Taxing Inventory: An Analysis of its Effects in Indiana

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Fewer than ten states tax the assessed value of business inventories as part of the property tax; Indiana is one of them. For years businesses have pressed the Indiana legislature to reduce or repeal this "inventory tax," but a concensus on its eradication has yet to be reached. Most recently, the 1999 session of the Indiana General Assembly debated bills to reduce or eliminate the inventory tax. The Governors' Citizens Commission on Taxes had placed elimination of this tax third from the top of their priority list in their December 1998 report (Citizens Commission on Taxes, 1998). The Senate Republicans proposed a ten year phase out of the tax, replacing lost local revenue with state funds. The House Democrats proposed to exempt the first $12,500 in assessed value of inventories, also replacing lost local revenue with state funds. What passed, in the end, was a $12,500 exemption for all personal property, including business inventories, business equipment and individually owned personal property such as mobile homes and recreational vehicles. To this extent the inventory tax lives on, as do the motives for its alteration.

One of the attractions of inventory tax reduction or elimination is the economic development benefits that it might bring. Proponents of elimination point to Indiana's location at the crossroads of many interstate highways (Styring, 1994). They argue that Indiana could be a major warehouse distribution center if the property tax on inventories was removed. The result could be increases in jobs, incomes and sales. Added income and sales could generate added state revenue through income and sales taxes. Some claim that this additional revenue would be enough to completely offset the cost of the inventory tax cut. Those who support the inventory tax are just as resolute as those who oppose it. They cite the fact that property taxes on inventories raised $395 million for Indiana local governments in 1998 (Indiana Legislative Services Agency, 1998). Indiana assessed inventories at $4.3 billion, 8% of the state's total assessed value.[1]

Would the reduction or elimination of property taxes on inventories increase the amount of inventories held in Indiana? Indiana data can be used to provide evidence on this question. In 1998 average property tax rates on inventories among Indiana counties varied from a low of $4.46 per $100 assessed valuation to a high of $18.46 per $100 assessed valuation. If inventory taxes inhibit inventory location, one would expect high tax rates to inhibit location more than low tax rates. All else equal, if inventory taxes affect inventory location, there would be more inventories in low tax counties and less in high tax counties.

This essay analyzes the response of inventory location to property tax rates in Indiana in 1998, then uses the results to estimate the increase in state revenue if the tax on inventories was eliminated. The analysis attempts to explain what determines the gross assessed value of inventories, which is the sum of taxed inventory assessments and the assessed value of untaxed inventories in enterprise zones. Data are available for the assessed values of business inventories for Indiana counties for 1997-98 (State Board of Tax Commissioners, 1999). Regression analysis may be used to estimate the effects of tax rates and other factors on inventory location.[2]

What Determines Inventory Assessments?

What is the effect of property tax rates on inventory assessments in Indiana counties, "all else equal?" A list of the determinants of inventory assessments is needed in order to know what "all else" might include. (See the **Data Appendix** for data sources.)

The primary interest is in the effect of the *property tax rate* on inventory assessments. The property tax rate is expected to be negatively related to inventory assessments; that is, counties with higher tax rates should see lower inventory assessments, all else equal. The tax rate is measured as the revenue collected by all governments within a county, from property taxes on inventories, divided by the gross assessed value of inventories (multiplied by 100).

Inventory location probably depends on factors related to demand and costs. Wholesale and retail inventories are needed to serve customers in each county. The more customers there are, the greater the quantity of inventories retailers are likely to keep. If these customers have more income, they are likely to buy more of most everything, so firms would keep a larger stock of inventories. *Population and per capita income* are likely to be positively related to the assessed value of inventories.

Manufacturers keep inventories for use in production of their products. The larger the number and size of manufacturers in a county, the more inventories are likely located there. *Manufacturing employment* is a convenient measure of the presence of manufacturing in a county; it is expected to be positively related to inventory assessments.

The *size of a county in square miles* may affect the demand for inventories. Residents of a small county frequently may cross county borders to shop. Retail inventories to serve a small county's consumers are more likely to be located in another county. Consumers in a large county may have to travel far to shop in another county, so the inventories that serve them are more likely to be in a large county. Put another way, all else equal, if inventory facilities are spread across the landscape, counties that occupy

more of that landscape will have more inventories than counties that occupy less. The larger the county in square miles, the more inventory assessed value it is likely to have.

