Macroeconomic Shocks and the Central Government Debt: The Philippine Case

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The Philippine debt profile does not only speak about the country's fiscal position. It is also indicative of the country's vulnerability to different macroeconomic shocks. Using quarterly time series data from 1996 to 2014, this paper investigates the impact of fiscal, real and financial shocks to central government debt-to-GDP ratio. This paper finds out that the central government debt become most susceptible to government expenditures (fiscal), inflation (real), and real effective exchange rate (financial) shocks. This paper also discusses the implications of the results to fiscal, monetary & financial policy, and debt management policy.

JEL Codes: E600, E620 and E630

1. Introduction

The importance of monitoring developments in the fiscal sector became more pronounced following the 2007-2009 Global Financial Crisis (GFC). The ramifications that the crisis might brim over in the fiscal sector came to the forefront of policy debates. In the wake of the financial crisis, governments are pushed towards more public spending through the injection of borrowed funds into the economy. Apprehensions that the government's high level of public debt might be subjected to macroeconomic vulnerabilities, identifying and managing the potential macroeconomic shocks has been one of the major concerns of many countries.

In the Philippines, the debt crisis began in the 1970s during the Marcos regime when the country's external debt ballooned to US $10.70 million in 1978 because of the country's large dependence on foreign borrowing to finance domestic investments. The second episode of debt crisis happened in 2004 during President Arroyo's administration when the country's central government (CG) debt to Gross Domestic Product (GDP) ratio hits 90.7 percent.

With respect to the Philippine debt profile, the CG is holding much of the country's public sector debt. In the Philippines, the CG's total debt accounts for the bulk of the country's public sector debt at ₱6,161.4 billion while debt held in foreign currency denomination constitutes up to 36 percent of the CG's debt as of end-2014. This significant portion of foreign currency denominated debt signals that the country is likely to be prone to exchange rate fluctuations.[1] This study will look at the impact of the different macroeconomic

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vulnerabilities such as fiscal shocks, real economy shocks and financial shocks to the Philippines' central government debt to GDP ratio in order to evaluate the central government's indebtedness as measured by central government debt-to-GDP ratio. Against this background, this paper answers the following research questions:

1.) How does the CG debt-to-GDP ratio of the Philippines respond to macroeconomic shocks? Are the impacts of these shocks to CG debt-to-GDP ratio transitory or permanent?

2.) Which among these macroeconomic shocks does debt-to-GDP ratio become most vulnerable to?

3.) What are the implications for fiscal, monetary and financial, and debt management policy of the results of this study?

Notwithstanding the compendium of empirical public finance papers on emerging countries, this field of economic research has rarely been discussed in the Philippine setting. Hence, this paper aims to fill this gap in the literature. Specifically, this paper will look at the magnitude of the impact of the different macroeconomic shocks to the country's indebtedness.

The paper will be outlined as follows. Section 2 of the paper discusses the review of related literature. Section 3 provides the research methodology as well as the variables used in this study. Section 4 presents and analyzes the empirical results derived from the model. Section 5 concludes the paper and presents the implications of the research results for fiscal, monetary and financial, and debt management policy.
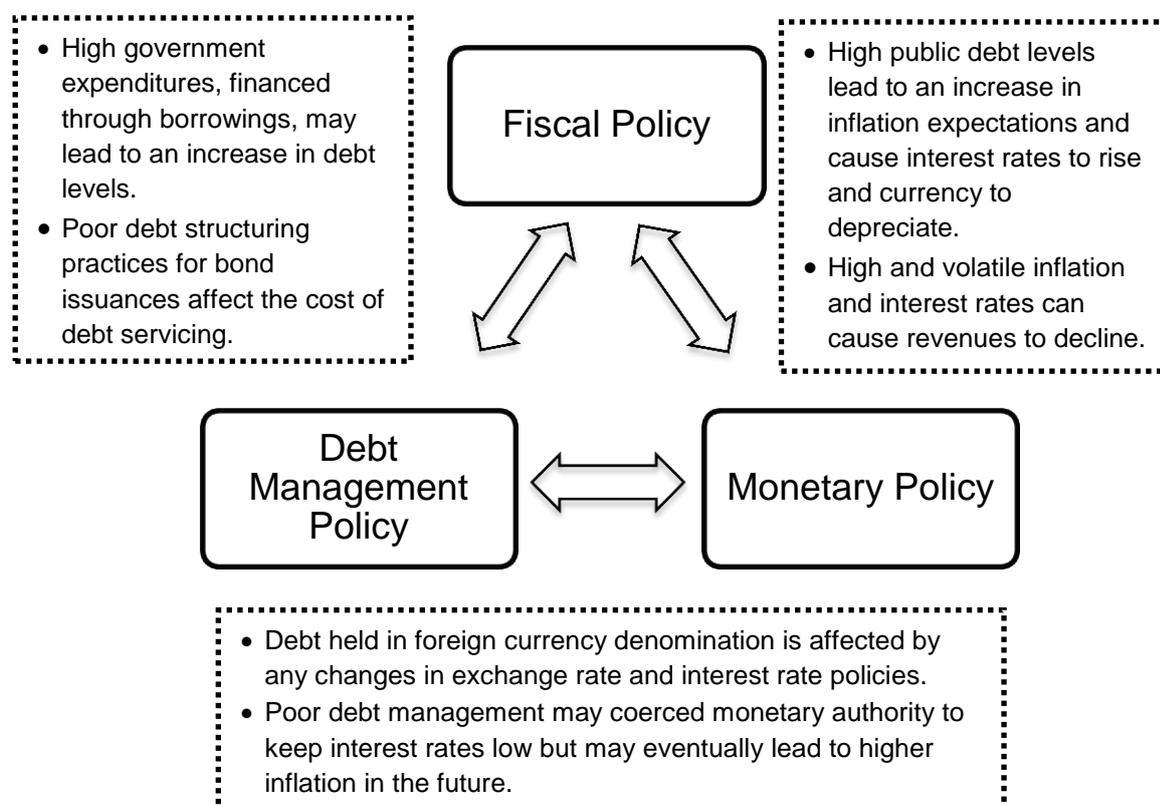
2. Review of Related Literature

