Iowa Leading Indicators Index: Twelfth Annual Assessment and Update

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In 2006, the Iowa Department of Revenue (IDR) created the Iowa Leading Indicators Index (ILII) as a tool to predict turning points in Iowa employment. By foreshadowing changes in the level of employment, which is closely linked to the level of individual income tax and sales tax receipts, the ILII also provides a signal of changes in these major revenue sources for the State. IDR has issued monthly ILII reports since the start of fiscal year (FY) 2007 and posted the reports on the IDR website. During FY 2018, the ILII exhibited three months with negative changes and nine months with positive changes, ending up 1.5 percent from the end of FY 2017. Employment increased the last eight months of the year, with the gains ranging from 0.04 to 0.11 percent and averaging 0.06 percent per month. Coinciding with the steady employment growth, State tax receipts increased a healthy 5.2 percent during FY 2018.

Annually, the IDR assesses how well the ILII has met the goals underlying its development, gauges the validity of the existing components, considers any additional components that may have been suggested in the past year, and carries out the necessary annual updates. This paper documents the eleventh annual assessment and update to the index. A step-by-step presentation of how the ILII is computed can be found in appendix A. The calculation of the diffusion index is discussed in appendix B.

Assessment of the Iowa Leading Indicators Index for Fiscal Year 2018

During FY 2018, the ILII increased from 107.3 in July 2017 to 108.7 in June 2018 (see Figure 1). The ILII experienced positive changes during the first seven months of FY 2018 and then experienced two consecutive months of negative change. In the final quarter, the index experienced both no change and negative changes. The annualized six-month percentage change began the fiscal year at 1.13 percent in July 2017, peaking at a nearly seven year high of 3.36 percent in January 2018, before steadily decreasing to -0.28 percent in June 2018. Strength in the index seen throughout the year was fairly widespread, with the monthly diffusion index remaining at or above 50.0 for the first seven months, peaking at 93.8 in October 2017. The non-farm employment coincident index, the 12-month moving average of non-seasonally adjusted, non-farm employment, experienced its first stretch of three consecutive months of decreases (July 2017 – September 2017) after seven years of continuous growth. However, these negative changes were reported with the 2017 revisions to state employment series released in March 2018; those monthly reports reported employment gains that was released by the Bureau of Labor Statistics at the time.

Between 1999 and 2018, the index signaled a contraction twice, from December 2000 through September 2001 and from August 2008 through November 2009. The initial contraction signals were followed by declines in employment stretching from July 2001 through December 2003 and November 2008 through October 2010, respectively.[1]

[1] December 2006 through February 2007 also meet the metrics of a contraction signal, but only in retrospect after seven years of data revisions. At the time of those reports, the index changes did not meet the metrics.

During 2017, the most recent annual data available, Iowa gross domestic product (GDP) decreased for the first time in eight years.[2] Iowa real GDP decreased an estimated 0.2 percent in 2018 (see Figure 2). Real personal income in Iowa decreased 1.1 percent in 2017 after an estimated 2.0 percent decrease in 2016 (see Figure 2). It is difficult to gauge the ability of the monthly ILII to signal changes in either state GDP or state personal income because these series are released infrequently, annually and quarterly respectively, and are subject to major revisions. Therefore the ILII is compared, on a monthly basis, to non-farm employment in Iowa, as reported by the Bureau of Labor Statistics. However, another test of the usefulness of the ILII is to compare movements in the index to the level of State General Fund revenues (see Figure 3). Iowa real receipts are measured using the 12-month moving average of individual, sales and use, corporation, inheritance, insurance premium, and franchise receipts, all adjusted using the Consumer Price Index (CPI) to 2016 dollars. This measure of real receipts experienced growth in FY 2018 with an increase of 2.8 percent. Weakness in the agriculture economy in late FY 2015 into FY 2016 was partially responsible for the drop in individual final returns for tax year 2016 realized in FY 2017. The other significant drag on FY 2017 revenues was weak sales and use tax revenues. FY 2018 revenues gains were the strongest in four fiscal years with strength in individual income and sales and use tax driving the gains. Those gains were partly in response to federal tax reform in late 2017 and decreases in federal withholding in early 2018.

Although IDR forecasts all sources of revenue for the State, the ILII is best suited to signal the future direction of taxes on employment and wages, or individual income tax revenues. Individual income taxes comprise over 50 percent of State General Fund receipts. Net

[2] Recently BEA has developed a quarterly State GDP series with estimates beginning in 2005.

individual income tax revenues are measured as the 12-month moving average of withholding plus estimate payments plus final return payments minus refunds, all adjusted to 2016 dollars using the CPI (see Figure 4). The initial drop in individual income tax revenues in 1999 reflects the individual income tax cut implemented during the 1998 tax year. Individual income tax revenues were strong in the spring of 2000, but fell in 2001 and 2002 with the national recession. Revenues began to rise again in 2004 and remained relatively strong through 2008, with a slight dip in 2005 and 2006. Net individual income tax revenues turned down in February 2009, following the ILII drop that started in April 2008. Revenues began to rise steadily in 2012 with a sharp jump in April reflecting behavioral changes pushing income into tax year 2012 resulting from federal tax law effective in tax year 2013. As expected, revenues reversed one year later, but the weakness continued through the end of fiscal year 2014 pulled down by estimate payments. Fiscal year 2015 saw a steady increase in revenues as estimate payments recovered and withholding experienced steady gains. Fiscal years 2016 and 2017 experienced weaker growth in revenue for the State of Iowa as dropping farm income dragged down final payments and withholding experienced weak growth. The State of Iowa experienced stronger growth in revenue during FY 2018 with a jump in estimate payments in December 2017 as taxpayers reacted to federal tax law changes effective in January as well as strong withholding gains, in part reflecting the drop in federal withholding in 2018.

The main goal for the creation of the Iowa Leading Indicators Index in 2006 was to serve as an additional tool for predicting the direction of the State economy. Indeed, the ILII began to decline in April 2008 and showed a contraction signal in August 2008. Three months later, the Iowa non-farm employment index began to show declines, following the path of the

slowing national economy. The index reached a bottom in September 2009, and then moved out of recession signal territory in November 2009, suggesting that the Iowa economy would see employment gains by mid to late summer. Those gains did not materialize until fall 2010, but employment has continued to rise in all but three months since October 2010, following the positive changes in the index. Overall, results over the past 12 years demonstrate that the ILII is a helpful tool in predicting the direction and turning points in Iowa non-farm employment.

A final comparison between the ILII and the National Leading Economic Indicators (LEI) produced by The Conference Board is presented (see Figure 5). The two series moved similarly between 1999 and 2005, the ILII dipped during the middle of the 2000's while the LEI bounced between positive and negative changes. The two series dived prior to the Great Recession, although the LEI started its drop in April 2007 (with the national recession starting in late 2007) while the ILII started to drop in February 2008 (with Iowa employment dropping in late 2008). Both series signaled a recovery, with the LEI logging strong positive gains beginning in April 2009 and the ILII in October 2009. While the ILII continued to post strong increases through April 2011, the LEI had more muted changes in April 2010. Both series showed parallel growth from 2011 through 2014, except for a small dip in the LEI during the middle of 2012. During FY 2015 the series experienced a dramatic divergence; the LEI demonstrated steady growth throughout the year finishing up 6.5 percent, with eleven positive changes and one month of no change, while the ILII had steady negative changes during the last six months of the year after weak gains and losses during the first six months finishing down 1.5 percent. During FY 2016 and FY 2017 the two series returned to correlated paths as they both experienced negative change with the ILII decreasing 1.0

percent and the LEI decreasing 0.7 percent in FY 2016 and positive change in FY 2017 with the ILII increasing 2.0 percent and the LEI increasing 4.9 percent. The ILII and LEI continued on correlated paths for much of FY 2018. The ILII did experience a three month stretch (February 2018-April 2018) where decreases in the ILII deviated from the continued increases experienced by the LEI. However, the ILII closed out FY 2018 up 1.5 percent from the close of FY 2017 while the LEI increased 5.7 percent over the fiscal year.

