Delta lncpi_t = \beta + \gamma\Delta lnexr_t + \rho\Delta lnoil_t + \pi\Delta lngap_t + \sigma\Delta lntbil_t + \delta\Delta region_t + \mu \quad (5)$$

$$\Delta lncpi_t = \beta + \gamma\Delta lnexr_t + \rho\Delta lnoil_t + \pi\Delta lngap_t + \sigma\Delta lntbil_t + \Omega\Delta global + \mu \quad (6)$$

Where $lncpi$ is the log of consumer price index; $lnexr$ is the log of nominal exchange rate. It is a measure of exchange rate pass through. $lnoil$ is the US Dollar price of crude oil. $lnoil$ measures

foreign marginal cost; $lngap$ is output gap calculated as the difference between the actual and potential real Gross domestic product (GDP). It is calculated using HP filter. $lntbil$ is the three months treasury bills. μ is the error term. $lnchina$ is Chinese presence in Zambia measured as Chinese imports as ratio of total imports in Zambia); $region$ is imports from SADC countries as a ratio of total imports in Zambia; $global$ is trade openness measured as total exports plus total imports in Zambia as ratio of GDP while $\beta, \gamma, \rho, \pi, \sigma, \tau, \delta \; and \; \Omega$ are coefficients to be estimated and γ measures exchange rate pass through to domestic consumer prices. Trade openness was chosen as a measure of multilateral globalization because, in a number of empirical studies, it is taken as a proxy for multilateral trade liberalization. In addition, many empirical studies on the effect of globalization on the exchange rate pass through have also used trade openness as a measure of multilateral globalization. For instance Villavicencio and Mignon (2017), Benigno and Faia (2016) and Ozkhan and Erden, (2015) used trade openness as a proxy for globalization in their respective studies on globalization and exchange rate pass through.

It should be noted that equation 3 is the baseline model. Equation 4 is the model that captures Chinese presence in Zambia. Equations 5 and 6 are models of regional and multilateral globalization respectively. To measure the impact of Chinese presence, regional globalization and multilateral globalization on the exchange rate pass through to consumer prices; the baseline model was estimated first followed by the other three models in sequence. Our analysis proceeded as follows; if there is a change in the exchange rate pass through coefficient as a result of introducing Chinese presence, regional globalization or multilateral globalization variables respectively, it would be interpreted as the impact of Chinese presence, regional globalization or multilateral globalization on the exchange rate pass through to consumer prices.

2.2. The Vector Error Correction Model.

Our main objective in the study was to examine the impact of globalisation on consumer prices in both the short and long run. In order to achieve this objective, the study employed the Vector error correction model (VECM). Recall that the VECM is a restricted Vector autoregression model (VAR). Therefore, the beginning point before arriving at the VECM is the VAR of order p given in equation 7 below

$$X_t = \mu + \mathrm{A}_1 \mathrm{X}_{t-1} + \mathrm{A}_2 X_{t-2} + \ldots\ldots\ldots + \mathrm{A}_p \mathrm{X}_{t-p} + \mathrm{E}_t \qquad (7)$$

Where X_t is an n x 1 vector of variables ($lncpi_t, lnexr_t, lnoil_t, lngap_t, lntbil_t, lnchina_t, region_t, global_t$) that are integrated of order one written as I(1); E_t is nx1 vector of innovations and A_1 up to A_P are *m* x *m* matrices and μ is an nx1 vector of deterministic variables. Equation (7) can be expressed in such a way that the short run and long run terms are incorporated as follows;

$$\Delta \mathrm{X}_t = \mu + \Pi \mathrm{X}_{t-1} + \sum_{t=1}^{p-1} \Gamma_i \, \Delta \mathrm{X}_{t-1} + \mathrm{E}_t \qquad (8)$$

Where $\Pi = \sum_{t=1}^{p} \mathrm{A}_i - I$, $\Gamma_i = \sum_{t=1}^{p} \mathrm{A}_j$ and $\Pi \mathrm{X}_{t-1}$ captures the long run relationship among variables in X_t while $\Gamma_i \, \Delta \mathrm{X}_{t-1}$ captures the short run relationship among variables in X_t. If variables in X_t are cointegrated, $\Pi \mathrm{X}_{t-1}$ follows the I(0) process. Thus, equation (8) can be expressed in the error correction representation form as follows

$$\Delta \mathrm{X}_t = \mu + \alpha \mathrm{ecm}_{t-1} + \sum_{t=1}^{p-1} \Gamma_i \, \Delta \mathrm{X}_{t-1} + \varepsilon_t \qquad (9)$$

Where $\alpha \mathrm{ecm}_{t-1} = \beta' \mathrm{X}_{t-1}$ is the error correction term representing long term relationships among the variables in X.

