Iowa Leading Indicators Index: Eleventh Annual Assessment and Update

Tax Research and Program Analysis Section
Iowa Department of Revenue
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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 2017, the ILII exhibited three months with negative changes and nine months with positive changes, ending up 1.9 percent from the end of FY 2016. Employment increased throughout the year, with the gains ranging from 0.01 to 0.15 percent and averaging 0.06 percent per month. Despite the steady employment growth, State tax receipts increased an anemic 1.7 percent during FY 2017.

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 2017

During FY 2017, the ILII increased from 105.1 in July 2016 to 107.0 in June 2017 (see Figure 1). The ILII experienced both positive and negative changes during the first quarter, then experienced two consecutive quarters of positive change. In the final quarter, the index again experienced both positive and negative changes. The annualized six-month percentage change began the fiscal year at a low of 0.31 percent in July 2016, peaking at a five year high of 3.13 percent in January 2017, before steadily decreasing to 0.72 percent in June 2017. Strength in the index seen throughout the year was fairly widespread, with the monthly diffusion index remaining at or above 50.0 for all but one month (September), peaking at 87.5 in January and February 2017. Similarly, the non-farm employment coincident index, the 12-month moving average of non-seasonally adjusted, non-farm employment, experienced continued growth during the year, and extending its positive streak that started in October 2010 to nearly seven years.

Between 1999 and 2017, 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 2016, the most recent annual data available, Iowa gross domestic product (GDP) increased for the seventh straight year.[2] Iowa real GDP increased an estimated 1.3 percent in 2016 (see Figure 2). Real personal income in Iowa decreased 0.5 percent in 2016 after an estimated -3.3 percent growth in 2015 (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. Receipts experienced weakened growth in FY 2017 with an increase of only 1.7 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, Along with the legislative change to exempt manufacturing supplies; the weakness appears to reflect changing consumer behavior toward on-line shopping and nontaxable services.

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. IDR will move the comparison in this analysis from utilizing annual to quarterly State GDP beginning in FY 2018.

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. A spike in the twelve-month moving average of revenues in April 2017 is a result of faster processing implemented by IDR speeding deposits that month relative to the prior year, creating the one-month an anomaly.

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 since October 2010, following the positive changes in the index. Overall, results over the past 11 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 4.4 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 1.6 percent. During FY 2016 and FY 2017 the two series returned to correlated paths as they both experienced negative change with ILII decreasing 1.0 percent and LEI decreasing 0.6 percent in FY 2016 and positive change in FY 2017 with the ILII increasing 1.8 percent and the LEI increasing 4.0 percent.

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 4.8 percent of Iowa GDP in 2016, 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 18.3 percent of GDP and 16.4 percent of total non-farm employment in 2016, 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 12.6 percent of GDP and 8.3 percent of non-farm employment in 2016. 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 ten years, during fiscal year 2017 the ILII generally continued to exhibit all of these attributes. During 2017, 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 increasing growth each month during the year. Should the index continue to demonstrate conformity and consistency, its signals suggest growth in employment should continue over the next few months.

Over the 12 months of FY 2017, six of eight components experienced gains (see Table 1). The largest positive contribution was made by building permits which added 0.65 points to the index between June 2016 and June 2017 and was a positive contributor nine months during FY 2017. The other positive contributors over the fiscal year were average weekly unemployment claims (inverted), new orders index, Iowa stock market index, agriculture future profits index, and diesel fuel consumption. Average weekly manufacturing hours was the largest negative contributor to the ILII in 2017 largely due to weakness in durable

manufacturing carrying over from FY 2016 into the first half of FY 2017. The national yield spread was the other negative contributor. With a majority of components and the ILII demonstrating positive signals in FY 2017 along with the continued positive growth in Iowa employment, 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 2017. 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 seven times in FY 2017. Currency concerns arose for diesel fuel consumption with revisions in four of the last six months of the fiscal year, a result of a major supplier failing to report gallons sold in a timely manner. It is hopeful that the supplier's delays will be worked through early in FY 2018 so future revisions can be minimized. If the supplier delays persist, IDR will examine ways to alleviate impact from the delay of data on the currency of the diesel fuel consumption series. Despite the noted revisions to the two components of the ILII, the index itself experienced revisions twice in FY 2017 (May and June) driven by the diesel revisions.

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 six of the eight components including the agricultural future profits index, average weekly manufacturing hours, average weekly unemployment claims (inverted), 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 2017 suggest the factors for all components will not change much. Three components experienced small declines, with the largest decline being 3.9 percent for residential building permits. Five other components experienced small positive increases. The ranking of the standardization factors among the components experienced no change from FY 2016 to FY 2017. 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 every month of FY 2017 independent of the signal from most components. The only exception is diesel fuel consumption; the six-month change would have experienced a slight decline in July 2016 and October 2016 if diesel fuel consumption was excluded indicating that the component was a strong positive contributor for those months. The analysis suggests residential building permits contributed the bulk of the positive influence to the index during FY 2017. However, strength in the index was fairly well distributed amongst the other components as well. Without the residential building permits component, the diffusion index would have consistently registered at 57.1 for 11 of the 12 months with a 0.9 percent annualized six-month change during 10 of the 12 months. On the other side of the spectrum, without average manufacturing hours, the diffusion index would have reached 100 in January and February of 2017, while six-month annualized percentage change would have peaked at a significantly higher 4.9 percent in January 2017.

