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# On the Issue of Predicting Global Financial and Economic Crises

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## ABSTRACT

Assumptions about the impending new global crisis, which are increasingly found in expert discussions, have intensified the search for reliable crisis predictors, despite the existing theoretical consensus on the fundamental impossibility of forecasting crises. **The purpose** of the article is to describe the most popular "new" crisis predictors and evaluate their predictive properties. The primary **research method** was monitoring the confirmation of signals supplied by predictors, indicators of macroeconomic dynamics based on retrospective data. As a **result** of the study, we clarified the classification of types of financial crises to determine the predictors that best predict certain types of financial crises, which in current conditions are very likely to be the starting stage of a new kind of financial and economic crisis. We analysed financial condition indices (FCI); VIX ("fear index"); yield spreads between US treasury bonds of different maturities; investor sentiment indices and risk premium indicators; CAPE (Schiller coefficient). We analysed the signals from the "new" crisis predictors about the possible onset of the crisis. The authors **concluded** that various predictors show good results concerning crises of a particular type (the starting point of which were different segments of the financial sector). The analysis of the predictor time of various predictors made it possible to build them in a certain sequence depending on the time interval between the predictor signal and the onset of the crisis. Based on combining the linking of predictors with the types of crises that they predict better, with a sequence of predictors arranged according to the time of the predictions, we proposed a flow chart for monitoring external crisis predictors.

***Keywords:*** financial and economic crisis; classification of financial crises; foresight; crisis predictors; financial markets; financial conditions index; VIX; yield spreads; risk premiums; Schiller coefficient; prediction time.

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## INTRODUCTION

By this article, we did not intend to contribute to the theory of cycles and/or crises, as well as to their predicting method. We aim to solve an applied problem: to describe the key proposals to construct crisis predictors and evaluate (based on retrospective data) their predictive power. Moreover, an attempt to follow in line with any group of theories of the cycle or crisis involves the adoption of one or another thesis of these theories, in particular, regarding the explanation of the causes of crises (here, the theories are completely different [1, pp. 6–42]). Such an approach seems unproductive when finding best indicators to predict the onset of a crisis, regardless of its causes. Strictly speaking, even the attempt to construct a crisis predictor contradicts many theoretical provisions that make it impossible to predict a crisis.

The thesis about the fundamental impossibility to predict a crisis has a rationale based on a description of specifics of a crisis as a social and economic development phenomenon. "A crisis cannot be predicted: it simply ceases to be a crisis if everyone expects it to happen tomorrow" [1, p. 6].

Researchers offer various interpretations why the signs of an impending crisis are not recognised. According to Reinhart and Rogoff, investors suffer from "this time is different" syndrome, failing to see crises coming because they do not recognize similarities among the different pre-crisis bubbles. As a result, every crisis surprises investors [2]. The assumption that investors do not see the difference between the low probability of causes of a crisis being realized and the zero probability of such a realization became the base for the psychological theory of neglecting risk and financial crises proposed by Nicola Gennaioli, Andrei Shleifer and Robert Vishny [3]. Andrei Shleifer also pointed out that at each new stage of development, new (newly emerging) risks significantly differ from those previously observed [4].

As seen from the examples above, researchers with almost opposite views on the reasons for not recognizing the signs of an impending crisis (some believe that there is a similarity among different crises, but investors do not recognize it; others believe that new crises bear fundamentally different risks), believe that crisis is impossible to forecast.

Nevertheless, it is possible to measure the likelihood of changes that could lead to a crisis. Observing the formation of causes of a crisis, accumulated in various irrationalities, helps assess the changing probability of the development of crisis phenomena. Despite the existing theoretical consensus about the impossibility to forecast crises, some central banks and many financial institutions facing the practical need to have crisis forecasting tools are actively working on developing crisis predictors.

The interweaving of financial and economic crises, typical of the 2007–2009 crisis and, apparently, for future crises, as well as the fact that in these new types of crises a financial crisis is followed by an economic one, enhance the relevance of the classification of types of financial crises.

There are many options to classify types of financial crises. Right after the 1997–1998 crisis, The International Monetary Fund (IMF) proposed the most comprehensive and detailed classification: financial crises fall into currency crises, banking crises, systemic financial crises, and external debt crises[1]. V. A. Tsvetkov groups financial crises into monetary (banking), currency and exchange [5, p. 338–347]. M. Dabrowski highlights banking, public debt and balance-of-payments crises [6].

The classification should obviously correspond to the aim of the work. Therefore, we use the classification of financial crises depending on the sector of the financial market where crisis phenomena first appeared. This classification makes it possible to identify the groups of the most effective crisis predictors

[1] World economic outlook. Washington: International Monetary Fund, 1998. URL: http://www.imf.org/external/pubs/ft/weo/weo0598/pdf/0598ch4.pdf (accessed on 17.02.2020).

for each type of financial crisis. In this context, three types of financial crises should be distinguished:

- the crisis begins on the stock market, and its immediate causes are most often violations of investor rights or corporate governance inefficiencies;
- the crisis begins in the debt market (debt crisis), its causes are most often defaulted by sovereign or corporate borrowers;[2]
- the crisis begins in the foreign exchange market (currency crisis), its causes are a sharp depreciation of a currency or a group of interdependent currencies.

