



# Economics & Financial

## FY21-22 Fourth Quarter

### The Florida Department of Financial Services



March 24<sup>th</sup>, 2022

#### Gasoline and Federal Funds Rate Hike Impacts on Florida GDP

A ¼% hike in gasoline prices, equivalent to \$0.01 (at an average of \$4.00 per gallon for gasoline) sets Florida GDP back by an estimated \$710.4 million. A ¼% federal funds rate hike sets Florida GDP back by an estimated \$590.5 million.

A \$0.0025 hike in gasoline sets GDP back by \$177.6 million, while the same \$0.0025 in rates (=¼% \* \$1,00) sets GDP back by the estimated \$590.5 million.

#### Gasoline and Florida GDP

Gasoline has been the focal point for months regarding its impact on Consumer Price Indices All Urban Consumers (CPI-U). However, there is more to gasoline than price inflation for consumers, hence this attempt to define a production function including gasoline. A production function relates physical inputs, such as labor and capital, to output or the production of goods. Production functions are estimated to create a framework in which to distinguish how much of economic growth to attribute to changes in factor allocation (for example, the accumulation of physical capital) and how much to attribute to advancing technology.<sup>1</sup>

The following format was used:<sup>2</sup>

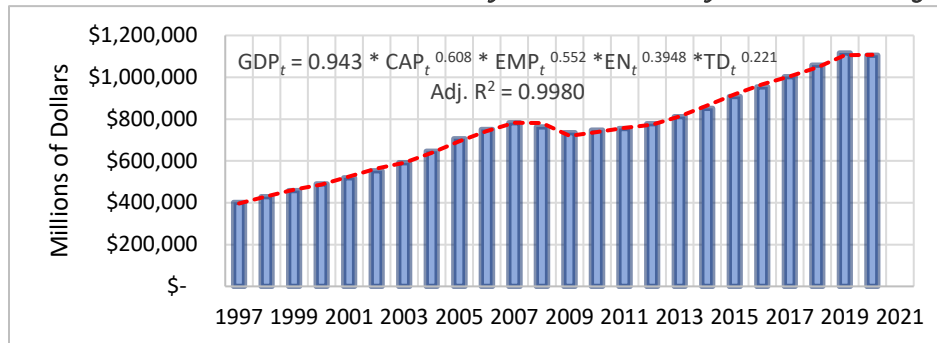
$$GDP_t = \alpha CAP_t^\beta EMP_t^\gamma EN_t^\delta TD_t^\epsilon$$

which when applied delivers:<sup>3</sup>

$$GDP_t = 0.943 CAP_t^{0.608} EMP_t^{0.552} EN_t^{0.3948} TD_t^{0.221} \quad \text{Adj. } R^2 = 0.998$$

Which is depicted in Figure 1. The blue bars represent actual Gross Domestic Product: All Industry Total in Florida data, and the dashed red line represents the estimate based on the Production Function.

Figure 1. Gross Domestic Product: All Industry Total in Florida, years 1997 through 2020.



<sup>1</sup> One formulation is:  $Q = \alpha_0 X_1^{\alpha_1} X_2^{\alpha_2} \dots X_n^{\alpha_n}$

in which:  $\alpha$  is the so-called total factor productivity,  $Q$  is output, and  $X$ 's are the factors of input (such as capital, labor, land or raw materials).

<sup>2</sup>  $CAP$  is allocation of capital,  $EMP$  is employment,  $EN$  is energy in case gasoline, and  $TD$  is a measure of efficiency or technological advances.

$GDP_t$	0.943	$CAP_t^{0.608}$	$EMP_t^{0.552}$	$EN_t^{0.3948}$	$TD_t^{0.221}$
$t$ Stat	-0.1040	6.1414	7.6364	6.4938	1.8474
$P$ -value	0.9183	6.6600E-06	3.3207E-07	3.1972E-06	0.0803

GDP: U.S. Bureau of Economic Analysis, Gross Domestic Product: All Industry Total in Florida [FLNGSP], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/FLNGSP>.

CAP: U.S. Bureau of Economic Analysis, Current-Cost Depreciation of Fixed Assets: Private [M1PTOTL1ES000], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/M1PTOTL1ES000>.

