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The Fiscal Impacts of Alternative Land Uses: An Empirical Investigation of Cost of Community Services Studies

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Abstract

Current knowledge of the fiscal impacts of alternative land uses comes largely from cost of community services (CCS) case studies, the results of which are viewed skeptically in the literature due to methodological concerns. To address these issues, we develop an econometric approach that allows us to capture both the direct and indirect relationships between a complete accounting of community fiscal measures and the full distribution of acres of land uses in a jurisdiction. Using a novel panel data set, we extensively document empirical correlations that have not yet been formally established in the literature. Our results are inconsistent with the broad conclusions of CCS studies: neither a shift from agricultural to

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residential land nor a shift to commercial land is associated with a significant change in the budget. We provide support for and insights into our results by extending our analysis to finer revenue/expenditure and land-use subcategories.

Keywords
cost of community services, fiscal impact, revenues, expenditures, land use

The land uses within a local government's borders strongly affect its revenues and expenditures. As a result, there has long been considerable interest in the fiscal impacts of alternative land uses.[1] These impacts are especially salient in light of recent events. In the aftermath of the Great Recession, many local governments are fiscally stressed and a growing number have filed for bankruptcy.[2] Land uses that do not "pay their own way," in the sense that they are associated with increased costs of providing public services that exceed the revenues they generate, contribute to this stress. The "fiscalization" of land-use planning, where all decisions are made with an eye toward their budgetary consequences, is one approach toward dealing with this stress. According to Kotchen and Schulte (2009), evidence on the relationship between land use and community budgets that guides these decisions is primarily based on cost of community services (CCS) case studies.[3] These studies analyze the effects of three types of land uses (residential, commercial/industrial, and agricultural/open space) on a jurisdiction's revenues and expenditures. CCS studies, which number in the hundreds, have consistently found that the ratio of expenditures to revenues is greater than 1 for residential land use but less than 1 for commercial/industrial and agricultural/open space land uses. As we outline in the next section, the CCS methodology is criticized as being crude, subjective, and biased in favor of producing a favorable expenditure to revenue ratio for agricultural/open space land at the expense of other land uses (Kotval and Mullin 2006; Kotchen and Schulte 2009).[4]

This article adopts a new approach that provides the first empirical evidence on the relationships that exist between alternative land uses and numerous elements of community budgets. In contrast to traditional CCS studies, our work relates changes in a local government's revenues and expenditures to shifts in the composition of the land-use "portfolio" in the community. To do so, we construct a novel, nine-year panel for Florida's counties that contains the annual government revenues and expenditures

within each county (see Table 1).[5] We use geographic information system (GIS) tools to augment these data with the percentage of the county's acreage in different land-use categories and then use our panel to estimate revenue and expenditure equations. A change in land use is allowed to be correlated with a county's budget over multiple years by including a lagged measure as an explanatory variable for each land use. We use county fixed effects to control for unobservable heterogeneity across counties and year fixed effects to control for time-variant factors that uniformly affect all counties.

Using our improved methodology, we first perform analyses analogous to those in CCS studies. We are able to replicate the broad conclusions of CCS studies using cross-sectional variation to identify our estimates: developing an agricultural parcel into residential housing is correlated with a small fiscal deficit whereas converting an acre of agricultural land into a commercial property is associated with a surplus. However, when we control for unobserved differences among communities, our estimates diminish in absolute magnitude and significance, and results are inconsistent with CCS findings. We find no evidence that a shift from agricultural to residential land is associated with a significant change in the budget, and there is at best only suggestive evidence that a shift to commercial land is correlated with a surplus. In other words, our results are consistent with residential, commercial, and agricultural land all having indistinguishable relationships with the community budget. Our data allow us to provide new insights into the channels through which these fiscal impacts operate that cannot be determined from the CCS studies. We do so in two ways. First, we disaggregate land uses into finer categories and show that the broader residential and commercial findings are not uniform across different subcategories. For instance, relative to agricultural land, single-family and retirement homes are correlated with deficits, whereas multifamily housing and condominiums are not associated with statistically significant changes in the deficit. Analogously, we find that there are surpluses associated with shifts from agricultural land to office properties, but shifts to retail and industrial properties do not have statistically significant relationships with community surpluses or deficits. Second, we disaggregate revenues and expenditures into nineteen and nine subcategories, respectively, and show that the conversion of agricultural land into residential properties is associated with significant increases in three revenue subcategories (*contributions, fines and forfeitures*, and *permits and licenses*) and two expenditure subcategories (*courts* and *human services*) as well as decreases in revenues from *special assessments* and *physical environment* expenditures.[6]

Table 1. Revenue and Expenditure Subcategory Means by Year.[a]

	Means		
Subcategory	2006	2010	2014
Panel A: Revenues			
Ad valorem	26,840	26,039	21,575
Contributions	3,133	3,023	3,553
Court related	738	188	523
Federal grants	5,817	5,948	4,386
General government (revenues)	8,983	8,693	8,833
Interest	5,828	5,434	6,086
Fines and forfeitures	665	473	585
Local government unit grants	695	698	522
Miscellaneous	3,871	2,081	1,991
Other sources	12,984	8,564	6,799
Permits and licenses	2,870	2,503	2,775
Rents and royalties	585	579	698
Sales of assets	449	146	149
Sales taxes	2,446	2,520	2,209
Service charges	48,580	52,230	49,621
Special assessments	4,885	3,038	3,537
State grants	3,088	1,980	1,361
State revenue sharing[b]	6,005	5,269	4,930
Schools (revenues)	21,603	21,744	17,826
Total revenue	160,065	151,150	137,959
Panel B: Expenditures			
Courts	1,437	1,451	1,370
Culture/recreation	6,804	5,873	4,989
Economic environment	4,635	5,359	4,770
General government (expenditures)	24,897	24,435	23,640
Human services	13,944	15,822	13,283
Physical environment	29,836	27,455	23,967
Public safety	23,093	23,850	22,602
Transportation	15,028	13,947	11,966
Schools (expenditures)	36,180	37,146	35,235
Total expenditures	155,854	155,338	141,822

[a]Means are in US$10,000 units and are expressed in real 2014 dollars. Detailed revenue and expenditure subcategory definitions are listed in Online Appendix 1.

