Municipal Bonds : Is India ready for more?

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26. March 2006

MUNICIPAL BONDS

IS INDIA READY FOR MORE?

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MARCH 27, 2006

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ACKNOWLEDGEMENT

We wish to thank many people who have helped us putting this document together. We wish to thank our advisors Mr. Robert Steel, Prof. Calestous Juma and our section leader Prof. Joseph Stern, at John. F. Kennedy School of Government, Harvard University for their support and time to guide us in drafting this policy paper.

Further we thank G.V. Ramakrishna former SEBI Chairman for educating us on the current developments in India and helping us reach relevant people for interviews in India. Our special thanks to G.Ramachandran of Business Economic and Risk Management, K. Venkitaramanan, former Governor of the Reserve Bank of India, K. Venugopal, Joint Editor of Hindu Business Line, K.P. Geethakrishnan, former Union Finance Secretary of India, T.N. Seshan, former Chief Election Commissioner of India, B.S.Raghavan, former Secretary to the Government of West Bengal for taking time out and explaining their views on municipal bond markets and Indian fiscal decentralization.

We also would like to thank Prof. Jeffery Frankel and Prof. Federico Sturzenegger at the Kennedy School, Harvard University for their advice. We sincerely appreciate our friend Sebastian James, the Joint Commissioner of Taxes, India and a current student at the Kennedy School, for his valuable input into Indian tax systems.

We assume full responsibility for all conclusions and any errors in this paper.

GLOSSARY OF TERMS

COC	Corporation of Chennai
CRISIL	Credit Rating Agency in India
FED	Federal Reserve Bank
GOI	Government of India
HUDCO	Housing and Urban Development Corporation
INR	Currency code for Indian Currency Rupee
MSBI	Municipal Securities Board of India
MSRB	Municipal Securities Regulation Board
MWSSB	Metropolitan Water Supply and Sewerage Board
RBI	Reserve Bank of India
SEBI	Securities and Exchange Board of India
SMZ	Special Municipal Zone
TNULB	Tamil Nadu Urban Local Body
ULB	Urban Local Bodies (Municipality)

EXECUTIVE SUMMARY

In India, municipal development projects benefiting the public often get impeded by the political and institutional framework of the Central Government. In many cases in India, a major constraint is financing these projects. According to the 12th Finance Commission report most of the infrastructure initiatives have been stalled due to financial constraints. For instance, the shortfall in financing to achieve the water and sanitation sector goals in India's Tenth Plan is estimated at **INR 179 billion**. Without the discretion to issue municipal bonds, municipalities are often dependent on transfers from the Government of India (GOI) since direct investment for these projects is difficult to secure.

While municipal governments are responsible for public service provision, their ability to do so is often constrained by inadequate GOI appropriations and/or missing municipal bond markets. On the other hand, private investors often lack the incentives to invest in public service projects due to high risks and insufficient returns. As a result, the provision of public goods such as infrastructure projects can be delayed or cancelled. Tax-free municipal bonds provide a potential mechanism to bridge the financing gap.

We have described the actual process of municipal bond process using the example of Corporation of Chennai and the desalination water project they propose to build. We present how tax incentives, transfers and private savings tie into the municipal bond framework. We believe that only a well performing municipality can be allowed to be fiscally independent and thus chose the Corporation of Chennai for analysis and go on to show what checks and balances are needed in the Indian scenario to support such a move towards sustainable financial decentralization.

This policy paper analyzes f**our key dimensions** of the expansion of the municipal bond market**.** Firstly, we analyze the driving forces for the evolution of a municipal bond market. Secondly, we develop an economic framework to value a municipal debt instrument and to estimate the optimal debt for the municipality to issue. In this section we also discuss the dynamics of the model and impacts of shocks and economic transfers on the municipal debt. Thirdly, we map the stakeholders and analyze the threats and benefits of a municipal bond issuance for these stakeholders. Finally**,** we recommend a framework for expansion of the municipal bond market while minimizing the potential for fiscal irresponsibility and uncontrolled growth of sub-national debt.

We propose the creation of **Special Municipal Zones** based on strong credit rating, accrual based accounting systems, optimal debt to revenue collection ratios and a strong financial need of the municipalities. To support such Special Municipal Zones, we recommend several key changes in the institutional framework including creation of the Municipal Securities Board of India.

INTRODUCTION

The right financing mechanism for development projects has been debated over years and the right financing method depends on various factors, *inter alia* institutional capacity, access to credit, maturity of capital markets, project returns, and investor's risk appetite. In this paper we analyze the use of municipal bonds as a financing tool for development projects. Although other financing mechanisms such as pooled financing, private investment, and loans are viable options, we focus on the municipal bond instrument as many municipalities in India have started to experiment with municipal bonds since 1997. While greater discretion for municipalities to issue bonds has the potential to increase accountability of municipal decision makers to local constituents, legitimate moral hazard concerns leading to fiscal irresponsibility and unsustainable growth of sub-national debt complicates this issue.

Municipal bond as a concept means the municipality in a country issues bonds to raise capital to finance its projects. We are advocating the use of municipal bonds in certain regions of developing countries which have sufficiently strong institutional and economic systems. The two key reasons for using municipal bonds are greater fiscal decentralization and effective distribution of funds by the GOI in the country.

To illustrate this case, we have looked at India and specifically the case of Corporation of Chennai (COC)[i]. We chose this municipality due to their strong economic performance along with their growing need for alternate financing routes. COC is an urban local body located in Chennai, the capital of the state of Tamil Nadu in India. We believe that COC should be granted limited discretion in raising capital through municipal bonds so that the state government can redirect its finances to other cities and towns and make effective use of funds. We show how COC on its own merit can raise capital through the issuance of bonds and then propose an economic model to estimate the "optimum" debt level that the city can bear such that the investors would be able to obtain tax free returns in such an environment.

We look at cases of municipal bonds to identify potential pitfalls and draw important lessons. Based on our analysis and these studies, we propose policy recommendations such that increased but limited fiscal independence be granted to municipalities such as COC and other well performing municipalities in India. India is coming of age where the country has demonstrated discipline and sustained economic growth in the last decade. It is important that the Government of India (GOI) address the need for greater fiscal flexibility at the municipal level while implementing safeguards against unsustainable sub-national debt accumulation in a way that rewards the well performing municipalities. Finally we conclude that this move towards the issuance of municipal bonds by local bodies should be a screened approach so that the exuberance does not lead to uncontrolled growth of sub-national debt as a result of moral hazard.

SECTION 1: BACKGROUND

While the 74th Constitutional Amendment of 1992 devolved a variety of service provision responsibilities[ii] to Municipalities, the sources of revenue devolved to municipalities have typically been insufficient, leaving the municipalities dependent on higher levels of government.[iii] Despite the change envisioned by the 74th Amendment, a study for the Twelfth Finance Commission found that "the tax jurisdiction of municipalities has not undergone any noticeable shift even with their changing functional portfolio."[iv] As Table 1 shows, fiscal transfers from states to municipalities still comprise a significant portion of municipal revenues, averaging 31.7% in 2001-2002, and have grown at an average rate of 13.5% over the same period.[v]

However, according to the 12th Finance Commission report, numerous infrastructure initiatives have been stalled due to financial constraints.[vi] In addition, the World Bank has identified a large financing gap for water infrastructure projects and their maintenance.[vii] The water sector has seen a decreasing trend in budgetary allocations, most of which is now used for personnel costs, combined with a growing need for future investments.[viii] The shortfall in financing to achieve the water and sanitation sector goals in India's Tenth Plan is estimated at INR 179 billion[ix]. Since traditional financial resources (state budgetary allocations, Housing and Urban Development Corporation, and municipal resources) have fallen short of estimated investment needs, Indian municipalities have turned to alternatives, including municipal bonds.[x]

In the state of Tamil Nadu, Section 66 of the Tamil Nadu Municipalities Act of 1998 authorized municipalities to take out loans from the public to finance deficits and infrastructure investments, contingent on the prior approval of the state government. The state government has guaranteed the loan liabilities of municipalities but is not obligated to do so. Also, Section 66 authorizes ULBs to issue bonds for specific capital expenditures provided that an independent credit rating is provided.[xi]

Table 1: Role of Transfers in Municipal Finances

State	Transfers (INR millions), 2001/02	% of total municipal revenues, 2001/02	Avg Annual Growth Rate % 1997/98 to 2001/02	Per capita transfers (INR), 2001/02
Andhra Pradesh.....	3,178.4	30.7	12.4	171.4
Assam.....	162.4	29.7	16.7	65.1
Bihar.....	555.9	62.0	-0.50	64.4
Chattisgarh.....	1,262.4	50.1	-	323.3
Goa	94.1	33.6	11.0	258.6
Gujarat.....	3,139.5	17.8	14.6	175.5
Haryana.....	789.2	39.5	18.6	135.5
Himachal Pradesh.....	278.7	58.5	0.7	472.6
Jammu & Kashmir.....	616.2	83.7	16.2	247.6
Jharkhand.....	244.0	62.0	-	64.4
Karnataka.....	6,085.9	51.9	14.5	347.7
Kerala.....	1,794.9	44.5	3.4	296.9
Madhya Pradesh.....	3,766.3	54.8	-2.1	241.4
Maharashtra.....	9,417.7	13.8	22.8	239.6
Manipur.....	19.5	46.5	33.1	36.1
Orissa.....	804.7	44.2	22.4	153.8
Punjab.....	848.9	10.1	9.7	105.1
Rajasthan.....	5,170.3	83.3	38.6	403.5
Tamil Nadu	4,677.0	33.7	-2.8	180.7
Tripura.....	110.0	83.5	5.6	297.8
Uttranchal.....	510.5	63.7	-	250.1
Uttar Pradesh.....	7,748.8	74.5	14.4	232.1
West Bengal.....	5,020.3	54.3	14.1	256.7
Average.....	**2,447.6**	**31.7**	**13.5**	**224.4**

Source: India's Municipal Sector: A Study for the Twelfth Finance Commission, (2004)

Recent Municipal Bond Experience

Municipalities in India have raised over INR 9 billion through taxable bonds, tax-free bonds and pooled financing.[xii] As shown in Table 2, municipalities with investment grade ratings have successfully accessed credit markets. But currently, municipal bond issuance is contingent on state government approval.

Table 2: Municipal Bonds in India

TAXABLE MUNICIPAL BONDS				
Year	**City**	**Project**	**Amount (INR million)**	**Interest Rate (%)**
1997	Bangalore	City Roads / Street Drains	1,250	13.00
1998	Ahmedabad	Water Supply / Sewerage	1,000	14.00
1999	Ludhiana	Water Supply / Sewerage	100	14.00
1999	Nashik	Water Supply / Sewerage	1,000	14.75
2000	Indore	City Roads	100	13.00
2001	Nagpur	Water Supply	500	13.00
2001	Madurai	City Roads	300	12.25

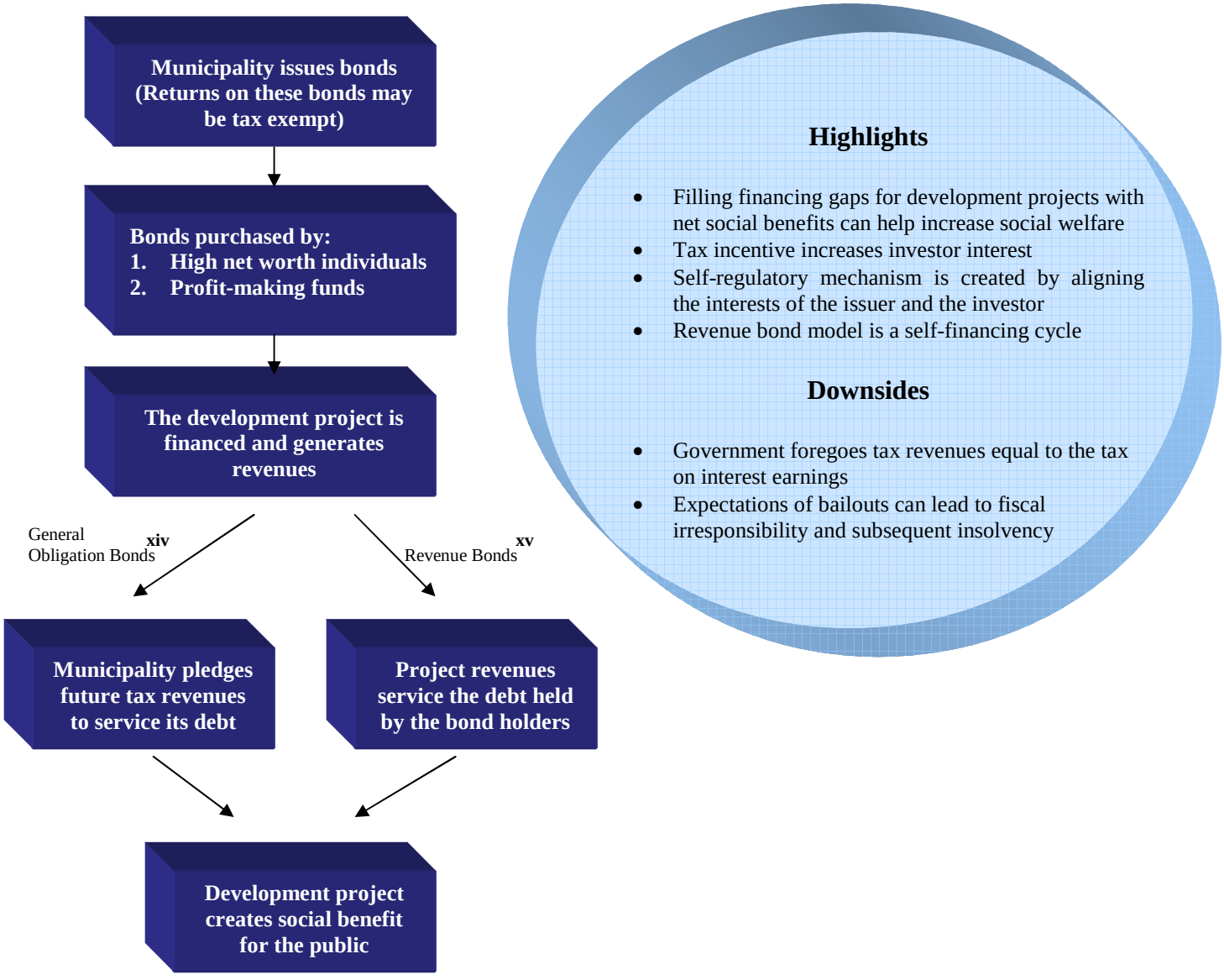
TAX-FREE MUNICIPAL BONDS				
Year	**City**	**Project**	**Amount (INR million)**	**Interest Rate (%)**
2002	Ahmedabad	Water Supply / Sewerage	1,000	9.00
2002	Nasik	Sewerage / Storm Water Drainage	500	N/A
2003	Chennai – MWSSB	Water Supply	420	N/A
2003	Hyderabad	Roads	825	N/A
2003	Hyderabad - MWSSB	Drinking Water	500	9.00
2003	Tamil Nadu - Pooled Fund	Water Supply / Sewerage	304	9.00
2004	Ahmedabad	Water Supply / Storm Water Drainage / Roads / Bridges and Flyover	580	N/A
2004	Visakhapatnam	Water Supply	500	7.25

