ANALYSIS OF THE RELATIONSHIP BETWEEN PURCHASING POWER PARITY, EXCHANGE RATE AND INFLATION IN TERMS OF THE DEPRECIATION RATE OF MYANMAR CURRENCY

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Abstract

This empirical study examines the cause and effect and the relationship between purchasing power parity, exchange rate, and inflation in terms of the depreciation rate of Myanmar currency which is Kyats in terms of US dollar during 1990- 2015. This research concerns the pros and cons of the depreciation rate of Myanmar currency as an increased amount of export of Myanmar yields literally a less amount of import. In this situation, Myanmar suffers from a negative effect of the depreciation rate of Myanmar currency (in terms of US dollars). The advantages of depreciates rate of currency in reducing the government debt, shrinking the trade deficit, and achieving the economic policy of a country should be given previously over the higher export rate. The analysis would undergo time-series for 26 observations. The dataset would be tested under the Levin, Lin and Chu test, Augmented Dickey-Fuller test and Phillip-Peron test for stochastic trend. At the 01% - 05 % significant level, the hypothesis is that a variable has unit root test for the Purchasing Power Parity (PPP), the Inflation (INF) and the Exchange rate (Ex) are rejected at 1st difference level. They are found to be moderately correlated to each other. The dataset estimated for analysis by equation shows the PPP has negative long-run relationship with both the INF and the Ex. Furthermore, there is seen to be no short-run relationship between PPP and Ex but PPP is short-run related to INF. Under Granger Causality test to find cause and effect between the variables, the results are that (1) PPP Granger Causes Ex, but Ex does not, (2) INF Granger Causes PPP, but PPP does not, and (3) Ex and INF do not Granger Cause each other.

Keywords*: Purchasing Power Parity, Exchange Rate, Inflation,* Granger

1. Introduction

Myanmar is rising out of decades of isolation with much hope and support from the global and regional communities. The country is highly potential for quick growth and development by virtue of its rich natural resources, adequate labor force, and strategic location between the two economic giants of the region: the People's Republic of China and India, and ports out to seas. As Myanmar is during the democratic transition by reforming Myanmar Economy and taking processes to peace between Tatmadaw and Ethnic Armed Organizations (EAOs) at the same time as a de facto president took a seat in 2015, the country paces to fulfill the Sustainable Development Goals by 2025.

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Strategic ports out to link the world economy by Special Economic Zones (SEZs) can unlock the growth potential arising from increased trade and cross-border investment. Myanmar is encouraged by ties with the Association of Southeast Asian Nations (ASEAN) and is utilize for its geographic position as a bridge between South and Southeast Asia, which creates a bunch of new opportunities. Working in cooperation with other countries will provide a solid platform for Myanmar's renaissance.

The following table shows strengths, constraints, opportunities and risks in Myanmar. As de jure leader Daw Aung San Suu Kyi undertakes the reforming of the country, constraints and risks are not issues to consider investment in the country.

Table 1: Strengths, Constraints, Opportunities and Risks in Myanmar

Strengths	**Constraints**
1. Strong commitments to reform economically and politically 2. Adequate labor-force to attract foreign investment 3. Rich supply of natural resource-land, water, gas, and minerals 4. Abundant agricultural resources to be exploited for productivity improvement 5. Tourism potential	1. Weak macroeconomic management and lack of experience with market mechanisms 2. Limited fiscal resource mobilization 3. Underdeveloped financial sector 4. Inadequate infrastructure, particularly in transport, electricity access and telecommunications 5. Low education and health achievement 6. Limited economics diversification
Opportunities	**Risks**
1. Strategic location 2. Potential of renewable energy 3. Potential for investment in a range of sector	1. Risks from economic reform and liberalization 2. Risks from climate change 3. Pollution from economic activities 4. Tension from internal conflicts

