Comparative Assessment of Fannie Mae's National Housing Survey®

December 2019

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Executive Summary

- **Study Objective**: We sought to understand how Fannie Mae's National Housing Survey® (NHS) results compare with other major consumer tracking surveys – including the University of Michigan Surveys of Consumers, the Conference Board Survey of Consumer Sentiment, and Gallup – on questions about the economy, personal finance, and housing sentiments, to test the consistency of the NHS, identify where and how much the NHS diverges from the other surveys, and explore the reasons.

- **Findings:**
  - We found very strong correlations between NHS questions and similar questions from other surveys. For the 113-month comparison period, 7 out of 10 questions between the NHS and the other surveys had correlation coefficients of 0.80 or higher. The remaining 3 questions are about unemployment rate, whether it is a good time to buy a home, and perceived home value. Compared to the previous comparison with only 89 months of data, the correlations with more data grow stronger for a majority of the questions.
  - We do observe some notable differences between the NHS and other surveys for some questions, both in terms of significantly different absolute levels of responses and low correlations. These differences may be attributable to differences in question designs.
    - More response choices for questions related to personal situation tend to lead to higher survey scores.
    - More response choices for questions about general economic or market conditions tend to lead to more negative survey results.
    - Neutral choices tend to lead to more negative survey scores.
  - With respect to general questions about economic or market conditions, NHS is helpful to forecast other surveys rather than the opposite. As to the economic outlook, other surveys are helpful to forecast NHS.
  - HPSI outperforms ICS and CCI to predict future market outcomes (home sales and housing starts).

Research Methodology

- A selected list of NHS questions[1] from June 2010[2] to October 2019 (113 months) were compared with similar questions from three major Consumer Surveys:
  - The University of Michigan Surveys of Consumers (Michigan)
  - The Conference Board Consumer Confidence Survey (Conference Board)
  - The Gallup U.S. Daily Survey (Gallup)

- For most of the questions, besides Percent Positive/Negative Responses, we also computed the Net Positive Percentage[3] as the basis for the comparison
  - Net Positive Percentage = Percent Positive Responses – Percent Negative Responses

- To assess similarity and differences between responses to similar questions from NHS and other surveys, the following methods are used:
  - Time-series plots for visual comparisons in trends, levels, peaks and troughs, etc.
  - Summary statistics including correlation coefficients, means, standard deviations, etc., to further quantify the similarities and differences between the comparison questions.
  - Granger causality test[4] to determine whether one question can be helpful to forecast similar questions in other surveys. In other words, this test is used to see if one question in one survey is useful for predicting the similar question in another survey when the latter's own history is already being used for the prediction. Time series stationary testing (KPSS test[5]) are conducted, and first (or higher) differences are applied to non-stationary data before Granger causality test.
  - Linear regression models are used to evaluate three indices' (HPSI, ICS, CCI) prediction performances on two housing related metrics (home sales and housing starts).

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1. See Appendix table 2 for complete list of questions compared
2. A few of the NHS questions didn't start until March 2011
3. This is very similar to Net Promoter Score used widely in market research, with the advantage of it being simple (just one number) and easy to interpret (e.g. positive sign means overall positive attitude)
4. See Appendix for the introduction of Grander causality test.
5. See Appendix for stationary test.

Results

Economic Outlook (Percent Positive and Negative Responses)

NHS: *In general do you think our economy is <u>on the right track or is it off on the wrong track</u>?*
Gallup: *Do you think that economic conditions in the country as a whole are <u>getting better or getting worse</u>?*
Michigan: *Now turning to business conditions in the country as a whole, do you think that during the <u>next 12 months</u> we'll have <u>good times</u> financially, <u>bad times</u>?*
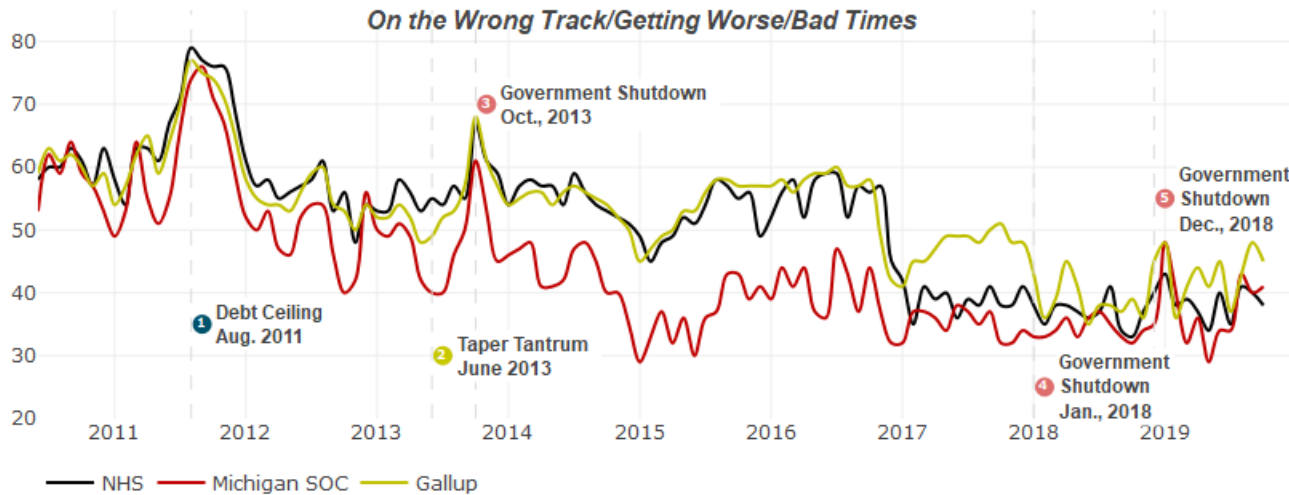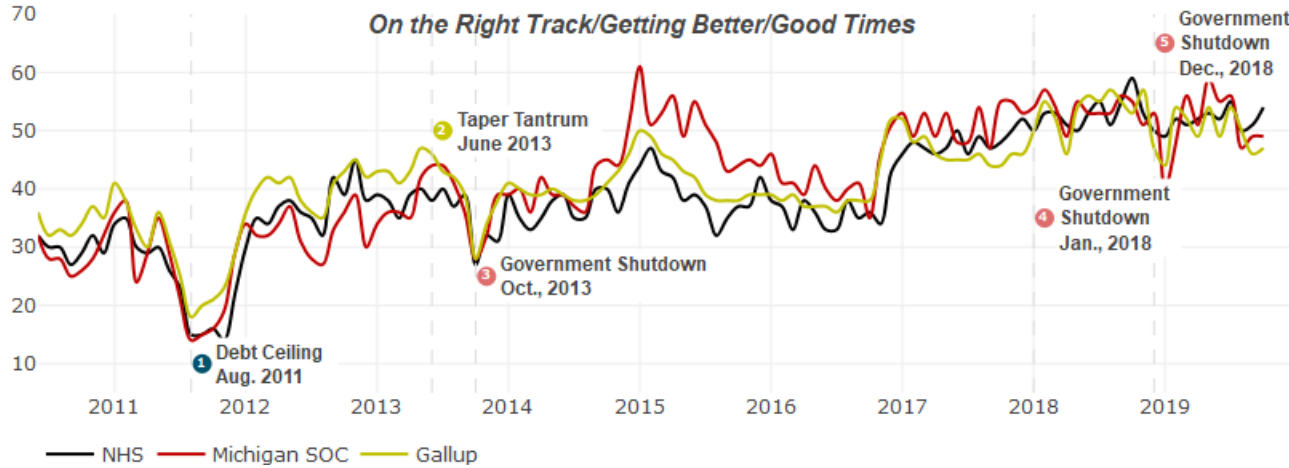
Economic Outlook	Obs	Mean	Std. Dev.	Min	Max
NHS (Right Track)	113	39.42	9.45	14	59
Michigan (Good Times)	113	41.66	10.59	14	61
Gallup (Getting Better)	113	41.65	7.85	18	57
NHS (Wrong Track)	113	51.63	10.54	33	79
Michigan (Bad Times)	113	43.90	10.27	29	76
Gallup (Getting Worse)	113	52.78	8.58	35	77

- Very high correlations in percent positive responses: r(NHS, Michigan)=0.87, r(NHS, Gallup)=0.93 and r(Michigan, Gallup)=0.87. Michigan and Gallup are close, 2 points higher than NHS.

- Very high correlations in percent negative responses: r(NHS, Michigan)=0.82, r(NHS, Gallup)=0.93 and r(Michigan, Gallup)=0.81. NHS and Gallup are close, about 8 points higher than Michigan.

Economic Outlook (Net Positive Percentage)

NHS: *In general do you think our economy is <u>on the right track or is it off on the wrong track</u>?*
Gallup: *Do you think that economic conditions in the country as a whole are <u>getting better or getting worse</u>?*
Michigan: *Now turning to business conditions in the country as a whole, do you think that during the <u>next 12 months</u> we'll have <u>good times</u> financially, <u>bad times</u>?*

Economic Outlook
Showing Net Positive Percent
(Jun 2010 - Oct 2019)

Variable	Obs	Mean	Std. Dev.	Min	Max
NHS	113	-12.2	19.9	-64	26
Gallup	113	-11.1	16.4	-59	21
Michigan	113	-2.2	20.6	-61	32

- Mostly negative and volatile. NHS and Gallup become positive briefly in Jan 2017, while Michigan basically remains positive after September 2014.

- Very high correlation: r(NHS, Michigan)=0.86, r(NHS, Gallup)=0.93 and r(Michigan, Gallup)=0.85.

- NHS on average is 10 points lower than Michigan survey, but close to Gallup.
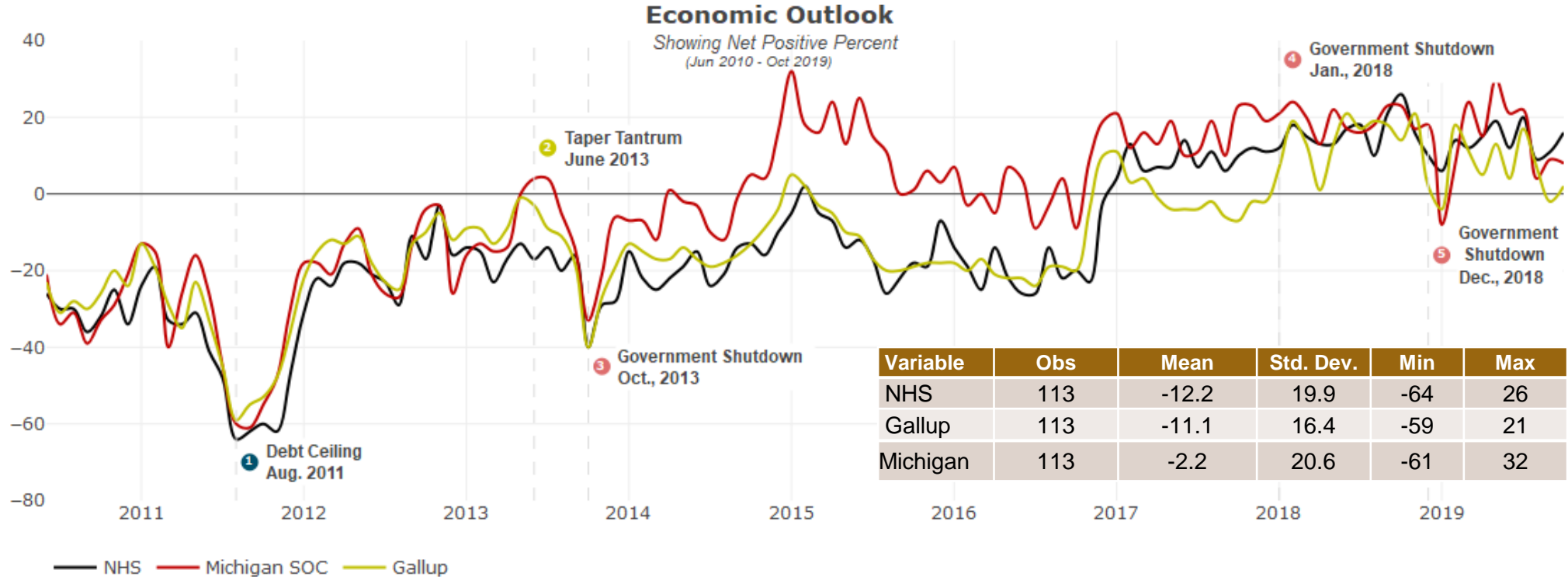
Economic Outlook (Net Positive Percent)

NHS: *In general do you think our economy is <u>on the right track or is it off on the wrong track</u>?*
Gallup: *Do you think that economic conditions in the country as a whole are <u>getting better or getting worse</u>?*
Michigan: *Now turning to business conditions in the country as a whole, do you think that during the <u>next 12 months</u> we'll have <u>good times</u> financially, <u>bad times</u>?*

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
NHS	Stationary	Non-Stationary	0.01	Non-Stationary
Michigan	Stationary	Non-Stationary	0.01	Non-Stationary
Gallup	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test*				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
NHS	Michigan	2	0.6158	Accept NH
Michigan	NHS	2	0.0015	Reject NH
NHS	Gallup	2	0.9966	Accept NH
Gallup	NHS	2	0.0005	Reject NH
Michigan	Gallp	2	0.4608	Accept NH
Gallup	Michigan	2	0.0291	Reject NH

*Null Hypothesis: cause variable does not help predict dependent variable.

- All three time series are non-stationary.
- Michigan Granger-cause NHS, which means including Michigan is useful for predicting NHS when NHS's own history (2 lags) is already being used for the prediction.
- Gallup Granger-cause NHS, which means including Gallup is useful for predicting NHS when NHS's own history (2 lags) is already being used for the prediction.
- Gallup Granger-cause Michigan, which means including Gallup is useful for predicting Michigan when Michigan's own history (2 lags) is already being used for the prediction.
- NHS does not Granger-cause Michigan and Gallup.