It should be noted that for error correction models, the cointegration test is a requirement. Johansen and Juselius (1990) cointegration test is a common test for cointegartion in empirical studies. In this study the Johansen and Juselius (1990) cointegration test was adopted. Johansen and Juselius (1990) proposed two different likelihood ratio tests for cointegration namely the trace statistic and the maximum statistic. These are specified as follows;

$$Q_{trace}\,(r) = -T \sum_{i=r+1}^{n} \mathrm{In}(1 - \lambda_i) \qquad (10)$$

$$Q_{max}(r, r+1) = -\mathrm{T}\,\mathrm{In}(1 - \lambda_{r+1}) \qquad (11)$$

Where T is the sample size; λ_i is the estimated value of the i^{th} eigenvalue from the rank Π matrix. The larger the value of the eigenvalue λ_i the larger the $In(1 - \lambda_i)$ and the larger the test statistic. Each eigenvalue λ_i is associated with a different cointegrating vector. The trace test statistic in equation (10) test the null hypothesis of *r* cointegrating vectors against the alternative that there are *n* number of cointegrating vectors. On the other hand, the maximum test statistic in equation (11) test the null hypothesis of r cointegrating vectors against the alternative of (*r+1*) cointegrating vectors. If the test statistic from either the Q_{trace} or the Q_{max} is greater than the critical values provided by Johansen's table or Osteward-Lenaum (1992), the null hypothesis in both Q_{trace} or Q_{max} is rejected respectively which signifies the presence of cointegration at 5% level of significance.

3.0. Source of Data

This study employed monthly data from January 2006 to December 2017. The data on the consumer price index (CPI) and exchange rates were obtained from the International Financial Statistics (IFS). The data on the Gross Domestic Product (GDP) , trade openness and oil prices were obtained from the World Bank Development Indicators and the World Bank commodity prices (World Bank pink sheet) respectively. The data on the three months treasury bills were obtained from the Bank of Zambia. The data on the imports from China, Southern African Development Community (SADC) countries and total imports were obtained from the Zambia Statistical Agency. GDP data on a monthly basis is not available. Therefore, GDP data was decomposed into a monthly series using the Quadratic method. Thereafter, the Hodrick-Prescott (HP) filter was used to generate the output gap, which was computed as the difference between the actual and the potential or trend output (GDP). Table 1 provides variable description and summary statistics for the monthly data for the period from January 2006 to December 2017.

Table 1: Variable Description and Summary Statistics-2006-2017

Variable	Description	Mean	Standard Deviation
cpi	Consumer price index (2010=100)	124.29	38.13
exra	Nominal exchange rate (K/USD)	5.93	2.29
oil	US Dollar price of crude oil per barrel	77.41	24.92
output	Output gap in Millions of kwacha	-0.02	0.13
china	Chinese imports (% of Total Imports)	7.01	3.70
region	SADC imports (% of Imports)	52.99	7.20
global	Total imports and Exports (% of GDP)	71.03	9.39
tbil	Three months Treasury Bill Rate (%).	13.53	5.03

4.0. Estimation of Results

4.1. Unit Root Test Results

Unit root tests were conducted to establish the order of integration of the variables. Two unit root tests were conducted namely, the Augmeted Dickey-Fuller (ADF) and the Philip Peron (PP) unit root tests. The null hypothesis of unit root is rejected if the calculated ADF and PP statistics are greater than their respective critical values. Table 2 displays the unit root tests results. The results show that all the variables are stationary at first difference since for all the variables, the ADF and PP test statistics are greater than the critical values at 1% and 5% respectively. This means that all the variables are integrated of order one. Only the region and lnchina variables are stationary both at level and first difference.

Table 2: Unit Root Test

	Level		First Difference		Mackinnon Critical Values	
Variable	ADF	PP	ADF	PP	Critical value	Critical value
	t-stat	t-stat	t-stat	t-stat	1% Level	5% Level
lncpi	-0.6563	-0.4238	-6.8671*	-6.9429*	-3.4768	-2.8818
lnexr	-0.9394	-0.7606	-8.7605*	-8.7388*	-3.4768	-2.8818
lnoil	-2.4064	-2.1184	-7.7645*	-7.8382*	-3.4768	-2.8818
lngap	-1.4538	-1.1680	-5.0825*	-4.3389*	-3.4768	-2.8818
lntbil	-2.5106	-2.2499	-8.7397*	-8.6705*	-3.4768	-2.8818
lnchina	-3.9398*	-5.277*0	-18.064*	-46.267*	-3.4768	-2.8818
region	-4.9347*	-4.6902*	-12.788*	-24.741*	-3.4768	-2.8818
global	-2.0219	-1.6762	-5.3202*	-4.6387*	-3.4768	-2.8818

