

Changes to the NFCI and ANFCI

July 8, 2020

This document outlines all changes that have been made to the Chicago Fed's National Financial Activity Index (NFCI) since the February 6, 2013, release. This background information will be updated whenever additional changes are implemented.

Variable composition

Based on our continual efforts to evaluate the appropriate mix of variables in the NFCI and on the availability of several new data sources, we have added six variables over time since February 6, 2013, shown in table 1, to the index. Several other variables, which are presented in table 2, were subsequently substituted for other data that were discontinued, became unavailable to us, or were found to be redundant. Finally, table 3 highlights changes to series transformations and other adjustments we have since made to the data. This results in a total of 105 financial indicators that are used to estimate the NFCI.

Table 1: Variables added to the NFCI

Date Added	Mnemonic	Name	Provider
06-Feb-2013	ABSSPREAD	BofAML Home Equity ABS/MBS yield spread	Haver
06-Feb-2013	RATELIQ	CME Eurodollar/CBOT T-Note Futures Market Depth	CME
06-Feb-2013	EQUITYLIQ	CME E-mini S&P Futures Market Depth	CME
06-Feb-2013	COMMODLIQ	COMEX Gold/NYMEX WTI Futures Market Depth	CME
06-Feb-2013	USD	Trade-weighted US Dollar Value Index	Haver
08-Jul-2020	SPOVX	CBOE Crude Oil Volatility Index, OVX	Haver

Table 2: Variables substituted in the NFCI

Date Substituted	Mnemonic	Name (old name)
06-Feb-2013	CMBS	BofAML 3-5 year AAA CMBS OAS spread (Bloomberg 5-year AAA CMBS spread to Treasuries)
06-Feb-2013	CPH	NRCEIF Commercial Real Estate Transactions-Based Price Index (MIT Center for Real Estate Transactions-Based Commercial Property Price Index)
05-May-2015	CPH*	FRB Commercial Property Price Index (NRCEIF Commercial Real Estate Transactions-Based Price Index)
06-Mar-2019	USD**	Advanced Foreign Economies Trade-weighted US Dollar Value Index (Trade-weighted US Dollar Value Index)
14-Aug-2019	CTABS	ICE BofAML ABS/5-yr Treasury yield spread (FTSE Russell US Global Markets ABS/5-yr Treasury yield spread)
14-Aug-2019	CTF	ICE BofAML Financial/Corporate Credit bond spread (FTSE Russell US Global Markets Financial/Corporate Credit bond spread)
14-Aug-2019	CTMBS	ICE BofAML Mortgage Master MBS/10-year Treasury yield spread (FTSE Russell US Global Markets MBS/10-year Treasury yield spread)
08-Jul-2020	MBOND	Bond Market Association Municipal Swap/State & Local Government 20-yr GO bond spread (20-yr Treasury/State & Local Government 20-yr GO bond spread)
08-Jul-2020	MSWAP	Bond Market Association Municipal Swap/State & Local Government 20-yr GO bond spread (Bond Market Association Municipal Swap/20-yr Treasury yield spread)

*In May 2015, we shifted to the Federal Reserve Board's Commercial Real Estate Price Index.

**To incorporate the Federal Reserve Board's *Revisions to the Federal Reserve Dollar Indexes*, we transitioned to the new variable beginning in March 2019.

Table 3: Variable transformation and other changes

Date of Change	Mnemonic	Name	Change
08-Jul-2020	CBPER	Commercial Bank 24-mo. Personal Loan/2-yr Treasury yield spread	Adjusted for mean break at 7/1/1990
12-Jun-2020	CCINC	S&P US Bankcard Credit Card: Excess Rate Spread	Changed from level to first difference
08-Jul-2020	LHY*	Markit High Yield (HY) 5-yr Senior CDS Index	Now relative to 3-year moving average
08-Jul-2020	LIG*	Markit Investment Grade (IG) 5-yr Senior CDS Index	Now relative to 3-year moving average
08-Jul-2020	SWAP10	10-yr Interest Rate Swap/Treasury yield spread	Adjusted for mean break at 11/21/2008
08-Jul-2020	SWAP2	2-yr Interest Rate Swap/Treasury yield spread	Adjusted for mean break at 1/1/2010

*Previously, consecutive Markit series were spliced together to form a consistent time series. Beginning with the July 8, 2020, release, we transitioned to a new approach that instead uses growth rates of the historical component series to extend the current Markit series back in time, resulting in a consistent time series.