Source: ADB

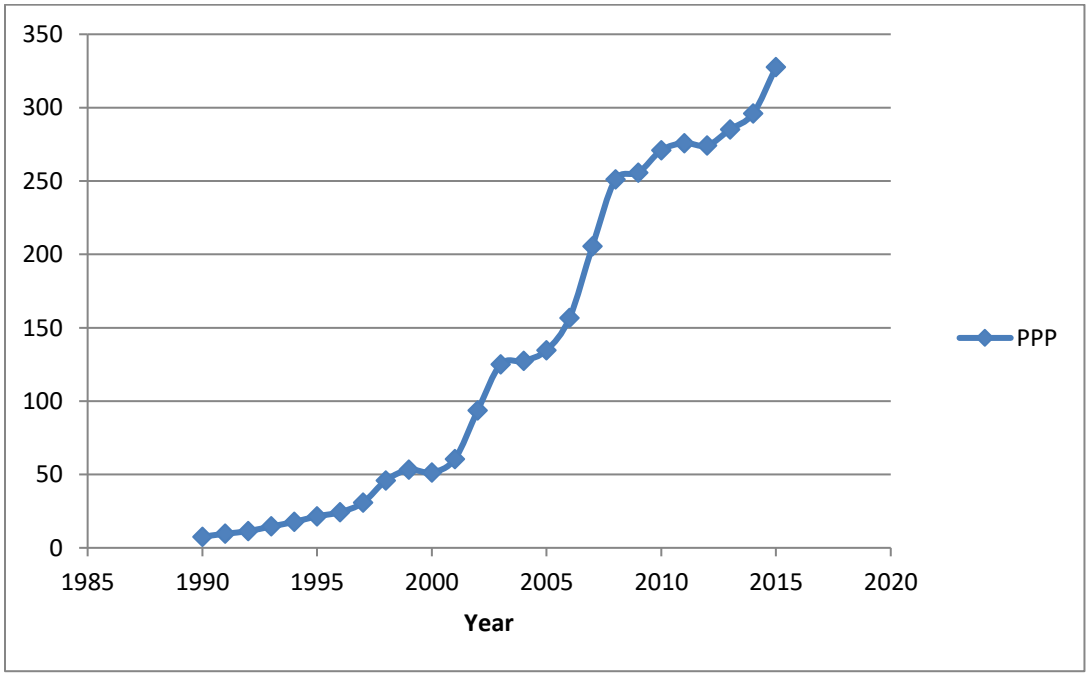
The world's Purchasing Power Parity (% of GDP) is equal to 87,250,000 million USD. The Purchasing Power Parity (% of GDP) of Myanmar is 111 billion USD with a global rank of 70 and a positive growth of 60.8% in five years during 2008 to 2013.

Table 2: The world rank of purchasing power parity in 2013

Country Name	Global Rank	GDP - Purchasing Power Parity (billions of $)
Angola	65	132
Puerto Rico	66	127
Cuba	67	121
Ethiopia	68	118
Uzbekistan	69	113
Myanmar **	70	111
Tunisia	71	108
Syrian Arab Republic	72	108
Bulgaria	73	105
Azerbaijan	74	103
Dominican Republic	75	101

Source: Meconmeter

Figure 1: Purchasing Power Parity (PPP) of Myanmar



Source: World Bank

Table 3: Currency Appreciation and Depreciation Rate

Yr	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CurrencyAppriciation / Depriciation		0.95	2.86	0.81	4.06	0.45	0.42	5.28	1.58	0.94

Yr	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CurrencyAppriciation / Depriciation	3.53	3.5	1.62	7.83	5.54	0.34	0.34	3.94	3.2	2.51

Yr	2010	2011	2012	2013	2014	2015
Currency Appriciation / Depriciation	1.06	3.37	99.15	31.37	5.16	15.33

*White box: Currency Appreciation rate in percentage, *Red box: Currency Depreciation rate in percentage
Source: Author's calculation

The economy is significantly stagnant, since 1997, owing to poor macroeconomic management, a large public sector debt, economic sanctions, and a slow surge in foreign investment. GDP in current US dollars was estimated at 56 billion USD, making per capita income $876 ($1,405 in purchasing-power parity terms) in 2012: one of the bottom-line rates in Asia.

Cross-country analysis also suggests that countries without significant growth have been unable to achieve significant poverty reduction. But the extent to which growth contributes to poverty reduction depends on a country's specific circumstances and policies. Growth alone is often found insufficient for effective poverty reduction.

The above paragraph means that growth in Myanmar is uncertain and will depend on the speed of technical progress, changes in country-specific structural conditions, and, more importantly, on the implementation of economic reforms and policies. Several recent studies have proposed various potential growth paths. The Asian Development Bank suggests that Myanmar could grow 7%–8% every year and achieve real per capita GDP ranging from $2,000 to $3,000 by 2030. The McKinsey Global Institute (2013) argues that the country has the potential to achieve growth of 8% a year by tapping key sectors, particularly agriculture, energy and mining, financial services, infrastructure, manufacturing, telecommunications, and tourism. This would push GDP up to over $200 billion, with per capita GDP at $5,100 in purchasing power parity by 2030.

Myanmar is emerging from five decades of isolation, both economically and politically. With its rich natural resources and strategic location, the country shows good potential for growth. Myanmar could become one of the next rising star in Asia if it can successfully leverage its rich endowments—such as its natural resources, labor force, and geographic advantage—for economic development and growth. Myanmar could grow at 7%–8% per year for a decade or more and raise its per capita income to $2,000–$3,000 by 2030.

Every country's development experience is unique, shaped by its specific history, culture, domestic conditions, and the prevailing international environment. Yet important lessons can also

be drawn from the experiences of other successful countries. Three broad lessons are apparent from Asia's rise. First, inflation must be kept low and stable through effective macroeconomic management. Second, high domestic savings levels are needed to finance investment. And third, agriculture is important but the economy needs to undergo a structural transformation to industry and services as a means to improve productivity, expand exports, and create employment. Along with these broad lessons, Asia's growth has required investments in human capital and efficient infrastructure, the creation of sound institutions and social stability, and the use of the market mechanism to allocate resources.