Updates for the Twelfth Year

Given that the original eight components continue to meet the Moore-Shiskin criteria, no new components were added, and no changes occurred among Iowa publicly-traded companies, only the annual updates to the AFPI were necessary to prepare the ILII for FY 2018.

Updates to the Agricultural Futures Profits Index

[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.

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 April 2017, none of the changes reported here reflect that final 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 2016 cash receipts, all AFPI values for January 2016 and later were updated to reflect the distribution of farm cash receipts for calendar year 2016. In 2016, total farm cash receipts for Iowa dropped 6.4 percent with hog receipts falling 15.5 percent and cattle receipts falling 12.6 percent. In contrast to livestock receipts, Iowa's crop receipts experienced positive growth. Soybean receipts jumped 19.5 percent, while corn receipts increased 0.6 percent compared to revised numbers for 2015. The gains in crop receipts reflected record yields in 2016 despite the continued weakness in prices.

In response to the noted changes, the distribution of cash farm income between the four commodities shifted predictably for 2016. The corn share of cash receipts between the four commodities increased from 33.2 to 34.6 percent and the soybeans share increased from 17.8 to 22.0 percent. The hog share decreased from 30.9 to 27.0 percent and the cattle share decreased from 18.3 to 16.4 percent. These revisions to the annual agriculture shares result

in the 10-year rolling average to increase the corn shares from 37.9 percent to 38.2 percent and soybean shares from 21.3 percent to 21.4 percent, while livestock shares decreased from 26.3 percent to 26.1 percent for hogs and from 14.5 percent to 14.4 percent for cattle.

Assessment of Update Impacts on the ILII

After updates to the AFPI for 2017 were completed, the standardization factors were finalized (see Table 4). Updates to the standardization factors after the component updates resulted in no discernable change from pre-update standardization factors. The updates to the AFPI and standardization factors had only a minor impact on the level of the index post April 2016 and no discernable change in most prior months (see Figure 6). The update resulted in an average downward shift in the level of the ILII of 0.1 points over the last three years (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 except for June 2017 due to rounding. The values of the components were unchanged, with the updates limited to the calculation of the AFPI (see Tables 7 and 8). During FY 2017, the values of the AFPI were reduced by an average of 2.2 percent each month following the updates. It should be noted that Tables 5 and 7 do not correspond with the previously released June 2017 report as revisions to diesel fuel consumption and average manufacturing hours were incorporated after the June 2017 release date.

Conclusions

The Iowa Leading Indicators Index established a good record during the recession and recovery spanning 2008 through 2014. During FY 2015 through FY 2016, the index demonstrated negative signals in nineteen months while the non-farm employment coincident index experienced growth each month during the two year period. During FY 2017, the index

experienced strong growth. The index showed positive growth in nine of twelve months with small, negative change in three months. Concurrently, the non-farm employment coincident index experienced consistent growth during FY 2017. 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 2017