**We also extended the time series for a number of existing indicators by using alternative measures from their primary sources. These include our high-yield bond spread and several other interest rate spreads measured relative to Treasury notes and bonds (February 2013) and On-the-run vs. Off-the-run 10-yr Treasury liquidity premium (July 2020).

Additional information can be found at www.chicagofed.org/digital_assets/others/research/data/nfci/nfci_indicators_list.pdf.

Construction of futures market depth measures

Three of the NFCI measures that were added to the index in February 2013, stem from our calculations based on data provided by the Chicago Mercantile Exchange (CME).¹ Using data from the order books of futures contracts, the CME has designed a liquidity measure called “Price Impact,” which jointly reflects the bid-ask spread (width), the ability of the market to absorb larger trades (depth), and the price deterioration due to these block trades (resiliency).

For a given futures contract, this measure is calculated according to the following logic. Suppose an order to purchase q contracts is placed in the market at time t . The order will be filled, to the extent possible, at the ask price p_{ask} . The residual amount, $q - q_{ask}$, will be filled to the maximum extent possible at stepwise increasing prices, $p_{ask} + \varepsilon$, $p_{ask} + 2\varepsilon$, etc. (where ε is the tick size), until the earlier of a complete fill or an exhaustion of all limit orders existing above p_{ask} .

By summing all of these prices, weighting by the amount filled at each price, and then dividing by q , we calculate the *quantity-weighted average price for a buy order*. Subtracting p_{bid} gives a number $PI_{buy}(q)$, which is a *quantity-weighted average price impact for a buy order*. A similar logic applies to a sell order, producing $PI_{sell}(q)$. In symbols, for each t ,

$$PI_{buy}(q) = \sum_{n=0}^{\infty} p_n \times \min \{ q(p_n), \max \{ q_n, 0 \} \} - p_{bid},$$

and

$$PI_{sell}(q) = p_{ask} - \sum_{n=0}^{\infty} p_n \times \min \{ q(p_n), \max \{ q_n, 0 \} \},$$

where p_n is the price of execution (equal to $p_{ask} + n\varepsilon$ for a buy or $p_{bid} - n\varepsilon$ for a sell), q is the total desired quantity or hypothetical trade size, $q_n = q - q_{n-1}$ denotes the quantity desired at price p_n (with $q_{-1} = 0$), $q(p_n)$ is the quantity available at price p_n (i.e., from the order book), and ε is the tick size.

The formula for $PI_{sell}(q)$ is symmetric to that of $PI_{buy}(q)$ around $n = 0$. Thus, the total (round-trip) price impact measure is

$$PI_t(q) = PI_{buy,t}(q) + PI_{sell,t}(q).$$

¹These measures include RATELIQ, EQUITYLIQ, and COMMODLIQ.

This measure is calculated each minute, and the intraday measures are averaged to obtain a daily measure. If either a buy or sell order of size q was impossible to execute at any sampled time in the day, the daily measure will be missing, $PI_t(q) = \infty$. The price impact measures we use in the NFCI are calculated for the futures products listed in table 4.

