

# Do Rising Gasoline Prices Yield Increased State Sales Tax Revenues? Evidence from New York State

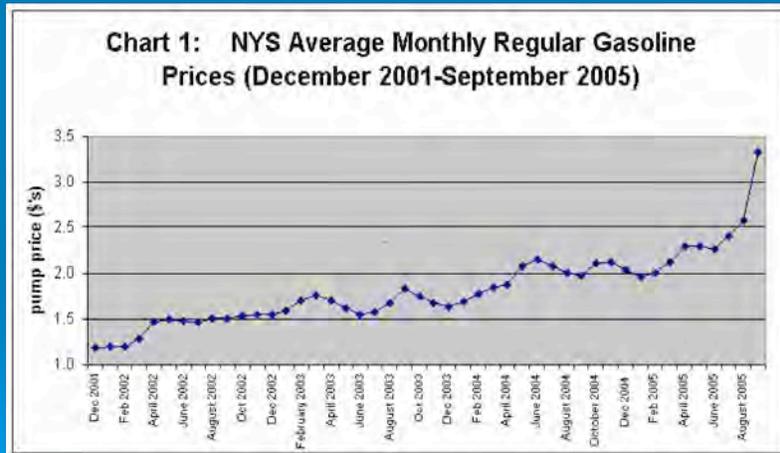
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- ❖ The views in this paper are those of the authors and do not represent the views of, and do not constitute any official statement by, the NYS Department of Taxation and Finance.

## Gasoline Prices on The Rise Nationally



New York State Motor gasoline prices have increased significantly over the last three years resulting in record high prices



## Rising Gasoline Prices:

- National Economic Problem
- Impacts state revenues and expenditures
- Impacts New York State sales tax revenues
- NYS is one of seven states that include motor fuels in their sales tax base.
- The other six states in this category are: California, Georgia, Hawaii, Illinois, Indiana and Michigan

## Media Interest in New York State on Tax Impact of Rising Gasoline Prices

- What are the total federal, State & local taxes on a gallon of gasoline – at different pump prices?
- Is New York State benefiting from increased sales tax revenues as the pump prices increase?

### Total Taxes per Gallon in New York State

**PUMP PRICE: \$1.50**

Tax Component	Tax Rate Cents Per Gallon
Excise Tax	8 cents
Petroleum Business Tax (PBT)	15.2 cents
State Sales Tax*	5.3 cents
Petroleum Testing Fee	.05 cents
Spill Tax	.3 cents
<b>Total State Tax</b>	<b>28.85 cents</b>
Local sales tax (4 % jurisdiction)**	5.3 cents
Federal Excise Tax	18.4 cents

**PUMP PRICE: \$3.00**

Tax Component	Tax Rate Cents Per Gallon
Excise Tax	8 cents
Petroleum Business Tax (PBT)	15.2 cents
State Sales Tax*	10.8 cents
Petroleum Testing Fee	.05 cents
Spill Tax	.3 cents
<b>Total State Tax</b>	<b>34.35 cents</b>
Local sales tax (4 % jurisdiction)**	10.8 cents
Federal Excise Tax	18.4 cents

## Media Inquiries:

- Is New York State getting a revenue windfall from rising gasoline prices?
- Media says yes.
- Media does static estimates (monthly taxable motor fuel gallons multiplied by change in prices)
- Several newspaper articles report on the estimated surplus.

## State Legislators Respond to Media Reports and Constituent Inquiries

- Is the state enjoying a “Windfall” in sales tax revenues?
- Numerous requests for collection data aimed at “State’s Windfall”

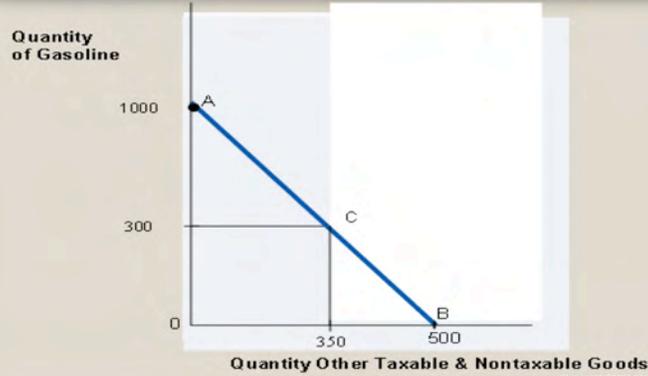
## Legislative Proposals in NYS Related to Motor Fuels

- Eliminate State Sales Tax
- Suspend State and local sales taxes
- Cap receipts subject to State and local sales taxes