* and ** denote variable is integrated at 1% and 5% respectively

4.2. Optimal Lag Determination

Before performing the co-integration analysis, it is also vital to establish the optimal lag length for the VECMs. The Akaike Information Criterion (AIC), Hannan and Quinn Criterion (HQ) and Final Prediction Error (FPE) information criterion were used to decide on the optimal lag length of the VECMs. Table 3 below displays results of the information criterion for optimal lag selection. Results in table 3 show that the AIC, FPE and HQ indicate the optimal lag length of two for all VECMs.

Table 3: Lag Length Determination For Four Baseline and Globalization Models

Lag Length Determination For Baseline Model

Endogenous variables: lncpi lnexr lnoil lngap lntbil

Lag	LogL	LR	FPE	AIC	SC	HQ
0	238.5707	NA	2.45E-08	-3.336724	-3.231666	-3.294032
1	1422.949	2267.238	1.57E-15	-19.89927	-19.26892	-19.64311
2	1530.085	197.4365*	4.86e-16*	-21.07264*	-19.91700*	-20.60302*

Lag Length Determination For Chinese Presence Model

Endogenous variables: lncpi lnexr lnoil lngap lntbil lnchina

Lag	LogL	LR	FPE	AIC	SC	HQ
0	172.0497	NA	3.76E-09	-2.372138	-2.246067	-2.320907
1	1372.23	2280.343	2.25E-16	-19.00329	-18.12079	-18.64467
2	1482.438	199.9493*	7.82e-17*	-20.06340*	-18.42449*	-19.39740*

Lag Length Determination For Regional Globalization Model

Endogenous variables: lncpi lnexr lnoil lngap lntbil lnsadc

Lag	Logl	LR	FPE	AIC	SC	HQ
0	344.3013	NA	3.21E-10	-4.832876	-4.706806	-4.781645
1	1563.268	2316.036	1.47E-17	-21.7324	-20.8499	-21.37378
2	1675.164	203.0124	4.98e-18*	-22.81663*	-21.17772*	-22.15063*

Lag Length Determination For Multilateral Globalization Model

Endogenous variables: lncpi lnexr lnoil lngap lntbil global

Lag	LogL	LR	FPE	AIC	SC	HQ
0	457.948	NA	6.33E-11	-6.4564	-6.33033	-6.405169
1	1924.028	2785.553	8.49E-20	-26.88612	-26.00363	-26.5275
2	2076.467	276.5674*	1.61e-20*	-28.54953*	-26.91061*	-27.88352*

4.3 Co-integration Test Results

To establish the presence of cointegration among the variables, cointegration tests proposed by Johansen and Juselius (1990) were performed on all the four VECM models. These are the baseline VECM, the Chinese presence VECM, the regional globalization VECM and the multilateral globalisation VECM. The results for cointegration are in appendix A. The co-integration test results show that the baseline and globalization models have one co-integrating equation since the maximum Eigen statistic and the Trace statistic are greater than their respective critical values at 5% in both cases. On the other hand, the Chinese presence model and the regional globalization model have two co-integrating equations. In both cases, the calculated Trace statistics and maximum Eigen values are greater than their respective critical values at 5%. This means that there is co-integration among variables. It should be noted here that, though the Johansen co-integration test showed that the baseline and multilateral globalization models have one co-integrating equation while the Chinese presence and regional globalization models have two co-integrating equations, all the models were estimated with one co-integrating equation for easy comparison among the models.

4.4. The Baseline VECM Short-run Results.

It should be noted here that, though the information criteria results indicated an optimal lag of two, all the models were estimated with lag one in order to correct serial correlation. Models with lag two were plagued with serial correlation. Table 4 below presents the short run results of the exchange rate pass through to consumer prices from the baseline VECM model.

Table 4: Results of Short Run Equation For Baseline VECM Model Table

Target Variable: lncpi [D(lncpi)]		
Variable	Coef.	Std. Err.
CointEq1	-0.02215	0.00949
D [lncpi(-1)]	0.314**	0.07732
D [lnexr(-1)]	0.0551*	0.01315
D [lnoil(-1)]	-0.00451*	0.00673
D [lngap(-1)]	0.01071	0.03486
D [lntbil(-1)]	-0.00011	0.00422
_Cons	0.00457*	0.00074
R-squared: 0.7042; Chi2 (321.3385-Prob:0.00); AIC:-21.0231; SBIC:-20.211; HQIC:-20.693		
* and ** show significance at 1% and 5% respectively.		