Table 4: Futures products used in the market depth NFCI measures

Short Name	Description	Contract Size	Tick Size	q
ED	one-year-away CME 90-day Eurodollar futures contract	\$1,000,000	\$6.25	500
TY	nearest-month CBOT 10-Year U.S. Treasury Note futures contract	\$100,000	\$15.625	200
SP	nearest-month CME E-Mini S&P 500 futures contract	$50 \times p_{emini}$	\$12.50	200
GC	nearest-month COMEX Gold futures contract	100 gold ounces	\$10	10
CL	second-nearest-month NYMEX WTI Crude Oil futures contract	1,000 oil barrels	\$10	10

For the NFCI, we first select a hypothetical trade size (i.e., the q in the preceding formulas) for each product. The q values are displayed in the final column of table 4. Then, we aggregate the daily price impacts, $PI_t(q)$, for each product into weekly measures by averaging the available cases each week. Finally, we create three summary measures, PI_{rate} , PI_{equity} , and PI_{commod} , from the six products that are then used as inputs into the NFCI:

$$PI_{rate} = \frac{q_{ED}PI_{ED}(q_{ED}) + q_{TY}PI_{TY}(q_{TY})}{q_{ED} + q_{TY}},$$

$$PI_{equity} = PI_{SP}(q_{SP}),$$

$$PI_{commod} = \frac{q_{GC}PI_{GC}(q_{GC}) + q_{CL}PI_{CL}(q_{CL})}{q_{GC} + q_{CL}}.$$

The NFCI before and after the 2013, 2019, and 2020 changes

Figures 1 and 2 plot the NFCI and ANFCI (index adjusted for the business cycle and inflation) with the previous and new mix of variables. This is done separately for changes implemented in the February 2013 (panel A), August 2019 (panel B), and July 2020 (panel C) releases of the NFCI.²

The change in variable composition made in February 2013 led to only small differences in the time series of the NFCI, and the differences tended to be even smaller for the ANFCI. The differences between the NFCI constructed with the old and new variables in the late 1980s and early 1990s could largely be traced back to the extension of the time series for the high-yield bond spread. In contrast, those near the end of the sample period derived mostly from the addition of the five variables described in table 1. Revisions due to changes made in August 2019 were even less pronounced.

The subsequent set of figures (3–6) repeats this analysis for all of the NFCI subindexes. This is also done separately for changes made in February 2013, August 2019, and July 2020.

As with the overall index, the revisions made in 2013 were more evident—the influence of the longer time series for the high-yield bond spread could again be seen in the credit subindex, with an additional impact in the late 1970s from some of the other interest rate spreads that had longer time series. In contrast, the differences in the risk and leverage subindexes highlighted the information gained from the five new variables in the latter half of the sample, as well as the impact of the variable substitutions. Finally, while none of the variables used in the nonfinancial leverage index changed in 2013, the resulting change in the estimated weights for these variables caused some slight changes in the history of this subindex. The changes in August 2019 only affected variables in the risk subindex, but minor changes in each subindex could be seen and were the result of changes in the estimated weights.

In recent years, the NFCI had developed a noticeable slight downward drift in its time series. This resulted in it becoming borderline nonstationary. To address this behavior, we reexamined the time series properties of its underlying data series and made several changes, described above, beginning with the July 8, 2020, release.

²This does *not* include revisions due to the transitions to the Federal Reserve Board’s Commercial Property Price Index and to the Advanced Foreign Economies Trade-weighted US Dollar Value Index, for the May 5, 2015, and March 6, 2019, releases, respectively. Nor does it include changes due to the updated transformation for the S&P US Bankcard Credit Card: Excess Rate Spread, which was first implemented with the June 12, 2020, release. However, the impact of these changes was minimal.

These changes reversed some of the downward drift in the NFCI since 2013 and resulted in slight differences to the earlier history of its time series. Similar differences were discernible in the ANFCI and its history. While these changes led to minor revisions to each of the NFCI subindexes, they were most pronounced for the credit subindex.