Validity of Existing Components

When the Iowa Leading Indicators Index was established in 2006, one method used to select components was to identify series of Iowa data that were equivalent to those used as leading economic indicators by other states and regions. This method resulted in the selection of Iowa unemployment insurance claims, average manufacturing hours in Iowa, and the new orders index for Iowa manufacturers. A second method used to select components was to identify series that predicted economic activity in the key sectors of the Iowa economy: agriculture, manufacturing, and finance. Agriculture comprised 4.5 percent of Iowa GDP in 2017, according to the Bureau of Economic Analysis. To capture the agriculture sector, an index of expected profits for producers of the four leading commodities in the state, corn, hogs, soybeans, and cattle was created. Manufacturing accounted for 18.1 percent of GDP and 14.1 percent of total non-farm employment in 2017, according to the Quarterly Census of Employment and Wage conducted by the Bureau of Labor Statistics. Along with average manufacturing hours and the new orders index, diesel fuel consumption was added to the index to measure demand for the transport of manufacturing inputs and final products within and through the state. Diesel fuel consumption also indicates demand for the production and transport of agricultural commodities. The insurance and finance sector accounted for 15.3

percent of GDP and 6.2 percent of non-farm employment in 2017. The insurance and finance sector is heavily represented in the Iowa stock market index, created as another component for the index.

During the development of the ILII, all potential indicators were weighed against six desired attributes of leading indicators that are known as the Moore-Shiskin criteria:

1. conformity – series must conform well to the business cycle
2. consistent timing – series must exhibit a consistent timing pattern over time as a leading indicator
3. currency – series must be published on a reasonably prompt schedule and not be subject to major revisions
4. economic significance – cyclical timing of the series must be economically logical
5. statistical adequacy – data must be collected and processed in a statistically reliable way
6. smoothness – month-to-month movements in the series must not be too erratic.

Continuing the success of the prior eleven years, during fiscal year 2018 the ILII generally continued to exhibit all of these attributes. During 2018, the index demonstrated positive signals in nine months while the non-farm employment coincident index, the 12-month moving average of non-seasonally adjusted, non-farm employment, experienced consistent growth in the final eight months of the year. Should the index continue to demonstrate conformity and consistency, its signals suggest employment growth will slow into the fall.

Over the 12 months of FY 2018, six of eight components experienced gains (see Table 1). The largest positive contribution was made by the new orders index which added 0.57 points to the index between June 2017 and June 2018 and was a positive contributor nine months during FY 2018. The other positive contributors over the fiscal year were the Iowa stock market index, diesel fuel consumption, average weekly manufacturing hours, average weekly unemployment claims (inverted), and the agriculture future profits index (AFPI). Building permits was the largest negative contributor to the ILII in 2018. The national yield spread was the other negative contributor. With a majority of components and the ILII demonstrating positive signals in FY 2018 leading the positive growth in Iowa employment seen over the last three quarters of FY 2018, the ILII continues to demonstrate consistent timing with economic activity.

Nothing in the past twelve months has changed opinions about the economic significance of the eight components as all continue to logically lead the economic cycle. Views about the statistical adequacy of the data are unchanged as sources for all the data series continue to be reliable.

Currency of the ILII's components proved to be reliable for almost all components during FY 2018. Seven of the eight components were available within four weeks after the close of the month for all months except January. In that month, labor force data including average manufacturing hours and non-farm employment were delayed by several weeks because the Bureau of Labor Statistics (BLS) was undertaking its annual benchmarking. Along with the annual benchmarking, the prior month value for average weekly manufacturing hours was revised nine times in FY 2018. Despite the noted revisions to the average weekly

manufacturing hours, the index itself experienced revisions once in FY 2018 (May) driven by revised historical grain breakeven prices.

Assessments of the components' smoothness did not change with the additional 12 months of data. The standard deviation of month-to-month changes in the components (measured using 12-month moving averages for all but the yield spread and stock market index) decreased for seven of the eight components including the agricultural future profits index, average weekly manufacturing hours, average weekly unemployment claims (inverted), diesel fuel consumption, the Iowa stock market index, the new orders index, and yield spread; all changes were small (see Table 2). The ILII is computed by weighting changes in the individual series by the standardization factors, calculated as the inverse of the standard deviation, normalized across all the components to one (see Appendix A). Updates to the standardization factors accounting for the observed volatility during FY 2018 suggest the factors for all components will not change much. Four components experienced small declines in standardization factors, with the largest decline being 2.9 percent for the Iowa stock market index. The other four components experienced small positive increases. The ranking of the standardization factors among the components experienced no change from FY 2017 to FY 2018. The final standardization factors will be computed after any individual component updates are completed.

An additional way to consider sensitivity is to focus on six-month percentage changes in the index and six-month diffusion index values under various modified versions of the index where, in each case, one of the eight components is excluded (see Table 3). Following The Conference Board, who publishes the national Leading Economic Indicators after which the

ILII was modeled, a contraction signal is the point when the annualized six-month percentage change declines by over two percent and the six-month diffusion index falls below 50.0.[3] The six-month changes to the ILII remained in positive territory for the first 11 months of FY 2018 independent of the signal from all components. In June 2018, the six-month annualized percentage change was in negative territory independent of all components as well. Strength in the index was fairly well distributed amongst all components throughout FY 2018. Without either national yield spread or the residential building permits component, the diffusion index would have consistently registered at 85.7 or higher for 6 of the 12 months and would have increased in 11 of the 12 months.

Updates for the Twelfth Year

Given that the original eight components continue to meet the Moore-Shiskin criteria, no new components were added. Two major steps were taken to prepare the ILII for FY 2019. First, one stock was removed from the Iowa stock market index. Second, the annual update to the agricultural futures profits index incorporating 2017 cash farm income was completed. As always, the standardization factors for the ILII were updated, incorporating the variability of the last year and causing a revision to the entire history of the ILII.

Updates to the Iowa Stock Market Index

During FY 2018, Bayer and Monsanto concluded a merger resulting in Monsanto becoming a subsidiary of the much larger German conglomerate of the Bayer brand and thus no longer

[3] The -2.0 percent annualized decline was the threshold for a recession signal prior to the 2001 revisions to the National Leading Indicators Index. At that time, The Conference Board moved to forecasting several of the components in the index, those not available until more than three weeks after the close of a month. With those revisions, the threshold for a recession signal was lowered to -3.5 percent. However, because the ILII relies on actual data series, the -2.0 percent threshold is still used.

meets the characteristics of stocks included in the Iowa stock market index. The Iowa stock market index now contains values for 34 Iowa-based companies or companies with a significant Iowa presence. Twelve of those companies are in the finance and insurance sector, seven are durable manufacturers, and two are nondurable manufacturers. The others include three utilities (electricity and telecommunications), three energy companies (gas stations and ethanol production facilities), two publishers, one fertilizer company, one biopharmaceutical company, one transportation company, one technology company, and now only one chemical company.