Asia would open Myanmar to a range of new opportunities. About 26% of ASEAN's total trade takes place among member countries. The group's trade with the PRC has grown significantly-from less than 4% in 2000 to more than 10% in 2011. During the same period, the share of ASEAN's trade with industrialized economies has declined from 54% to 36%. The examples of Cambodia and Viet Nam show that Myanmar can leverage its affiliation with sub regional groups and expand from there.

Key development agendas include the following:

- **Provide macroeconomic stability.** A stable macro environment provides a foundation for investment and long-term growth. Key elements of sound macroeconomic policy include low and stable inflation; a sustainable fiscal position; and a flexible, market-based exchange rate.
- **Mobilize resources for investment.** Increased domestic and foreign savings are critical to meeting the enormous requirements of the private and public sectors. In addition, higher government revenues (e.g., taxation) and more efficient financial intermediation will also help to provide sustainable financing for development.
- **Improve infrastructure and human capital.** The removal of structural impediments in the key areas of education, health, and infrastructure can provide a basis for human capital development and improve connectivity.
- **Diversify into industry and services, while improving agriculture**. Broadening the economic base beyond primary industries can raise productivity and value addition. Yet agriculture, fisheries, and resource industries are not to be neglected as they contain considerable potential for expansion.
- **Reduce the state's role in production**. A further reduction in the government's ownership and control of productive activities can help spur competition and increase investment by creating a level playing field.
- **Strengthen government institutions**. Economic transformation can be supported by effective government institutions, although building institutions and their capacity may take time. Attention might focus on nurturing administrative and regulatory systems; managing resources; and, most importantly, enhancing the capabilities of government personnel throughout the system.

Economic activity in Myanmar did not pick up strongly during the 1980s and 1990s though in the 1960s, Myanmar was one of Asia's leading economies. Its per capita income in 1960 was about $670—more than three times that of Indonesia, more than twice that of Thailand, and slightly

lower than that of the Philippines (Booth 2003). However, the IMF estimates that in 2010, Myanmar had Southeast Asia's lowest per capita GDP in purchasing power parity despite relatively good growth during 2000– 2010.

Inflation stood at 4.2% for 2011 and is expected to rise to 6.2% in 2012 as the effect of the recent moderation in food prices fades. These signal-digit rates, however, hide the fact that the inflation rate was historically high and variable. The price level in Myanmar nearly quadrupled from 2001 to 2007 with an average annual inflation of 25.3%. While Myanmar's official figures may not be fully reliable, it is clear that the country has experienced periods of exceedingly high inflation. The monetization by the Central Bank of Myanmar (CBM) of government debt has contributed to this high inflation.

Myanmar announced an overhaul of its complex exchange rate system in March 2012 as a part of broad reforms to modernize its economy. Myanmar's multiple exchange rate regime included official, semi-official, and unofficial rates. The official government rate, which was fixed at about 6 Kyats per US dollar, was widely ignored, as the running rate on the black market averaged about 800Kyats per US dollar. The new managed floating exchange rate regime, which came to effect in April 2012, has a single, market-determined rate. (Park, Khan & Vandenberg, 2012)

2. Literature review

At the heart of the modelling the relationship between exchange rate and interest rate and inflation are theories and postulates that underpin volatility in their periodic values, which include but are not limited to:

2.1 Exchange Rate Theories

Exchange rate is one of the basic economic tools that are used to correct a number of economic misalignments facing nations. It has been widely applied in most structural adjustment programmes across the world. It has been used as a strategic policy vehicle for directing the direction of flow of economic resources (skilled labour, Capital, managerial know-how, and foreign exchange) into import and export sectors. However, for this to result in sustainable economic growth and development stability must be maintained in exchange rate regime (Schaling, 2008). A number of theories have been postulated for the determination of exchange rate.

They include Purchasing Power Parity (PPP) Theory, Interest Rate Parity theory, Demand and Supply Theory, Portfolio-balance Theory.

2.1.1 Purchasing Power Parity (PPP) Theory

The purchasing power theorem as posit by (Kuttner & Posen, 2010) assumes that the normal equilibrium rate of exchange existing between two inconvertible currencies is determined by the ratios of their purchasing powers, hence the rate of exchange tends to be established at the point of equality between the purchasing powers of the two currencies. In essence, when one

country's inflation rate rises relative to that of another country, decreased exports and increased imports depress the country's currency. The theory attempts to quantify inflation-exchange rate relationship by insisting that changes in exchange rate are caused by the inflation rate differentials (Allsopp, Kara, & Nelson, 2006).In absolute terms, PPP theory states that the exchange rate between the currencies of two countries equals the ratio between the prices of goods in these countries (Khodeir, 2012), implying that exchange rate must change to adjust to the change in the prices of goods in the two countries. However, the expected inflation differential equals the current spot rate and the expected spot rate differential (Kamin, 1997).