[b]Florida has a county revenue sharing program. An allocation formula is used to distribute 2.9 percent of net cigarette collections and 2.044 percent of sales and use tax collections.

Revenues from special assessments have the opposite relationship with commercial properties, as they are the primary channel through which commercial revenue increases operate.[7] On the commercial expenditure side, we find evidence that shifts to more commercial properties are correlated with significant decreases in human services and *schools* expenditures.

While it may be tempting to interpret our findings to mean that a given change in a particular land use causes a change in the budget, we caution the reader not to view our empirical results in this way. Our modest goal in this article is to extensively document empirical correlations that have not yet been formally established in the literature. As such, our methodology does not address the fact that the distribution of land uses within a given community is not determined at random. In particular, aside from the inclusion of community fixed effects, we do not account for spatial patterns (density, colocation, sprawl, etc.) in land use which are known to affect community budgets (Ladd 1994; Burchell et al. 1998; Carruthers and Ulfarsson 2003). If these spatial patterns (or other omitted factors that influence both the budget and how land is used) vary over time, our estimates cannot be considered causal. In addition, policy makers, developers, and/or residents may base their land-use decisions on the fiscal health of the community. This situation also confounds causal inference.[8] We acknowledge these endogeneity concerns but note that there is no notion of causality in CCS studies and leave development of a methodology that identifies causal relationships between land uses and community budgets for future research.

While our study is primarily descriptive, our methodology and panel provide numerous improvements over existing fiscal impact (CCS) studies. First, we estimate the relationships between observed acres of land use within categories and local budgets instead of relying on the imprecise assignment of revenues and expenditures to land uses.[9] Second, our work is the first to document empirical estimates of fiscal impacts based on the full distribution of land use in a community, and our data allow us to document the revenue and expenditure changes associated with changes in the land areas of much finer land-use subcategories than the heavily aggregated, three categories commonly found in the CCS literature. Third, our model allows us to determine the magnitude of the deficit or surplus associated with a change in a particular land use as opposed to simply the change in the ratio of revenues to expenditures, which is the focus of a CCS study.[10] Fourth, our coefficient estimates represent the marginal change in the budget associated with a change in the composition of land uses, as opposed to a static measure of the average revenues and expenditures

associated with the given land use at a point in time found in CCS case studies. Fifth, our empirical approach captures both direct and indirect fiscal effects from changes in land use. For example, an industrial property directly adds to the tax base but may indirectly reduce the base by producing negative spillover effects, such as noise and air pollution. These indirect effects are ignored in CCS studies (Paulsen 2014). Sixth, we completely account for all revenues and expenditures within a county by summing those of the county government and all subjurisdictions within the county (cities, school districts, and special districts). Finally, we estimate separate revenue and expenditure models to uncover which components of the budget are most important in explaining more aggregate findings. This provides a deeper understanding of the relationship between land uses and community budgets.

We proceed by providing background information on CCS studies and elaborating on the known flaws in their methodology that we improve upon. Next, we provide an overview of the basic theoretical motivation for our empirical analysis.[11] We then describe our data and our empirical methodology. Finally, we present our results and conclude.

CCS Background

The methodology of a CCS study is uncomplicated. The revenues and expenditures of a local government (city or county) are grouped and then allocated to the three alternative land uses mentioned previously (residential, commercial/industrial, and agricultural/open space). The allocations are based on an examination of records, interviews with financial officers and public administrators, and default percentages.[12] This methodology was pioneered by Burchell and Listokin (1978) and is commonly known as an average cost approach because it averages total revenues/expenditures across land uses at a point in time (Coupal, McLeod, and Taylor 2002).

Kelsey (1996) and Kotchen and Schulte (2009) criticize the use of only three land-use categories in the CCS methodology and the use of the ratio of expenditures to revenues as the fiscal impact measure instead of the difference between the two. The level of aggregation in the former misses the fact that there may be countervailing forces in the subcategories of land use at work.[13] The problem with the latter is that ratios do not reflect the magnitude of the deficit or surplus generated by the land use. Their most damaging criticism of the CCS methodology is that it yields the average rather than the marginal fiscal impact of each of the three land uses. From a planning perspective, a forecast of the change in the budget from a shift

in the composition of land use in favor of a particular category is needed. Despite frequently being interpreted in this way, CCS studies do not provide this information because of the nature of how they are constructed. Kelsey (1996) also raises the issue that by denominating land in terms of value when calculating default percentages, CCS studies do not provide an "apples to apples" comparison of land uses. Instead, he advocates measuring land in terms of acres (producing ratios in terms of dollars per acre).

Others have also criticized CCS studies. Kotval and Mullin (2006) argue that CCS studies are biased toward producing a favorable expenditure/revenue ratio for agricultural/open space because the methodology assumes that there are no service costs, such as street maintenance or fire protection, associated with agricultural use.[14] Paulsen (2014) emphasizes that CCS studies (and fiscal impact analyses) ignore indirect effects arising from the externalities that some land uses emit and from multiplier effects.[15] Coupal, McLeod, and Taylor (2002) point out that CCS studies are based on a "snapshot" of land uses and finances, so they implicitly assume that the relationship between land uses and community budgets is constant over time. There is no reason to think that this is the case which implies that an approach that allows for dynamics is required.

Given the numerous, well-known issues with CCS studies, we use a marginal cost approach to estimate the relationship of interest. We are not the first to estimate a statistical model of the association between community characteristics and elements of community budgets. However, much of the existing literature has focused on a single-expenditure category (Craig and Heikkila 1989; Heikkila and Craig 1991; Heikkila and Kantiotou 1992; Lieske et al. 2012) or used broad land-use measures to explain community revenues and expenditures (Coupal, McLeod, and Taylor 2002; Hortas-Rico 2014). To our knowledge, ours is the first study that models the relationship between revenues, expenditures, and a detailed set of land-use categories and addresses all of the outlined concerns with CCS studies raised in the literature.

