**GDP Intertwined Bonds**

Miss Vishakha Agrawal¹ & Mr. Aviruk Chakroborty²  
¹BA (Hons) Economics, Pandit Deendayal Petroleum University, India  
²MS Computational Engineering, Ruhr University, Germany

**Abstract:** Post 2013 when Bond Yield surge for Greek Sovereign Bonds, a newer paradigm for sovereign financing had to be explored. One of the core issues in Greece was the huge debt load with a minuscule GDP growth where reducing expenditure would only further push the economy into a vicious cycle of lower GDP growth perpetuating like a self-fulfilling prophecy. Today on the other hand, developing economies are cash strapped to fuel their growth plans. Due to the risk of default, developing countries pay a sizable default risk premium on their debt. (Reinhart and Rogo, 2008) This study has potentially useful implications for advanced countries, such as those affected by the euro zone debt crisis as well as an implantation road map for the emerging economies to get higher investments and better growth opportunities.

After detailed qualitative and quantitative analysis we propose a new structural instrument for sovereign financing: Intertwined GDP bonds, where there two countries on opposite end of growth and risk spectrum collaborate to raise money from international bond market. This paper details the requirement and working of the Intertwined GDP Bonds along with the financial model and the avenues where the money raised can be spent. It shall also illustrate the working of the bond with country case brief and its benefit to both the developing and developed nation. The research shall be descriptive and analytical with secondary data in practice.

**Key Words :** GDP Bond, Economic Growth, GDP intertwining, macroeconomics, blockchain, geopolitics, sovereign bond, municipal bond, credit default swaps

**Introduction**

Subsequently the end of World War II brought a revolution in global trade. Between 1980 and 2007, world trade tripled, while world economic output only doubled. (Centre for EU Forum, 2014) Since 1950s, East Asia has evolved as major manufacturing hub. This advent initiated from Japan and was passed on by South Korea, South East Asia and China. Fall in transport costs and tariffs steadily have benefited trade the most by dropping the cost of trade. Governments have also abridged ‘non-tariff barriers’ (NTBs) with WTO’s involvement globally and various different regulations, quotas and protections that made trading unattractive for exporters and enter foreign markets have been subsidized.

Global Trade is influenced by one prominent theory of development – David Ricardo’s Comparative Advantage. The cumulative division of labor between developed and emerging economies in the lieu of comparative advantage has led to increase in trade volumes. If each country in the bilateral trade specializes in producing the type of good it is best at, their combined output is higher if they trade freely with one another. (Ricardo, 1951) Its reason being specialization leads to increase in productivity, and progressive productivity leads to higher output. Comparative advantage has determined the progress in trade between the developed world and the developing economies, as the former have specialized in high technology value-added production and the latter in labor intensive manufacturing.

China’s economy grew by over six per cent a year between 2005 and 2016, expanding its trade with rest of the world. India managed growth of average seven per cent over this period. Developing economies’ growth has slowed since the crisis – and in all likelihood will be permanently lower – but they will continue to expand more rapidly than developed countries. But they haven’t overcome their socioeconomic backdrops and political risks. The new world after 2008 recession has been seeing growth at a very low rate.

Post 2013 when Bond Yield surge for Greek Sovereign Bonds, a newer paradigm for sovereign financing had to be explored. One of the core issue in Greece was a huge debt load to GDP with a minuscule GDP growth where reducing expenditure would only further push the economy into a vicious cycle of lower GDP growth perpetuating like a self-fulfilling prophecy. Today on the other hand, developing economies are cash strapped to fuel their growth plans. This study has potentially useful implications for developed countries, such as those affected by the euro zone debt crisis as well as for the emerging countries, who due to the risk
of default, pay a sizable default risk premium on their debt.

