

Maximum Sustainable Level of National Debt

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The interest in the level of National Debt accumulated by countries has peaked recently due to difficulty in repayment or refinancing of maturing debt experienced by a number of countries. National debt is defined as the accumulated fiscal deficit owed by a country's central or Federal government. Current efforts in determining a sustainable level of debt are focused on establishing a global standard for sustainable level of debt as well as annual deficit for a group of countries. These standards are set irrespective of a country's economic structure or its level of development. This paper attempts to develop a model that will estimate the level of national debt with reference to economic factors unique to the U.S.

INTRODUCTION

National debt is the accumulated annual fiscal deficits incurred by federal or central governments of a country over a period of time. The total national debt is funds owed by a government to private lenders and to other government agencies whose surpluses are borrowed to cover tax revenue shortfalls. An example of such 'off-budget' deficit is surplus from Social Security Accounts drawn for meeting budgetary shortfalls by the US government. The effective national debt is the total debt owed to the private lenders. Analysis conducted in this paper covers the total national debt consisting of debt held by the public as well as debt owed to other government agencies. For international comparison, national debt is measured as the ratio of debt of a country to its GDP. The drawback of such a comparative measure is that even when the ratio is held constant, absolute level of debt will increase with an increase in GDP.

While annual fiscal deficit is the difference between contemporaneous government expenses and tax receipts, it can also be viewed as future tax receipts. The amount of future tax gets compounded due to interest payments on the initial debt. The interest on national debt is an obligatory portion of government expenses and the service burden is directly related to the absolute level of national debt and the effective interest rate on national debt.

Although a number of macro guidelines about a sustainable level of national debt held by a country have been suggested, these are not necessarily based on a thorough analysis of the critical economic factors. These critical factors could include the economic structure of a country that is able to support the level of debt both in terms of ability to repay the debt as well as the resources available to service the debt

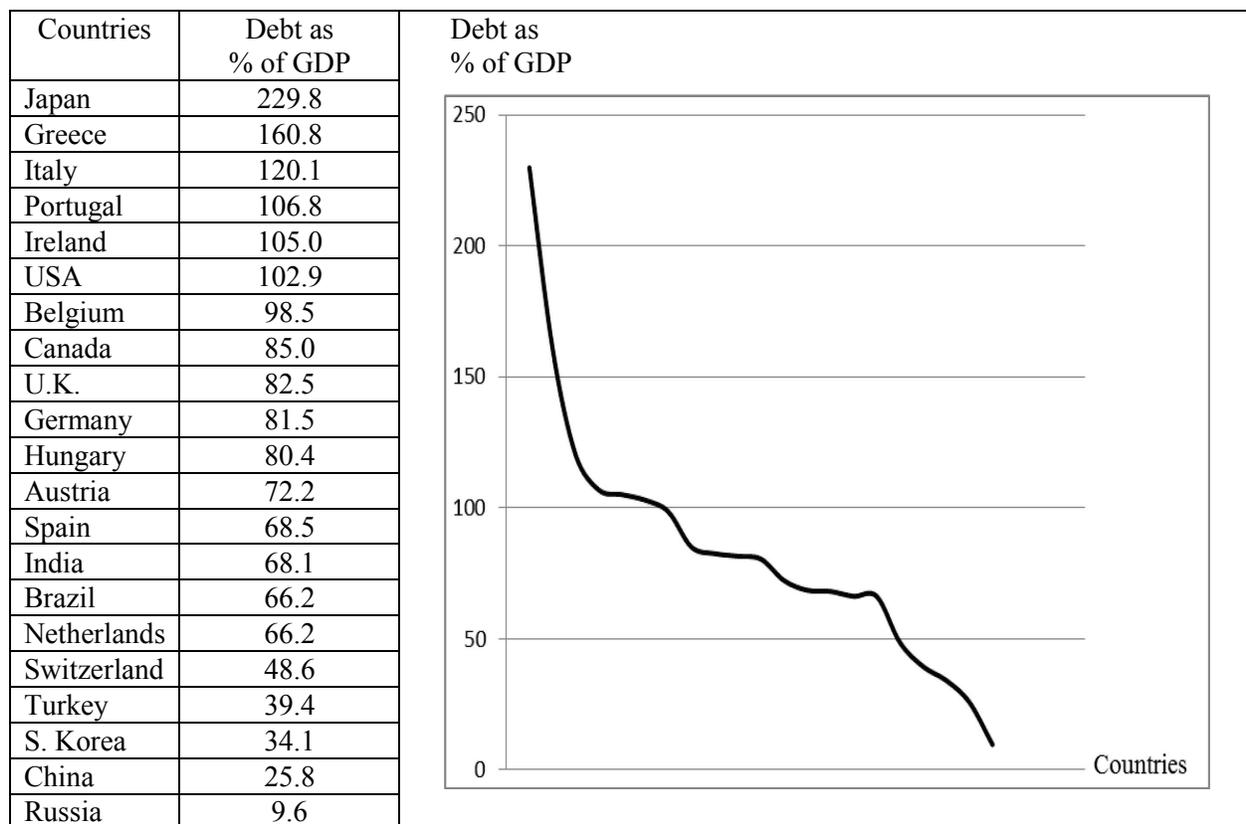
on an annual basis. The marginal cost of debt often depends on the financial rating assigned to a country by rating agencies like Moody's, S & P and Fitch. A qualitative proxy variable for the cost of new debt can thus be the rating of a country's debt assigned by these agencies.