Removing Monsanto increased the value of the stock market index by approximately 1.9 points on average in recent years. The Iowa stock market index is standardized to an average value of 100 for the 1984-1986 period; with the removal of a stock (where the values of all stocks are extrapolated back to the earliest date based on the first capitalization value observed), the total valuation for that period decreased. When the value for the base period falls, the entire index increases once it is standardized by dividing by the lower base. The monthly variability of the Iowa stock market index also increased with the removal of the significant value associated with Monsanto, making variations in the smaller stocks more evident. However, the average change in the level of the Iowa stock market index dropped slightly over the entire history.

Corresponding with the noticeable change in the monthly values and the decrease in historic monthly changes seen in the Iowa stock market index, the update to the component resulted in an average downward shift in the level of the ILII of 0.4 points over the last six months.

Updates to the Agricultural Futures Profits Index

The AFPI requires annual updates to the index to account for newly available data on the distribution of annual cash receipts among the four commodities in the index and to incorporate the last 12 months of data in the standardization factors used to weight the index. Additionally, in some years, updated historical breakeven costs for corn and soybeans are incorporated. Because those updates were incorporated in June 2018, none of the changes reported here reflect that step.

Each fall annual cash receipts for various farm commodities in Iowa for the previous calendar year are released by the Economic Research Service of the U.S. Department of Agriculture. The distribution of cash receipts between the four commodities included in the AFPI is used to weight the four profits series in the index. With the release of the 2017 cash receipts, all AFPI values for January 2017 and later were updated to reflect the distribution of farm cash receipts for calendar year 2017. In 2017, total farm cash receipts for Iowa increased 0.6 percent over 2016 with hog receipts increasing 9.3 percent and cattle receipts rising 7.6 percent. In contrast to livestock receipts, Iowa's crop receipts experienced negative growth. Soybean receipts fell 12.8 percent, while corn receipts decreased 3.6 percent compared to revised numbers for 2016. The declines in crop receipts reflected continued weakness in prices.

In response to the noted changes, the distribution of cash farm income between the four commodities shifted predictably for 2017. The corn share of cash receipts between the four commodities decreased from a revised 34.2 to 33.3 percent and the soybeans share decreased from a revised 24.1 to 21.2 percent. The hog share increased from a revised 26.4

to 29.0 percent and the cattle share increased from a revised 15.3 to 16.6 percent. These revisions to the annual agriculture shares result in the 10-year rolling average to decrease the corn shares from 38.2 percent to 37.8 percent and soybean shares from a revised 21.7 percent to 21.5 percent, while livestock shares increased from a revised 25.8 percent to 26.3 percent for hogs and from a revised 14.3 percent to 14.4 percent for cattle. Incorporating the updated income shares into the AFPI did not change the values of the component for the last six months (see Tables 7 and 8).

Assessment of Update Impacts on the ILII

After updates to the AFPI and the Iowa stock market index for 2018 were completed, the standardization factors were finalized (see Table 4). Updates to the standardization factors after the component updates resulted in a considerable change from pre-update standardization factors for the Iowa stock market index. The Iowa stock market index's standardization factor decreased by 10.5 percent, indicating that removing Monsanto raised the variability of the index.

The updates to the Iowa stock market index, AFPI, and standardization factors had a noticeable impact on the level of the index going back 12 years, lowering the level an average of 0.3 points (see Figure 6). The update resulted in an average downward shift in the level of the ILII of 0.4 points over the last six months (see Tables 5 and 6). However, the monthly percentage changes and the level of the six-month annualized percentage change were unaffected during those months. The values of the components were unchanged with the exception of the already mentioned Iowa stock market index (see Tables 7 and 8).

Conclusions

The Iowa Leading Indicators Index established a good record during the recession and recovery spanning 2008 through 2014. During FY 2015 and FY 2016, the index demonstrated negative signals in nineteen months, although never reaching a recession signal, while the non-farm employment coincident index experienced growth each month during the two-year period. During FY 2017, the ILII showed positive growth in nine of twelve months with small, negative change in three months. Concurrently, the non-farm employment coincident index experienced growth during FY 2017. During 2018, the ILII demonstrated positive signals in seven months, negative signals in two months, and was unchanged for the last three months. The non-farm employment coincident index, after revisions released in early 2018, recorded three negative months in the middle of 2017 but steady growth in the final eight months of the fiscal year.

With the flat monthly values and the dip of the six-month measures into negative territory during the last month of FY 2018, the ILII signals suggest employment growth will slow into the fall. With the past success of the ILII in providing leading signals, IDR will continue to closely monitor the ILII with the hope that it will continue to inform policy makers about the direction of future economic activity and revenues in the State.

Figure 1. Iowa Leading Indicators Index and Iowa Non-Farm Employment Coincident Index: January 1999-June 2018

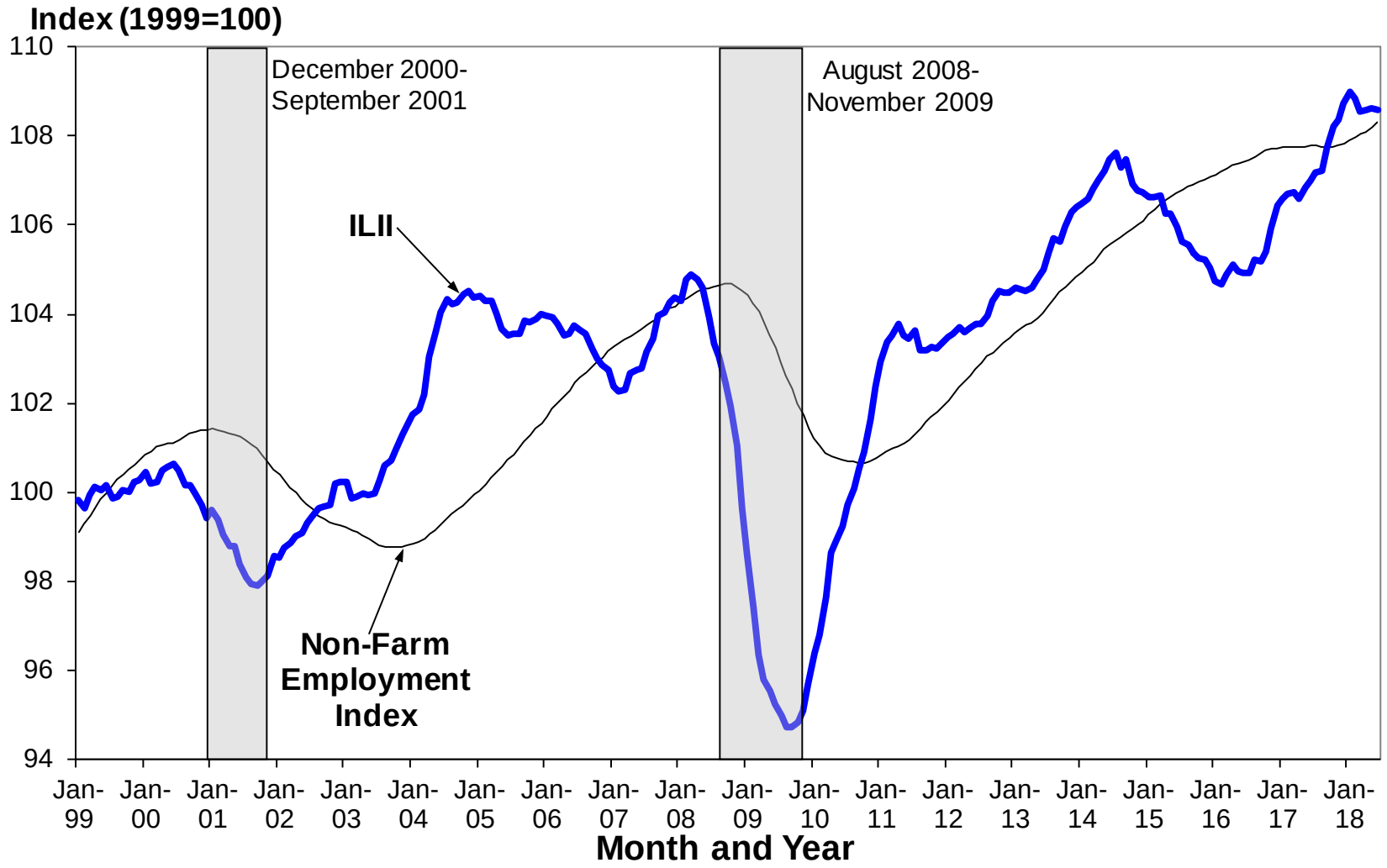

Figure 2. Iowa Leading Indicators Index, Iowa GDP, and Iowa Personal Income: January 1999-June 2018