## Is New York State Experiencing a Sales Tax Windfall?

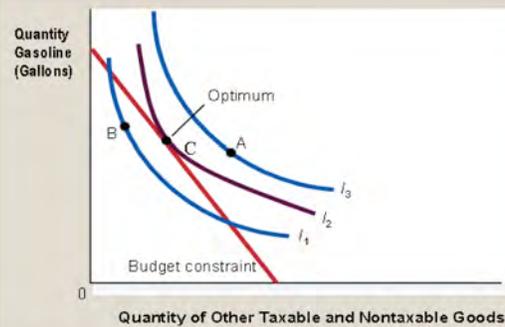
- Our investigation in New York State
- Micro economic consumption theory is a good starting point for our research

**Figure 1 The Household Budget Constraint**



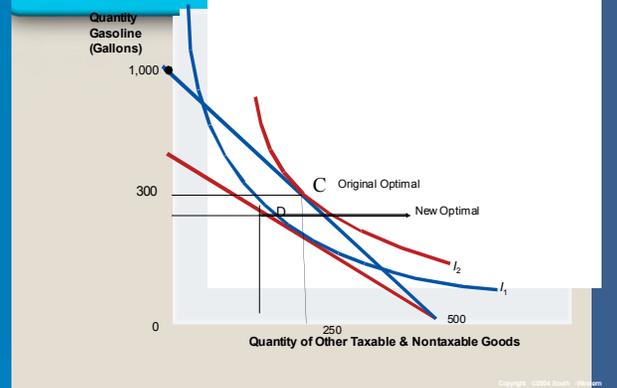
- Traditional consumer (or household) budget constraint is illustrated in Figure 1. Graph shows household's monthly income budget constraint indicating quantities of gasoline (gallons) that can be purchased by households (given fixed income) on vertical axis, and quantities of other goods and services, that household's income allows household to purchase in the month, on horizontal axis.

**Figure 2 The Household Optimum**



- Figure 2, shows what household would like to consume. Indifference curves represent the set of consumption choices that make consumers equally happy.

Figure 3 Increase in Price of Gasoline



- Using analytical tools of indifference curves and household budget constraint, we examine the impact on household's decision making with an increase in the price of gasoline. As illustrated in Figure 3, an increase in prices of gasoline relative to other goods and services will pivot budget constraint down vertical axis from the 1,000 gallon maximum consumption point. Households are able to purchase less gasoline using all their income and each gallon of gasoline consumed will cost more in terms of other goods and services given up.

### Micro Economic Consumption Theory tells us that impact of rising gasoline prices on State sales tax revenue is an empirical question

- Theory is ambiguous — answers depend on aggregation of individual household decisions relative to their preferences and income budget constraints and whether changes in consumption choices involve taxable or non-taxable goods and services.
- Example: In NYS, if consumers use more of their budget to consume gasoline (due to increased prices) and less to dine out in restaurants (also a taxable transaction), then NYS will not benefit in surplus revenue from this consumption reallocation.
- However, if consumers make this same shift to gasoline but offset this in their household budget with reduced purchases of movie admissions (not a taxable transaction), then NYS incurs a net benefit in sales tax revenue from this reallocation.
- At higher incomes, more consumers and households are likely to be able to increase budgets or budget constraints, and increase spending on gasoline and other taxable goods and services when prices rise.

## Model

- Tax Department's sales tax reporting system provides quarterly sales tax collections attributable to motor fuels so this component of the fiscal impact is known.
- As stated before, it is the impact from the rising gasoline prices on the household reallocation of resources – subject to the budget constraint that we are interested in.
- Using household consumption theory and practical experience, we attempted numerous formulations using quarterly State sales tax collections regressed on disposable personal income, household financial assets, interest rates, personal consumption, housing starts, business investment, consumer debt as well as motor fuel taxable sales.
- It became quickly apparent that our explanatory data series were collinear in many cases.

## Equation I

$$\text{Equation 1: SALESTXCOLL} = \beta_0 + (.04) \text{MFTAXSAL} + (\beta_2) \text{YDNYNMF} + (\beta_3) \text{HHFASSETSNY} + (\beta_4) \text{DCLOTHING} + (\beta_5) \text{DQTR2} + (\beta_6) \text{DQTR3} + (\beta_7) \text{DQTR4}$$

- In particular, NYS disposable personal income was highly correlated with motor fuel taxable sales.
- The coefficient on this variable is a known parameter from an accounting identity embedded in the relationship with the dependent variable – motor fuel taxable sales x 4 percent equals the portion of quarterly sales tax collections derived from these sales.
- Given that economic theory, practical experience and our particular needs require that the personal income and motor fuel taxable sales variables appear in the right hand side of the model, the multicollinearity statistical problem provides a roadblock.
- Given our prior knowledge on the coefficient for motor fuel taxable sales, we believe this multicollinearity was material and needed remediation.