It is clear from table 4 that the exchange rate pass through variable is significant at 1% level. The coefficient of the exchange rate pass through is 0.055. This result means that exchange rate changes significantly influence consumer price inflation in the short run. When the exchange rate increases by 10% in a month, 0.55% of that increase will be passed across to domestic consumer price inflation. As can be observed from the results, it is clear that the exchange rate pass through in the short run is incomplete in Zambia. This confirms that foreign exporters practice pricing to market

in marketing their goods. In other words, foreign exporters absorb part of exchange rate movements into their mark-up to stabilize prices in the export market. This allows them to maintain their market share. This makes exchange rate pass through to be incomplete.

4.5. Baseline VECM Long Run Results

We present the results for the co-integrating equation or the long run equation of the baseline VECM in table 5. Recall that in interpreting the co-integrating equation, signs of coefficients must be reversed. The co-integration equation results tabulated in table 4 indicate that the exchange rate pass through is significantly positive at 1% in the long run. The coefficient of the exchange rate pass through is 1.064. This shows that the exchange rate pass through is complete in the long run. This implies that when the Kwacha depreciates by 100%, domestic price inflation will also increase by 100% in the long run. This means there is a one to one relationship between exchange rate movements and consumer prices in Zambia.

Table 5: Results For Long Run Equation For Baseline VECM Model

Target Variable: lncpi		
Johansen normalization restriction imposed on lncpi		
Variable	Coef.	Std. Err.
lnexr	-1.06405*	0.02901
lnoil	-0.37084*	0.03651
lngap	0.14872	0.11224
lntbil	0.06553*	0.02813
_cons	-1.53026	
R-squared: 0.7042; Chi2 (321.339-Prob:0.00); AIC:-21.023; SBIC:-20.211; HQIC:-20.693		
* and ** show significance at 1% and 5% respectively.		

4.6. Results from the Globalization Models

To examine the impact of globalization on the exchange rate pass through, we have employed three variables of globalization. These are the Chinese presence in Zambia computed as imports from China over total imports; SADC presence as indicator of regional globalization computed as imports from SADC countries over total imports and multilateral globalization (trade openness). This is measured as total exports and imports as a ratio of GDP in Zambia. The study estimated the VECM models by introducing these variables one by one in the baseline VECM model. We could not introduce these variables of globalisation all at once, as that could have introduced multi-collinearity. Tables 5 and 6 show the short and long run results for all the three variables of globalization respectively.

Table 6: VECM Short Run Results

Target Variable is lncpi

	Chinese Presence	Regional Globalization	Multilateral Globalization
Variable	Coefficient	Coefficient	Coefficient
CointEq1	-0.00736	-0.02275**	-0.02104**
	(0.00619)	(0.00893)	(0.00921)
D [lncpi(-1)]	0.34006*	0.30952*	0.30445*
	(0.07984)	(0.07703)	(0.07794)
D [lnexr(-1)]	0.06249*	0.05481*	0.05729*
	(0.01257)	(0.01269)	(0.01304)
D [lnoil(-1)]	-0.00061	-0.00614	-0.00479
	(0.00637)	(0.00664)	(0.00679)
D [lngap(-1)]	0.01637	0.00961	0.01929
	(0.03583)	(0.03449)	(0.03576)
D [lntbil(-1)]	0.00022	-0.00081	-0.00022
	(0.00433)	(0.00416)	(0.00423)
D [lnchina(-1)]	-0.00173		
	(0.00125)		
D [region(-1)]		0.0075	
		(0.00486)	
D [global(-1)]			-0.05524
			(0.06462)
_cons	0.00415*	0.00467*	0.00489*
	(0.00071)	(0.00074)	(0.00077)

* and ** show significance at 1% and 5% respectively.

Standard errors are in parenthesis

Results tabulated in table 6 and 7 show that for the Chinese presence variable, the exchange rate pass through coefficient for the short run and long run are 0.062 and 1.326 respectively. These are positively significant at the 1% level both in the short and long run. The results imply that Chinese presence in Zambia, increases exchange rate pass through to consumer prices. The exchange rate pass through coefficient for the short and long run for the multilateral globalization are 0.057 and 1.127 respectively. Multilateral globalization significantly increases the exchange rate pass through to consumer prices at 1% level in both the short and long run. . Finally, table 6 and 7 also show the results for regional globalization VECM both in the short and long run respectively. For regional globalization, the exchange rate pass through coefficient in the short and long run are

0.055 and 1.062 respectively. The coefficients are significant at the 1% level in both the short and long run.