Overview of Conceptual Framework

There are a number of straightforward ways that land-use mix impinges upon a local government's budget.[16] More generally, however, these relationships are complex and little can be said a priori about the expected effects of land development on public finance without making strong assumptions (Paulsen 2014). Hence, we do not attempt a formal model or develop specific hypotheses. This complexity arises for a variety of reasons;

for example, each land use impacts different revenues and expenditures, the time patterns of the impacts vary across land uses, there are spillover effects from one land use to another, and some land uses complement one another, while others are substitutes. In Online Appendix 2, we explicitly detail a number of the pathways whereby a change in the mix of land uses within a community affects revenues and expenditures. Our modest goal is to demonstrate the complexity inherent in these relationships and convince the reader that changes in the mix of land uses within a community can have important effects on both revenue and expenditure sides of the budget.

Data

Our panel consists of all sixty-seven of Florida's counties and covers the years from 2006 to 2014. Our data come from three main sources: city, county, and special district revenue/expenditure records from the Florida Department of Financial Services (FDFS), school district revenue/expenditure records from the Florida Department of Education (FDOE), and property tax appraisers' standardized parcel maps that every county is required to submit to the Florida Department of Revenue (FDOR).

The data from the first source, the revenue and expenditure figures, are found in the Annual Financial Reports (AFRs) that taxing authorities must submit to the FDFS.[17] While the FDFS data contain information about city and county revenues and expenditures, school districts are considered separate entities and their budgets are not included with those figures. Kelsey (1996) explains that failure to include educational expenditures has a large influence on CCS study ratios, so we augment our data with information from complete profiles of each district's revenues and expenditures that the FDOE publishes as part of a transparency initiative. Although school districts and counties are politically distinct, they are geographically identical; hence, we avoid many of the typical complications associated with assigning school district revenues and expenditures to multiple jurisdictions. Mean values (US$2014) for total revenues and expenditures and for each subcategory from the FDFS and FDOE data are reported for selected years of our panel in Table 1.

Our third primary data source contains administrative and geographic information from the FDOR submitted by the local property appraiser for every property in Florida. The county property appraisers have access to ninety-nine different land-use codes that categorize properties by their actual use (or in the case of unimproved properties by their intended use), and each parcel record is associated with one of these land-use designations.[18] We combine these ninety-nine land uses into well-recognized

Table 2. Land-Use Subcategory Means by Year.[a]

	Means		
Subcategory	2006	2010	2014
Residential subcategories			
Single-family	9.98	10.63	10.52
Multifamily	0.60	0.67	0.67
Condominiums	0.26	0.20	0.25
Retirement homes	0.01	0.01	0.01
Mobile homes	2.50	2.44	2.52
Miscellaneous residential	0.24	0.26	0.28
Cooperatives	0.01	0.01	0.01
Total residential	13.60	14.22	14.26
Commercial subcategories			
Commercial offices	0.29	0.33	0.32
Retail	0.90	0.93	0.92
Industrial	0.94	1.04	1.00
Other commercial	1.21	1.29	1.20
Total commercial	3.34	3.59	3.44
Other subcategories			
Agricultural	63.60	66.20	66.30
Government	1.45	1.56	1.91
Institutional	0.82	0.94	0.86
Miscellaneous	2.52	3.75	5.31
Vacant lots	14.59	9.66	7.80
Total other	82.98	82.11	82.18

[a]Means represent the percentage of total land area in each subcategory averaged over counties.

groups (that vary by specification) and use GIS software (ArcGIS 10.2.2 for Desktop) to calculate the total land area in each county/year falling into each land-use group.[19] Table 2 summarizes this information. The columns contain the percentage of total land area in each subcategory averaged over counties. For example, on average, 9.98 percent of the acres in each county were classified as being part of the *single-family* land-use subcategory in 2006.[20]

Method

In this section, we first provide an overview of our empirical approach to estimating the fiscal relationships between alternative land uses and community budgets and then describe in detail the equations estimated.

Overview

Our observational unit is the county. We study the fiscal impacts of alternative land uses at the county level for two reasons. First, fiscal impacts extend beyond the boundaries of cities and special districts; aggregation of revenues and expenditures at the county level helps to mitigate the effects of spillovers at finer levels of geography.[21] There may be fiscal spillovers across counties, but they are expected to be minimal in comparison to those across cities and districts within the same county. Second, as previously noted, school districts have their own authority to levy millages, and their exclusion from CCS analyses can be influential (Kelsey 1996). Since school districts and counties share boundaries in Florida, county-level analysis is an ideal way to account for all relevant revenues and expenditures in the context of our data.

To estimate the fiscal relationships of alternative land uses, we regress the natural logs of revenues and expenditures on the percentages of county land area in each of the land-use categories listed in Table 2, save for the agricultural land use (to avoid perfect collinearity). Expenditures are the sum of spending on personnel services; operating expenses; and debt service payments for counties, cities, schools, and special districts.[22]

Our conceptual framework suggests several control variables. Revenues are, in part, a function of the demand for private-sector consumption (through sales taxes) and expenditures reflect the demand for public services. The demands for both private and public goods are functions of the aggregate income and preferences of the community's residents. We therefore include median income and proxy preferences with community-level controls for population, unemployment, and political affiliation. Our preferred specification also includes county and year fixed effects to control for constant, unobserved spatial and temporal effects.

We include lagged explanatory variables in our regressions because the fiscal impact of a land use is unlikely to manifest itself immediately due to the time it takes to convert or construct structures and for occupants to move into them. To compute the long-run change in revenues or expenditures after a permanent shift to the given land use, we obtain the long-run propensity (LRP) by summing the estimated coefficients on the t and $t-1$ variables.[23]

Estimated Equations

Let $ln(\text{rev}_{jt})$ denote the natural log of total revenues in jurisdiction (county) j in period t, and $ln(\text{exp}_{jt})$ denote the natural log of total expenditures. These variables are the dependent variables in our primary regressions. Let $i \in I$

so that we can more generally represent our dependent variables as y^i_{jt}. In our baseline specification, $I = \{\text{rev}, \text{exp}\}$ and in a subsequent specification, I contains nineteen revenue and nine expenditure subcategories listed in Table 1.