Personal Finance Next Year (Percent Positive and Negative Response)

NHS: *Looking ahead one year, do you expect your personal financial situation to get much better, somewhat better, stay about the same, get somewhat worse, or get much worse?*

Michigan: *Now looking ahead–do you think that a year from now you (and your family living there) will be better off financially, or worse off, or just about the same as now?*
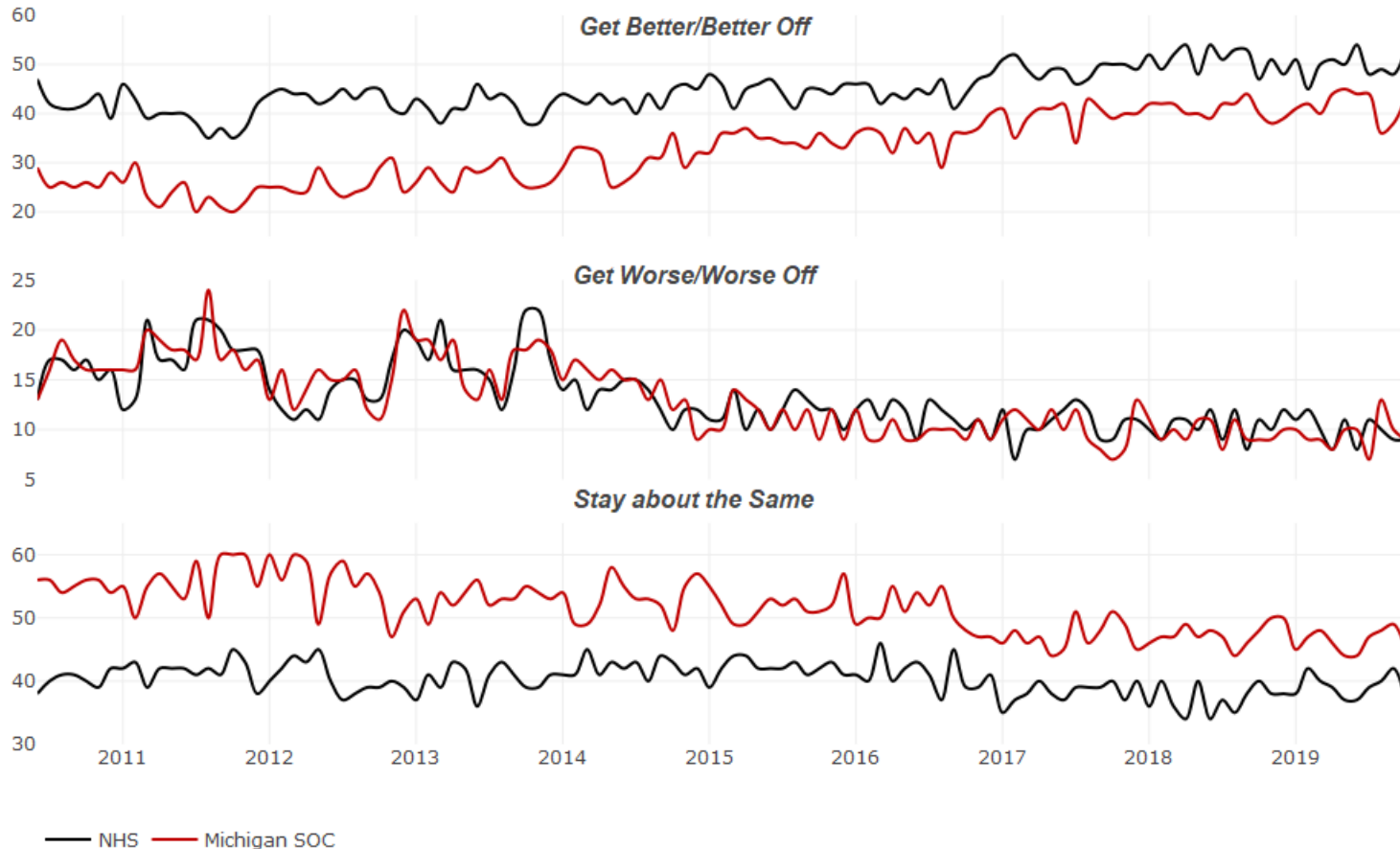
Personal Finance	Obs	Mean	Std. Dev.	Min	Max
NHS (Get Better)	113	44.96	4.31	35	54
Michigan (Better Off)	113	32.63	6.89	20	45
NHS (Get Worse)	113	13.2	3.4	7	22
Michigan (Worse Off)	113	13.0	3.7	7	24
NHS (Same)	113	40.27	2.49	34	46
Michigan (Same)	113	51.54	4.25	44	60

- High correlation in percent positive response: r(NHS, Michigan)=0.80.

- High correlation in percent negative response: r(NHS, Michigan)=0.83.

- Correlation in percent neutral response: r(NHS, Michigan)=0.34.

- NHS percent positive response on average is 12 points higher than Michigan, and Michigan percent neutral response is 11 points higher than NHS, that is because NHS has 5 choices, and Michigan has just 3 choices. More choices for questions related to personal situation tend to lead to higher survey scores.

Personal Finance Next Year (Net Positive Percentage)

NHS: *Looking ahead one year, do you expect your personal financial situation to get much better, somewhat better, stay about the same, get somewhat worse, or get much worse?*

Michigan: *Now looking ahead–do you think that a year from now you (and your family living there) will be better off financially, or worse off, or just about the same as now?*

Personal Finance Next Year
Showing Net Positive Percent
(Jun 2010 - Oct 2019)

Personal Finance	Obs	Mean	Std. Dev.	Min	Max
NHS	113	31.81	7.32	14	46
Michigan	113	19.65	10.11	-1	37
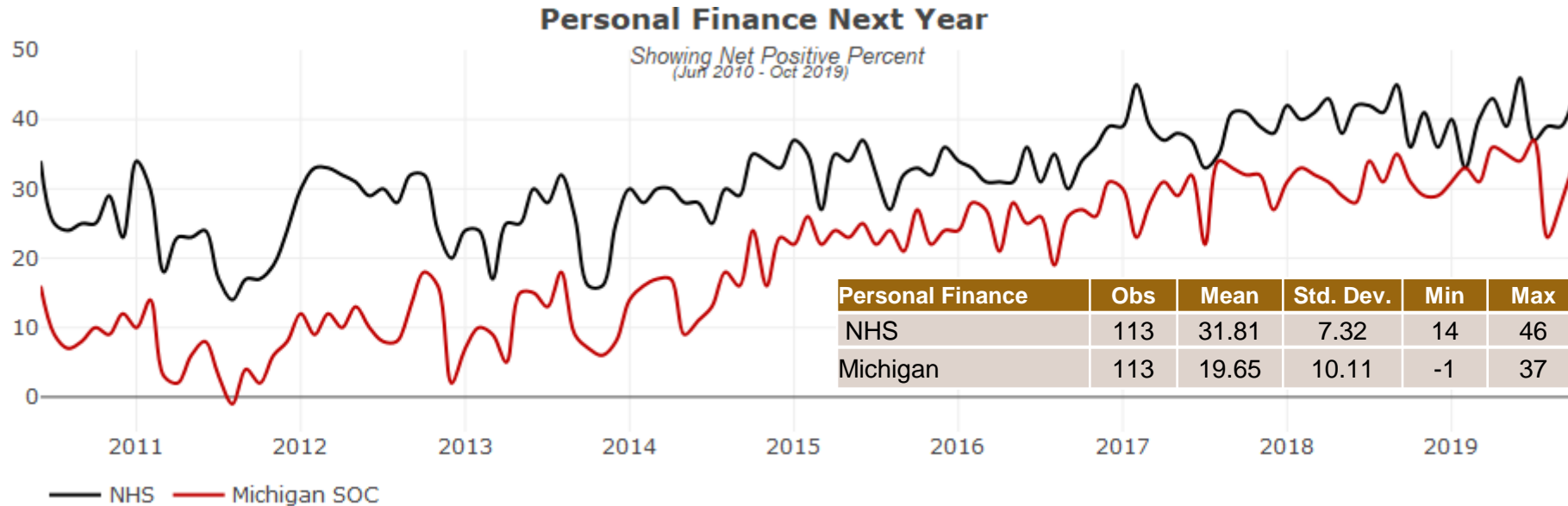
- Both start trending up since July, 2014. The gap between NHS and Michigan gets smaller starting from mid year 2013, as the economy gets more stable and people become more certain about their future financial conditions.

- High correlation (r=0.87) between the two time series.

- NHS on average is 12 points higher than Michigan.

- The Michigan survey has more people choose "the same" than the NHS (51.5% vs 40.3%), possibly due to fewer question choices than NHS (5 options for NHS vs 3 options for Michigan). About the same percentage of respondents choose "worse" (13.2% vs 13.0%). Also, the orders of the choice options are different between NHS and Michigan.

Personal Finance Next Year (Net Positive Percent)

NHS: *Looking ahead one year, do you expect your personal financial situation to get <u>much</u> better, <u>somewhat</u> better, stay about the <u>same</u>, get <u>somewhat</u> worse, or get <u>much</u> worse?*

Michigan: *Now looking ahead–do you think that a year from now you (and your family living there) will be <u>better off</u> financially, or <u>worse off</u>, or just about the <u>same</u> as now?*

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
NHS	Stationary	Non-Stationary	0.01	Non-Stationary
Michigan	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
NHS	Michigan	2	0.0000	Reject NH
Michigan	NHS	2	0.4843	Accept NH

*Null Hypothesis: cause variable does not help predict dependent variable.

- Both NHS and Michigan are non-stationary time series.
- NHS Granger-cause Michigan, which means including NHS is useful for predicting Michigan when Michigan's own history (2 lags) is already being used for the prediction.
- Michigan does not Granger-cause NHS.

Personal Finance Past Year

NHS[1]: *Now looking back over the past year, has your personal financial situation gotten <u>much</u> better, <u>somewhat</u> better, stayed about the <u>same</u>, gotten <u>somewhat</u> worse, or gotten <u>much</u> worse?*
Michigan: *Would you say that you (and your family living there) are <u>better off</u> or <u>worse off</u> financially than you were a year ago?*
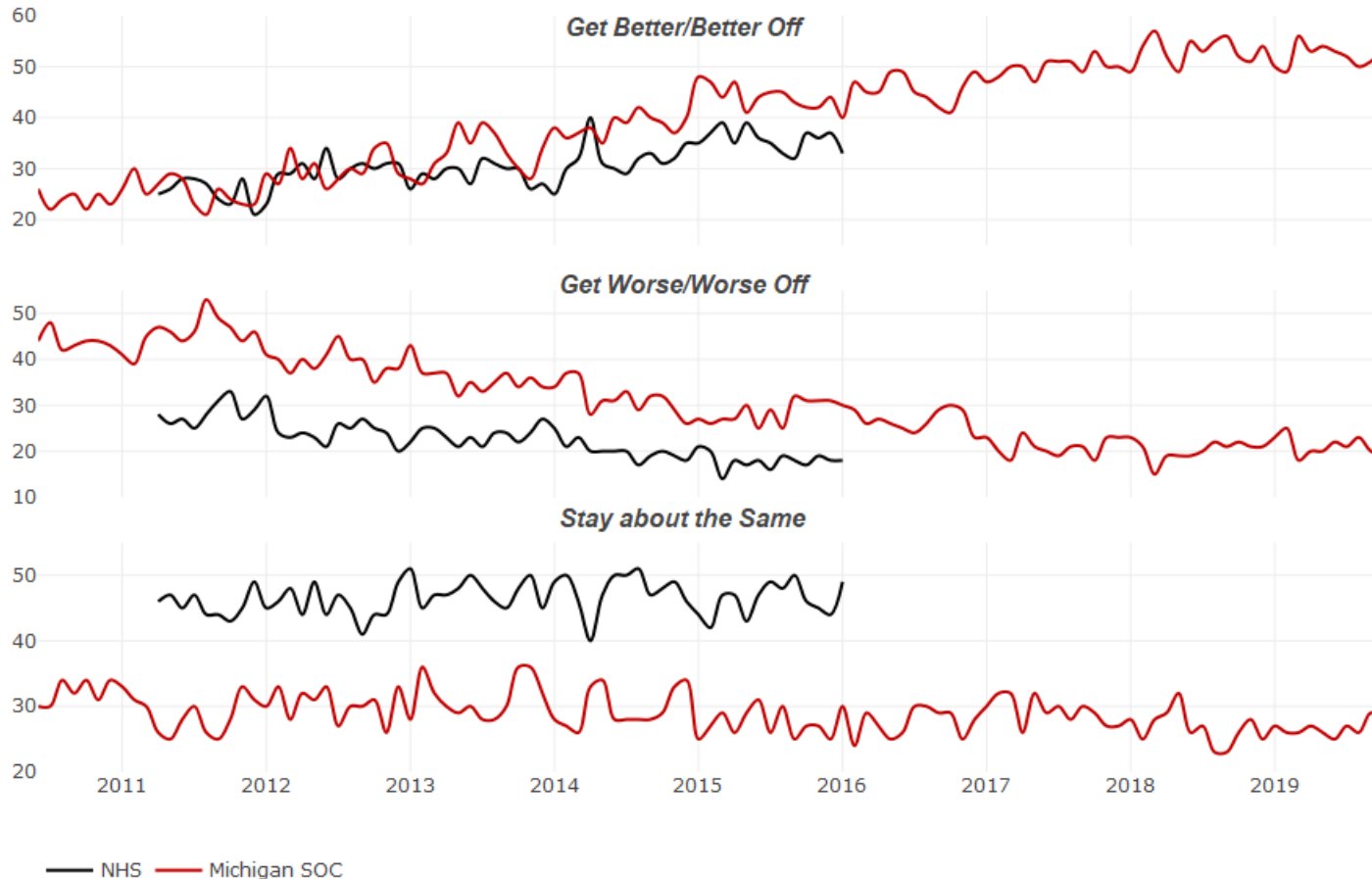
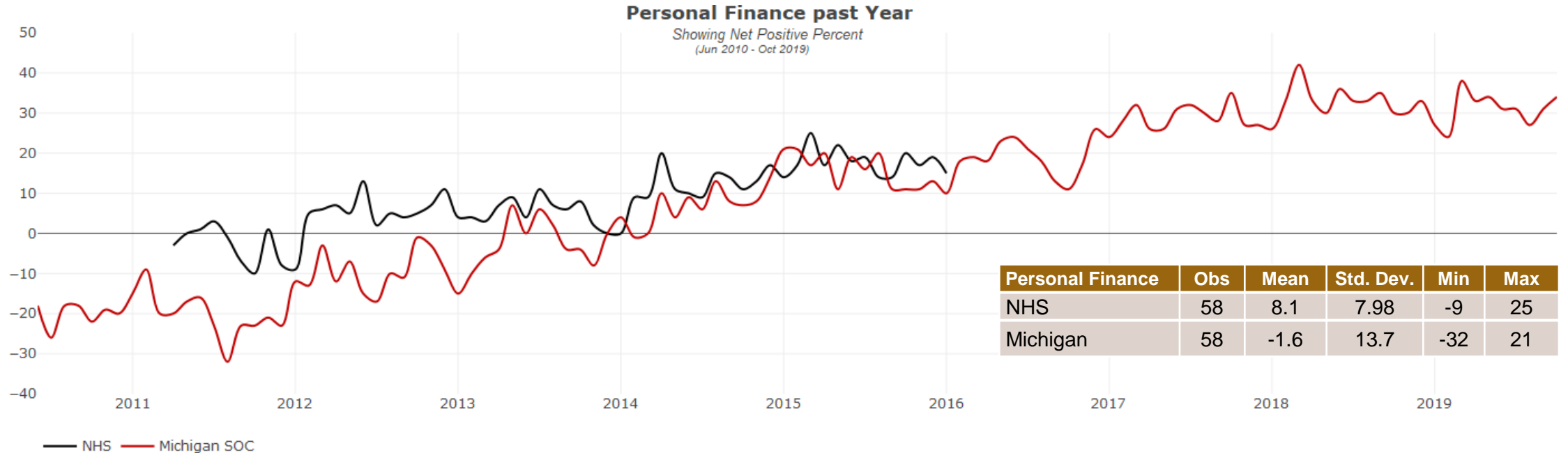| Personal Finance	Obs	Mean	Std. Dev.	Min	Max
NHS (Get Better)	58	30.60	4.18	21	40
Michigan (Better Off)	58	34.67	7.16	21	48
NHS (Get Worse)	58	22.5	4.1	14	33
Michigan (Worse Off)	58	35.8	6.7	25	53
NHS (Same)	58	46.55	2.51	40	51
Michigan (Same)	58	29.38	2.97	25	36

- The NHS didn't start this question until March, 2011 and ended on December, 2015, comparisons are based on 58 months data only, we still plot data from June 2010 for consistency.

- Correlation of percent positive responses: r(NHS, Michigan)=0.74; Correlation of percent negative responses: r(NHS, Michigan)=0.82; Correlation of percent neutral responses: r(NHS, Michigan)=0.01.

- NHS percent negative response on average is 13 points lower than Michigan, while its percent neutral response is 17 points higher than Michigan. This may be related to the differences in respondents' personal interpretation. Also, compared to "Personal Finance Next Year", only 58 monthly data are used here.

Personal Finance Past Year

NHS[1]: Now looking back over the past year, has your personal financial situation gotten <u>much</u> better, <u>somewhat</u> better, stayed about the <u>same</u>, gotten <u>somewhat</u> worse, or gotten <u>much</u> worse?