Source: Vaidya and Vaidya, “Municipal Bonds in India: Experience So Far”

SECTION 2: THEORY OF MUNICIPAL BONDS

Municipal bonds are issued by the municipality to raise capital for development projects. Usually the income earned from these bonds is tax exempt. These bonds are bought by investors who would like to reduce their tax liabilities. Thus there is dual benefit for the issuer and the investor as the issuer is able to raise capital at a lower cost[xiii] and the investor is able to maximize one's returns from investments post tax. The process is explained below.

Figure 1: Municipal Bond Issuance Process



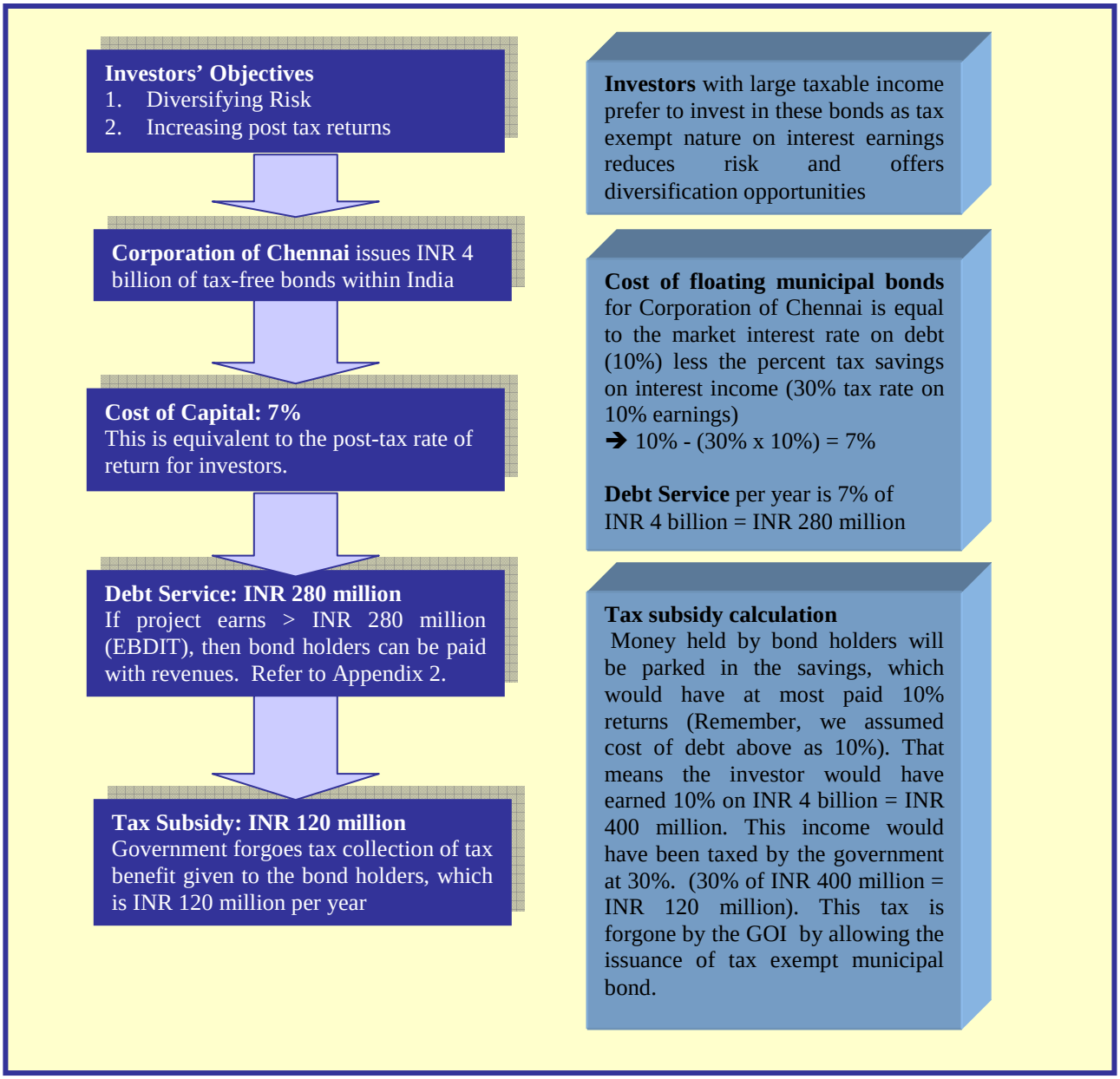
A Practical Example: Financing Water Infrastructure in Chennai

In the drought-prone city of Chennai, water is an essential input to many industries as well as for households and agriculture. As such, water availability is a key consideration in making decisions about locating industries in Tamil Nadu. In the 1990s, as a result of a severe drought, major chemical and fertilizer plants located in the Chennai area stopped production for six months due to a lack of water.[xvi] This illustrates that the adequate and reliable provision of water will be an important factor in economic development in the drought prone city of Chennai and the state of Tamil Nadu. With a limited supply of 240 million liters per day in Chennai and a projected growth in demand, water infrastructure improvements, in addition to more efficient use of available water resources, are needed in Chennai.[xvii] We illustrate this process through a stylized illustration of how a municipal bond could finance addition water infrastructure in Figure 2, using the assumptions below.

Assumptions:

1. Municipal bonds are floated to finance a water infrastructure project in Chennai, India.
2. Cost of the project is INR 4 billion and is entirely funded by the issuance of municipal bonds and these bonds are fully subscribed.
3. These bonds are revenue bonds whose debt is serviced from the project revenues.[xviii]
4. Investors buy these bonds for diversification and reducing their tax liabilities.
5. Investors could be retail or institutional and their preferences are the same.
6. The marginal income tax rate for investors is 30%.
7. The market interest rate on debt[xix] is 10%.
8. Investors have their money in one or other forms of savings.[xx]
9. The financial model for the proposed water infrastructure is a hypothetical one and does not represent any actual numbers.
10. The bonds will be fully subscribed.

Figure 2: Municipal Bonds -- Chennai Water Infrastructure Financing



SECTION 3: DRIVING FORCES FOR MUNICIPAL BONDS

For a municipality to raise capital and remain solvent, it needs to excel in its financial condition, have a good institutional framework, and a growing economy and tax base. These factors are used to analyze the credit worthiness of a municipality to take on additional decision-making responsibility regarding its level of debt. The framework below is used to analyze the potential for COC to issue municipal bonds to support its financial needs.

FINANCIAL CLIMATE

a) Credit Rating

A good credit rating to attract investors and to minimize the interest rate on debt is critical to the viability of municipal bonds. In addition, ratings of bonds on a continuous basis will enable investors to monitor the management efficiency of the municipal entities. An example of this effectiveness was demonstrated when the Chennai Metropolitan Water Supply and Sewerage Board (MWSSB), the water utility under the jurisdiction of the COC, made its entry into the municipal bond market in 2003-04 to issue of tax free bonds for an amount of INR 420 million. At that time the Board received a rating of AA[xxi] by CRISIL, an independent Indian bond rating agency like Standard and Poors. This rating depicted a strong stand-alone credit quality and low risk for the investor. This rating enabled Chennai MWSSB to issue bonds at a coupon rate of 5.20% for 7-year a tenure.

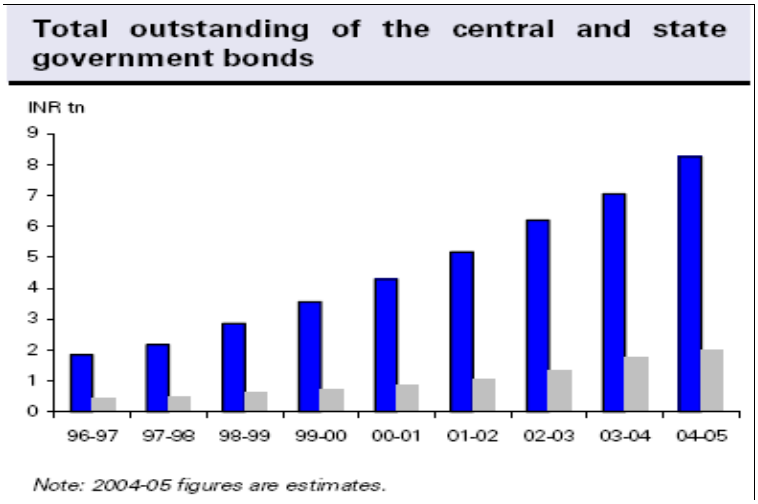
b) Liquidity

The Indian bond market -- for corporate and federal bonds – is fairly developed and has one of the highest bond issuance in the Asian region. Additional bond issuances by Chennai MWSSB[xxii] are likely to be absorbed by the market immediately. This is based on three points: 1) previous bond issues, as shown in Table 2, were fully subscribed, 2) the Indian bond market is quite large and developed (approximately INR 12.7 trillion), and 3) household savings are mainly invested in banks – a liquid source for funding bonds (See Appendix A6).

The key issue is how liquid the secondary bond market will be to trade these municipal bonds. The presence of a large base of corporate and federal bonds helps investors to trade these municipal bonds as interest rate spreads[xxiii] to the existing bonds. This liquidity will help in ascertaining a fair price for these bonds and places a market mechanism to monitor the risk associated with these bonds relative to the treasury bonds issued by the central bank of India. The total outstanding bonds in India are approximately INR 12.7 trillion of which 70% are the government bonds. In terms of traded volume 95% of the bonds

traded are government bonds with strong preference to benchmark. This is evident from the fact that the only top five bonds dominate the total 40% of the daily trading volume[xxiv].

Figure 3: India's Bond Market Size



Source: Deustche Bank Report, using Reserve Bank of India data.

c) Investor Preferences

The investors in these bonds are of two types: retail and institutional. Most retail investors will be high net worth individuals who will have a marginal tax rate of 30% and the institutional investors will be funds or corporations who will have a marginal tax rate of 35%[xxv]. Investors typically have a plethora of choices to invest in which includes, equity and debt instruments, treasury bills and municipal bonds[xxvi]. The returns on equity are high but are risky. For the period 1991-2004 in India, the equity premium was 11.3% and the average volatility of returns was 37.7%.[xxvii] In addition, debt instruments like a corporate bond could be attractive, but the returns are taxed. The tax-free municipal bonds have a risk profile similar to the treasury bills[xxviii] because the issuer is a municipal entity, which is closely tied in to the government[xxix]. Although India offers a variety of instruments, the municipal bond will be one more product in the basket of financial instruments permitting investor to diversify risks.[xxx]

INSTITUTIONAL CLIMATE

a) **Regulatory**

Although the regulatory mechanism for securities exchange is well set up in India, the regulatory framework for bonds is deficient. The Securities and Exchange Board of India (SEBI) monitors the performance of institutions from a securities point of view. India lacks an equivalent of the Municipal Securities Regulatory Board (MSRB) in the United States, which regulates all municipal bond issues.[xxxi] A similar institution needs to be created to ensure greater transparency, standardization, and clear stringent

penalties for violations to create a self-regulatory mechanism for the Indian bond market, including the municipal bond market. A self-regulatory mechanism could be fostered through standardized public reporting requirements and clear operational regulations that would enable investors and the general public to scrutinize municipal fiscal positions. Self-regulation also reduces the need for resource-intensive monitoring bodies. Thus, a rule-making body like MSRB could aid in efficient policy making and impact.

b) Federalism

Despite the seventy-fourth amendment intended to decentralize responsibilities to lower levels of government, the majority of the fiscal responsibility currently rests with the GOI. Per the constitution, tax collection and expenditures are managed in three main ways:

a) GOI collects taxes and GOI decides expenditures
b) GOI collects taxes and allocates a portion to states to decide expenditures
c) State and municipalities collect taxes and decide on expenditures

Since the majority of the taxes are collected by the GOI (a & b above), this means that municipal bodies have limited ability to determine expenditures, particularly since the state governments retain control on municipal access to raising capital and expenditure on capital investments.