**EU and GCC – The Stagnant Growth Story**

The EU nations have been facing backlog in their economy in the last decade and were majorly affected by the 2008 recession. A mutual European determinant points towards risk linked with it and it cannot be discriminated so that the investment in the portfolio of euro-zone sovereigns is constricted to the premium this risk grosses. Partly by necessity, partly by design, the EU’s trade policy has been “walking on two legs” since its early days: multilateral liberalization and regional integration. (OECD, 2000) Now, after Brexit implications are to be followed for both UK as an individual and EU whose one of the most significant ally has left it. It would allow the UK to negotiate its own trade deals with non-EU countries. But as a small country, the UK would have less bargaining power than the EU. (Dhingra and Sampson, 2016)

![EU 28 Countries GDP Growth Rate](image)

Data – Eurostat
Accessed on 29-08-2016

Greece is today one of the most obligated countries in Europe with public debt level reaching around 113% of the nation’s GDP. As a direct significance of the substantial debt, Greece had been suffering from a severe public deficit that ranged from around 12% of GDP in 2006 to almost 14% of GDP in 2010. (IMF Databank) The country’s current account deficit is also approximated at around -1.8% of GDP in 2015. Nevertheless, the situations are similar to other European nations as well. Other European countries such as Portugal, Italy, Ireland, and Spain in addition to Greece are facing similar circumstances with similar debt, deficit and banking characteristics.

Many researchers have assessed the root of problem in Greece. The Greek economy was one of the fastest growing in the euro zone two decades back as it grew with an average over the period of approximately 5%. A robust economy in combination with a low bond yields have facilitated the country sustain a large structural deficit from public spending and imports went unnoticed. But after the 2008 international financial crisis the Greek economy cracked for the worse since its two key established segments, namely tourism and shipping, were suffering from diminishing returns. And as a result, Greece economy crashed severely leading to a rise in its unemployment rate.
Data – Trading Economics
Accessed on 29-08-2016
Middle East – Rising above Dependence on Oil Revenue

Low oil prices, flaring fiscal deficits, growing populations, political disorder, terrorism, religious bigotry and high unemployment summon up a call for economic adversity for the region that once exacted the world’s main energy supplies and was enticing on long-term economic success. The GCC countries which are heavily Oil Revenue dependent nations, are troubled from fall in oil prices and high fiscal spending.

Substantial cost in terms of power, water, credit subsidies, tax exemption and other benefits along with reliance on imported capital equipment, management, and labor have led to fiscal inertia in GCC region. The Middle East oil-rich states now have to survive, some for the first time, with increasing budget deficits that have demanded a shift from the typical state economy concerning a lessening in their dependence on oil revenues. This significant move, is increasingly the need of the hour since turmoil is being felt by the current generation of youth in GCC as several regional countries facing unemployment, with graduates not able to find engagement in either private or public sector.

<table>
<thead>
<tr>
<th>Country</th>
<th>UAE</th>
<th>Saudi Arabia</th>
<th>Oman</th>
<th>Bahrain</th>
<th>Qatar</th>
<th>Kuwait</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Growth</td>
<td>3.90%</td>
<td>1.50%</td>
<td>-14.10%</td>
<td>0.90%</td>
<td>-2.60%</td>
<td>1.80%</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>4.30%</td>
<td>5.60%</td>
<td>7.20%</td>
<td>3.70%</td>
<td>0.20%</td>
<td>2.20%</td>
</tr>
<tr>
<td>Government Debt to GDP</td>
<td>15.68%</td>
<td>5.90%</td>
<td>9.20%</td>
<td>42%</td>
<td>35.80%</td>
<td>7.10%</td>
</tr>
</tbody>
</table>

Data – Trading Economics Accessed on 29-08-2016

Independence from Oil Revenue is also driven by the fact that hydrocarbon reserves are projected to be exhausted in some countries (Bahrain and Oman) relatively soon. Economic broadening needs to be reinforced by structural reforms, in particular, globalization and market liberalisation, sectors in which GCC countries have made noteworthy progress over recent years. Since the non-oil sector is inhibited by inadequate agricultural land and domestic labour, lack of skilled manpower, high illiteracy rate, and a relatively small market size, the paper presents an opportunity for these nations to concentrate on expanding their respective expertise across the globe and generate business revenue.

Literature Review

There is a large literature on the pricing of sovereign bonds spreading across analysis of government bonds in developing nations as well as others discussing safe bonds of advanced economies. Early as well as modern studies are also assessing the various determinants that condense the value of the sovereign bond. Researchers have also contributed in the studies which anticipate changing financial scenarios and their impact on a country’s performance.