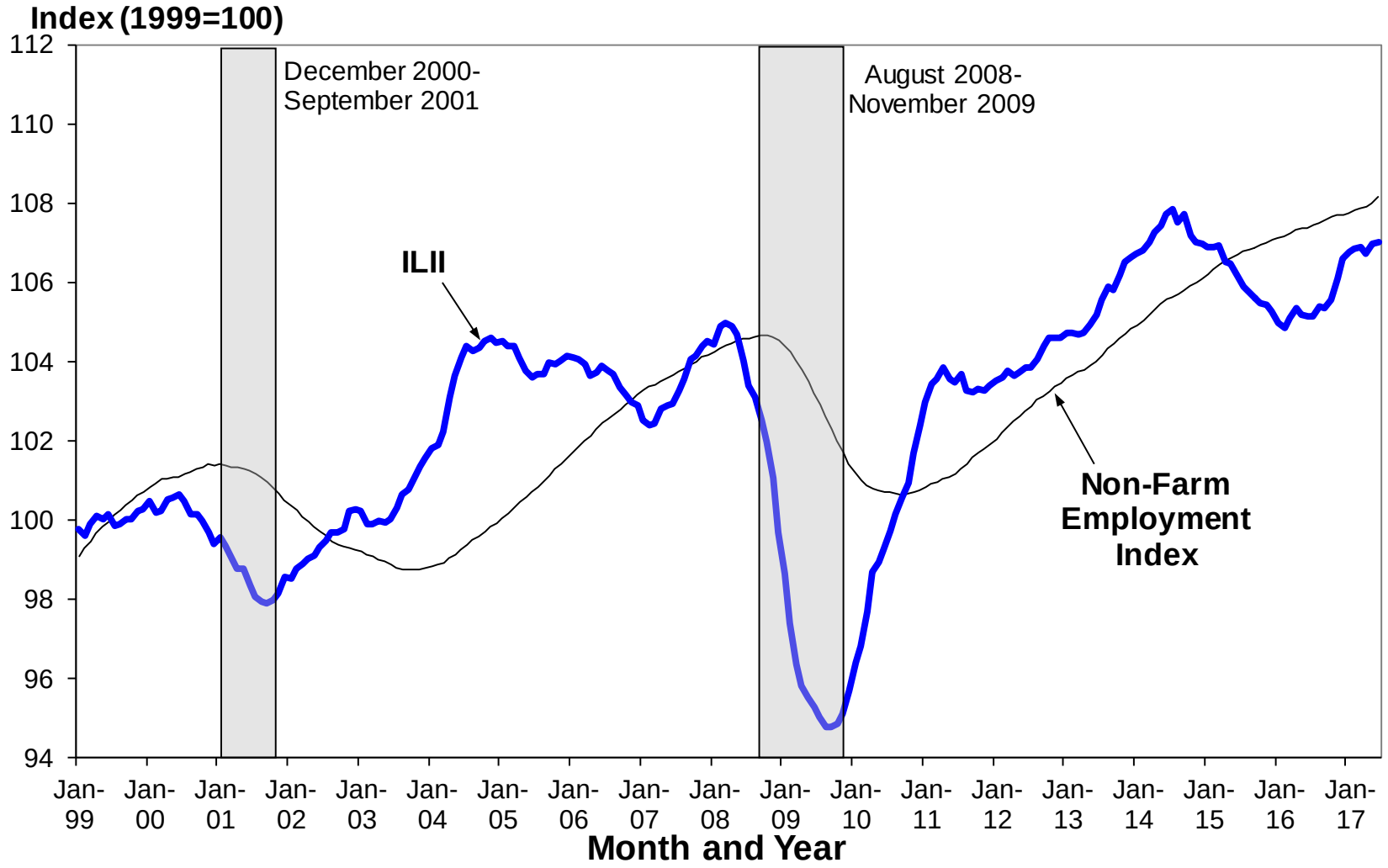

Figure 2. Iowa Leading Indicators Index, Iowa GDP, and Iowa Personal Income: January 1999-June 2017

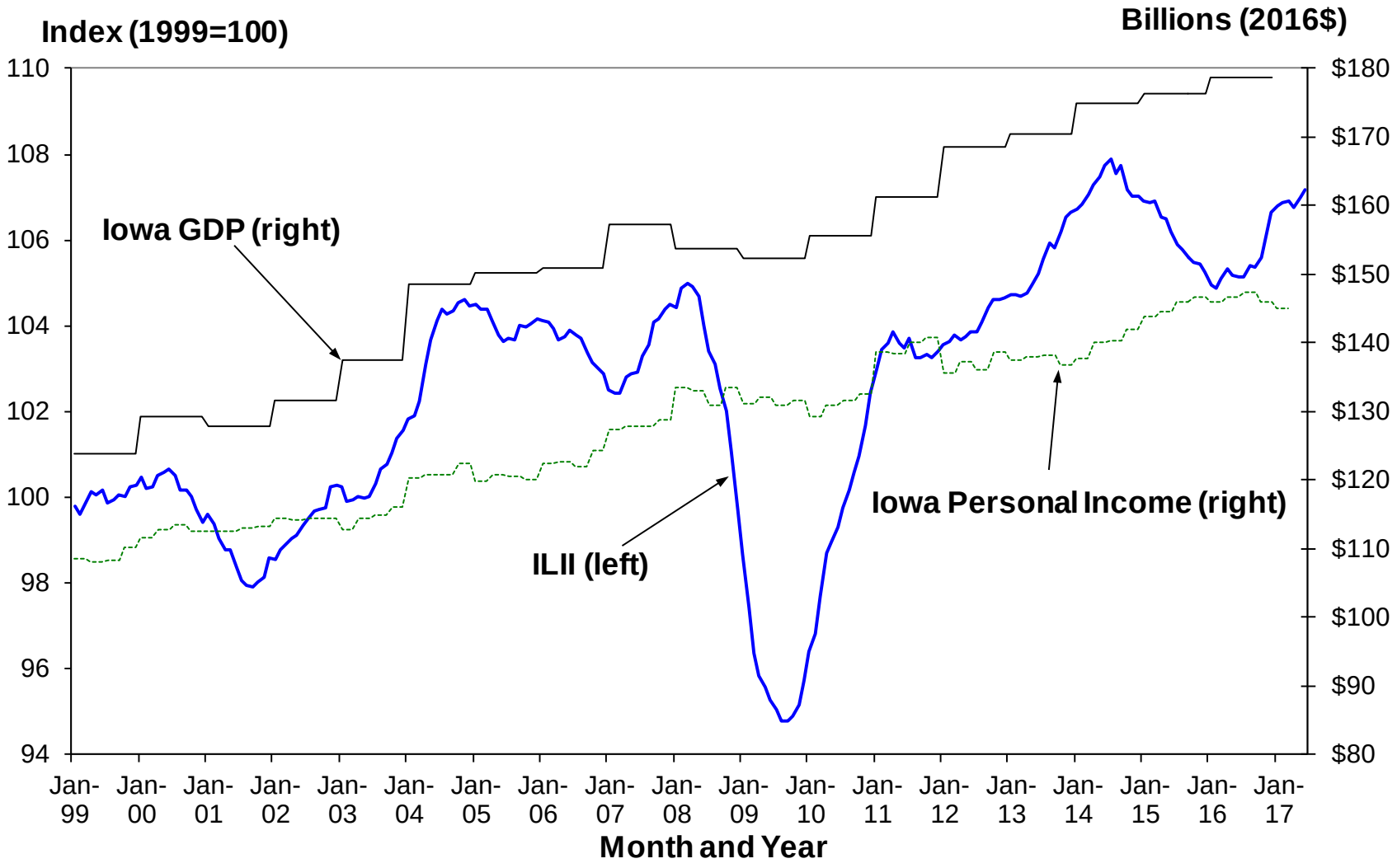

Figure 3. Iowa Leading Indicators Index and Iowa Real Tax Receipts: January 1999-June 2017