This classification has helped us link various crisis predictors to the type of financial crisis related to which it can be most effective. Assessing accumulated risks in various segments of the financial sector, it allows targeted monitoring of crisis predictors.

## THE SUMMARY OF SUGGESTED REASONS FOR THE FAILURE OF PREVIOUS GENERATION OF CRISIS PREDICTORS

After the development of the 2007–2009 crisis, it became clear that the previously suggested indicators aimed at predicting the crisis (crisis predictors) did not live up to expectations; a lot of literature appeared on the analysis of the causes of their failure. Among these works, two should be especially highlighted. Work [7] provides an analysis and mathematical modeling of the causes of errors in IMF forecasts. In [8], the authors analyze an analysis of the evolution of theories and models used to predict recessions. Both works were prepared by the IMF staff, which indicates that this organization is actively analyzing the causes of failure of its own crisis prediction models.

There are also domestic works in Russian on crisis predictors and forecasting problems. M. A. Shchepeleva studied global models of analysis of financial contagion [9]. The author classified the crisis distribution channels among countries, with particular attention to the mechanisms for transmitting risks through financial markets. For the first time in Russian-language literature, this work briefly described several crisis predictors, including financial condition indexes, the largest family of crisis predictors by now.

Crisis forecasts have two typical types of errors: type 1 error — a recession happened but was not forecast; and type 2 error — a recession did not happen but was falsely forecasted.

Work [8] carried out a panel analysis of recession cases. The results of this analysis show that 148 of 153 recessions were missed by IMF analysts a year before the recession. This indicator declines over time; but even in the year when the recession started, 35 recessions were missed. Moreover, forecasts are revised in more than 80% of cases of recession.

Until 2007, the IMF's methodological toolkit on the Early Warning Exercise (EWE) was considered the most advanced predictive mechanism aimed at warning of financial and economic crises[3]. However, the 2007–2009 crisis revealed many of its weaknesses, including:

- impossible to predict the timing of crises;
- the results are not available to the general public and, accordingly, are subjective in their interpretation;
- permanent revision of the methodology [10].

In our opinion, the importance of EWE as a crisis predictor was significantly discounted:

- the duration of the analysis (3 months) and a six-month cycle in the presentation of the results;
- a large number of models within the EWE (about 30 models, grouped in sections, but not interconnected) that gave conflicting signals that were not summarized in integral indicators.

[2] In this classification, banking crises, which often stand out as a separate type of financial crisis (see, for example, [5, p. 338]), fall into the category of debt crises.

[3] The IMF-FSB Early Warning Exercise. Design and Methodological Toolkit. IMF; 2010.

The natural response to the failure of an entire generation of crisis predictors was the intensive construction of new predictors, attempting to consider the revealed weaknesses of the previous predictors.

## "NEW" CRISIS PREDICTORS

### General patterns of designing and using a new generation of crisis predictors

The most important feature of using crisis predictors after 2008 is the reorientation to integrated indicators based on a large number of primary indicators. This, of course, increases the probability of crisis prediction (even if only mathematically). Another feature is the kick start of designing indicators that measure investor sentiment online based on modern communication tools. These tools allow conducting numerous surveys of a wide range of investors; the results can be presented to the public as quick as possible.

The world and Russian economic literature offers many indicators promoted as leading indicators of economic transition from stationary development to turbulence. In this article, we kept to the most debated crisis predictors based on information generated in financial markets. This very information is most often used to form forecast indicators, including crisis predictors, since financial markets perform their prognostic function.

Based on information from financial markets, the crisis predictors seem to most focus on analysing crisis symptoms, which determines their value. Symptoms of the crisis are visible (captured by available indicators) evidence of hidden processes, predetermined by the causes of the crisis. They may not be associated with triggers that open the way to the crisis, but they reflect, directly or indirectly, the accumulated (due to the fundamental causes of the crisis) imbalances. This is why numerous forecasting mechanisms used by investment bank analysts most often analyze the symptoms of the crisis.

At the same time, these crisis predictors have a natural weakness, which is in focusing on financial shocks. Given that the recent global crises can be more characterized not as purely economic, but financial and economic, this weakness is becoming less significant. In conditions of financialization of the economy, the most severe shocks of the economic system do not form in goods and services markets, but in capital flows and financial asset markets. Therefore, it becomes more likely that economic crises do not occur outside financial crises, taking on the nature of financial and economic crises.

In this article, we focused on analyzing a limited number of crisis predictors based on financial market indicators:

- financial condition indexes (FCIs);
- VIX (the so-called "fear index");
- yield spreads between US treasury bonds of varying maturities;
- investor sentiment indexes and risk premium indicators;
- CAPE (Schiller coefficient).

