Analysing Urban Growth Boundary Effects in the City of Bengaluru

Address for Correspondence:
Dr. Madalasa Venkataraman
Lead Researcher,
IIMB- Century Real Estate Research Initiative,
IIM Bengaluru
Karnataka 560071
email: madalasa.venkataraman@iimb.ernet.in
Ph: 080-26993740

ABSTRACT

The city of Bangalore is encircled by a green belt area, instituted as an urban growth boundary to contain sprawl, ensuring equitable growth and preserving lung spaces. Urban growth boundaries world over are typically known to drive land prices higher in the inner city area. Bangalore has witnessed significant increase in land prices over the last decade, making it increasingly unaffordable. In this context, this paper examines whether the green belt in Bangalore has had a significant impact on land prices, through an analysis of price differentials within and outside the urban growth boundary. This study also debates the relevance of green belt as an urban containment tool in regimes characterized by in-effective provision of infrastructure and lax implementation of zoning regulations.

1. Introduction

Debates on Urban sprawl have taken centre-stage in recent years amongst policy makers and urban planners. While there is no single definition of what constitutes urban sprawl and how to measure it (Malpezzi, 1999; Ewing et al., 2002; Galster et al., 2001), conversations on sustainable cities often consider ways to mitigate the negative impact of sprawl on the individual resident, the economy and the society. (Burchell et al., 1998, 2005; Downs 1998; Burton 2000; Ewing, 1997, 2008; Johnson, 2001). The compact city is one such hypothesis that has been put forward to reduce sprawl, lower private vehicle usage and conserve green spaces. Compact cities, especially in the developing world, use urban containment policies to achieve their objectives. These policies focus on reducing sprawl, ensuring equitable growth, promoting inner city revitalization and at the same time preserving lung spaces. Urban growth boundaries have emerged as a leading containment tool, limiting the expansion of the city and demarcating the urban areas from the rural areas.

Enclosing an urban area within a growth boundary has its supporters as well as detractors. The positive aspects are the reduced cost of haphazard extensions to infrastructure and improvements in the aesthetic quality of life by reducing sprawl. However, this also means that the supply of land for residential uses is artificially restricted, leading to issues of housing affordability, pricing the city out of range to people and firms and making it non-competitive. It also imposes huge costs in terms of monitoring conformance to planning regimes.

The metropolitan strategy for many cities in the world, and specifically the city of Bengaluru, India is based on the concept of urban growth boundaries. The city is encircled within a green belt with significant zoning restrictions, as a measure to limit sprawl. At the same time, land prices have increased substantially within the city centre, leading to densification in the periphery where land prices are cheaper. So while the green belt has been a planned response to limit sprawl in a burgeoning city, it may equally be responsible for the land price increase within the city. There is thus a need to rethink and review the green belt policy– is it acting as an urban containment policy? Is it creating an artificial supply constraint leading to increasing land prices in the city?

This paper studies the policy framework of the green belt in Bangalore from a planning and an enforcement perspective. Using price trends of real estate within the city contiguous to the green belt, it examines whether the urban growth boundary policy has limited land supply within the city and has effectively contained urban sprawl. Understanding the impact of green belt policies on residential real estate prices is essential from a policy perspective and has large implications on housing affordability in rapidly urbanising cities. The motivation for this study stems from the dialogue on affordable housing in India. Indian cities are considered unaffordable and the onus of this allegedly rests with the state which restricts land supply, through provisioning of infrastructure. The green belt is simply another hard supply constraint by nature of its zoning. How the green belt impacts prices of land, and how the green belt itself is impacted by the rising prices of land is an interesting, and topical study.

1.1 Debates on the Urban Growth Boundary as a Planning tool

A Urban Growth Boundary (UGB) is loosely defined as an "officially adopted and mapped line that separates an urban area from its surrounding greenbelt of open lands, including farms, watersheds and parks, for a set period of time." and with an intent "to contain urban development within planned urban areas where basic services, such as sewers, water facilities, and police and fire protection, can be economically provided." (Sayer, 1997, 1:5). An urban growth boundary is typically a "written agreement" to map the area within which growth will be contained, for a certain pre-determined period of time. (Daniels 2010).