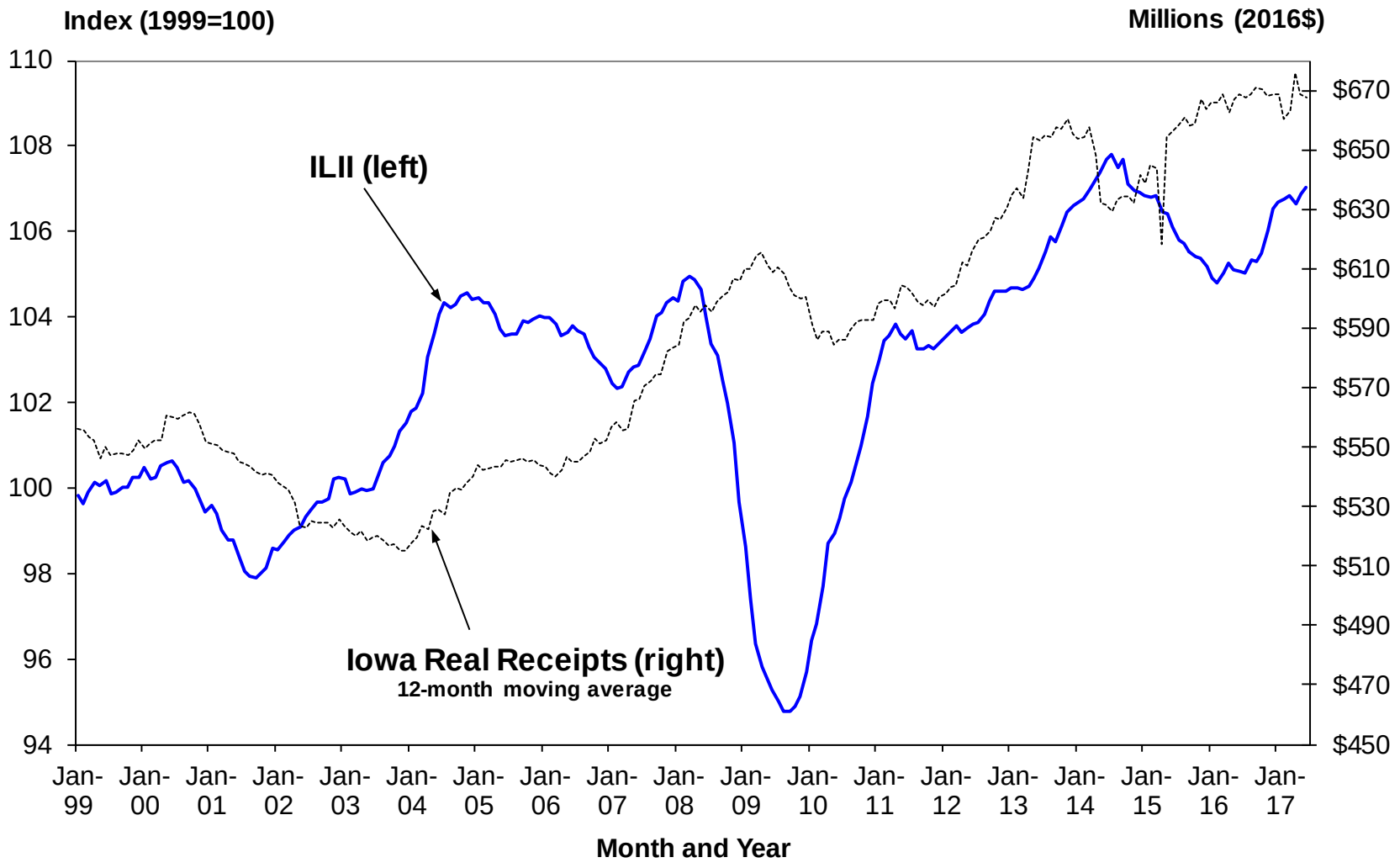

Figure 4. Iowa Leading Indicators Index and Iowa Real Net Individual Income Tax Revenues Index: January 1999-June 2017