We are interested in estimating the effects of shifts in land uses over time, and we construct our explanatory variables to this end. We first define $\text{acres}_{j\ell t}$ as the number of acres within the boundaries of county j that are classified in land-use category ℓ (*residential*, *commercial*, etc.) during period t.[24] This allows us to define $x_{j\ell t}$ as the percentage of acres in the given category, denominated in percentage points. Formally,

$$x_{j\ell t} = \left(\frac{\text{acres}_{j\ell t}}{\sum_{\ell=1}^{L} \text{acres}_{j\ell t}} \right) \times 100.$$

To estimate the fiscal impacts of alternative land uses, we regress log revenues and log expenditures on the percentage of acres in each of $L - 1$ land-use categories in the current year (t) and the one-year lag ($t - 1$) of the same measure. We omit the percentage of agricultural acres (and its lag) to prevent perfect collinearity. This means that our coefficients are interpreted as the effect of a one percentage point shift in the county's land from agriculture to the given land use.[25] We include a vector of controls (Z_{jt}) and county and year fixed effects (α_j and δ_t, respectively). Formally, we estimate[26]

$$y^i_{jt} = \alpha^i_j + \sum_{\ell=1}^{L-1} \left(\sum_{m=0}^{1} \beta^i_{\ell m} x_{j\ell(t-m)} \right) + Z_{jt}\gamma^i + \delta^i_t + \varepsilon^i_{jt}, \forall i \in I \,. \qquad (1)$$

The LRP for either revenues or expenditures and for each land-use category can be expressed as

$$\text{LRP}^i_\ell = (\beta^i_{\ell 0} + \beta^i_{\ell 1}).$$

In order to determine whether a shift from agriculture to a particular land use is associated with a change in the surplus/deficit, we calculate long-run budget effects as

$$\pi_\ell = \text{LRP}^{\text{rev}}_\ell - \text{LRP}^{\text{exp}}_\ell,$$

for each land-use category.

Results

This section is divided into three parts. The first subsection reports the estimated LRPs for total revenues, total expenditures, and their differences

from an econometric specification designed to match the CCS studies as closely as possible. The next subsection demonstrates the relationships between a county's fiscal position and a more disaggregate set of land uses. The final subsection reports the results obtained from estimating with expenditures and revenues broken down into their component subcategories. These results show the types of revenues and expenditures associated with changes in land use.

Estimated LRPs for Total Revenues, Total Expenditures, and Their Differences

We begin by estimating seemingly unrelated regression focusing on the same land-use categories used in the CCS studies; namely, residential, commercial, and agricultural.[27] Estimates can be found in Table 3. Columns 1 and 2 report LRP_{ℓ}^{i} estimates from the revenue and expenditure equations, respectively. The difference between the two estimates (π_{ℓ}) is reported in column 3.[28] When multiplied by 100, each of the coefficients represents the long-run percentage change in the given budget variable (revenues, expenditures, or the difference) associated with a one percentage point increase in the given land use. Stated another way, the residential land-use coefficient of .0537 from the revenue equation in the baseline specification indicates that a one percentage point increase in residential acres is associated with a 5.37 percent decrease in long-run revenues. Standard errors clustered at the county level are reported in parentheses, followed in brackets by the magnitude of the change implied by the LRP applied to the level of total revenues or expenditures in the median county (in US$100,000). The latter are to give the reader a better sense of the magnitude of the estimated relationships.

We estimate four different specifications of our model. Columns 1 through 3 of panel A report the results obtained from estimating our baseline specification, which includes only time fixed effects.[29] This specification is designed to be the statistical analog of CCS case studies: the coefficients are identified using only cross-sectional variation in the data at each point in time. Columns 4 through 6 of panel A add basic controls, which include the natural logs of the county population, per capita income, the unemployment rate, and the percentage of registered voters identifying as democrats in the given year. In both specifications, the results of panel A are consistent in that shifts from agricultural to residential land are associated with deficits and shifts to commercial land are associated with surpluses. These findings mirror the general conclusions from CCS studies.

Table 3. The Cost of Community Services Analog Estimates.

Variable	(1) Revenue	(2) Expenditure	(3) Difference	(4) Revenue	(5) Expenditure	(6) Difference
Panel A: Without fixed effects						
Residential[a]	0.0537**	0.0583**	−0.00468**	−0.0197***	−0.0130***	−0.00669***
Standard error	(.027)	(.026)	(.002)	(.005)	(.004)	(.001)
50th	[113.2]	[123.1]	[−9.882]	[−41.54]	[−27.43]	[−14.11]
Commercial	0.108	0.0934	0.0144**	0.0359*	0.0259	0.0100**
Standard error	(.094)	(.088)	(.007)	(.021)	(.018)	(.004)
50th	[227.4]	[197.1]	[30.28]	[75.72]	[54.55]	[21.16]
County fixed effects	x	x	x	x	x	x
Control variables				x	x	x
Observations[b]	528	528	528	529	529	529
R^2	.5967	.585		.9647	.976	
Panel B: With fixed effects						
Residential	−0.0019	0.00022	−0.0021	−0.00071	0.00062	−0.0013
Standard error	(.004)	(.002)	(.004)	(.005)	(.003)	(.004)
50th	[−4.092]	[0.480]	[−4.572]	[−1.507]	[1.323]	[−2.831]
Commercial	0.0273**	0.00807	0.0192*	0.0192	0.00356	0.0157
Standard error	(.012)	(.006)	(.011)	(.012)	(.006)	(.011)
50th	[57.55]	[17.02]	[40.53]	[40.59]	[7.508]	[33.08]
County fixed effects	x	x	x	x	x	x
Control variables				x	x	x
Observations	524	524	524	525	525	525
R^2	.9971	.9991		.9972	.9991	

Note: All regressions include time effects and the percentage of government, institutional, miscellaneous, and vacant acres in the county.

[a]Estimates are long-run propensities (LRPs) of the given land use, standard errors clustered by county, and LRPs applied to the median county.

[b]We use the dfbeta diagnostic technique to identify and drop outliers (Bollen and Jackman 1990). We follow the common practice of removing observations with a dfbeta value greater than |1|. Results obtained using this technique are qualitatively similar to estimates based on the full sample.

*Significance at the 10 percent level.

**Significance at the 5 percent level.

***Significance at the 1 percent level.

While the net effects are consistent, the individual revenue and expenditure coefficients are not. The residential revenue and expenditure coefficients are both positive in the baseline specification and negative when controls are added.[30] The commercial estimates vary in magnitude and significance between specifications. We attribute this lack of robustness in the revenue and expenditure estimates to the significant heterogeneity across counties that is at best only partially controlled for with available control variables. As such, the estimates reflect differences between counties in their levels of development and corresponding levels of revenues and expenditures rather than the correlation between shifts in land use and community budgets.