Figure 1: NFCI before and after the documented changes

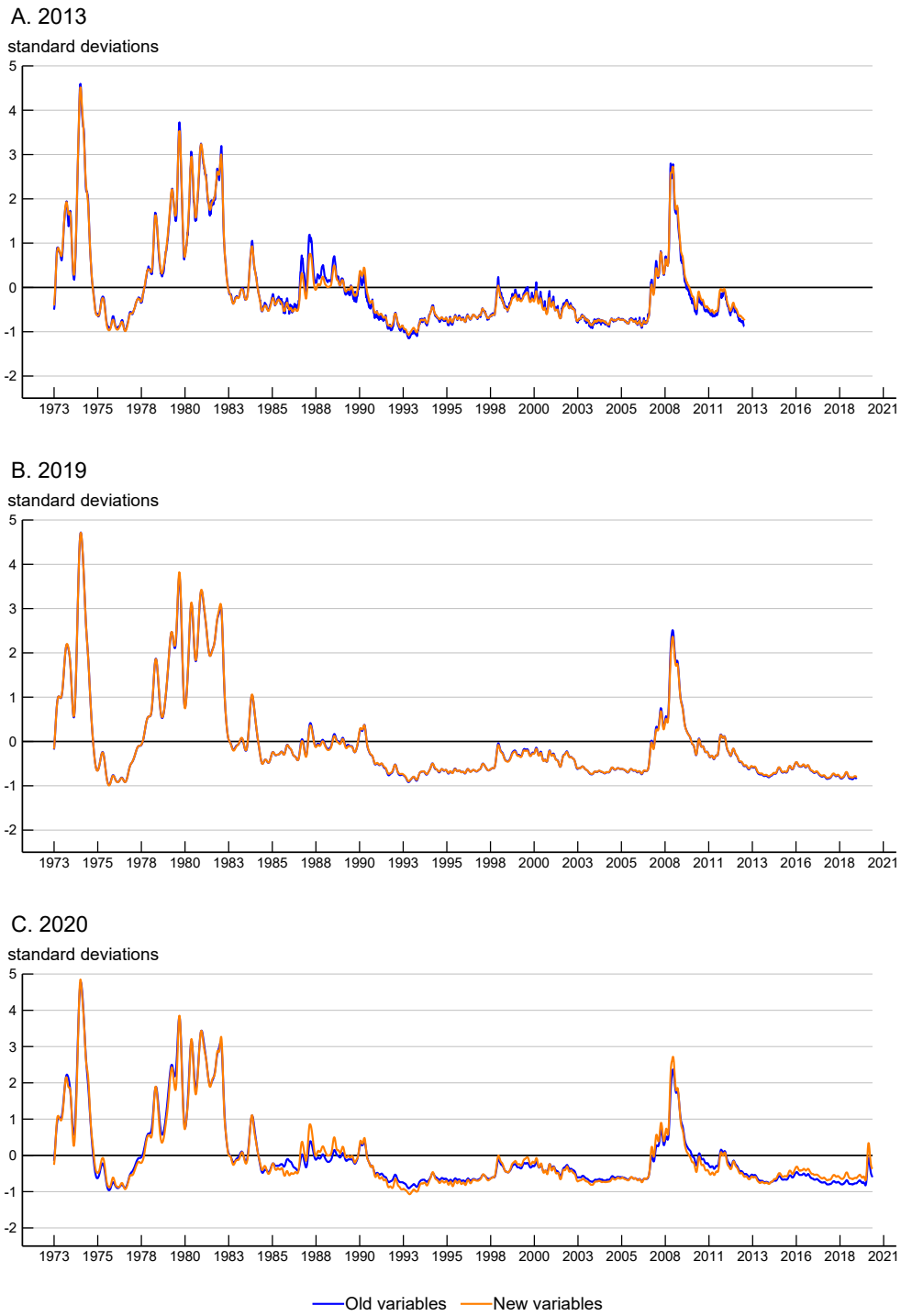


Figure 2: ANFCI before and