Table 7: VECM Long Run Results For Globalization Models

Target Variable is lncpi
Johansen normalization restriction imposed on lncpi

	Chinese Presence	Regional Globalization	Multilateral Globalization
Variable	Coefficient	Coefficient	Coefficient
lnexr	-1.32641*	-1.06208*	-1.12695*
	(0.06035)	(0.03031)	(0.04736)
lnoil	-0.48655*	-0.39967*	-0.42044*
	(0.05596)	(0.04048)	(0.04282)
lngap	-0.010190	0.105940	0.100240
	(0.15692)	(0.11758)	(0.11655)
lntbil	0.037280	0.047160	0.037580
	(0.03943)	(0.02941)	(0.03072)
lnchina	0.20446*		
	(0.03466)		
region		-0.14794***	
		(0.07684)	
global			0.25386***
			(0.15318)

*, ** and ***show significance at 1%, 5% and 10% respectively.

4.7. Comparative Analysis of the Exchange Rate Pass Through Coefficients: Baseline and Globalization Models.

To investigate the impact of globalization on the exchange rate pass through to consumer prices in Zambia, we analyse the exchange rate pass through coefficients from the baseline and the globalization VECMs. These are shown in table 8. Table 8 shows the exchange rate pass through coefficients for the short and long run for the baseline and globalisation VECMs. The short and long run results for the baseline and globalization models are tabulated in the second and third columns of table 8 respectively.

Table 8 shows that the short run exchange rate pass through coefficient from the baseline VECM is 0.055. This is significant at the 1% level. When the Chinese presence variable is introduced in the equation, the exchange rate pass through coefficient increases to 0.062. This is also significant at the 1% level in the short run. This is shown in the fourth row of table 8. This result means that

Chinese presence in Zambia significantly increases the exchange rate pass through to domestic consumer price inflation by 13.41% in the short run.

The fifth row of table 8 shows the short run exchange rate pass through coefficient when the regional globalization variable is introduced. The regional globalization coefficient is 0.054. It is significant at 1% level. This coefficient is slightly lower than the baseline exchange rate pass through coefficient of 0.055. This means that, in the short run, regional globalization significantly reduces the exchange rate pass through from 0.055 to 0.054. In other words, regional globalisation reduces the exchange rate pass through by 1.7%,

The sixth row of table 8 displays the short run exchange rate pass through to consumer prices for multilateral globalization. The short run exchange rate pass through coefficient for multilateral globalization is 0.057. This is significant at the 1% level. It is higher than the short run exchange rate pass through coefficient of the baseline model. This means that when we introduce multilateral globalization in the baseline equation, the short run exchange rate pass through slightly increases. The increase in the exchange rate pass through is about 4%.

Our findings show that the introduction of Chinese presence and multilateral globalization into the baseline model increases the exchange rate pass through to consumer prices in the short run. However, the impact of Chinese presence on the exchange rate pass through to consumer prices is greater than that of multilateral globalization. For instance, the results in table 8 indicate that Chinese presence increases the exchange rate pass through to consumer prices by 13.4% while multilateral globalization increases the exchange rate pass through to consumer prices by only 4%. Regional globalization, on the other hand, has a negative effect on the short run exchange rate pass through to domestic consumer prices. Our results are similar to those of Villavicencio and Mignon (2017). Their results showed that multilateral globalization as measured by trade openness increases the exchange rate pass through while regional globalization as measured by intra-European Union (EU) imports as a ratio of total EU imports reduces the exchange rate pass through in the three Eurozone countries. Their study further showed that when multilateral globalization is introduced, the exchange rate pass through to consumer prices becomes complete.

Table 8: Globalization and Exchange Rate Pass Through Coefficients

	Short run	Long run
Model	coefficent	Coefficient
Baseline	0.05510*	-1.06405*
	(-4.1900)	(-36.670)
Chinese Presence	0.06249*	-1.32641*
	(-4.9700)	(-21.980)
Regional Globalization	0.05418*	-1.06208*
	(-4.3200)	(-35.040)
Multilateral Globalization	0.05700*	-1.12695*
	(-4.3900)	(-35.040)

* and ** show significance at 1% and 5% respectively.
Standard errors in parenthesis

Table 8 also displays the long run exchange rate pass through results for the baseline and globalization models. Table 8 shows that the long run exchange rate pass through coefficient is 1.064 for the baseline model. This is significantly positive at the 1% level. When the Chinese presence variable is introduced in the baseline model, the exchange rate pass through coefficient increases from 1.064 to 1.326. This is shown in the fourth row column three of table 8. It is clear that in the long run, Chinese presence significantly increases the exchange rate pass through to consumer price inflation by 24.66%.

