Gateway Blueprint Model Workshop 2005

Impacts of Land-Use Change on the Fiscal Health of Municipalities

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Abstract:
This report describes enhancements made to an earlier model for assessing how future land-use change scenarios (as simulated in the Blueprint Model) affect municipal expenditures. The enhanced model now also accounts for changes in municipal revenues and develops a more complete picture of the impact of land-use change on the fiscal health of municipalities. To capture the mechanisms through which revenues and expenditures adjust over the years, we developed a model of the process in STELLA™ and tested the model using data from the city of Edwardsville.

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Impacts of Land-Use Change on the Fiscal Health of Municipalities

Introduction:

This report describes enhancements made to an earlier model for assessing how future land-use change scenarios (as simulated in the Blueprint Model) affect municipal expenditures. The enhanced model now also accounts for changes in municipal revenues and develops a more complete picture of the impact of land-use change on the fiscal health of municipalities.

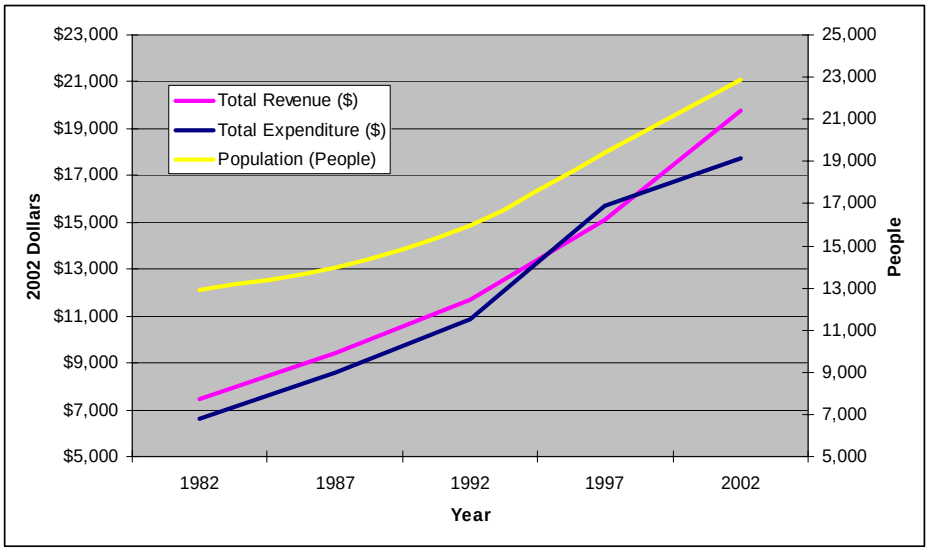
Background:

An analysis of expenditures in the year 2000 by close to 50 Illinois jurisdictions in the metropolitan St. Louis region indicate that

- Larger jurisdictions spend more per person
- Jurisdictions with denser development patterns spend less per person
- Jurisdictions that generate more sales tax spend more per person

But what about the other aspect of municipal finances? How do revenues change as land-use patterns change? In general, we find that revenues and expenditures track each other fairly closely. We see this in data from Edwardsville, IL, for example (see Figure 1). We assume

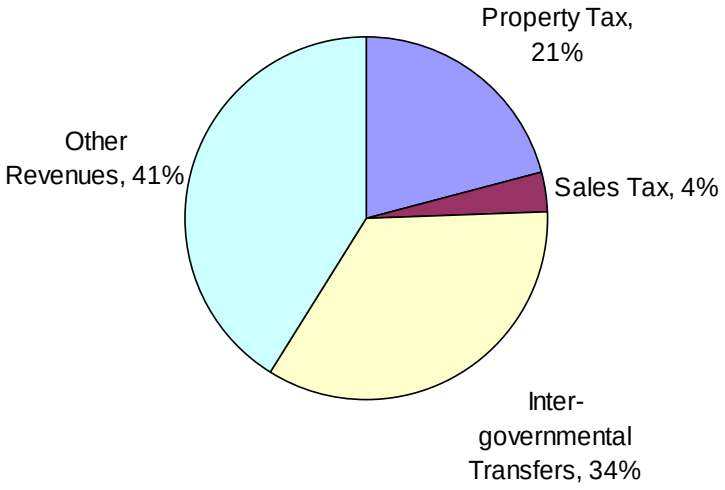
Figure 1



that expenditure and revenue are constantly corrected to minimize the gap, but over-correction in one direction or the other causes the process to continue indefinitely. We also see that expenditures and revenues increase at a rate faster than the growth in population.