The intensive use of expansionary fiscal policy by the CG during crises resulted to substantial accrual of debt levels and increase in debt-to-GDP ratio, which prompted international discussions on fiscal and debt sustainability. One topic of contention about debt sustainability is the determination of the sustainable threshold for the debt-to-GDP. There are three (3) empirical studies that identify the benchmarks on debt thresholds for "market access countries (MACs)".[2] First, the study by Reinhart, *et.al.*, (2003) identifies that the threshold for external debt as percentage of GDP should fall within the range of 15-20 percent using a sample of 53 high, middle and low-income countries. Second, Patillo, *et.al.,* (2004) noted that an 18 percent external debt-to-GDP might start signalling negative effects on growth based on a sample of 61 developing countries from Africa, Asia, Latin America, and Middle East over the period of 1969-1998. Drawing inference from these studies on the threshold for external debt-to-GDP, the Philippines total external debt-to-GDP of 27.3 percent[3] as of end-2014 implies that the country is more vulnerable to external shocks. Meanwhile, Gill & Pinto (2005) computed that the sustainable government debt-to-GDP should be set at 25 percent based on a sample of 21 developing countries from 1985-2002. Again, the Philippines' CG debt-to-GDP of 66.3 percent from 1996-2014 do not satisfy the benchmark level for a sustainable debt-to-GDP.

While these studies need further qualifications and verifications, Gill & Pinto (2005) suggests that developing countries should target for a stable and lower debt-to-GDP to reduce debt vulnerabilities. Because of the potential susceptibility of debt-to-GDP to

macroeconomic shocks, understanding the interlinkages of macroeconomic policies (i.e., fiscal, financial or monetary, and external policy) is indispensable for better policy responses and actions.

Figure 1: Interlinkages of the Macroeconomic Policies

- High government expenditures, financed through borrowings, may lead to an increase in debt levels.
- Poor debt structuring practices for bond issuances affect the cost of debt servicing.

Fiscal Policy

- High public debt levels lead to an increase in inflation expectations and cause interest rates to rise and currency to depreciate.
- High and volatile inflation and interest rates can cause revenues to decline.

Debt Management Policy

Monetary Policy

- Debt held in foreign currency denomination is affected by any changes in exchange rate and interest rate policies.
- Poor debt management may coerced monetary authority to keep interest rates low but may eventually lead to higher inflation in the future.

Source: *Togo, Eriko (2007). "Coordinating Public Debt Management with Fiscal and Monetary Policies", p.9.*
Note: *Modifications on the figure's representation and explanatory notes were made by the author of this paper.*

Meanwhile, despite a number of papers on incorporating debt in VAR estimations, discussions and analyses on the impulse responses of debt to macroeconomic shocks are seldom extensive (Cherif & Hasanov, 2012). Public finance empirical papers, for the most part, were centred on themes ranging from debt sustainability to the impact of fiscal policy on growth. First was that of the remarkable work of (Favero & Giavazzi, 2007) which investigated the impact of government revenue and expenditure shocks on growth. In the same way, Barro (1980) made an analysis on the effect of United States' public debt shocks on output and unemployment with the use of regression without VAR dynamics.