Decentralization also raises the issue of fiscal federalism and the role of the constitution. The case of fiscal responsibility with the states and local municipal bodies can be successful only if there are sufficient and necessary legal provisions to ensure investor protection and delinquency laws. Indian common law is still designed for a federal structure. The borrowing powers designed for only the center and there are no specific guidelines for the state. This is an important change that needs to be made to address before moving into complete fiscal decentralization.

c) **Political**

With India's proportional representation electoral system, political impasses between the center and the state governments occur often. The friction between the different ruling parties in a state and the GOI can lead the predominance of the GOI's political agendas over local priorities for development and sound financial decisions. This has been witnessed time and again. There are large numbers of political parties[xxxii] whose agendas are very different from each other, especially in regard to support of municipal bonds. In addition, since municipal bonds are tax-free for investors who are usually high wage earners, tax-free bonds can be adamantly misinterpreted as being a boon for the rich in a pro-poor electorate. Thus, garnering political support and managing political risks is a key issue with municipal bonds. In addition, the ratings of the bonds are highly dependent on the political outcome, which may lead to higher volatility hence greater costs of capital for projects[xxxiii].

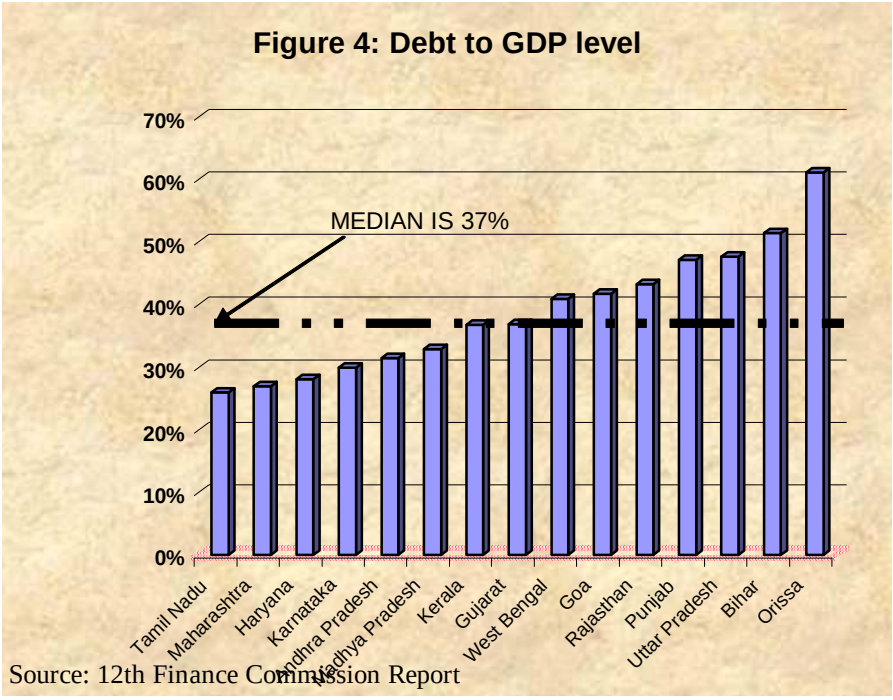
SECTION 4: ECONOMIC ANALYSIS

Since data on municipal bonds is still scarce, we developed a model to better understand the ramifications of an expansion of municipal bonds in India. Treating a large municipality as a small and open economy, we construct a macroeconomic model (Refer to Appendix I for the construct of the model) in order to estimate "optimal" debt levels for a municipality. To do this, we obtain the debt dynamics for a municipality and subsequently value the price of such a debt using Merton's continuous time approach.[xxxiv] Our approach to the economic analysis has been to develop a framework for analyzing the economic strength of a municipality and to value the debt in case the municipality decides to float the bond.

OPTIMAL DEBT

It is important for the municipality to recognize the sources of revenues and expenditures and understand how they would vary over time. In our model, we look at three sources of revenues namely, transfers from the GOI to the municipalities, tax collections for the municipality and aid or grants received directly. We also assumed that investments by the government are time variant but depend on the rate of change of capital stock. Using this framework we solve for an optimal capital stock, which leads us to an optimal debt level for the municipality. As mentioned in the Twelfth Finance Commission report, debt or debt to municipal GDP would not be a good measure (See Appendix I).[xxxv] In addition, the median debt to GDP ratio for the states is 37% which by itself cannot be used as a benchmark. (See Figure 4).

Figure 4: Debt to GDP level



Source: 12th Finance Commission Report

Instead, we use a ratio of debt to municipal tax revenue and propose that each municipality has a different optimum level of debt. Thus, GOI decisions regarding municipal debt based on a national average may not be appropriate given the variance.

VALUATION

Valuation is key as municipal debt is new and we do not have much history to predict returns on this instrument. To overcome this barrier, we have used the continuous time framework[xxxvi] based on the expected value of deficit or surplus for the municipality. Thus we have priced this municipal bond as a contingent liability owned by the investors who faces a risk of municipality defaulting. Further, we have gone ahead and established the optimal amount of wealth that an investor would invest in municipal bonds assuming that the investors are risk averse (Refer to Appendix I). This model can estimate the demand function for municipal bonds as well as estimate an optimal supply level for the debt by the municipality. This model can help a policy-maker design, value, and create a debt instrument, which was non-existent earlier.

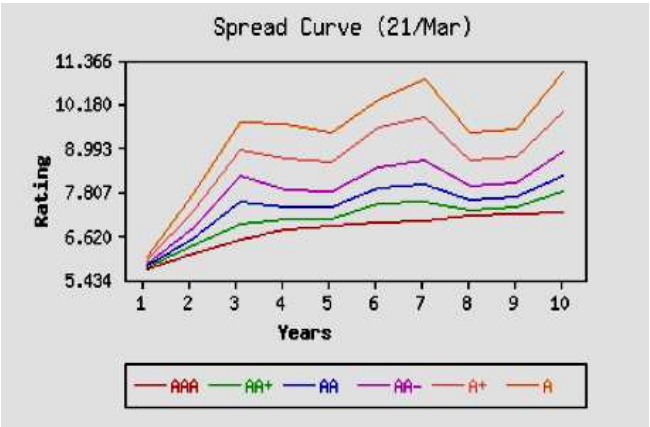
DYNAMICS OF THE MODEL

This valuation model helps us understand key characteristics of the municipal debt market before we make decision on accepting or rejecting municipal debt as a financing alternative. Firstly from the investor's point of view it is useful in valuing the price of such a new instrument. Municipal debt will be new to the Indian market and the investors will be worried if they are paying the right price for this instrument especially since it has no history of returns. Our model can value this by just looking at expected fiscal situation of the municipality and knowing the risk free rate of return. The fiscal situation of a municipality can be obtained by looking at the credit rating and the corresponding interest rate differential as shown in the figure below.

Figure 5: Bond Ratings and Yield Spreads in India

CRISIL'S RATING SCALE	
RATING SYMBOL	**DEFINITION**
INVESTMENT GRADE BONDS	
AAA	HIGHEST SAFETY
AA	HIGH SAFETY
A	ADEQUATE SAFETY
BBB	MODERATE SAFETY
SPECULATIVE GRADE BONDS	
BB	INADEQUATE SAFETY
BB	HIGH RISK
C	SUBSTANTIAL RISK
D	DEFAULT

Source: CRISIL



Source: India Infoline (March 22, 2005)

Note: In this paper we recommend that for a municipality to obtain a SMZ status, AA rating is necessary. These ratings also signify the cost of capital that the municipality will eventually pay for floating a bond as shown above

Secondly, from a regulatory stand point, policy makers can estimate the gross demand for such new instruments in the market. This can help policy makers plan necessary control mechanisms such that demand remains in place and does not affect the market and the economy in adverse ways. The demand estimation is key as the trend in savings is moving towards government securities away from pension funds and corporate stocks and bonds in India as shown in Figure 6. As these municipal bonds will be primarily funded by private savings, we looked at the household savings below.

Figure 6: Distribution of Savings in India

As of 08/30/2004
Table: Financial Saving of The Household Sector (Gross)(Percentage Distribution)
Source: Reserve Bank of India

			2003-04	2002-03	2001-02	2000-01	1999-00
Financial Saving (Gross)			**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
a)	Currency		10.10	8.50	9.70	6.30	8.80
b)	Deposits		**42.90**	**41.50**	**39.40**	**41.00**	**36.30**
	i)	with banks	40.50	36.30	35.30	32.50	30.80
	ii)	with non-banking companies	0.20	1.60	2.60	2.90	1.70
	iii)	with co-operative banks and societies	2.30	3.70	3.60	5.60	4.30
	iv)	trade debt (net)	(0.10)	(0.10)	(2.10)	0.10	(0.40)
c)	Shares and debentures		**1.40**	**1.60**	**2.70**	**4.10**	**7.70**
	i)	private corporate business	0.70	0.80	1.50	3.10	3.40
	ii)	co-operative banks and societies	-	-	0.10	-	-
	iii)	units of UTI	(0.40)	(0.50)	(0.60)	(0.40)	0.80
	iv)	bonds of PSUs	-	-	-	0.10	0.10
	v)	mutual funds (other than UTI)	1.10	1.30	1.80	1.30	3.40
d)	Claims on government		**17.70**	**18.60**	**17.90**	**15.70**	**12.30**
	i)	investment in government securities	**4.00**	**4.30**	**5.80**	**1.70**	**0.90**
	ii)	investment in small savings, *etc* .	**13.70**	**14.30**	**12.10**	**14.00**	**11.30**
e)	Insurance funds		**14.90**	**15.50**	**14.20**	**13.60**	**12.10**
	i)	life insurance funds	14.50	14.80	13.50	12.90	11.20
	ii)	postal insurance	0.10	0.20	0.30	0.20	0.30
	iii)	state insurance	0.30	0.50	0.40	0.50	0.60
f)	Provident and pension funds		**13.00**	**14.30**	**16.10**	**19.30**	**22.80**
			(2.00)	(2.00)	(2.00)	(2.30)	(2.80)

Note
1. Figures in parentheses are percentages to GDP at current market prices.

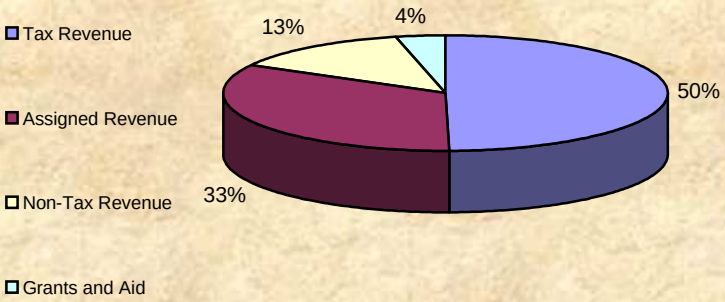
Source: Reserve Bank of India

The table shows that the household savings moved into the government securities sector and bank deposits while the decrease was in the pensions and shares segment. Thus municipal bonds should see a good interest from the investors when launched.

Thirdly, the model can estimate the effects of changes in tax collection efficiency, increase in government transfers and grants from external entities like the World Bank on the price of municipal debt. The model captures the elasticity of an increase in such alternate sources of income for the state versus value of the debt floating. This provides a tool for assessing the future solvency of municipalities. For example, a municipality could request increases in transfers or aid by citing not only socio-economic benefits from such aid but also a potential positive balance sheet effect[xxxvii]. In addition, in building the model we assumed that aid and grants contributing towards revenue were constant. Indian municipalities have

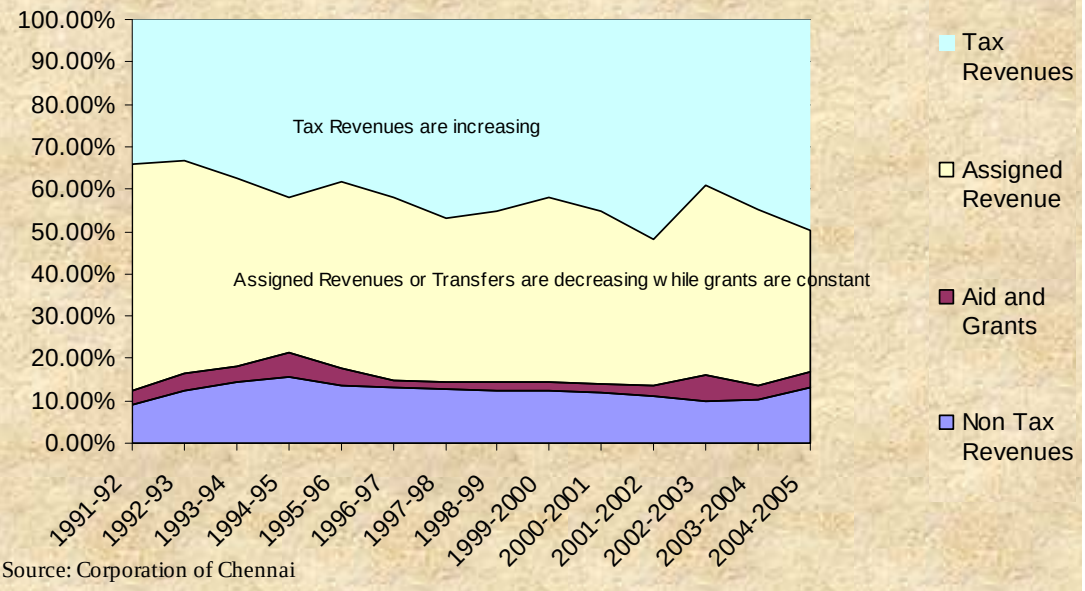
four types of revenue sources of which aids and grants are the least. A well-managed municipality like COC has lower dependence on assigned revenues or transfers compared to its counterparts. As shown in Figure 7, half of the revenues generated by COC are from mainly property taxes and entertainment taxes, and only one third is contributed by the transfers or assigned revenues. For fiscal decentralization, a key trend should be to continue to lower dependence on assigned revenues. In our model (Refer to Appendix I) we have shown that transfers decrease with an increase in bond issuance by the municipalities. To verify we looked at the municipality of COCover the last fifteen years and the share of transfers or assigned revenues has reduced from 50% to 33% of the total tax revenues, as shown in Figure 8.