The PPP in its simplest form asserts that in the long run, changes in exchange rate among countries will tend to reflect changes in relative price level. (Kamin & Klau, 2003) are of the view that if exchange rates are floating, the observed movement can be explained entirely in terms of changes in relative purchasing power, while if it is fixed, equilibrium can be determined by comparing satisfactory methods for:

- Explaining the observed movements in exchange rates for countries whose rates were floating
- Determining equilibrium parity rates for those countries whose surviving rates were out of line with post war market conditions.
- Assessing the appropriateness of an exchange rate.

Despite criticisms of PPP theory, the theoretical foundation and explanation may sound reasonable and acceptable but its practical application in real situation may be an illusion, especially in the long run.

The pitfalls notwithstanding, PPP theory is generally a sine-quo-non in the exchange rate determination literature, and continues to remain relevant in the determination of exchange rate among countries of the world (Nucu, 2011).

2.1.2 Interest Rate Parity Theory

The interest rate parity characterizes the relationship between interest rate and exchange rate of two countries. It assumes that the exchange rate of two countries will be affected by their interest rate differentials. The interest rate parity tries to relate interest rate of one country to the exchange value of her trading partner. In other words, interest rate change in a country is a reflection of the exchange value of the currency of that country and her trading partners(s).

Accordingly, the difference in the rate of interest in two countries should be able to explain the exchange value of the currencies of the countries. Thus, when interest rates are low, exchange value of the domestic currency in relation to international currencies will be low (devaluation). The reverse is the case if interest rates are high. But where relative interest rates levels exist, an increase in a country's interest rates will lead to a depreciation of its currency (Bergen, Hawton, Waters, Cooper, & Kapur, 2010). This is the same as in the traditional flow model, which posits that increase in domestic interest rate relative to foreign interest rate causes an appreciation of the exchange rate through induced capital inflow. Thus, changes in interest rate (interest rate differentials) can cause major changes in the exchange rates (Carrera & Restout, 2008).In the views

of Abdul & Husain (2010) the nexus between exchange rate and interest rates can be explained in the following steps:

- Increasing domestic present interest attracts more foreign capital
- Increasing preference to purchase more foreign-dominated bonds.
- Increasing demand for foreign currency put pressure on the value of foreign currency.

This therefore goes to show that the relationship between interest rate changes and the exchange rate volatility is usually inverse relationship. Hence, the interest rate structures between two economies show their exchange rates. Interest rates differentials are therefore a major determinant of exchange rate.

2.1.3 Inflation Theories

Demand Pull: The demand pull suggests that the inflation occurs when the aggregate demand for goods and services is greater than aggregate supply, such that the resultant excess cannot be satisfied by running down the existing stock, diverting surplus from exports market to the domestic market.

The cost push school: The cost push school suggests that inflation arises from increase in the cost of production, rise in wages from trade union activities and embodies a socio-political view (Alpanda, et al; 2010). The cost push views attribute inflation to a host of non-monetary supply oriented influences of shocks that raise costs and consequently price.

The structuralists: The structuralists according to (G. E. Ezirim, 2012) explains the long run inflationary trend in developing countries in terms of structural rigidities, market imperfection and social tension, relative inelasticity of food supply, shortage of foreign exchange, contracting protective measures, rise in demand for food, fall in export earnings, hording import substations, industrialization, political instabilities.

The Monetarists: The Monetarists opined that "inflation is always and everywhere" hence prices tend to rise when the rate of increase in money supply is greater than the rate of increase in real output of goods and services. This is explained, is in line with Fisher's equation of exchange.

$$MV = PT \qquad (1)$$

Where: M = Supply of money
V = Velocity of money in circulation
P = Price of goods and services and
T = the transaction (output)

On the other hand, it is argued imported inflation arises from international trade where inflation is transmitted from inflationary country to the other, especially during the period of rising price all over the world.

2.2 Empirical Literature

One of the view is that the high interest rate policy does not defend currencies against speculative attacks; implying that there is a stinking lack of any systematic association between interest rates and the outcome of speculative attack. However, (Utami & Inanga, 2009) examined the influence of interest rate differentials on exchange rate changes based on the IFE theory and

the influence of inflation rate and interest rate differentials in Indonesia using quarterly and yearly data for the interest , inflation differentials and changes in exchange rate over a five year period, 2003-2008, using four foreign countries namely the USA, Japan, Singapore and the UK, and Indonesia as the home country, found that interest rate differentials have positive but no significant influence on changes in exchange rate for the USA, Singapore and the UK, relative to that of Indonesia. On the other hand, interest rate differentials have negative significant influence on changes in exchange rate for Japan.