Tax rates are a cost side variable. Also on the cost side are *enterprise zones*, which provide firms with a tax exemption for their inventories. The effect of enterprise zones is incorporated into the average county property tax rates on inventories. But the zones may have an independent effect, indicating a "business friendly" environment. The presence of an enterprise zone in a county is expected to have a positive effect on inventory assessments, beyond the effect on property tax rates.

The convergence of interstate highways in Indiana could make the state a prime location for warehouse facilities. Major highways reduce travel time, and so reduce the cost of serving regional markets. Some Indiana counties have interstate highway mileage within their boundaries, while some do not. In addition, some have state four lane highway mileage and some do not. The *number of miles of major roads* in a county is expected to be positively related to inventory assessments.

Table 1
Means and Standard Deviations

Variable	Mean	Standard Deviation
Inventory Assessed Value	49,558.06	96,554.89
Population	63,740.30	104.568.10
Per Capita Income	20.310.74	2,987.69
Manufacturing Employment	7,481.01	12,036.79
Square Miles	389.89	96.08
Property Tax Rate	7.50	1.66
Enterprise Zone	0.20	0.40
Highway Miles	39.67	44.84
Rent	238.48	50.37
Wage	21,811.13	3,596.99
Distance to Metro Area	9.83	10.72

Warehouse facilities require land, which must be purchased or rented. Firms are less likely to locate warehouses where land is more costly. No data on land rents are available, but data on *contract rents for rental housing* are. These rents partially reflect the rental value of land in the county. Contract rent is expected to be negatively related to inventory assessments.

Warehouse facilities also require employees. Firms may avoid locating warehouses in counties where employees are expensive—that is, where wages are high. The *average wage* in the county is expected to be negatively related to inventory assessments.

Finally, the *distance of the county from the nearest metropolitan area* may have an effect, though its direction is open to question. On the one hand, firms may locate warehouses in counties close to a metro area in order to serve the demands of the large number of people nearby. The closer to a metro area, the larger inventory assessments are expected to be. On the other hand, consumers in counties close to a metro area may shop in the metro county rather than in their home counties. With fewer customers, local firms may stock fewer inventories. The closer to a metro area, the smaller inventory assessments are expected to be.

Table 1 shows the variable means and standard deviations. For the regression, all data are converted to natural logarithms, except the enterprise zone dummy variable, the highway miles variable and the distance to metro area variable. These latter three have some counties with zero values, and the logarithm of zero is not defined. Coefficients on logarithmic variables may be interpreted as elasticities, meaning that they show the percentage effect on inventories of a one percent change in the explanatory variable. For example, the coefficient on population will show the percent change in inventory assessments expected from a one percent change in population. Coefficients on the non-logarithmic variables may be interpreted as the percentage effect on inventories of a one unit change in the explanatory variable. For example, the coefficient on highway mileage will show the percent change in inventory assessments from a one mile change in highway mileage.

Regression Results

Table 2 presents the results of two regressions. The first includes all the variables described above. The second includes only explanatory variables that are significant at least at the ten percent level. The statistical problem of heteroskedasticity was not present in the first regression, according to the White Test. It was present in the second regression, so the results reported here are corrected for heteroskedasticity

using the White heteroskedasticity-consistent standard errors and covariance correction. The R-squared statistic measures the share of the variation in inventories explained by the explanatory variables. The R-squared statistic indicates that each equation explains about 94% of inventory variation.

The enterprise zone, rent and wage variables are dropped for estimation of the second regression. The enterprise zone and rent variables are dropped because they are far from significant in the first. The wage variable is also dropped, though it is significant in the first. The reason is that once the other two variables are eliminated, and the heteroskedasticity correction is made, the wage variable is no longer significant. In the first regression the wage variable has a sign opposite of what is expected. Higher wage costs were expected to discourage inventory location, but according to the regression higher wages are associated with more inventories. It may be that the wage variable, like the income variable, measures the purchasing power of local consumers. Support for this possibility comes from the fact that the per capita income variable becomes more significant (a higher t-statistic) when the wage variable is eliminated. The correlation between the two variables is .603, which is relatively high. In the first regression, the highway miles variable is not significant, but when included in the second regression it is significant.