Figure 7: Distribution of Revenue for Corporation of Chennai for 2004-2005



Source: Corporation of Chennai

Figure 8: Trends in Revenue Sources for Corporation of Chennai

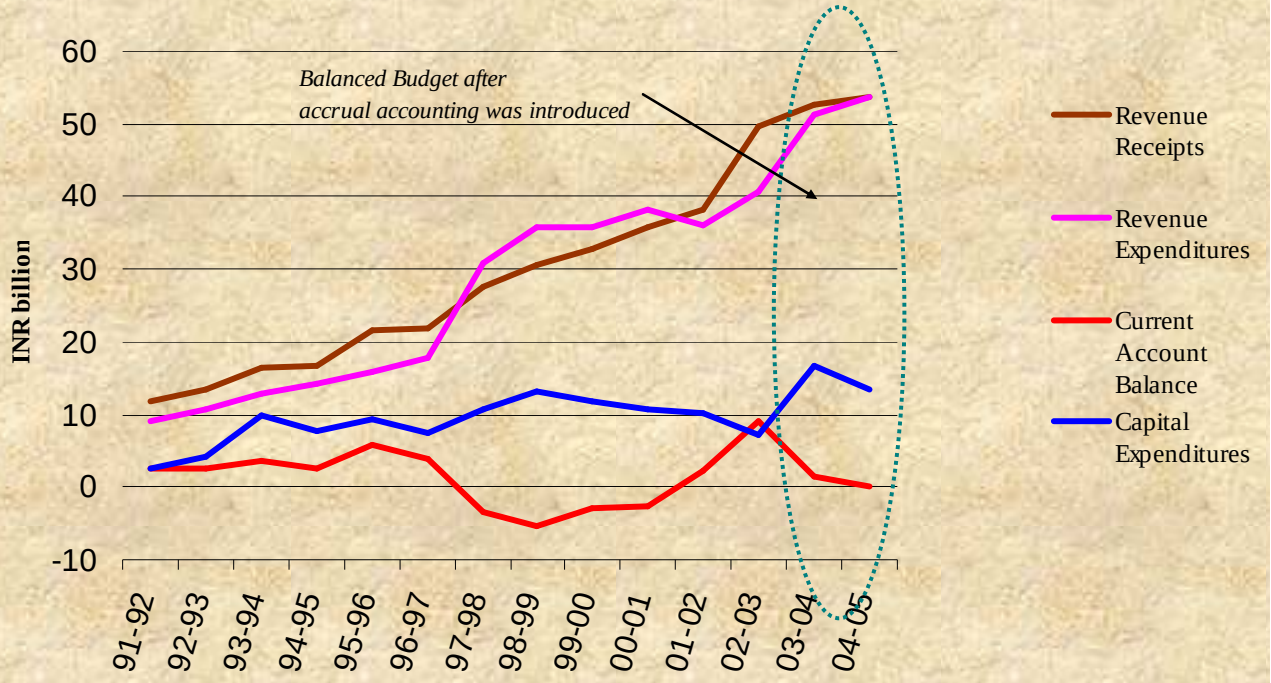


Source: Corporation of Chennai

Municipalities must move towards self revenue generation and rely less on transfers or assigned revenue sources as evidenced in COC here. (Refer to Table 1 on transfers for all states in India). Figure 8 shows that the percentage of aid and grants are almost constant.

The model also establishes the debt level that a municipality can take on to follow a balanced growth path. It shows that in response to a positive economic shock such as an increase in productivity, the level of debt falls instantaneously. Thus if there was a negative economic shock, the debt levels increases but as municipality have to show a balanced budget at end of the year, the eventual effect is that the consumption shifts to a new permanent level. Hence, municipality has a higher debt to tax collection ratio which affects its rating and thus the future borrowing capacity. To be utilizing this framework and monitor

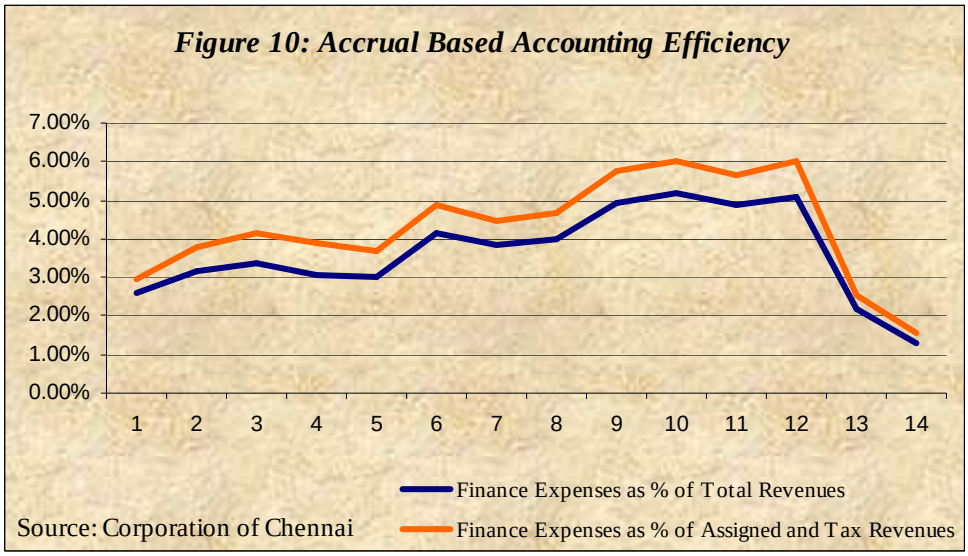
Figure 9: Corporation of Chennai Fiscal Accounts



Source: Corporation of Chennai

the dynamics above, it is necessary to have a good accounting system. This model's predictability depends on fine tuning it with the data collected through proper measurement and accounting system which we found evident in the Chennai. COC has been able to show a balanced budget after moving towards the accrual method of accounting as shown in Figure 9 below. All the states in India use cash-based accounting system which leads to underestimating the expenditures. The merits of the accrual based system can be seen in the substantial decrease in the finance expenses after 2002 in Chennai. Figure 10 shows that finance expenses as a percentage of the total revenues decreased to almost 1.2%. Finance expenses are usually adjustment expenses written off to cover expenditures. As the cash based accounting system underestimates the expenditures, the finance expenses increase in the subsequent fiscal year. This can be brought down by accrual based accounting.

Figure 10: Accrual Accounting Effect.



In addition, this model provides useful insights for a small and open economy. Our objective was to provide a framework for assessing the dynamics of debt, quantifying an optimal debt level and valuing the debt. We assume in our model that all the debt floated by the municipality will be absorbed by the market as there is a substantial growth in the wholesale debt market in India (Refer to Figure 11) and also there is a strong preference for investors to move towards the government securities and deposits. (Refer to Figure 12 and Figure 6).

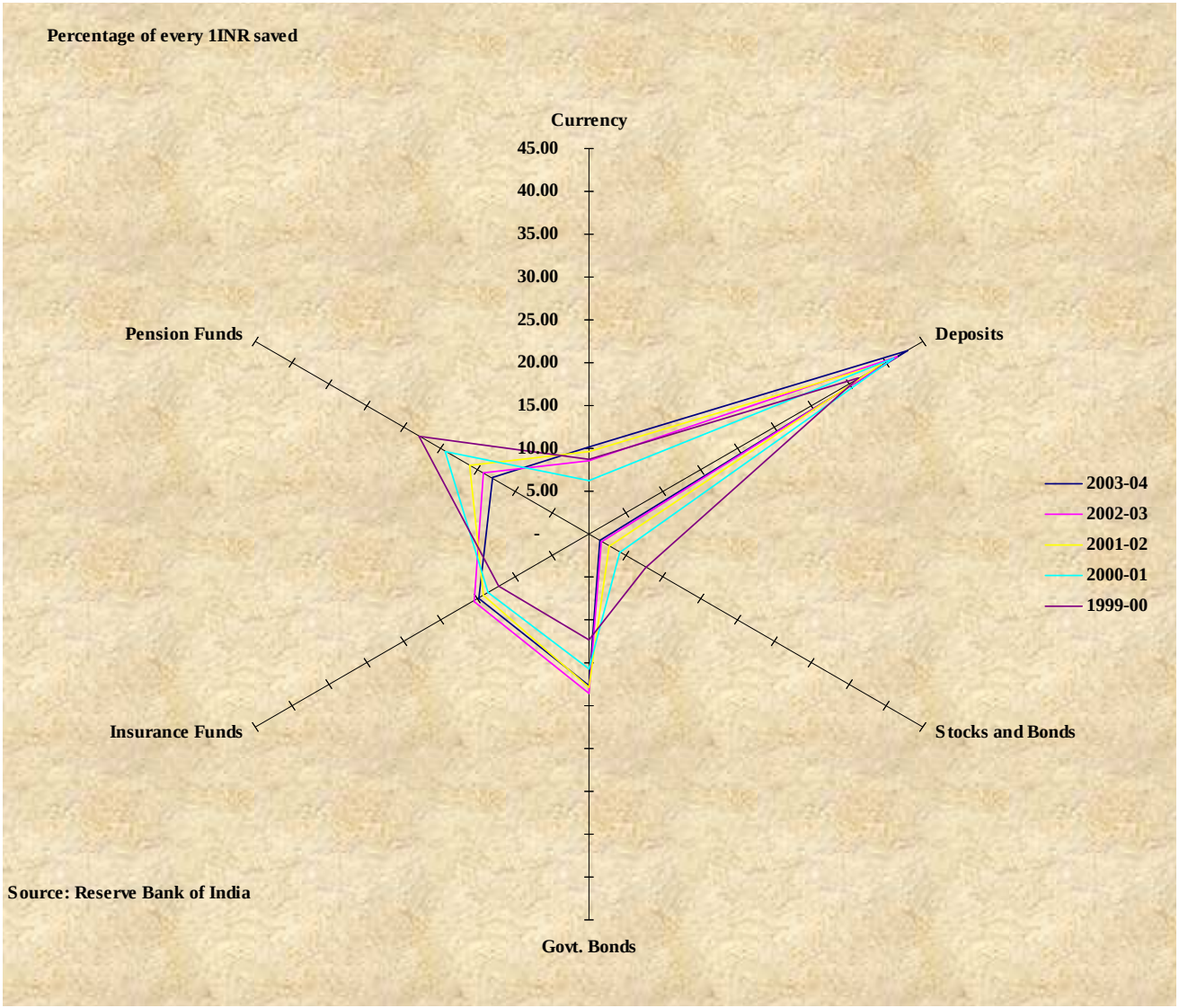
Figure 11: Growth of Wholesale Debt Market in India

	Market Capitalisation		Net Traded Value	Average Daily Value	Average Trade Size
Year	INR billion	Number of Trades	INR billion	INR billion	INR million
2005-2006	15,534	60,159	4,584	18	76
2004-2005	14,617	124,308	8,873	30	71
2003-2004	12,159	189,518	13,161	45	69
2002-2003	8,645	167,778	10,687	36	64
2001-2002	7,568	144,851	9,472	33	65
2000-2001	5,808	64,470	4,286	15	67
1999-2000	4,940	46,987	3,042	10	65
1998-1999	4,115	16,092	1,055	4	66
1997-1998	3,432	16,821	1,113	4	66
1996-1997	2,928	7,804	423	1	54
1995-1996	2,078	2,991	119	0	40
1994-1995	1,582	1,021	68	0	66

Source: National Stock Exchange of India

The market capitalization has grown by 10 times and average trade size by more than 100 times in the last ten years.

Figure 12: Skew towards Deposits and Government Securities



In the last five years we have seen household savings towards government bonds and deposits which is why there is a skew above

SECTION 5: STAKEHOLDER ANALYSIS

We have divided this section in assessing the threats and benefits for the stakeholders. The objective of this section is to analyze what the key issues that the stake holders shall be looking at and how that will affect the issuance of the municipal bonds from a stakeholder's perspective.

THREATS ANALYSIS

While municipal bonds may look like an attractive and innovative means of financing and of enabling fiscal decentralization, it would not be wise to undermine the threats that could potentially harm the economy and the sustainability of municipal bonds. There are two major threats: institutional failures which result from regulatory and supervisory inadequacies and the threat of moral hazard. We have addressed both these issues by drawing upon two important case studies in the history of municipal bonds later in the section. Apart from those two main threats, we have identified other potential hazards which could impede municipal bond financing alternative. They can be primarily classified as either economic or institutional in nature.

ECONOMIC THREATS

1. **Systemic Risk:** While one can advocate that financially strong and well performing municipalities can issue debt based on their balance sheet, one should not forget that these municipalities still come under the aegis of the state government which means that while individual projects and municipalities might look efficient, under extra-ordinary conditions[xxxviii] the performance of all these municipalities might get correlated leading to successive defaults resembling a contagion effect. Since the state government needs to contain this contagion, this might severely limit the borrowing capacity for the state government in the future. Thus risk diversification may not be complete[xxxix].

2. **Revenue Projection Errors[xl]:** In India, most of the taxes are collected by the GOI and only property taxes and smaller revenue sources are left to the state's jurisdiction. As municipal bonds are valued based on the municipality's expected revenue base[xli], it is important that this stream of income is secure. Under the current conditions, this may not be true due to various reasons of which business cycle correlation is an important aspect[xlii]. Usually the property taxes and revenue sources fluctuate with business cycles and if that being true in India, it is difficult to predict the income streams for the municipalities. In addition most of the states and municipalities in India depend on the center for fiscal transfers as a significant percentage of their revenue base (Refer to Table 2).