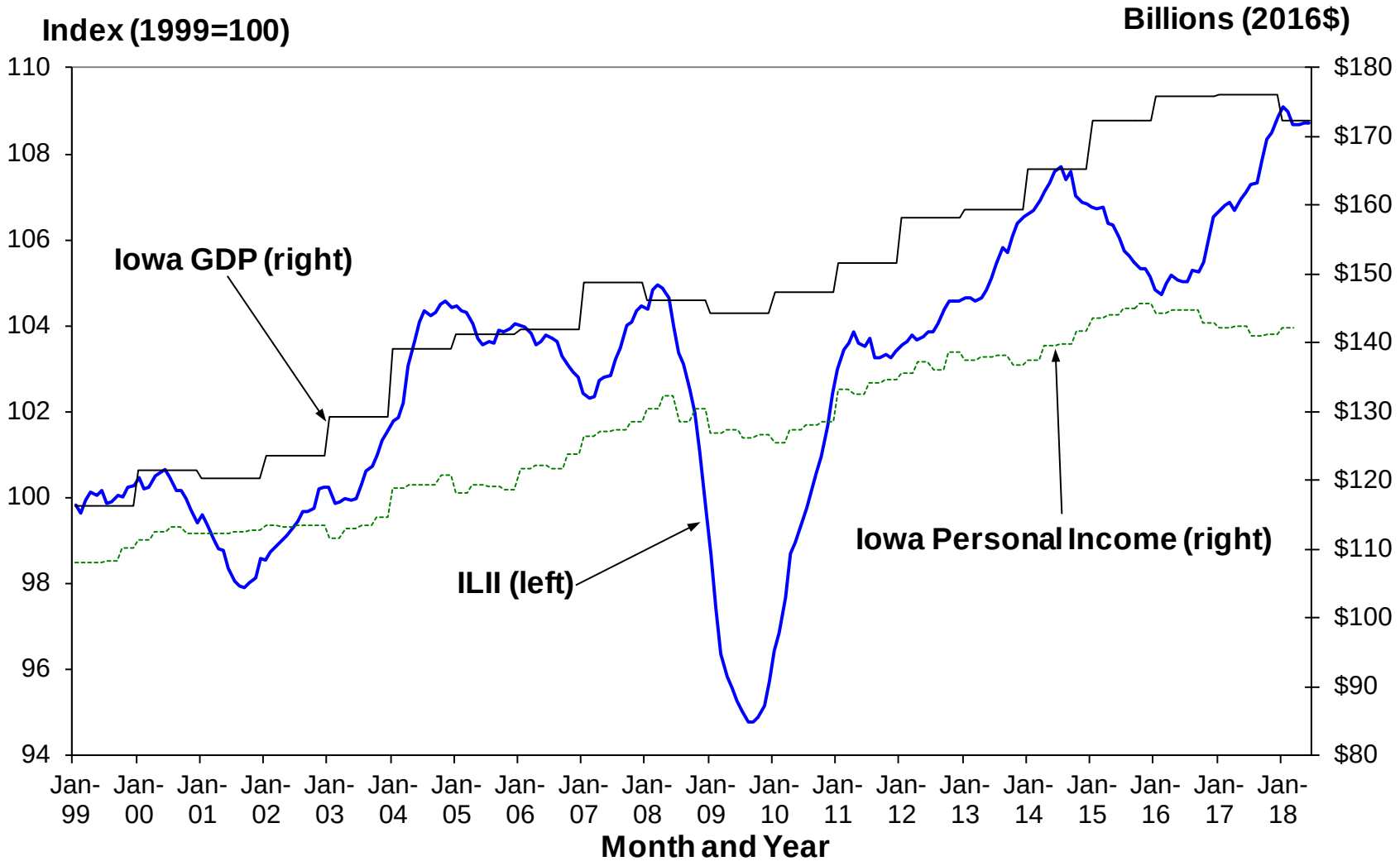

Figure 3. Iowa Leading Indicators Index and Iowa Real Tax Receipts: January 1999-June 2018