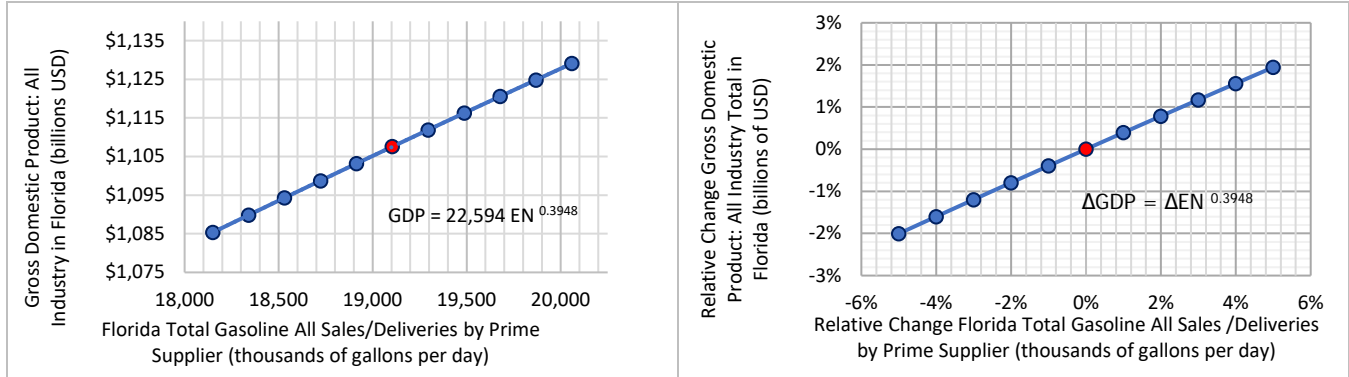
EMP: U.S. Bureau of Labor Statistics and Federal Reserve Bank of St. Louis, All Employees: Total Nonfarm in Florida [SMU12000000000000001A], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/SMU12000000000000001A>.

EN: Energy Information Administration, Florida Total Gasoline All Sales/Deliveries by Prime Supplier (Thousand Gallons per Day), retrieved from EIA, [http://www.eia.gov/dnav/pet/pet\\_sum\\_mkt\\_dcu\\_sfl\\_m.htm](http://www.eia.gov/dnav/pet/pet_sum_mkt_dcu_sfl_m.htm). (N.B. Gasoline is taken as a variable representing energy use. When oil prices go up all energy prices go up in a concerted fashion limiting energy sales).

TD: proxy for tech. development or efficiency using a rate induced regression on GDP, e.g.,  $TD = C_{t-1} * (1 + \frac{r}{100})$ ;  $C_0$  and  $r$  estimated using OLS.

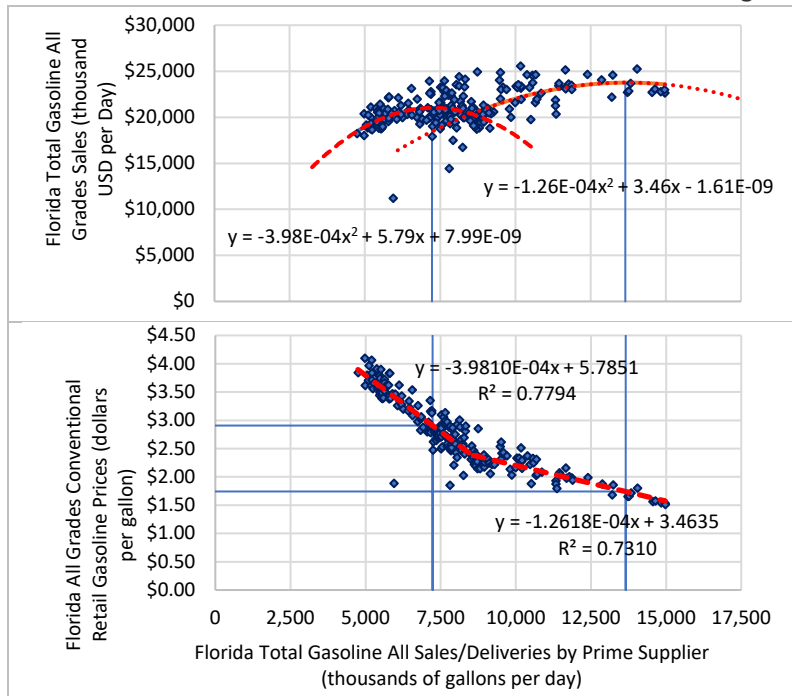
Subsequently, this model is used to apply small variations in gasoline and the resulting changes in Florida GDP. The red dot represents the positions during 2020.