Data from the financial census of local governments point to four major sources of revenue: inter-governmental transfers (from federal, state, and other units), sales taxes, property taxes, and other revenues (other fees and charges). The share of each of these sources of revenues for Edwardsville in 2002 is shown in Figure 2.

Figure 2



Local jurisdictions have the most control primarily over property tax by adjusting the tax rate depending on the assessed value of properties. So, we assume that property taxes are adjusted to fill the gap between expected revenues from the other three sources and expected expenditures.

Method:

To capture the mechanisms through which revenues and expenditures adjust over the years, we developed a model of the process in STELLA™ which is shown in abstract form in Figure 3. Here, the different forms of revenue combine to replenish the jurisdiction's reserves which are then depleted by expenditure. This is functionally equivalent to adding surpluses

(excess revenue over expenditure) to or deducting deficits (excess expenditure over revenue) from the reserves. Thus, the reserves represent the accumulation of the jurisdiction's deficits and surpluses over the years.

The model balances revenues and expenditures in two ways: by adjusting the rate of expenditure, and by adjusting the property tax rate. The role of *Expenditure Adjustment* is shown in Figure 3 and detailed in Figure 4. Essentially, in any given year, expenditure per high-density and low-density residential acre and per commercial acre is set based on the state of the reserves in the previous year. If prior reserves were positive, then the expenditure per acre is increased; if the reserves were negative, then the expenditure per acre is decreased. This adjustment is subject to a cap.

Figure 3

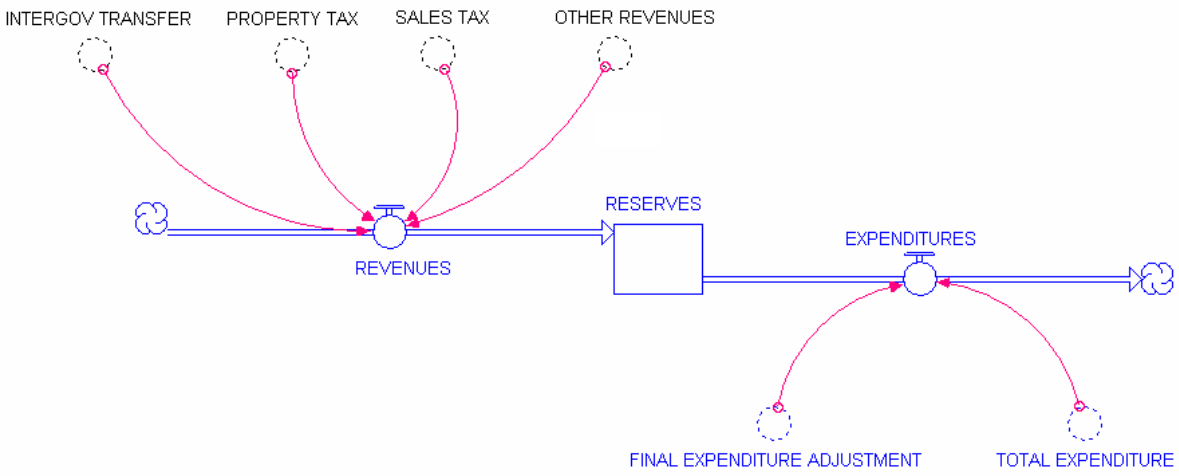
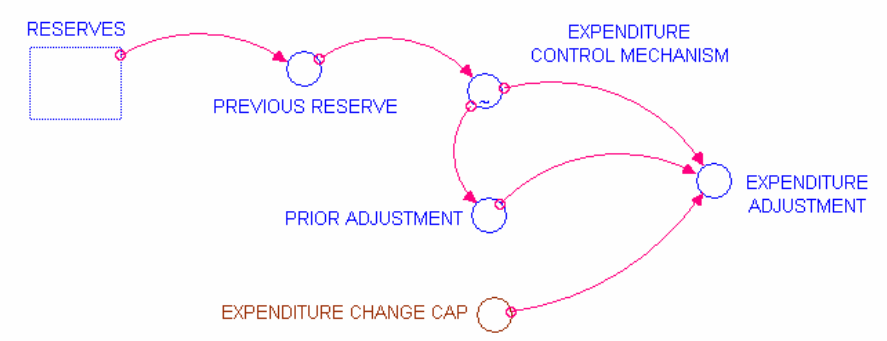


Figure 4



Property tax rates are also set using a similar control mechanism but the logic is reversed. The rate is set based on the state of the reserves in the previous year. If the prior reserves show a surplus, then the tax rate is lowered; if the reserves show a deficit, then the tax rate is raised.

Expenditures and revenues are computed based on changes in land-use over time, and this information is read in from a LEAM simulation. Different amounts of growth in low-density and high-density residential and commercial uses result in different quantities of expenditures and revenues.