Growth boundaries are used by the city administrators to plan for infrastructure provisions to a contained urban area. An important corollary of fixing the urban growth boundary is that urban services will not be extended beyond the said boundary. On the other hand, an urban growth boundary is not expected to be static. Knaap and Lewis (2001), using an inventory approach to land management, state that boundaries need to be revised on a continuous basis reacting to the available supply and price of vacant land, taking into account the relative price differential of land inside and outside the boundary.

Growth boundaries are envisaged to embrace a residential land supply for 20 years, with projected changes in population and net-urban migration as well as anticipated increase in income levels. Residential land market assessments and land inventories are undertaken to document vacant, underutilized and re-developable lands and exclude severely constrained land. The growth boundary is settled upon after consideration of density and land use requirements.

To be effective, zoning regulations are needed in conjunction with growth boundaries, else rural sprawl and leapfrogging would replace urban sprawl. (Daniels, 2010). The effectiveness of the growth boundary as a containment strategy depends on two factors – the accuracy of the projections and the enforcement of the growth boundary.

If the planning authority has released enough developable land to account for changes in population there will be little or no speculation beyond the growth boundary. If it is perceived that the projections are static and the city is growing beyond the planned population and/or land use levels, development beyond the growth boundary is likely. If enforcement is lax, the growth limit may be circumvented, and the objective of the growth boundary may be defeated.

Internationally, there is substantial literature on whether the growth boundary is the best way to contain the growth of the city, and this is intertwined with the debate on the undesirability of sprawl. Arnott, (1979), Kanemato (1977) and Pines and Sadka, (1985) show that in a standard monocentric city, urban growth boundaries are the second best option to congestion pricing. Dissenting views by Anas and Rhee (2006, 2007) show that real-world polycentric cities with low travel costs, high congestion and high cross-commuting between polycentric nodes, sprawl should be allowed to reduce aggregate travel costs. Breuckner (2007) extends the model to indicate that if the excessive expansion occurs due to congestion externality, then the growth boundary may not be an effective containment policy.

The use of the growth boundary as a containment strategy leads to higher prices due to land development activity: increasing densities emerge because on the production, higher densities within the city are incentivized; on the consumption side, as the cost of land rises, houses tend to be built on smaller lots given a constant budget constraint. (Mildner et al., 1996).

However, studies also reveal that there may be negative externalities to the growth boundary strategy. The supply of land for residential uses is artificially restricted, leading to issues of housing affordability, pricing the city out of range to people and firms and making it non-competitive. This also imposes huge costs in terms of monitoring conformance to planning regimes and transfers wealth from renters to home owners. Knapp and Hopkins (2001) show that when boundaries are not revised on a continuous basis as a function of land demand and supply, growth boundaries will lead to inefficiencies in land markets.

A large body of literature supports the claims of increase in land prices due to growth control systems. A study by Knapp (1985) on the urban growth boundary of Portland, Oregon, showed that there is significant increase in land price within the city due to imposition of the growth boundary. This is also confirmed by Downs (2002, 2004). Since the market perceived the growth boundary to be a genuine and binding supply constraint, prices seem to move towards their long-term equilibrium. In San Diego, Downs (1992) claimed that median price of current housing stock rose by more than 50% over three years due to adopting a growth boundary approach. Glaeser and Gyourko (2002) finds that growth boundaries, amongst other types of land use regulations, has significant impact on housing prices with various cities in the United States. The increase in house prices as a function of regulation is also seen across New Zealand, (Grimes, 2007).

On the other hand, there are studies that debate land price increase due to growth boundaries, such as Phillips and Goodstein, (2000), who claim that while there has been an increase in prices because of the growth boundary in Portland, Oregon, the effect of the prices is really very slight considering comparable towns. They claim that the marked differential in prices on either side of the growth boundary can be attributed to the services that are provided to the demarcated urban areas. Downs (2002) finds that 'even a stringent growth boundary need not lead to long-run increase in prices over comparable growth towns', but a tightly drawn and enforced growth boundary can exert upward pressure on house prices in the short run when housing demand is high. The same is confirmed by Jun (2006) who finds that when developers optimise on costly inputs (viz land) growth boundaries do not necessarily lead to price increase.