Michigan: Would you say that you (and your family living there) are <u>better off</u> or <u>worse off</u> financially than you were a year ago?

Personal Finance past Year
Showing Net Positive Percent
(Jun 2010 - Oct 2019)

Personal Finance	Obs	Mean	Std. Dev.	Min	Max
NHS	58	8.1	7.98	-9	25
Michigan	58	-1.6	13.7	-32	21

- Both are trending up from negative to positive for the comparison period.

- High correlation (r=0.88) between the overlap of two time series.

- NHS on average is about10 points higher than Michigan.

- The NHS didn't start this question until March, 2011 and ended on December, 2015, comparisons are based on 58 months data only, we still plot data from June 2010 for consistency

Personal Finance Past Year

NHS[1]: *Now looking back over the past year, has your personal financial situation gotten <u>much</u> better, <u>somewhat</u> better, stayed about the <u>same</u>, gotten <u>somewhat</u> worse, or gotten <u>much</u> worse?*
Michigan: *Would you say that you (and your family living there) are <u>better off</u> or <u>worse off</u> financially than you were a year ago?*

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
NHS	Stationary	Non-Stationary	0.01	Non-Stationary
Michigan	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
NHS	Michigan	2	0.5298	Accept NH
Michigan	NHS	2	0.0133	Reject NH

[*]Null Hypothesis: cause variable does not help predict dependent variable.

- Both NHS and Michigan are non-stationary time series.

- Michigan Granger-cause NHS, which means including Michigan is useful for predicting NHS when NHS's own history (2 lags) is already being used for the prediction.

- NHS does not Granger-cause Michigan. Compared to the Granger Causality testing results in "Personal Finance Next Year", only 58 monthly data are used in "Personal Finance Past Year".

Unemployment (Percent Positive and Negative Response)

NHS[1]: How concerned are you that you will lose your job in the next twelve months? Are you very concerned, somewhat concerned, not very concerned, or not at all concerned that you will lose your job in the next twelve months?
Michigan: *How about people out of work during the coming 12 months--do you think that there will be more unemployment than now, about the same, or less?*
Conference Board: *Six months from now, do you think there will be [more/same/fewer] jobs available in your area?*
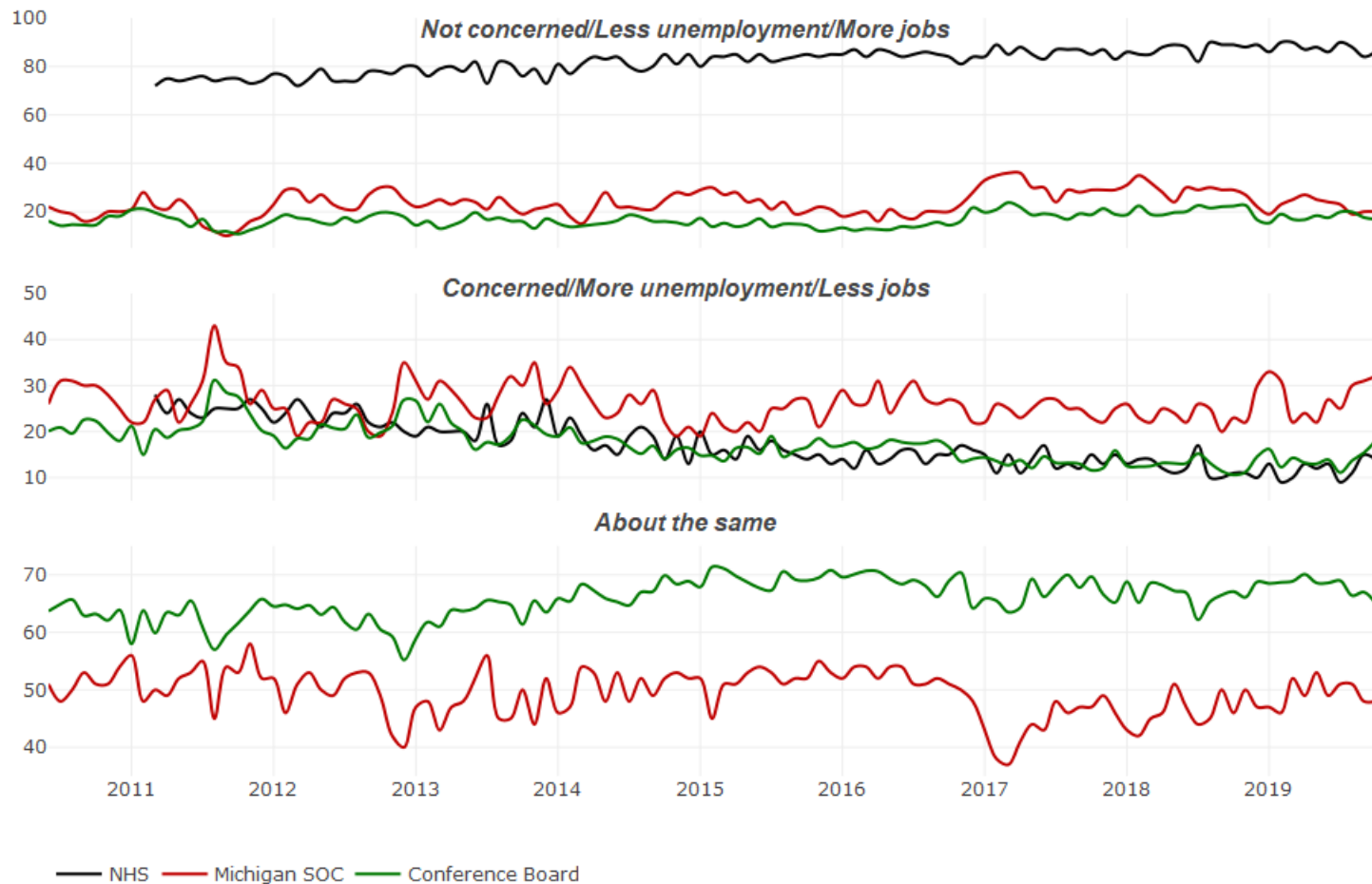
Unemployment	Obs	Mean	Std. Dev.	Min	Max
NHS (Not Concerned)	104	82.2	5.00	72	90
Michigan (Less Unemployment)	104	24.0	5.18	10	36
Conference Board (More Jobs)	104	16.7	2.90	11	24
NHS (Concerned)	104	17.2	4.99	9	28
Michigan (More Unemployment)	104	26.0	4.20	19	43
Conference Board (Less jobs)	104	17.2	4.09	11	31
Michigan (Same)	104	49.2	4.04	37	58
Conference Board (Same)	104	66.1	3.32	55	71

- NHS's percent positive response keeps on trending up since 2011. It is on average about 60 points more than Michigan and Conference Board. One major reason is that Michigan and Conference Board have neutral choice which take a large percent of the respondents. Correlations: r(NHS, Michigan) = 0.35, r(NHS, Conference Board) = 0.31, r(Michigan, Conference Board) = 0.70.

- Michigan's percent negative response on average is 9 points higher than NHS and Conference Board. Correlations: r(NHS, Michigan) = 0.20, r(NHS, Conference Board) = 0.74, r(Michigan, Conference Board) = 0.54.

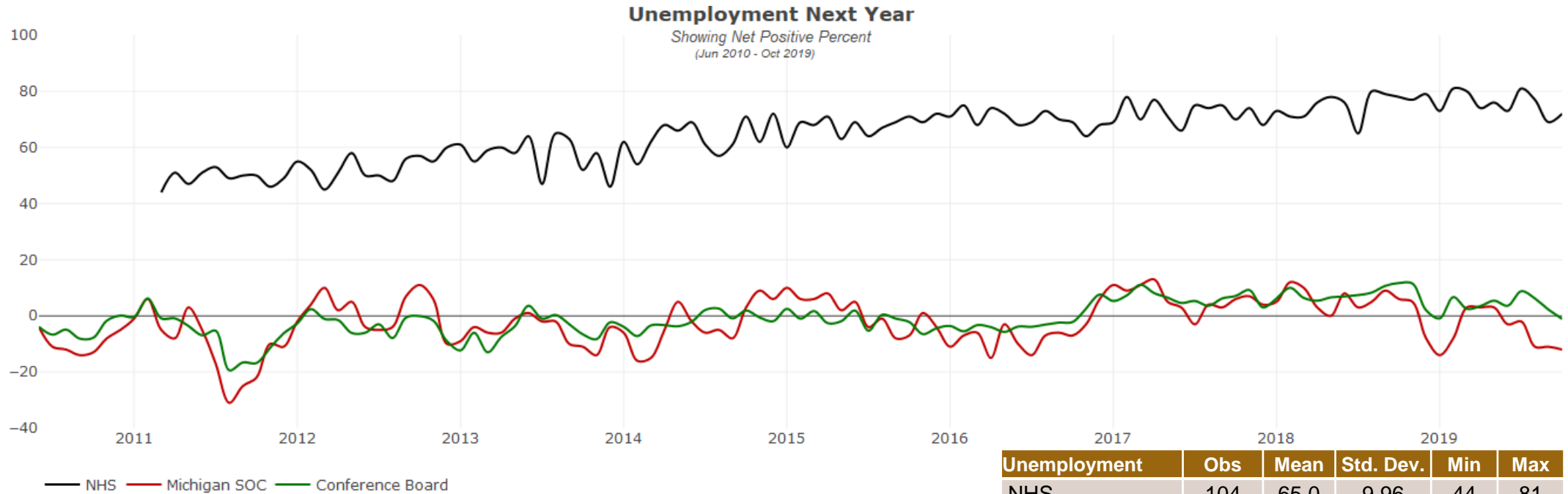- With respect to percent neutral response, Conference Board is 17 points higher than Michigan. Correlation is 0.23.

Unemployment (Net Positive Percentage)

NHS[1]: *How concerned are you that you will lose your job in the next twelve months? Are you <u>very concerned</u>, <u>somewhat concerned</u>, <u>not very concerned</u>, or <u>not at all concerned</u> that you will lose your job in the next twelve months?*
Michigan: *How about people out of work during the coming 12 months--do you think that there will be <u>more unemployment</u> than now, <u>about the same</u>, <u>or less</u>?*
Conference Board: *Six months from now, do you think there will be [more/same/fewer] jobs available in your area?*

Unemployment Next Year
Showing Net Positive Percent
(Jun 2010 - Oct 2019)

Legend: —— NHS —— Michigan SOC —— Conference Board

Unemployment	Obs	Mean	Std. Dev.	Min	Max
NHS	104	65.0	9.96	44	81
Michigan	104	-2.0	8.52	-31	13
Conference Board	104	-0.4	6.27	-19.4	11.7

- NHS is more positive and has stronger upward trend upward than the other two series
- Positive but low correlations between NHS and Michigan (r = 0.31), and Conference Board (r=0.63) . Correlation between Michigan and Conference Board is 0.69.
- The NHS didn't start this question until March, 2011,comparisons are based on 104 months data only, we still plot data from June 2010 for consistency
- NHS is much higher than Michigan and Conference Board because majority of the latter choose the same. NHS does not have neutral choice for this question.

Unemployment (Net Positive Percent)

NHS[1]: How concerned are you that you will lose your job in the next twelve months? Are you <u>very concerned</u>, <u>somewhat concerned</u>, <u>not very concerned</u>, or <u>not at all concerned</u> that you will lose your job in the next twelve months?
Michigan: *How about people out of work during the coming 12 months--do you think that there will be <u>more unemployment</u> than now, <u>about the same</u>, <u>or less</u>?*
Conference Board: *Six months from now, do you think there will be <u>[more/same/fewer] jobs</u> available in your area?*

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
NHS	Stationary	Non-Stationary	0.01	Non-Stationary
Michigan	Stationary	Non-Stationary	0.09	Stationary
Conference Board	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
NHS	Michigan	2	0.6903	Accept NH
Michigan	NHS	2	0.9269	Accept NH
Michigan	Conference Board	2	0.0581	Accept NH
Conference Board	Michigan	2	0.3733	Accept NH
NHS	Conference Board	2	0.8851	Accept NH
Conference Board	NHS	2	0.9985	Accept NH

*Null Hypothesis: cause variable does not help predict dependent variable.

- NHS and Conference Board are non-stationary time series, and Michigan is more stationary.

- All three time series do not Granger-cause with one another.

Home Price- Direction (Percent Positive and Negative Response)

NHS: During the next 12 months, do you think home prices in general will go up, go down, or stay the same, as where they are now?
Michigan: What do you think will happen to the prices of homes (like yours) in your community over the next 12 months? Will they increase at a rapid rate, increase at a moderate rate, remain about the same, decrease at a moderate rate, or decrease at a rapid rate?
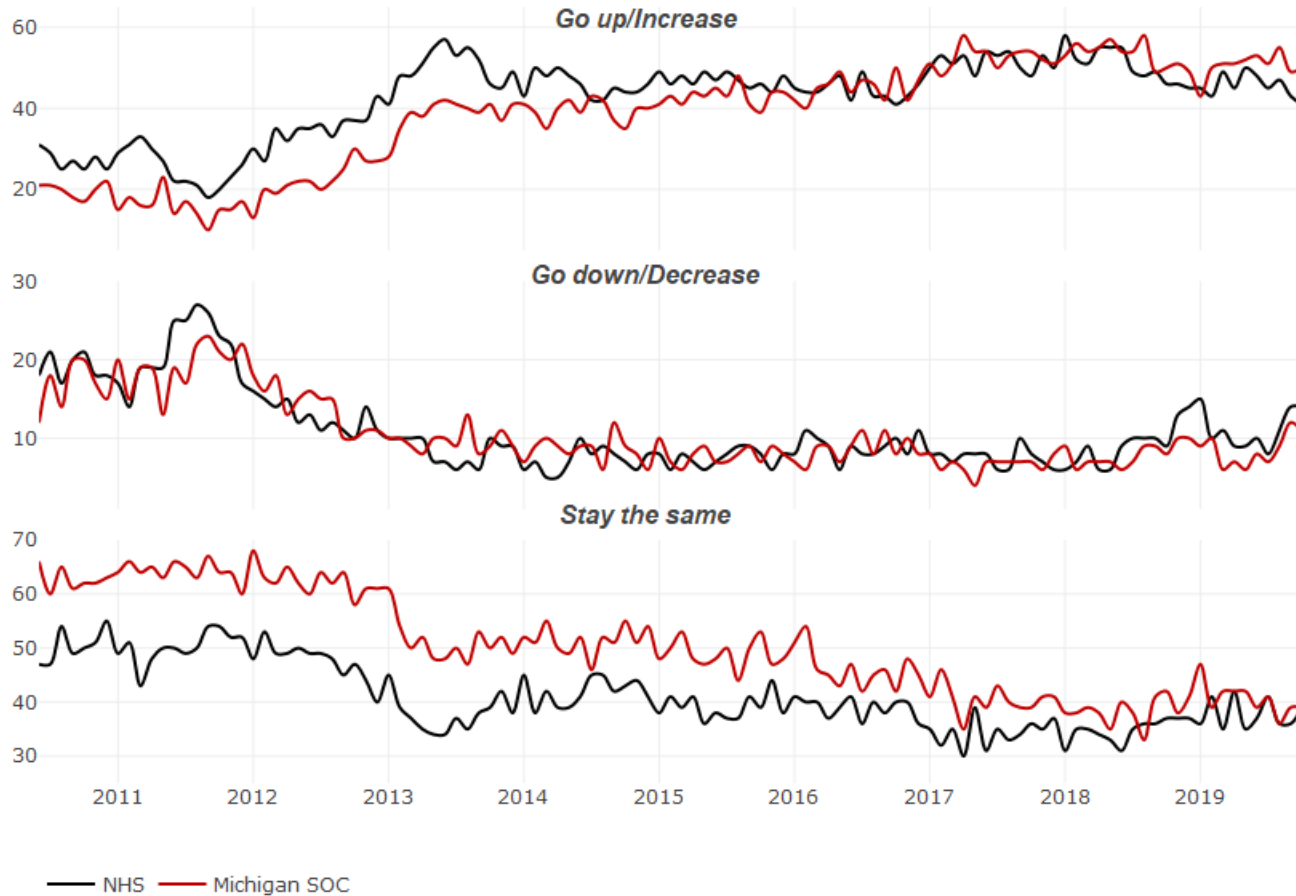
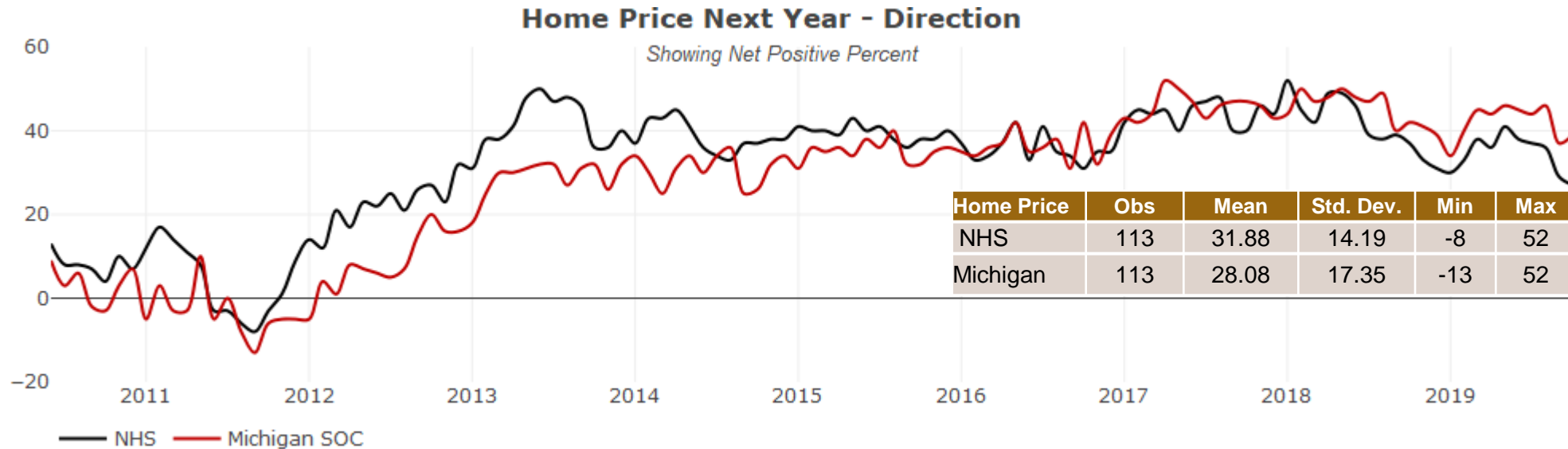| Home Price Next 12 Months	Obs	Mean	Std. Dev.	Min	Max
NHS (Go up)	113	42.8	9.5	18	58
Michigan (Increase)	113	38.6	13.3	10	58
NHS (Go down)	113	10.9	5.0	5	27
Michigan (Decrease)	113	10.5	4.4	4	23
NHS (Same)	113	40.9	6.1	30	55
Michigan (Same)	113	50.3	9.5	33	68