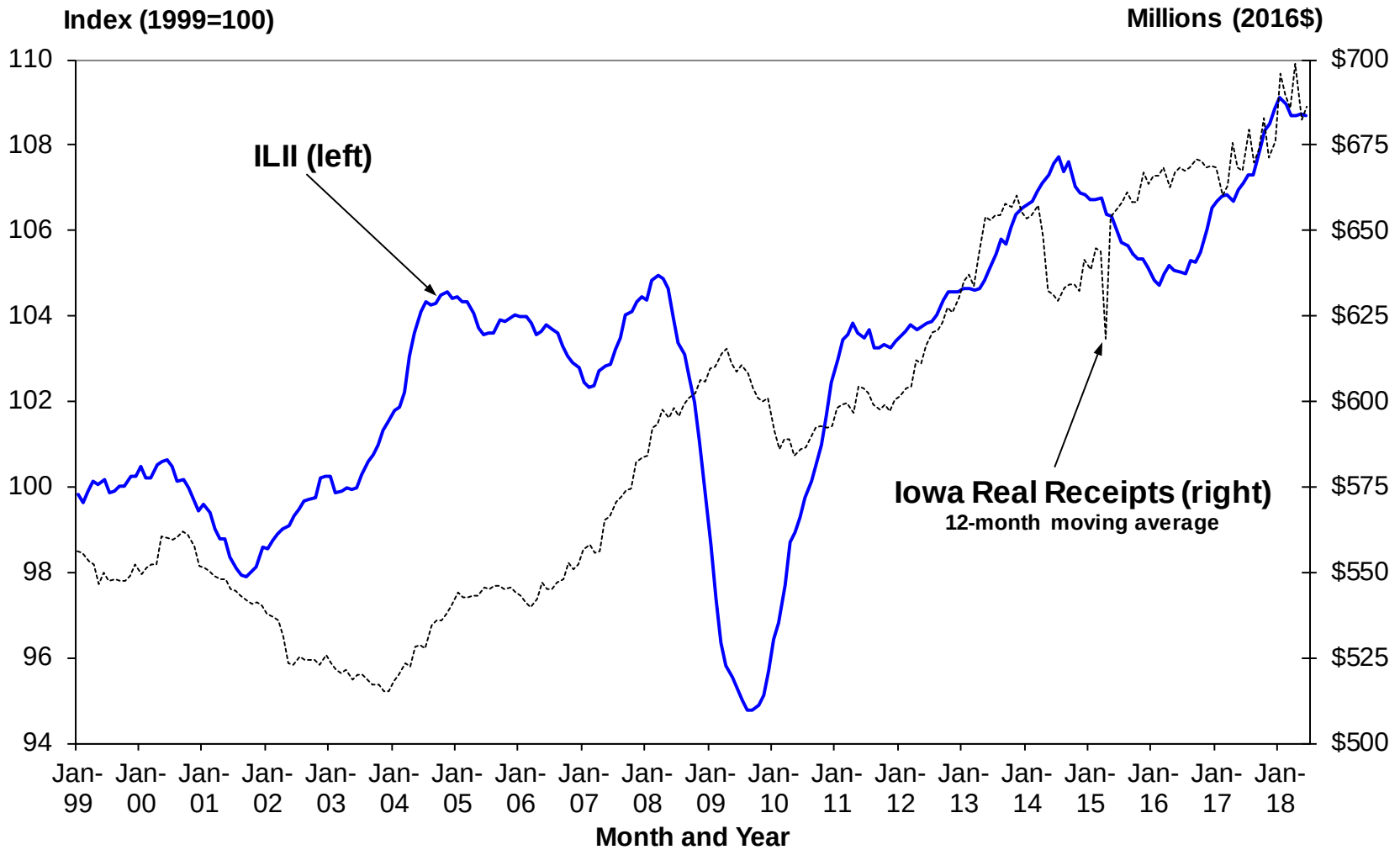

Figure 4. Iowa Leading Indicators Index and Iowa Real Net Individual Income Tax Revenues Index: January 1999-June 2018

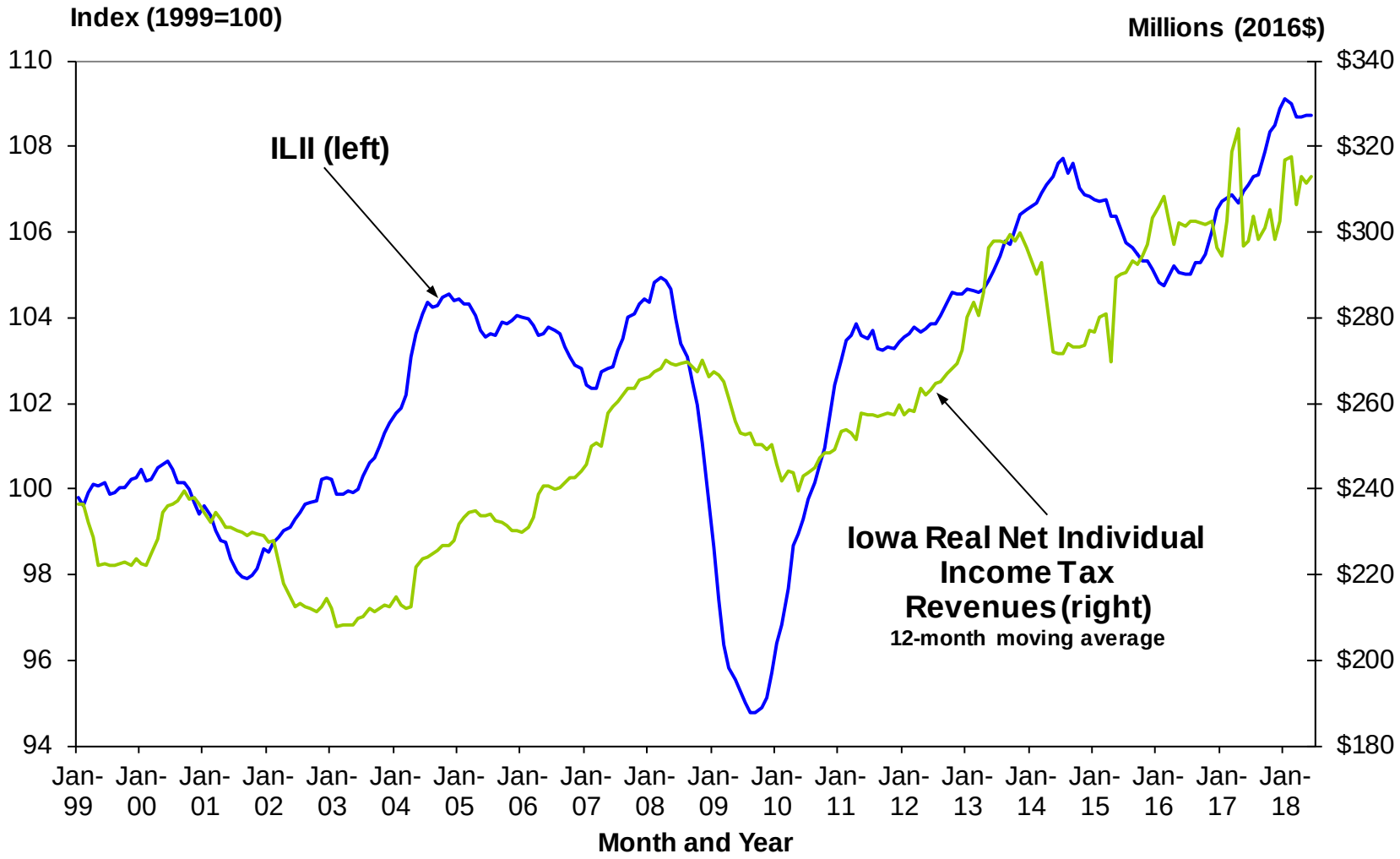

Figure 5. Iowa Leading Indicators Index Compared to U.S. Leading Economic Indicators: January 1999-June 2018