All of the above studies confirm that when growth boundaries are tightly enforced, and there is a lag in dynamically resetting growth boundaries according to projections on certain key factors such as population and income, prices within and outside the growth boundary will be different. This is expected to be so, since within the boundary, land is priced on factors such as accessibility, infrastructure and services, and distance from the city centre. Outside the growth boundary of the city, the price of land should only be equal to its agricultural returns, including the transportation costs to the nearest (urban) trade centre.

However, the price differential is also a function of the binding nature of the growth boundary. A study by Pendall (1999) reveals that where enforcement of the growth boundary is weak, it does not act as a urban containment tool and price differentials may not exist for areas within and outside the growth boundary.

One methodology that is commonly used to price attributes that impact price of bundled gods is the hedonic model. This approach has been used in multiple studies to evaluate whether zoning constraints, specifically urban growth boundaries, have an implicit price associated with them. The hedonic method decomposes the property price into its constituent characteristics and obtains estimates of the value of each characteristic, in essence assuming that there is a separate market for each characteristic. It recognises that properties are composite products; although attributes are not sold separately, regressing the sale price of properties based on their various characteristics yields the marginal contribution of each characteristic. Various studies have used the hedonic model to price the green belt attribute notably Knaap (1985), Downs (1998).

1.2 Bengaluru's Green Belt - a historical perspective

The city of Bengaluru is the fastest growing city in India in terms of its population growth, having added an estimated 46% to its count over the last decade (Census 2011). Bengaluru is the third most populous city in India and the 18th most populous city in the world. The estimated population under the city municipality area (Bruhat Bengaluru Mahanagara Palike) as per the 2011 census is 84.74 lakhs, up from 45.92 lakhs in 2001 with a corresponding increase in area from 254 sqkm to 800 sqkm. The density of Bengaluru is estimated at 10592.5 persons per sqkm. Since the economic liberalization of the 1990's Bengaluru has been the hub of growth in technology intensive industries and is known as the 'Silicon Valley of India'. Bengaluru has contributed to nearly 75% of Karnataka State's corporate tax collections, 80% of sales tax collections and 90% of luxury tax collections. (Revised CDP, 2009)

Historically, the urban area of Bengaluru has been determined by the successive master plan exercises that are undertaken and published by the planning authority for the city. Bengaluru, through the 1972 Outline Development Plan, was one of the first cities in India to have an urban growth boundary. The city notified its green belt in the late 1970's. Of a total metropolitan planning area of 500 sqkm in the plan, 220 sqkm comprised the conurbation area and 280 sqkm was the designated agricultural zone. Ever since, Bengaluru has traditionally grown at the cost of the rural-urban periphery. In the 1984 Comprehensive Development Plan, the metropolitan planning area was increased to 1279 sqkm, with 439 sqkm of conurbation and 840 sqkm of agricultural zone, and virtually the entire planning area of 1972 outline development plan area was urbanized by this time. In 1995, the city expanded at the cost of the green belt area again: the conurbation zone stood at 597 sqkm and the green belt was revised down to 682 sqkm by this time to accommodate the growth of the city, a compromise of 158 sqkm on the 'green belt zone'.

In 2007, another expansion of the Bengaluru metropolitan region was undertaken based on the 2005 Master plan, in which seven adjoining city municipal corporations, one town municipal corporation, and about 110 villages were merged with the erstwhile Bengaluru metropolitan area. Currently, the metropolitan planning area spans about 1300 kms, of which 800 sqkm is under the jurisdiction of the Bruhat Bengaluru Mahanagare Palike, the urban local body governing the city. The green belt area encompasses 270 sqkm, or about 20.7% of the total planning area as 'Green Belt' zone and another 13.5% (174 sqkm) as an agricultural zone, a total of about 32.10% of the metropolitan area (excluding the area under the jurisdiction of the Bengaluru-Mysore Infrastructure Corridor Project Planning Area (BMICPA)). In terms of zoning restrictions, the green belt and the agricultural zone are subjected to the same restrictions to retain their predominantly agricultural status.