One of the strengths of our data set is that its panel nature allows us to improve upon the cross-sectional nature of CCS studies by controlling for time-invariant differences in county characteristics. The results of the regressions reported in panel B of Table 3 include county fixed effects, both without (columns 1–3) and with the controls (columns 4–6).[31] When we include county fixed effects in our specification, estimates are identified using variation within a county over time, and we isolate the effect of within-county shifts from agricultural land to other land uses over time. In doing so, our results are a significant departure from those in panel A, and no longer support the conclusions of CCS case studies. Instead, the lack of a significant correlation between shifts from agricultural to residential land use is consistent with agricultural and residential land having the same effect on the budget. That we find only suggestive evidence of an association between commercial shifts and budget surpluses also suggests that the two land uses do not have substantially different impacts on the community budget.

While inconsistent with conventional wisdom from CCS studies, the net surplus/deficit estimates are more aligned with economic theory. Specifically, Fischel (1985, 2001) argues that existing community residents are primarily concerned with the preservation of their property values when making decisions that affect their community. If new, deficit-producing properties are a drain on community budgets and result in increased taxes for all citizens that are capitalized into property values, existing residents are likely to influence revenue, expenditure, and land-use decisions in ways that preclude deficit-producing shifts.

On both the revenue and expenditure sides of the budget, neither a shift to residential nor a shift to commercial is associated with a significant change in revenues or expenditures.[32] While the expenditure results may be due to a low marginal cost of providing additional services due to excess capacity in the existing infrastructure and the commercial revenue result is

only marginally insignificant in our preferred specification (p value = .11), the residential revenue result is particularly surprising. We would expect an acre of developed residential land to be more valuable than an acre of agricultural land all else equal. In other words, we would expect conversions to residential land uses to increase the tax base and ultimately revenues. There are several possible explanations for this result. First, it may be the case that there are opposing, offsetting effects among land-use or revenue subcategories. For instance, shifts to single-family homes may increase revenues relative to agriculture, but shifts to multifamily homes may decrease them. Further exploration of these possibilities follows in the subsequent sections. Second, it is well documented in the literature that agricultural land and other types of open spaces increase the values of neighboring properties.[33] Given these spillovers, it is not clear what the net effect on the total value of the tax base would be when land is converted from agricultural to residential use. Third, the state's homestead exemption reduces the assessed value of a homeowner's primary residence by US$50,000 when determining ad valorem property taxes. The vast majority of residential housing that results from the conversion of agricultural land is single-family, owner-occupied homes that would quality for the homestead exemption. This would mute the association between a shift to residential land and tax revenues especially because agricultural land is largely commercially owned within the state of Florida.

These estimates cast doubt on the conclusions from CCS studies, but they also raise questions that indicate further investigation is warranted. We proceed with additional analyses into the nature of these findings.

Estimated LRPs for Land-use Subcategories

Table 4 presents the results from estimating our preferred specification with residential and commercial land uses broken down into finer subcategories.[34] We investigate whether subcategories of residential and commercial land uses display significant relationships that are obscured when using the aggregate land-use categories found in CCS studies. This is the case for several revenue, expenditure, and difference relationships. In the residential subcategories, both *single-family* and *retirement homes* are associated with significant deficits, while none of the other residential land-use subcategories are associated with significant changes in the budget relative to the omitted category of agricultural.[35] The increased deficit associated with a shift to single-family homes is the result of the combined effects of a statistically insignificant change in revenues and a significant increase in

expenditures. In the case of retirement homes, neither the revenue nor the expenditure effect is statistically significant, but the difference (revenues – expenditures) is significant. In comparison to the deficit accompanied by a one percentage point increase in the amount of land devoted to single-family homes, the same increase in land area devoted to retirement homes is associated with a much greater deficit. In Florida, retirement homes tend to be substantial in size and have large dependent populations. They also have access to considerable tax exemptions.[36] It is not surprising, therefore, that the deficit they create results from the combined effect of a reduction in revenues and an increase in expenditures.

An additional interesting finding from the residential land use estimates in Table 4 concerns multifamily housing. Conventional wisdom holds that multifamily housing creates a fiscal deficit because it increases expenditures (by increasing population and many times bringing in residents in need of a higher level of public services) while decreasing revenues (due to negative externalities that lower nearby property values). While our results show evidence of a marginally significant increase in expenditures, the relationship between *multifamily* and the difference between revenues and expenditures is insignificant. This may be due to the extensive screening multifamily homes are subjected to in the development and approval process, consistent with strategic behavior on the part of neighboring residents.[37] Alternatively, multifamily housing is likely to be associated with increased density, but since we do not explicitly control for spatial patterns in our estimation, our results may be biased if these omitted variables are time varying.[38] Further examination of these issues is left for future research.

Next, we examine the commercial land-use subcategory results. Although three of the four subcategories display significant revenue and/or expenditure relationships, only *commercial offices* is associated with a significant net effect. This subcategory includes professional office buildings, financial institutions, and insurance offices. These types of properties tend to be coveted by local governments because they attract a highly skilled labor force to live and/or spend money in their jurisdiction, and they may compound this effect by attracting other businesses to the area. They also use relatively few public services. A shift to commercial offices is correlated with an increase in revenues and an insignificant change in expenditures. This results in a net surplus estimate that is highly significant at better than the one percentage level.

The contrast between Tables 3 and 4 highlights a shortcoming of CCS studies. Not all commercial and residential properties are made equal, but

Table 4. Land-Use Subcategory Estimates.