**Figure 2. Production Function Based Absolute and Relative Changes on GDP All Industries in Florida.**



It may be taken from the figures that a 1 percent change (for example a decline in total gasoline sales) results in a decline of Florida GDP at a rate of 0.3948 percent. For a price relation, we need an additional Price-Demand or Sales function, as shown at the bottom of Figure 3.<sup>4</sup> The obvious interruption in the Price-Demand series may be a structural change as it can be dated to approximately 2016, when production of oil and gas extraction (NAICS 211) in Florida suffered a significant downturn or adjustment.

**Figure 3. Florida All Grades Conventional Retail Gasoline, June 2003 through December 2021**



Price anelasticity of demand in the lower segment is calculated at \$1.74 at a volume of 13,656 Gallons per Day (GpD). The drawn lead line from \$1.74 at 13,656 GpD to the top figure lands at the maximum of the drawn parabola, representing maximum revenue. Price anelasticity of demand for the upper segment is \$2.91 at a volume of 7,229 GpD; in the same place a lead line

<sup>4</sup> Sales = q \* p (q = quantity, p = price)

Price elasticity of demand is (with cause always in the denominator):  $E_d = \frac{\text{relative change } q_d}{\text{relative change } p_d}$

If Elasticity of demand is equal to -1 (Anelastic), then a 1% rise in price would result in a 1% drop in demand (and vice versa)

When the elasticity of demand is seen to be Inelastic (i.e.,  $-1 < E_d < 0$ ): 1) an increase in p causes a reduction in q, but an increase in revenue, and 2) a decrease in p causes an increase in q, but a decline in revenue.

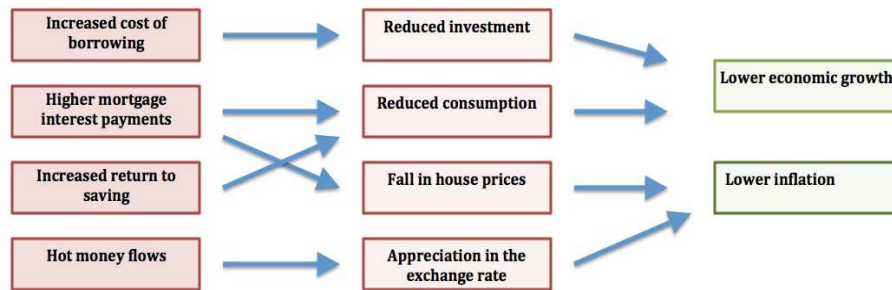
When the elasticity of demand is said to be Elastic (i.e.,  $E_d < -1$ ): 1) an increase in p causes a reduction in q, and a decrease in revenue, and 2) a decrease in p causes an increase in q, and an increase in revenue.

from this position in the lower figure will match with the maximum of the parabola on the left hand side in the upper figure. From both positions mentioned, increasing prices will lead to reduced revenues due to price elastic conditions on demand. In tying the Production function and Price-Demand function together, it may be surmised that an increase of 1 percent in gasoline prices, for instance from \$4.00 to \$4.04, will result in lower sales at minus 100,478 GpD (the equivalent of minus 0.53 percent of total GpD), which in turn lowers GDP by 0.21 percent. Ceteris paribus (all things being equal or considered unchanged), a sustained \$0.20 higher price on gasoline will set back Florida's' GDP growth by approximately 1 percent.