The analysis undertaken in this paper builds upon an earlier study by the authors (Jadhav, Neelankavil, 2011) and other research studies that have analyzed the issue of national debt. In addition, recent empirical evidence from countries that have been saved from bankruptcy is also utilized in the paper to augment the analysis. The investigation starts with a brief summary of the current situation, followed by a literature review, next the methodology used in the analysis is presented which is followed by the analysis and results section. Finally, the conclusions of this analysis are integrated with a few recommendations to policy makers.

CURRENT SITUATION

It is clear from the IMF World Outlook reports that many countries have accumulated substantial national debts alarming enough to drive the world's financial markets into jitters. Figure 1 presents the national debt to GDP ratio for selected countries for 2011. What is noticeable in this graph is the wide range within which the national debt to GDP ratio falls for these countries. At one extreme we have Japan with 229.8 percent and at the lower end of spectrum there is Russia with only 9.6 percent.

FIGURE 1
GROSS NATIONAL DEBT AS A % OF GDP FOR SELECTED COUNTRIES 2011



Japan has a much higher national debt to GDP ratio than Greece, but the concern over Japan's indebtedness is not raising that many concerns as that of Greece's national debt. One of the reasons might be that Greece's economy has many structural flaws that are not easily rectifiable, but Japan is still the

third largest economy in the world and has a strong manufacturing and export base. Ireland, Portugal, Italy, and Spain are also considered to be in precarious situations because these countries suffer from stagnation, high unemployment rate, and a weak banking system. Although, Spain's debt to GDP ratio is much lower at 68.5 percent, the country is in a severe double dip recession with unemployment rate approaching 24 percent. Moreover, Greece, Ireland, Portugal, Italy, and Spain are part of the European Union and hence are tied to and dependent on the member countries' economic policies to save them from default.

A number of organizations such as EU have laid out guidelines for the maximum sustainable national debt. Under these guidelines, gross sovereign debt as a percent of GDP should be reduced to 60 percent by 2030 for advanced economies. An oblique footnote makes an exception for Japan at a target ratio of 200 percent. The corresponding rate for emerging economies is set at 40 percent. Emerging economies depend on FDI for economic growth, do not have sufficient domestic capital formation, and they are generally smaller economies consequently their debts tend to be smaller in size and, hence, the lower target rate. Unfortunately, such broad target rates do not take into account individual country specific factors and could result in policies with excessive fiscal restraints that could impact growth of an economy adversely.

LITERATURE REVIEW

Sovereign debt issues seem to have a cyclical pattern in terms of its prominence for policy makers as well as academicians. In terms of research, it was a hot topic in the 1980s, went out of fashion for over a decade, reappeared in the late 1990s and has risen to the forefront because of the current global economic crisis. This time around, the problem seems to have reached a critical state with diverging views on how to resolve the debt crisis. In the European Union (EU), where a large number of countries are on the brink of default, the situation is further complicated because of limited authority of the European Central Bank's (ECB) and lack of a common fiscal policy due to fiscal autonomy of member countries. The common currency integration into Euro zone makes it impossible to devalue Euro by a member country, thus eliminating this option to mitigate debt crisis.

Research studies that have investigated debt defaults in financially integrated countries such as the EU have demonstrated that the debt contagion effect could be considerably reduced if these countries are willing to agree on fiscal integration as well. Fiscal integration usually results in more efficient equilibrium supply of government debt (Bolton and Olivier, 2011). The downside of fiscal integration is that it normally reduces the welfare of the country that provides the 'safe-haven' asset below the autarky level.

There is a large body of research that has focused on the causes of sovereign default. According to these researchers, the root cause of defaults by countries could be traced to many reasons including structural issues, international capital flows, the introduction and growth of securitized debt instruments, and many others. In fact, there are researchers who strongly feel that credit market imperfections might be more to blame for the serial default of many countries (Reinhart and Rogoff, 2004). This becomes more evident when you consider that developing countries, who are often the debt defaulters, neither invented sovereign default nor serial default. Historically, both developed and developing countries have faced defaults.

Research on the subject of default by Cuadra and Sapriza suggests that political stability of a country is an important factor in determining probability of default. Using quantitative analysis, they were able to show that high turnover rates, length of tenure of policymakers, and the degree of conflict within a country affect sovereign spreads, debt and default rates. The analysis further demonstrated that politically unstable and more polarized economies experience higher default rates and larger level and volatility of sovereign interest rate spreads (Cuadra and Sapriza, 2008). This conclusion is reinforced by Zakaria (Zakaria, 2011) who points out that the presence of archaic rules enable one senator in the U.S. Senate to put a hold on a bill without giving any reason and bring the democratic process to a halt. Two-year election cycle for U.S. House of Representatives is blamed for making the representatives preoccupied

with reelection, be dependent on special interest funding for election, and, therefore, focus on short-run maximization rather than on long term improvements in economy. An improvement in legislative processes could facilitate prompt implementation of measures to reduce national debt.

There are other studies that link defaults to political instability. In analyzing countries that default on their debt more often than others, Giordano and Tommasino postulated that sovereign default is the outcome of a political struggle among different groups of citizens. According to these researchers, defaults are less likely to happen if domestic debt-holders are politically strong and/or the costs of the financial turmoil typically triggered by a sovereign bankruptcy are large (Giordano and Tommasino, 2011).