The green belt area is divided into 12 sectors according to the Master Plan 2015. These 12 sectors are identified using the roads that encircle the sectors. Figure 1 is a schematic map of the 12 sectors and the road networks that define the sectors. The current approach to the green belt, according to the Master Plan 2015, is the 'Adopted Approach' where there is a partial opening of the agricultural zone with a road transport system; the agricultural belt is retained in the South and in the West of the city, in view of retaining the hydraulic system of the city.

Figure 1: Map of Green Belt Area in Bengaluru

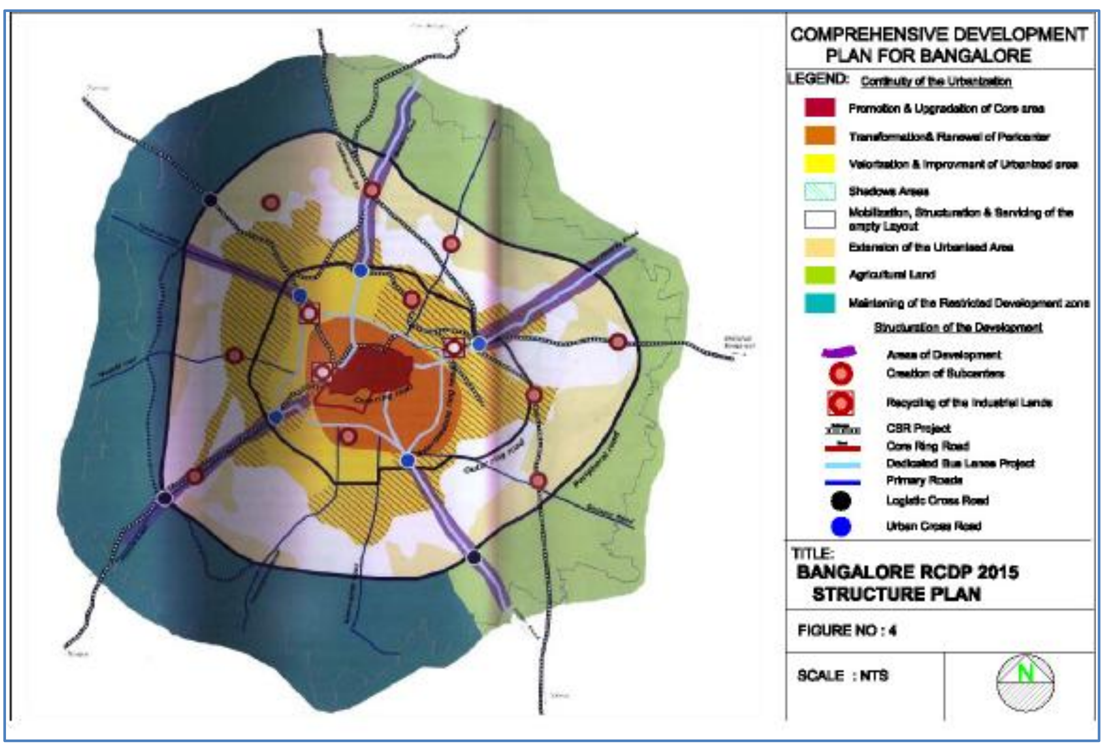
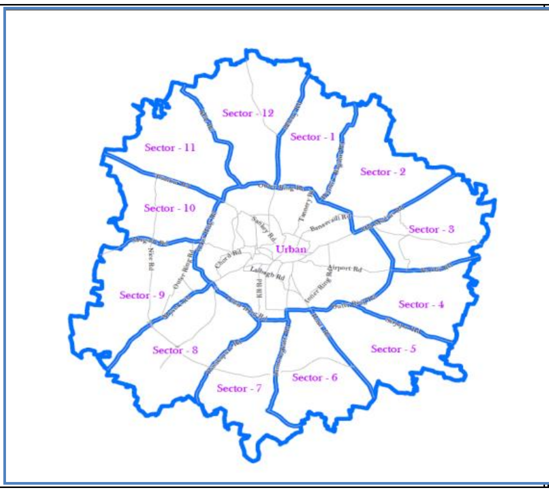