Model parameters are not static over time. The model takes into account the effect of inflation, so that the change in revenues and expenditures reflect change as a result of change in land-use but also as a result of inflation. In addition, expenditures per acre increase with increasing acreage in a particular land-use. Lastly, revenue sources not easily controlled by the jurisdiction can, if desired, be allowed to fluctuate at random but within limits. This helps the model capture the consequences of unexpected events.

Results:

The model was populated with data from Edwardsville in the year 2000 and run for 30 years into the future using data on land-use change from a Blueprint Model simulation. The results are intuitive. Figure 5 shows the graph of expenditures, revenues, and reserves over time. As expected, expenditures and revenues (blue and pink lines) track each other quite well, and reserves (red line) fluctuate around zero, the small surplus or deficit each year causing reserves to be as much as $500,000 in surplus or deficit.

Figure 5

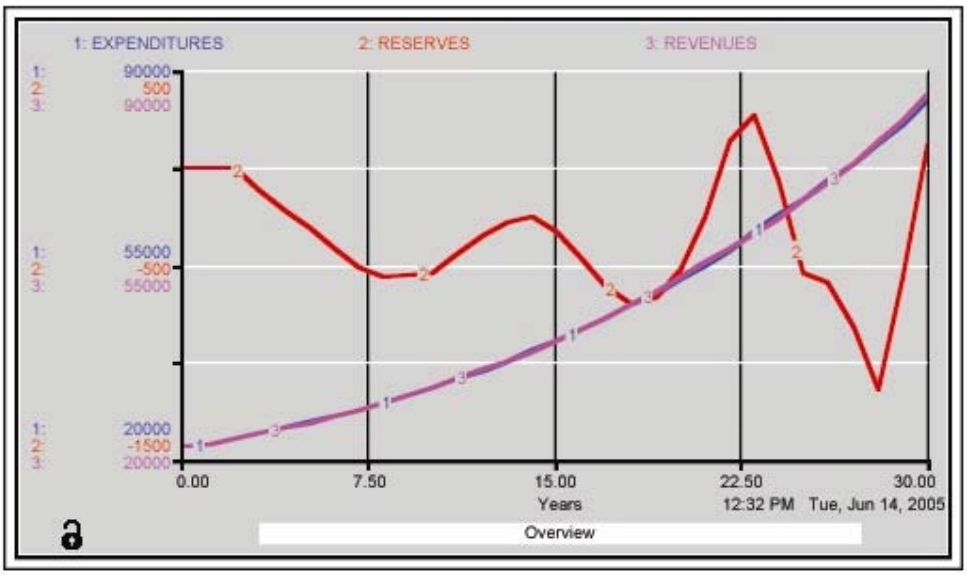
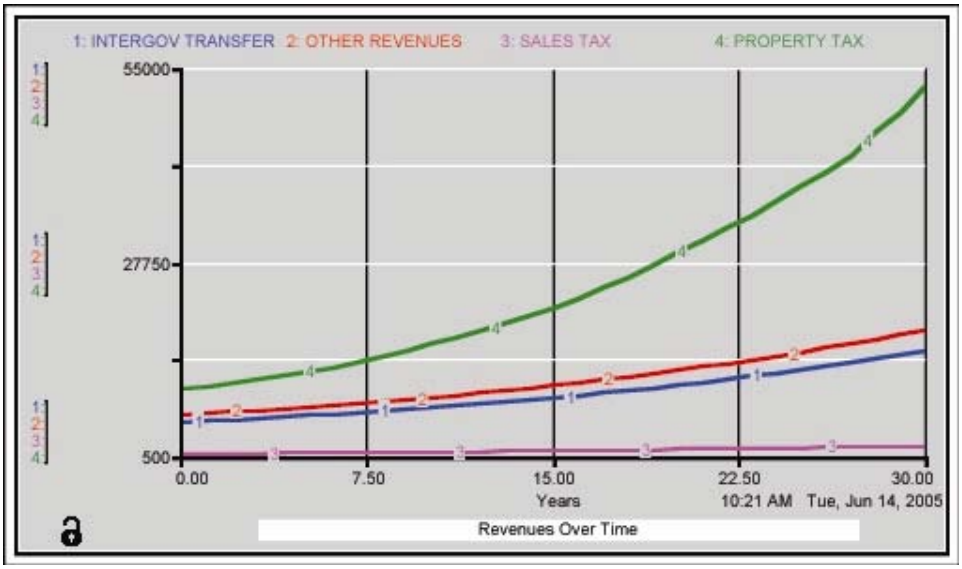