Table 2
Regression Results

	Regression 1		Regression 2	
Explanatory Variable	Coefficient	t-Statistic	Coefficient	t-Statistic
Constant	-14.6560**	-4.48	-10.9123**	-3.32
Population	0.6157**	4.87	0.5004**	5.21
Per Capita Income	0.8423**	2.11	1.1344**	3.43
Manufacturing Employment	0.3708**	7.62	0.4242**	7.28
Square Miles	0.2462*	1.97	0.2719**	2.45
Property Tax Rate	-0.4506**	-2.30	-0.3831**	-2.57
Enterprise Zone	-0.1070	-0.98		
Highway Miles	0.0018	1.43	0.0022**	2.55
Rent	-0.2881	-0.81		
Wage	0.7774**	2.56		
Distance to Metro Area	0.0058*	1.68	0.0062**	2.27
R-squared	.9462		.9403	
F-statistic	142.33**		189.11**	
White heteroskedasticity test	77.06		72.25**	

*Significant at 10% confidence level **Significant at 5% confidence level

The variables that remain in the second regression all have the expected signs, and all are significant at the 5% confidence level. The demand side variables, population, per capita income and manufacturing employment, are all positive. Firms appear to locate inventories close to their customers, whether these customers are consumers or firms. The coefficient on square miles is also positive, indicating that in larger counties consumers are less likely to cross county boundaries to shop. Demand side considerations appear to dominate the distance to metropolitan area variable. Its positive coefficient implies that consumers are more likely to shop in their home county when a metropolitan area is farther away. On the cost side, highway miles has a positive coefficient. This implies that the presence of four lane highways increases the attractiveness of a county for warehouse facilities. Add five miles of four lane road and inventory assessments rise one percent.

Property tax rates affect inventory location. Higher property taxes result in fewer inventories located within the county. The coefficient in the first regression is -.45, the coefficient in the second is -.38. These imply that each ten percent increase in the tax rate (for example, from $8.00 to $8.80 per $100 assessed value) is associated with an approximately four percent reduction in inventory assessments.

Tax Elasticity of Business Activity

Proponents of inventory tax elimination argue that it would increase the amount of inventories in Indiana, and hence the jobs and income related to inventories. Evidence exists showing that economic activity is likely to increase if business taxes are reduced. The size of this increase may be represented by a tax elasticity, showing the percentage increase in business activity in response to a one percent reduction in business taxes. Many studies have provided many estimates of the size of this effect. Timothy Bartik (1991) has done the most complete review of the literature on the effects of state and local taxes on economic development. Bartik writes:

> the long-run elasticity of business activity with respect to state and local taxes appears to lie in the range of –0.1 to –0.6 for intermetropolitan or interstate business location decisions, and –1.0 to –3.0 for intrametropolitan business location decisions. That is, if a given small suburban jurisdiction within a metropolitan area raises its taxes by 10 percent, it can expect in the long run a reduction in its business activity by from 10 to 30 percent. If an entire metropolitan area or state raises its taxes by 10 percent, the estimated long run effect would be a reduction of business activity between 1 percent and 6 percent. These estimated tax effects assume public services are held constant as taxes change (pp. 43-44).

The conclusion that tax rates have any effect on business activity is controversial, however. Recently, more studies than not have found that taxes influence business activity, but some studies have found otherwise. McGuire (1992), reviewing Bartik's book, concluded from the same evidence that "the effects of state and local tax policy are so uncertain that concern over this issue should not be a driving force in general fiscal policy decisions" (p.458).

This study finds that taxes affect business activity. The assessed value of inventories is one measure of business activity, so the coefficients on the property tax rate may be treated as tax elasticities. The elasticities of -.45 and -.38 are within Bartik's intermetropolitan range of -0.1 to -0.6.

Inventories are a narrow measure of business activity, so the relationship between the results here and Bartik's range should be interpreted with care. Increases in inventory assessments may be associated with added economic activity. A larger quantity of inventories held in Indiana could increase income of Indiana residents if firms locate more inventory facilities in the state, requiring more employees who earn more income. However, increases in inventory assessments may be associated with changes in the way firms operate. If inventory taxes are cut, keeping inventories is less expensive. This may encourage firms to substitute one method of production for another, while the level of business activity changes little. For example, with inventories cheaper, firms might decrease their emphasis on "just in time" inventory methods. They might dismiss truck drivers and hire warehouse employees, with little change in the overall level of employment or economic activity.