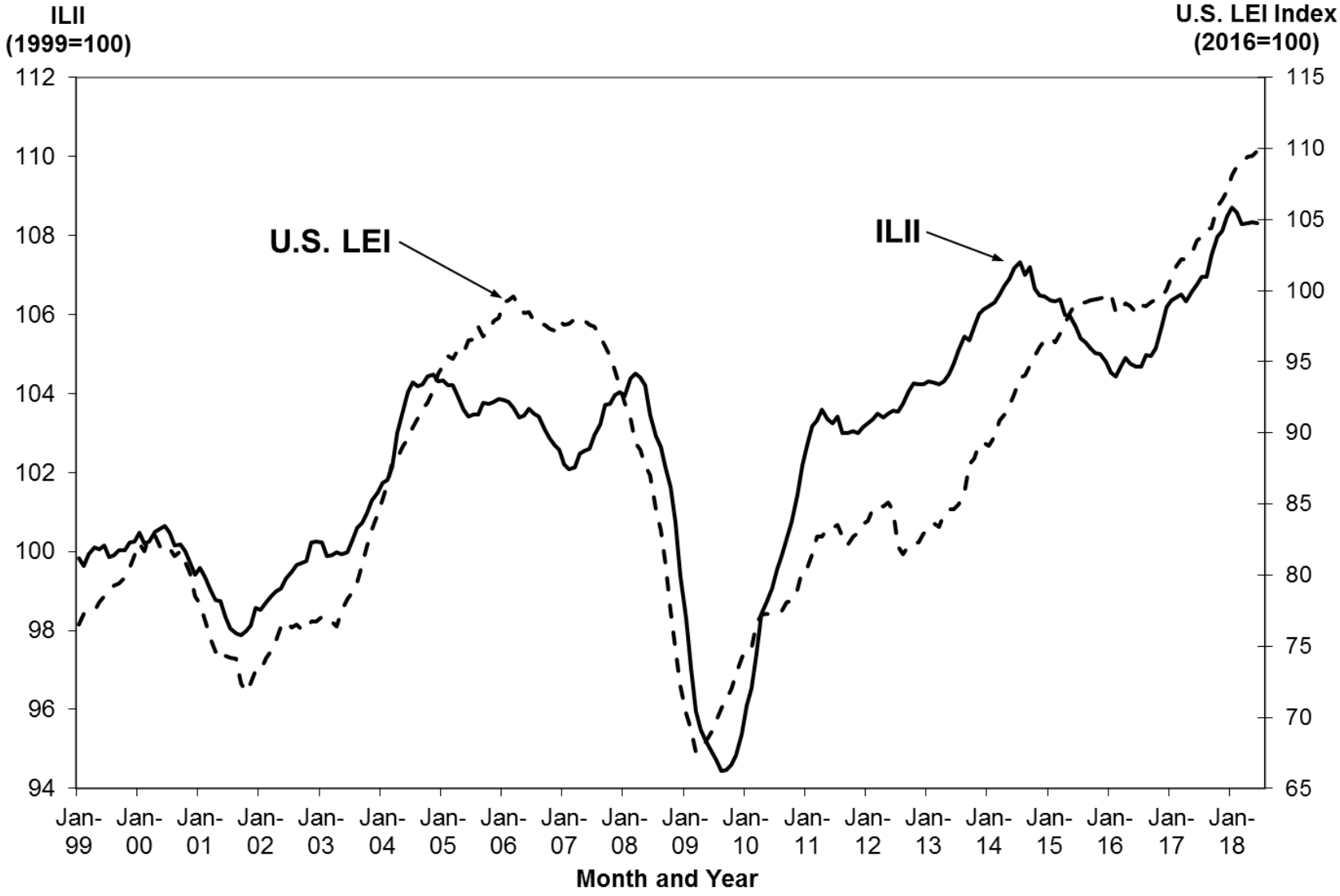

Table 1. Iowa Leading Indicators Index Components: Annual Overview

Component Series Monthly Values[a]		2017 June	2018 June	Contribution to ILII Change
AFPI[b]	↑c			0.02
Corn Profits (cents per bushel)		67.3	96.0	
Soybean Profits (cents per bushel)		217.4	192.8	
Hog Profits (cents per pound)		19.1	15.7	
Cattle Profits (cents per pound)		6.7	7.1	
Iowa Stock Market Index (10=1984-86)	↑	94.36	115.46	0.38
Yield Spread (10-year less 3-month)	↓	1.19	0.97	-0.07
Building Permits	↓	1,135	1,074	-0.18
Average Weekly Unemployment Claims[d]	↑	2,703	2,594	0.15
Average Weekly Manufacturing Hours	↑	41.6	42.0	0.30
New Orders Index (percent)	↑	53.6	62.5	0.57
Diesel Fuel Consumption (mil gallons)	↑	59.13	60.18	0.31

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 20, 2018

a. For all component series except for the yield spread (the only national series) the values represent 12-month backward moving averages.

b. The agricultural futures profits index is computed as the sum of the standardized symmetric percent changes in the four series, each weighted by the commodity's annual share of Iowa cash farm income (updated March 8, 2018).

c. Arrows indicate the direction of the series' contribution to the ILII over the last 12 months

d. Changes in unemployment claims are inverted when added to the ILII, thus a negative change in the series contributes positively to the index.

Table 2. Changes in ILII Standardization Factors Accounting for FY 2018 Data

Leading Indicator	Jul-2017 Standard Deviation	Jul-2018 Standard Deviation	Percent Change in Standard Deviation	Jul-2017 Standardization Factor	Rank	Jul-2018 Standardization Factor	Rank	Percent Change in Standardization Factor
Agricultural Futures Profits Index	2.446	2.394	-2.1%	0.034	6	0.034	6	0.4%
Iowa Stock Market Index	4.445	4.500	1.2%	0.019	8	0.018	8	-2.9%
Yield Spread	0.246	0.240	-2.2%	0.339	1	0.341	1	0.5%
Building Permits	2.606	2.579	-1.0%	0.032	7	0.032	7	-0.7%
Average Weekly Unemployment Claims	2.345	2.291	-2.3%	0.036	5	0.036	5	0.6%
Average Weekly Manufacturing Hours	0.280	0.274	-2.0%	0.298	2	0.299	2	0.3%
New Orders Index	1.300	1.287	-1.0%	0.064	4	0.064	4	-0.7%
Diesel Fuel Consumption	0.466	0.462	-0.8%	0.179	3	0.177	3	-0.9%

Each data series considers month-to-month changes over January 1999 to June 2017 for July 2017 values and January 1999 to June 2018 for July 2018 values. For all series except for the yield spread and the Iowa stock market index, the changes are based on 12-month backward moving averages. The yield spread and new orders index changes are simple arithmetic changes; changes for the other six components are computed as symmetric percentage changes.

Table 3. Iowa Leading Indicators Index Component Sensitivity

Six-Month Values	Jan to July	Feb to August	Mar to September	Apr to October	May to November	June to December	July to January	Aug to February	Sept to March	Oct to April	Nov to May	Dec to June
ILII												
Percentage Change (Annualized)	1.1%	1.0%	1.9%	3.1%	2.9%	3.3%	3.4%	3.1%	1.5%	0.6%	0.4%	-0.3%
Diffusion Index	68.8	62.5	75.0	75.0	75.0	75.0	75.0	87.5	68.8	50.0	56.3	50.0
ILII without AFPI												
Percentage Change (Annualized)	1.0%	0.8%	1.8%	3.0%	2.8%	3.2%	3.2%	3.2%	1.6%	0.9%	0.8%	-0.1%
Diffusion Index	64.3	57.1	71.4	71.4	71.4	71.4	71.4	85.7	78.6	57.1	64.3	57.1
ILII without Iowa Stock Market												
Percentage Change (Annualized)	1.0%	1.1%	1.5%	2.4%	2.1%	2.3%	2.3%	2.2%	1.3%	0.8%	0.5%	-0.1%
Diffusion Index	64.3	71.4	71.4	71.4	71.4	71.4	71.4	85.7	64.3	57.1	64.3	57.1
ILII without Average Manufacturing Hours												
Percentage Change (Annualized)	1.6%	1.3%	2.4%	3.8%	3.5%	4.0%	4.1%	3.7%	1.7%	0.5%	0.3%	-0.6%
Diffusion Index	71.4	57.1	71.4	71.4	71.4	71.4	71.4	85.7	64.3	42.9	50.0	42.9
ILII without Yield Spread												
Percentage Change (Annualized)	2.4%	2.2%	3.5%	4.9%	4.7%	5.1%	5.2%	4.6%	2.3%	1.2%	0.7%	-0.3%
Diffusion Index	78.6	71.4	85.7	85.7	85.7	85.7	85.7	85.7	71.4	57.1	57.1	57.1
ILII without Diesel Fuel												
Percentage Change (Annualized)	1.8%	1.2%	1.7%	3.2%	2.9%	3.3%	3.2%	2.7%	1.1%	0.2%	0.3%	-0.4%
Diffusion Index	78.6	57.1	71.4	71.4	71.4	71.4	71.4	85.7	64.3	42.9	50.0	42.9
ILII without New Orders Index												
Percentage Change (Annualized)	0.2%	0.1%	0.9%	2.2%	1.9%	2.4%	2.6%	2.5%	1.0%	0.3%	0.1%	-0.5%
Diffusion Index	64.3	57.1	71.4	71.4	71.4	71.4	71.4	85.7	64.3	42.9	50.0	42.9
ILII without Unemployment Claims												
Percentage Change (Annualized)	0.8%	0.6%	1.6%	2.9%	2.7%	3.1%	3.3%	3.1%	1.4%	0.5%	0.3%	-0.3%
Diffusion Index	64.3	57.1	71.4	71.4	71.4	71.4	71.4	85.7	64.3	42.9	50.0	42.9
ILII without Building Permits												
Percentage Change (Annualized)	0.8%	1.1%	2.3%	3.3%	3.3%	3.6%	3.8%	3.4%	1.8%	0.9%	0.5%	-0.1%
Diffusion Index	64.3	71.4	85.7	85.7	85.7	85.7	85.7	100.0	78.6	57.1	64.3	57.1

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 20, 2018 using updated standardization factors through June 2018.