In recent years, because of the poor assessment by rating agencies and their role in the financial crisis, academic researchers have raised a question whether rating agencies played a passive role or were an active driving force during Europe's sovereign debt crisis. In a study that addressed the role of rating agencies, Gärtner, Griesbach, and Jung, were able to establish relationships between sovereign debt ratings and macroeconomic as well as structural variables. The researchers found that, both ratings and economic structural variables do affect credit spreads, which opens the possibility that arbitrary rating downgrades trigger a process of self-fulfilling prophecies that may drive even relatively healthy countries towards default (Gärtner, Griesbach, and Jung, 2011).

An area that was thought to be a major contributor to a country's default, namely domestic output has not always been a good predictor of sovereign defaults. In an extended research based on data for more than 184 years, Tomaz and Wright (Tomaz and Wright 2007) found a negative but surprisingly weak relationship between economic output in the borrowing country and default on loans from private foreign creditors. Moreover, in their study, countries have indeed defaulted during periods when output was relatively low, but they have also suspended debt repayments when the domestic economy was healthy. There are cases where countries have maintained debt service payments in the face of adverse shocks.

The instances of high national debt default during times of economic downturn as well as upturn have puzzled economic theorists of international debt. Theories of international debt suggest a much tighter negative relationship between economic output and default because default provides partial insurance against declines in output (Tomaz and Wright, 2007). In a study of Argentina's debt crisis, Arellano, observed that his model closely matches business cycles in Argentina predicting high volatility of interest rates, higher volatility of consumption relative to output, and negative correlations of output with interest rates and the trade balance (Arellano, 2008). Similarly, in a study of developing countries, Malone observed that output and defaults may be correlated if the inherent political system interferes with consumption and output to safeguard a particular political party's continuity as the rulers of the country as these politicians fear losing their prospects to rule the country because of costly defaults. For developing countries, Malone's cross country regressions revealed that higher indebtedness is associated with higher monetary, fiscal, and public investment policy volatility and with policies that increase output volatility at the expense of growth (Malone, 2011).

An interesting area that a few researchers have concentrated on is why defaults continue to exist at all, especially after trying different prescriptions over the past several decades. Some researchers feel that it might be due to the non-existence of mechanisms to punish those countries that serially default. What many of these researchers have found is that, unlike corporate defaults, there are no judicial systems that handle a country if it defaults on its debt. That is, the lack of an established legal system makes it difficult to force countries to payback their debts. Interestingly, in a study focusing on the most recent debt crises and defaults, Panizza, et al., found limited support for theories that explain the feasibility of sovereign debt default based on either external sanctions or exclusion from the international capital market and more support for explanations that emphasize domestic costs of default (Panizza, Sturzenegger, Zettelmeyer, 2009).

Fortunately, despite the non-existence of a legal framework to force countries to pay back their debts, most countries do pay back their debts and there still exists a debt market. In fact, quite a few academic papers have focused their attention on this phenomenon (Eaton and Gersovitz, 1981; Kletzer, 1994; and Kletzer and Wright, 2000). Their conclusion is that the creditors-debtors have a continuous relationship

and denying future credit to debtor countries is not the answer. Instead, after a default both parties potentially benefit from reaching a new agreement involving positive lending. An equally strong argument for the continuation of the debt market even under risk of defaults is the fear that default might lead to shrinkage of international trade (Pose and Spiegel, 2004).

In the area of early warning systems in predicting potential defaults, research studies have proposed various models. A few of these have definitely worked in the short-term. For example, Yeyati and Panizza examined the impact of default on growth using quarterly data and found that output contractions precede defaults and that output starts growing after the quarter in which the default took place (Yeyati and Panizza, 2011). Their conclusion is that default episodes mark the beginning of the economic recovery and that the negative effects of a default on output are likely to be driven by the anticipation of default, independently of whether or not the country ultimately decides to validate it. But, the majority of these models lack the predictability and accuracy from a long-term point of view, which is essential for policy makers to ward off defaults in order to take corrective actions before the actual default happens.

Although not a predictive model, but a close proxy for anticipating defaults, researchers have found that by examining equilibrium determination under different monetary policy regimes it might be possible to determine when a government might default on its debt. By applying a cash-in-advance model where the government does not have access to non-distortionary taxation and does not account for initial outstanding debt when it sets the income tax rate, Schabert showed that, if money supply is controlled, the equilibrium allocation can be uniquely determined (Schabert, 2010).

Recently, researchers have turned their attention to the idea of considering an economic ceiling to external debt. Stein and Paladino evaluated probability of foreign debt default by modeling a level of optimum/maximal foreign debt (Stein and Paladino, 2001). The authors employed stochastic optimal control models to determine how a country can anticipate foreign debt default risk as it approaches the maximum sustainable foreign debt. In a subsequent study, Reinhart and Rogoff concluded that beyond a maximum sustainable foreign debt level of 60 percent of GDP, rate of growth of GDP declines (Reinhart and Rogoff, 2009).

Reinhart and Rogoff soon focused their attention on search for an optimum or sustainable level of national debt. Based on empirical study of forty countries, they concluded that for advanced economies, a debt to GDP ratio between 30 percent and 90 percent limits the growth of GDP at a median rate of about 3 percent per year. When the ratio exceeds 90 percent, GDP growth declines considerably to about 1.9 percent. For emerging economies, the median growth rate of GDP stays around 4-4.5 percent at a ratio below 90 percent and falls to 2.9 percent when the debt ratio exceeds 90 percent. The authors do suggest that the growth rates will be different for individual countries, once again reflecting the variability in the critical factors that determine a nation's debt levels. (Reinhart and Rogoff, 2010).