Beber, Brandt and Kavajecz (2008) have shown that for the bond market in the euro area countries, investors care about credit quality and liquidity with variations over time. Zhang et al. (2011) developed quantifications regarding conditional probability of default on the debt of a country, dependent on the default of another country. Some studies use large international panels, and mostly analyses the importance of common factors in the pricing of sovereign bonds (such as Martell 2008) or Credit Default Swap markets (such as Longstaff et al. 2011).

Most countries issue sovereign bonds to access capital markets to finance their development. A sovereign bond is a debt security issued by a national government. (Investopedia) But a question at the heart of the policy debate is to which extent market prices of sovereign bonds reflect economic fundamentals in an appropriate fashion, or whether swings in risk appetite have led to an under-pricing of risk prior to the global financial crisis, and possibly an over-pricing of risk during the European sovereign debt crisis (Aizenman, 2011). One unique feature is fiscal sustainability which concerns the developed economies more than it concerns emerging economies. Several nations with long-standing excellent credit ratings have been affected. For instance, the United States lost their AAA rating (which they had held for 70 years) by Standard and Poors in August 2011, on concerns about the government's budget deficit and rising debt burden. Subsequently, also France was downgraded from AAA to AA+ by Standard and
Poors in January 2012. Similarly, Japan was downgraded by Moody’s in August 2011, from Aa2 (the third-best rating) to Aa3. (European Central Bank, 2013)

The subject of debt management is now a top priority in the developed economies with almost stagnant growth rate, as demonstrated by the stern conditions faced in 2008 financial crisis, when sovereigns were forced to restructure their debts with a knock-on effect on the rest of that global economy. Not even the most experienced economists had predicted the range of economic impacts of the global economic downturn of 2008. Hence it is becoming all the necessary for developed nations to bolster economic growth with preventive arrays and entice on opportunities present elsewhere across time zones.

But none is trying to explore an adjunct route to what has been already been suffered, that is none of the study addressed how the sovereign bonds restructuring can get incremental growth for both advanced and emerging economies. This paper suggests Intertwined GDP Bonds which is through clubbing the growth of the developing economies with covering risk through developed nations assistance.

**Intertwined GDP Bond**

One of the philosophical foundations for creating this hybrid financial instrument is to use the power of financial engineering to improve the socio economic climate of developing nations by opening up new avenues of growth capital. Our belief is that today developing nations do not need foreign aid but growth capital to not only survive but flourish.

The paradigm is shifting with the creation of a vast middle class across all the emerging and under developed economies with a possibility of more growth due to demographic dividends and underutilized consumer economies. What the economists of 60's considered the reason for poverty has become the reason for rejoicing today as a growth catalyst i.e. the population. As not only they provide a large consumer base but also a large work force base. Along with the fact that the emerging markets and under developed nations are the only ones who will not reach saturation and face deflationary pressure like Europe soon. This hybrid instrument is dedicated as a vital tool towards unleashing this growth possibility.

A new Trust Neutral Framework needed for implementing this new macroeconomic Financial instrument: Due to the new nature of the bond we propose a completely new trust neutral framework for controlling the bond issue and ledger maintenance.

This is especially important as without this framework the bond cannot be implemented as in the first transaction neither government trusts the other government. The government computers of are maintained in such as manner that the number of nodes is finalized before the launch of the block chain and included as a part of the deal memorandum.

The block chain framework is especially robust because they use elliptical curve cryptography. Due to various diplomatic, political and security reasons we understand that both countries will be reluctant to cede the control and monitoring of the bond to the other party which would in evitable delay the launch of the bond. Hence after analyzing the entire spectrum of possibilities we came to the conclusion that the current protocol used in similar situations today i.e. the formation of a neutral 3rd party clearing house type organization would not only impede and delay the bond issue but might stall it for good. So we propose a more economical and trust neutral framework: Public private block chains to maintain the ledger.