A diffusion index measures the proportion of components that are rising based on the actual changes (not the standardized contributions to the ILII). Components experiencing increases greater than 0.05 percent are assigned a value of 1.0, components that experience changes less than an absolute value of 0.05 percent are assigned a value of 0.5, and components experiencing decreases greater than 0.05 percent are assigned a value of 0.0. The Conference Board considers a contraction signal reliable when the index declines by at least two percent over a six-month period (using an annualized rate) and a majority of the individual components also decline over those six months measured as a six-month diffusion index value below 50.

Table 4. Changes in ILII Standardization Factors Accounting for FY 2018 Data and All Updates

Leading Indicator	Jul-2017 Standard Deviation	Jul-2018 Standard Deviation	Percent Change in Standard Deviation	Jul-2017 Standardization Factor	Rank	Jul-2018 Standardization Factor	Rank	Percent Change in Standardization Factor
Agricultural Futures Profits Index	2.446	2.391	-2.2%	0.034	6	0.034	6	0.7%
Iowa Stock Market Index	4.445	4.886	9.9%	0.019	8	0.017	8	-10.5%
Yield Spread	0.246	0.240	-2.2%	0.339	1	0.341	1	0.6%
Building Permits	2.606	2.579	-1.0%	0.032	7	0.032	7	-0.6%
Average Weekly Unemployment Claims	2.345	2.291	-2.3%	0.036	5	0.036	5	0.8%
Average Weekly Manufacturing Hours	0.280	0.274	-2.0%	0.298	2	0.299	2	0.4%
New Orders Index	1.300	1.287	-1.0%	0.064	4	0.064	4	-0.6%
Diesel Fuel Consumption	0.466	0.462	-0.8%	0.179	3	0.177	3	-0.8%

Each data series considers month-to-month changes over January 1999 to June 2017 for July 2017 values and January 1999 to June 2018 for July 2018 values. For all series except for the yield spread and the Iowa stock market index, the changes are based on 12-month backward moving averages. The yield spread and new orders index changes are simple arithmetic changes; changes for the other six components are computed as symmetric percentage changes.

Figure 6. Comparison of Iowa Leading Indicators Index in FY 2018 and Update for FY 2019: January 1999-June 2018

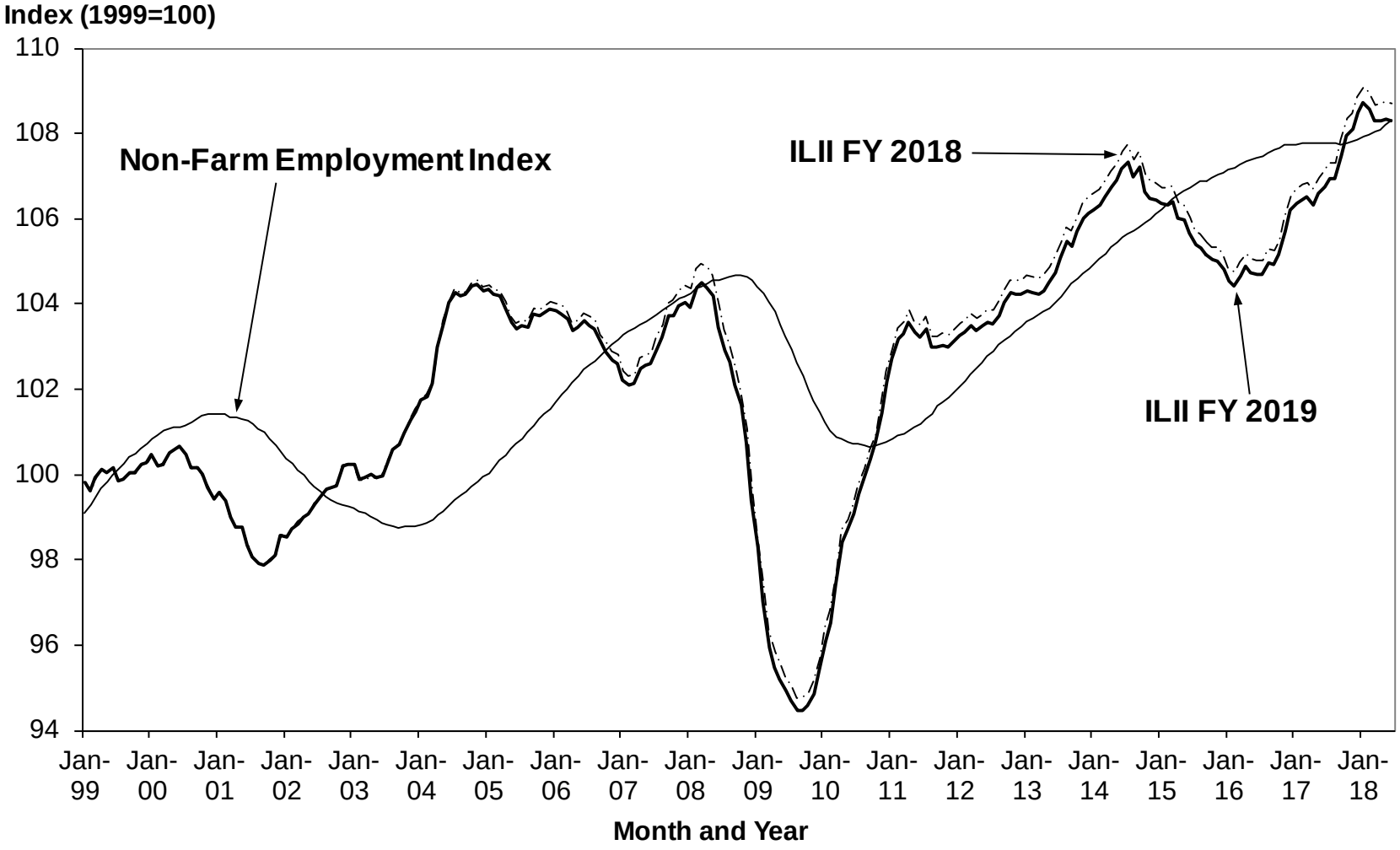

Table 5. Iowa Leading Indicators Index: Six Month Overview for June 2018 Prior to the FY 2019 Annual Update

Monthly Values	2018 January	February	March	April	May	June
ILII	109.1	109.0	108.7	108.7	108.7	108.7
Percentage Change[a]	0.2%	-0.1%	-0.3%	0.0%	0.0%	0.0%
Diffusion Index[b]	81.3	43.8	31.3	56.3	62.5	43.8

Six-Month Values	July to January	August to February	Sept to March	Oct to April	Nov to May	Dec to June
ILII						
Percentage Change	1.7%	1.5%	0.8%	0.3%	0.2%	-0.1%
Annualized Percentage Change	3.4%	3.1%	1.5%	0.6%	0.4%	-0.3%
Diffusion Index	75.0	87.5	68.8	50.0	56.3	50.0

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced July 27, 2018.
a. Percentage changes in the ILII do not always equal changes in the level of the ILII due to rounding.
b. A diffusion index measures the proportion of components that are rising based on the actual changes (not the standardized contributions to the ILII). Components experiencing increases greater than 0.05 percent are assigned a value of 1.0, components that experience changes less than an absolute value of 0.05 percent are assigned a value of 0.5, and components experiencing decreases greater than 0.05 percent are assigned a value of 0.0.