- Both positive percent trend up from 2011-2013, then stay relatively flat. From Oct., 2016 to mid of 2017, positive percent trend up again. r(NHS, Michigan) = 0.88.

- Both negative percent trend down from 2011-2013, then stay relatively flat. r(NHS, Michigan) = 0.85.

- Still 40%+ respondents in two surveys think the home price in next 12 months will stay the same since the beginning of 2017.

Home Price- Direction (Net Positive Percentage)

NHS: *During the next 12 months, do you think home prices <u>in general</u> will <u>go up</u>, <u>go down</u>, or <u>stay the same</u>, as where they are now?*
Michigan: *What do you think will happen to the prices of homes <u>(like yours) in your community</u> over the next 12 months? Will they <u>increase at a rapid rate</u>, <u>increase at a moderate rate</u>, <u>remain about the same</u>, <u>decrease at a moderate rate</u>, or <u>decrease at a rapid rate</u>?*

Home Price Next Year - Direction
Showing Net Positive Percent

Home Price	Obs	Mean	Std. Dev.	Min	Max
NHS	113	31.88	14.19	-8	52
Michigan	113	28.08	17.35	-13	52

Legend: —— NHS   —— Michigan SOC

- Both trend up from 2011-2013, then stay relatively flat.
- Very high correlation (r=0.88) between the two time series
- NHS on average is 3.8 points higher than Michigan.
- The difference might be partially due to the question construction – general vs your community. Also, NHS has fewer choice options than Michigan (3 options vs 5 options).

Home Price- Direction (Net Positive Percentage)

NHS: *During the next 12 months, do you think home prices <u>in general</u> will <u>go up</u>, <u>go down</u>, or <u>stay the same</u>, as where they are now?*

Michigan: *What do you think will happen to the prices of homes <u>(like yours) in your community</u> over the next 12 months? Will they <u>increase at a rapid rate</u>, <u>increase at a moderate rate</u>, <u>remain about the same</u>, <u>decrease at a moderate rate</u>, or <u>decrease at a rapid rate</u>?*

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
NHS	Stationary	Non-Stationary	0.01	Non-Stationary
Michigan	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
NHS	Michigan	2	0.0099	Reject NH
Michigan	NHS	2	0.4105	Accept NH

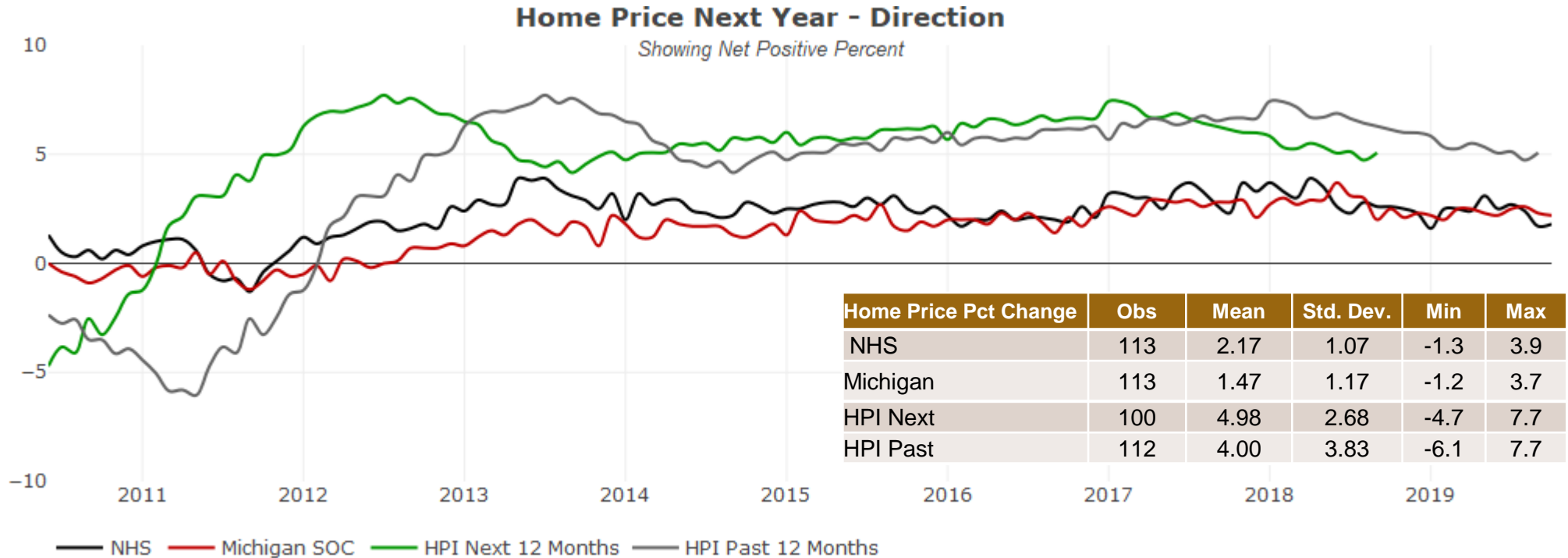[*]Null Hypothesis: cause variable does not help predict dependent variable.

- Both are non-stationary time series.
- NHS Granger-cause Michigan, which means including NHS is useful for predicting Michigan when Michigan's own history (2 lags) is already being used for the prediction.
- Michigan does not Granger-cause NHS.

Home Price – Average Percentage Change

NHS: *By about what percent do you think home prices <u>in general</u> will go down/up on the average over the next 12 months?*

Michigan: *By about what percent do you expect prices of homes <u>like yours in your community</u> to go (up/down), on average, over the next 12 months?*

Home Price Next Year - Direction
Showing Net Positive Percent

Home Price Pct Change	Obs	Mean	Std. Dev.	Min	Max
NHS	113	2.17	1.07	-1.3	3.9
Michigan	113	1.47	1.17	-1.2	3.7
HPI Next	100	4.98	2.68	-4.7	7.7
HPI Past	112	4.00	3.83	-6.1	7.7

Legend: NHS — Michigan SOC — HPI Next 12 Months — HPI Past 12 Months

- NHS estimates are higher than Michigan estimates, both are lower than the actual results.

- High correlation (r=0.80) between the two time series, both are highly correlated with HPI past 12 month (r > 0.80) and both have much lower correlations with HPI next 12 months (r < 0.55).

- Michigan is specific to the respondents' community and NHS is about the general housing market.

- FHFA House Price Index – Purchase Only; data used here are HPI growth rates for the next 12 months (time series ends in Sep., 2018) and for the past 12 months (time series ends in Sep., 2019).

Home Price – Average Percentage Change

NHS: *By about what percent do you think home prices <u>in general</u> will go down/up on the average over the next 12 months?*
Michigan: *By about what percent do you expect prices of homes <u>like yours in your community</u> to go (up/down), on average, over the next 12 months?*

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
NHS	Stationary	Non-Stationary	0.01	Non-Stationary
Michigan	Stationary	Non-Stationary	0.01	Non-Stationary
HPI Next	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
NHS	Michigan	3	0.0184	Reject NH
Michigan	NHS	3	0.4446	Accept NH
NHS	HPI Next	3	0.9909	Accept NH
Michigan	HPI Next	3	0.2506	Accept NH

[*]Null Hypothesis: cause variable does not help predict dependent variable.

- All are non-stationary time series.
- NHS Granger-cause Michigan, which means including NHS is useful for predicting Michigan when Michigan's own history (3 lags) is already being used for the prediction.
- Michigan does not Granger-cause NHS.
- NHS and Michigan do not Granger-cause actual result (HPI next 12 months).

Good Time to Buy (Percent Positive and Negative Response)

NHS: *In general, do you think this is a <u>very good</u> time to buy a house, a <u>somewhat good</u> time, a <u>somewhat bad</u> time, or a <u>very bad</u> time to buy a house?*
Michigan: *Generally speaking, do you think now is a <u>good</u> time or a <u>bad</u> time to buy a house?*
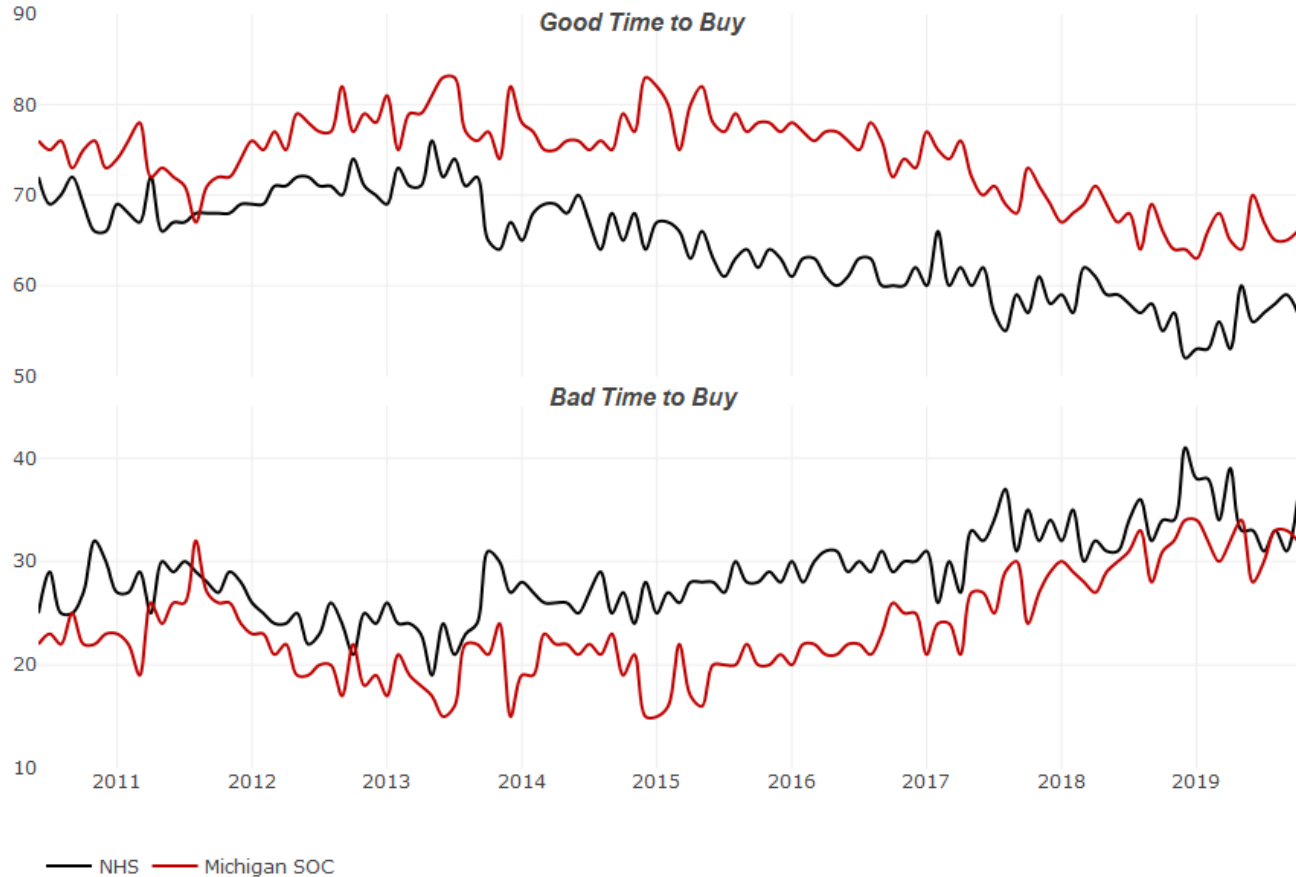
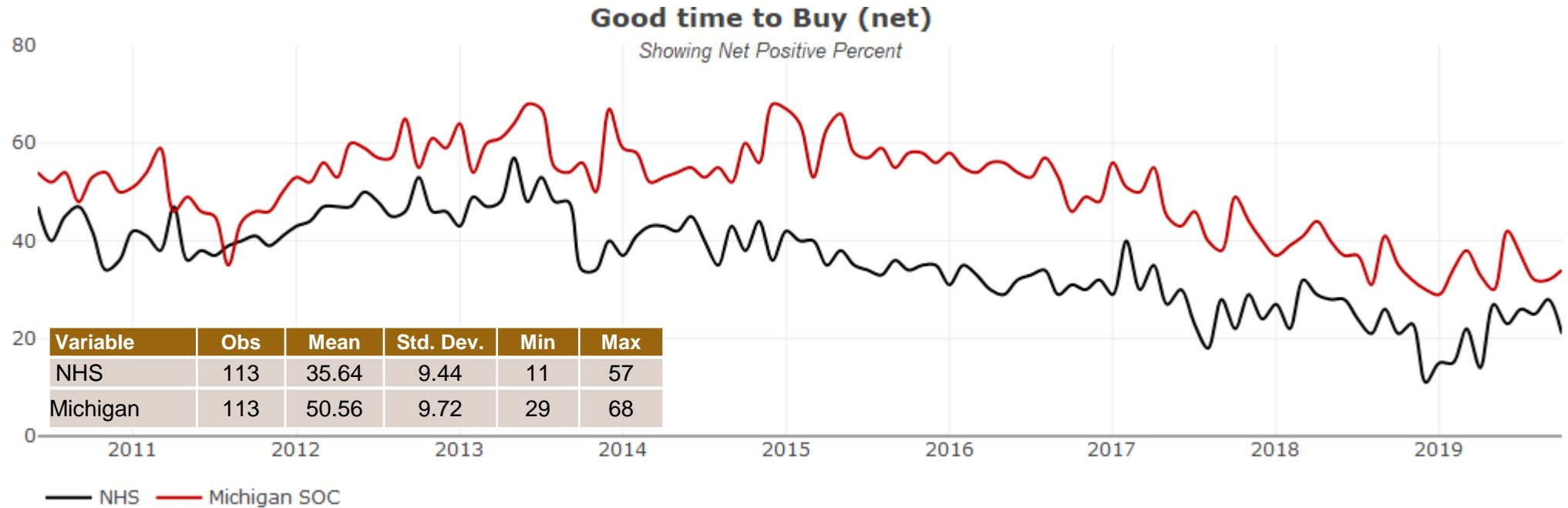| Buy a House	Obs	Mean	Std. Dev.	Min	Max
NHS (Good Time)	113	64.43	5.56	52	76
Michigan (Good Time)	113	74.13	4.90	63	83
NHS (Bad Time)	113	28.80	4.07	19.0	41.0
Michigan (Bad Time)	113	23.58	4.86	15.0	34.0

- Both NHS and Michigan seem to have trended down regarding to good time to buy since 2015. NHS on average is 10 points lower than Michigan. The correlation between two time series is 0.67.