A customized block chain solves this by using the distributed ledger framework. The aim is in three parts (a) to ensure the blockchain’s activity visible only to chosen participants i.e. sellers and buyers and issuers of the bond but the public part will display price information if the yield is floating (b) to introduce controls over which transactions are permitted including various fraud analytics frameworks and (c) to enable mining to take place securely without proof of work and its associated costs. Once a blockchain is in a public - private domain, problems relating to scale are easily resolved, since the chain’s participants can control the maximum block size. In addition, as a closed system, the blockchain will only contain transactions which are of interest to those participants.

The only users who will be able to append this block chain are - the 2 government during issue and post that only buyers and sellers will be able to make changes to the block chain once they purchase the bond. A similar framework of smart bonds developed and tested by UBS bank used for this framework.

Blockchain is basically a distributed database for transaction processing. Although most current blockchain operate financial transactions, this is not necessarily the case; in the most generic case, transactions could be viewed simply as atomic
changes to the system state. For example, a blockchain may be used to timestamp documents and secure them from alterations. All transactions in a blockchain are stored onto a single ledger - this leader is stored in a distributed fashion on the system of all its users. As transactions are ordered by time, the present state of the system (in the case of a financial blockchain, the collection of all users’ financial transaction i.e. bond buying and selling) is uniquely determined by the ledger. Storing all transaction history has other benefits such as increased regulatory compliance and the ability to determine the state of the system at any specified moment of time by “replaying” corresponding transactions.

Blocks compiling transaction data for a certain period of time are linked into a chain and each block contains a timestamp, hash value of the preceding block, nonce, and information on transaction records included in the relevant block.

Blockchain Technology involves a ledger of transactions that are maintained on a network of servers called “nodes.” Each node maintains a ledger reflecting the ownership of assets. The ledger is “distributed” because it is maintained simultaneously on all of the nodes in the network. The ledger contains a continuous and complete record of all transactions dating back to the origination of the ledger (the “chain”).

Any government would not like sharing its financial data systems especially their data based with the new partners. Hence in our opinion in “Blockchain versus databases” the block chain wins hands down. Blockchain also provide immutability and transparency on transactions that have already happened, along with cryptographic guarantees on every single transaction. Blockchain systems are also automatically decentralized and therefore resilient to failures, security compromises and failures of individual systems.

The fundamentals of Elliptic Curve Digital Signature Algorithm (ECDSA) in blockchain. When the term “key”, “key pair” or “private/public key” is used in Blockchain / bitcoin it means an ECDSA key pair. To make chains to the underlying chain and make changes one needs a access to an ECDSA private and public key pair.

ECDSA is a process that uses an elliptic curve and finite to “assign and plant” data in such a way that third parties can verify the authenticity of the signature while the signer retains the exclusive ability to create the signature. With block ECDSA has separate procedures for signing and verification. Each procedure is an algorithm composed of a few arithmetic operations. The signing algorithm makes use of the private key, and the verification process makes use of the public key. An elliptic curve is represented algebraically as an equation of the form: $y^2 = x^3 + ax + b$

Elliptical curve cryptography is much stronger than the general RSA cryptography and a proof of work framework can be used to access this system hence stopping it from a DDOS based attack, how this intertwined bond will use the efficient market hypothesis for making it more risk neutral and reflect the realities of the national economies in a real time basis: We use a Dynamic floating yield option open in the equity tranche of the bond where the entire bond is structured like a Collateralized Debt Obligation with tranches with respect to seniority being available to different types of global investors. Starting from Super senior tranches being available for pension funds and sovereign funds and central banks with lower yield and the equity tranche of the bond.

For dynamic floating yield options for keeping the fiscal health of the economy in check using market mechanism - we propose

a) Inflation indexed GDP intertwined bonds

b) GDP Growth rate indexed GDP intertwined bonds

This market mechanism will favor nations which are more fiscally responsible in using the funds and leading to reduced borrowing costs hence leading to a virtuous cycle and vice versa it can lead an ill managed economy to spiral downwards seemingly out of control.

We learned this lesson from the Greek crisis as Germany blamed Greek’s of not being more fiscally responsible and don’t want such issues in this bond if one member of the pack is an EU member. Here they can show their displeasure by just jacking up the yield i.e. the price of borrowing and this being a
A joint bond does not increase the public debt profile of the borrower and does not violate their fiscal laws and does not impact negatively their sovereign rating. This makes it eligible for not only nation states but also municipalities and state/emirate governments. We believe that an open market mechanism is a better option as it will not lead to clashes between the finance ministries and central banks of the two nations who will release this bond.