## Equation II

Equation 2:  $SALESTXCOLLNMF = \beta_0 + (\beta_1) GASIMPACT + (\beta_2) YDNYNMF + (\beta_3) HHFASSETSNY + (\beta_4) DCLOTHING + (\beta_5) DQTR2 + (\beta_6) DQTR3 + (\beta_7) DQTR4 + (\beta_8) AR(1)$

- A second equation was then developed to focus on our empirical question.
- Because we are interested in the interaction of rising gasoline prices and household budget constraints, we modeled the following relationship:

$GASIMPACT = (\text{the rate of quarterly change in NY disposable personal income minus the rate of quarterly change in NY motor fuel taxable sales}) \times (\text{quarterly motor fuel taxable sales})$ .

- This formulation allows us to examine the impact of conditions where personal income is growing faster than motor fuel costs and where motor fuel costs are growing faster than personal income.

## Analysis of Regressions

Estimation Results Equation I

Sample: 1 47  
 Included observations: 47  
 $SALESTXCOLL = B(0) + .04 * MFTAXSALE + B(2) * YDNYNMF + B(3) * HHFASSETSNY + B(4) * CLOTHING + B(5) * SECONDQTR + B(6) * THIRDQTR + B(7) * FOURTHQTR$

	Coefficient	Std. Error	t-Statistic	Prob.
C	120.6081	63.34849	1.903883	0.0641
YDNYNMF	0.012199	0.000838	14.55840	0.0000
HHFASSETSNY	0.137064	0.042829	3.200252	0.0027
CLOTHING	-66.16035	22.20164	-2.979976	0.0049
SECONDQTR	86.36820	25.84043	3.342367	0.0018
THIRDQTR	-40.19314	26.90849	-1.493697	0.1431
FOURTHQTR	-170.5777	27.84804	-6.125301	0.0000
R-squared	0.957425	Mean dependent var	1909.124	
Adjusted R-squared	0.951038	S.D. dependent var	277.8905	
S.E. of regression	61.48954	Akaike info criterion	11.21222	
Sum squared resid	151238.5	Schwarz criterion	11.48777	
Log likelihood	-256.4871	Durbin-Watson stat	2.468704	

- The dependent variable is total quarterly State sales tax collection (SALESTXCOLL) and the known coefficient (.04) on quarterly motor fuel taxable sales (MFTAXSALE) is treated as a constraint or restriction on the regression.
- The adjusted R2 for the regression is .95, meaning 95% of the variation in the dependent variable is explained by the variation in the explanatory variables. While adjusted R2's are commonly high in time series analysis, this result appears a good overall fit for the model. The coefficients on the unrestricted independent variables are all properly signed and are statistically significant at the 95% confidence level. The T-statistics are all over 2 in absolute value.

## Estimation Results Equation I

Sample: 1 47  
 Included observations: 47  
 SALESTXCOLL = B(0) +.04\*MFTAXSALE+ B(2)\*YDNYNMF +B(3)  
 \*HHFASSETSNY +B(4)\*CLOTHING +B(5)\*SECONDQTR +B(6)  
 \*THIRDQTR +B(7)\*FOURTHQTR

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➤ The coefficient on quarterly NYS disposable personal income variable is positively signed and highly significant.

➤ Evaluated at the mean, this coefficient, .012199, implies that a \$1 billion increase in quarterly disposable personal income (excluding the income spent on motor fuel) would be associated with a \$305 million increase in quarterly taxable sales.

## Estimation Results Equation II

Dependent Variable: SALESTXCOLLNMF  
 Method: Least Squares  
 Date: 09/21/05 Time: 14:28  
 Sample(adjused): 6 47  
 Included observations: 42 after adjusting endpoints  
 Convergence achieved after 7 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	136.4147	55.71013	2.448652	0.0198
GASIMPACT	-0.100052	0.039412	-2.538645	0.0160
YDNYNMF	0.012707	0.000598	21.25347	0.0000
HHFASSETSNY	0.096421	0.031682	3.043401	0.0046
CLOTHING	-74.29344	15.32692	-4.847253	0.0000
SECONDQTR	83.60306	32.24941	2.592390	0.0141
THIRDQTR	-40.11970	23.76368	-1.688278	0.1008
FOURTHQTR	-181.1667	32.79830	-5.523662	0.0000
AR(1)	-0.363547	0.168742	-2.154453	0.0386
R-squared	0.958811	Mean dependent var	1882.983	
Adjusted R-squared	0.948826	S.D. dependent var	245.8381	
S.E. of regression	55.61293	Akaike info criterion	11.06212	
Sum squared resid	102062.3	Schwarz criterion	11.43448	
Log likelihood	-223.3045	F-statistic	96.02264	
Durbin-Watson stat	2.215387	Prob(F-statistic)	0.000000	
Inverted AR Roots	-.36			

➤ The estimation procedure used was ordinary least squares regression. The dependent variable is quarterly total State sales tax collections less the motor fuel component collections (SALESTXCOLLNMF). The adjusted R<sup>2</sup> for the regression is .948, again, a good overall fit for the model. The coefficients for each of the explanatory variables are properly signed and statistically significant at the 95% confidence level.