An IMF study (IMF 2009) confirmed the conclusions of Reinhart and Rogoff (2009) analysis, although their estimates of impact are different. IMF estimates indicate that a 10 percentage point increase in the debt to GDP ratio will decrease the annual real per capita GDP growth by 0.15 percent for advanced economies and 0.2 percent for emerging economies. A ten percentage point increase in initial debt will also reduce investments by 0.4 percent of GDP and increase 10-year bond yield by 2 percent in advanced economies. The impact will be more adverse on emerging economies. A number of other studies have come to similar conclusions.

IMF has set targets for maximum gross debt to GDP ratio at 60 percent for advanced economies and a ratio of 40 percent for emerging economies to be effective by 2030. The IMF has also developed a quantitative formula to reduce the current ratio of debt to GDP to target ratio. (IMF 2010). The drawback of establishing a common debt to GDP target ratio for a heterogeneous group of economies is that it does not take into account country specific economic structure that has ability to service and repay the national debt. The study further establishes average fiscal adjustment required to reach the debt to GDP ratio targets.

METHODOLOGY

Using the IMF model as the starting point, the model developed in this paper not only contains the factors that lead to national debt (GDP growth rate, tax revenues, government outlays, and interest rates), but also those factors that reflect economic variability within individual countries.

The IMF Fiscal Adjustment Model

The debt dynamics equation used in IMF analysis to determine the fiscal adjustment required to bring the current debt to GDP ratio to a set target ratio is:

$$\Delta dt = -pbt + \frac{(rD-g)}{1+g}d_{t-1}$$

Where, dt is gross debt to GDP ratio in period t ; pbt represents fiscal deficit plus net interest payments in period t ; rD is nominal interest rate on gross debt; g stands for nominal GDP growth rate; and d_{t-1} denotes the gross debt in prior period.

The two key determinants of the fiscal adjustment are the interest rate and growth differential $rD - g$ and the initial debt represented by d_{t-1} . It appears that both rD and g are positively correlated and both contain an inflation rate component. In the event the differential is equal to zero, the equation reduces to an identity without any additional fiscal adjustment determinant. If the differential is positive, the fiscal adjustment needed to reach target debt to GDP ratio, is progressively higher. It is clear that when the differential is negative, meaning nominal growth of GDP is higher than the nominal interest rate on gross debt, fiscal adjustment is automatic. This conclusion emphasizes the importance of growth of an economy as the prime factor for reducing unemployment, fiscal deficit, and national debt. The equation does not take into account the impact of FDI and level of private savings which could have a bearing on interest rates.

Structure of New Model

Fiscal deficit or balance is defined as:

$$D = T - G$$

where D stands for deficit, T for tax receipts, and G for government expenses.

Rather than debate whether government expenses are too high or too low, it is desirable to determine an optimum level of government expenditure. To begin, the functions of federal or central government are defined in a country's constitution. The extent of service provision or expenditure for each of these functions is often based upon past levels, current priorities, and emergency requirements determined by legislators in each country. Since government expenditure leads to direct government employment and/or private sector employment, there is a general reluctance by elected representatives to reduce any expenditure that might adversely affect employment levels of their constituents. Thus optimum government expenditure can be defined as:

$$\text{Optimum government expenditure} = f(\text{prioritized minimum critical functions of government, level of each function})$$

This is not an easy task, however, an estimate of level of service and priorities preferred by the general public can be obtained through annual surveys. Annual review of such surveys will keep the process dynamic and also offer flexibility for emergency appropriations.

Tax receipts should be adequate to cover optimum government expenditure. If a country needs to reduce its national debt, tax receipts should exceed government expenditures to create fiscal surplus.

Tax receipts = f (Optimum govt. expenditure, tax base, tax expenditures, tax rates, national debt servicing requirements)

Tax structure should be consistent with economic cycle. Tax receipts should increase during upturn of economic cycle to create fiscal surplus for reduction of national debt.

$$\text{Tax receipts} = \begin{cases} T < G & | \text{downturn} \\ T > G & | \text{upturn} \end{cases}$$

This theoretical ideal may not be accomplishable, at least in the immediate future. Pending such a solution, a practical solution is developed in the following model. The model assumes that:

- National debt could approach zero but will never be zero or negative.
- Growth rate of market based advanced nations will be lower in the near future, partly due to sheer size of their GDP. Partially managed and regulated economies will experience higher rates of growth.
- Consumption, both domestic and overseas through exports, will continue to be the prime driver of economic growth.

Model Specification

National debt consists of accumulated past fiscal deficits. Annual fiscal deficit is defined as receipts less expenses.

$$D = \Sigma(T-G)$$

Macroeconomic analysis suggests that

$$Y = C + I + G + (X - M) \quad \text{and also} \\ Y = C + S + T$$

Where Y is GDP, C is private consumption, I is private investment, G is government spending, (X – M) gives current account trade balance, S is savings of private sector; and T represents taxes. Combining the equations, fiscal deficit will equate to:

$$(T - G) = (X - M) - (S - I)$$

Where (T – G) represents fiscal deficit or fiscal balance, (X – M) denotes current account trade deficit; and (S – I) describes difference between domestic savings and domestic investment needs.

Based on prior research conducted by the authors (Jadhav, Neelankavil, 2011), (T-G) can be explained by: Government consumption, private consumption, GDP growth rate, interest rate, unemployment rate, current account trade balance, domestic savings, and FDI.

National debt or accumulated deficits would require a slightly different set of explanatory variables to identify key factors that determine the level of debt. These include: current level of national debt, current level of annual fiscal deficit, annual debt servicing cost, interest rate on outstanding debt, nominal GDP growth rate, and tax receipts. Dividing both sides by GDP, the absolute value variables can be expressed in terms of percent of GDP and making them compatible with other variables expressed in percent.