- Both NHS and Michigan seem to have trended up regarding to bad time to buy since 2015. NHS on average is 5 points higher than Michigan. The correlation between two time series is 0.74.

Good Time to Buy (Net Positive Percent)

NHS: *In general, do you think this is a <u>very good</u> time to buy a house, a <u>somewhat good</u> time, a <u>somewhat bad</u> time, or a <u>very bad</u> time to buy a house?*
Michigan: *Generally speaking, do you think now is a <u>good</u> time or a <u>bad</u> time to buy a house?*

Good time to Buy (net)
Showing Net Positive Percent

Variable	Obs	Mean	Std. Dev.	Min	Max
NHS	113	35.64	9.44	11	57
Michigan	113	50.56	9.72	29	68

Legend: — NHS — Michigan SOC

- Both are highly positive for the comparison period. Both NHS and Michigan seem to have trended down since 2015.

- Positive correlation (r=0.72) between the two time series.

- NHS on average is 15 points Lower than Michigan.

- Despite the high similarity of the question text in the two surveys, we still saw large differences. This may indicate that the differences in question design matters. NHS has four choice options, while Michigan only has two options. Also this is more subject to individual interpretation and therefore have large variations, 10 people may have 10 different reasons when saying "it is a good time to buy".

Good Time to Buy (Net Positive Percent)

NHS: *In general, do you think this is a <u>very good</u> time to buy a house, a <u>somewhat good</u> time, a <u>somewhat bad</u> time, or a <u>very bad</u> time to buy a house?*
Michigan: *Generally speaking, do you think now is a <u>good</u> time or a <u>bad</u> time to buy a house?*

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
NHS	Stationary	Non-Stationary	0.01	Non-Stationary
Michigan	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
NHS	Michigan	4	0.0146	Reject NH
Michigan	NHS	4	0.0175	Reject NH

[*]Null Hypothesis: cause variable does not help predict dependent variable.

- Both NHS and Michigan are non-stationary time series.
- Michigan Granger-cause NHS, which means including Michigan is useful for predicting NHS when NHS's own history (4 lags) is already being used for the prediction.
- NHS Granger-cause Michigan, which means including NHS is useful for predicting Michigan when Michigan's own history (4 lags) is already being used for the prediction.

Good Time to Sell (Percent Positive and Negative Response)

NHS: In general, do you think this is a <u>very</u> good time to sell a house, a <u>somewhat</u> good time, a <u>somewhat</u> bad time, or a <u>very</u> bad time to sell a house?
Michigan: What about selling a house–generally speaking, do you think now is a <u>good</u> time or <u>bad</u> time to sell a house?
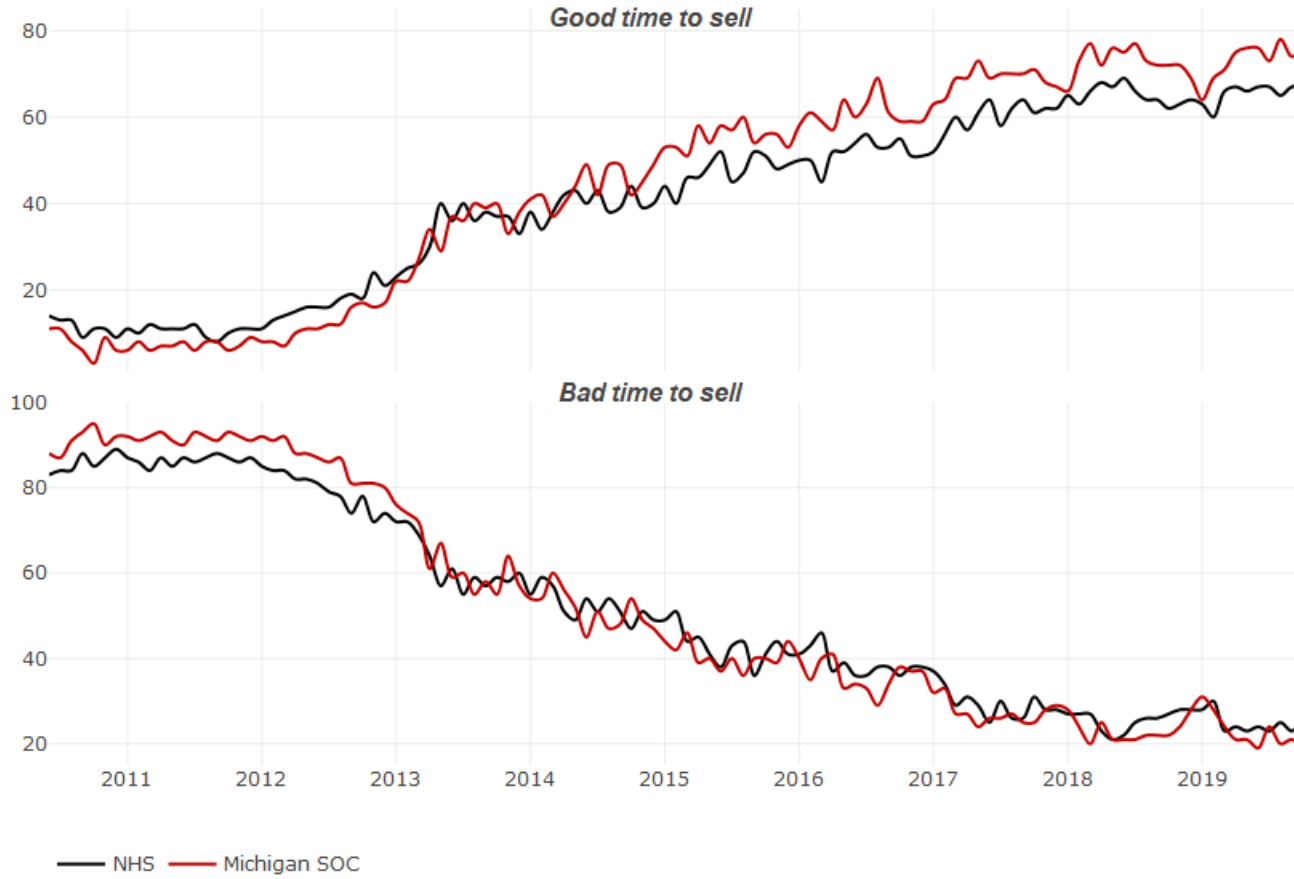
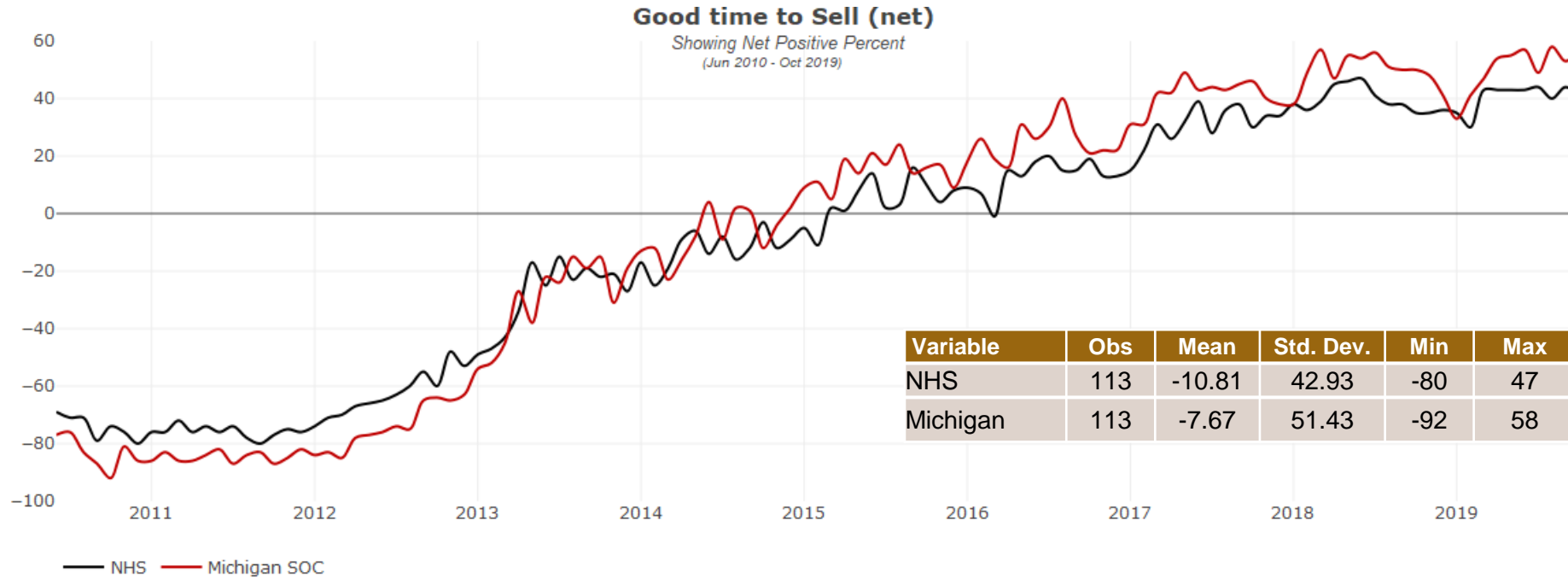|	Obs	Mean	Std. Dev.	Min	Max
NHS (Good time to sell)	113	41.00	20.10	8	69
Michigan (Good time to sell)	113	44.53	25.21	3	78
NHS (Bad time to sell)	113	51.81	22.86	21.0	89.0
Michigan (Bad time to sell)	113	52.20	26.24	19.0	95.0

- Both NHS and Michigan show strong upward trends after 2013 regarding to "Good time to sell". Very high correlation (r = 0.99) between two time series. NHS on average is 3 points lower than Michigan.

- Both NHS and Michigan show strong downward trends after 2013 regarding to "Bad time to sell". Very high correlation (r = 0.99) between two time series. NHS is basically the same as Michigan.

Good Time to Sell (Net Positive Percent)

NHS: *In general, do you think this is a <u>very</u> good time to sell a house, a <u>somewhat</u> good time, a <u>somewhat</u> bad time, or a <u>very</u> bad time to sell a house?*
Michigan: *What about selling a house–generally speaking, do you think now is a <u>good</u> time or <u>bad</u> time to sell a house?*

Good time to Sell (net)
Showing Net Positive Percent
(Jun 2010 - Oct 2019)

Variable	Obs	Mean	Std. Dev.	Min	Max
NHS	113	-10.81	42.93	-80	47
Michigan	113	-7.67	51.43	-92	58

- Mostly negative but strong upward trend before 2015, turned positive in 2015, after that, strong upward trend till currently.
- Very high correlation (r=0.99) between the two time series. Much higher than the correlation (0.71) of Good time to buy. Maybe respondents are more uncertain about purchasing than selling, and then more divergent opinions towards good time to buy.
- NHS on average is 3 points lower than Michigan.

Good Time to Sell (Net Positive Percent)

NHS: In general, do you think this is a <u>very</u> good time to sell a house, a <u>somewhat</u> good time, a <u>somewhat</u> bad time, or a <u>very</u> bad time to sell a house?
Michigan: What about selling a house–generally speaking, do you think now is a <u>good</u> time or <u>bad</u> time to sell a house?

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
NHS	Stationary	Non-Stationary	0.01	Non-Stationary
Michigan	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
NHS	Michigan	2	0.0000	Reject NH
Michigan	NHS	2	0.0018	Reject NH

- Both NHS and Michigan are non-stationary time series.

- Michigan Granger-cause NHS, which means including Michigan is useful for predicting NHS when NHS's own history (2 lags) is already being used for the prediction.

- NHS Granger-cause Michigan, which means including NHS is useful for predicting Michigan when Michigan's own history (2 lags) is already being used for the prediction.

Interest Rate (Percent Positive and Negative Response)

NHS: During the next 12 months, do you think <u>home mortgage interest rates</u> will go up, go down, or stay the same as where they are now?

Michigan: No one can say for sure, but what do you think will happen to <u>interest rates for borrowing money</u> during the next 12 months--will they go up, stay the same, or go down?