**Federal Funds Rate Hike**

The Federal Open Market Committee of the Federal Reserve decided to raise the target range for the federal funds rate to ¼ to ½ percent.<sup>5</sup> “Changes in the federal funds rate trigger a chain of events that affect other short-term interest rates, foreign exchange rates, long-term interest rates, the amount of money and credit, and, ultimately, a range of economic variables, including employment, output, and prices of goods and services.”<sup>6</sup> Likewise, the hike will have an impact on Florida GDP (as well as on the GDP of other states). Various effects of higher interest rates are depicted in Figure 4.<sup>7</sup>

**Figure 4. Effects of Higher Interest Rates**



Instead of making an inventory and analyzing all of the relations above, here it is assumed that all decisions are the same as in the last period (*i.e.*, year) assuming Ceteris Paribus (*i.e.*, small changes while everything else remains the same; same incomes, same unemployment, same expectations, etc.), except for the target fed rate as mentioned. Hence, the following function is used:

$$G\dot{D}P_t = \alpha + \beta [ \ln(GDP_t) - \ln(GDP_{t-1}) ] + \gamma [ \ln(r_t) - \ln(r_{t-1}) ] + \varepsilon_t$$

which when applied, delivered:<sup>8</sup>

$$G\dot{D}P_t = (1.23E - 04) + 1.0058 [ \ln(GDP_t) - \ln(GDP_{t-1}) ] - (6.13E - 4) [ \ln(r_t) - \ln(r_{t-1}) ] \quad adj. R^2 = 0.99911$$

Based on the results two calculations were made, with slightly different outcomes. One using the additive capacity of the function only looking at changes regarding the third variable or interest, and the second based on the full equation, where both are related to the last datapoint on GDP available, namely \$1,227.0 billion on October 10, 2021, as well as an estimated \$1.353.1 billion on April 1, 2022. The direct and momentarily effect of the federal funds rate hike to ¼ to ½ percent is that the hike results in a growth set back of -0.0425 and -0.0436 percent. In GDP, this equates to a setback of \$521.3 and \$535.4 million. Once related to the estimated GDP as of April 1, 2022, the ante is upped to \$574.9 and \$590.5 million, respectively. Instead, had the federal funds rate hike been to ½ to ¾ the setback would have been to the order of \$911.2 and \$926.8 million, respectively (based on GDP estimate as of April 1, 2022). That said, we do not live in a static world. The moment of “freeze”

<sup>5</sup> Federal Reserve press release, March 16<sup>th</sup>, 2022. Retrieved from: <https://www.federalreserve.gov/monetarypolicy/files/monetary20220316a1.pdf>

<sup>6</sup> Federal Open Market Committee, see <https://www.federalreserve.gov/monetarypolicy/fomc.htm>

<sup>7</sup> Figure from Economics Help, Helping to Simplify Economics. Retrieved from: <https://www.economicshelp.org/macroeconomics/monetary-policy/effect-raising-interest-rates/>

“Hot money” refers to funds that are controlled by investors who actively seek short-term returns. These investors scan the market for short-term, high interest rate investment opportunities.

<sup>8</sup> In which:  $G\dot{D}P_t$  is relative change in GDP Q-to-Q,  $r$  is interest,  $\alpha$ ,  $\beta$  and  $\gamma$  coefficients and  $\varepsilon$  the error term with observation count  $n=66$ . All data from 1997 through 2021-07-01.

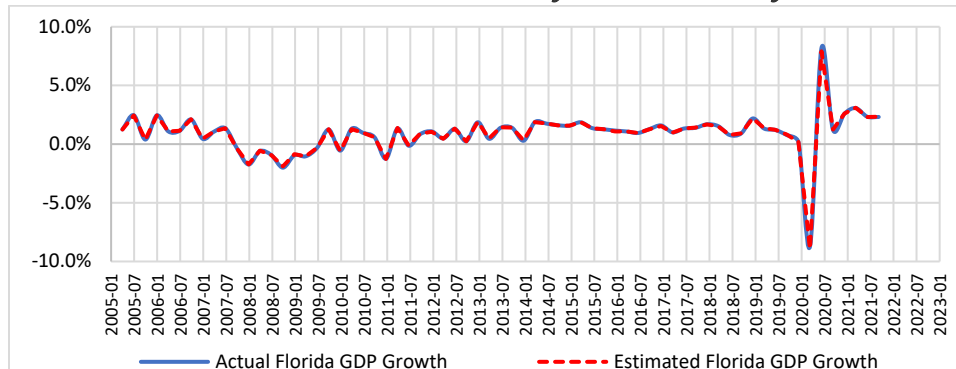
$G\dot{D}P_t$	Intercept	$[\ln(GDP_t) - \ln(GDP_{t-1})]$	$[\ln(r_t) - \ln(r_{t-1})]$
<i>t Stat</i>	1.5177	211.1605	-4.2265
<i>P-value</i>	0.1341	1.62E-91	7.81E-05

GDP: U.S. Bureau of Economic Analysis, Gross Domestic Product: All Industry Total in Florida [FLNGSP], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/FLNGSP>.