National debt $t = f(\text{National debt } t-1, \text{ fiscal deficit } t, \text{ rate of inflation } t, \text{ nominal GDP growth } t, \text{ unemployment rate } t, \text{ 10-year government bond yield } t)$

where 't' denotes time period.

Final statistical computations were undertaken with elimination of variables with low significance and substitution of a few by proxy variables.

ANALYSIS AND RESULTS

This paper employs the technique of panel analysis to monitor movement of significant explanatory variables over the recent six year period from 2005 to 2010. The panel of 32 countries includes major European economies, Japan, and the U.S. This rolling analysis of periodic stationary data also ascertains the stability of parameters to be used for the purpose of estimating the future level of gross national debt. Due to volatility of economic activities for years 2009 and 2010, the results for these years do not show a consistent cause and effect pattern. The results for years 2005 to 2008 are given in Table 1.

TABLE 1
PANEL REGRESSION COEFFICIENTS

Panel year	Panel Regression Coefficients			
	2005	2006	2007	2008
Intercept	66.29	75.33	92.84	51.13
Fiscal Balance (T-G)	-1.67	-1.33	-2.13	-1.05
Interest rate less GDP growth rate	2.55	4.08	2.77	0.27

The rolling coefficients values suggest change in the weights attached to variables with changes in values of the variables. Thus, while the coefficient of fiscal balance (i.e., annual deficits) is decreasing, the amount of deficits is increasing. The 'interest rate less GDP growth rate' differential that is pivotal in IMF studies also shows similar trends.

The causal relationship of final five explanatory variables on national debt was analyzed through a vector autoregressive (SVAR) model that can be summarized as:

$$Y_t = \beta_0 Y_{t-p} + \beta_1 X_{1t-p} + \beta_2 X_{2t-p} + \beta_3 X_{3t-p} + \beta_4 X_{4t-p} + \beta_5 X_{5t-p} + \varepsilon_{t-q}$$

Where, Y_t represents debt to GDP ratio in period t . The analysis includes five X vectors: fiscal balance as percent of GDP, interest rate less growth rate of nominal GDP (IMF definition $rD-g$), annual fiscal deficit as percent of budgetary outlays, unemployment rate; and exports as percent of GDP. Lagged value of debt to GDP ratio appears as the sixth explanatory variable. 10-year commercial interest rate is used as a proxy variable for yield on 10-year government bonds. The VAR matrix has 41 rows and 6 columns, where Y is the sixth vector. This model was applied to U.S. data series from 1970 to 2010. Summary of three SVAR specifications results are presented in Table 2.

TABLE 2
SVAR COEFFICIENTS AND SIGNIFICANCE STATISTICS

Variable descriptions and Statistics	MODEL 1	MODEL 2	MODEL 3
	Coefficient	Coefficient	Coefficient
Constant	-1.82383	-4.25396	-13.2369
Gross Debt as % of GDP in period (t – 1)	1.05194	1.06415	1.2051
Fiscal Balance (outlays less receipts) as % of GDP	0.81472	1.01828	
Interest rate <u>less</u> nominal GDP growth rate	0.47979		0.4302
Annual Deficit as % of budget	0.03377	0.0874	
Unemployment rate (%)		0.12868	0.9807
Exports as % of GDP			-0.4152
<i>Comparison of actuals v/s projections for gross debt as % of GDP for year 2010</i>			
2010 Actuals (%)	92.6	92.6	92.6
2010 Projections (%)	96.2	99.2	92.5
Forecast error for 2010 (%)	3.89%	7.13%	-0.11%
Lag	1	1	1
Degrees of freedom	35	35	35
RSE	2.438	2.774	2.801
R ²	0.9749	0.9675	0.9668
F Statistics	379.5	291.0	285.2
P-value	<2.2e-16	<2.2e-16	<2.2e-16

It is interesting to note that a test of the models for forecasting gross debt as percent of GDP for the year 2010 is within acceptable range for VAR models 1 and 3. This can be easily explained by the significance statistics given in the bottom section of Table 2.

A corollary of the above results is estimation of impact on gross debt to GDP ratio as the U.S. economy recovers from the 2008 great recession and approaches full employment level. Based on past experiences and a few fiscal and monetary measures that are being proposed, an experiment was conducted to estimate the impact of full employment budget concept values of X variables on the gross debt to GDP ratio. If the full employment budget concept merely means zero fiscal balance, it may reduce gross debt as percent of GDP in the future due to growth of the GDP. It will not reduce the absolute level of either gross debt or annual cost of servicing gross debt. These values, therefore, should not be limited to elimination of fiscal deficits alone but also include measures for reducing outstanding gross debt in absolute terms. Thus the values should produce a surplus which will appear as a negative fiscal balance value.