The tax elasticities estimated here may reflect tax effects on both economic activity and on firm operations. The tax elasticity for economic activity alone is probably smaller than the elasticities estimated here. Recent studies using tax elasticities for Indiana have used more conservative estimates. Styring (1994) reviewed the literature and settled on –0.15 in his analysis of the effect of inventory taxes in Indiana. Bohannon and McClure (1998) reviewed the literature and settled on –0.30 in their analysis of the effect of property taxes on Indiana output and employment.

How Much State Revenue Would Inventory Tax Elimination Generate?

The property tax on the assessed value of inventories—the inventory tax—raised $395 million in calendar 1998. It is 8% of total assessed value. Coincidently, it is also 8% of all business taxes, which include property taxes on business equipment, land and buildings, business income and corporate income taxes, and other business taxes. Eliminating the inventory tax would reduce business taxes by 8%. This would increase business activity and generate new revenues from other state taxes. How much?

Table 3 shows a series of calculations using tax elasticities of -0.1, -0.4 and -0.6. Bartik's range was -0.1 to -0.6. The above regressions found an elasticity of approximately -0.4, a figure which probably includes both economic activity and business operation effects. An 8% tax cut with an elasticity of –0.1 would imply an increase in business activity of 0.8%; an elasticity of –0.4 would imply an increase of 3.2%; an elasticity of -0.6 would imply an increase of 4.8%.

Suppose state income reflects these changes in business activity, that is, as business activity increases, employment and wages rise, increasing state income. Additional elasticities may be used to estimate the change in state revenue from percentage increases in income. Regression results for the state income and sales taxes show income elasticities of 1.14 and 0.93, respectively. This means that each one percent increase in income results in a 1.14% increase in income tax receipts and a 0.93% increase in sales tax receipts. In fiscal 1998 Indiana raised $3,433 million in income taxes and $3,278 in sales taxes.

Table 3 shows the implications of these estimates for state revenue. For example, a tax elasticity of -0.4 implies an increase in business activity of 3.2%. If this is a 3.2% increase in income, the income and sales elasticities imply increases in income and sales tax revenues of 3.65% and 2.98%, respectively. Taking fiscal year 1998 income and sales tax collections as a base, the increases in revenue are $125 million and $98 million, respectively, for a total state revenue increase from these two taxes of $223 million. An additional $172 million would be required to offset the $395 million inventory tax cut.

Table 3
Calculation of Added State Revenue From Tax Elasticities

Business Tax Elasticity	-0.1	-0.4	-0.6
Business Tax Reduction	8%	8%	8%
Increase in Indiana Business Activity (Income)	0.8%	3.2%	4.8%
Percent Increase in Income Tax Revenue, Income Elasticity=1.14	0.91%	3.65%	5.47%
Percent Increase in Sales Tax Revenue, Income Elasticity=0.93	0.74%	2.98%	4.46%
Dollar Increase in Income Tax Revenue, based on FY 1998 Revenue=$3,422 million	$31 million	$125 million	$187 million
Dollar Increase in Sales Tax Revenue, based on FY 1998 Revenue=$3,278 million	$24 million	$98 million	$146 million
Total Added State Revenue	$54 million	$223 million	$333 million
Added Cost to Replace $395 million	$341 million	$172 million	$62 million

These added revenue figures represent what would have happened had the inventory tax been completely eliminated for tax payments in 1998. The figures will grow in future years as income and sales tax revenues grow, because the percentage increases in revenues will correspond to larger dollar figures. Added revenues could also grow if, in future years, the inventory tax becomes a larger share of total business taxes. Its elimination would then represent a bigger business tax cut. Of course, in future years inventory tax revenue will increase as well, meaning more revenue must be generated to offset its elimination.

These are long run elasticities. At first, the responses of income to tax changes might be smaller, because it takes time for businesses to change business plans, hire new employees and construct new facilities. When all of these changes are complete, the total effect is reflected by these tax elasticities.

Added state revenue does not fully offset the $395 million cost of inventory tax elimination in any of these simulations. A tax elasticity of about –0.7 would be required for the state tax revenue increases to fully offset the inventory tax cuts. This is beyond Bartik's range of -0.1 to -0.6, and a bigger response than the inventory assessment elasticity of -0.4 found in the above regression.