3. **Non – Pareto Optimality:** One of the arguments that Gordon (1983) makes is the lack of optimal allocation of the tax subsidy in the tax free municipal bonds.[xliii] The argument is that investors are both rich and poor. To achieve full subscription of the bonds, the government needs to attract the poor investors too. These poor investors expect greater returns and the government eventually has to oblige to their needs hence these municipal bonds give returns slightly above the market clearing rate. This higher return benefit is passed on to the rich investors as well. Since most of the investors in the tax-free municipal bonds are rich the tax suboptimal pricing of these bonds benefits the rich.

4. **"Too Big To Fall":** The government is ultimately responsible for the municipal debt, thus from an investor's point of view, over a period of time, these municipal bonds will very closely resemble risk-free treasury bonds though they differ in credit quality and seniority terms. The investor knows that government will need to bailout large municipal bond defaults. This means that the interest rate differential between the municipal bonds and treasury bonds is a subsidy given by the government to the municipality. In other words, the municipality earns free profit equal to the difference between the returns of municipal bonds and treasury bonds[xliv].

INSTITUTIONAL THREATS

1. **Inconsistent Tax Policy:** The municipal debt is issued tax exempt in most situations. In India, the income tax is collected by the GOI where as the municipal debt is floated by the local government. Hence there is a mismatch between revenue responsibility and debt issuance. The absence of a state income tax system could be a potential threat in exacerbating the moral hazard problem and a cause for lack of effective control on revenues and expenditures for both the state and GOI.

2. **"Black Bonds":** In some ways, these municipal bonds being tax free can be thought of a bond which attracts "black money", illegal untaxed money. Thus, if the source of the funds which were used to buy these bonds are not checked then it is in a way attracting the "black money" holders to invest in these bonds. This throws in the case of setting a bad precedent for the honest tax payers who would think of this tax exemption as a penalty for them. This could send a wrong signal to law abiding citizens and could thereby potentially lead to higher rate of tax evasion.

3. **Political Malpractice:** The democratic system in India which is so often prided upon can be misused to divert funds and also endorse financially and socially unworthy projects. In addition, under the Indian multiparty political system, if there are elections on the horizon there is always a threat of mis-application of funds through the issuance of bonds. This money could be used in wasteful projects for the purpose of attracting voter's interest.

Case Study I: Orange County Regulatory Failure [xlv]

Orange County is an important case to understand the regulatory and supervisory failure[xlvi], which led to unchecked investment extravagance by the county's chief treasurer. The result was unpleasant as the county declared the largest municipal bankruptcy in the history of United States. Orange county is the second most populous county in California and also the fifth most populous county in USA with a population of 3,056,865[xlvii]. The county has many sources of revenues including the famous Disney parks which put them into a financially strong municipality to borrow. Given this stature, the county treasurer invested $ 7.4[xlviii] billion of funds in interest rate sensitive products, which resulted in losses as the FED hiked up interest rates, and the fund lost close to $1.6 billion dollars.

The main reason for this well funded municipality which had enormous tax base and large revenue streams was due to the mis-management of funds by the county treasurer. The treasurer invested the funds available to him in volatile instruments[xlix], which earned good returns. This led a monitoring and regulatory failure to check the treasurer's investment strategies resulting in staggering losses. This is a key lesson to learn as in municipal financing, the individual municipality such as COC might be performing well, but the overall state or city government's politics and economics can affect the functioning of the system. A good regulatory and monitoring system is thus vital to the performance of the municipal bond financing.

Salient Features

- ✓ In December 1994 the Orange county in California was forced to declare bankruptcy as the investment pool had suffered a loss of $ 1.6 billion
- ✓ The key reason for bankruptcy was cited as the mis-management of funds by the county treasurer Bob Citron.
- ✓ The aggressive investment strategy followed by the treasurer who was supposed to manage risks led to the failure of the county's fiscal performance.
- ✓ The political pressure from the voters to minimize taxes also helped the deficit to balloon to unmanageable levels.

Lessons Learned

- ✓ Constant regulatory checks are needed to protect investors from losing interest in future bond issues
- ✓ Lender of the last resort: Generally in such big and municipal failures, the federal bank has to bail out the county which leads to moral hazard and dilution of self regulation on the part of investors
- ✓ Such bankruptcies throw in important questions of who needs to be protected first: 1) The investors in such bonds or 2) the county so that public service is not hindered. This is a tricky question always in front of the federal government in these mis-haps

Case Study II: Brazil - Moral Hazard of Fiscal Federalism[l]

Expectations of federal government bailouts of state defaults constituted a moral hazard problem, resulting in an excessive bond issuance at the state level in Brazil. The domestic investors' implicit assumption of federal guarantees on state debt permitted states to raise capital through their bond market beyond fiscally responsible levels.

In the late 1980's, the states of São Paulo, Rio de Janerio, Minas Gerais, and Rio Grande do Sul, along with others, faced severe problems in servicing their obligations on their state bonds. In response to precarious state finances, the credit market demanded higher interest rates and shorter maturities. The financial risks of holding state debt eventually grew to the point that private investors refused to hold state debt.

On the verge of default, the states turned to the federal government for a bailout. Concerned that state defaults could have a ripple effect and destabilize the entire domestic capital market, triggering bank runs and undermining credibility, the federal government responded with the so-called *troca* arrangement, whereby the states were authorized to exchange their state bonds for federal bonds.

Under this scheme, the Central Bank assumed responsibility for the state bonds by floating the corresponding amount of new Central Bank bonds and then transferring them to the states. The Senate subsequently authorized 100% rollovers for most indebted states as well as the capitalization of accumulated interest into the outstanding stock of bond debt at each rollover. While Congressional representation of the most indebted states was only 12 of 81 seats, representatives colluded to protect the interests of the large indebted states in exchange for proportionate benefits for the other states.

Given that the interest rate on the federal bonds remained high, the capitalization of interest triggered a rapid growth in the total stock of state debt. By September 2001, 84% of the state debt was held by the central government.

Due to moral hazard, the Ministry of Finance was reluctant to grant debt relief. However, because the largest indebted states were also the most fiscally autonomous, the central government found itself with limited leverage over the states when renegotiating the debt structure.

Case Study II: Brazil - Moral Hazard of Fiscal Federalism[li] (continued)

As a result of the financial crises and subsequent debt negotiations between the states and federal government, several reforms were eventually instituted:

- Adjustment targets, including scheduled declines in debt-revenue ratios, increases in primary balance, growth in own-source revenues, and limits on investments. (Law 9496 of 1997)[lii]
- Hierarchical mechanisms designed to limit states' access to credit, including restrictions on new bond issues and prohibition of borrowing by jurisdictions without positive primary balances in previous 12 months. (Senate Resolution 78; 1998)[liii]
- Autonomy and discretion to National Monetary Council to prohibit lending to states violating resolutions. (Resolution 2653)[liv]
- Prohibition of debt swap and other bail-out mechanisms and greater transparency of central bank operations. (Fiscal Responsibility Law, May 2000; Penal Law for Fiscal Crimes, October 2000)[lv]

Bailouts

- ✓ Given the large municipal bond debt, the federal government intervened fearing the destabilization of the entire domestic market.
- ✓ Common knowledge that some states are "too big to fail" reinforced moral hazard.
- ✓ Although the largest debtor states only held 12 of 81 seats, the representatives from less indebted states negotiated proportionate benefits in exchange for protection of large debtor states interests. Result has been unchecked spending and debt relief.

Moral Hazard

Fiscal irresponsibility resulted from:

- ✓ Investors continuing to purchase bonds under the implicit assumption of government guarantee.
- ✓ States issuing more debt than was sustainable under expectations of federal government bailout.

BENEFIT ANALYSIS

Assuming that productive development projects are not being implemented due to insufficient transfers from the GOI, municipal bonds offer a mechanism by which such projects could be financed. It is critical that every project be evaluated closely to evaluate the financial viability and net economic benefits. Assuming that the project offers large net social welfare benefits, some of the potential benefits of the municipal bond financing are outlined below.

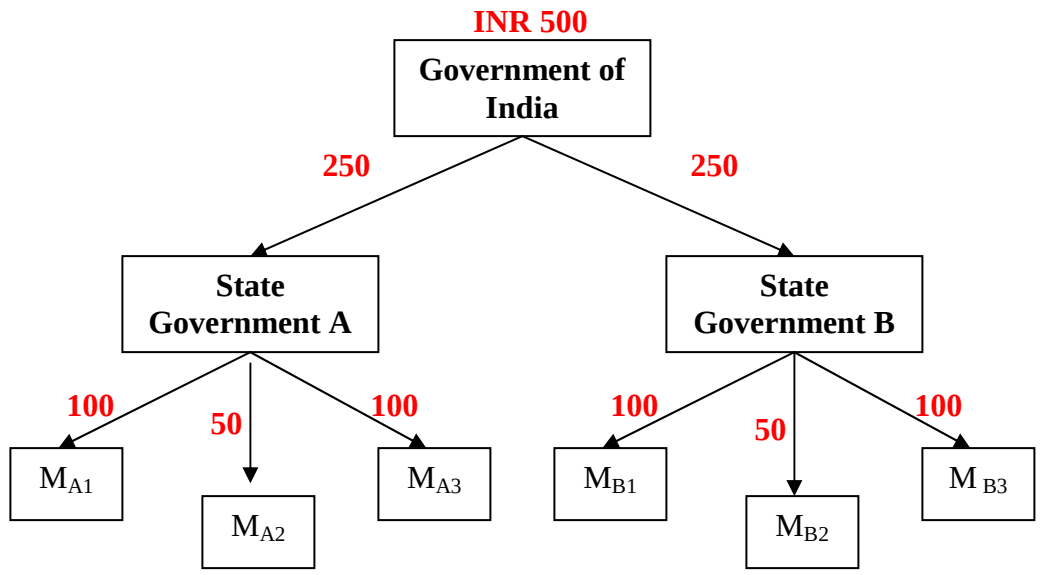
Economic and Social Benefits:

If municipal bond financing permits investment in productivity enhancing projects, in particular those that would not be implemented by the private sector alone due to coordination failures[lvi], then productivity gains which would not have otherwise been realized may be achieved. Also, independent municipal financing can free up resources for the government to redistribute capital more equitably across states and municipalities. Productive investments have the potential of creating employment as well as improving the provision of services to the population.

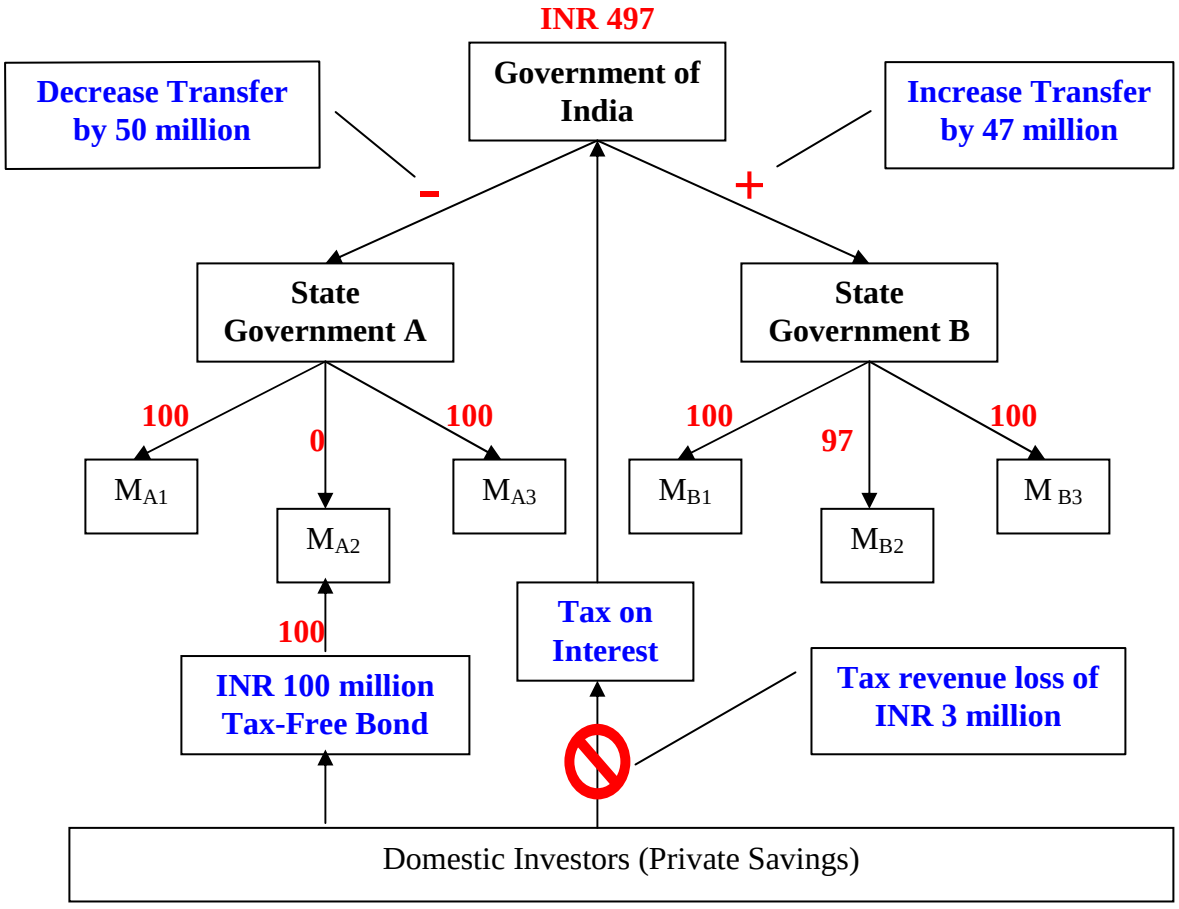
The diagram below (Figure 4) helps illustrate the potential redistribution possibilities. Assume that the government has limited resources to distribute among municipalities and that all productive projects cannot be financed. In part (a) of the diagram below, if municipalities M_{A2} and M_{B2} would both like to implement a project requiring INR 100 million but were only allocated INR 50 million each, the projects are constrained by access to finance. In this case, assume that the municipality M_{A2} has adequate credibility and the institutional capacity to access the private credit market while M_{B2} does not. In part (b), if M_{A2} issues a 100 million tax-free bond, the GOI forgoes the tax on the interest income the domestic investors earned on the tax-free bond. At a tax rate of 30% and interest rate of 10%, the tax foregone would be INR 3 million. The government could then reallocate the 50 million originally designated to M_{A2} less the 3 million in foregone tax revenues to M_{B2}. In this way, the government can permit a greater number of municipalities to finance development projects. This scheme allows well performing municipalities to raise capital independently while freeing up resources for less developed municipalities.