Conference Board: What do you think will happen to <u>interest rates</u> [over the next 12 months]? [five-point scale: increase, slightly increase, remain the same, slightly decrease, decrease]
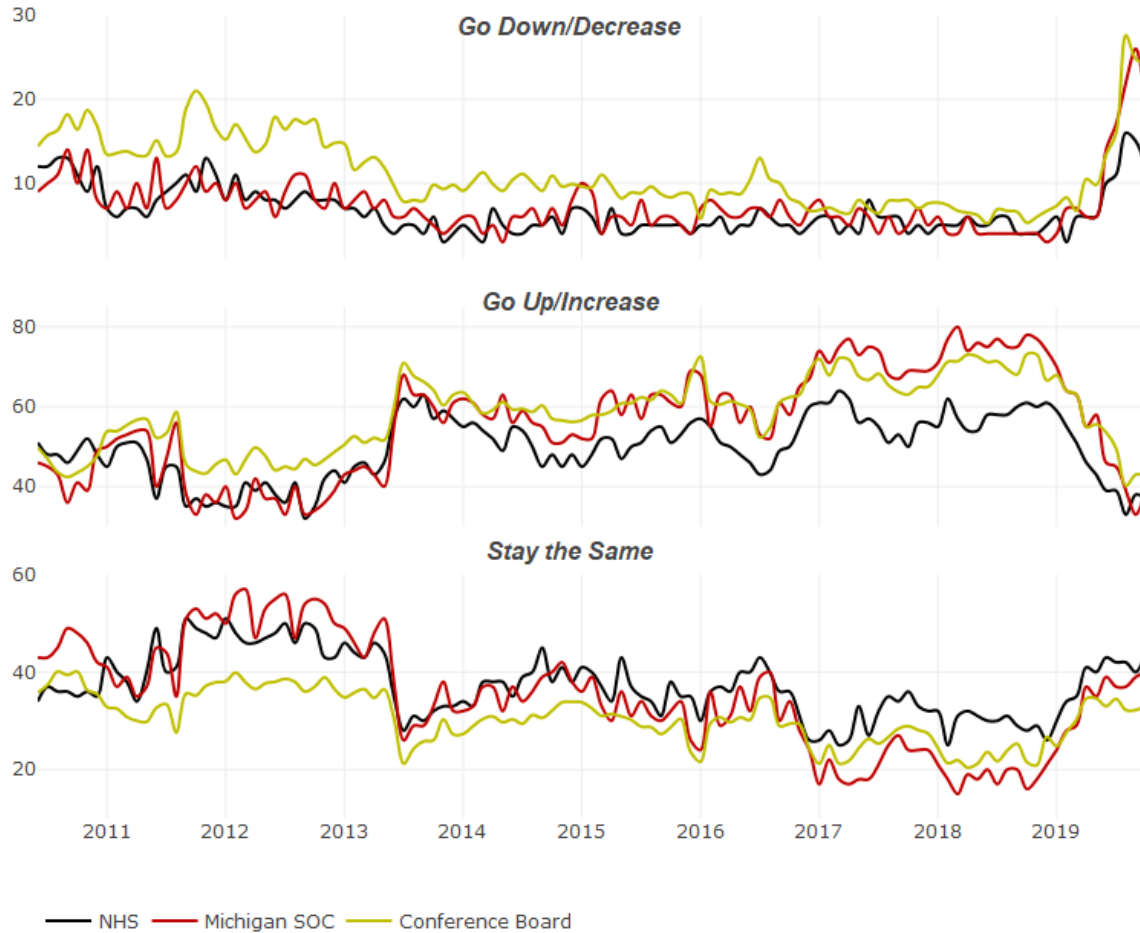
Mortgage Rate	Obs	Mean	Std. Dev.	Min	Max
NHS (Go Down)	113	6.60	2.70	3	16
Michigan (Go Down)	113	7.42	3.60	3	26
Conference Board (Decrease)	113	11.25	4.45	5	28
NHS (Go Up)	113	49.59	7.91	32	64
Michigan (Go Up)	113	56.08	13.32	32	80
Conference Board (Increase)	113	58.22	9.08	40	73
NHS (Same)	113	37.35	6.55	25	51
Michigan (Same)	113	35.12	11.09	15	57
Conference Board (Same)	113	30.54	5.26	20	40

- With respect to percent positive response, the three time series slightly trend downward between 2011 and 2014, and remain relatively stable between 2014 and 2018, then start trending upward strongly since the end of 2018.

- With respect to percent negative response, the three time series remain relatively stable between 2014 and 2018, then start trending downward strongly since the end of 2018.

- Since the end of 2018, more respondents think the interest rates over the next 12 months will stay the same.

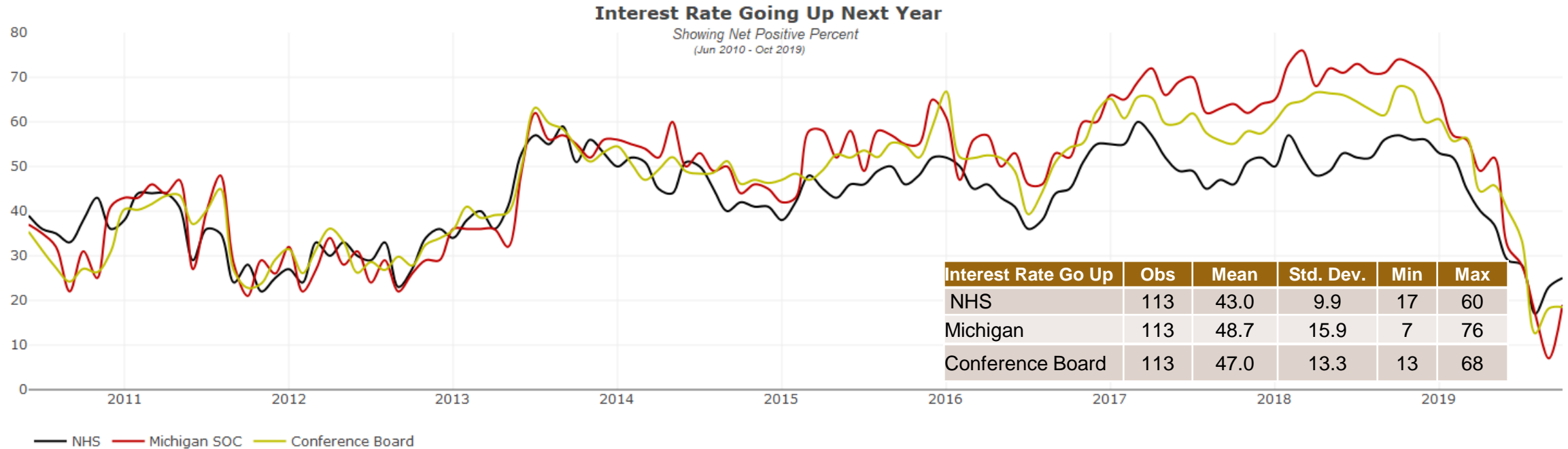- NHS, Michigan and Conference Board trend closely.

Interest Rate (Net Positive Percent)

NHS: During the next 12 months, do you think <u>home mortgage interest rates</u> will go up, go down, or stay the same as where they are now?
Michigan: No one can say for sure, but what do you think will happen to <u>interest rates for borrowing money</u> during the next 12 months--will they go up, stay the same, or go down?
Conference Board: What do you think will happen to <u>interest rates</u> [over the next 12 months]? [five-point scale: increase, slightly increase, remain the same, slightly decrease, decrease]

Interest Rate Going Up Next Year
Showing Net Positive Percent
(Jun 2010 - Oct 2019)

Interest Rate Go Up	Obs	Mean	Std. Dev.	Min	Max
NHS	113	43.0	9.9	17	60
Michigan	113	48.7	15.9	7	76
Conference Board	113	47.0	13.3	13	68

— NHS — Michigan SOC — Conference Board

- Since Aug. 2018, three time series trend downward strongly.

- The three time series trend closely: r(NHS, Michigan) = 0.89, r(NHS, Conference Board) = 0.90, r(Michigan, Conference Board) = 0.96.

- NHS is about the home mortgage interest rates, while Michigan and Conference Board refer to interest rate in general. Conference Board has more choice options than the other two. Also, The order of choices in NHS are different from the other two surveys.

Interest Rate (Net Positive Percent)

NHS: During the next 12 months, do you think <u>home mortgage interest rates</u> will go up, go down, or stay the same as where they are now?

Michigan: No one can say for sure, but what do you think will happen to <u>interest rates for borrowing money</u> during the next 12 months--will they go up, stay the same, or go down?

Conference Board: What do you think will happen to <u>interest rates</u> [over the next 12 months]? [five-point scale: increase, slightly increase, remain the same, slightly decrease, decrease]

| Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
NHS	Stationary	Non-Stationary	0.01	Non-Stationary
Michigan	Stationary	Non-Stationary	0.01	Non-Stationary
Conference Board	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
NHS	Michigan	2	0.0001	Reject NH
Michigan	NHS	2	0.1771	Accept NH
NHS	Conference Board	2	0.0086	Reject NH
Conference Board	NHS	2	0.1637	Accept NH
Michigan	Conference Board	2	0.0804	Accept NH
Conference Board	Michigan	2	0.0084	Reject NH

[*]Null Hypothesis: cause variable does not help predict dependent variable.

- All three are non-stationary time series.
- NHS Granger-cause Michigan, which means including NHS is useful for predicting Michigan when Michigan's own history (2 lags) is already being used for the prediction.
- NHS Granger-cause Conference Board, which means including NHS is useful for predicting Conference Board when Conference Board's own history (2 lags) is already being used for the prediction.
- Conference Board Granger-cause Michigan, which means including Conference Board is useful for predicting Michigan when Michigan's own history (2 lags) is already being used for the prediction.

Current Home Value

Expected Value of Current Home (median)
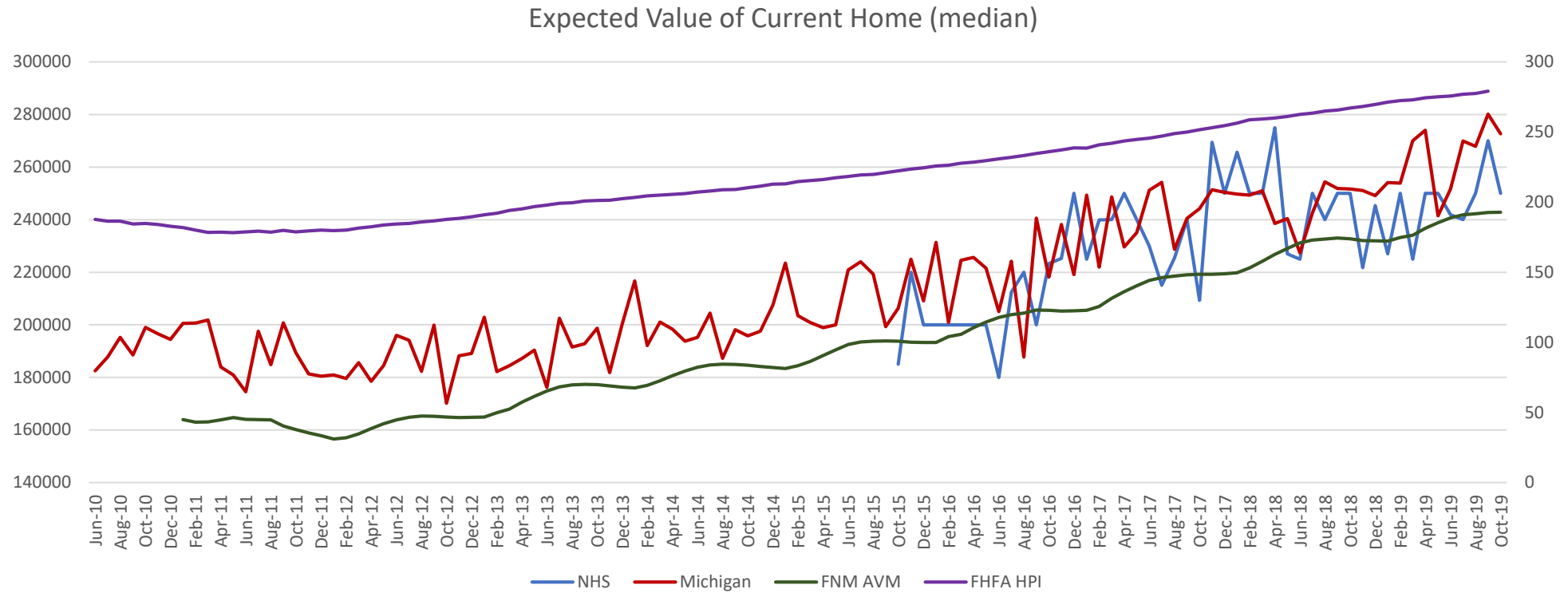
- The time series have all trended up since 2013 . The FHFA HPI have less volatility than the two current market value estimates of primary homes from surveys.
- Positive correlations between the four series: r(NHS, Michigan) = 0.61, r(NHS, HPI) = 0.63, r(Michigan, HPI)=0.92, r(NHS, AVM)=0.66.
- The NHS data didn't started until October 2015, we still present data for the other time series from June 2010 for consistency.

Question Comparison – Neutral Ground, the Number of Choices and the Measurements

NO.	Questions	NHS Questions		Comparative Survey Questions			Measurements	
		Neutral Ground	# of Choices	Sources	Neutral Ground	# of Choices	Correlations	Granger Causality*
1	Economy Outlook	No	2	Gallup	No	2	0.93	-
				Michigan	No	2	0.86	-
2*	Personal Finance Next Year	Yes	5	Michigan	Yes	3	0.87	+
3*	Personal Finance Past Year	Yes	5	Michigan	Yes	3	0.83	-
4*	Unemployment	No	4	Michigan	Yes	3	0.31	
				Conf. Board	Yes	3	0.63	
5^	Home Price -Direction	Yes	3	Michigan	Yes	5	0.88	+
6	Home Price - % change	No	2	Michigan	No	2	0.80	+
7^	Good Time to Buy	No	4	Michigan	No	2	0.72	+/-
8^	Good Time to Sell	No	4	Michigan	No	2	0.99	+/-
9	Interest Rate Increase Next Year	Yes	3	Michigan	Yes	3	0.89	+
				Conf. Board	Yes	5	0.90	+
10	Perceived Home Value			Michigan			0.61	
				FNM AVM			0.66	

- **More choices for questions related to personal situation (**highlighted in orange & marked with *) tend to lead to more positive survey scores.** For example, both the NHS and the Michigan survey ask about personal finance expectations in Question 2 and the past personal finance in Questions 3. The NHS offers five response choices (much better/somewhat better/same/somewhat worse/worse) while the Michigan survey only offers three (better/same/worse). Possibly as a result of fewer response choices, the Michigan survey respondents report a higher percentage of "same" and a lower percentage of "better" than NHS.
- **More choices for questions about general economic or market conditions (**highlighted in green and marked with ^) tend to lead to more negative survey scores.** For example, more response choices lead to lower scores in home price directions for Michigan in Question 5, good time to buy for NHS in Question 7 and good time to sell for NHS in Question 8, as well as higher scores for Conference Board in Question 9 on expected interest rate increase.
- **Neutral choices tend to lead to more negative survey scores**. Respondents tend to be more positive when neutral choice is not available. For example, both the NHS and the Michigan survey ask about how concern lose your job in next twelve month. The NHS offers four response choices (very concerned/somewhat concerned/not very concerned/not at all concerned) while the Michigan survey offers three (more unemployment/same/less unemployment). NHS respondents report a higher percentage of "Not Concerned" than the Michigan(less unemployment).
- **Correlation and Grander-causality reflect the similarity of the same question from different surveys**. Good time to buy/sell, interest rate increase next year are closest, while unemployment has the least similarity between NHS and Michigan/conference Boards.
  '+' means NHS Granger-cause other surveys; '-' means other surveys Granger-cause NHS; '+/-' means both Granger-cause each other.
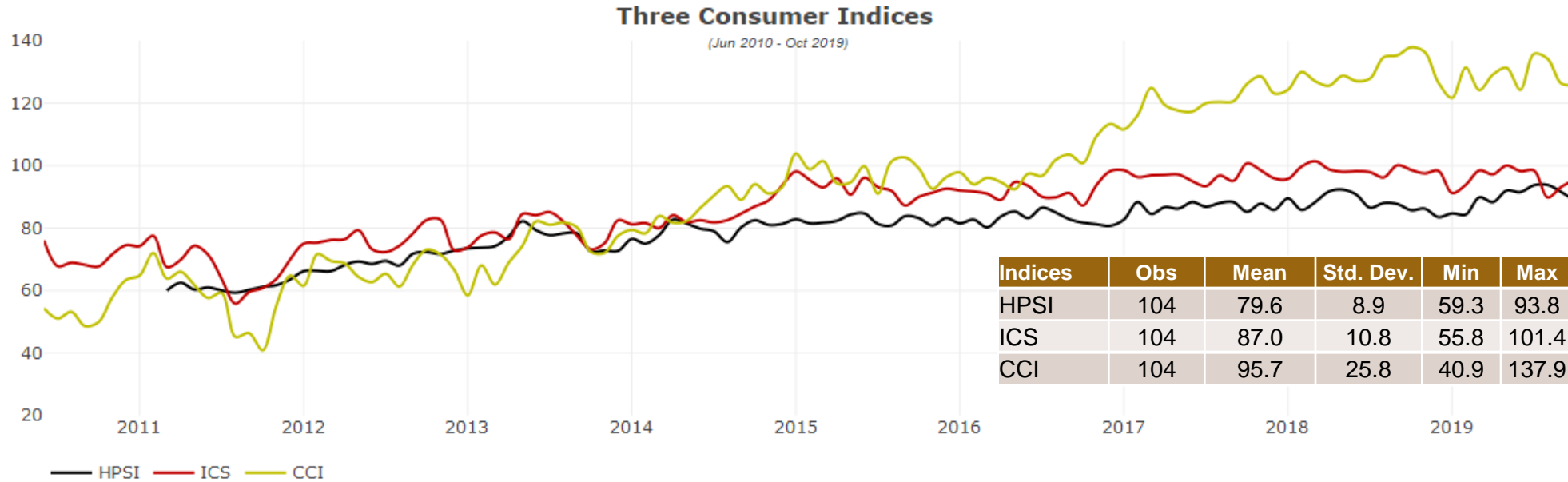
Three Consumer Indices

Fannie Mae Home Purchase Sentiment Index (HPSI): Averaging net positive percentages of six NHS questions on housing and personal finance
Michigan Index of Consumer Sentiment (ICS): Average of net positive percentages five questions on personal finance, business condition, and buying durable goods
Conference Board Consumer Confidence Index (CCI): Average of five questions on business condition, employment, and family income

Three Consumer Indices
(Jun 2010 - Oct 2019)

Indices	Obs	Mean	Std. Dev.	Min	Max
HPSI	104	79.6	8.9	59.3	93.8
ICS	104	87.0	10.8	55.8	101.4
CCI	104	95.7	25.8	40.9	137.9

- The three time series all trending upwards for the observation period, HPSI and ICS have less variations than CCI. CCI is much higher than HPSI and ICS since 2017.