Variable	(1) Revenue	(2) Expenditure	(3) Difference
Residential subcategories			
Single-family[a]	−0.00438	0.0149*	−0.0192*
	(0.0147)	(0.00774)	(0.0112)
	[−47.73]	[162.0]	[−209.8]
Multifamily	0.0297	0.0310*	−0.00134
	(0.0289)	(0.0168)	(0.0221)
	[323.6]	[338.2]	[−14.61]
Condominiums	−0.00539	0.0222	−0.0275
	(0.0277)	(0.0137)	(0.0212)
	[−58.78]	[241.5]	[−300.3]
Retirement homes	−0.459	0.606	−1.065**
	(0.734)	(0.418)	(0.521)
	[−5,005]	[6,604]	[−11,609]
Mobile homes	0.0339	0.00301	0.0309
	(0.0374)	(0.0173)	(0.0297)
	[369.9]	[32.77]	[337.1]
Miscellaneous residential	0.0525	−0.00343	0.0560
	(0.0461)	(0.0242)	(0.0380)
	[572.5]	[−37.36]	[609.9]
Cooperatives	0.0529	0.0991	−0.0461
	(0.395)	(0.191)	(0.329)
	[576.8]	[1,080]	[−503.0]
Commercial subcategories			
Commercial offices	0.360*	−0.0758	0.436***
	(0.194)	(0.126)	(0.128)
	[3,923]	[−826.1]	[4,749]
Retail	−0.153**	−0.162***	0.00890
	(0.0631)	(0.0412)	(0.0493)
	[−1,671]	[−1,768]	[97.01]
Industrial	0.0337	0.0277***	0.00596
	(0.0312)	(0.00961)	(0.0269)
	[366.8]	[301.9]	[64.95]
Other commercial	0.00741	−0.0109	0.0184
	(0.0177)	(0.00908)	(0.0125)
	[80.72]	[−119.3]	[200.0]
County fixed effects	x	x	x

(continued)

Table 4. (continued)

Variable	(1) Revenue	(2) Expenditure	(3) Difference
Control variables	x	x	x
Observations[b]	528	528	528
R^2	.997	.998	

Note: All regressions include time effects and the percentage of government, institutional, miscellaneous, and vacant acres in the county.
[a]Estimates are long-run propensities (LRPs) of the given land use, standard errors clustered by county, and LRPs applied to the median county.
[b]We use the dfbeta diagnostic technique to identify and drop influential outliers (Bollen and Jackman 1990). Results obtained using this technique are qualitatively similar to estimates based on the full sample.
*Significance at the 10 percent level.
**Significance at the 5 percent level.
***Significance at the 1 percent level.

CCS studies treat them as if they are by using overly aggregated land-use categories. Doing so obscures important patterns in the data. Although aggregate results indicate that land-use shifts are not associated with significant net changes in the budget, there is evidence that some land uses are associated with deficits and others with offsetting surpluses. This is consistent with Fischel's (1985, 2001) hypothesis and also suggests that there are additional, important dimensions along which land uses are evaluated by residents. We leave an analysis that incorporates these trade-offs to future research.

Estimated LRPs for Revenue and Expenditure Subcategories

In much the same way that we decompose land uses into finer subcategories, we investigate the effects from more disaggregate definitions of revenues and expenditures. Table 5 presents the results of estimating equation (1) where I contains twenty-eight revenue and expenditure subcategories.[39] The table reports the dollar change in the revenue (expenditure) subcategory experienced by the median county from a shift from agricultural land resulting in a one percentage point increase in residential or commercial land use, respectively.

Again, the subcategory correlations reveal numerous significant, countervailing associations that are hidden in the aggregate revenue and expenditure estimates. Recall that Table 4 showed no significant relationship

between residential land use and total expenditures. Decomposing total expenditure into its components exposes significant, offsetting relationships between shifts to residential land use and expenditures on courts (+), human services (+), and physical environment (–). We would expect that as a community becomes more residential court-related and social services spending would rise. The negative correlation between residential land use and physical environment expenditures is likely due to developers and homeowners privately incurring the costs required to ensure a suitable living environment.

Turning to the estimated relationships between a shift to residential land use and the individual revenue subcategories, we find positive correlations between residential shifts and contributions, fines and forfeitures, and permits and licenses. The former revenue source represents gifts to the community from private donors, and the latter two revenue sources are due to procedural and administrative costs imposed on property owners. It is intuitive that these revenues would increase with residential land use.

The most surprising finding is the decline in revenue from special assessments. Special assessments are fees paid by property owners to fund capital improvements or services that directly benefit the owner's property. A priori, we would expect that these assessments would be more prevalent on residential land than agricultural land, so we contacted representatives from the counties where this negative relationship is the strongest and inquired about the properties on which they levy assessments.[40] Special assessments for fire services on agricultural land are levied by most counties, but localities use ad valorem taxation to collect fire service fees from residential properties.[41] This provides a plausible explanation for a seemingly unintuitive result.

Next, we turn to the changes associated with a shift to commercial land use. There are significant decreases in two expenditure subcategories: schools and human services. That commercial properties are associated with decreased expenditures on schooling is intuitive, although the magnitude of this effect is larger than expected. The human services expenditure subcategory includes hospital, mental health, and public assistance services. Again, as commercial property takes up an increasing share of the land in the county, we would expect less need for spending in this subcategory. The only subcategory of expenditures that increases with more commercial land use is physical environment. This is also intuitive, since new commercial buildings typically require additional spending on road and other public infrastructure services.

Table 5. Revenue and Expenditure Subcategory Estimates.

Variable	(1) Residential	(2) Commercial
Revenue subcategories		
Ad valorem[a]	381	186
Contributions	160*	277
Court related	−334	540
Federal grants	115	−292
General government (revenues)	−174	770
Interest	272	−472
Fines and forfeitures	52*	8
Local government unit grants	41	−7
Miscellaneous	60	−226
Other sources	278	945
Permits and licenses	101*	−222
Rents and royalties	16	−72
Sales of assets	142	−520**
Sales taxes	−49	55
Service charges	216	−537
Special assessments	−1,814**	5,813**
State grants	−68	244
State revenue sharing	−61	−84
Schools (revenues)	313	261
Expenditure subcategories		
Courts	279*	167
Culture/recreation	−84	110
Economic environment	−156	287
General government (expenditures)	73	249
Human services	608***	−2013**
Physical environment	−790***	2,964***
Public safety	39	−61
Transportation	−182	334
Schools (expenditures)	335	−1,920***
County fixed effects	x	x
Control variables	x	x

Note: All regressions include time effects and the percentage of government, institutional, miscellaneous, and vacant acres in the county. We use the dfbeta diagnostic technique to identify and drop outliers (Bollen and Jackman 1990). Relative to those based on the full sample, several estimates are sensitive to the use of dfbeta in magnitude and significance, but there are no significant differences in sign. Regression diagnostics for each equation are omitted due to space constraints but are available from the authors by request.