The results also showed that several inflation rate differentials have significant positive influence on interest rate differentials. Another study investigating the relationship between expected inflation and nominal interest rates in South Africa and the extent to which the Fisher Effect hypothesis holds using 3months banker's acceptance rate and the 10 year government bond rate to proxy both short and long term interest rates, found the existence of long term unit proportional relationship between nominal interest rates and expected inflation using Johansen co-integration test. (Nucu, 2011) examining the influence of gross domestic product (GDP), inflation rate, money supply, interest rates and balance of payments on exchange rate of Romanian currency against the most important currencies (EUR, USD) for the period 2000 to 2010 and found an inverse relationship between these variable, GDP, and money supply. On the other hand a direct relationship was found between EUR/RON, Inflation and Interest rate. The validation of the correlation between exchange rate and balance of payment could not be established because it is not significant. (Odedokun, 1995) using data from 35 countries for the period 1971 to 1990, obtained results suggesting that monetary growth, rate of domestic currency depreciation, and the expectation of inflation have positive effects on inflation, while expansion of per capita food production as well as overall economic growth serve to reduce inflation rates.
(C. Ezirim, Nwibere, & Emecheta, 2012) investigated the interdependencies between exchange rates and inflation **r**ates behavior in Nigeria. Using autoregressive distributed lag analytical framework, they found that exchange rates movements and inflation spiral are cointegrated, associating both in the short run and in the long run. Thus, indicating that in a regime of inflation targeting, policy aimed at exchange rates manipulation becomes a proper monetary action, and vice versa. The present study includes interest rate as one of the explanatory variables given that it is one of the important monetary phenomena, which is a key driver of exchange rate in an economy.

3. Methodology

3.1 Research Design

The analysis of the relationship between Purchasing Power Parity (PPP), Exchange Rate (EX) and Inflation Rate (INF) was under taken under Vector Error Correlation Model (VECM) for equation estimation. The research is going under the process of econometrics to study relations and Granger Causality Effect between the endogenous variables which is PPP and the exogenous variables which are EX and INF.

The time-series dataset covering the time period 1990 to 2015 in Myanmar is tested for being not stochastic by Levin, Lin and Chu Unit Root test, Augmented Dickey Fuller Unit Root test and Philip-Peron Unit root test, then co-integration test. Eventually, Vector Error Correction Model (VECM) test is to estimate an econometric equation. Whereby, the relationship between PPP, EX and INF is to distinguish positive or negative. Moreover, to find out cause and effect of the endogenous variable and exogenous variables, the Granger Causality test was used.

3.2 Augmented Dicker Fuller Test

The augmented Dickey–Fuller (ADF) statistic, used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit root at some level of confidence. **Augmented Dickey–Fuller (ADF) test** is conducted by "augmenting" the preceding three equations by adding the lagged values of the dependent variable *_Yt* . To be specific, suppose we use eq(1). The ADF test here consists of estimating the following regression:

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \delta_1 \Delta Y_{t-1} + \cdots + \delta_{p-1} + \Delta Y_{t-p=1} + \varepsilon_t \qquad (2)$$

Where,

α = a constant,
β = the coefficient on a time trend
p = the lag order of the autoregressive process.
Imposing the constraints α = 0 and β = 0 corresponds to modelling a random walk and using the constraint corresponds to modeling a random walk with a drift. By including lags of the order p the ADF formulation allows for higher-order autoregressive processes. This means that the lag length p has to be determined when applying the test. One possible approach is to test down from high orders and examine the t-values on coefficients.

3.3 Phillip-Perron Test

Phillips and Perron (1988) developed a number of unit root tests that have become popular in the analysis of financial time series. The Phillips-Perron (PP) unit root tests differ from the ADF tests mainly in how they deal with serial correlation and heteroskedasticity in the errors. In particular, where the ADF tests use a parametric auto regression to approximate the ARMA structure of the errors in the test regression, the PP tests ignore any serial correlation in the test regression. The test regression for the PP tests is:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + \mu_t \qquad (3)$$

where error term (u_t) is level I(0) and may be heteroskedastic. The PP tests correct for any serial correlation and heteroskedasticity in the errors u_t of the test regression by directly modifying the test statistics tπ=0 and T ˆπ. These modified statistics, denoted Zt and Zπ, are given by

$$Z_t = T\hat{\pi} - 1/2 \left[\frac{T^2 SE\,\hat{\pi}}{\hat{\sigma}^2}\right] [\lambda^2 - \hat{\sigma}^2] \qquad (4)$$

The terms $\widehat{\boldsymbol{\sigma}}^{\boldsymbol{2}}$ and $\boldsymbol{\lambda}^{\boldsymbol{2}}$ are consistent estimates of the variance parameters.
The sample variance of the least squares residual ˆut is a consistent estimate of σ2, and the Newey-West long-run variance estimate of ut using ˆut is a consistent estimate of λ2.

Under the null hypothesis that $\pi = 0$, the PP Zt and Zπ statistics have the same asymptotic distributions as the ADF t-statistic and normalized bias statistics. One advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroskedasticity in the error term ut. Another advantage is that the user does not have to specify a lag length for the test regression.