- High correlations, r(NHS, Michigan) = 0.92, r(NHS, Conference Board) = 0.90, r(Michigan, Conference Board)=0.92.

- The NHS HPSI didn't started until March 2011, we still present data for the other indices from June 2010 for consistency.

Three Consumer Indices

Fannie Mae Home Purchase Sentiment Index (HPSI): *Averaging net positive percentages of six NHS questions on housing and personal finance*
Michigan Index of Consumer Sentiment (ICS): *Average of net positive percentages five questions on personal finance, business condition, and buying durable goods*
Conference Board Consumer Confidence Index (CCI): *Average of five questions on business condition, employment, and family income*

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
HPSI	Stationary	Non-Stationary	0.01	Non-Stationary
ICS	Stationary	Non-Stationary	0.01	Non-Stationary
CCI	Stationary	Non-Stationary	0.01	Non-Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
HPSI	ICS	2	0.4742	Accept NH
ICS	HPSI	2	0.1318	Accept NH
HPSI	CCI	2	0.3165	Accept NH
CCI	HPSI	2	0.5284	Accept NH
ICS	CCI	2	0.0004	Reject NH
CCI	ICS	2	0.4294	Accept NH

[*]Null Hypothesis: cause variable does not help predict dependent variable.

- All three indices are non-stationary time series.
- ICS Granger-cause CCI, which means including ICS is useful for predicting CCI when CCI's own history (2 lags) is already being used for the prediction.

Three Consumer Indices

Fannie Mae Home Purchase Sentiment Index (HPSI)*: Averaging net positive percentages of six NHS questions on housing and personal finance*
Michigan Index of Consumer Sentiment (ICS)*: Average of net positive percentages five questions on personal finance, business condition, and buying durable goods*
Conference Board Consumer Confidence Index (CCI)*: Average of five questions on business condition, employment, and family income*
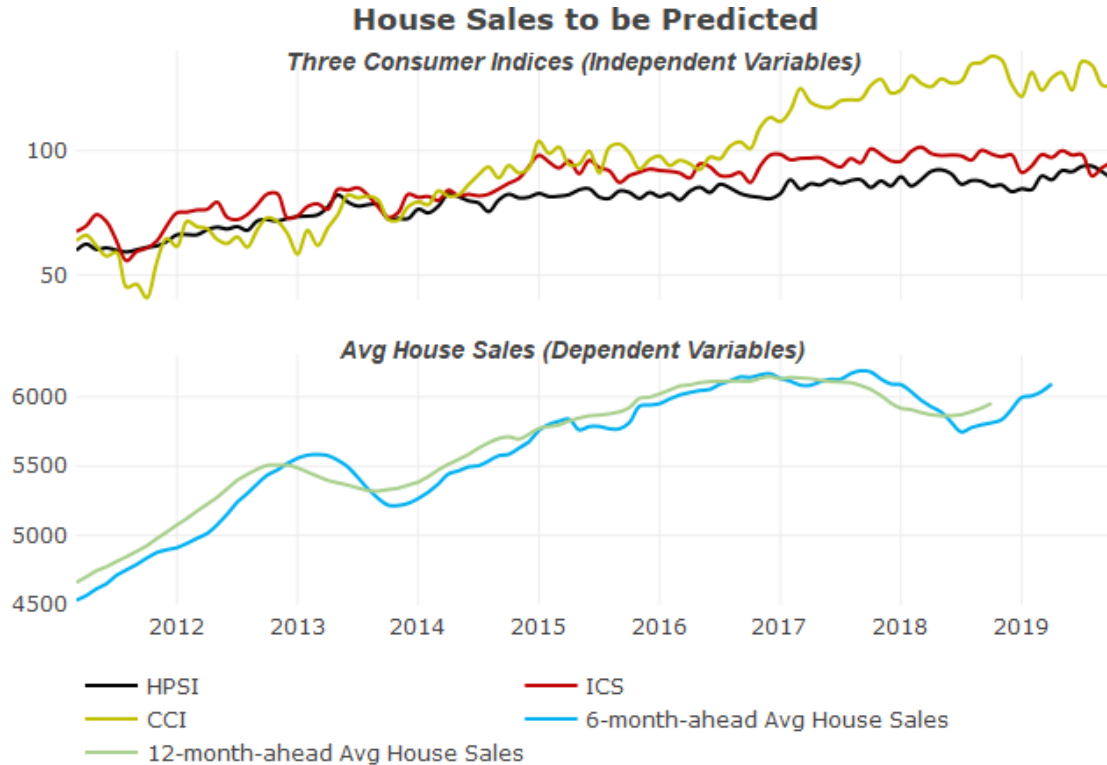
Regression of House Sales		
Explanatory Variables	6-month-ahead Avg House Sales[1]	12-month-ahead Avg House Sales[2]
HPSI	47.94***	42.75***
	(22.04)	(19.59)
Observations	98	92
R-Squared	0.8333	0.808
ICS	36.95***	33.59***
	(18.97)	(18.54)
Observations	98	92
R-Squared	0.7872	0.7902
CCI	14.89***	14.17***
	(14.33)	(14.24)
Observations	98	92
R-Squared	0.6782	0.6891

t-statistics in parentheses. Asterisks denote statistical significance at the 10 (*), 5 (**), and 1(***) percent levels.
[1,2] Average of next 6 or 12 months' house sales.

- Three indices are compared using regression models. Dependent variables in models are 6-month-ahead and 12-month-ahead home sales.

- In 6-month-ahead models, based on R^2, HPSI/ICS/CCI can explain 83.3%/78.7%/67.8% variance of 6-month-ahead home sales, respectively.

- In 12-month-ahead models, based on R^2, HPSI/ICS/CCI can explain 81%/79%/68.9% variance of 12-mouth ahead home sales, respectively.

- HPSI has the best performance to predict the future home sales on average, then followed by ICS and CCI.

Three Consumer Indices

Fannie Mae Home Purchase Sentiment Index (HPSI): *Averaging net positive percentages of six NHS questions on housing and personal finance*

Michigan Index of Consumer Sentiment (ICS): *Average of net positive percentages five questions on personal finance, business condition, and buying durable goods*

Conference Board Consumer Confidence Index (CCI): *Average of five questions on business condition, employment, and family income*
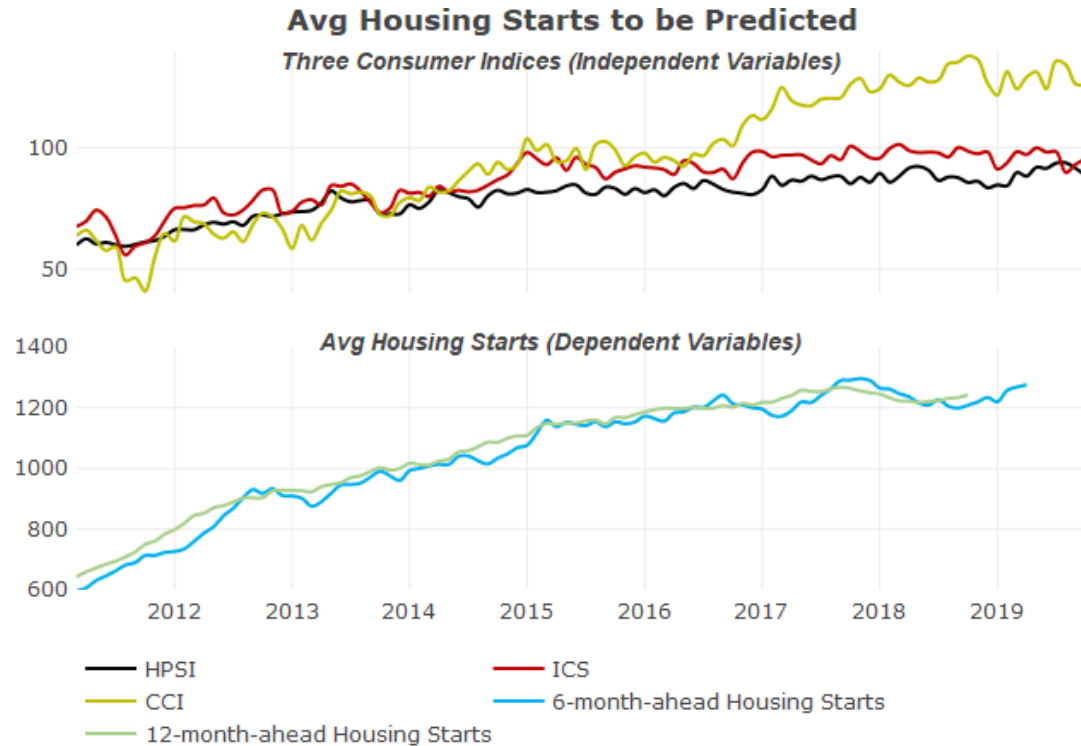
Regression of the Housing Starts		
Explanatory Variables	**6-month-ahead Avg Housing Starts[1]**	**12-month-ahead Avg Housing Starts[2]**
HPSI	21.26***	19.55***
	(29.33)	(29.76)
Observations	98	92
R-Squared	0.8986	0.9067
ICS	16.35***	15.14***
	(23.09)	(23.75)
Observations	98	92
R-Squared	0.8458	0.8609
CCI	6.95***	6.68***
	(20.48)	(20.51)
Observations	98	92
R-Squared	0.8118	0.8218

t-statistics in parentheses. Asterisks denote statistical significance at the 10 (*), 5 (**), and 1(***) percent levels.

[1,2] Average of next 6 or 12 months' housing starts.

- Three indices are compared using regression models. Dependent variables in models are 6-month-ahead and 12-month-ahead housing starts.

- In 6-month-ahead models, based on R^2, HPSI/ICS/CCI can explain 86.9%/84.6%/81.2% variance of 6-month-ahead housing starts, respectively.

- In 12-month-ahead models, based on R^2, HPSI/ICS/CCI can explain 90.7%/86.1%/82.2% variance of 12-month-ahead housing starts, respectively.

- HPSI has the best performance to predict the future housing starts on average, then followed by ICS and CCI.

Three Consumer Indices - Annual Changes

Fannie Mae Home Purchase Sentiment Index (HPSI): *Averaging net positive percentages of six NHS questions on housing and personal finance*
Michigan Index of Consumer Sentiment (ICS): *Average of net positive percentages five questions on personal finance, business condition, and buying durable goods*
Conference Board Consumer Confidence Index (CCI): *Average of five questions on business condition, employment, and family income*

Three Consumer Indices Annual Changes
(Jun 2010 - Oct 2019)

Legend: HPSI, ICS, CCI
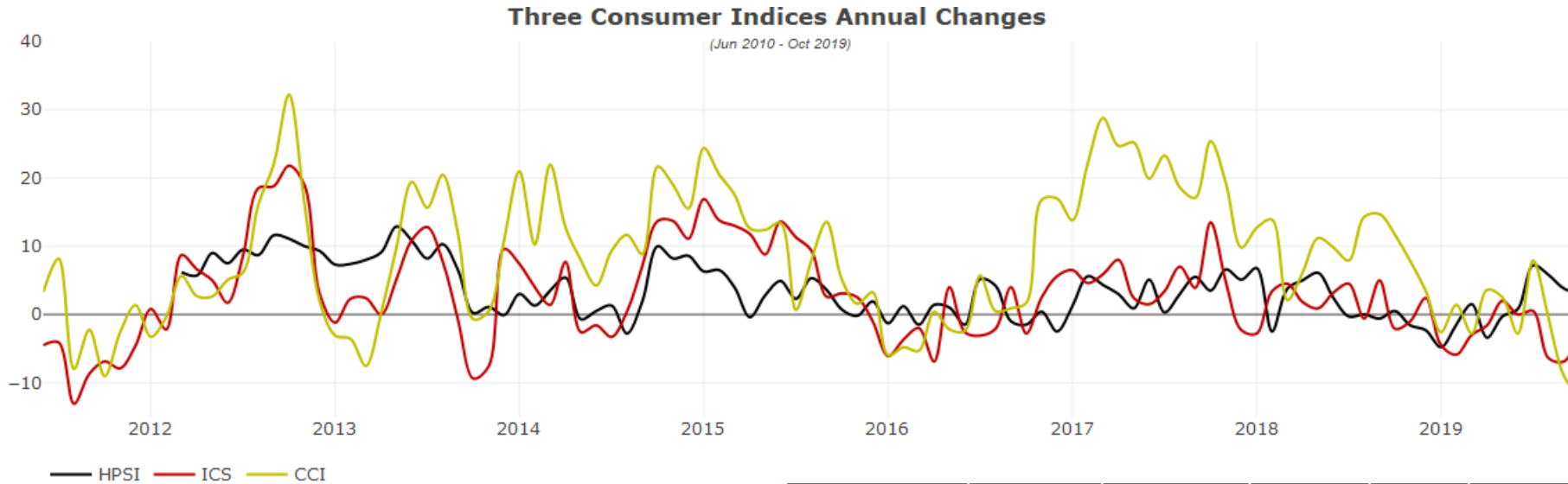
Indices Change	Obs	Mean	Std. Dev.	Min	Max
HPSI	92	3.5	4.0	-4.8	12.9
ICS	92	3.7	6.6	-9.4	21.8
CCI	92	9.3	9.5	-12.0	32.2

- Among the three time series, HPSI and ICS have less variations than CCI.
- r(HPSI, ICS) =0.50, r(ICS, CCI) =0.29 and r(HPSI, CCI) =0.64.
- The NHS HPSI didn't started until March 2012, we still present data for the other indices from June 2011 for consistency.