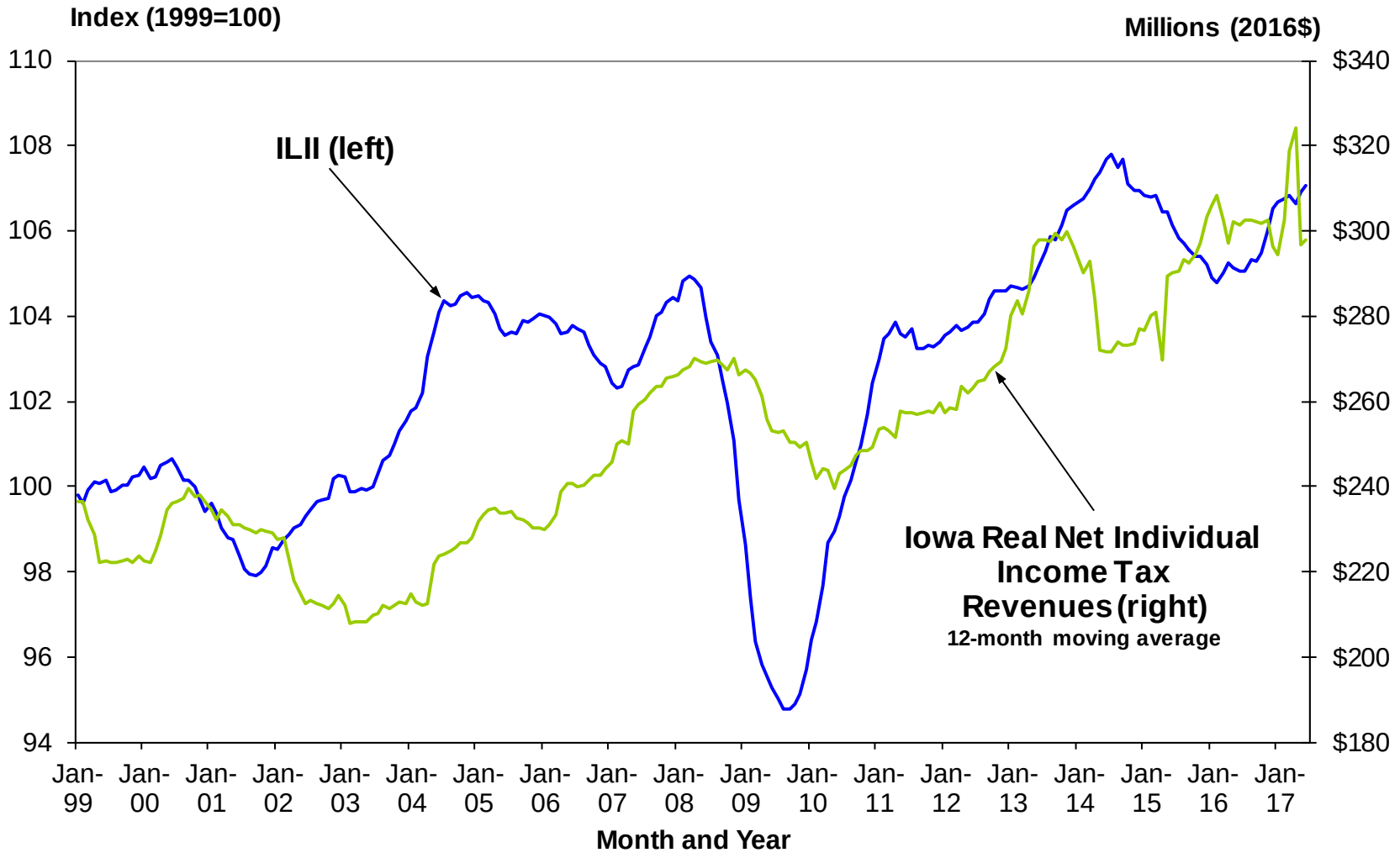

Figure 5. Iowa Leading Indicators Index Compared to U.S. Leading Economic Indicators: January 1999-June 2017