[a]Estimates are the long-run propensities multiplied by the revenue or expenditure of the median county in that subcategory. In other words, we report the dollar change in the revenue (expenditure) subcategory experienced by the median county from a shift from agricultural land resulting in a one percentage point increase in residential or commercial land use, respectively.

*Significance at the 10 percent level.

**Significance at the 5 percent level.

***Significance at the 1 percent level.

Finally, there are the individual revenue subcategory correlations with a shift in favor of commercial land use. There is a negative relationship between those shifts and *sales of assets* (usually surplus materials). Why such a relationship exists is unclear. There is also a significant relationship between commercial shifts and revenues from special assessments. As is true for a shift to residential land use, the change in special assessment revenues is large. Unlike the residential case, the change is positive rather than negative so this is not a surprising result. New commercial developments frequently require special services related to security, traffic control, storm water management, and utilities that are funded by special assessments.

While we have focused on the statistically significant effects found in Table 5, an insignificant effect merits comment. We close by pointing out that neither a shift to residential nor commercial land use is found to have a positive, significant correlation with ad valorem. These results are surprising because, as discussed previously, we would expect conversions to these land uses to increase the tax base, all else equal. These nonresults are both consistent with the existence of positive agricultural land spillovers. The residential result is also consistent with Florida's homestead exemption muting the revenue effects of residential shifts. A detailed examination of the mechanisms that underlie these results is left for future research.

Conclusion

In this article, we use a new approach to document the first empirical estimates of the relationship between a complete accounting of community fiscal measures and the full distribution of acres of land uses in the jurisdiction. Our methodology makes numerous improvements to the accounting approach taken by CCS studies. We estimate econometric models that describe the actual changes in expenditures and revenues associated with the residential and commercial development of agricultural land. Results based on our improved methodology cast doubt on the general conclusions of CCS studies.

We also provide new knowledge of fiscal impacts by analyzing subcategories of land uses and more disaggregate budget measures. Estimates exploiting the former type of disaggregation show that residential and commercial findings are not uniform after breaking down these aggregate land uses into their components. Commercial office development is associated with a significant surplus, but this is not the case for other commercial land use subcategories. Similarly, most residential subcategories are not correlated with budget changes, but shifts to retirement homes are strongly

correlated with residential deficits, most likely due to tax exemptions available to retirement facilities. When estimating the relationships between land-use categories and revenue/expenditure subcategories, we uncover numerous significant relationships that are obscured by the aggregate data and surprisingly insignificant relationships between shifts from agricultural land and ad valorem tax revenues. Taken together, our subcategory results provide evidence that our failure to uncover a significant difference between the associations of residential/commercial and agricultural land uses with the community budget are indicative of a true nonrelationship rather than statistical imprecision. We attribute this, in part, to both a reduction in positive agricultural spillovers that reduces the overall tax base and various favorable tax treatments given to residential properties.

We conclude by acknowledging a few caveats that serve to point to possible directions for future research. First, we remind the reader that our estimates represent correlations and cannot be interpreted as causal. We do not control for spatial patterns such as density nor do we account for the fact that land-use decisions are likely to be affected by community budgets. Causal analyses will require accounting for not only the magnitudes of shifts in land use but also the locations of those shifts. Additionally, it will require modeling development decisions along with their fiscal impacts. Both improvements to our methodology pose considerable challenges to future researchers but make this an area ripe for future research. Second, as is true of all studies that use local data, there is the concern that our results for Florida may not be generalizable to the nation as a whole. We therefore encourage research on fiscal impacts using data for other places, especially in light of the fact that our estimates represent the only econometric evidence available. Finally, our data cover nine rather tumultuous years in our nation's history, characterized by the housing market crash, the Great Recession, and the early recovery from these events. It is therefore important for future research to investigate whether the relationships we have discovered are applicable to more normal times. Despite these caveats and the obvious need for additional research, the relationships we estimate have not previously been documented, and they represent an important first step in our understanding of an issue that has significant policy implications. We hope that this work provides insight into the fiscal impacts of alternative land uses as well as useful directions for future research.

Authors' Note

All remaining errors are our own.

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Supplemental Material

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Notes

1. The term "fiscal impact" is a misnomer because it implies a causal relationship that many studies do not identify. Nevertheless, since the term is commonly used to describe any type of study that relates land uses to the budget in a community, we continue with this convention.
2. The fiscal stress of cities is monitored by the National League of Cities, which conducts an annual survey of cities (see, e.g., Pagano, Hoene, and McFarland 2012). There have been eight recent bankruptcy filings of cities and counties (http://www.governing.com/gov-data/municipal-cities-counties-bankruptcies-and-defaults.html).
3. The cost of community services (CCS) methodology was first developed by the American Farmland Trust (AFT). The AFT designed CCS studies to be both an inexpensive and uncomplicated way for communities to inform their growth decisions and a way to show the value of agricultural land to the local budget (2010).
4. CCS studies should not be confused with fiscal impact analyses (FIAs). Unlike CCS studies, FIAs do not focus on the fiscal impacts of general categories of land use but rather on the fiscal impact of a proposed new development, for example, a new shopping center. The results of FIAs are generally consistent with the conventional wisdom that residential land use is deficit producing. FIAs have their own significant limitations (see Edwards and Huddleston 2009).