Figure 2 : Schematic Map of Green Belt Sectors - Bangalore



Sector	Roads
Sector 1	Bellary Road to Hennur-Bagalur Road
Sector 2	Hennur-Bagalur Road to Old Madras Road
Sector 3	Old Madras to Varthur Road
Sector 4	Varthur Road to Sarjapur Road
Sector 5	Sarjapur Road to Hosur Road
Sector 6	Hosur Road to Bannerghatta Road
Sector 7	Bannerghatta Road to Kanakapura Road
Sector 8	Kanakapura Road to Mysore Road
Sector 9	Mysore Road to Magadi Road
Sector 10	Magadi Road to Tumkur Road
Sector 11	Tumkur Road to BEL Road
Sector 12	BEL Road to Bellary Road

Note: Map not to scale
Source : Master Plan 2015 of Bengaluru Development Authority

1.3 Urbanisation of the Green Belt in Bengaluru

Successive master plans have dynamically altered the green belt to cope with population and income pressures, directly impacting land use and the land cover of the region. The rural-urban periphery is in a state of transition and is considered as urban-land-in-waiting by the owners. there is extensive building of 'revenue layouts' in these transition areas and in the green belt zone. Revenue layouts are private layouts that are culled out from agricultural land that is converted for non-agricultural uses, often illegally and without necessary approvals. The price of land of land in revenue layouts is lower than that of developed inner-city land, and it caters to residents who are marginalised and unable to afford a home in the city centre. There are questions of political economy and equity which come into play; irregular or unapproved constructions in these areas have been ‘regularised’ over time, on payment of conversion charges or ‘betterment levy’. It is impossible to turn back the clock on an area that has developed informally, even if such development is illegal.

When such organically developed outgrowths are absorbed periodically into the city and infrastructure extended to service these areas, there is a perception created that the planning authority has not only fallen short of adequate planning measures on the land use side, but that the laws are also elastic and there are various levels of subversion possible at the time of enforcement. This led to an increase in speculative activity in green belt areas, based on the assumption that the administration would continue to deal with unplanned development by regularising unplanned and illegal construction within the green belt area.

1.3 Current Status of the Green Belt in Bengaluru

A study by Ravindra et al (2012) on the Land Market Assessment of Bangalore indicates that the suggests that about 11% of the total green belt area was converted into land used for non-agricultural purposes. Nearly 22.3 square kilometres of land (about 5.37% of the green belt area, or about 50% of the urbanised green belt land) had been developed without authorisation between 2003 and 2010. The highest conversion was observed near the North and the West regions of the city, especially where the land adjoins the Tumkur Local Planning Authority. Table 1 provides the details of total conversion in green belt land.

Table 1 Sector-wise Conversion of Green Belt Area

Sector Number	Total Sector Area (ha)	Total Converted as per 2010 (ha)	Converted as per Existing Land use 2003 (ha)	Converted between 2003 and 2010 (ha)	Unapproved Conversions (ha)	% of Sector Area converted
1	2484.06	741.38	394.4228	346.9572	298.0872	29.85%
2	4068.26	532.81	303.6357	229.1743	223.7543	13.10%
3	1999.93	117.12	71.93308	45.18692	37.99692	5.86%
4	2937.64	159.99	76.2315	83.7585	66.3185	5.45%
5	3164.15	221.83	102.1476	119.6824	107.1924	7.01%
6	4056.62	414.19	190.1191	224.0709	215.0009	10.21%
7	3851.11	341.35	154.819	186.531	186.471	8.86%
8	1459.33	88.97	52.08881	36.88119	36.75119	6.10%

9	4298.37	472.58	163.9325	308.6475	296.5875	10.99%
10	2857.96	566.13	228.2132	337.9168	334.6368	19.81%
11	4641	657.45	378.039	279.411	233.101	14.17%
12	5730.57	402.09	150.8606	251.2294	194.8394	7.02%
Total	**41549**	**4715.89**	**2266.44289**	**2449.44711**	**2230.73711**	**11.35%**

Source: Ravindra (2012), Table:16, Pg:66

Note: It should be noted that some proportion of development is a reclassification from prior quarry/ vacant/ unclassified sites into converted land.

The above table indicates that there is widespread and rampant illegal conversion of the green belt area in Bengaluru metropolitan region. More than 11% of the green belt/agricultural zone is already converted, at the very least, and more than 50% of the land area converted is through unapproved conversions.