Three Consumer Indices - Annual Changes

Fannie Mae Home Purchase Sentiment Index (HPSI): *Averaging net positive percentages of six NHS questions on housing and personal finance*
Michigan Index of Consumer Sentiment (ICS): *Average of net positive percentages five questions on personal finance, business condition, and buying durable goods*
Conference Board Consumer Confidence Index (CCI): *Average of five questions on business condition, employment, and family income*

Stationary (KPSS) test				
Variable	Null Hypothesis	Alt Hypothesis	P Value	Conclusion
HPSI	Stationary	Non-Stationary	0.01	Non-Stationary
ICS	Stationary	Non-Stationary	0.02	Non-Stationary
CCI	Stationary	Non-Stationary	0.10	Stationary

Granger causality test[*]				
Cause Variable	Dependent Variable	Lags Used	P Value	Conclusion
HPSI	ICS	2	0.6576	Accept NH
ICS	HPSI	2	0.0087	Reject NH
HPSI	CCI	2	0.2214	Accept NH
CCI	HPSI	2	0.6411	Accept NH
ICS	CCI	2	0.0215	Reject NH
CCI	ICS	2	0.0070	Reject NH

*Null Hypothesis: cause variable does not help predict dependent variable.

- HPSI and ICS are non-stationary time series, CCI is stationary time series.

- ICS annual change Granger-cause HPSI annual change, which means including ICS annual change is useful for predicting HPSI annual change when HPSI's own history (2 lags) is already being used for the prediction.

- ICS annual change Granger-cause CCI annual change, which means including ICS annual change is useful for predicting CCI annual change when CCI's own history (2 lags) is already being used for the prediction.

- CCI annual change Granger-cause ICS annual change, which means including CCI annual change is useful for predicting ICS annual change when ICS's own history (2 lags) is already being used for the prediction.

NHS HPSI

Michigan ICS

Conference Board CCI

HPSI (<$25k) — HPSI ($25k-50k) — HPSI ($50k-100k) — HPSI ($100k+) — ICS (Bottom 33% Income) — ICS (Mid 33% Income) — ICS (Top 33% Income) — CCI (<$15K) — CCI ($15-25K) — CCI ($25-35K) — CCI ($35-50K) — CCI ($50K+)
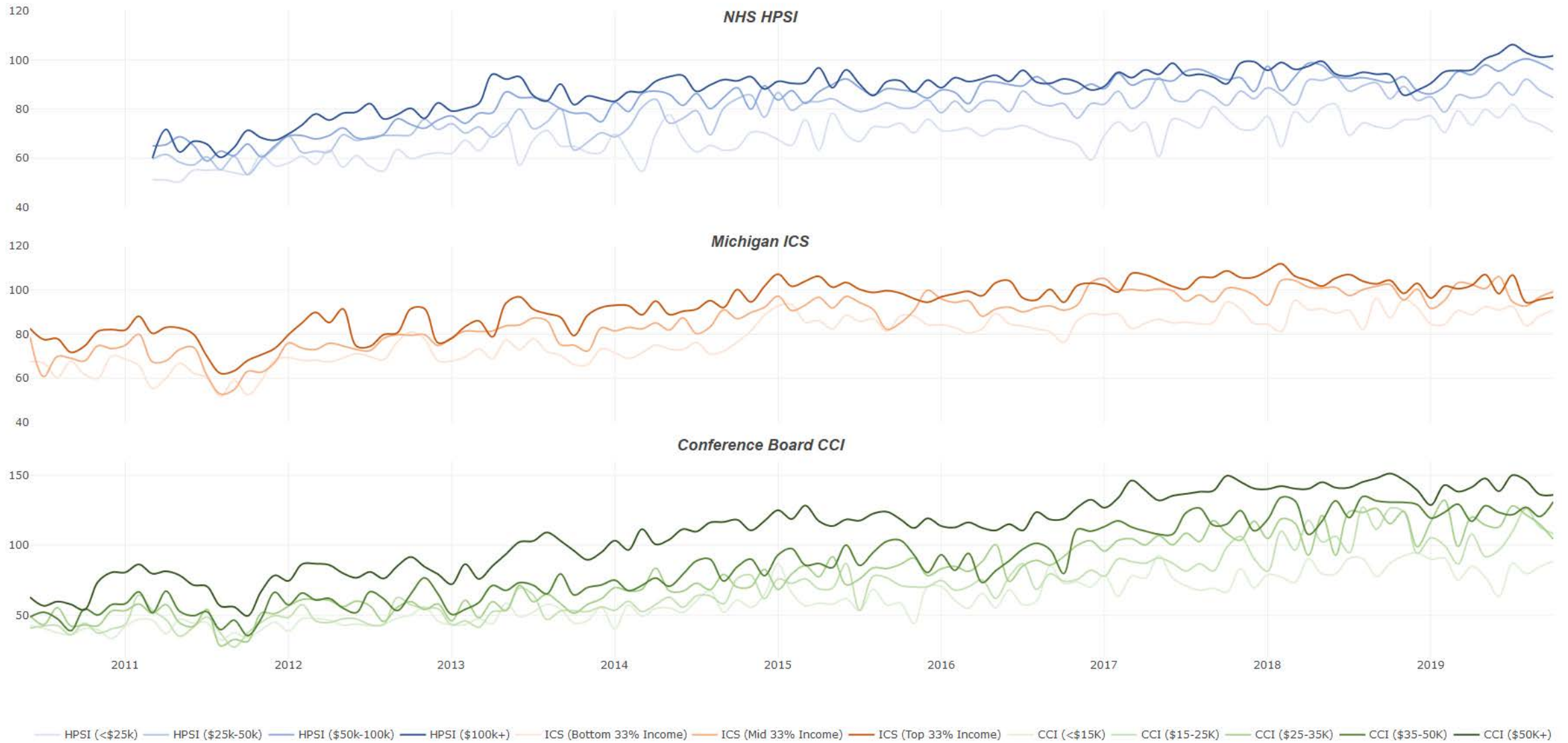
Appendix

National Housing Survey

Background

- The Fannie Mae National Housing Survey is a monthly attitudinal survey, which polls the adult general population of the United States to assess their attitudes toward owning and renting a home, home purchase and rental prices, homeownership distress, household finances, and overall confidence in the economy.

- Each respondent is asked more than 100 questions, making the Fannie Mae National Housing Survey the most detailed attitudinal survey of its kind. The survey is conducted on a monthly basis to track attitudinal shifts that occur among Homebuyers and renters in the United States.

Survey Methodology

- Each month, beginning in June 2010, approximately 1,000 live (not automated) telephone interviews via landline and cell phone with Americans age 18 and older are conducted by Penn Schoen Berland (PSB), in coordination with Fannie Mae. The margin of error for the total monthly sample is ±3.1 percent at the 95 percent confidence level and larger for sub-groups. Data collection occurs over the course of the first three weeks of each month although most occurs in the first two weeks of the month.

Monthly and Topic Analyses and Research Briefs

- Monthly reports provide a timely view of trends in consumers' attitudes using twelve key indicators.
http://www.fanniemae.com/portal/research-insights/surveys/national-housing-survey.html

- Topic analyses provide deeper insights into one or more issues based on the compilation of three monthly samples. The three monthly studies that make up any given topic analysis are identical in wording and placement of questions. Additionally, research briefs are occasional and rigorous research reports, conducted internally or by external partners such as academics, exploring attitudes and behaviors on key issues.
http://www.fanniemae.com/portal/research-insights/surveys/special-topics.html

Table 1 – Consumer Survey Methods: NHS[1], Michigan[2], and Conference Board[3]

Survey Method	NHS	Michigan	Conference Board
Mode	40% landline and 60% cell phone dials[4]	Landline and cellphone (starting in 2013) with unknown cellphone percentage	Mail
Sampling	Random digit dial	Random digital dial Also include a rotating panel with 60% first-timers and 40% re-interviewed 6 months later	Stratified, probability sample design, using USPS master address file as sampling frame
Weighting	Weighted to match the most recent Census 1-year American Community Survey estimates, in age, gender, race ethnicity, income, education, and housing tenure.	Both household weights and adult weights are calculated, to match the Census Current Population Surveys estimates, in age and income	Post stratification weighting structure to cover Census divisions, age, gender, and income
Sample size	1,000 monthly	250-300 for mid-month release 500 for end-of-month revision	About 2,500 for end-of-month release; 3,500 for later revision
Field period	The first three weeks of the month	Around first of the month through a few days before the release	Sent first of the month; Accepts returns through end of month
Fieldwork	Penn Schoen Berland	Michigan Survey Research Center	The Nielsen Company
Release	Generally, the 7th of the next month	Preliminary figures at mid- month; final figures at end of the month	Prelim. figures, last Tuesday of month; final figures with next month's release
History	Monthly Since June, 2010	Started annually in 1946; quarterly in 1952 and monthly in 1978	Started bimonthly in 1967; went to monthly in 1977

1. Fannie Mae National Housing Survey Technical Notes http://www.fanniemae.com/resources/file/research/housingsurvey/pdf/nhstechnicalnotes.pdf
2. University of Michigan Surveys of Consumers sample design https://data.sca.isr.umich.edu/fetchdoc.php?docid=57449
3. Conference Board Consumer Confidence Survey Technical Note https://www.conference-board.org/pdf_free/press/TechnicalPDF_4134_1298367128.pdf
4. From October, 2014, NHS increased cell phone dials from 25% to 60%, to obtain a 40% cell-phone-only (CPO) sample that matches the current national CPO household percentages as estimated by CDC http://www.pewresearch.org/fact-tank/2014/07/08/two-of-every-five-u-s-households-have-only-wireless-phones/

Table 2 – Consumer Survey Questions Analyzed

NO.	NHS Question	Comparative Survey/Source	Comparable Question/Data
1	Q10 In general do you think our economy is on the right track or is it off on the wrong track?	Gallup[1]	Do you think that economic conditions in the country as a whole are getting better or getting worse?
		Michigan[2]	A4 Now turning to business conditions in the country as a whole, do you think that during the next 12 months we'll have good times financially, or bad times or what?
2	Q11 Looking ahead one year, do you expect your personal financial situation to get much better, somewhat better, stay about the same, get somewhat worse, or get much worse?	Michigan	A3 Now looking ahead--do you think that a year from now you (and your family living there) will be better off financially, or worse off, or just about the same as now?
3	Q11b Now looking back over the past year, has your personal financial situation gotten much better, somewhat better, stayed about the same, gotten somewhat worse, or gotten much worse?	Michigan	A2 We are interested in how people are getting along financially these days. Would you say that you (and your family living there) are better off or worse off financially than you were a year ago?
4	Q112b How concerned are you that you will lose your job in the next twelve months? Are you very concerned, somewhat concerned, not very concerned, or not at all concerned that you will lose your job in the next twelve months?	Michigan	A10 How about people out of work during the coming 12 months–do you think that there will be more unemployment than now, about the same, or less?
		Conference Board[3]	2A Six months from now, do you think there will be [more/same/fewer] jobs available in your area?
5	Q15 During the next 12 months, do you think home prices in general will go up, go down, or stay the same, as where they are now?	Michigan	A24a What do you think will happen to the prices of homes (like yours) in your community over the next 12 months? Will they increase at a rapid rate, increase at a moderate rate, remain about the same, decrease at a moderate rate, or decrease at a rapid rate?

1. Gallup U.S. Daily Survey
2. University of Michigan Survey of Consumers
3. Conference Board Consumer Confidence Survey

Table 2 – Consumer Survey Questions Analyzed (Continued)

NO.	NHS Question	Comparative Survey/Source	Comparable Question/Data
6	Q16/Q17 By about what percent do you think home prices in general will go up/down on the average over the next 12 months?	Michigan	A24b By about what percent do you expect prices of homes like yours in your community to go (up/down), on average over the next 12 months?
7	Q12 In general, do you think this is a very good time to buy a house, a somewhat good time, a somewhat bad time, or a very bad time to buy a house?	Michigan	A16 Generally speaking, do you think now is a good time or a bad time to buy a house?
8	Q13 In general, do you think this is a very good time to sell a house, a somewhat good time, a somewhat bad time, or a very bad time to sell a house?	Michigan	A17 What about selling a house -- generally speaking, do you think now is a good time or bad time to sell a house?
9	Q20b During the next 12 months, do you think home mortgage interest rates will go up, go down, or stay the same as where they are now?	Michigan	A11 No one can say for sure, but what do you think will happen to interest rates for borrowing money during the next 12 months–will they go up, stay the same, or go down?
9		Conference Board	5A What do you think will happen to interest rates [over the next 12 months]?
10	Q223 If you were selling your home now, what do you think the selling price would be?	Michigan	A23 What is the current value of your home? (if you sold it today, how much would it bring in?)
11	Home Purchase Sentiment Index	Michigan	Index of Consumer Sentiment

The Fannie Mae Home Purchase Sentiment Index (HPSI): The Average of Six Questions from Fannie Mae's NHS

$$HPSI = \frac{Q12 + Q13 + Q15 + Q20B + Q112B + Q116}{6} + 63.5$$

Number	NHS Question
Q12	Net Good Time to Buy *(Very and Somewhat Good Time To Buy - Very and Somewhat Bad Time To Buy)*
Q13	Net Good Time to Sell *(Very and Somewhat Good Time To Sell - Very and Somewhat Bad Time To Sell)*
Q15	Net Home Prices Will Go Up (next 12 months) *(Home Prices Will Go Up – Home Prices Will Go Down)*
Q20B	Net Mortgage Rates Will Go Down (next 12 months) *(Mortgage Rates Will Go Down – Mortgage Rates Will Go Up)*
Q112B	Net Confident about Not Losing Job (next 12 months) *(Not at All and Not Very Concerned about Losing Job – Very and Somewhat Concerned about Losing Job)*
Q116	Net Household Income is Significantly Higher (past 12 months) *(Income is Significantly Higher – Income is Significantly Lower)*

Notes:
1. Survey responses are expressed as net percent positive, e.g., good minus bad, up minus down.
2. The net percent positives for each question are weighted equally in calculating the HPSI.
3. HPSI set to 60 at March, 2011, the first month that Question 112B was asked in the NHS.

Stationarity and differencing

- A **stationary** time series is one whose properties do not depend on the time at which the series is observed. Thus, time series with trends, or with seasonality, are not stationary — the trend and seasonality will affect the value of the time series at different times. Most statistical forecasting methods are based on the assumption that the time series used are approximately stationary.

- We can use statistical tests like the unit root stationary tests to detect stationarity. Unit root indicates that the statistical properties of a given series are not constant with time, which is the condition for non-stationary time series. KPSS test is one type of unit root stationary test which is often used for testing a null hypothesis that an observable time series is stationary around a deterministic trend (i.e. trend-stationary) against the alternative of non-stationary.

- Differencing (computing the differences between consecutive observations) is the method often performed on a non-stationary time series to make it become stationary.

Granger causality test

- The **Granger causality test** is a statistical hypothesis test for determining whether one time series is useful in forecasting another. A more precise statement would be we are checking to see if including X is useful for predicting Y when Y's own history is already being used for the prediction.

- A time series X is said to Granger-cause Y if it can be shown, usually through a series of t-tests and F-tests on lagged values of X (and with lagged values of Y also included), that those X values provide statistically significant information about future values of Y.

- The lag length used in the test is determined in VAR, based on usual information criteria (AIC).

- **Mathematical statement,**

  Let y and x be stationary time series. To test the null hypothesis that x does not Granger-cause y, one first finds the proper lagged values of y to include in a univariate autoregression of y:

  $$y_t = a_0 + a_1 y_{t-1} + a_2 y_{t-2} + \cdots + a_m y_{t-m} + \text{error}_t.$$

  Next, the autoregression is augmented by including lagged values of x:

  $$y_t = a_0 + a_1 y_{t-1} + a_2 y_{t-2} + \cdots + a_m y_{t-m} + b_p x_{t-p} + \cdots + b_q x_{t-q} + \text{error}_t.$$

  One retains in this regression all lagged values of x that are individually significant according to their t-statistics, provided that collectively they add explanatory power to the regression according to an F-test (whose null hypothesis is no explanatory power jointly added by the x's).