The choice of these crisis predictors is determined by the following factors:

- these indicators are widely discussed in the economic expert community after the 2007–2009 crisis, which suggests that they are considered by many experts and politicians as indicators that should be paid special attention when developing government policies considering the need to prevent or stop crises;
- most of these indicators have the necessary fundamental justification, which allows reckon on obtaining results that go beyond the analysis of crisis predictors, but appeal to a wider range of issues in economic theory;
- these indicators have certain positive results of testing on the data of previous financial and economic crises;
- this set of indicators can be the basis for the formation of integrated crisis management systems used in the operational management of the national economy.

### Financial conditions indexes (FCIs)

A financial conditions index (FCI) summarizes the information about the future economic

situation contained in these current financial variables[4]. Ideally, a FCI should measure financial shocks — exogenous shifts in financial conditions that influence or otherwise predict future economic activity [11]. Many of these indicators are developed by investment banks, US Federal Reserve Banks, international financial organizations and research centers in relation to individual countries. The most known predictors of this family, calculated since the early 1990s, are:

1) the Bloomberg Financial Conditions Index is an equally weighted sum of three major sub-indexes: money market indicators, bond market indicators, and equity market indicators. Each major sub-index is then made up of a series of underlying indicators, which receive an equal weight in that sub-index (10 variables in total);

2) the Goldman Sachs Financial Conditions Index is a weighted sum[5] of a short-term bond yield, a long-term corporate yield, the exchange rate, and a stock market variable;

3) the Federal Reserve Bank of Kansas City Financial Stress Index consists of 11 financial indicators that can be divided into two categories: yield spreads and asset price behavior;

4) the OECD Financial Conditions Index is a weighted sum of six financial variables, where the variables are weighted according to their effects on GDP over the next four to six quarters. Weights are assigned to indicators depending on the regression coefficients in the model, whose dependent variable is the dynamics of GDP.

*Table 1* presents the key features of the most frequently used FCIs, including those listed above.

FCIs are a large family of crisis predictors, united by common approaches to the design. Creating these indexes aims to overcome the limited predictive capabilities of individual indicators previously used as crisis predictors. They have better predictive power than the individual indicators of the situation of financial markets included in their composition. At least some of the FCIs listed above predicted, to various levels of accuracy, one or more previous economic crises (recessions as defined by the US Bureau of Economic Research).

This technology of forming crisis forecasting tools attracted attention of users after it identified the failure of crisis predictors developed by the IMF and other international financial organizations before the 2007–2009 crisis. Instead of searching for individual new predictors of the crisis, "miraculously" capable of predicting a new crisis, it uses the "portfolio" technology to search for pre-crisis signals. Used when calculating FCI, the indicators of the situation of the financial sector are selected based on theoretically correct considerations. The FCI calculation includes the financial variables that are the channels of capital transfer.

The increased attention to FCIs provoked an intensive process of constructing new FCIs mainly for those countries where these tools were not previously calculated. Work [12] attempted to predict the Norwegian GDP using a FCI. Work [13] showed that FCIs can predict inflation based on Singapore data. In work [14], the IMF staff constructed the FCI for South Africa. In work [15], in 2013, the Asian Development Bank constructed an FCI for five Asian countries. In work [16], an FCI was constructed for China; it included the interest rate, exchange rate, stock market quotes and housing prices. The index was constructed based on the principal component method and the dynamic factor method.

There is a significant correlation between the indexes considered in *Table 1*. It is quite logical, since they intersect in the composition of indicators used in the calculation. The Kansas City Financial Stress Index (KCFSI) and the Chicago FED (CNFCI) are most correlated because they contain the same variables

[4] A number of indexes related to this family of indicators are called financial stress indexes.

[5] The Federal Reserve Board's macroeconomic model (the FRB/US model) is used to determine the weights (general equilibrium model of the U.S. economy that has been in use at the Federal Reserve Board since 1996).

*Table 1*

**Key features of the most famous FCI**

| Organization calculating FCI | Public access | Calculation frequency | Start of FCI calculation | Calculation methodology | Composition (indicators used) |
|---|---|---|---|---|---|
| Bloomberg (BFCI) | No | Day | 1991 | An equally weighted sum with equal weights | 10 variables of money, debt and stock markets |
| Chicago FED (CNFCI) | Yes | Week | 1971 | Principal component method | 105 variables of money, debt and stock markets |
| IMF | No | Month | 1990 | Dynamic factor method | 16 variables, including interest rate, spreads, credit growth, stock market returns, exchange rate and VIX |
| Kansas City Financial Stress Index (KCFSI) | Yes | Week | 1990 | Principal component method | 11 variables, including interest rate, yield spread, exchange rate and inflation variables |
| OECD | No | Quarter | 1995 | Weighted average with weights based on the effect of the variable on GDP | 6 variables, including short-term rate, high-yield bond spread, lending standards, real exchange rate, stock market capitalization |
| Goldman Sachs (GS or GSFCI) | No | Day | 1995 | Weighted average based on the effect of the variable on GDP (with lag –1) | 5 variables: the FRB rate, 10-year bond yield, spread between BBB rating bond yield and the FRB rate, S&P 500 index and TWI effective exchange rate index |
| The St. Louis Fed Financial Stress Index (STLFSI) | Yes | Week | 1993 | Principal component method | 18 variables, including 7 interest rate indicators, 6 yield spreads and 5 other indicators (VIX, S&P 500, bond market indexes) |

*Source:* compiled by the authors.

and are calculated by the same method — the principal component method. All indicators correlate with VIX (but it should be borne in mind that the STLFSI, KCFSI, CNFCI and BFCI indexes include VIX in the composition of the indicators used).