$r$ : Board of Governors of the Federal Reserve System (US), Federal Funds Effective Rate [FEDFUNDS], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/FEDFUNDS>.

takes only a second, as people do and will continue their business as usual, with subsequent actions as well as expectations, all subject to the machination of markets doing their part, will dilute this impact. In short, the second variable in the function above will weigh in and may catch up/overcome the setback (if not, it may be a trigger to a self-inflicted recession).<sup>9</sup>

**Figure 5. Actual versus Estimated Growth GDP: All Industry Florida, Quarterly, 2005:Q1 through 2021:Q3.**

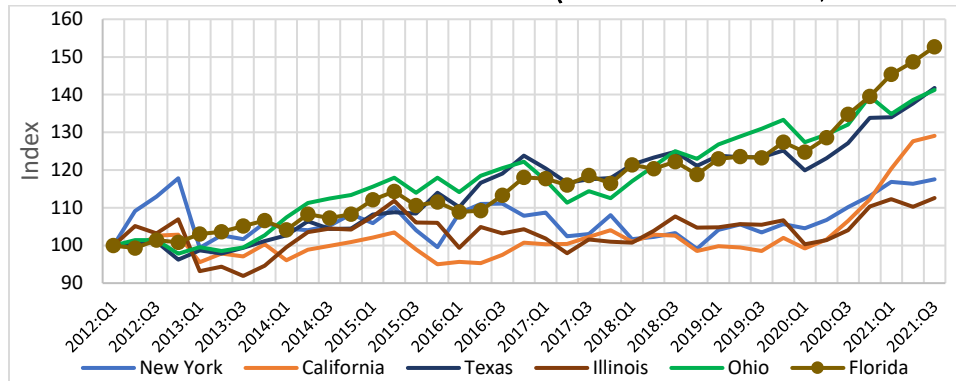


**States Ranking and Growth in Finance and Insurance**

Here, we used concentration ratios to quantify market concentration based on states' market shares in the Finance and Insurance industry.<sup>10</sup> The CR<sub>4</sub> and CR<sub>8</sub> concentration ratios are commonly used.

The CR<sub>4</sub> includes the states of New York, California, Texas, and Illinois, and represents 41.7 percent of GDP in the Finance and Insurance market. The CR<sub>8</sub>, includes the states of Ohio, Florida, Massachusetts, and Pennsylvania, and when added to the CR<sub>4</sub> represent 57.0 percent of industry GDP. Both indicate a low to medium concentration (from perfect competition to a market being dominated by a small number of states each with significant market shares). The same is seen in the Herfindahl-Hirschman Index (HHI), which scores 0.067, indicating an unconcentrated industry. Hence criteria differ, and while size does matter, growth is a different metrics leading to Figure 6. Florida, ranked fifth in size, is clearly the runner up, with the highest growth since 2012. Interesting is the emerging growth gap between Florida, Texas, and Ohio on the one hand and California, New York, and Illinois on the other.

**Figure 6. Index Real GDP Finance and Insurance (Chained 2012 dollars; 2012:Q1=100)**



Source: BEA

<sup>9</sup> N.B. The gasoline and rate hike issues with respect to Florida GDP comparatively; a ¼% hike in gasoline prices i.e. \$.01 (at an average of \$4.00 for gasoline) sets Florida GDP back by an estimated \$710.4 million, a ¼ federal funds rate set Florida GDP back by an estimated \$590.5 million. Alternately, a \$.0025 hike in gasoline sets GDP back by \$177.6 million, while the same \$.0025 in rates (=1/4% \* \$1,00) sets GDP back by the estimated \$590.5 million).

<sup>10</sup> Concentration ratios are calculated as follows:  $CR_n = C_1 + C_2 + \dots + C_n$ , and  $HHI = C_1^2 + C_2^2 + \dots + C_n^2$   
 Where:  $C_n$  defines the market share of the  $n^{th}$  largest state in Finance and Insurance as a percentage of total industry market share.  
 $n$  defines the number of States included in the concentration ratio calculation.