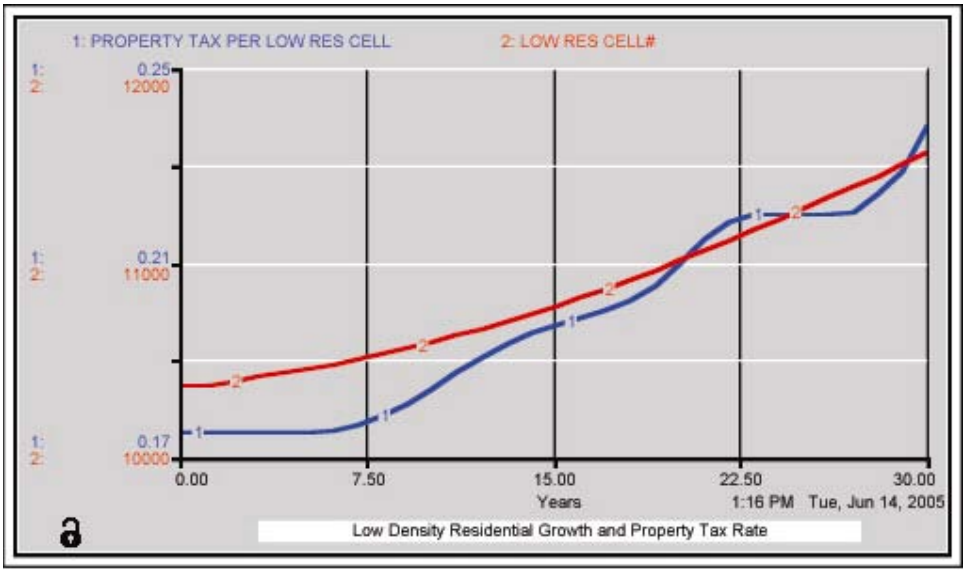
Figure 6



The share of different sources of revenue changes over time, as can be seen in Figure 6. Property taxes become a larger portion of the revenue stream as expenditure per unit of land used increases with increasing city size. The other sources of revenue increase relatively at the same rate, the rate of inflation. The assessed value of property is also assumed to keep pace with inflation.

Figure 7 below shows change over time in the amount of low-density residential land and the property tax rate on this type of land use. This graph illustrates the typical relationship between amount of land consumption and the property tax rate needed to support that land consumption. The constant growth of developed land (red line) results in expenditure increases that cannot be met by current revenue levels and the property tax rate (blue line) has to be periodically raised to help cover the deficit.

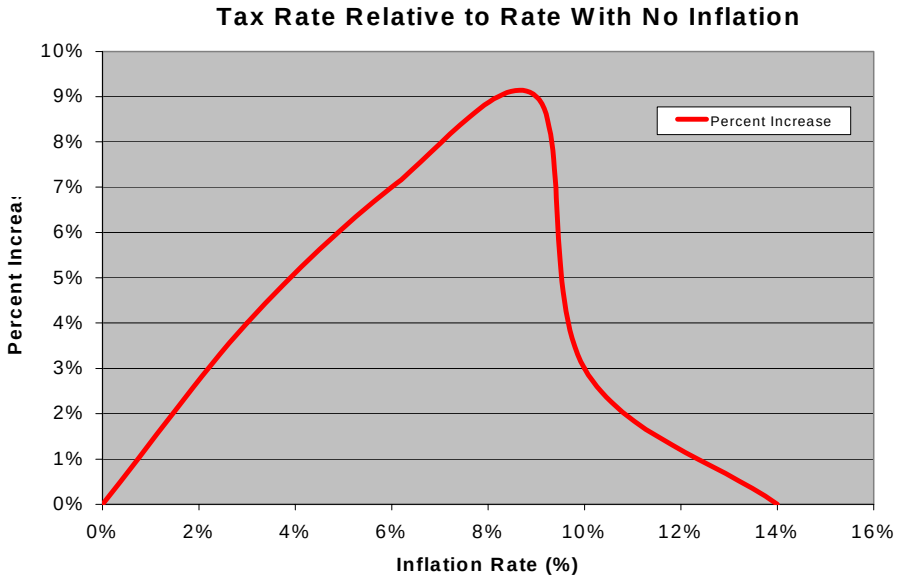
Figure 7



These results reflect an inflation rate of 3%, while the allowable property tax adjustment from the prior year increases from 0% when reserves are 0 to 5% when reserves are $1million in deficit or in surplus. Likewise, allowable expenditure adjustment from the prior year increases from 0% when reserves are 0 to 10% when reserves are $1million in deficit or in surplus.