Table 6. Iowa Leading Indicators Index: Six Month Overview for June 2018 After the FY 2019 Annual Update

Monthly Values	2018 January	February	March	April	May	June
ILII	108.7	108.6	108.3	108.3	108.3	108.3
Percentage Change[a]	0.2%	-0.1%	-0.3%	0.0%	0.0%	0.0%
Diffusion Index[b]	81.3	43.8	31.3	56.3	62.5	50.0

Six-Month Values	July to January	August to February	Sept to March	Oct to April	Nov to May	Dec to June
ILII						
Percentage Change	1.7%	1.5%	0.7%	0.3%	0.2%	-0.1%
Annualized Percentage Change	3.3%	3.0%	1.5%	0.6%	0.4%	-0.3%
Diffusion Index	75.0	87.5	68.8	50.0	56.3	50.0

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 30, 2018.
a. Percentage changes in the ILII do not always equal changes in the level of the ILII due to rounding.
b. A diffusion index measures the proportion of components that are rising based on the actual changes (not the standardized contributions to the ILII). Components experiencing increases greater than 0.05 percent are assigned a value of 1.0, components that experience changes less than an absolute value of 0.05 percent are assigned a value of 0.5, and components experiencing decreases greater than 0.05 percent are assigned a value of 0.0.

Table 7. Iowa Leading Indicators Index Components: Six Month Overview for June 2018 Prior to the FY 2019 Annual Update

Component Series Monthly Values[a]		2018 January	February	March	April	May	June
AFPI[b]	↑c	*0.4*	*-2.2*	*-0.8*	*-0.6*	*-0.6*	*1.2*
Corn Profits (cents per bushel)		87.0	88.7	91.7	95.3	99.6	96.0
Soybean Profits (cents per bushel)		193.0	190.5	191.3	196.0	200.0	192.8
Hog Profits (cents per pound)		21.1	17.9	16.3	14.8	13.3	15.7
Cattle Profits (cents per pound)		8.3	8.2	8.1	7.3	6.3	7.1
Iowa Stock Market Index (10=1984-86)	↑	128.5	121.5	116.5	111.4	113.7	115.5
Yield Spread (10-year less 3-month)	↓	1.15	1.27	1.11	1.08	1.08	0.97
Building Permits	↓	1,105	1,074	1,045	1,064	1,075	1,074
Average Weekly Unemployment Claims[d]	↓	2,613	2,610	2,608	2,571	2,559	2,594
Average Weekly Manufacturing Hours	↓	41.99	42.01	42.01	42.08	42.07	42.04
New Orders Index (percent)	↓	62.4	61.9	62.2	62.5	62.9	62.5
Diesel Fuel Consumption (mil gallons)	↑	60.13	60.56	60.42	60.21	60.05	60.18

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced July 27, 2018.
a. For all component series except for the yield spread and the Iowa stock market index, the values represent 12-month backward moving averages.
b. The agricultural futures profits index is computed as the sum of the standardized symmetric percent changes in the four series, each weighted by the commodity's annual share of Iowa cash farm income (updated March 8, 2018).
c. Arrows indicate the direction of the series' contribution to the ILII for the latest month.
d. Changes in unemployment claims are inverted when added to the ILII, thus a negative change in the series contributes positively to the index.

Table 8. Iowa Leading Indicators Index Components: Six Month Overview for June 2018 After the FY 2019 Annual Update

Component Series Monthly Values[a]		2018 January	February	March	April	May	June
AFPI[b]	↑c	*0.4*	*-2.2*	*-0.8*	*-0.6*	*-0.6*	*1.2*
Corn Profits (cents per bushel)		87.0	88.7	91.7	95.3	99.6	96.0
Soybean Profits (cents per bushel)		193.0	190.5	191.3	196.0	200.0	192.8
Hog Profits (cents per pound)		21.1	17.9	16.3	14.8	13.3	15.7
Cattle Profits (cents per pound)		8.3	8.2	8.1	7.3	6.3	7.1
Iowa Stock Market Index (10=1984-86)	↑	133.1	125.2	119.7	113.8	116.1	117.9
Yield Spread (10-year less 3-month)	↓	1.15	1.27	1.11	1.08	1.08	0.97
Building Permits	↓	1,105	1,074	1,045	1,064	1,075	1,074
Average Weekly Unemployment Claims[d]	↓	2,613	2,610	2,608	2,571	2,559	2,594
Average Weekly Manufacturing Hours	↓	41.99	42.01	42.01	42.08	42.07	42.05
New Orders Index (percent)	↓	62.4	61.9	62.2	62.5	62.9	62.5
Diesel Fuel Consumption (mil gallons)	↑	60.13	60.56	60.42	60.21	60.05	60.18

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 30, 2018.
a. For all component series except for the yield spread and the Iowa stock market index, the values represent 12-month backward moving averages.
b. The agricultural futures profits index is computed as the sum of the standardized symmetric percent changes in the four series, each weighted by the commodity's annual share of Iowa cash farm income (updated August 30, 2018).
c. Arrows indicate the direction of the series' contribution to the ILII for the latest month.
d. Changes in unemployment claims are inverted when added to the ILII, thus a negative change in the series contributes positively to the index.

Appendix A: Computation of the Iowa Leading Indicators Index

The ILII was computed following the five step process presented in the *Business Cycle Indicators Handbook* by The Conference Board.

1. Calculate month-to-month changes for each component. For the components already in percent form (including the yield spread and the new orders index) simple arithmetic differences are calculated. For the other components, a symmetric percent change formula is used because this formula will return the original value if equal positive and negative changes occur in consecutive months.

   = 200*(current month value – last month value)/(current month value + last month value)

2. Multiply each component's month-to-month changes by the standardization factor. Standardization factors, the inverse of the standard deviation of the changes in the series normalized across all series to sum to one, equalize the volatility of each component in the index (see Table 4 for the standardization factors currently being used).

3. Add the standardized month-to-month changes across all eight indicators to compute each monthly ILII change.

4. Compute preliminary values of the index using a cumulative symmetric percent change formula. The initial month's value is set to 100, then to compute the cumulative

change of the index, each of the index's value is multiplied by the following monthly change:

$ILII_0$=100

$ILII_1$= $ILII_0$*(200 + month one ILII change)/(200 - month one ILII change)

5. Rebase the index to average 100 in the base year (1999). The preliminary levels are multiplied by 100 and divided by the average preliminary value over the 12 months in 1999.

Because many of the series are subject to a lot of seasonal variation, before calculating month-to-month changes all series except the yield spread and the Iowa stock market index are smoothed by taking 12-month backward moving averages.

The standardization factors are recalculated and any revisions to historical data (beyond the previous two months) are incorporated annually during the summer.

The Non-Farm Employment Coincident Index is computed following this same method; however, with only one component, steps 2 and 3 are unnecessary.

Appendix B: Computation of the Diffusion Index

A diffusion index measures the proportion of components rising in a given time period. Components experiencing an increase of more than 0.05 percent are assigned a value of 1.0; components experiencing a change in absolute value of 0.05 percent or less are assigned a value of 0.5; components experiencing a decrease of more than 0.05 percent are assigned a value of 0.0. These assigned values are then summed over all of the components. The sum is multiplied by 100 and divided by the number of components. Thus a value below 50 indicates more than half of the components declined in value during the period of interest.

The diffusion index is based on the actual changes in the components, not the standardized contributions used to compute the ILII. A diffusion index is computed for one-month and six-month symmetric percent changes in the components (see Figure B1).

Figure B1. Iowa Leading Indicators Index One-Month and Six-Month Diffusion Indexes: Jan. 1999-June 2018