after the documented changes

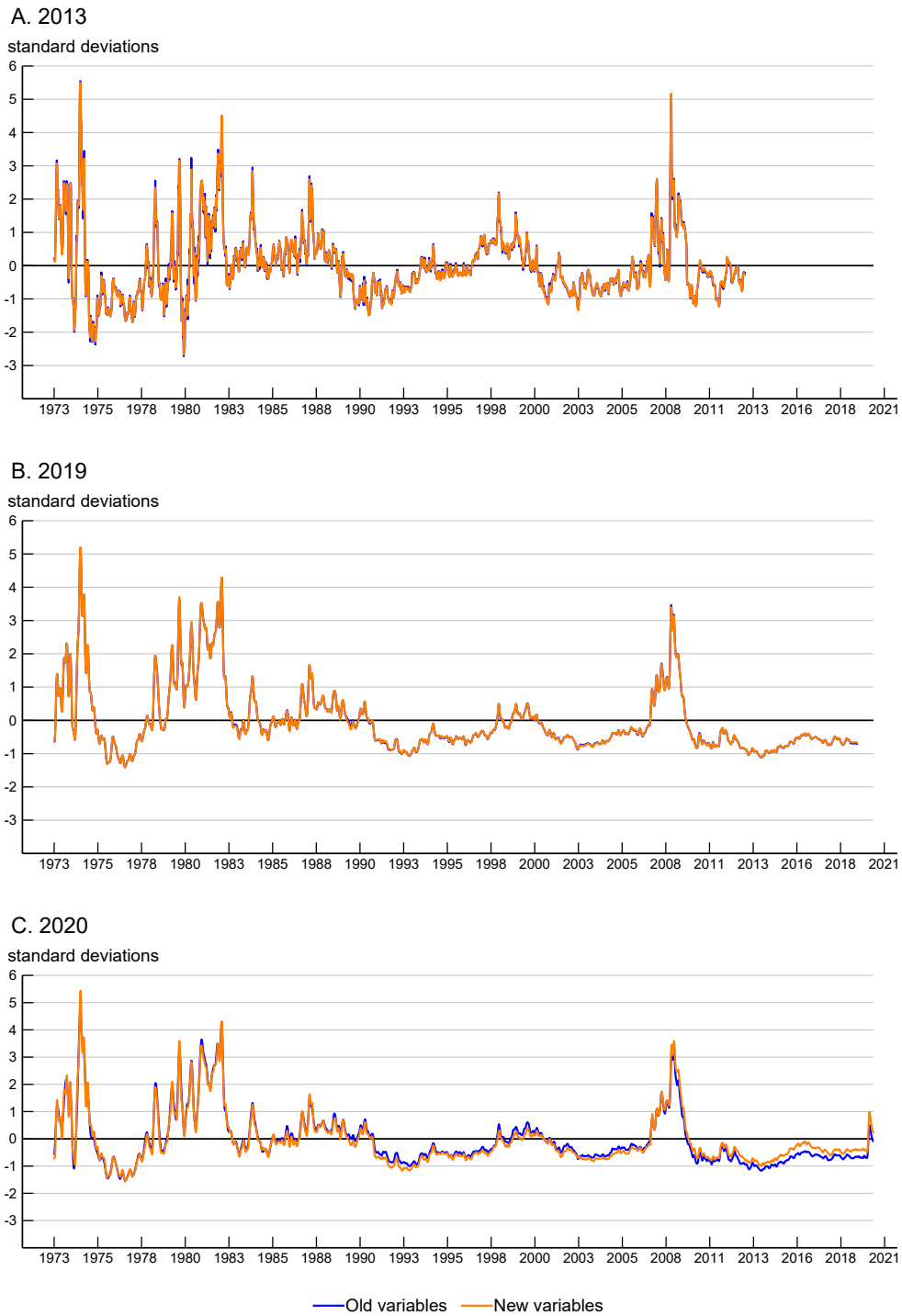


Figure 3: NFCI risk subindex before and after the documented changes