3.4 The Johansen Cointegration Test

The Johansen test uses the likelihood ratio to test for cointegration. Up to (r-1) co-integrating relationships may exist between a set of r variables. The hypothesis of cointegration is accepted if the number of cointegrating relationships is greater than or equal to one. The decision rule compares the likelihood ratio to the critical value for a hypothesised number of cointegrating relationships. If the likelihood ratio is greater than the critical value, the hypotheses of co-integration is accepted, if not it is rejected.

Johansen co-integration test defines the numbers of co-integrating vectors in a nonstationary time series of Vector Autoregressive (VAR) with some restriction imposed, namely Vector Error Correction model (VECM). Johansen co-integration test can be expressed as follows:

$$y_t = \alpha_0 + \sum_{i=0}^{n} \alpha_{t-i}\, x_{t-i} + \sum_{j=1}^{m} \beta_{t-j}\, y_{t-j} + \varepsilon_t \qquad (5)$$

3.5 Vector Error Correction (VEC) model

The vector autoregressive (VAR) model is a general framework used to describe the dynamic interrelation among stationary variables. If all the variables are stationary at first difference and cointegration is found, vector error correction (VEC) model can be used. A simple VEC term can be present as the follows;

$$\Delta y_t = \beta_{y0} + \beta_{y1}\Delta y_{t-1} + \cdots + \beta_{yp}\Delta y_{t-p} + y_{y1}\Delta x_{t-1} + \cdots + y_{yp}\Delta x_{t-p} - \lambda_y(y_{t-1} - \alpha_{0} - \alpha_1 x_{t-1}) + v_t^x \qquad (6)$$

$$\Delta x_t = \beta_{x0} + \beta_{x1}\Delta y_{t-1} + \cdots + \beta_{xp}\Delta y_{t-p} + y_{x1}\Delta x_{t-1} + \cdots + y_{xp}\Delta x_{t-p} - \lambda_x(y_{t-1} - \alpha_{0} - \alpha_1 x_{t-1}) + v_t^x \qquad (7)$$

3.6 Granger Causality Test

Granger Causality Test is used to estimate the causality between variables. This test also shows the direction of the causality among variables. It can simply check where the past values of one variable could explain or affect a change in the present values of another variable or not. If a change in variable X causes variable Y to change, then it can be argued that X Granger causes Y,

i.e., if the past value of variable X increase the forecasting of variable Y, then it can be said that X Granger cause Y.

This test consists of estimating the following equations:

$$Y_t = \alpha_0 + \sum_{i=1}^{n} a_i Y_{t-i} + \sum_{j=1}^{m} b_j X_{t-j} + \in_t \quad (8)$$

$$X_t = \beta_0 + \sum_{i=1}^{n} c_i X_{t-i} + \sum_{j=1}^{m} d_j y_{t-j} + \mu_t \quad (9)$$

Where it is assumed to have that both e_{yt} and e_{xt} are uncorrelated white noise erro

4. Empirical result

4.1 Unit Root Test

Unit root tests are taken to investigate that there are no random walk in respective variables which are purchasing power parity (PPP), exchange rate (Ex) and inflation rate (Inf) under Augmented Dickey Fuller (ADF) test and Philip-Peron (PP) test. Table (4) shows the determination of degree of stationary of those variables used in the model.

Table 4: The degree of stationary of variables

	ADF test		PP test	
	Level	1st different	Level	1st different
PPP	0.9945 (0.958204)*	0.0235 (-3.362027)*	0.9976 (1.257000)*	0.1307 (-2.487717)*
Ex	0.9988 (1.516191)*	0.0358 (-3.154237)*	0.9971 (1.183438)*	0.0395 (-3.106725)*
Inf	0.9972 (1.240718)*	0.0014 (-4.699772)*	0.0792 (-2.755273)*	0.0000 (-7.594616)*

Source: Author's calculation

All variables are not determined stochastic under 5% significant levels. Under the Schwarz Info criterion, the numbers of lag are taken 5 at maximum. In the table, P-values are shown and t-statistics values are show in bracket; (-)*.

H0: PPP has unit root
H1: PPP has no unit root

Under the Augmented Dickey Fuller (ADF) test, Purchasing power parity (PPP) is resulted, at level, P-value (0.9945) and t-statistics (0.958204)* and at 1st difference level, P-value thereof is (0.0235) and t-statistics is (-3.362027)*.

Under the Philip-Peron test, the result of PPP is P-value (0.9976) and t-statistics (1.2570)* at level, and P-value (0.1307) and t-statistics (-2.487717) at 1st difference level.

According to those results under ADF test and PP test, the null hypothesis is rejected as P-value is under 5% significant: 2.35% at ADF and 1.307% at PP and those t-statistics values are taken negative. On the other hand, PPP is stationary at 1st difference.