Including VIX in the financial condition indexes seems entirely justified. Obviously, VIX has certain predictive capabilities, but it is quite difficult to use through formalized procedures. When this indicator is included in a wider list of crisis predictors, it becomes possible (due to the confirmation of the signals of this indicator by other indicators) to use simple logical constructions such as "if X > a, then ...".

### VIX as an independent crisis predictor

The very name of "fear indexes" reflects the desire to identify signs of panic within the financial market environment. They are calculated based on the results of trading options on stock indices. VIX stands out among such "fear indexes". Since 1993, it has been calculated based on an analysis of put and call options on the S&P 500 stock index with different (from more than 23 days to less than 37 days to fulfillment) expiration (execution) periods traded on the Chicago Board Options Exchange (CBOE) and out-of-the-money, i.e. having zero "intrinsic value" [17, p. 276].

VIX has long been regarded as one of the most reliable market predictors in financial markets. How much can this indicator be an independent strong crisis predictor, without considering its use in calculating wide integrated crisis predictors? We think to answer this question it is important to consider the results in work [18]. Based on the Markov switching model, it investigated the role of US macroeconomic variables as leading indicators of regime shifts in the VIX index using a regime-switching approach. The authors found that there are three distinct regimes in the VIX index during the 1990 to 2010 period:

1) tranquil regime with low volatility;
2) turmoil regime with high volatility;
3) crisis regime with extremely high volatility.

The three modes have quantitative descriptions, including the probabilities of switching from one regime to another. According to the authors, the probability of the regime shift from the tranquil to the turmoil regime is significantly predicted by interest rate spreads. Lower term spreads indicate a high probability of the VIX index shift from the tranquil to the turmoil regime. The FRB rate indicator also has a statistically significant coefficient of shift from the tranquil to the turmoil regime.

### Yield spreads between US treasury bonds of varying maturities

Yield spreads between US treasury bonds of varying maturities are currently the most popular and most debated crisis predictor in the wider investment community. In recent decades, the disappearance of the spread (or even its value turning negative) always occurs before crises (usually, it happens 12–18 months before a crisis). Therefore, the existing consensus of analysts regarding the predictive capability of this spread is plausible. For instance, the Federal Reserve Bank of San Francisco employees consider it as a reliable predictor of recessions. They concluded that the difference between ten-year and three-month Treasury rates is the most useful term spread for forecasting recessions [19, p. 3]. The less predictive power of the term spread is between ten-year and one-year Treasury yields, ten-year and two-year Treasury yields, as well as between 6-quarter and 3-month forward yields [20]. In Russia, in recent years, the most widely discussed the spread between the ten-year and two-year US Treasury yields and between the five-year and two-year US Treasury yields. It is stated that the spread became negative 15–20 months before a cyclical downturn in the US economy [21][6].

[6] The time gap from fixing negative spreads to the onset of a recession depends on the length of yield bonds to calculate the spreads. In addition, this gap varies for different recessions.

Being crisis predictors, yield spreads have a certain theoretical justification. Initially, the theory of term structure of interest rates claimed that they were predictors of changes (in this case, decrease) in interest rates [22]. First the idea of the predictability of the yield spread for output dynamics appeared in 1989 [23], much later than its predictability for future interest rates and for inflation. Since 1991 (when the first work was published [24]), numerous studies have also offered empirical evidence of the value of the yield spread as a predictor of economic growth and economic recession.

As for T-bond yield spreads as a crisis predictor, we find another issue more interesting: how does the activity of the US Federal Reserve affect it? We studied the spreads between the yields of ten-year and two-year US Treasury bonds, as well as the spreads between the yields of five-year and two-year US Treasury bonds. It turned out that the yield spread has negative correlation with the target and effective rates of the US Federal Reserve on federal funds. At the same time, the correlation is quite significant: the correlation coefficient is –0.86 between the yield spread of two-year and five-year bonds and the target rate, and it is –0.88 between the yield spread of two-year and ten-year bonds and the target rate. The correlation coefficients with the effective rate are, respectively, —0.85 and –0.88 [25].

The obtained results make raise a "blasphemous" question about the predictability of the US Federal Reserve rate. Indeed, if there is a high correlation between yield spreads recognized as reliable predictors of recessions and the US Federal Reserve rate, it is logical to conclude that the US Federal Reserve rate is also a good predictor of recessions. Given that a group of people sets the FRB target rate, it provides the hypothesis that any crisis is man-made.