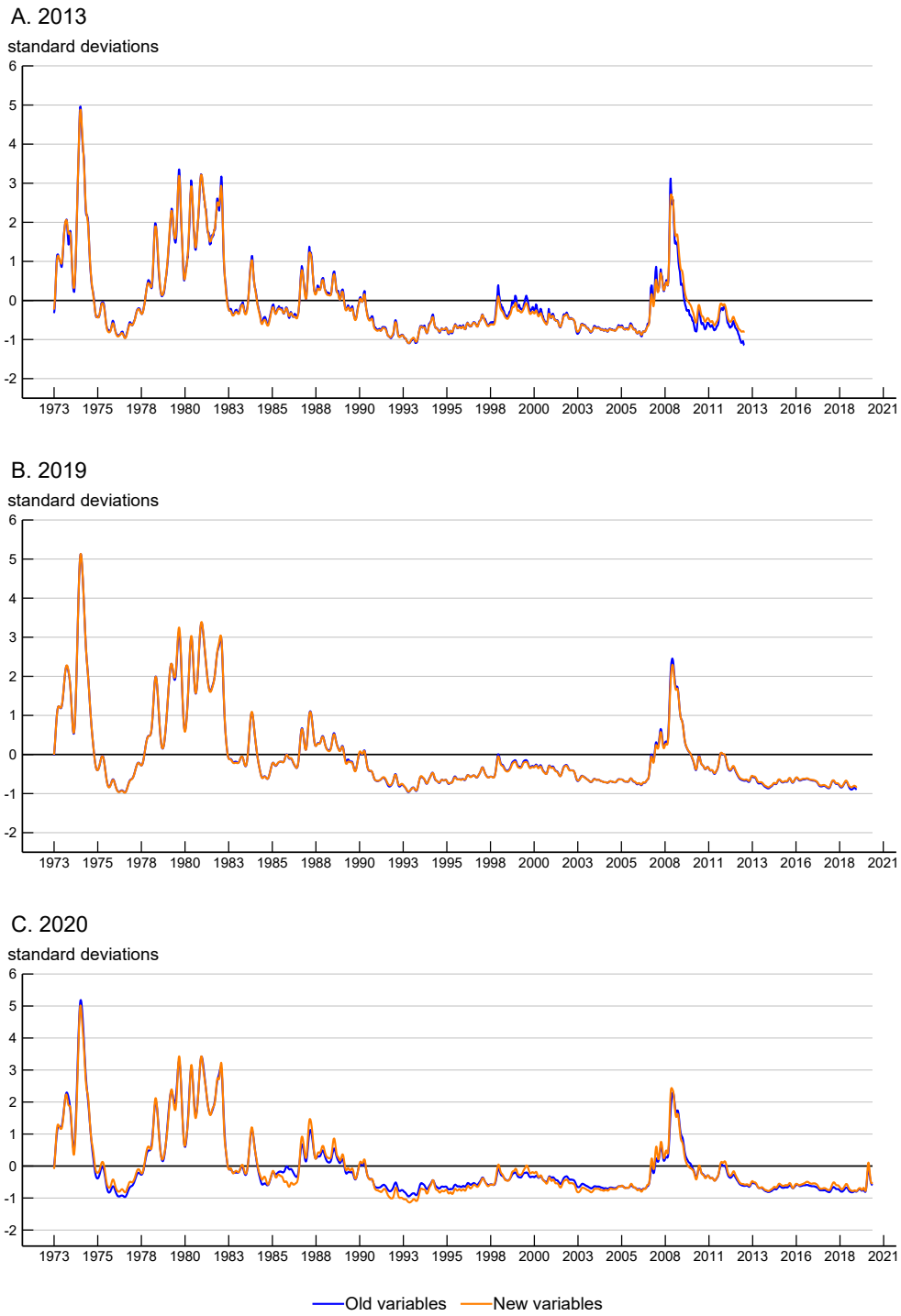


Figure 4: NFCI credit subindex before and after the documented changes

