APPENDIX

Figure 1. Nominal GDP and Adjusted Gross Income are highly correlated

Correlation	GDP	AGI
GDP	1	0.97
AGI	0.97	1

Source: BEA and IRS

For all the Illinois data used in this report, the sample period is 1976 to 2017. Data on nominal GDP were collected from the Bureau of Economic Analysis. Data for inflation were taken from the Bureau of Labor Statistics regional consumer price index. Data for unemployment rates were also collected from the BLS.

The yearly change in GDP in state s has been measured by:

$$\Delta GDP = \frac{GDP_t^s}{GDP_{t-1}^s} - 1$$

Where ΔGDP is the change in GDP between time t and $t-1$.

Several authors (Robertson and Tallman, 1999) have suggested that a vector autoregression (VAR) model is the most accurate for forecasting GDP growth.

Forecasts are made one-step-ahead (horizon $t+1$) and iterates forward. The first forecast for $t+1$ is based on the primary estimated parameters and the information available at time t. Then the updated estimated parameters are used to make one-step-ahead forecasts for the desired number of periods, until $t+h$. A one-step horizon $(t+1)$ show that the forecast is made for one year ahead. Forecasts are performed for horizons up to $t+4$, which is 4 years ahead. Forecasts start in 2017 and end in 2020. The performance of the forecast has been evaluated by a comparison of real observed GDP and forecasted values between 2016 and 2017.

Similar to Marcellino, Stock and Watson (2003) a three variable VAR model is used. This model also uses GDP, unemployment and inflation. Adding more variables does not necessarily give better results since simple models are frequently only marginally less precise than forecasts made by complex models.

We use a reduced form of VAR to forecast future values of GDP. A reduced VAR model express each variable used for the forecast as a linear function of its own historical values. This way all previous data for all the variables are taken into account and the error term is said to include all omitted variables that affect a change in GDP. The error term is said to explain shocks and other unexpected movements in the variables that occur when previous values are taken in to account (Stock & Watson, 2001).

$$GDP_{1t} = \alpha + \beta_1 GDP_{t-1} + \beta_2 GDP_{t-2} + \beta_j GDP_{t-j} + \gamma_1 P_{t-1} + \gamma_2 P_{t-2} + \gamma_j P_{t-j} + \delta_1 UN_{t-1} + \delta_2 UN_{t-2} + \delta_j UN_{t-j} + \mu_t$$

Which implies:

$$GDP_{1t} = \alpha + \sum_{j=1}^{k} \beta_j GDP_{t-j} + \sum_{j=1}^{k} \gamma_j P_{t-j} + \sum_{j=1}^{k} \delta_j UN_{t-j} + \mu_t$$

Where β, γ, δ are coefficients that represent the contributions of each variable to GDP. Two other similar equations, which set P_t and UN_t as dependent variables complete the model setup. We choose four lags after the Akaike and Schwarz criterions (Gujarati, 2004).

Figure 2. VAR model accurately predicts past GDP growth
Actual and forecasted GDP, 2011-2020 (dollars in millions)