We also show the long run exchange rate pass through coefficient when the regional globalization variable is introduced. The regional globalization coefficient is estimated at 1.062. It is significant at the 1% level. The long run exchange rate pass through coefficient for regional globalization is slightly lower than the baseline exchange rate pass through coefficient of 1.064. Thus, in the long run, regional globalization significantly reduces the exchange rate pass through from 1.064 to 1.062. In other words, in the long run, regional globalization reduces the exchange rate pass through by about 0.19 %.

Table 8 also shows the exchange rate pass through for multilateral globalization. The long run exchange rate pass through coefficient for multilateral globalization is 1.127. This is significant at the 1% level. It is also higher than the long run exchange rate pass through coefficient of the baseline model. This result means that multilateral globalization increases the long run exchange rate pass through. The increase in the exchange rate pass through due to multilateral globalization is about 5.91%.

It is, therefore, clear from our findings that Chinese presence and multilateral globalization increases the exchange rate pass through to consumer prices in both the short and long run. However, the impact of Chinese presence is greater than that of multilateral globalization. Regional globalization, on the other hand, has a negative effect on the exchange rate pass through to consumer prices. This is both in the short and long run. There could be reasons why Chinese

presence and multilateral globalization increase the exchange rate pass through while regional globalization reduces it. Chinese presence and multilateral globalization are likely to increase the exchange rate pass through to consumer prices because imported goods are quoted in US Dollars. Fluctuations in the US Dollar is likely to increase the price of imported goods. This in turn may increase the exchange rate pass through to consumer prices. This explanation is in line with globalization theory. Globalization theory argues that globalization may lead to an increase in the exchange rate pass through because the more open an economy is, the larger the quantities of imports that enter the domestic economy. This means that exchange rate fluctuations impact a wider category of goods. This is especially so if the imported goods account for a bigger percentage of goods purchased in the domestic economy. This may cause the overall price index in the domestic economy to be more sensitive to external factors. One such external factor is the exchange rate (Villavicencio and Mignon, 2017).

Our findings also show that regional globalization has a negative effect on the exchange rate pass through to domestic consumer prices in both the short and long run. This maybe because regional trade may involve cross border trade in local regional currencies as opposed to global trade where vehicle currencies such as the US Dollar is used for trade. This may have a negative effect on the exchange rate pass through, as has been observed, both in the short and long run. In addition, one stream of globalization theory argues that globalization can have a negative effect on the exchange rate pass through in the sense that trade integration leads to higher international competition among multinational firms. This may cause exporters to absorb part of the exchange rate changes so as to maintain their market share in the export market. This may cause incomplete exchange rate pass through to prices (Ozkhan & Erden, 2015). Finally, when trade costs become low as a result of regional trade integration, exchange rate pass through may reduce (Ozkhan & Erden, 2015).

4.8. Diagnostic Tests and Stability for all VECM.

The estimated standard errors of the VECM output from STATA output are robust to heteroscedasticity. Therefore, we only did serial correlation, normality and stability tests. Table 9 below shows the VECM diagnostic tests for all the models namely the baseline and the globalization models. The results in table 9 for all the VECM models show that all the four VECMs do not suffer from serial correlation because in all the cases the probability of the LM test statistic is above 5%. However, all the models suffer from non-normality of residuals. In all cases the probability of the Jarque Bera test is less than 5%. However, non-normality is expected due to a number of reasons. First, financial data such as price and exchange rate data normally come from a process with fat tails, which can cause residuals to be non-normal. Second, excessive appreciation or depreciation of the exchange rate can cause non-normality. Finally, rapid changes in the condition of an economy can also lead to non-normality of residuals.

Table 9: VECM Diagnostic Tests For All VECM Models

VECM Diagnostic Tests For Baseline Model		
Test Type	LM-Stat/ Chi-square	Probability
Lagrange Multiplier test for Serial Correlation	1 18.3844	0.8256
VECM-Jarque Bera-Residual Normality test	555.3140	0.0000
VECM Diagnostic Tests For Regional Globalization Model		
Test Type	LM-Stat/ Chi-square	Probability
Lagrange Multiplier test for Serial Correlation	33.67200	0.5798
VECM-Jarque Bera-Residual Normality test	1756.4610	0.0000
VECM Diagnostic Tests For Chinese Presence Model		
Test Type	LM-Stat/ Chi-square	Probability
Lagrange Multiplier test for Serial Correlation	38.43780	0.3597
VECM-Jarque Bera-Residual Normality test	1673.8920	0.0000
VECM Diagnostic Tests For Globalization Model		
Test Type	LM-Stat/ Chi-square	Probability
Lagrange Multiplier test for Serial Correlation	30.78590	0.7147
VECM-Jarque Bera-Residual Normality test	2037.6650	0.0000