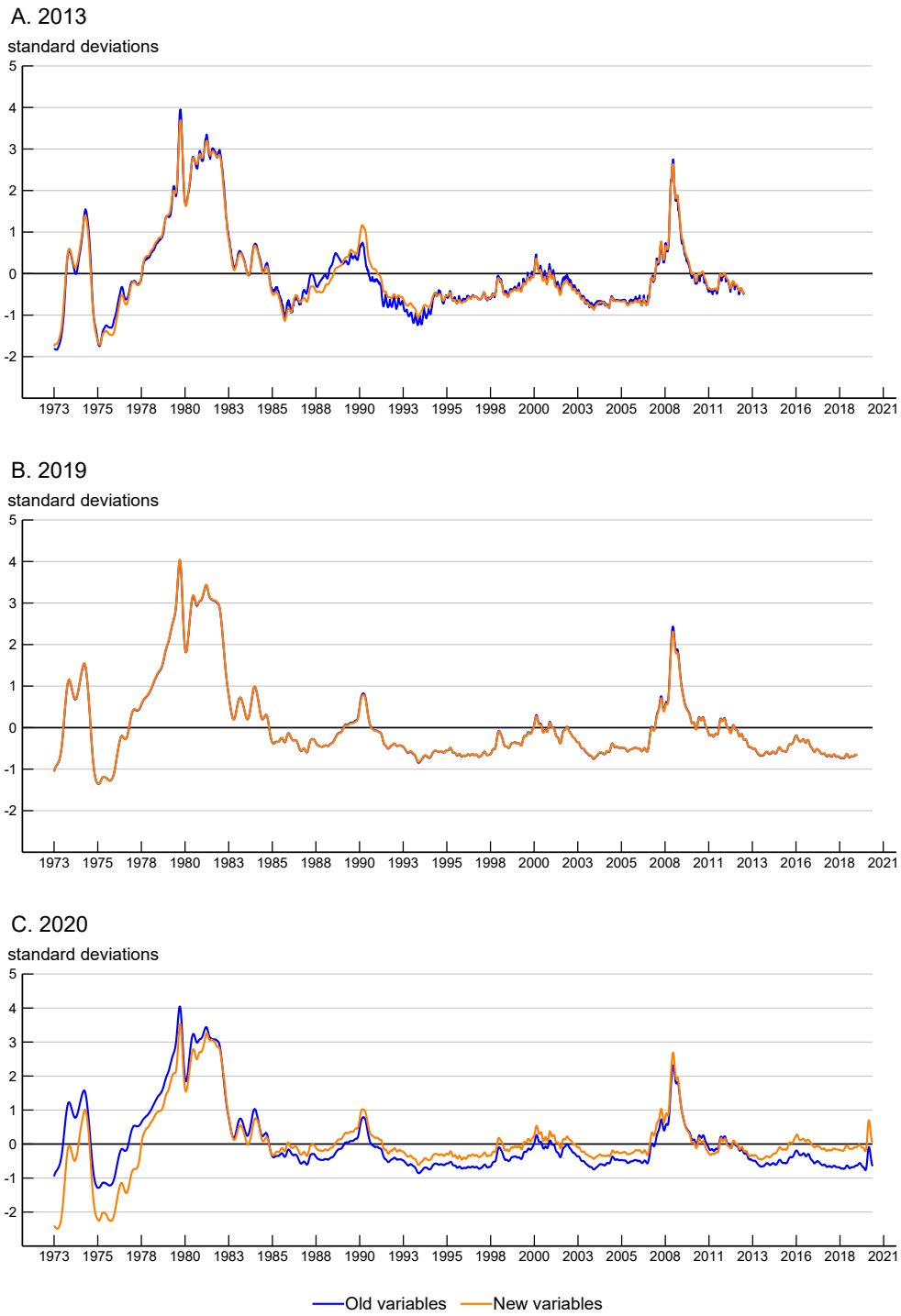


Figure 5: NFCI leverage subindex before and after the documented changes