Figure13: Potential Redistribution of Transfers (a stylized example, in INR million)

a) Initial allocation of transfers



b) Potential redistribution with municipal bond issues[lvii]



THE ACTUAL BENEFITS

Black Money:

A tax-free bond has the potential of attracting illegal 'black money[lviii]' into the formal financial market. The amount of 'black money' in India is estimated at 20 to 25% of national income[lix]. Since an investor holding 'black money' does not pay taxes on it, tax-free bonds would offer an opportunity for such an investor to secure returns at a low level of risk in the formal market. Since the GOI did not collect tax on this 'black money' to start with, it would not forgo additional tax revenues. In other words, tax-free bonds have the potential of bringing illegal money into the formal financial system to raise capital for a municipality without any incremental losses in income tax revenues[lx]. (The potential negative externality of greater tax evasion was discussed earlier in the threats analysis)

Fiscal Responsibility:

Greater fiscal independence to well performing municipalities can provide incentives for greater fiscal responsibility. Since a municipal government should be better informed of the constraints and opportunities of the local economy, devolving decision making to municipal governments may facilitate better allocation of resources. Since a municipality's ability to access private markets in the future is dependent on the strength of their balance sheets, it is in the interest of a municipality to maintain solvency. Thus, creating greater flexibility for municipalities that have already demonstrated sound fiscal management has the potential of engendering more responsible decision-making when investing in projects vis-à-vis with funds transferred from the state or GOI. (The potential for moral hazard and fiscal irresponsibility has been addressed in the threats analysis section)

No Balance Sheet Effect:

Since the municipal bonds are entirely domestic debt, these municipal bonds would avoid the potential for a balance sheet effect associated with debt denominated in international currencies. A large devaluation would not create a currency mismatch with this domestic currency denominated municipal bonds nor threaten the net worth of municipalities.

Table 3 Summary of Stakeholder Analysis

	Benefits	Stakeholder	Threats	Stakeholder
Economic	Increased investments	Municipality	Systemic risk	Government
	Incentive based wealth transfer	Government	Sub-optimal subsidy strategy	Government
	Tax free status	Society/investors	Black money	Society
	Market based intervention	Government	Economic shocks	Government
	Black money	Government		
Institutional	Fiscal decentralization	Municipality	Moral hazard	Government
	Self regulation	Government	Municipal inefficiency	Government
	Greater checks on municipality	Society		
	Ratings for municipality	Government		
Political	Keeps parties under check	Society	Political mal-practice	Society
	Performance advertising	Municipality	Mis-use of bond proceeds	Society/investors
	Greater incentives for tax collection	Municipality	Overuse of municipal bonds	Government

SECTION 6: POLICY RECOMMENDATIONS

Granting greater discretion to municipalities regarding bond issuance involves both significant opportunities and risks (as summarized in the previous section). Thus, the challenge will be to minimize the identified risks while ensuring that the necessary institutional capacity exists at municipal, state, and national levels. We propose a path[lxi] for approaching the issue of municipal debt issuance in India. Well performing municipalities should be screened and they should be allowed to become financially self-sustainable. In any case we believe that before the government of India allows any municipality to issue bonds, there are few key issues that need to be addressed. Our recommendations on those fundamental changes are listed below:

Municipal Securities Board of India

We propose the creation the Municipal Securities Board of India (MSBI), which shall regulate and monitor the municipal market in India[lxii]. This body shall be a part of the existing Securities Board of India (SEBI).

Transfer Policy

Once MSBI is created and the SMZ[lxiii] status is granted to the municipality, the GOI should reduce the state transfers as the municipality has alternate sources of financing and also this keeps in check the ratio of debt to revenues of the municipality. We base this argument on the economic model we developed as shown in Appendix 1, that can calculate the actual reduction in transfers for every INR of bonds floated assuming a given probability of municipality defaulting.

Bankruptcy

In India the municipal bankruptcy laws[lxiv] need to be made clear and well defined as they are for the corporations. This change can be brought about by MSBI. In addition regulatory mechanisms should be able to aid development of the secondary municipal bond markets where a market mechanism to exchange risk[lxv] would be created and default risk can be priced[lxvi].

Taxation

As analyzed in our model the tax rate plays an important role[lxvii]. Thus we propose that any debt issuance by the municipality shall be tax free only on the interest income and shall not be tax free on the capital gains. In addition, the sources of funds used to buy these bonds need not be disclosed.

Insurance

In addition the government should encourage the issuance of revenue bonds over general obligation bonds as the revenues act as an additional level of self insurance against any potential default. The government should also allow private firms to insure these bonds for risk mitigation and credit enhancement.

Exchange Based Listing

The municipal bonds should be listed on the National Exchanges. It is important that these municipalities are under the scrutiny of the investors on a daily basis and listing will increase liquidity. Private and over the counter market trading should be discouraged initially as regulating two parallel markets will be difficult in this new industry.

Municipal Swap Curve

The National Stock Exchange was able to create a zero coupon yield curve for the Indian debt market. Similarly it is important that a national swap rate for the municipal bond market is created. This will help increase the liquidity in the market and will create many avenues for the issuer and investor to lay off risks through a market based mechanism.

Arbitration

Legal systems in India mainly cater to the corporate bond market. This system needs to be extended to the municipal bonds and detailed rule book should be created. This is important to address the cases of bankruptcy and default charges.

Classification

Government should allow only competitive issues as the negotiated bond issues have considerably higher net interest cost[lxviii]. Separately, the government of India should give additional incentives to municipalities to raise capital in under invested areas such as education, women's health etc.

Revenue Transfers

The government of India should follow a phased reduction of transfers to the states. This fiscal decentralization should be able to able to fill in the gap created by the reduction in transfers. This phased approach can then lead to optimality[lxix]. Incentives such as lump sum transfers as discussed above then will be a bonus to the municipalities.

SPECIAL MUNICIPAL ZONES

We propose that Government of India establish the designation of **Special Municipal Zone (SMZ)**, which will authorize select municipalities greater discretion in raising debt based on the merits of their balance sheet. By establishing a benchmark for municipal fiscal performance, the government can encourage other municipalities to perform well.

The government of India should invite applications from interested municipalities who meet the SMZ criteria proposed below. The government of India should scrutinize these applications and award qualified candidates the status of SMZ. The municipality will have the responsibility of demonstrating compliance with the criteria annually in order to maintain the SMZ status. To do this we propose the creation of a new Office of Municipal Finance within the Capital Markets Division of the Ministry of Finance - Department of Economic Affairs. This office shall report into the Joint Secretary of Capital Markets. The onus of getting the SMZ status lies with the municipality. They shall prepare a report elaborating their qualification. The report shall be approved by the Joint Secretary of Capital Markets based on the four criteria shown below.

1. **Independent credit rating of AA or better:** We propose that two independent rating agencies evaluate each municipality on a monthly basis, one appointed by the municipal government and the other by the GOI. If discrepancies arise, we recommend using the more conservative rating. Eventually we believe that the bond issuance's success depends on it quality[lxx].

2. **Transparent double-entry accrual accounting practices[lxxi]:** The use of double entry – accrual based accounting system[lxxii] should be made mandatory by the GOI whether the municipalities intend to use the SMZ scheme or not. This will create greater standardization and benchmarking across the nation. COC is the only municipality in India which uses this system.

3. **Municipalities should maintain an optimal debt to tax collection ratio:** Based on our economic model, a municipality should calculate the optimal debt d*[lxxiii] as a ratio of its tax collection revenues. Note that we do not propose any target number at this time because[lxxiv] we believe that each municipality has a unique optimum. If the existing ratio exceeds the optimal ratio the municipality should be disqualified from being awarded a SMZ status. This optimality should be maintained for the last three consecutive years before the SMZ status application can be made.

4. **Why Municipal Debt?** The municipality also should be able to demonstrate that raising capital through debt issuance is the best route to finance its development needs. They should be able to compare the benefits of issuing bonds versus alternate financing techniques such as loans, public-private partnerships, grants etc.

This methodology will establish the list of the special municipal zones in the country and create a standard guideline for borrowing powers which is currently absent in India. These recommended changes and the creation of Special Municipal Zones should be able to place Indian municipalities in the space of a new and sustainable financing mechanism. We believe that overall this decentralization of fiscal responsibilities would be ideal for the growing financing needs and development of India[lxxv].

APPENDIX I: The Economic Model for Municipal Bonds

DEMAND SIDE

INVESTORS DILEMMA

As an investor, we evaluate three things in relation to municipal bonds. Firstly, the value of such a security called municipal bond, secondly the optimal allocation of savings into this new asset class and thirdly the demand for municipal bonds. The sections below will illustrate this approach.

SECTION 1: MUNICIPAL DEBT VALUATION

The framework we chose here is to first analyze the value of these bonds and then establish a demand function. We assume that the COC issues zero coupon bonds value of b which matures at time T. These bonds are unsecured and the COC would pay back at the end of maturity INR b. In addition, we assume that the COC does not issue any debt later and if it does then the debt b is senior to future debt issues. In case of default, the bond holders only get net reserves that the Corporation has which will be equal to the Sum of Revenues Less Sum of Expenditures (We call it V_t[lxxvi]). The bond holders cannot hold claim to the fixed assets of the Corporation.

Thus at time T, bondholders get min {V_t, b}……. (i)

Further we assume that the municipal bond security follows a random walk hence the security can be represented by the form

$dV_t = (\mu dt + \sigma dz)V_t$ …….. ……..(ii)

Where μ is the instantaneous return, σ is the instantaneous volatility and dz is a wiener process[lxxvii].

Now to determine the price of a security such that the pay off is as shown by (i), we use the differential equation[lxxviii].

$$\frac{1}{2}\sigma^2 V_t^{\,2}\frac{\partial^2 f}{\partial V_t} + r_f V_t \frac{\partial f}{\partial V_t} + \frac{\partial f}{\partial t} - r_f f = 0 \quad \text{……. (iii)}$$

Thus we solve equation (iii) subject to the following boundary conditions. *f* is the price of the security which has the payoffs as shown below which in our case is the bond.

a. $F(V_t,T) = \text{Min}\{V_t,b\}$

b. $F(V_t,t)/\ V_t \leq 1$

c. $F(0,t) = 0$

Here we assume the risk free interest rate to be r_f and there are no coupon payments as it is a zero coupon bond. To solve this differential equation with boundary conditions, we assume $V_t = \ln Y_t$ and substitute for $\tau = T - t$. The equation (iii) becomes

$$\frac{1}{2}\sigma^2\frac{\partial^2 f}{\partial Y^2} + (r_f - \frac{\sigma^2}{2})\frac{\partial f}{\partial Y} + \frac{\partial f}{\partial \tau} - r_f f = 0 \quad \text{.....(iv)}$$

The boundary conditions then become $f(Y_t, t) = \min\ (e^{Y_t}, b)$

Assuming that equation four has the solution of the form

$$f(Y_t,t) = e^{Y_t}(1 - \prod\nolimits_{1,t}) + e^{-r_\tau}(b\prod\nolimits_{2,t}) \quad \text{.....(v)}$$

Let's divide the R.H.S into two parts namely part 1: $e^{Y_t}(1 - \prod_{1,t})$ and part 2: $e^{-r_\tau}(b\prod_{2,t})$

Subject to $\prod_{1,T} = 1_{e^{Y_t} \geq b}$ and $\prod_{2,T} = 1_{e^{Y_t} \geq b}$

We start with substituting for part 1, hence the partial differential equation simplifies to

$$\frac{1}{2}\sigma^2\frac{\partial^2 \prod_{1,t}}{\partial Y^2} + (r_f + \frac{\sigma^2}{2})\frac{\partial \prod_{1,t}}{\partial Y} + \frac{\partial \prod_{1,t}}{\partial \tau} = 0$$

Subject to $\prod_{1,T} = 1_{e^{Y_t} \geq b}$

The solution for this equation is given by standard mathematical results which is

$$\prod\nolimits_{1,t} = \Phi\left[\frac{Y_t + (r_f + \frac{\sigma}{2})\tau - \ln b}{\sigma\sqrt{\tau}}\right]$$ where Φ denotes a normal distribution……(vi)

Similarly solving for part 2 we get the partial differential equation as

$$\frac{1}{2}\sigma^2\frac{\partial^2 \prod_{2,t}}{\partial Y^2} + (r_f - \frac{\sigma^2}{2})\frac{\partial \prod_{2,t}}{\partial Y} + \frac{\partial \prod_{2,t}}{\partial \tau} = 0$$

Subject to $\prod_{2,T} = 1_{e^{Y_t} \geq b}$

The solution for this equation is obtained as above which is

$$\prod_{2,t} = \Phi\left[\frac{Y_t + (r_f - \frac{\sigma}{2})\tau - \ln b}{\sigma\sqrt{\tau}}\right] \quad \text{.....(vii)}$$

Therefore substituting for Y_t and τ we get the value of the security f.

$$\text{Thus f (V, t)} = be^{-r(T-t)}\ \Phi\left[\frac{\ln\frac{V_t}{b} + (r_f + \frac{\sigma}{2})\tau}{\sigma\sqrt{T-t}}\right] - V_t\ \Phi\left[\frac{\ln\frac{V_t}{b}Y_t + (r_f + \frac{\sigma}{2})\tau}{\sigma\sqrt{T-t}}\right] \quad \text{.....(viii)}$$

This shows the value of the municipal bond at time t and it captures the risk of the municipality. We did not assume any utility function for the investor to price this security as it is not required.