However, we believe that there are no "conspiracy theories" here: both the FRB, by setting the target rate, and yield spreads respond to the same processes in the economy and in the financial sector.

### Investor sentiment indexes and risk premium indicators

Numerous simple indicators measure investor sentiment in the financial markets[7]. They have been used in predicting the movements of these markets for a long time. All these indicators have a certain predictive power, but first, they predict market movements for individual financial assets (in a best-case scenario — classes of financial assets). Second, they predict only relatively short-term (from several minutes to several weeks) market fluctuations, which are natural market moves within the periods of their stable stationary development.

Therefore, more stable investor sentiment indicators are required to predict financial and economic crises that would forecast only long-term market fluctuations. These indicators, in our opinion, include risk premium indicators. As an indicator of the risk premium, the stock market uses the ratio of annual earnings per share to its value (the inverse of the P/E ratio) minus the risk-free rate. As a risk premium in debt (bond) markets, DRP (debt risk premium; bond risk premium) is usually used, equal to the difference between the yield to maturity of the corporate bond portfolio and the FRB rate. In Russian literature, work [26] described these crisis predictors in detail.

In historical series, risk premiums sometimes show very good results as predictors. Therefore, in the last 2–3 years, they intensified the study of investor sentiment using various indicators of risk premiums, but not historical market data, but investor perceptions about the current value of risk premi-

[7] For example, they include deviations of the futures market prices from their fundamental (theoretical prices); the put-call ratio; the bid-to-cover ratio; the buyer-to-seller ratio; the ratio between the current market price of a financial asset and the moving average of this price (market momentum); the ratio between the stocks at annual price highs and the stocks at annual price lows (stock price strength).

ums. To this end, investor surveys determine their assessment of the risk premiums used in making investment decisions regarding various asset classes. According to a global survey conducted among 1836 investors from 84 countries (the authors of the review limited the analysis to 69 countries, as they considered only countries with at least 8 answers), a group of Spanish scientists prepared a review of risk-free rates and market risk premiums used in March 2019 [27, p. 11]. Based on the data on changes in risk premiums, it will be possible to form crisis predictors with high predictive power. Introducing telegram channels into human communication opens up immense possibilities for developing this class of indicators.

Another group of tools for assessing investor sentiment, used as crisis predictors, is those analyzing the difference between the behavior of qualified and unskilled investors. Thus, the investment bank Goldman Sachs uses as a crisis predictor a comparison of net ETF inflows of professional investors (Professional Equity ETFs) with net inflows to all equity ETFs, including funds for retail investors. In 2018, this indicator turned out to be a good predictor of the decline in stock markets. Since January 2018, professional funds recorded an outflow of investor funds (i.e. professional investors started selling stocks) amid continued flow of funds to all funds (i.e. retail investors kept buying stocks, offsetting the sales of professional investors). A few months later, at the end of 2018, all this ended in a significant drop in stock indexes.

Not to challenge the predictive capabilities of this indicator, it should, however, be noted that it does not predict an economic recession, but a decline in stock markets. Bearing in mind that the decline in stock markets classically precedes the economic collapse, this indicator may be used as a predictor of economic recessions. Unfortunately, a more detailed study is impossible due to the closed (non-public) nature of the predictive power of this indicator.

**CAPE (Schiller coefficient)**

CAPE (cyclically-adjusted price-to-earnings) ratio, or Shiller P/E (Schiller coefficient), the ratio of the current capitalization of the stock market to the average profit of listed companies over the past 10 years, adjusted for inflation. The modernization of the well-known market P/E ratio is due to the following consideration. In a recession, stock prices fall; at the same time, company profits also fall, which may temporarily increase the P/E ratio. A high value of the P/E indicator indicates that stock prices are still high, although in fact this is no longer the case, as the cyclical nature of the economy will bring future profits back to corresponding levels. To avoid this distortion, Robert Schiller proposed smoothing out the companies' profit indicator: instead of the current annual profit, the average profit for the previous 10 years is calculated, adjusted for inflation. A high CAPE indicates that the stock prices are too high because it does not correlate with profit margins, which means that the market is overvalued, and there is a risk of lower stock prices in the near future.

The time horizon (10 years) over which profit is averaged was selected on the assumption that this period includes both high-profit years (obtained during periods of good economic situation) and relatively low-profit years (years with poor economic situation).

The Schiller coefficient on retrospective data performed well as a predictor for the Great Depression and the 2000–2002 crisis, as well as in a less explicit form — for the crises of 1938, 1946, and 1987. Moreover, before the 2007–2009 crisis, it was not possible to predict the crisis based on the Schiller coefficient's behavior. Thus, the Schiller coefficient is predictive only regarding some crises. By analyzing the nature of these crises, it can be assumed that this indicator is a good predictor of only the crises resulting in "bubbles" in the stock market. The crises that arising for other (including debt) reasons, to a lesser extent can be predicted using the Schiller coefficient.