Public finance literature also encompassed empirical works that were made in the context of emerging countries. Using the combination of estimated fiscal reaction function and country-specific VARs for macroeconomic aggregates without debt feedback, Celasun et.al (2007) conducted debt path simulations from a panel regression of emerging countries. While there have been a lot of studies on the impact of macroeconomic shocks to central government debt in emerging countries, these studies were not able to address and present in a single paper the impact of the three (3) macroeconomic shocks (i.e., fiscal, real and financial). Previous public finance papers also failed to discuss which type of macroeconomic shocks central government debt becomes most vulnerable to.

This paper argues that the high level of CG debt does not only speak about the fiscal position of the country. Moreover, this paper claims that the Philippines is more vulnerable to government expenditure (fiscal), inflation (real) and real effective exchange rate (financial) shocks. In this regard, this paper provides validation on the aforementioned hypothesis and aims to fill the gap in the literature by evaluating the response of central government debt to the three shocks. Moreover, this study discusses the implications of the results to fiscal, monetary and financial, and debt management policies.

3. Research Methodology

3.1 Model Specification

The model used by the researcher to analyze the impact of macroeconomic shocks on debt-to-GDP is given by the following:

$$DY_t = \sum_{i=1}^{k} A_i Y_{t-i} + \varepsilon_t \qquad \text{eq. (1)}$$

Where DY_t is the CG debt-to-GDP; Y_t is a vector of contemporaneous endogenous variables which include the following macroeconomic variables that are considered to be the potential source of shocks to debt-to-GDP: (i) log of government expenditures; (ii) log of government revenues; (iii) real GDP growth rate; (iv) inflation rate; (v) effective real interest rate on CG debt; and (vi) log of real effective exchange rate.

The model above enables the researcher to investigate how the CG debt-to-GDP responds to: (i) real shocks; (ii) financial shocks; and (iii) fiscal shocks. Likewise, the model also includes (ε_t) as the idiosyncratic error which accounts for the unobserved factors and k which represents the number of lags used in estimating the model. The notation A is a matrix of estimated coefficients for the lagged endogenous variables.

In this paper, the researcher added the real effective exchange rate as part of the potential source of financial shock to be able to determine the impact of currency appreciation or depreciation to the country's fiscal position. By including in this one model the impact of fiscal, real and financial shocks, policymakers are able to formulate better and active policy responses.

3.2 Estimation Methods

The paper uses quarterly data from 1996:Q1 – 2014:Q4. This study starts with 1996 to account for the extent of the impact of Asian Financial Crisis (AFC) and ends with the period 2014 to evaluate the country's fiscal position following the 2007-2009 GFC.

The researcher performs the following econometric methodologies. First, those variables that were found out to have seasonality were seasonally adjusted using the Census X12 statistical tool. Likewise, some of the variables were transformed into their natural logarithmic to get rid of heteroskedasticity.

To examine the response of CG debt-to-GDP to various macroeconomic shocks, the Impulse Response Function (IRF) was generated. The IRF in the VECM shows whether the

effect of a shock to the variable of interest is permanent or transitory. The variance decomposition test was also performed to determine how much each of the macroeconomic variables or shocks explains the variations or changes in the CG debt-to-GDP.