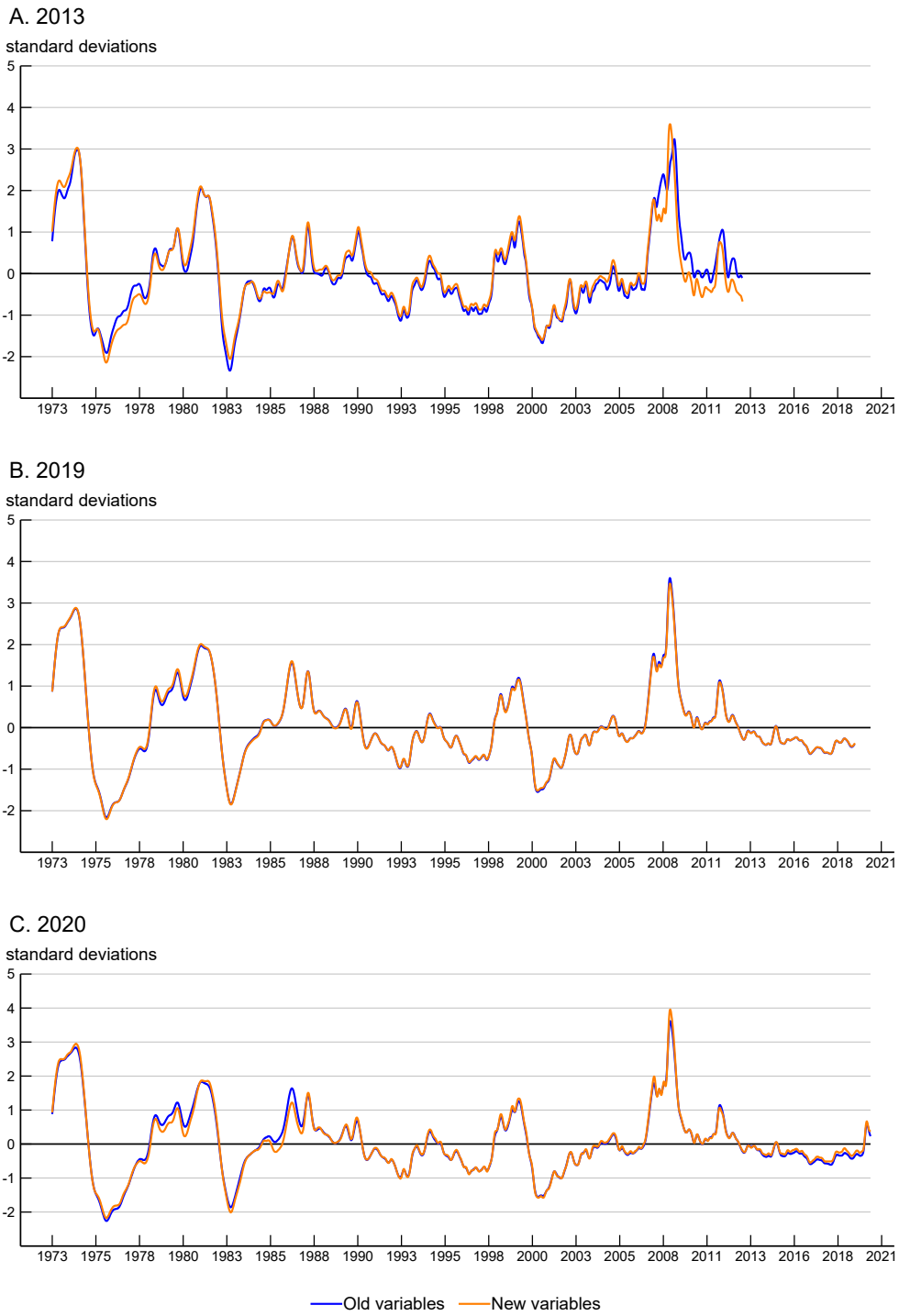


Figure 6: NFCI nonfinancial leverage subindex before and after the documented changes