Robert Schiller calculates CAPE not only for the US market, but also for other major national or regional stock markets. However, it is precisely the Schiller coefficient for the USA after the 2007–2009 crisis that grows much faster than similar ratios in other countries. Robert Schiller admits that it is impossible to pin down the full cause for such a noticeable separation of the United States from other countries. He points to this phenomenon as an example of a situation that should remind all investors of the importance of diversification, and that the overall U.S. stock market should not be given too much weight in a portfolio. Another feature of the behavior of Schiller coefficients after the 2007–2009 crisis he calls a significant variation in their performance across stock markets of various countries [28].

## ANALYSIS OF THE "NEW" CRISIS PREDICTORS SIGNALLING THE LIKELIHOOD OF A CRISIS

### Comparing crisis predictors with types of financial crises

We analyzed cases of "new" crisis predictors signalling the likelihood of a crisis. It turned out that different predictors can better predict different types of crises. Since the crisis predictors in question are based on information from financial markets, they, as a rule, primarily signal financial crises. Above, we proposed a classification of financial crises based on what segment of the financial sector such crises began. We seem to have established a certain connection between the type of a financial crisis and crisis predictors that catch impending crises better than others do.

When the financial crisis triggered an economic recession, the recessions were usually characterized by the complex nature of the financial crisis accompanying the recession. With a decline in production, deterioration in debt servicing, sharp moves in the exchange markets, and sharp fluctuations in stock markets take place. However, the starting (initial) point in each crisis period usually differs from the starting points in other crises. In this case, by the starting (initial) point of the crisis, we understand the events that happen immediately after the event, which will subsequently be described as a trigger for the crisis. Speaking about financial and economic crises, as a rule, these events focus on a certain, more or less limited part of the financial sector.

Thus, the latest crisis (2008) began in the debt market; initially, it was of a debt nature. Others, earlier crises, had other launch pads and a different initial nature of crisis events.

The 2001–2002 crisis — "dot-com crisis" — began on the stock market. It was immediately caused by poor corporate governance (including disclosure) in a number of corporations of the "new economy".

Initially, the 1997–1998 crisis had the nature of a currency crisis. It then developed into a currency-debt crisis in emerging markets (in this case, in 1997, at the very beginning of the crisis period, some countries had crisis phenomena in corporate governance accompanied by the decline in some emerging stock markets).

*Table 2* presents the results of our assumptions about the comparability of the nature of the crisis and the most adequate (corresponding to the given nature of the crisis at its initial point) crisis predictors.

There seem to be a certain logic in which predictors responded better to certain crises. Thus, the Schiller coefficient sent stronger signals before the 2002 crisis. This may be because the starting point of the crisis was the events on the stock market, i.e. directly affecting the parameters used in the calculation of this indicator. Indicators of financial cycles better signal crises with an element of the debt crisis at the starting point, etc.

In this article, we consider the crisis predictors that have long been discussed by the expert community. We also constructed an original crisis predictor based on information from the American financial and real estate markets; using retrospective data, it signalled quite well the crises of 1980–1982, 1990–1991, 2001–2002, and 2008. This predic-

*Table 2*

**The crisis predictors that most adequately signaled the largest crises of the last 40 years**

| Crises | Global reach | Starting point of crisis | | Most effective predictors |
|---|---|---|---|---|
| | | Nature of crisis | Market segments | |
| 1980–1982 | The United States and developed countries | Corporate governance crisis | Stock market | DRP; FCI |
| 1991–1992 | The United States and developed countries | Currency and debt | Exchange and debt markets | Separate FCI; yield spreads |
| 1997 | Developing countries | Corporate governance crisis | Stock market | ERP; VIX |
| 1998 | | Currency crisis followed by the debt one | Exchange and debt markets | Separate FCI; VIX |
| 2001–2002 | The United States | Corporate governance crisis | Stock market | Shiller coefficient CAPE; ERP; VIX; separate FCI; yield spreads |
| 2008 | Global crisis | Debt crisis | Debt markets | Yield spreads; FCI; VIX |

*Source:* compiled by the authors.

*Note.* Corporate governance crisis; ERP — equity risk premium; DRP — debt risk premium; FCI — financial conditions indexes; yield spreads — yield spreads between US treasury bonds of varying maturities.

tor is the spread between the real estate price index and the thirty-year mortgage rate index in the United States, whose various presentation forms were predicted by all recent crises in the United States.

Based on the critical analysis of new indicators proposed as crisis predictors, including the assessment of their response to various types of financial crises, we made assumptions about their possible use as predictors of various types of financial crises (*Table 3*).

Based on the analysis results, among all, we picked the most promising indicators from their use perspective as crisis predictors:

- financial conditions indexes;
- US Treasury bond yield spreads;
- risk premiums and assessments of investor sentiment.

### General trends in the development of a new generation of crisis predictors

The analysis of indicators proposed as new crisis predictors also allowed for more general considerations.