The stability test for all the VECM was also conducted. The condition for VECM stability is that if there are *r* co-integrating relations in a *k* variable model, the companion matrix will have *k-r* unit Eigenvalues. If the remaining *r* Eigenvalues are less than one, the VECM is stable (Johansen, 1995; Nikolic and Zoroja, 2016; Zou, 2018). The stability tests results displayed in appendix B show that all the VECMs are stable because they satisfy the condition of stability.

5.0. Conclusion and Policy Recommendations

Our study examined the impact of globalization on the exchange rate pass through to domestic consumer prices. We have found that Chinese presence and multilateral globalisation increase the exchange rate pass through to consumer prices in both the short and long run in Zambia. However, the impact of Chinese presence on the exchange rate pass through is greater than that of the impact of multilateral globalization. One might argue that Chinese presence and multilateral globalization increase the exchange rate pass through because imported goods are quoted in the US Dollar. Consequently, fluctuations in the US Dollar are likely to increase the price of imported goods, which will subsequently increase the exchange rate pass through to consumer prices.

Our findings have important implications for trade policy and domestic inflation. This is in respect to trade with China and to the participation of regional trade arrangements. There might be a need

to engage China in a bilateral trade agreement. There are two main reasons for that. Firstly, this is in order to reduce trade costs and trade tariffs on goods imported from China. This may have the negative effect on the exchange rate pass through to consumer prices and consequently on inflation in Zambia. Secondly, Zambia could start trading directly in Chinese Yuan when trading with China as opposed to the US Dollar. Trading directly with Chinese currency may have the negative effect on the exchange rate pass through to consumer prices. This will have a stabilizing effect on the Zambian Kwacha. It should be mentioned here that, trading directly with Chinese currency should be considered as a long term option as it cannot be implemented in the short term. Finally, results in this study have also shown that regional globalization reduces exchange rate pass through to consumer prices in Zambia. This is attributed to cross border trade in the region. This signals to policy makers that the pursuit for regional integration is a worthwhile policy. There should therefore, be strengthened efforts to increase participation in regional trade arrangements as part of the strategy to domestic inflation in Zambia.

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APPENDIX A

Table A1: Johansen Cointegration Test for Baseline Model

Cointegration Test [Trend assumption: Linear deterministic trend (In First Difference-1 lag)]

Unrestricted Cointegration Rank Test (Trace)

Ho	Ha	Egeinvalue	Trace Statistic	5% Critical value	Probability
None*	At most 1	0.283058	92.07928	69.81889	0.0003
At most 1	At most 2	0.137327	44.82735	47.85613	0.0937
At most 2	At most 3	0.092964	23.85123	29.79707	0.2068
At most 3	At most 4	0.067900	9.995807	15.49471	0.2811
At most 4	At most 5	7.81E-05	0.011084	3.841466	0.9159

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Ho	Ha	Eigenvalue	Max-Egein Statistic	5% Critical value	Probability
None*	At most 1	0.283058	47.25193	33.87687	0.0007
At most 1	At most 2	0.137327	20.97612	27.58434	0.2777
At most 2	At most 3	0.092964	13.85542	21.13162	0.377
At most 3	At most 4	0.0679	9.984723	14.2646	0.2129
At most 4	At most 5	7.81E-05	0.011084	3.841466	0.9159

Note: * and ** denotes rejection of the hypothesis at the 0.05 and 0.10 level respectively.

Table A2: Johansen Co-integration Test for Chinese Presence Model

Co-integration Test [Trend assumption: Linear deterministic trend (In First Difference-2 lags)]

Unrestricted Co-integration Rank Test (Trace)

Ho	Ha	Eigenvalue	Trace Statistic	5% Critical value	Probability
None*	At most 1	0.326582	142.5060	95.75366	0.0000
At most 1*	At most 2	0.249968	86.36081	69.81889	0.0014
At most 2	At most 3	0.134903	45.51602	47.85613	0.0816
At most 3	At most 4	0.099493	24.93835	29.79707	0.1637
At most 4	At most 5	0.06821	10.05708	15.49471	0.2764

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Ho	Ha	Eigenvalue	Max-Eigen Statistic	5% Critical value	Probability
None*	At most 1	0.326582	56.1452	40.07757	0.0004
At most 1*	At most 2	0.249968	40.84479	33.87687	0.0063
At most 2	At most 3	0.134903	20.57767	27.58434	0.3026
At most 3	At most 4	0.099493	14.88127	21.13162	0.2973
At most 4	At most 5	0.068210	10.03194	14.2646	0.2098

Note: * and ** denotes rejection of the hypothesis at the 0.05 and 0.10 level respectively.