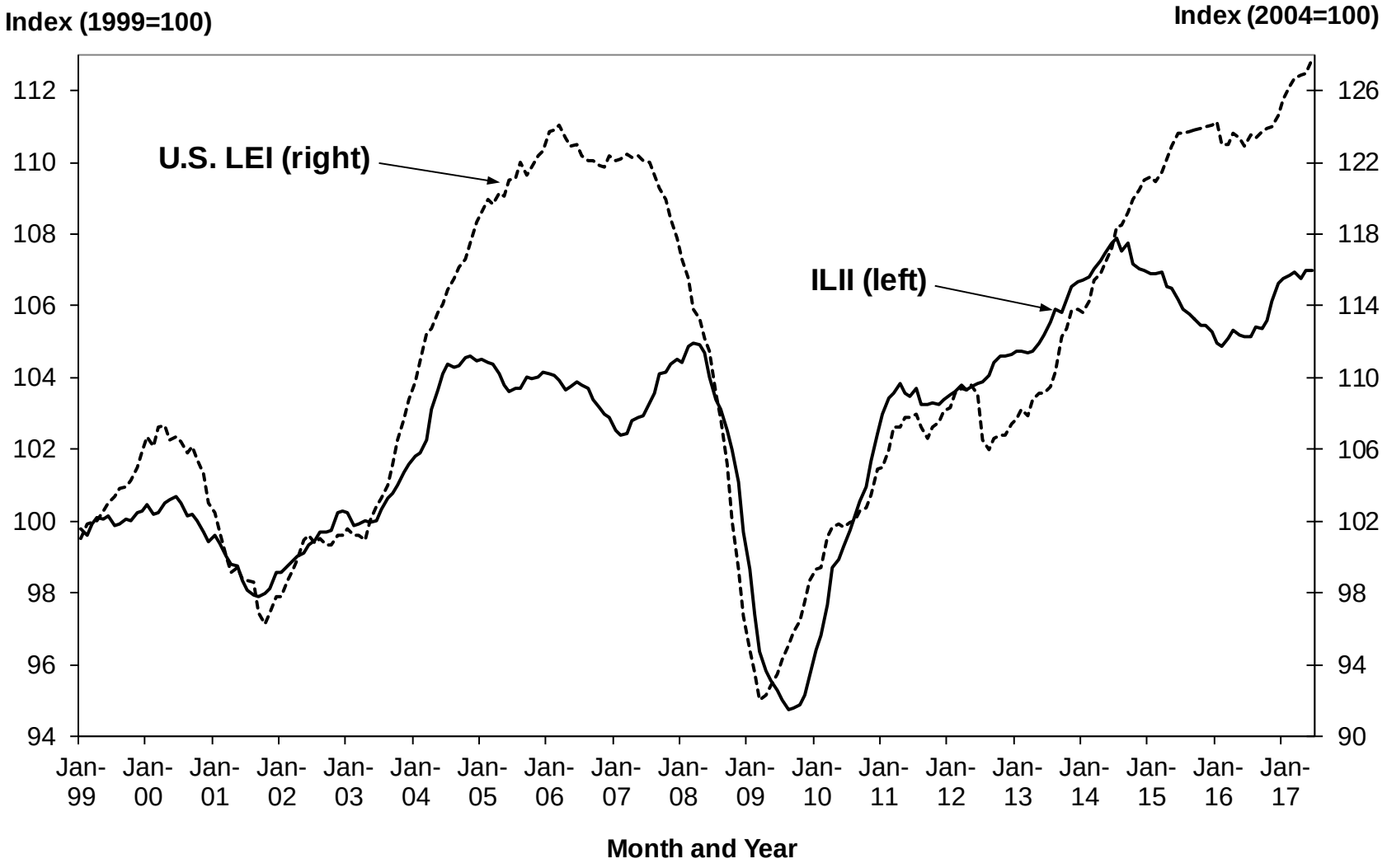

Table 1. Iowa Leading Indicators Index Components: Annual Overview

Component Series Monthly Values[a]		2016 June	2017 June	Contribution to ILII Change
AFPI[b]	↑[c]			0.14
Corn Profits (cents per bushel)		58.6	60.9	
Soybean Profits (cents per bushel)		104.9	193.0	
Hog Profits (cents per pound)		16.6	19.1	
Cattle Profits (cents per pound)		11.2	6.7	
Iowa Stock Market Index (10=1984-86)	↑	83.04	94.36	0.24
Yield Spread (10-year less 3-month)	↓	1.37	1.19	-0.06
Building Permits	↑	935	1,135	0.62
Average Weekly Unemployment Claims[d]	↑	3,091	2,703	0.48
Average Weekly Manufacturing Hours	↓	41.9	41.6	-0.17
New Orders Index (percent)	↑	46.9	53.6	0.43
Diesel Fuel Consumption (mil gallons)	↑	58.49	59.13	0.20

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 28, 2017

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 10, 2017).

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 2017 Data

Leading Indicator	Jul-2016 Standard Deviation	Jul-2017 Standard Deviation	Percent Change in Standard Deviation	Jul-2016 Standardization Factor	Rank	Jul-2017 Standardization Factor	Rank	Percent Change in Standardization Factor
Agricultural Futures Profits Index	2.488	2.438	-2.0%	0.034	6	0.034	6	0.9%
Iowa Stock Market Index	4.512	4.446	-1.5%	0.019	8	0.019	8	0.4%
Yield Spread	0.249	0.246	-1.5%	0.338	1	0.339	1	0.4%
Building Permits	2.532	2.606	2.9%	0.033	7	0.032	7	-3.9%
Average Weekly Unemployment Claims	2.385	2.345	-1.7%	0.035	5	0.036	5	0.6%
Average Weekly Manufacturing Hours	0.286	0.280	-2.3%	0.294	2	0.298	2	1.2%
New Orders Index	1.313	1.300	-1.0%	0.064	4	0.064	4	-0.1%
Diesel Fuel Consumption	0.460	0.466	1.2%	0.183	3	0.179	3	-2.2%

Each data series considers month-to-month changes over January 1999 to June 2016 for July 2016 values and January 1999 to June 2017 for July 2017 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)	0.3%	1.1%	0.5%	0.5%	1.8%	2.8%	3.2%	2.7%	2.9%	2.2%	1.6%	1.0%
Diffusion Index	50.0	62.5	37.5	50.0	75.0	75.0	87.5	87.5	75.0	75.0	62.5	68.8
ILII without AFPI												
Percentage Change (Annualized)	0.3%	0.9%	0.6%	0.5%	1.7%	2.8%	3.1%	2.7%	2.7%	2.0%	1.4%	0.9%
Diffusion Index	42.9	57.1	42.9	42.9	71.4	71.4	85.7	85.7	71.4	71.4	57.1	64.3
ILII without Iowa Stock Market												
Percentage Change (Annualized)	0.2%	0.8%	0.6%	0.5%	1.7%	2.4%	2.8%	2.3%	2.4%	1.7%	1.4%	1.0%
Diffusion Index	42.9	57.1	42.9	57.1	71.4	71.4	85.7	85.7	71.4	71.4	57.1	64.3
ILII without Average Manufacturing Hours												
Percentage Change (Annualized)	0.8%	2.1%	1.3%	1.3%	3.0%	4.5%	5.0%	4.3%	4.4%	3.3%	2.5%	1.4%
Diffusion Index	57.1	71.4	42.9	57.1	85.7	85.7	100.0	100.0	85.7	85.7	71.4	71.4
ILII without Yield Spread												
Percentage Change (Annualized)	1.1%	1.8%	1.1%	0.9%	2.5%	3.7%	4.1%	3.5%	4.0%	3.3%	2.8%	2.3%
Diffusion Index	57.1	71.4	42.9	57.1	71.4	71.4	85.7	85.7	71.4	71.4	71.4	78.6
ILII without Diesel Fuel												
Percentage Change (Annualized)	-0.5%	0.7%	0.0%	-0.1%	1.7%	2.8%	3.4%	3.0%	3.6%	3.1%	2.1%	1.3%
Diffusion Index	42.9	57.1	28.6	42.9	71.4	71.4	85.7	85.7	85.7	85.7	71.4	78.6
ILII without New Orders Index												
Percentage Change (Annualized)	0.6%	1.6%	1.0%	0.9%	2.2%	3.0%	3.2%	2.4%	2.4%	1.4%	0.9%	0.1%
Diffusion Index	57.1	71.4	42.9	57.1	85.7	85.7	85.7	85.7	71.4	71.4	57.1	64.3
ILII without Unemployment Claims												
Percentage Change (Annualized)	0.3%	1.1%	0.4%	0.3%	1.4%	2.5%	2.6%	2.2%	2.4%	1.6%	1.2%	0.5%
Diffusion Index	57.1	57.1	28.6	42.9	71.4	71.4	85.7	85.7	71.4	71.4	57.1	64.3
ILII without Building Permits												
Percentage Change (Annualized)	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	2.0%	1.3%	0.9%
Diffusion Index	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	71.4	57.1	57.1

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 18, 2017 using standardization factors through June 2016.