First, there is a great increase in attention paid to integrated indicators, based on a large number of primary indicators of the state and development of financial markets; each of them has a certain predictive power. Another important feature is the increased use of indicators

*Table 3*

**Assessment of the possibility of using the analyzed indicators as crisis predictors**

| Analyzed indicators | Can be used | | | |
|---|---|---|---|---|
| | a separate indicator, or together with other predictors | only together with other predictors: for forecasting | | |
| | | any crises | debt crises | stock market crises |
| Financial conditions indexes | + | + | + | + |
| "Fear index" (VIX) | – | + | + | + |
| T-bond yield spreads | – | + | + | + |
| Risk premiums and assessments of investor sentiment | + | – | + | + |
| Schiller coefficient | – | – | – | + |

*Source:* compiled by the authors.

*Note.* Any crises are financial crises of any of the three types (currency; debt; in the stock market).

measuring investor sentiment that can consider the opinions of investors around the world and be presented to the public as soon as possible.

Second, among crisis predictors based on indicators of financial markets that are more or less successful in predicting crisis phenomena in the economy and/or in financial markets, very few have good predictive power against debt crises. Considering that many researchers recognize debt nature as the most probable one of a future global financial and economic crisis (or a local crisis that could trigger a global crisis), the existing set of developed crisis predictors may not be very effective in predicting the next crisis.

Third, some predictors show a close correlation with the rate of the US Federal Reserve (besides T-bond yield spreads, many risk premium indicators also apply to such predictors). In our opinion, this is becoming a significant problem in the modern financial world: many key parameters of the situation of financial markets depend on the decisions of one authority (people who may make mistakes) which indicates an additional systemic risk factor.

Fourth, some crisis predictors that can be used as part of practical work to anticipate the crisis are limited in public use. At the same time, many of these indicators are very successful crisis predictors in the financial markets (for example, the above-mentioned Goldman Sachs bank indicator).

Fifth, the function of creating crisis predictors passed from the IMF and other international financial organizations actively involved in this before the 2007–2009 crisis to central banks, private financial institutions, and even individual researchers.

*Table 4*

**Crisis predictors, taking into account the assessment of the prediction time from historical data (previous crises), months**

| Crisis (year) in the USA | Financial conditions indexes | | | Yield spreads | | VIX | Prediction range | Average prediction time |
|---|---|---|---|---|---|---|---|---|
| | KCFSI | CNFCI | STLFSI | between 2-year and 5-year | between 2-year and 10-year | | | |
| 1973 | N/a | 7 | N/a | N/a | N/a | N/a | 7 | 7.0 |
| 1980 | N/a | 2 | N/a | N/a | N/a | N/a | 2 | 2.0 |
| 1981 | N/a | 3 | N/a | N/a | N/a | N/a | 3–6 | 5.0 |
| 1990 | Not predicted | 9 | N/a | 4/3 | 4/2 | Not predicted | 3–9 | 4.6 / 4.0 |
| 2001 | 15 | 2 | 2 | 12/2 | 13/2 | 0.5 | 2–15 | 8.1 / 5.1 |
| 2008 | 4 | 3 | 3 | 18/3 | 22/2 | 2 | 2–4 | 7.9 / 2.9 |
| Prediction range | 4–15 | 2–9 | 2–3 | 12–18/2–3 | 13–22/2 | 2 | | 2–15 |
| Average prediction time | 9.5 | 4.3 | 2.5 | 15/2.5 | 17.5/2 | 1.5 | | 4.2 |

*Source:* compiled by the authors.

*Note.* Financial conditions indexes: KCFSI — the Kansas City Financial Stress Index; CNFCI — the Chicago Fed National Financial Conditions Index; STLFSI — the St. Louis Fed Financial Stress Index. Yield spreads; between 2-year and 5-year — between 2-year and 5-year US Treasury bonds; between 2-year and 10-year — between 2-year and 10-year US Treasury bonds.

### Estimation of prediction time by various crisis predictors

We used the graphs of crisis predictors combined with the temporal boundaries of recessions to analyze the prediction time for various crisis predictors (regarding the recessions of the past 50 years in the USA). *Table 4* presents the analysis results.

*Table 4* presents two versions of data on the prediction time for the US Treasury bond yield spreads. We believe, the first signal is observed at the moment when spread data become stable negative, and the second signal — at the moment when these indicators leave the negative range and begin their steady growth.

Besides the results in *Table 4*, one should consider the result from work [29] regarding the predictive power of indicators of the national financial cycle. With reservations (related to the obvious fact that not every economic crisis is predicted by the financial cycle indicators, i.e., recession), however, in some cases, the financial cycle peak with an approximately 2-year lag precedes the economic recession.

As of December 2019, most of the examined crisis predictors do not signal a possible impending crisis. The exceptions are yield spreads between US treasury bonds of varying maturities (they indicate a possible impending crisis in the middle — end of 2020), the Schiller index (indicates the American Stock Market Overvaluation), and individual assessments of investor sentiment.

## PREDICTING GLOBAL CRISES — SPECIFICS OF RUSSIA

Due to its commodities exports, Russia is currently doomed to be highly dependent on the situation of global markets. Thus, according to the estimates in work [30], the shocks of the world oil market describe about 26% of the variance of the ruble exchange rate and 20% of inflation, and the dynamics of the VIX "fear index" determines 16% of the spreads of sovereign Russian credit default swaps and 13% of the industrial production.