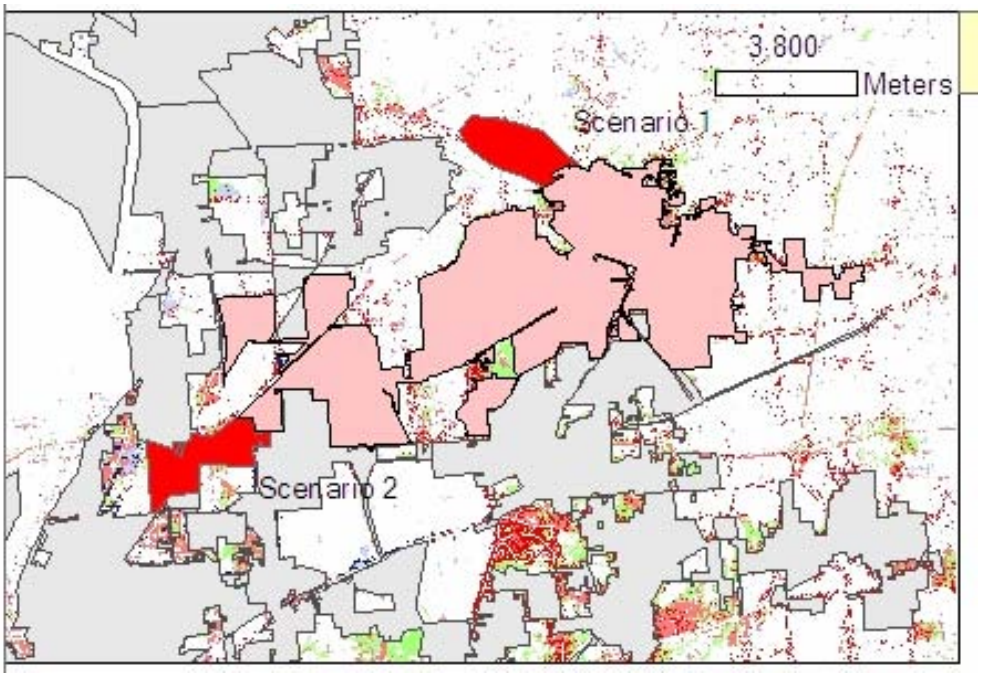
Inflation has a differential impact on property taxes needed to cover the gap between expenditures and revenues. Compared to the property tax rate necessary to cover the gap if inflation were zero, with increasing inflation the tax rate keeps increasing until inflation reaches just over 9% after which it falls precipitously. (See Figure 8.) This is because at 9% inflation catches up with the rate at which expenditures are increasing, and after that mark other revenue streams contribute at rates faster than growth in expenditure and revenue.

Figure 8



The model was also used to compare the fiscal impact of growth in two scenarios that are different from the one modeled above in which growth occurs entirely within current boundaries. As shown in Figure 9, one area northwest and another area southwest of the city might be annexed. Area 1 is primarily a residential addition and by 2030 increases residential uses 5% and commercial uses 2.5%. Area 2, on the other hand, is primarily commercial and by 2030 increases residential uses 6.6% and commercial uses by 134%.

Figure 9



The differential impacts of these two growth scenarios, shown in Figure 10, reminds us that the composition of land uses that make up that growth plays an important role in fiscal impacts. Annexing Area 1, which is predominantly residential, increases expenditure by $1.6 million and 88% of this increase is covered by an increase in property tax. Annexing Area 2, which is predominantly commercial, increases expenditure by $3.9 million but only 61% of this increase is covered by an increase in property tax. Increases in sales tax and other forms of revenue shrink the gap that needs to be filled. The model allows us to evaluate these differences.

Figure 10

Changes Through Annexation (Million Dollars)

	Expenditure Increase	Revenue Increase	Property Tax Increase	Tax/Exp
Area 1 Annexed	$1.57	$1.76	$1.38	88%
Area 2 Annexed	$3.87	$4.21	$2.38	61%

Next Steps

While the model has been significantly enhanced as described above, a number of steps could help further refine it.

- We assume that the rate at which revenue is generated from some sources (inter-governmental transfers, other revenues) does not change over time other than to grow at the rate of inflation. Is there also a connection with growth? Does growth change this rate in any way? The answer to that question could change the impact on property tax rates.
- This model is currently focused on a single jurisdiction. There needs to be a way to compute fiscal impacts for all jurisdictions at the same time. If each undeveloped cell in the region has associated with it a jurisdiction that is likely to collect revenue and provide services if the cell is developed, then when the cell is developed it can be added to the area being served by that jurisdiction. As LEAM simulations assign growth differently in different jurisdictions, the model should then generate differential fiscal impacts in the region.