These assumptions require placing a higher priority on growth of the economy and following it with a reduction in fiscal deficit. Austerity measures have highest impact on reduction in fiscal deficits and national debt after the economy resumes a sustainable growth rate. Implementing austerity measures before the economy reaches a sustainable growth rate may actually reduce the growth rate and increase unemployment, even with quantitative easing steps taken by the central bank. Current economic upheaval in a number of EU countries that has resulted in a double dip recession and record unemployment is a real time case study that is a testimonial to this conclusion. Worst yet, a decline in GDP will call for an

additional reduction in absolute level of debt just to maintain the debt to GDP ratio at the same value. The expectations that immediate austerity measures will create confidence in the bond market and keep a lid on bond yields have not proven correct. If the economic growth of a country emanates significantly from net exports, domestic austerity measures could have a modest adverse impact on growth. The over emphasis on austerity measures in EU countries could trigger a political backlash leading to a shift in favor of growth policies. The IMF 2010 World Economic Report concludes that a fiscal consolidation of 1 percent typically reduces GDP by about 0.5 percent within two years and raises unemployment rate by about 0.3 percentage points. A recent paper by Ball, et al., (IMF 2011) evaluates 173 episodes of fiscal austerity over the past 30 years. The average deficit reduction in these instances amounted to 1 percent of GDP. The authors conclude that austerity “lowers incomes in the short term, with wage-earners taking more of a hit than others; it also raises unemployment, particularly long-term unemployment.” These assumptions are also consistent with the IMF ($rD - g$) differential analysis where ‘g’ or growth of nominal GDP plays a lead role in reduction of national debt. In a full employment scenario, the value of $(r-g)$ will be negative because ‘g’ will be higher than ‘r’. This experiment assumes holding the current gross debt to GDP ratio at 2010 level.

The internal consistency of values and models is also tested for estimating unemployment rate. Model 2 coefficients estimate the unemployment rate at 3.5% and Model 3 coefficients place the rate at 3.3%, and both compare favorably with the assumed 4 percent value.

TABLE 3
ASSUMPTIONS ABOUT FULL EMPLOYMENT VALUES OF X VARIABLES FOR THE U.S.

Gross debt as % of GDP	Fiscal Balance	Interest rate less GDP growth ($r-g$)	Deficit as % of outlays	Unemployment rate	Exports as % of GDP
92.6*	-2.0	-2.0	-1.0	4.0	15.0

* Value in year 2010.

The projections of gross debt to GDP ratio are indicative of maximum sustainable ratio in the full employment environment. The projected debt ratio for Model 1 is 92.96% for Model 2 it is 92.68%; and for Model 3 places it at 95.19%. Based on these results, it appears that a near term improvement in fiscal balance and growth stimulation should bring the gross debt to GDP ratio to 93 percent. This ratio should be viewed as an upper limit on debt ratio when the economy is operating at its full potential. A higher debt to GDP ratio is unsustainable and will drive the economy into a succession of lower growth periods accompanied by increased unemployment. In a leaner economic and fiscal scenario, this maximum is not sustainable, hence the search for an optimum debt to GDP ratio.

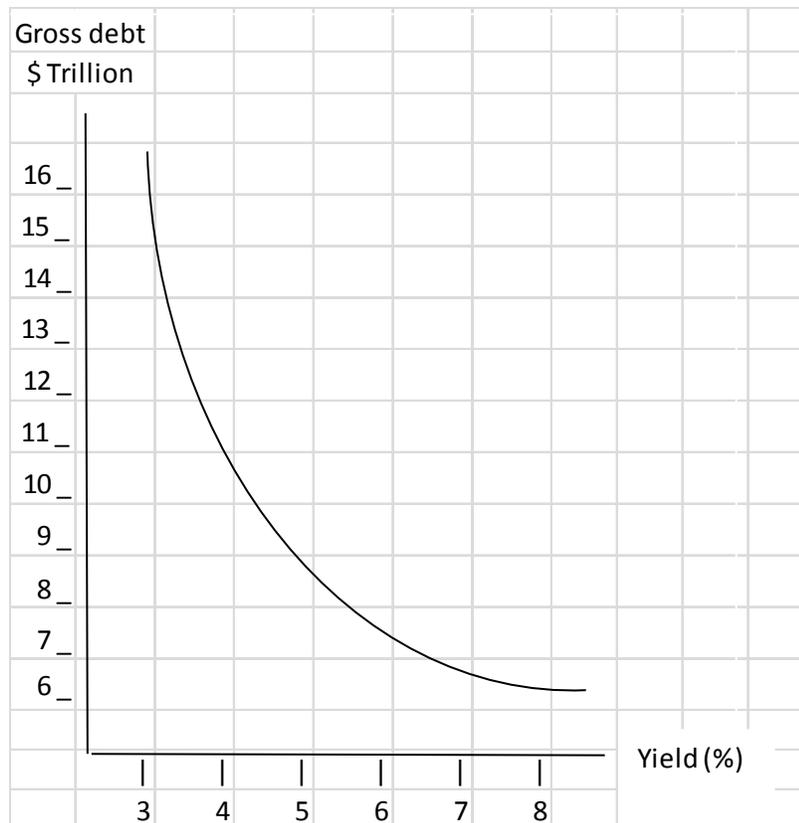
The probability of default is much higher for repayment or refinance of gross debt than for failing to pay interest on the debt. Debt servicing cost primarily depends upon the level of gross debt and the long term rate of interest on sovereign debt. Currently, the average interest rate on gross debt for the U.S. is about 3 percent. Figure 2 shows the relationship between average rate of interest and gross debt at a given cost of servicing sovereign debt.

After deriving the maximum limit on national debt, it is desirable to estimate an optimum level of debt as a target debt to GDP ratio. Optimum level of national debt at a given rate of interest should be stated in both an absolute number as well as in relative terms as ratio of debt to GDP. This level must be estimated with reference to debt servicing cost and fiscal balance. It is that level of debt at which the annual debt servicing cost and actuarial installment of principal is paid entirely out of budget surplus, meaning that no deficit is incurred to pay for the cost of servicing debt. The balance of budget surplus should be appropriated into a national debt reduction fund to be used for reduction in debt. This will require tax restructuring as well as expense reduction. As the absolute level of national debt goes down, the cost of servicing the debt will also decline thereby reducing the pressure on creating budget surpluses.