4. Results / Analysis

4.1 Presentation of the Results

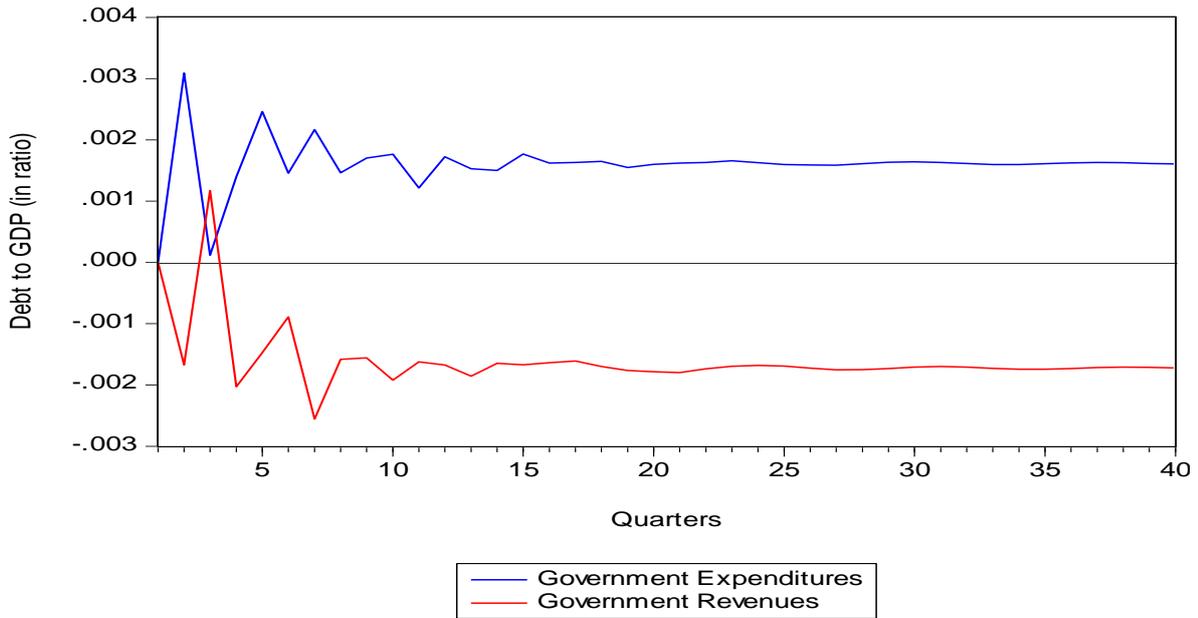**Figure 2: Response of CG Debt-to-GDP to Fiscal Shocks**
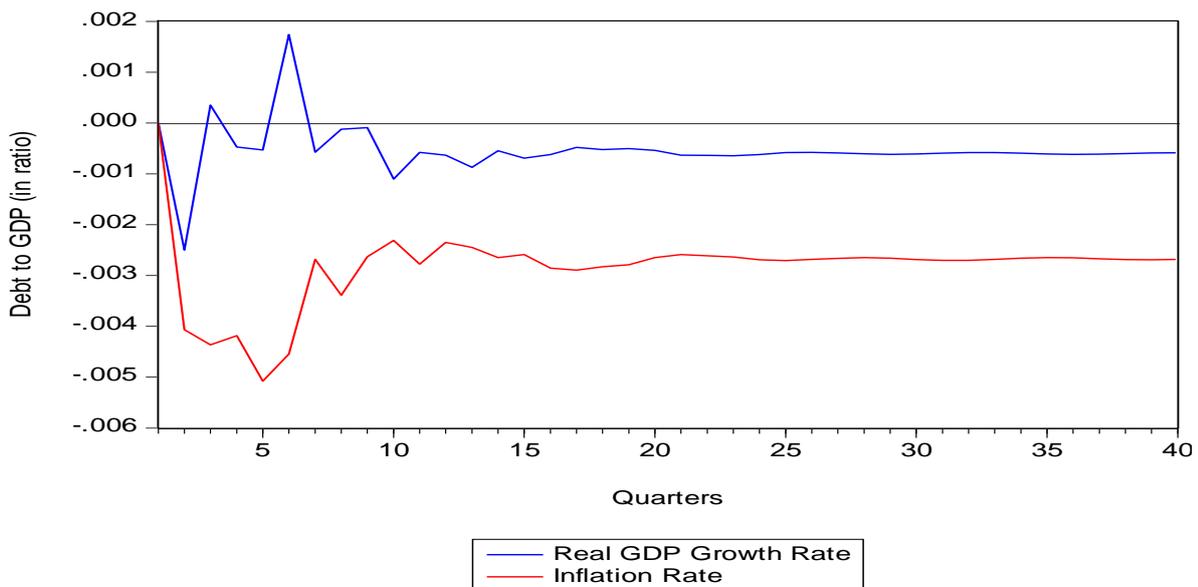

Figure 3: Response of CG Debt-to-GDP to Real Shocks

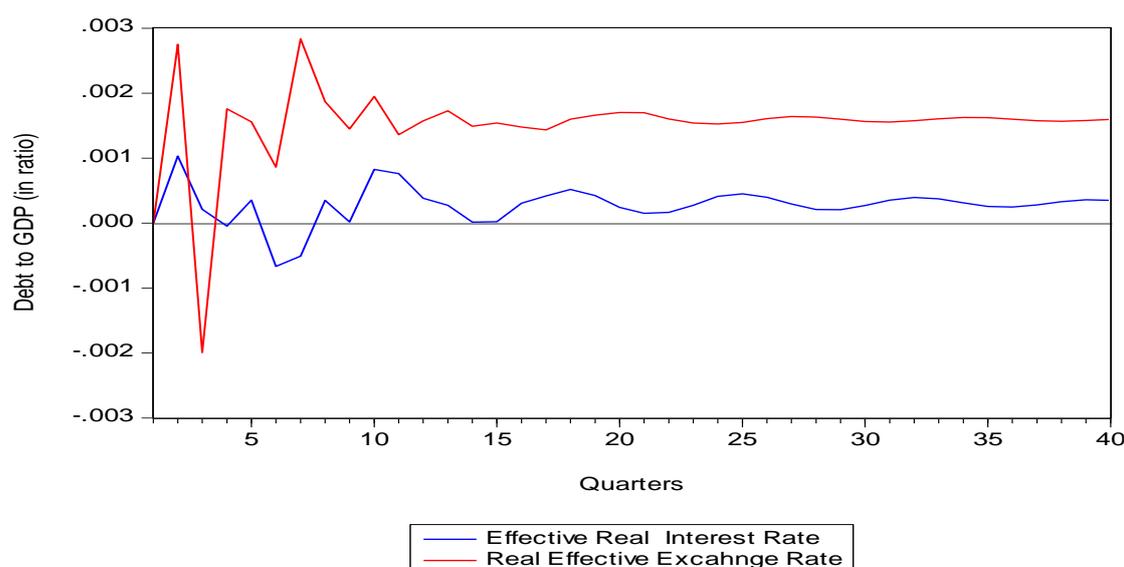## Figure 4: Response of CG Debt-to-GDP to Financial Shocks