2. Effect of Green Belt on Land Prices

The aim of this study is to document the effects of the urban growth boundary on Bengaluru's land prices. Within the context of land prices across Bengaluru, I examine whether the boundaries of the city of Bengaluru, as set by the BBMP, are relevant. I test whether the growth boundary exhibits a containment effect through comparing the price differentials for sites based on their zoning regulations. A test on the price impact of growth boundary compares the price within and outside the urban growth boundary. Specifically, land price on a per square metre basis is compared within and outside the growth boundary to evaluate whether it is perceived as a binding constraint on the growth of the city. If there is a price differential, the growth boundary influences existing land-use controls, and is perceived as binding in the long run. In case there is no price effect of the growth boundary, it can be inferred that the growth boundary is redundant.

2.1 Data and Methodology

The data set comprises of about 315 transactions over the period from December 2007 to Feb 2011, which was when this study was visualised. Of these, more than 40% of the plots are within the green belt and the rest are within the conurbation area. Individual plot level valuations are obtained from the Bengaluru Chapter of the Institute of Valuers, which is a premier body involved in survey and appraisal work in India. Each plot was then located on the map of Bengaluru, to identify distance from the city centre and other metrics required for hedonic regression. To simplify the hedonic regression, I take only vacant plots rather than houses.

About 283 transactions of this were rendered usable at the end of the data cleaning and location exercise, of which 99 were outside the urban growth boundary and the rest 184 were within the city limits. A smaller sub-sample was also created, comprising of land within 3 kilometres of the growth boundary on either side. This smaller sub-sample contained 99 data points outside the growth boundary and 105 data points inside the city, within three kilometres of the growth boundary.

For all our estimates, I deflate the land prices by the level of CPI inflation in India. In the baseline mode, the variables used in the hedonic regression are the distance from the city centre, distance from nearest key node, distance to major arterial road (in kilometres, calculated from the GIS maps, arterial roads identified from the CTTP of Bengaluru), availability of water within 500 metres, availability of electricity within 500 metres, availability of sewerage connections within 500 metres, and a dummy variable for whether the land is zoned within the conurbation area of the city, or outside the growth boundary area[i]. The availability of water, electricity and sewerage connections are dummy variables, coded as 'zero' for not available and 'one' for available.

The table below lists the independent variables and the expected relationship with the dependent variable

Table 2 Description of Variables

Variable	**Description**	**Source**	**Expected Sign**
LNMV	Natural Logarithm of market value per unit area in Rupees per square metres	Primary Data	
SQPLOTTAGE	Land parcel size in square metres, squared	Primary Data	Negative
DISTCBD	Distance of the parcel from the central business district in kilometres	Bengaluru Road maps overlay	Negative
DISTROAD	Distance to arterial road (nearest) in kilometres	Bengaluru maps overlay	Negative

DISTEMP	Distance to nearest employment node in kilometres	Bengaluru Road maps overlay	negative
MULT	Dummy variable = 1 if multiple land uses are allowed in the specific area; 0 otherwise	Zoning regulations - Master Plan 2015	Positive
ELECTRICITY	Dummy variable =1 if electricity is provided by BESCOM, 0 otherwise	BESCOM maps	Positive
WATERCONN[ii]	Dummy variable = 1 if water connection to BWSSB water supply is present, 0 otherwise	BWSSB overlay maps	Positive
SEWERAGE	Dummy variable = 1 if Sewerage connection to BWSSB is present, 0 otherwise	BWSSB overlay maps	Positive
UGB	Dummy variable = 1 if within the UGB, 0 if outside the UGB	Zone maps with green belt (CDP/ Master Plan)	Positive
YEAR	Dummy for each year (2007 is base year)		Positive

The descriptive statistics of the variables are provided in the following table.