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 2017 Data and All Updates

Leading Indicator	Jul-2016 Standard Deviation	Jul-2017 Standard Deviation	Percent Change in Standard Deviation	Jul-2016 Standardization Factor	Rank	Jul-2017 Standardization Factor	Rank	Percent Change in Standardization Factor
Agricultural Futures Profits Index	2.488	2.438	-2.0%	0.034	6	0.034	6	0.9%
Iowa Stock Market Index	4.512	4.446	-1.5%	0.019	8	0.019	8	0.3%
Yield Spread	0.249	0.246	-1.5%	0.338	1	0.339	1	0.4%
Building Permits	2.532	2.606	2.9%	0.033	7	0.032	7	-3.9%
Average Weekly Unemployment Claims	2.385	2.345	-1.7%	0.035	5	0.036	5	0.6%
Average Weekly Manufacturing Hours	0.286	0.280	-2.3%	0.294	2	0.298	2	1.2%
New Orders Index	1.313	1.300	-1.0%	0.064	4	0.064	4	-0.1%
Diesel Fuel Consumption	0.460	0.466	1.2%	0.183	3	0.179	3	-2.2%

Each data series considers month-to-month changes over January 1999 to June 2016 for July 2016 values and January 1999 to June 2017 for July 2017 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 2015 and Update for FY 2016: January 1999-June 2017

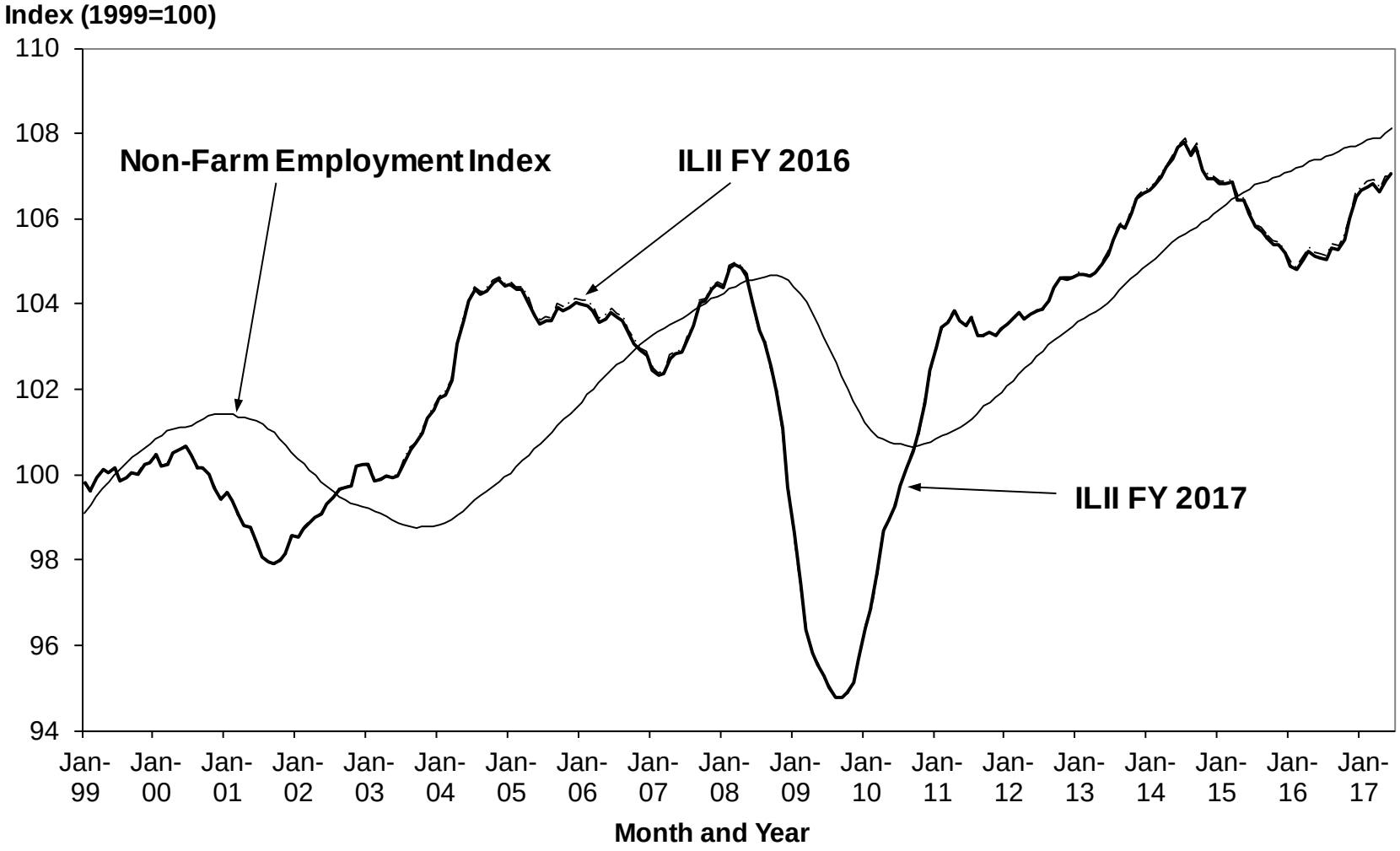

Table 5. Iowa Leading Indicators Index: Six Month Overview for June 2017 Prior to the FY 2018 Annual Update