Table 1: Variance Decomposition of CG Debt-to-GDP

Yr	Qrtrs.	Inflation	Gov't. Expenditures	Real Effective Exchange Rate	Real GDP Growth Rate	Gov't. Revenues	Effective Real Interest Rate
1	1	0.00	0.00	0.00	0.00	0.00	0.00
	2	4.61	2.66	2.11	1.74	0.78	0.30
	3	8.66	2.33	2.81	1.55	1.01	0.27
	4	10.42	2.26	2.87	1.29	1.62	0.22
2	5	14.30	3.19	3.09	1.25	1.89	0.22
	6	16.13	3.19	2.89	1.60	1.82	0.27
	7	15.79	3.61	3.82	1.51	2.63	0.29
	8	16.64	3.74	4.13	1.44	2.85	0.29
3	9	16.56	3.89	4.16	1.36	3.00	0.27
	10	16.41	4.09	4.43	1.44	3.32	0.35
	11	16.66	4.10	4.47	1.42	3.50	0.40
	12	16.54	4.26	4.56	1.40	3.66	0.40
4	13	16.56	4.35	4.71	1.43	3.90	0.39
	14	16.69	4.43	4.77	1.41	4.05	0.38
	15	16.74	4.58	4.83	1.41	4.18	0.36
	16	16.96	4.68	4.88	1.40	4.30	0.36
5	17	17.16	4.77	4.90	1.37	4.39	0.36
	18	17.29	4.85	4.97	1.35	4.50	0.38
	19	17.41	4.91	5.05	1.32	4.63	0.38
	20	17.45	4.97	5.13	1.31	4.76	0.37

4.2 Interpretation and Discussion of the Results

Figures 2-4 show the plots of the impulse response function of the debt-to-GDP ratio to fiscal, real and financial shocks. The results showed that the hypotheses of this paper is accepted in that central government debt-to-GDP becomes more susceptible or responsive

to shocks or changes in government expenditures, inflation and real effective exchange rate. The individual respones of the debt-to-GDP ratio to these shocks will be discussed in turn.

4.2.1 Fiscal Shocks

4.2.1.1 Government Expenditures

An increase in the level of government expenditures causes an immediate rise in the debt-to-GDP. In addition, Figure 2 also illustrates that the upward pressure of the shock to debt-to-GDP is permanent since the IRF does not revert back to zero. The plot likewise shows that there were periods of cyclical pattern of adjustment in the debt-to-GDP but the effect of the shock started to stabilize on the 20th quarter (Q4 2000). The result shows two (2) periods where the debt-to-GDP ratio was at its highest. The impact of the shock was observed and felt on the 2nd quarter (Q2 1996) and 5th quarter (1997:Q1) as an offshoot of the 1997 AFC.

During and following this period (AFC), the government adopted pump-priming strategies to avert the economic slowdown brought about by the AFC. To finance the government's stimulus strategy, it resorted to foreign borrowings which resulted to a deficit of ₱6.7 billion pesos during the first quarter of 1997. The ₱6.7 billion pesos budget deficit during the 1997:Q1 was caused by the interest payments, which accounted for 18.7 percent of the total government expenditures. It can then be infered that the interest payments was the major contributory factor in the impact of the government expenditures shock to the debt-to-GDP ratio.

4.2.1.2 Government Revenues

The immediate impact of an increase in government revenues is a decrease in the debt-to-GDP. The revenue shock was also observed to be permanent as the IRF does not revert back to zero. The desirable effect of government revenues to debt-to-GDP can be attributed to the significant contribution of remittances to the country.