The surplus can, thereafter, be converted either into tax reduction or undertaking essential national projects.

The optimum debt ratio should serve as a target to be achieved over a specific time period. Estimation of this target will require identification of long term equilibrium term for incorporation in an Error Correction Model. Authors of this paper have embarked on such investigation. Pending the results of the new study, a practical estimation method based on average interest rate on national debt is suggested in the next paragraph. Optimum debt ratio is expected to be lower than the maximum debt ratio. Neither maximum nor optimum levels are static estimates. A change in the average rate of interest on sovereign debt will impact on the fiscal balance and lead to different optimum and maximum debt to GDP ratio. The sustainable and optimum debt levels are inversely related to the long term average interest rate on long term sovereign bonds as shown in Figure 2. The debt servicing indifference curve holds the 2011 servicing cost of \$454 billion constant to compute appropriate level of debt at different yields. The indifference analysis suggests that at the current level of debt, a 1 percent increase in average interest rate on sovereign debt will require a 25 percent reduction in the debt to hold debt servicing cost at \$454 billion. Since the national debt is accumulated through annual or marginal deficits, it does not have a single maturity date and the probability of such a drastic increase in average interest on national debt is low. The following indifference curve shows the relationship between rate of interest and the gross debt.

FIGURE 2
INDIFFERENCE CURVE AT CURRENT U.S. DEBT SERVICING COST



As the U.S. economy moves towards full employment level, the average interest rate on outstanding national debt will increase. The 10 year average interest rate on sovereign debt for period 2002 to 2011 was 4.2 percent. Given the measures underway to reduce fiscal imbalance in the U.S., recessionary trends in the European Union, and an increasing flow of foreign funds from the rest of the world to the U.S., it is

very likely that the average interest rate on the U.S. national debt will stabilize around 4 percent in the near future. If these assumptions are valid, the indifference analysis suggests an optimum rate of debt to GDP ratio for the U.S. to be at 65 percent. This target ratio can be reached within the next ten years, given the heightened concern for deficits in the U.S. and the fiscal efforts aimed at reduction in national debt. This optimum debt ratio is within the safe range suggested in Reinhart and Rogoff empirical study (Reinhart and Rogoff, 2010) and surprisingly close to the IMF target for advanced economies.

CONCLUSIONS

The panel analysis brings out the importance of three critical economic variables. These are fiscal balance, prevailing long term rate of interest, and nominal GDP growth rate. These three collectively determine maximum sustainable level of debt to GDP ratio. For the fiscal year 2011, the ratio of debt to GDP for the U.S. was 102.9 percent. Our analysis of the US debt for the years 1970 to 2011 has resulted in establishing a maximum sustainable national debt to GDP ratio for the U.S. at 93 percent. It should be noted that while the “off-budget surplus” as an internal source of deficit financing is getting smaller, the reduction in outlays beginning with reduction in war expenses and mandatory across the board reduction in expenses could offset this shortfall. U.S. exports are showing a growth trend and could provide a source of economic growth. On an international basis, net exports amount to a zero sum game since all countries cannot simultaneously be net exporters.

It appears that the estimate of optimum debt to GDP ratio of 65 percent for the U.S. which could be reached within ten years is compatible with the ratio of 60 percent proposed by the IMF for developed countries (IMF, 2010) and within the safe range proposed in Reinhart and Rogoff analysis quoted above.

In addition, one must be aware that these ratios are dynamic, not static. As the underlying economic structure changes, the maximum and optimum debt to GDP ratios will change. Average rate of interest on sovereign gross debt is of particular importance in estimating the debt to GDP ratio. Interest rate is inversely related to the absolute level of outstanding debt and would necessitate a drastic reduction in debt if average interest rate increases substantially. Fortunately, national debt is accumulated through annual fiscal deficits and the dollar averaging principle will not precipitously increase average rate of interest on national debt.

Both IMF conclusions and our results indicate that policy measures that promote growth of U.S. economy should be a preferred option as compared to focusing on expense reduction alone. Projects that increase employment within the country will have the highest multiplier effect on both income and consumption. Another set of policy measures that will produce similar outcome are those which promote exports. The partial coefficient for exports as a percent of GDP indicates that a one percent improvement in this ratio will reduce annual deficit to GDP ratio by 0.42 percent.

Due to economic uncertainties in European Union countries, international flows of funds have favored the U.S. These investment flows along with liquidity infusion by the Federal Reserve have increased supply of funds in the U.S. and has acted as counterbalance for lower domestic savings. Increased availability of funds in the U.S. has kept the yield on government bonds low in comparison to many developed economies, with the exception of Japan. When European economies improve, the FDI flows to the U.S. may decrease. FDI has not been included as an explicit variable in this analysis but appears indirectly through (r-g) differential. Maintaining proper level of this differential will require another set of fiscal and financial measures. The importance of increasing economic growth (g) is already emphasized. For appropriate level of (r-g) differential, it is also essential that the interest on sovereign debt (r) be kept low.

Recent experience of European countries suggests that the burden of avoiding default may not fall entirely on the tax payers but also has to be borne by investors. Corporate bondholders are familiar with this remedy and the corporate bond yield reflects cost imposed by such risk. Extension of the risk burden to sovereign bond holders will introduce a risk premium in hitherto risk free interest rate on government bonds. This sharing of burden with investors should be handled carefully to prevent an excessive increase in yield on government bonds to a level that will warrant further reduction in absolute level of debt.