SECTION 2: OPTIMAL ALLOCATION PROBLEM

In this section we estimate what would be the optimal fraction of an investor's income that she would allocate to purchasing municipal bonds. We have developed the approach used by Piros (1987). We use the price of the municipal bond as calculated from the earlier section. Let $f(V_t, t)$ be price P_1 which has returns μ_m and risk of σ_m. Also let us assume that price of another security be P_2 with returns μ_{Alt} and risk $\sigma_{Alt.}$ We have assumed that all investors are risk averse or chose a mean-variance portfolio which means that the investor tries to minimize risk for given returns or maximize returns for a given amount of risk. In addition we have assumed that the marginal tax rate t' for the investors is an increasing function.

Let α be the proportion of savings that the investor invests in municipal bond and 1-α be the proportion of savings in alternate assets. The returns from the municipal bonds are tax exempt but the returns from the alternative investments are taxable. Let us further assume that at any given time t, the pre tax income for the investor is i_{pre} and savings are $s_{t.}$ We also assume that savings are invested in only these two asset classes.

Hence the Net Income for the investor post taxes = Income pre tax + returns from municipal bonds + returns from alternative assets Less taxes paid which mathematically means,

$$i_{post} = i_{pre} + \alpha s\ \mu_m + (1-\alpha)s_t\mu_{Alt} - t^{'}\{i_{pre} + (1-\alpha)s_t\mu\ \} \text{ .....(ix)}$$

The investor wants to maximize this expected return which can be denoted as $E\left[U\left(i_{post}\right)\right]$

Subject to $i_{post} = i_{pre} + \alpha s_t\mu_m + (1-\alpha)s_t\mu_{Alt} - t^{'}\{i_{pre} + (1-\alpha)s_t\mu_{Alt}\ \}$

We can optimize this using a standard LaGrange

L: $E\left[U\left(i_{post}\right)\right] + \lambda\ [\ i_{pre} + \alpha s_{t_t}\mu_m + (1-\alpha)s_t\mu_{Alt} - t^{'}\{i_{pre} + (1-\alpha)s_t\mu_{Alt}\ \}\ ]$ ....(x)

To calculate the optimal allocation in municipal bonds we take the first derivative of L with respect to α and equate it to zero.

$$\frac{\partial L}{\partial \alpha} \Rightarrow E[U^{'}\{s_t^{'}\mu_m - s_t^{'}\mu_{Alt} + t^{'}s_t^{'}\mu_{Alt}\}]\ = 0 \text{ if } 0<\alpha<1$$

For $\alpha \geq 1,\ E[U^{'}\{s_t^{'}\mu_m - s_t^{'}\mu_{Alt} + t^{'}s_t^{'}\mu_{Alt}\}] \geq 0$

For $\alpha = 0,\ E[U^{'}\{s_t^{'}\mu_m - s_t^{'}\mu_{Alt} + t^{'}s_t^{'}\mu_{Alt}\}] \leq 0$

If we know that the expected utility function is strictly concave in α then, we can say that investor prefers a unique combination of the two asset classes[lxxix]. We also know that since the investor is risk averse, she would invest in the municipal bonds only if there was an embedded premium in the returns, otherwise the investor would have been risk neutral. Thus from this optimization problem we can determine α. Hence at time t, if we know the savings s_t and income i_{pre} then it is possible to find the proportion of savings that will be invested in municipal bonds which we call it w_t.

SECTION 3: ESTIMATION OF DEMAND FOR BONDS

Now that we have estimated the price of such a security and the wealth that an investor would allocate in this good, we can find the individual demand function using the basic microeconomic theory. Given the vectors price and wealth, we can arrive at the indirect utility function $v(p,w)$. We know that this has a property $\frac{-v''}{v'} \geq 0$ as the investor is risk averse. In addition we can find the individual demand function for investor i, as x_i . The individual demand function can be established from the Roy's Identity which is

$$x_i = -\frac{\partial v(p,w) \big/ \partial p_i}{\partial v(p,w) \big/ \partial w} \quad \text{.....(xi)}$$

Hence we can estimate the aggregate demand function for municipal bonds as $\sum x_i$

THE SUPPLY SIDE

Municipal Bonds leads to increase in indebtedness hence it is important to analyze what would be the optimum level of bond issuance. We develop this model below for an Indian Municipality to solve for the optimal debt level. The objective of this model is to represent different scenarios like shocks, fall in tax revenues etc and how COC's fiscal stability be affected.

The budget constraint is constructed with the aid of the following details for the municipality

Source of funds for the Municipality

1. Tax revenue per capita (τ_t) collected on output at tax rate β[lxxx].
2. Transfers from GOI (z_t) to municipality (via state government)
3. Bonds (d_t)
4. Aid (l_t)

Expenditure of funds for COC

1. Interest on bonds (r[lxxxi]d_t)
2. Government expenditures (g_t)

Assumptions

i) We assume a Cobb Douglas production function for output.

ii) We further assume that there is no population growth hence L is constant

The government tries to maximize the welfare of its citizens hence its objective function will be

Max $\int_0^{\infty} U(c_t)e^{-\rho t}dt$

Subject to the constraint,

$\dot{d}_t = rd_t + g_t - \tau_t - z_t - l_t$ xii

$\dot{d}$, the rate of change of Chennai's debt reflects if the economy is running surplus or deficit. Further rd_t is the interest earned on the debt, g_t is the government purchases or the investment in the economy, τ_t is the tax revenues, z_t is the transfers from central or state government to COC and l_t is the aid coming in from other institutions. For simplicity, we will assume that l_t is constant and the tax base τ_t is a fraction β times the output of the economy.

We also assume that the investor is risk averse hence the utility function is assumed to be $U(c_t) = \log c_t$. This is because with a log utility function, the consumer is risk averse since $r_A = \frac{-u'''}{u'} > 0$ according to the Arrow-Pratt measure.

Thus the optimizing problem for the government becomes,

H: $\int_0^{\infty} \log(c_t)e^{-\rho t}dt + \lambda[rd_t + g_t - \tau_t - z_t - l_t]$ xiii

Further we assume that the government expenditures are in the form of investments and this is equal to the rate of change of capital stock. Again to simply the solution, we assume that there is no depreciation of capital. Thus,

$g_t = i_t = \dot{k}_t$ xiv

The production function is assumed to be Cobb-Douglass hence, the tax base will be $\tau_t = \beta \cdot f(K,L)$ such that {0<β<1), where $f(K,L) = A \cdot K^{\alpha} L^{1-\alpha}$ and $f(k) = Ak^{\alpha}$, and the marginal product of capital, $f_k = \alpha A k^{\alpha-1}$. We get this by dividing the entire equation by L as it is constant since n, the population growth is assumed constant.

Substituting these in the budget constraint I, we get

$\dot{d}_t = rd_t + i_t - \beta Ak^{\alpha} - z_t - l_t$ ……xv

and optimization problem becomes

H: $\int_0^{\infty} \log(c_t)e^{-\rho t}dt + \lambda\left[rd_t + i_t - \beta Ak^{\alpha} - z_t - l_t\right]$ ……..……xvi

To solve this firstly we define inter-temporal elasticity of substitution as σ = $\frac{u'}{u''C_t}$, then we know that $\dot{\lambda}/\lambda$ = $-\frac{\dot{c}_t}{c_t}$ x σ^{-1}, Substituting these we get $\frac{\dot{c}_t}{c_t} = r - \rho$ ……...…xvii

And the solution for this equation is $c_t = c_o e^{-(\rho - r)t}$. Note that ρ is the rate at which investors or consumers discount the future

We now proceed to look at the optimization problem and apply the Hamiltonian boundary conditions.

1. $\lambda = \frac{dH}{di} = 1$……(a)

2. $\dot{\lambda} = \rho\lambda - \frac{dH}{dk} = \rho\lambda - \beta A\alpha k^{\alpha-1} = 0 \rightarrow \dot{\lambda} = \rho - \beta A\alpha k^{\alpha-1}$ ……....(b)

Thus dividing equation (b) by (a) and equating to VI, we get $\rho - \beta A\alpha k^{\alpha-1} = r - \rho$

$\rightarrow k^* = \left[\frac{2\rho - r}{A\alpha\beta}\right]^{\frac{1}{\alpha-1}}$. This is optimal capital stock, which we substitute into the production function to get the output, $f(k^*) = A\left[\frac{2\rho - r}{A\alpha\beta}\right]^{\frac{\alpha}{\alpha-1}}$. Hence the tax revenues are now $\tau^* = \beta \cdot f(k^*)$ and the investment is i*.

To obtain optimal debt, we substitute these in the constraint and get $\dot{d}_t = rd_t + i_t - \beta A(k^*)^{\alpha} - z_t - l_t$.

This is a linear differential equation which can be solved as

$\dot{d}_t - rd_t = i_t - \beta A(k_t)^{\alpha} - z_t - l_t$

$d_t = d_o e^{rt} + \int_0^t [i_t - \beta A(k_t)^{\alpha} - z_t - l_t] \cdot e^{-rt}dt$ ……xviii

Applying the TVC we get the LHS.

$$\lim_{T\to\infty} d_T e^{-rt} = d_o + \int_0^{\infty} [i_t - \beta A(k_t)^{\alpha} - z_t - l_t] \cdot e^{-rt} dt \leq 0$$

Solving for d_o:

$$d_o \leq \int_0^{\infty} [\beta A(k_t)^{\alpha} + z_t + l_t - i_t] e^{-rt} dt \quad \text{.....xix}$$

In other words we can describe this as saying that the initial level of debt for COC has to be less than or equal to the present value of future net income streams which includes, transfers, tax collections and grants and aid net of all investments. Thus, we arrive at the demand and supply side of the municipal market. With these equations xviii and xix with can estimate the effects of shocks on the bond holdings and deficit. Also this model can be simplified further to suit the needs of specific municipality if we can establish a relationship of transfers and tax rates over time.

Thus in our model, we derived the demand side for the municipal bonds without having a history of average returns or taking into account the investor preferences[lxxxii]. In addition the supply side of the model was derived from an inter-temporal approach. This demand and supply side should be able to give an unique equilibrium for every municipality by plugging in the relevant data and factors.

APPENDIX II: Financial Analysis of Proposed Desalinization Plant[lxxxiii]

Project Cost INR	4,000,000,000										
Life of the Plant	25										
Year in Number		1	2	3	4	5	6	7	8	9	10
		Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Volume	Litres/day	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000
Cap Utilization	%	100%	100%	100%	100%	100%	90%	90%	90%	90%	90%
Days	24 Hour Days	360	360	360	360	360	360	360	360	360	360
Annual Volume	Litres	36,000,000,000	36,000,000,000	36,000,000,000	36,000,000,000	36,000,000,000	32,400,000,000	32,400,000,000	32,400,000,000	32,400,000,000	32,400,000,000
Price P1	INR Per KL	35	35	35	35	35	37	37	37	37	37
Price P2	INR Per KL	60	60	60	60	60	63	63	63	63	63
Weightage P1		60%	60%	60%	60%	60%	60%	60%	50%	50%	50%
Weightage P2		40%	40%	40%	40%	40%	40%	40%	50%	50%	50%
Weighted Price		45.00	45.00	45.00	45.00	45.00	47.25	47.40	49.88	49.88	49.88
Exchange Rate	1										
Collection Rate		90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Annual Revenues	INR	1,458,000,000	1,458,000,000	1,458,000,000	1,458,000,000	1,458,000,000	1,377,810,000	1,382,184,000	1,454,355,000	1,454,355,000	1,454,355,000
Total Revenues		**1,458,000,000**	**1,458,000,000**	**1,458,000,000**	**1,458,000,000**	**1,458,000,000**	**1,377,810,000**	**1,382,184,000**	**1,454,355,000**	**1,454,355,000**	**1,454,355,000**
Costs											
Variable Costs											
- Operational	INR 30 per KL	1,080,000,000	1,080,000,000	1,080,000,000	1,080,000,000	1,080,000,000	972,000,000	972,000,000	972,000,000	972,000,000	972,000,000
- Distribution	INR 2 per KL	72,000,000	72,000,000	72,000,000	72,000,000	72,000,000	64,800,000	64,800,000	64,800,000	64,800,000	64,800,000
Total Var		1,152,000,000	1,152,000,000	1,152,000,000	1,152,000,000	1,152,000,000	1,036,800,000	1,036,800,000	1,036,800,000	1,036,800,000	1,036,800,000
Fixed Costs											
- Labor	INR per year	16,000,000	16,000,000	16,000,000	16,000,000	16,000,000	16,800,000	17,640,000	18,522,000	19,448,100	20,420,505
Total Fixed		16,000,000	16,000,000	16,000,000	16,000,000	16,000,000	16,800,000	17,640,000	18,522,000	19,448,100	20,420,505
Total Costs		**1,168,000,000**	**1,168,000,000**	**1,168,000,000**	**1,168,000,000**	**1,168,000,000**	**1,053,600,000**	**1,054,440,000**	**1,055,322,000**	**1,056,248,100**	**1,057,220,505**
EBDIT		290,000,000	290,000,000	290,000,000	290,000,000	290,000,000	324,210,000	327,744,000	399,033,000	398,106,900	397,134,495
- Interest Cost	@7% MUNICIPAL BOND RATE	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000
CASH PROFIT		**10,000,000**	**10,000,000**	**10,000,000**	**10,000,000**	**10,000,000**	**44,210,000**	**47,744,000**	**119,033,000**	**118,106,900**	**117,134,495**
- Depreciation	@ 7% per annum	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000
Net Profit/Loss		**(150,000,000)**	**(150,000,000)**	**(150,000,000)**	**(150,000,000)**	**(150,000,000)**	**(115,790,000)**	**(112,256,000)**	**(40,967,000)**	**(41,893,100)**	**(42,865,505)**
NPV For the Project	**INR 555,556**										

FINANCIAL PLAN CONTINUED..