Monthly Values	2017 Jan	Feb	Mar	Apr	May	Jun
ILII	106.8	106.9	106.9	106.7	107.0	107.2
Percentage Change[a]	0.1%	0.1%	0.1%	-0.2%	0.2%	0.2%
Diffusion Index[b]	68.8	56.3	75.0	37.5	75.0	75.0

Six-Month Values	Jul to Jan	Aug to Feb	Sept to Mar	Oct to Apr	Nov to May	Dec to Jun
ILII						
Percentage Change	1.6%	1.4%	1.5%	1.1%	0.8%	0.5%
Annualized Percentage Change	3.2%	2.7%	2.9%	2.2%	1.6%	1.0%
Diffusion Index	87.5	87.5	75.0	75.0	62.5	68.8

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 31, 2017.
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 2017 After the FY 2018 Annual Update

Monthly Values	2017 Jan	Feb	Mar	Apr	May	Jun
ILII	106.7	106.8	106.8	106.6	106.9	107.1
Percentage Change[a]	0.1%	0.1%	0.1%	-0.2%	0.2%	0.1%
Diffusion Index[b]	68.8	56.3	75.0	37.5	75.0	75.0

Six-Month Values	Jul to Jan	Aug to Feb	Sept to Mar	Oct to Apr	Nov to May	Dec to Jun
ILII						
Percentage Change	1.6%	1.4%	1.5%	1.1%	0.8%	0.5%
Annualized Percentage Change	3.1%	2.7%	2.9%	2.2%	1.6%	1.0%
Diffusion Index	87.5	87.5	75.0	75.0	62.5	68.8

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 31, 2017.
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 2017 Prior to the FY 2018 Annual Update

Component Series Monthly Values[a]		2017 Jan	Feb	Mar	Apr	May	Jun
AFPI[b]	↓[c]	*0.9576*	*-0.1379*	*1.2616*	*-0.5379*	*1.5408*	*-1.3501*
Corn Profits (cents per bushel)		54.9	57.7	60.1	62.5	63.8	60.9
Soybean Profits (cents per bushel)		185.8	200.7	212.1	215.0	211.6	193.0
Hog Profits (cents per pound)		18.4	17.7	18.2	17.2	19.3	19.1
Cattle Profits (cents per pound)		9.5	7.4	8.1	7.3	7.3	6.7
Iowa Stock Market Index (10=1984-86)	↑	93.74	96.55	97.23	93.69	93.21	94.36
Yield Spread (10-year less 3-month)	↓	1.91	1.89	1.73	1.49	1.40	1.19
Residential Building Permits	↑	1,097	1,124	1,142	1,119	1,134	1,135
Average Weekly Unemployment Claims[d]	↑	2,820	2,801	2,779	2,765	2,724	2,703
Average Weekly Manufacturing Hours	↑	41.62	41.59	41.63	41.58	41.61	41.63
New Orders Index (percent)	↑	47.7	49.0	50.0	51.2	51.8	53.6
Diesel Fuel Consumption (mil gallons)	↓	59.46	59.01	58.63	58.68	58.88	59.13

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 31, 2017.

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 10, 2017).

c. Arrows indicate the direction of the series' contribution to the ILII for the latest month.

d. Changes in average weekly initial unemployment insurance 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 2017 After the FY 2018 Annual Update

Component Series Monthly Values[a]		2017 Jan	Feb	Mar	Apr	May	Jun
AFPI[b]	↓[c]	*0.9620*	*-0.1117*	*1.2608*	*-0.5188*	*1.5237*	*-1.3546*
Corn Profits (cents per bushel)		54.9	57.7	60.1	62.5	63.8	60.9
Soybean Profits (cents per bushel)		185.8	200.7	212.1	215.0	211.6	193.0
Hog Profits (cents per pound)		18.4	17.7	18.2	17.2	19.3	19.1
Cattle Profits (cents per pound)		9.5	7.4	8.1	7.3	7.3	6.7
Iowa Stock Market Index (10=1984-86)	↑	93.74	96.55	97.23	93.69	93.21	94.36
Yield Spread (10-year less 3-month)	↓	1.91	1.89	1.73	1.49	1.40	1.19
Residential Building Permits	↑	1,097	1,124	1,142	1,119	1,134	1,135
Average Weekly Unemployment Claims[d]	↑	2,820	2,801	2,779	2,765	2,724	2,703
Average Weekly Manufacturing Hours	↑	41.62	41.59	41.63	41.58	41.61	41.63
New Orders Index (percent)	↑	47.7	49.0	50.0	51.2	51.8	53.6
Diesel Fuel Consumption (mil gallons)	↓	59.46	59.01	58.63	58.68	58.88	59.13

Source: Tax Research and Program Analysis Section, Iowa Department of Revenue, produced August 31, 2017.

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 10, 2017).

c. Arrows indicate the direction of the series' contribution to the ILII for the latest month.

d. Changes in average weekly initial unemployment insurance 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 2017