5. Revenues and expenditures include those at all four levels of local government in Florida: the county, city, school district, and special district levels (http://www.floridaleagueofcities.com/Resources.aspx?CNID=878).
6. The definitions of all revenue and expenditure subcategories can be found in Online Appendix 1. That our results suggest that special assessments on agricultural properties are high relative to residential properties is somewhat unexpected. Based on interviews with community representatives, we believe the result is primarily due to the use of special assessments as means of charging for fire protection services for agricultural properties, whereas ad valorem taxes are used to fund those services for residential properties. Additionally, that shifts to residential land uses are not associated with significant increases in ad valorem revenues is also unexpected. We posit that this may be due to the loss of positive spillovers from agricultural land that reduces the residential tax base as agricultural land is developed (see McConnell and Walls [2005] for a review of the literature on land-use spillovers) or Florida's homestead tax exemption, which decreases the assessed value of homeowners' primary residences by US$50,000.
7. The commercial–special assessment result is much more intuitive: communities use special assessments to ensure that new commercial development pays an appropriate share of the capital improvements and service upgrades required to support the converted land.
8. See Baum-Snow and Ferreira (2015) for an overview of causal inference related to urban and regional research.
9. As we explain in more detail in the next section, CCS studies assign revenues and expenditures to each land use category based on "interviews with financial officers and public administrators" (AFT 2010).
10. To see why this is important, consider the following illustrative example. City A has revenues of US$10,000,000 and expenditures of US$5,000,000. City B has revenues of US$100,000 and expenditures of US$50,000. In a CCS study, the ratio of revenues to expenditures is the same in both cities, but the magnitudes of the differences are very different.
11. The full framework is contained in Online Appendix 2.
12. The default percentage is the aggregate value of properties within the land-use category divided by the total value of all property on the property tax roll. Where recorded data and interviews fail to indicate where expenditures should be allocated, they are allocated across the three land uses based on their default percentages.
13. For instance, it may be the case that single-family residential properties are associated with a deficit but condos are not, but when aggregating this distinction will not be apparent.

14. This bias is attributed to the fact that the pioneer of this approach, the AFT, has as its goal the preservation of farmland on the fringe of urban areas.
15. The former is illustrated by the industrial properties example provided in the previous section. An example of the latter would be an increase in commercial land use that expands the community's workforce, which in turn creates more housing construction.
16. For example, the first-order change in property tax revenue from a new development is the change in the tax base caused by the development times the millage rate.
17. The Annual Financial Reports are audited and standardized according to the Uniform Accounting System Manual published by the Florida Department of Financial Services, so we take the data to be a consistent and accurate representation of the actual funds collected and outlaid by county.
18. Appraisers ("assessors" in other states) must meet certain performance standards as mandated by state statutes.
19. Online Appendix 3 provides more details about the available data, our GIS calculations, and how we addressed complications in the data.
20. We merge our data sources by county and year. Online Appendix 4 discusses how we merge sources that span different time periods.
21. The majority of Florida's special districts reside wholly within a given county. However, 72 of Florida's 1,325 special districts span multiple counties. In these instances, we split the spending of that district evenly between the counties.
22. Note that expenditures exclude capital outlays. Because these outlays tend to be quite lumpy, including them could distort the annual cost of providing public services.
23. We provide a discussion of additional features of the data that motivate our decision to use a lag structure and an explanation of our choice of a one-period lag specification in Online Appendix 5.
24. Totals are defined as the sum of all given land-use categories. Swamplands, lakes, forests, canals, drainage ditches, and so on were removed from the analysis.
25. We discuss alternative model specifications and their implications in Online Appendix 6.
26. Our revenue and expenditure equations are estimated as a two-equation system using seemingly unrelated regression (SUR), but since we include the same explanatory variables in both equations, our estimates neither differ from nor are more efficient than those we would obtain by estimating each equation independently. The benefit of SUR is that it allows for tests of significant differences in estimated coefficients across equations. This is necessary because

we are interested in the difference between revenues and expenditures; a reliable test of this difference requires SUR estimation.

27. Estimated equations include controls for the percent of acres in the county associated with government, institutional, miscellaneous, and vacant land uses.
28. A positive (negative) coefficient estimate in this column indicates that the given change is associated with a surplus (deficit) and is analogous to a CCS study ratio of less than (greater than) one.
29. In lieu of the year fixed effects, all specifications were also estimated with a linear time trend. Results are qualitatively similar between these two approaches to controlling for time effects.
30. Recall that because CCS studies only report ratios of revenues to expenditures, these differences in sign, and the different mechanisms they suggest, would not be obvious from a CCS study.
31. The latter (columns 4–6) is our preferred specification because it controls for as many potentially confounding factors as possible. The full set of results including estimates for control variables can be found in Online Appendix 7.
32. We focus on our preferred specification (columns 4–6) in our discussion of individual revenue and expenditure results.
33. Results are similar in sign, significance, and magnitude when the control variables are excluded.
34. The retirement homes subcategory includes multiresidence facilities for senior citizens such as nursing homes and assisted living facilities. Retirement communities, neighborhoods where seniors live in detached homes, are considered single-family dwellings by property tax assessors.
35. See http://dor.myflorida.com/dor/property/taxpayers/exemptions.html for exemption details. For example, in Miami-Dade County in fiscal year 2014, retirement homes were only eligible to be taxed on 54 percent of their assessed value.
36. This added scrutiny is thought to manifest itself in the form of impact fees and developer concessions in order to gain project approval. Developer concessions might include expanding or upgrading the road network, running utilities to the new development, or creating neighborhood amenities such as a new park. These allowances may mute the negative effects that multifamily housing development would otherwise have on local government budgets.
37. As explained in Ladd (1994), increased density results in economies of scale in the provision of government services, but it is also associated with a harsher environment that increases costs and expenditures. If the latter effect dominates, our results will be biased upward. This would be the case if, for instance, greater density is associated with increased police and fire expenditures because denser neighborhoods are intrinsically more difficult to protect.

38. Since not all jurisdictions collected revenues from and/or spent funds on all subcategories in all periods, we estimate Tobit models where appropriate. For ease of exposition, we report the estimates from each equation in a different row, as opposed to a different column in the previous tables. Columns contain estimates from a model with county fixed effects, time effects, and controls, but results are similar in sign, magnitude, and significance across specifications.
39. To determine which counties exhibit the most negative relationships, we estimate a simpler version of the special assessments equation separately by county. By doing so, we are also able to determine that a small subset of jurisdictions do not drive the result, as fifteen of the sixty-seven counties (22. 4 percent) display a negative, significant relationship between shifts to residential land and special assessment revenues. These results are available by request.
40. As agricultural land is developed into residential properties, the new development occurs either in the incorporated or in the unincorporated portion of the county. If it is in the incorporated area, fire service fees are part of ad valorem taxation. If the development is in the unincorporated area, in most cases, it is found within a fire services special district that also uses ad valorem taxation to collect these funds. This mechanism implies that counties are the primary users of special assessments because special districts and cities use other revenue sources for the same service. Evidence of this mechanism could be found if removing county revenues from this subcategory led to reduced significance on special assessments. This is exactly what we find when we rerun the regressions.

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