## Estimation Results Equation II

Dependent Variable: SALESTXCOLLNMF  
Method: Least Squares  
Date: 09/21/05 Time: 14:28  
Sample(adjusted): 6 47  
Included observations: 42 after adjusting endpoints  
Convergence achieved after 7 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	136.4147	55.71013	2.448652	0.0198
GASIMPACT	-0.100052	0.039412	-2.538645	0.0160
YDNYNMF	0.012707	0.000598	21.25347	0.0000
HHFASSETSNY	0.096421	0.031682	3.043401	0.0046
CLOTHING	-74.29344	15.32692	-4.847253	0.0000
SECONDTTR	83.60306	32.24941	2.592390	0.0141
THIRDTTR	-40.11970	23.76368	-1.688278	0.1008
FOURTHTR	-181.1667	32.79830	-5.523662	0.0000
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Durbin-Watson stat	2.215387	Prob(F-statistic)	0.000000	
Inverted AR Roots	-.36			

- Diagnostic tests and examination of a correlogram of the residuals from the original regression indicated a potential slight 1st order serial correlation problem. Therefore, an AR(1) autoregressive term was added and the overall fit of the regression improved.
- The coefficient on the GASIMPACT variable is (-.100052) and is statistically significant at the 95% confidence level.

## Estimation Results Equation II

- The sign on the coefficient is negative and consistent with our position that when the rate of increase of gasoline costs exceeds the rate of increase in income, this will cause a reduction in sales tax collections from other goods and services.
- The interpretation of this coefficient, for SFY 2004-05, is that when motor fuel expenditures rise more rapidly than income, 75 percent of the increased gasoline expenditures are financed by reductions in purchases of other taxable goods and services. The remaining 25 percent is explained by reductions in the purchases of non-taxable goods and services. However, the 75 percent estimate should be viewed with some caution as it is somewhat overstated because the analysis has not included the effects of an increase in consumer debt.
- As an illustration of the interpretation of the GASIMPACT coefficient, evaluated at the mean, during the annual April 2004 through March 2005 collection period, the estimated reduction in State sales tax collections from taxable non-motor fuel sales is approximately \$33 million. This is compared with the known increase in State sales tax collections from motor fuel of \$44 million during this period – or roughly a 75 percent offset to the motor fuel sales tax increase.

## Conclusion & Policy Implications

- The empirical analysis conducted in this paper suggests that there is likely some level of increased net State sales tax revenues accruing to New York State due to the increased gasoline prices.
- While the statistical results from the analysis done in this study are powerful enough to draw inferences about the magnitude of this impact, because this is a first attempt at measuring this impact, we are cautious about making definitive statements about this relationship. As stated in our analysis section, the coefficient on the GASIMPACT variable is signed negative and highly statistically significant at the 95 percent confidence level.
- For the April 2004 to March 2005 period, it suggests roughly 75 percent of increased gasoline expenditures are financed by reductions in purchases of other taxable goods and services. The remaining 25 percent of increased gasoline expenditures are financed through reductions in purchases of non-taxable goods and services.

## Conclusion & Policy Implications

- We believe this modeling approach has yielded interesting insight into the impact of rising gasoline prices on reductions in purchases of other taxable goods and services in NYS, at least in the data periods used in our analysis. We do not yet have data from the April to September 2005 periods in our sample. These periods have seen record gasoline price increases. This suggests that our study would benefit further from inclusion of these additional quarters of data in the analysis.
- We intend to revisit this work in early 2006 when this additional data become available.

### **Application to Other States With Sales Tax Imposition on Motor Fuels**

- For states with motor fuel in their state sales tax base, our study suggests there may be some net increase accruing to states from the increased gasoline prices.
- Net impact includes a reduction in State sales tax collected from other goods and services as the household budget constrains purchases of other taxable goods and services. We have estimated this effect, in NYS, at roughly a \$33 million offset to the \$44 million increase in State sales tax collected from motor fuel during the April 2004 to March 2005 collection period.
- Implications of this finding for the six other states which include gasoline in their sales tax base are less clear. These states likely have different sales tax bases than NYS's tax base. Therefore, impacts from increased gasoline sales, resulting in reductions in consumption of other goods and services, may differ across states. That is, composition of this reduction between taxable and non-taxable goods and services may differ.

### **Application to Other States Without Sales Tax Impositions on Motor Fuels**

- For states without motor fuel in their sales tax base, our study suggests the net fiscal impact is unambiguously negative.
- As increased gasoline sales draw increasing shares of household budgets, less spending power will be available to purchase other goods and services — both taxable and non-taxable in that state.