Conclusion

This paper reports the results of a statistical analysis of the effects of property tax rates and other factors on the assessed value of inventories in Indiana counties in 1997-98. It then applies these results to the question of whether enough extra state revenue would be generated from the elimination of property taxes on inventories to fully offset lost revenue. The evidence here implies that:

- Lower property taxes are associated with a greater amount of inventory assessments, with each 10% reduction in inventory taxes raising the assessed value of inventories about 4%. Reduction or elimination of property taxes on inventories would likely increase the quantity of inventories held in Indiana.
- This tax effect is probably not large enough for inventory tax cuts to be completely offset by added state income and sales taxes from increased business activity.
- All else equal, firms locate their inventories to be near their customers.
- The presence of four lane highway mileage increases the level of inventories kept in a county.

The most important result here is the 4% increase in inventory assessments for each 10% tax rate reduction. It might be argued that the estimate of this response is too small. It is based solely on variations in Indiana tax rates and Indiana inventories. Perhaps the elimination of the property tax on inventories would encourage the location of inventories in Indiana from out of state. This would imply a bigger inventory response to tax rates.

However, it also might be argued that the estimate of this response is too big. As noted above, part of the increase in inventories in response to an inventory tax cut represents a change in business operations. With inventories cheaper, businesses may hire warehouse workers and fire truckers, with little or no change in total employment. There may also be a data problem. Businesses hold tax sales to reduce their inventory assessments on March 1. The assessed value of inventories undoubtedly understates the quantity of inventories on hand throughout the rest of the year. Businesses in high tax counties probably make greater efforts to reduce inventories on the assessment date than do businesses in low tax counties. If so, high tax county inventories are understated by more than low tax county inventories. This implies that some of the relationship between tax rates and inventory assessments is an illusion, true on March 1 but at no other time of the year.

Finally, this analysis focuses only on inventory taxes, not on other policies that could enhance economic development. The results here imply that

eliminating inventory taxes would impose costs on the state. State revenue increases are unlikely to be enough to completely offset local inventory tax revenue losses. With a tax elasticity of -0.4, for example, the state would have to provide about $172 million from its own revenue sources to replace local revenues (see **Table 3**). Is the elimination of property taxes on inventories the best use for $172 million in state funds? Could such funding be devoted to other economic development programs, such as tax cuts for high-tech equipment, or funding for local infrastructure, that might produce more added jobs and income? That is a topic for another day.

Notes

[1] Assessed value is the "base" of the property tax, the dollar measure of property to which property tax rates are applied. The property tax is almost exclusively a local tax, collected by counties, cities, towns, school corporations and other local units. The assessment date is March 1 each year, which is why the end of February always sees an advertising blitz for "tax sales." Businesses try to sell their inventories so their assessment on March 1 is as small as possible.

[2] Regression analysis estimates an equation that best describes the variable to be explained using a number of explanatory variables.

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Data Appendix

• The assessed value of inventories include taxable inventory assessments and untaxed inventories in enterprise zones. Data are from the State Board of Tax Commissioners (1999).

• County population is estimated by the U.S. Bureau of Census, and is for 1997. It is available on the Census Bureau's web site, *www.census.gov* and on STATS Indiana, *www.stats.indiana.edu*.

• County per capita income is estimated by the Bureau of Economic Analysis of the U.S. Department of Commerce. The data are for 1996, the most recent year available at the time of the analysis. Data are available on the BEA website, *www.bea.doc.gov*.

• County manufacturing employment is estimated by the Bureau of Economic Analysis. The data are available for 1997 on the STATSIndiana website, *www.stats.indiana.edu*.

• Square miles are the number of square miles within each county's boundaries. The figures were obtained from the Indiana Business Research Center's Indiana Fact Book, 1998-99.

• The property tax rate on inventories are the pre-1998 average rates for all units within a county. These average tax rates are calculated by dividing the inventory tax net levy by the sum of inventory taxable assessed values and untaxed assessed values in enterprise zones.

• The presence of enterprise zones within a county is measured as a zero-one "dummy variable." If the variable equals one the county has an enterprise zone, if it equals zero it does not.

• Rent is contract rent on rental housing. These are data from the Census for 1990, available from the Indiana Business Research Center's Indiana Factbook 1998-99.

• Wage is the average wage paid to all employees within a county. The data are for 1995, and are available from the Indiana Business Research Center's Indiana Factbook 1998-99.

• Highway miles are the sum of interstate and major artery road mileage within each county. Distance from metropolitan statistical area is the distance from the center of each county to the center of the nearest county within a metropolitan area, as defined by the U.S. Bureau of Census. Counties that are within a metropolitan area are considered to have a distance of zero. Data for these variables were created from an Indiana roadmap.