Remittances are viewed to affect the country's debt sustainability in the form of higher tax base. Inflows of remittances may indirectly increase the revenue that the government receives from consumption and trade-based taxation (Abdih, *et.al.*, 2009). Remittances, when transmitted through formal channels, can be taxed using financial transaction costs. Moreover, the steady inflow of remittances by the Overseas Filipinos (OFs) leads to an increase in the resources available for domestic consumption and production expenditure of Filipino households. The implication of the households' consumption and production expenditures to government revenues is significant since approximately half of the developing countries' revenues are due to consumption and production taxes (Roger & Li, 2006). The contribution of remittances as part of the country's tax base leads to an increase in the resources that the country has in order to service its debt.

4.2.2 Real Shocks

4.2.2.1 Real GDP Growth

As expected, the initial impact of a positive GDP shock (increase in total output) causes debt-to-GDP to decrease. However, there were two (2) episodes in which debt-to-GDP

rises as a result of negative GDP shock. These two episodes were observed during the 3rd and 6th quarter, with the highest peak seen on the 6th quarter (1997:Q2). It was during the AFC where the country's economic performance, as measured by GDP growth rate, decelerated. The impact of the economic slowdown during the AFC puts burden on the country's debt sustainability because of the effect of a lower GDP growth rate to unemployment rate. The most noted economic cost of a negative GDP shock was reflected in the number of total workers that were affected by the crisis which includes permanent lay-off, temporary lay-off and rotation etc. throughout the AFC (from 1996 to 1998). Because the number of unemployed workers escalated, revenue generation is likewise affected via a decrease in the country's tax base which is labor income.

4.2.2.2 Inflation Rate

The effect of an inflation shock could lead to either a decrease in the debt-to-GDP by means of eroding the *real* value of the debt (first effect) or an increase in the debt-to-GDP through the negative effect of inflation via supply shock on the level of GDP (second effect). However, the first effect dominates the second effect. A rise in inflation can erode the *real* value of the level of debt. This result happens through the following mechanism. Suppose creditors purchase X dollars of government debt with a nominal interest rate of i percent and the debt has m years until maturity. If the annual inflation rate is π, then the real value of the debt after m years is $V = Xe^{(i-\pi)m}$ (Aizenman & Marion, 2009). In this equation, if annual inflation rate rises, the real value of the debt declines which means that debtor pays less while creditor receives less.

4.2.3 Financial Shocks

4.2.3.1 Effective Real Interest Rate

The initial response of debt-to-GDP following a real interest rate shock leads to a increase in the debt-to-GDP. An increase in the interest rate (financing cost), *ceteris paribus*, will make it more difficult for a government to service its debt obligations because interest is treated as payment for debt incurred. Figure 4 illustrates three (3) peak episodes in which the observed impact of an interest shock puts upward pressure to the debt-to-GDP ratio. These periods were observed in 1996:Q2, 1997:Q1 and 1998:Q2 – all of which were AFC periods. This significant rise in interest rates created pressures on the country's fiscal position during the AFC periods as the surge in interest rates led to an increased interest payments.

4.2.3.2 Real Effective Exchange Rate (REER)

A rise in the REER index,[4] an appreciation of the currency, could impact the debt-to-GDP in either two ways. First, a currency appreciation creates a negative income effect in the country's trade balance because a rise in REER index decreases the price competitiveness of the economy. As a result, exports go down which translates into lower GDP and thus, higher debt-to-GDP. Second, a currency appreciation could have a positive balance sheet effect on the public debt as currency appreciation slows down the foreign interest payments on debt, causing the debt-to-GDP to drop. However, in this study, it emerged that the negative income effect dominated the positive balance sheet effect. As exports decreases, GDP also declines which consequently pushes up the debt-to-GDP.

The Magnitude of Impact of Each Macroeconomic Shock to Debt Ratio

Among the fiscal shocks, the debt-to-GDP becomes more susceptible to changes in government expenditures. Immediately following the fiscal shocks, around 3 percent of the debt-to-GDP adjustments during the 4th quarter is due to shocks in government expenditures. The extent of impact of government expenditure shock to changes in the response variable continues to increase up to the 20th quarter (year 5). In terms of the real shocks, much of the variations in the response of the debt-to-GDP are brought about by an inflation shock. The impact of inflation shock (decrease in debt-to-GDP) to the response variable is persistent and permanent. On the financial shocks, the debt-to-GDP is more susceptible to real effective exchange rate shock than with effective real interest rate.

5. Conclusion

The research objectives of this study focus on two key themes. First, this paper examines the response of the debt-to-GDP to the different macroeconomic shocks and investigates whether the impact of these shocks are transitory or permanent. Second, this paper identifies which among those macroeconomic shocks do the debt-to-GDP ratio become most vulnerable to by implementing VECM IRF. Meanwhile, the second objective of this paper was addressed with the implementation of the variance decomposition.