Table 3 Descriptive Statistics

Variable	**Average**	**StDev**	**Maximum**	**Minimum**
Rate per Sqm	22312.78	42472	134676.58	7854.37
Lot Size (Sqm)	465.60	234.2	5153.91	14.60
Distance from CBD (km)	13.53	16.2	28.5	7.29
Distance from arterial road (km)	4.51	5.2	7.43	1.67
Distance from employment node (km)	8.5	10.2	15.0	3.2

Based on the above data set, I estimate the coefficients of the hedonic regression, which is of the form:

$$LN(MV) = \beta_0 + E_j \beta_j + UGB * \beta_2$$

Where LNMV is the log of the market price per square metre of the vacant land; Ej is a vector of independent variables in the hedonic regression as per Table I and UGB is the dummy denoting whether the site is within the UGB or outside the UGB. Specifications similar to this have been used in a variety of studies testing the relevance of the UGB, especially Downs (1998), Knapp (1985). Other models that were tested. The first was a model with region-wise dummy variables to test for region-wide differences in land prices within and outside the growth boundary. A second model used the reduced sample set of all data points which were within a three kilometre distance from the growth boundary on either side to have a more matched pair of values.

The effect of the UGB can be tested using the above hedonic regression. The coefficient β_2 estimates the impact of the UGB on price of the land parcel; if β_2 is significantly greater than zero, then urban and is valued higher than land within the green belt. However, there may be two specific inferences of the coefficient β_2 in this context - one, to do with the intrinsic valuation of land itself, and second, with the enforcement. If the green zone, or the boundary set by the planning authority is considered to be a binding constraint on land supply for the city, land just inside the boundary will be valued more highly than land just outside the boundary. If the public or the speculators perceive that the city's planning authority will expand the city at a future date to absorb all violations into the city and provide infrastructure at a later point of time to these nodes of suburban development, there is likely to be no gradient just within and just outside the city boundaries. The perception of laxity in enforcement of laws, coupled with the huge gains to speculation in land, will impact the coefficient β_2.

2.2 Results and Analysis

Table IV presents the results of the ordinary least-squares estimates of the hedonic regression[iii]. Of the eight extraneous variables that were utilized in pricing the land, it was found that five were significant. All plots had access to electricity within 500 metres and therefore this variable was dropped from the regression.

Table 4   Vacant Land - Hedonic Pricing model

Regressor	Coefficient (t-val)
UGB Dummy	.027 (0.98)
Distance to CBD	-0.672 (4.454)**
Distance to Arterial Road	-0.0901 (5.57)*
Distance to nearest employment node	-0.245 (4.23)**
Multiplicity of Land use	0.0864 (0.465)*
Square of Plot size	-0.13 (2.85)
Water	0.0044 (0.95)
Sewerage	0.002 (1.24)
Year	0.85 (1.85)**
R- square	0.823
N	283
F- Stat	85.32

As expected from the vast literature that precedes this study, land values decrease as the distance to city centre increases, decrease as distance to key nodes increases, and decrease with distance to major arterial road. Plottage seems to have an insignificant effect in the base model, but has a significant effect in the model with reduced sample (matched pair model). This seems to indicate that size of the plot does not impact price across all of the city, but in specific regions close to the periphery, size has a negative impact on price - higher the size, lower the average price per square meter of land. The coefficients on Water and sewerage connectivity are not significant, though water connectivity has a positive sign.

The coefficient for the UGB is positive, indicating that land inside the UGB is valued higher than land outside the UGB. This simplistic evaluation, though in keeping with international evidence, shows only part of the story. Land which is outside the UGB is typically converted into illegal 'revenue' layouts which are then sold piecemeal to public at large, awaiting regularization at a later point in time. For some purposes, land can be legally converted through the District Commissioners' office[iv], on payment of a certain 'conversion fee' which is essentially a change of zoning fee from agricultural to other uses. There are a restricted list of uses allowed in the green belt area, and conversion may be obtained from the District Commissioners' office to pursue specific permitted land use objectives.

When prices of urban and rural land are compared for similar uses, the transaction costs of converting green belt land into urban land needs to be considered as part of the land cost. *When the land outside the UGB is adjusted to reflect the higher costs of purchase including transaction costs of conversion, it is found that there is no significant difference in the price of land inside and outside the urban growth boundary*. The coefficient is positive and insignificant. This is further strengthened by the results for the smaller matched sample, where the difference in prices within and outside the growth boundary is neither positive nor significant.