Based on the above analysis, it appears that a universal static target debt to GDP ratio for a group of countries can at best be considered transitional, pending development of a country specific dynamic target. The significant variables in establishing a country specific target include: fiscal balance, rate of inflation, growth rate of GDP, unemployment rate, yield on government bonds, level of exports, FDI, etc. There are a few offsetting trends among these variables. An improvement in productivity due to technological advances increases growth rate of GDP but often leads to an increase in unemployment, a case of jobless recovery. If U.S. corporations decide to give away some of their retained earnings to stockholders in the form of dividends, consumption could increase. On the other hand, reduction in government expenses may mean an increase in expenses shifted to citizens and a consequent reduction in their disposable income, if the functions eliminated by government were essential.

Unfortunately, it is not easy to establish single country National debt to GDP ratios due to a number of limitations. Some countries, which are part of an economic union, may require a ratio representing the collective group. Many others, especially developing countries in Africa, parts of Asia, and Latin America are economically weak and do not have the necessary information or are willing to tolerate higher debt to stimulate their economies. These countries need the assistance of international organizations such as the IMF to establish individual targets and an early warning system to avoid default of national debt.

LIMITATIONS

The authors plan to enhance this study by employing Error Correct Model for a better estimation of the country specific optimum level of national debt and extending coverage to major economies.

REFERENCES

Arellano, Cristina, (2008), "Default Risk and Income Fluctuations in Emerging Economies, *American Economic Review*, 98, no. 3: 690-712.

Bolton, Patrick and Jeanne Olivier, (2011), "Sovereign Default Risk and Bank Fragility in Financially Integrated Economies" *IMF Economic Review*, 59, no. 2: 162-194.

Cuadra, Gabriel and Horacio Sapriza, (2008), "Sovereign default, interest rates and political uncertainty in emerging markets" *Journal of International Economics*, 76, no. 1: 78-88.

Eaton, Jonathan, and Mark Gersovitz. 1981. "Debt with Potential Repudiation: Theoretical and Empirical Analysis." *Review of Economic Studies*, 48(2): 289-309.

Gärtner, Manfred, Björn Griesbach, and Florian Jung, (2011), "PIGS or Lambs? The European Sovereign Debt Crisis and the Role of Rating Agencies, *International Advances in Economic Research*, 17, no. 3: 288-299.

Giordano, Raffaella and Pietro Tommasino, (2011), "What determines debt intolerance? The role of political and monetary institutions" *European Journal of Political Economy*, 27, no. 3: 471-484.

IMF (2009), "*The State of Public Finances Cross-Country*", IMF Staff Position Note, November 3, 2009.

IMF (2010). "Navigating the Fiscal Challenges Ahead", *IMF Staff Paper*, May 14, 2010.

IMF (2011). "Painful Medicine", *IMF paper*, September 2011, Vol. 48, No. 3.

Jadhav, Arvind and James Neelanakvil (2011), "Deficit Financing: Cases, Consequences, and Potential Cures," *Journal of Applied Business and Economics*, December 2011, Vol. 12(6): 83-99.

Kletzer, Kenneth M. 1994. "Sovereign Immunity and International Lending." In *Handbook of International Macroeconomics*, ed. Frederick van der Ploeg, 439–79. Malden, Mass. and Oxford: Blackwell.

Kletzer, Kenneth M., and Brian D. Wright. 2000. "Sovereign Debt as Intertemporal Barter." *American Economic Review*, 90(3): 621-639.

Malone, Samuel W., (2011), "Sovereign indebtedness, default, and gambling for redemption, *Oxford Economic Papers*, 63, no. 2: 331-354.

Panizza, Ugo, Federico Sturzenegger, and Jeromin Zettelmeyer, (2009), "The Economics and Law of Sovereign Debt and Default," *Journal of Economic Literature*, 47, no.3: 651-698.

Pose, Andrew K., and Mark M. Spiegel, (2004), "A Gravity Model of Sovereign Lending: Trade, Default, and Credit *IMF Staff Papers*, 51, (Special Issue): 50-63.

Reinhart, Carmen M., and Kenneth S. Rogoff, (2004), "Serial Default and the "Paradox" of Rich-to-Poor Capital Flows" *American Economic Review*, 94, no. 2: 53-58.

Reinhart, Carmen M., and Kenneth S. Rogoff (2009). "*This Time is Different: Eight Centuries of Financial Folly*," Princeton, NJ: Princeton Press.

Reinhart, Carmen M., and Kenneth S. Rogoff, (2010). "Growth in Time of Debt", *American Economic Review*, 100, no. 2, 573-578.

Schabert, Andreas, (2010), "Monetary policy under a fiscal theory of sovereign default," *Journal of Economic Theory*, 145, no. 2: 860-868.

Stein, Jerome L., and Giovanna Paladino, (2001). "Country Default Risk: An Empirical Assessment," *Australian Economic Papers*; 40, no. 4, 417-437.

Tomaz, Michael and Mark L. J. Wright, (2007), "Do Countries Default in "Bad Times"?, *Journal of European Economic Association*, 5, no. 2/3: 352-360.

Yeyati, Eduardo Levy and Ugo Panizza, (2011), "The elusive costs of sovereign defaults" *Journal of Development Economics*, 94, no. 1: 95-105.

Zakaria, Fareed, *Time*, Volume 177, Issue 10, March 11, 2011.