From a policy perspective, the findings of this paper generate important implications for fiscal, monetary and financial, and debt management policy. These policy implications that were drawn from the results of the analysis in Section 4 is discussed in this section.

5.1 Fiscal Policy

In this paper, there is an evidence that government revenues improve the country's debt sustainability by pulling down the debt-to-GDP in the long-run while the government expenditures including interest payments worsens the country's debt sustainability by putting upward pressure in the debt-to-GDP level in the long-run. In this connection, fiscal policy should centre more on improving revenue generation while reducing government expenditures that are financed through borrowings.

Taxes are the countries' direct and major source of revenue. In the Philippines, two-thirds of its total tax revenues are sourced from value added taxes (VAT: 12 percent), corporate income tax (CIT: 30 percent) and personal income tax (PIT: maximum of 34 percent and minimum of 5 percent). While the statutory tax rates on these kinds of taxes are relatively high vis-à-vis its neighboring countries in East Asia and the Pacific, the country's tax productivity is still considerably low (Usui, 2011). Table 2 shows the comparison of tax rates in selected countries in the East Asia and the Pacific.

Table 2: Tax Rates in East Asia and the Pacific Countries

Tax rate (%)	VAT	CIT	PIT	
			Max.	Min.
East Asia and the Pacific (2006)	10.7	27.6	29.4	9.4
PRC (2006)	17.0	33.0	35.0	5.0
Republic of Korea (2007)	10.0	27.5	35.0	8.0
Indonesia (2007)	10.0	30.0	35.0	5.0
Malaysia (2006)	10.0	27.0	27.0	1.0
Philippines (2009)	12.0	30.0	34.0	5.0
Thailand (2007)	7.0	30.0	37.0	10.0
Viet Nam (2007)	10.0	28.0	40.0	10.0

CIT = corporate income tax, PIT = personal income tax, PRC = People's Republic of China, VAT = value-added tax.
Source: World Bank, World Development Indicators.

Changing the rates (i.e., raise) of those major kinds of taxes (VAT, CIT and PIT) is not the key to augment government revenue collection since our rates for these types of taxes are one of the highest in the region. The real policy challenge then arises from concerns and issues of government's weak revenue performance as a result of weak tax administration measures. Tax effort, measured as tax revenue collection as percentage of GDP, has remained mediocre from 1996-2014 (Figure 5).

Figure 5: Philippines' Tax Effort (1996-2014)
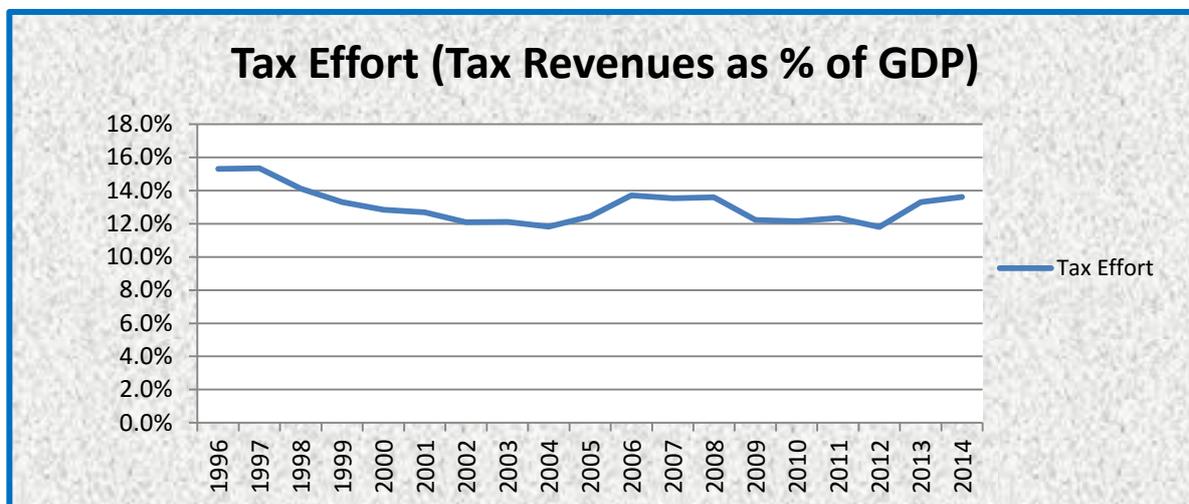
Source: Bureau of Treasury and National Statistical Coordination Board

Weak tax administration in the country takes place because the country's overall capacity – that is, human resources – for tax administration is low. In the region, the country has the lowest ratio of tax staff to overall population at 0.13 and the highest ratio of taxpayers per tax staff (1:609) (Usui, 2011).