Another aspect that needs adjustment is the impact of nodes outside the city on areas within the planning district. The green belt is a ring around the city of Bengaluru, and the conversions in the green belt may be influenced by activities that are outside the city since these sites could potentially be closer to other municipalities. For instance, in the North-west, green belt site prices could be influenced by the growth of Tumkur, an adjoining district, rather than Bengaluru's own growth. If the Tumkur Local Planning Authority is lax in terms of enforcement, a negative externality will accrue to the city of Bengaluru. The base model was subsequently adjusted to incorporate the location-specific fixed effect of municipal neighbourhood on the price differential by using dummies for each of the green belt sectors. The location-specific fixed effects coefficient indicates that some areas have a high positive coefficient. There is a variance across green belt sectors in terms of price differential within and outside the UGB, and this correlates to the average land prices in the specific sector, indicating the presence of speculative activity.

3. Conclusion

The analysis of the market for vacant land in the city of Bengaluru sought to identify the impact of the urban growth boundary on prices of land within and outside the city limits. A hedonic model was used to identify the price differential for vacant land sites within and outside the UGB using extraneous factors, and modelling explicitly for the 'green belt' and 'urban' nature of land. Site specific prices were used to test the hedonic model, which was then analysed to reflect on the effectiveness of the green belt as a containment strategy.

The results of the analysis seem to indicate that there is no significant difference in prices within and outside the urban growth boundary, when adjusted for the conversion charges. This indicates that the market does not perceive the urban growth boundary to be an effective containment strategy. The UGB is reduced to a redundant policy which has not necessarily achieved its goal of containing sprawl.

The redundancy of the UGB casts light on how enforcement of UGB norms is perceived by residents. Since successive master plans have absorbed illegal and unplanned revenue layouts into the city ever since 1972, the growth boundary is not perceived as a binding constraint in the long term. This has given rise to transactions in land outside the growth boundary and the entire planning area is perceived to be a single market for land. The lax enforcement of the planning norms both within and outside the city have given rise to this perception, and the political-economy of land market related decisions has reiterated time and again that planning can be bypassed.

Coupled with the results that water and sewerage connectivity do not have a positive and significant coefficient either, the story that evolves from this model us alarming: it seems to indicate that there is no advantage to being within the urban limits of the city of Bengaluru. This is an deeply troubling conclusion from the perspective of the urban containment strategy. If the prices within the city and outside the city are not different, this means that residents do not attribute any location-specific advantage to living within the confines of the city. Service delivery and infrastructure provision, especially for water and sewerage, are effectively not priced by the residents of the city.

This is not surprising, since the state has, in most cases, absolved itself of provision of basic infrastructure. Specifically, water is obtained through individual investments in wells or bore-wells, and soak pits are used for sewerage in the peripheries of most Indian cities. The dependence on the state for provision of these two services is negligible, which is why essential services, provided by the urban local body are not priced, except for road and transportation.

This study has significance for the urban policy making - in fast growing Indian urban cities, where planning regimes are predominantly tied to the decadal master planning process, the green belt is at best redundant where enforcement is lax, or at worst, inflationary. With the increasing land prices in our cities and debate on affordable housing taking centre stage, here is a need to debate objectively on the green belt policies of our cities.

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[i] Areas in the North and West where partial opening of green belt is allowed were taken as part of the 'urban' area even though current usage on the parcels may be 'agricultural'

[ii] Ideally, water connections and sewerage connections should go hand-in-hand since both are administered by the Bengaluru Water Supply and Sewerage Board (BWSSB). But given the peculiarities of Bengaluru, water and sewerage connections to the main lines may be available, but water may not be piped. So there are some cases where sewerage infrastructure is available, but water is not available. The water dummy obtains a value of 1 when water is piped by the BWSSB, irrespective of the sufficiency of the water, or the number of hours of supply. In the sub-sample estimation, the supply of water shows a marked decrease.

[iii] It was established that there is no serious multi-collinearity, and chow's test validated that there was stability of coefficients.

[iv] Section 95(3B) of the Karnataka Land Revenue Act prohibits use of green belt land for any other purposes. However, Section 109 of Karnataka Land Reforms Act allows for conversion of green belt land for limited specific purposes such as schools, hospitals, libraries, sports clubs, temples etc. Conversion is a mandatory legal process by which the property owner makes an application to the District Commissioner seeking assent for the converting the zoning on agricultural land into permitted non-agricultural use, after payment of prescribed conversion fee.