H0 : Ex has unit root

H1 : Ex has no unit root

Under the ADF test and PP test, Exchange rate is resulted, at level, P-value (0.9988) and t-statistics (1.516191)* and at 1st difference level, P-value thereof is (0.0358) and t-statistics is (-3.154237)*

Under the Philip-Peron test, the result of Ex is P-value (0.9971) and t-statistics (1.183438)* at level, and P-value (0.0395) and t-statistics (-3.106725) at 1st difference level. According to those results under ADF test and PP test, the null hypothesis is rejected as P-value is under 5% significance: 3.58% at ADF and 3.95% at PP and those t-statistics values are taken negative. So that, EX has no unit root at 1st difference.

H0: Inf has unit root

H1: Inf has no unit root

Under the Augmented Dickey Fuller (ADF) test, Inflation rate (Inf) is resulted, at level, P-value (0.9972) and t-statistics (1.240718)* and at 1st difference level, P-value thereof is (0.0014) and t-statistics is (-4.699772)*

Under the Philip-Peron test, the result of PPP is P-vale (0.0792) and t-statistics (-2.755273)* at level, and P-value (0.0000) and t-statistics (-7.594616) at 1st difference level.

According to those results under ADF test and PP test, the null hypothesis is rejected as P-value is under 5% significant: 0.14% at ADF and 0.00% at PP and those t-statistics values are taken negative. Hence, Inf has no random-walk at 1st difference.

4.2 Johansson Cointegration test

Table 5: Trace test under Johansson Cointegration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Prob.**
None *	0.719914	43.35512	29.79707	0.0008
At most 1	0.374896	12.81130	15.49471	0.1219
At most 2	0.061964	1.535202	3.841466	0.2153

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Author's calculation

H0: There is no cointegration among variables (None)
H1: There is cointegration among variables

According to the table 5, Trace Statistics (43.35512) is greater than 0.05 critical value (29.79707); besides, P-values is (0.0008) which is less than 5% significant level. Hence, the null hypothesis that there is no cointegration among variables is rejected. On other words, there is cointegration among variables.

H0 : There is at most 1 cointegration (at most 1)
H1 : There is no at most 1 cointegration

As it is calculated under the Trace Test of Johansson Cointegration test, Trace value (12.81130) is less than 0.05 critical value (15.49471), moreover, P-value (0.1219) is greater than 5% significance level. Whereby, the null hypothesis is accepted; there is at most 2 cointegrations.

Table 6: Maximum Eigenvalue test under Johansson Cointegration test

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.719914	30.54382	21.13162	0.0018
At most 1	0.374896	11.27609	14.26460	0.1409
At most 2	0.061964	1.535202	3.841466	0.2153

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

H0: There is no cointegration among variables (None)
H1: There is cointegration among variables

According to the table 6, Max-Eigen Statistics (30.54382) is greater than 0.05 critical value (21.13162); besides, P-values is (0.0018) which is less than the 5% significance level. Hence, the null hypothesis that there is no cointegration among variables is rejected; it means that there is cointegration among variables.

H0: There is at most 1 cointegration (at most 1)
H1: There is no at most 2 cointegration

As it is calculated under the Maximum Eigenvalue test of Johansson Cointegration test, Max-Eigen value (11.27609) is less than 0.05 critical value (14.26460), moreover, P-value

(0.1409) is greater than 5% significance level. Whereby, the null hypothesis is accepted; there is at most 1 cointegrations.

Trace test and Maximum Eigenvalue test under the Johansson Cointegration test show the same result; means that there is one error term but variables have long rum relationship. As a result of that, Vector Error Correlation Model (VECM) is able to be tested for model estimation.

4.3 Vector Error Correlation Model (VECM)

Table 7: VECM equation-estimation for long run

D(PPP) = C(1)*(PPP(-1) + 0.0236509021397*EX(-1) + 14.400419083*INF(-1) - 399.440559643) + C(2)*D(PPP(-1)) + C(3)*D(PPP(-2)) + C(4)*D(EX(-1)) + C(5)*D(EX(-2)) + C(6)*D(INF(-1)) + C(7)*D(INF(-2)) + C(8)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.137715	0.071862	-1.916382	0.0746
C(2)	0.793953	0.308985	2.569556	0.0214
C(3)	0.133746	0.324263	0.412462	0.6858
C(4)	0.009911	0.020932	0.473467	0.6427
C(5)	0.001769	0.020823	0.084962	0.9334
C(6)	1.563792	0.667092	2.344192	0.0333
C(7)	0.680192	0.489622	1.389218	0.1850
C(8)	3.504656	4.994149	0.701752	0.4936

Source: Author's calculation

The following equation is estimated by Vector Error Correlation Model (VECM); at the hypothesis of C(1), P-value is 0.0746 which is significant under 10% significance level, furthermore the value of coefficient is negative. It shows that Purchasing power parity (PPP) has negative long run relationship with or long run casualties on Exchange rate (Ex) and Inflation (Inf).