**Hedging at a sovereign level**

Use of GDP intertwined bond as a national GDP growth hedge. For example, an oil producing nation like UAE can reduce their GDP risk by having this bond with an economy whose expose to oil is not more than 5-10% of their GDP.

This is especially appealing to nations with slow GDP growth and deflationary pressure. The ROI and tax revenue this bonds liquidity injection to the developing economy will trigger a virtuous cycle where the majority of technology advanced work will be given to the firms registered in the more stable country. Thus the spill over impact of the GDP bond will benefit the richer nation directly by adding to its tax and GDP kitty.

**Tax Incentive**

As an incentive to both the buyers and sellers of this bond we can offer to make it tax free and without cap gains tax as the indirect spill over impact of the bond does add to the tax collection of both the economies. Due to a strong reliance on oil (Abu Dhabi 94 years of oil reserves and Adu Dhabi banks releasing Zero Coupon Bonds) and being a tax free regimen UAE should be considered as a prime proponent for this sort of bonds.

**Rating methodology**

This mix bonds Rating methodology is a mix of rating of sovereign bonds and corporate bonds with an open framework as for this to be market indexed it has to have an open financial and rating architecture.

The rating will only be defined by the fiscal and monetary projects of both the economies and an appropriate weight given to each in proportion to their GDP size but also that growth rates will be given higher weights. We will integrate equity uptick and credit default swap based insurance in this bond to make it more interesting for the investors and also safer at the same time.

Five-year Abu Dhabi CDS (Credit Default Swaps) tightened by 3 basis points on week to be at 81 basis points, while 5-year Dubai CDS also tightened by 2 basis points to be at 169 basis points as published in Gulf news. This bond will also add to the export based currency pool of both the nations central banks especially in USD/Euro pair.

How is it better than sovereign bonds - This bond is safer than the sovereign bond due to the Credit Default Swap portion of the bond and at the same time it has i.e. higher yields in its junior tranches.

Post bond issue we have a protocol mentioned in the Bond prospective/red herring about Department to department cooperation protocol. As the Richer nation gets an equity uptick in case of better performance by the emerging nation.

**Making the world safer**

By integrating various financial incentives of multiple nations we reduce the probability and financial incentive of armed conflict.

Also for example if Sri Lanka and Norway has co underwritten a bond then Norway would have higher clout in the peace negotiation process with a quantified financial carrot and stick.

This intertwined bond effects the trade pacts positively by not negatively impeding the framework but rather adding to the commerce volume of the region and making the trade transactions and financial instruments like LC more liquid in the local markets and in the process increase the depth in the market of these financial instruments.

**How will bond help both the countries?**

Developing countries can make themselves more attractive to bond inflows by: developing a clear plan to use the proceeds to plug economic and social infrastructure gaps; by improving economic growth potentials; generating greater commodity revenues; lowering inflation; reducing deficits on current account and government balances; and fostering capital-account convertibility and financial market development.

**Yield to Maturity, Yield to Call or Yield to Put Formula**

\[
\text{Bond Price} = \sum \frac{C}{(1+Y)^t} + \frac{P}{(1+Y)^n}
\]

Where \( C \) = coupon payment per period

\( P \) = par value of bond call premium
n = number of years until maturity or until call or until put is exercised

Y = yield to maturity, yield to call, or yield to put per pay period, depending on which values of n and P are chosen

This basic formula is used as the foundation of the bond pricing model.

The red herring prospectus will also define the money use / allocation pattern of this bond. For example, we can allocate 40 % for basic growth infrastructure, 30 % for socio economic factors like industry specific education and 30 % for sustainable energy framework along with smart city feature implementations. This framework can also be implemented for the Municipal bonds especially for sister cities.

References

1. IMF Databases
2. Khateeb Luay Al, August 2015, Gulf oil economies must wake up or face decades of decline, https://www.brookings.edu/opinions/gulf-oil-economies-must-wake-up-or-face-decades-of-decline/
3. Trading Economics, Various Databases
5. World Bank Databases