Table A3: Johansen Co-integration Test for Regional Globalization Model

Co-integration Test [Trend assumption: Linear deterministic trend (In First Difference-2 lags)]

Unrestricted Co-integration Rank Test (Trace)

Ho	Ha	Eigenvalue	Trace Statistic	5% Critical value	Probability
None*	At most 1	0.251171	113.7775	95.75366	0.0016
At most 1*	At most 2	0.214824	72.99406	69.81889	0.0273
At most 2	At most 3	0.133807	38.89353	47.85613	0.2645
At most 3	At most 4	0.080775	18.63931	29.79707	0.5190
At most 4	At most 5	0.04678	6.763653	15.49471	0.6053

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Ho	Ha	Egeinvalue	Max-Egein Statistic	5% Critical value	Probability
None*	At most 1	0.251171	40.78345	40.07757	0.0416
At most 1*	At most 2	0.214824	34.10052	33.87687	0.0470
At most 2	At most 3	0.133807	20.25422	27.58434	0.3238
At most 3	At most 4	0.080775	11.87566	21.13162	0.5600
At most 4	At most 5	0.046780	6.755227	14.26460	0.5185

Note: * and ** denotes rejection of the hypothesis at the 0.05 and 0.10 level respectively.

Table A4: Johansen Co-integration Test for Multilateral Globalization Model

Co-integration Test [Trend assumption: Linear deterministic trend (In First Difference-1 lag)]

Unrestricted Co-integration Rank Test (Trace)

Ho	Ha	Eigenvalue	Trace Statistic	5% Critical value	Probability
None*	At most 1	0.295988	108.9600	95.75366	0.0045
At most 1	At most 2	0.165510	59.12363	69.81889	0.2633
At most 2	At most 3	0.103619	33.43095	47.85613	0.5331
At most 3	At most 4	0.075656	17.89765	29.79707	0.5737
At most 4	At most 5	0.044872	6.726352	15.49471	0.6097

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Ho	Ha	Eigenvalue	Max-Eigen Statistic	5% Critical value	Probability
None*	At most 1	0.295988	49.83639	40.07757	0.0030
At most 1	At most 2	0.16551	25.69268	33.87687	0.3398
At most 2	At most 3	0.103619	15.53330	27.58434	0.7050
At most 3	At most 4	0.075656	11.17130	21.13162	0.6302
At most 4	At most 5	0.044872	6.519179	14.26460	0.5475

Note: * and ** denotes rejection of the hypothesis at the 0.05 and 0.10 level respectively.

APPENDIX B

Table B1: AR Roots For VECM Stability-Baseline Model

Root	Modulus
1	1
1	1
1	1
1	1
0.7476525	0.747652
.5030407 + .3037406i	0.587629
.5030407 - .3037406i	0.587629
0.4806224	0.480622
.211496 + .1057451i	0.236458
.211496 - .1057451i	0.236458

The VECM specification imposes 4 unit moduli.

Table B2: AR Roots For VECM Stability- Chinese Presence Model

Root	Modulus
1	1
1	1
1	1
1	1
1	1
0.7692258	0.769226
0.4962187	0.496219
.4014327 + .2799581i	0.489413
.4014327 - .2799581i	0.489413
-0.3315018	0.331502
.2029378 + .09583388i	0.224428
.2029378 - .09583388i	0.224428

The VECM specification imposes 5 unit moduli.

Table B3 : AR Roots For VECM Stability- Regional Globalization Model

Root	Modulus
1	1
1	1
1	1
1	1
1	1
0.7491668	0.749167
.4881949 + .3268922i	0.587531
.4881949 - .3268922i	0.587531
0.518195	0.518195
-0.2279055	0.227905
.19657 + .06834572i	0.208113
.19657 - .06834572i	0.208113

The VECM specification imposes 5 unit moduli.

Table B4: AR Roots For VECM Stability- Globalization Model

Root	Modulus
1	1
1	1
1	1
1	1
1	1
0.7811515	0.781152
0.6751313	0.675131
.4950766 + .3334227i	0.596885
.4950766 - .3334227i	0.596885
0.4589189	0.458919
.214564 + .07248171i	0.226476
.214564 - .07248171i	0.226476

The VECM specification imposes 5 unit moduli.