The gains from improving revenue generation go beyond from increasing government revenue to accelerating socioeconomic-related government expenditures that are financed from the government's own-revenue sources. Government expenditures that are financed through borrowings increases the debt-to-GDP ratio because of the interest payments

associated with the cost of borrowing. This implies that funding government expenditures through public debt is unsustainable in the long-run.

5.2 Monetary & Financial Policy

The findings of this paper indicate that inflation and real effective exchange rate shocks considerably influence debt-to-GDP. These results highlighted the role of central banks in debt management.

While the results suggest that a rise in the inflation rate signals a decrease in the debt-to-GDP ratio because of the impact of inflation in eroding the real value of debt, the implications of this result for monetary policy do not necessarily imply for a very accommodative monetary policy in order to allow high inflation. One plausible reason that could explain the results for the effect of inflation shock to debt ratio is the condition of the country's domestic capital market. Because the domestic capital market is dominated by government-issued debt securities with longer maturity profile, the government has the incentive to inflate away its debt. In cases where the maturity of debt has longer profile, the government is able to reduce its debt burden through inflation (Aizenman & Marion, 2009). These conditions imply that from the perspective of a central bank, "additional resident-sourced sovereign debt" reduces the incentive for the government to inflate away its debt (Guinigundo, 2012).[5]

With respect to the impact of REER shock to debt-to-GDP ratio, the negative income effect dominates the positive balance sheet effect of a rise in the REER index (currency appreciation). This means that, in the Philippine context, the direct effect of a decrease in exports to the level of GDP has a stronger influence in affecting the debt-to-GDP rather than the effect of lower interest payments (positive balance sheet effect) to debt. While a strong currency brings about economic benefits such as lower debt servicing and build-up of country's international reserves, the prolonged appreciation of the currency also poses perils on significant sectors of the economy. The manufacturing and agri-based exporters are the most hard-hit sector as the economy losses its external price competitiveness.

Concerns that currency appreciation might prolong for a long period of time, policy responses from the central bank and government is therefore imperative. The central bank can moderate the rapid appreciation of the currency by engaging in sterilization of capital inflows and by mopping out excess liquidity through the use of open market operations (OMOs). It should be noted, however, that sterilization should be exercised with greater prudence. Tempering peso appreciation through sterilization cannot be applied indefinitely because of the fiscal costs associated with this measure. From this perspective, policy coordination between the fiscal and monetary authorities is vital to avoid inconsistencies of monetary and fiscal policy actions. The government has launched two kinds of hedging instruments to protect the exporters from foreign exchange risks. The first instrument is foreign exchange insurance fee where the exporters pay a certain amount of insurance fee in exchange of their "protection rate". The second hedging instrument is the forward exchange rate protection in which the exporters and the Development Bank of the Philippines (DBP) enter into a forward contract.

5.3 Debt Management Policy

The main thrust of debt management policy is to ensure that government's financing needs and payment obligations are met at the lowest possible cost over the medium to long term.

Often, the policy instrument is for the government to issue medium to long-term debt, and the composition is managed through new debt issuance, as well as changing the maturity of existing debt issuance. Debt management process has always been in the form of extending or lengthening the maturity of debt-issued securities. This practice reduce the default risks for borrowers because there would be less exposure to rollover risks or to liquidity risks. However, "bunching up on maturities" can also create problems for rolling over the debt (Guinigundo, 2012).

Monitoring and managing potential vulnerabilities to government debt portfolio is crucial in ensuring the country's debt sustainability. In this regard, (Anderson, 1999) suggested that the "Asset and Liability Management" framework can assist the debt managers in identifying and managing the vulnerabilities to government debt portfolio. The framework allows the CG to understand the possible crisis that may arise with its balance sheet especially when mismatch between its financial assets and liabilities occur. It is also through this framework where government are able to determine whether its cash flows can meet future liabilities or debt obligations.

For future research undertakings, this paper can be extended by investigating the exchange rate balance sheet effect on government debt with considerations on the debt's size and composition in terms of maturities. In addition, future studies can also look at the minimum threshold for the debt-to-GDP ratio that will determine the country's debt sustainability.

Endnotes

[1] Source: Bureau of Treasury
[2] The Philippines was included in those empirical studies as part of MACs.
[3] Source: Bangko Sentral ng Pilipinas
[4] With bilateral exchange rate (i.e., Peso per U.S dollar rate), an increase in the bilateral exchange rate (i.e., from ₱43/$1 to ₱45/$1) denotes peso depreciation. But, with the effective exchange rate, an increase in the REER index denotes peso appreciation.
[5] Resident-sourced sovereign debt refers to the private firms' debt securities issuances.

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