Table 8: VECM equation estimation for short-run between PPP and Ex

Test Statistic	Value	df	Probability
F-statistic	0.147638	(2, 15)	0.8640
Chi-square	0.295276	2	0.8627

Null Hypothesis: C(4)=C(5)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	0.009911	0.020932
C(5)	0.001769	0.020823

Source: Author's calculation

H0: There is no short run causalities from PPP to Ex [C(4)=C(5)=0]
H1: There is shot run casualties from PPP to Ex

The P-value is 0.8627 which is not significant even under 5% and 10 % significance level. As a result, null hypothesis which mentions there is no short run casualties from PPP to Ex is accepted.

Table 9: VECM equation estimation for short-run between PPP and Inf

Test Statistic	Value	df	Probability
F-statistic	3.161018	(2, 15)	0.0715
Chi-square	6.322037	2	0.0424
Null Hypothesis: C(6)=C(7)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(6)		1.563792	0.667092
C(7)		0.680192	0.489622

Source: Author's Calculation

H0: There is no short run causalities from PPP to Inf [C (6)=C(7)=0]
H1: There is shot run casualties from PPP to Inf

The P-value is 0.0424 which is significance even under 5% and 10 % significant level. Since null hypothesis which mentions there is no short run casualties from PPP to Ex is rejected, it means PPP has short run casualties on Inf.

4.4 Granger Casualties test

Table 10: Granger Casualties Test

Sample: 1990 2015

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
EX does not Granger Cause PPP	24	0.48491	0.6232
PPP does not Granger Cause EX		4.10236	0.0330
INF does not Granger Cause PPP	24	3.54717	0.0491
PPP does not Granger Cause INF		21.1540	1.E-05
INF does not Granger Cause EX	24	1.05039	0.3693
EX does not Granger Cause INF		1.43072	0.2638

Source: Author's calculation

Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term, and it's important to note that the statement "Granger causes" does not imply that is the effect or the result of the P-value being significant under the 5% significance level. According to table 10, Exchange does not Granger Cause Purchasing Power Parity but Purchasing power parity Granger Causes Exchange rate. Inflation Granger Cause Purchasing Power Parity but Purchasing power parity does not Granger Cause inflation. Exchange rate and Inflation do not Granger Cause each other.

5. Conclusion

According to empirical result, the exogenous variable which is Purchasing Power Parity has negative relationship with or casualties on the endogenous variables which are Exchange rate and Inflation. In Myanmar, Inflation rate and Exchange rate are going up, so that Purchasing Power Parity gets decreased. On the other hand, Myanmar currency is depreciating year by year.
There are advantages and disadvantages of currency depreciation.

Advantages of currency depreciation

1. Exports become cheaper and more competitive to foreign buyers. Therefore, this provides a boost for domestic demand and could lead to job creation in the export sector.
2. Higher level of exports should lead to an improvement in the current account deficit.
3. Higher exports level with higher level of production can lead to higher rates of economic growth.

Disadvantages of currency depreciation

1. It is likely to cause inflation because:

- Imports use more expensive (any imported good or raw material will increase in price)
- Aggregate demand increases causes demand pull inflation.
- Firms / exporters have less incentive to cut costs because they can rely on the depreciation to improve competitiveness. The concern is in the long-term depreciation and devaluation may lead to lower productivity because of the decline in enterprise incentives.

2. Reduces the purchasing power of citizens abroad. E.g. more expensive to go on holiday abroad.
3. If consumers have debts, e.g. mortgages in foreign currency – if Myanmar currency is depreciated, they will see a sharp rise in the cost of their debt repayments.

To be able to increase the value of Myanmar Currency:

- Sell foreign exchange assets and buy foreign currency
  If Myanmar government sold Treasury bills and brought back the proceeds to Myanmar, this would cause a depreciation in the dollar, and the Myanmar Kyats would appreciate (supply of dollars would rise, and demand for Myanmar Kyat would increase). Because

Myanmar Central Bank has a certain amount of dollar assets, they could cause a reasonably significant fall in the value of the dollar.

- Higher interest rates
  Higher interest rates would attract some hot money flows. Hot money flows occur when banks and financial institutions move money to other countries to take advantage of a better rate of return on saving. Given interest rates are close to zero in the US, higher interest rates in developing countries give a significant incentive to move money and savings there. However, as a drawback, higher interest rates may reduce the rate of economic growth. In many circumstances, e.g. in recession, higher interest rates would not be suitable due to side effect on economic growth. However, if the economy was booming, higher interest rates would cause an appreciation and moderate the rate of economic growth.
- Long-term supply-side policies
  In the long term, a strong currency depends on economic fundamentals. To have a stronger exchange rate, countries will need a combination of low inflation, productivity growth, economic and political stability. To increase the value of the currency in the long-term, the government will need to try supply-side policies to increase competitiveness and cut costs of production, for example, privatization and cutting regulations may help the export industry to become more competitive in the long-term.

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