Project Cost INR	4,000,000,000									
Life of the Plant	25									
Year in Number		**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
		Yr 11	**Yr 12**	**Yr 13**	**Yr 14**	**Yr 15**	**Yr 16**	**Yr 17**	**Yr 18**	**Yr 19**	**Yr 20**
Volume	**Litres/day**	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000
Cap Utilization	%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Days	24 Hour Days	345	345	345	345	345	330	330	330	330	330
Annual Volume	Litres	31,050,000,000	31,050,000,000	31,050,000,000	31,050,000,000	31,050,000,000	29,700,000,000	29,700,000,000	29,700,000,000	29,700,000,000	29,700,000,000
Price P1	INR Per KL	37	37	37	37	37	40	40	40	40	40
Price P2	INR Per KL	63	63	63	63	63	69	69	69	69	69
Weightage P1		50%	50%	50%	50%	50%	40%	40%	40%	40%	40%
Weightage P2		50%	50%	50%	50%	50%	60%	60%	60%	60%	60%
Weighted Price		49.88	49.88	49.88	49.88	49.88	57.75	57.75	57.75	57.75	57.75
Exchange Rate	1										
Collection Rate		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Annual Revenues	INR	1,471,187,813	1,471,187,813	1,471,187,813	1,471,187,813	1,471,187,813	1,629,416,250	1,629,416,250	1,629,416,250	1,629,416,250	1,629,416,250
Total Revenues		**1,471,187,813**	**1,471,187,813**	**1,471,187,813**	**1,471,187,813**	**1,471,187,813**	**1,629,416,250**	**1,629,416,250**	**1,629,416,250**	**1,629,416,250**	**1,629,416,250**
Costs											
Variable Costs											
- Operational	INR 30 per KL	931,500,000	931,500,000	931,500,000	931,500,000	931,500,000	891,000,000	891,000,000	891,000,000	891,000,000	891,000,000
- Distribution	INR 2 per KL	62,100,000	62,100,000	62,100,000	62,100,000	62,100,000	59,400,000	59,400,000	59,400,000	59,400,000	59,400,000
Total Var		993,600,000	993,600,000	993,600,000	993,600,000	993,600,000	950,400,000	950,400,000	950,400,000	950,400,000	950,400,000
Fixed Costs											
- Labor	INR per year	21,441,530	22,513,607	23,639,287	24,821,251	26,062,314	27,365,430	28,733,701	30,170,386	31,678,906	33,262,851
Total Fixed		21,441,530	22,513,607	23,639,287	24,821,251	26,062,314	27,365,430	28,733,701	30,170,386	31,678,906	33,262,851
Total Costs		**1,015,041,530**	**1,016,113,607**	**1,017,239,287**	**1,018,421,251**	**1,019,662,314**	**977,765,430**	**979,133,701**	**980,570,386**	**982,078,906**	**983,662,851**
EBDIT		456,146,282	455,074,206	453,948,525	452,766,561	451,525,498	651,650,820	650,282,549	648,845,864	647,337,344	645,753,399
- Interest Cost	@7% MUNICIPAL BOND RATE	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000
CASH PROFIT		176,146,282	175,074,206	173,948,525	172,766,561	171,525,498	371,650,820	370,282,549	368,845,864	367,337,344	365,753,399
- Depreciation	@ 7% per annum	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000
Net Profit/Loss		**16,146,282**	**15,074,206**	**13,948,525**	**12,766,561**	**11,525,498**	**211,650,820**	**210,282,549**	**208,845,864**	**207,337,344**	**205,753,399**

Project Cost INR	4,000,000,000					
Life of the Plant	25					
Year in Number		**21**	**22**	**23**	**24**	**25**
		Yr 21	**Yr 22**	**Yr 23**	**Yr 24**	**Yr 25**
Volume	**Litres/day**	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000
Cap Utlization	%	90%	90%	90%	90%	90%
Days	24 Hour Days	330	330	330	330	330
Annual Volume	Litres	29,700,000,000	29,700,000,000	29,700,000,000	29,700,000,000	29,700,000,000
Price P1	INR Per KL	44	42	42	42	42
Price P2	INR Per KL	76	76	76	76	76
Weightage P1		40%	40%	40%	40%	40%
Weightage P2		60%	60%	60%	60%	60%
Weighted Price		63.53	62.72	62.72	62.72	62.72
Exchange Rate	1					
Collection Rate		95%	95%	95%	95%	95%
Annual Revenues	INR	1,792,357,875	1,769,546,048	1,769,546,048	1,769,546,048	1,769,546,048
Total Revenues		**1,792,357,875**	**1,769,546,048**	**1,769,546,048**	**1,769,546,048**	**1,769,546,048**
Costs						
Variable Costs						
- Operational	INR 30 per KL	891,000,000	891,000,000	891,000,000	891,000,000	891,000,000
- Distribution	INR 2 per KL	59,400,000	59,400,000	59,400,000	59,400,000	59,400,000
Total Var		950,400,000	950,400,000	950,400,000	950,400,000	950,400,000
Fixed Costs						
- Labor	INR per year	34,925,993	36,672,293	38,505,908	40,431,203	42,452,763
Total Fixed		34,925,993	36,672,293	38,505,908	40,431,203	42,452,763
Total Costs		**985,325,993**	**987,072,293**	**988,905,908**	**990,831,203**	**992,852,763**
EBDIT		807,031,882	782,473,754	780,640,140	778,714,844	776,693,284
- Interest Cost	@7% MUNICIPAL BOND RATE	280,000,000	280,000,000	280,000,000	280,000,000	280,000,000
CASH PROFIT		527,031,882	502,473,754	500,640,140	498,714,844	496,693,284
- Depreciation	@ 7% per annum	160,000,000	160,000,000	160,000,000	160,000,000	160,000,000
Net Profit/Loss		**367,031,882**	**342,473,754**	**340,640,140**	**338,714,844**	**336,693,284**

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END NOTES

[i] One of the best performing municipalities, Venkatachalam (2005)
[ii] Part 3(g) of the 74th Amendment calls for "the devolution by the State Legislature of powers and responsibilities upon the Municipalities with respect to preparation of plans for economic development and social justice, and for the implementation of development schemes as may be required to enable them to function as institutions of self-government."
[iii] Chetan Vaidya and Hitesh Vaidya, Indo-USAID FIRE Project (Municipal Bonds in India: Experience So Far, 2004 draft)
[iv] Mather and Thakur, pg 52.
[v] Ibid.
[vi] 12th Finance Commission Report.
[vii] Briscoe.
[viii] Brisco. pg 6.
[ix] http://indiabudget.nic.in (estimated required funds of INR 537 billion and likely availability of funds of INR 358 billion)
[x] Vaidya and Vaidya.
[xi] World Bank, India: Urban Governance and Finance Review, Annex III, p 66.
[xii] Vaidya and Vaidya.
[xiii] Lower cost arises due to tax exemption given to the investors hence the cost of capital reduces for the municipality
[xiv] General Obligation Bonds: A bond secured by a pledge of the issuer's taxing powers (limited or unlimited). More commonly the general obligation bonds of local governments are paid from ad valorem property taxes and other general revenues.
[xv] Revenue Bonds: A municipal bond whose debt service is payable solely from the revenues derived from project acquired or constructed with the proceeds of the bonds
[xvi] Briscoe, p 29.
[xvii] Vackayil.
[xviii] To see the revenue model, please refer to Annexure 1 on the financial model for the water project as an illustrative example
[xix] Cost of Debt here is assumed to be the Prime Lending Rate and for illustrative purposes we have assumed it to be 10% per annum
[xx] See Figure 6 for the type of savings that Indian Investors have
[xxi] See Figure 5 for Bond Rating System in India and significance of AA rating
[xxii] Urban Finance (2002)
[xxiii] Interest rate spreads can be constructed such that municipal bonds trade either at a discount or a premium to the more liquid Government of India bonds
[xxiv] Deutsche Bank's report on Indian Bond Markets.
[xxv] Note that we have used 30% as the tax rate for both individuals and corporations to keep our estimates conservative for calculation purposes.
[xxvi] See Figure 6 on savings which illustrates how Indian households have parked their savings in different instruments
[xxvii]Mehra (2006)
[xxviii] Risk as measured by volatility for Indian Treasury bills are approximately 1.73%, see Mehra (2006)
[xxix] Municipality is tied into the government which indirectly means that the government is the lender of the last resort. Hence we go on in paper to illustrate the effects of this moral hazard and prescribe an optimal debt issue

[xxx] Thus, investor preferences will be such that they will maximize the returns while minimizing the risk while achieving optimality on their utility function. Mathematically Utility = U (t, C_A, C_M) where t is time and C_A are the returns from all other alternative assets and C_M are returns from municipal bonds. The budget constraint will be the total invest-able wealth held by the individual or a firm. We will optimize the investor's utility maximization problem as shown in the model in this paper

[xxxi]

[xxxii] We interviewed T.N.Seshan, the former chief election commissioner of India and a Kennedy School alumnus who opined that it was constitutionally wrong to restrict the number of parties

[xxxiii] Greater political risk leads to greater volatility which means the cost of debt will increase even if the interest rates do not change. The assumption here the debt follows the Brownian motion model $dP_D=(\mu dt + \sigma dz)P_D$, which is usually true. An increase in volatility σ increases dP_D / P_D (% change in the price of debt) hence cost of capital goes up.

[xxxiv] Merton (1973)

[xxxv] Finance Commission (2004)

[xxxvi] Merton (1973)

[xxxvii] Here, a positive inflow of aid will increase the price of the debt or reduce the bond holdings for the municipality thus having a positive effect on its balance sheet. See the valuation of model in appendix 1 for details

[xxxviii] We are referring to shocks and crisis

[xxxix] This is like saying that one invests in different stocks like IBM, GE, GM etc but all of them fall under one asset class called equities. Thus no diversification is achieved despite investment in different securities

[xl] Virtue (1949)

[xli] See our economic model – valuation of municipal bond in the appendix 1

[xlii] Virtue (1949)

[xliii] Gordon

[xliv] A similar case is Fannie Mae, where the firm gets an indirect subsidy by the government as it is too big to fail and has the moral hazard of lender of the last resort.

[xlv] Summary from issue 11 of the Public Policy Institute of California

[xlvi] Jorion, Philipp.

[xlvii] 2005 Estimate, Department of Finance of California, http://www.dof.ca.gov/HTML/DEMOGRAP/e-1press.pdf

[xlviii] With the strong performance of the county, the treasurer borrowed $ 2 for every $ 1 of assets and invested them

[xlix] Interest rate derivatives with a hope that interest rates will increase

[l] Rodden (2003); this is a summary of Rodden's case study of Brazil.

[li] Rodden (2003); this is a summary of Rodden's case study of Brazil.

[lii] Rodden (2003)

[liii] Rodden (2003)

[liv] Rodden (2003)

[lv] Rodden (2003)

[lvi] Coordination failures are relevant here as it is difficult to get few private sector investors to coordinate in a multi-million public utility project

[lvii] Gordon (1983), Slemrod (1983)

[lviii] For an economic analysis see Varma (1989)

[lix] Kothari, pg. 98;citing Kamal Narayan Kabra (1983) The Black Economy in India: Problems and Policies.

[lx] The introduction of black money does bring a problem of excess money supply into the market which is beyond the scope of analysis for this paper

[lxi] For an alternative path see Municipal Finance Overview (2005)

[lxii] Regulations are important and are in the interest of the government, Yale Law Journal (1977)
[lxiii] Special Municipal Zone: We have discussed the concept later in this section
[lxiv] Jones (1976)
[lxv] We base our argument on the development of credit default obligations and credit default swaps market.
[lxvi] Appendix 1, section 1 shows the pricing of bonds with a default risk factored in
[lxvii] We have assumed that the marginal tax rate is an increasing function of the individual's income, Blanchard (1983)
[lxviii] Simonsen (1996)
[lxix] The optimal reduction $(\frac{\partial d_t}{\partial z_t} = -1)$ between debt raised and transfers is one on one but we approach it over time
[lxx] Hsueh (1990) and Liu (1990)
[lxxi] Zimmerman (1977)
[lxxii] Finance Commission (2004)
[lxxiii] Based on the economic model proposed in this paper
[lxxiv] We believe that for the sake of indicating a country wide ratio based on averages or national debt to gdp ratio would be incorrect. We think that using data and our model would yield the optimum for the municipality
[lxxv] Oates (1999)
[lxxvi] $V_t = [\tau_t + z_t + l_t - g_t]$
[lxxvii] This is the standard form for representing the price of a security in a continuous time framework
[lxxviii] This differential equation form is the Merton's model for valuing a security in continuous time. This is an equation to price any contingent liability. See Merton (1973)
[lxxix] It can be proved by showing that U'' <0

[lxxx] The tax rate is usually an increasing function of the income, as shown in Blanchard (1983)
[lxxxi] This *r* is the same as μ_m from the demand side of the model
[lxxxii] We assumed only that the investor is risk averse but did not specify any utility function to establish the price of a municipal bond
[lxxxiii] The costs, revenues and other details were picked from various news sources and we cannot prove their correctness. This model has been solely used to illustrate an example of municipal bond issuance as a financing mechanism