The lag of the Russian financial sector development from socio-economic development as a whole, also mentioned by the World Economic Forum competitiveness ranking[8], objectively lowers Russia's resistance to external shocks in the context of the financialization of the global economy. While China and India benefit from the financialization process by increasing attracted investment resources, Russia, with the weak national financial sector, is becoming increasingly vulnerable to external shocks [31].

Besides, the deterioration in Russia's financial structure since 2008 [32] has also increased the vulnerability of the Russian financial sector to external shocks. In their work, Yu. Danilov, O. Buklemishev and A. Abramov noted that "... the countries with the largest gap between the development of the banking sector and the non-banking financial sector are the most vulnerable to a crisis in the global financial market. This is because the banking sector translates external shocks; while institutional investors, the core of the non-banking financial sector, on the contrary, absorb external shocks, reducing their impact on the real sector of the economy" [33].

These circumstances predetermine the increased vulnerability of the Russian economy to external shocks; increase the likelihood of infection of the Russian financial system with risks from the global market. Therefore, predicting global crises is especially relevant for our country. Currently, the Bank of Russia is monitoring a relatively small number of indicators that could assess the accumulation of internal risks and the potential for translating external shocks.

The latest financial stability review by the Bank of Russia[9] indicates mainly the pro-

[8] Russia ranks 43rd in the Financial Sector in 2019; and it ranks 95th in the world — see The Global Competitiveness Report 2019. Geneva: WEF; 2019.

[9] Bank of Russia. Financial Stability Review. Information and analytical material. No. 1 (14). Q4 2018 — Q1 2019. M.: Bank of Russia; 2019.

cesses in the Russian banking sector as the key vulnerabilities in the Russian financial system. They may lead to increased risks of insolvency of bank borrowers, insolvency of the banks themselves, as well as risks of the foreign currency and time structure of bank liabilities[10]. Besides, this report addresses selected issues of macroprudential policy and systemic risks of financial institutions.

This approach does seem to be complex. Many indicators should be integrated into financial stability monitoring. Given the fundamental increased vulnerability to external shocks, Russia should raise the profile of indicators assessing external risks. Among them, crisis indicators with strong predictive power should take a special place. It would be useful if the Russian financial authorities constantly monitored reliable crisis predictors, and the results of this monitoring were available online to all economic agents.

## CONCLUSIONS

Given the identified sequence of crisis predictors, the authors built a block scheme to monitor external crisis predictors. It combines the behavior analysis of predictors in terms of prediction time with the analysis of predictors in terms of predicting the nature of the starting point of a future crisis. A basic block-diagram may be as follows:

1. *If the signal of the financial cycle indicators is recorded*[11] *(financial cycle break point, the maximum point of the financial cycle passed), then:*

1.1. The period of possible start of a future crisis is determined (2 years after the maximum point was passed).

1.2. Debt market indicators, including default risk assessments, get heightened attention.

2. *If T-bond spreads become negative, then:*

2.1. The period of possible start of a future crisis is determined (12–18 months after the spreads become negative).

2.2. The period of a possible confirmation signal from this group of crisis predictors is determined.

2.3. The period for enhanced monitoring of other crisis predictors, as well as the list of these predictors, are determined[12].

3. *If the signal financial conditions indexes is recorded, then:*

3.1. The period of a possible start of a future crisis is specified (3–4 months after the signal is received).

3.2. The probability of the onset of the crisis is specified (considering the crisis predictors that worked and did not work earlier).

3.3. Particular attention is paid to indicators of debt burden, interest and currency risks.

3.4. Requested is an in-depth analysis of the dynamics of other crisis predictors, whose prediction time is close to financial conditions indexes.

4. *If the signal of the Schiller coefficient and stock indexes is recorded, then:*

4.1. The period of a possible start of a future crisis is specified (0–2 months after the signal is received).

4.2. The nature of the initial period of the crisis is determined — the stock market crisis.

If all of the above signals are triggered, there is little doubt about the onset of the crisis. Then, the government should begin implementing the previously outlined countermeasures against the crisis.

[10] The vulnerabilities indicated in the Review by the Bank of Russia are as follows: the rapid growth of the household debt burden against the excessive growth of consumer lending; banking sector dollarization and dependence on external financing (understood as the dollarization of household deposits and dependence on foreign investors); growth in short-term funding of banks; growing concentration of banks' loan portfolio on selected largest borrowers with high debt burden.

[11] In this article, we did not consider these indicators, since the financial cycle has a significantly longer duration than the business cycle, and no downward movement of the long-term financial cycle is expected in the near future.

[12] Financial conditions indexes — approximately 8 months after the spreads become negative; the spread between the mortgage rate and the real estate price — approximately 9 months after the spreads become negative; stock indexes and the Schiller coefficient — about 6 months after the spreads become negative; etc.

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Danilov Yu.A. — statement of the problem, development of the concept and methodology of the article, a critical analysis of the literature, the formation of the conclusions of the study.
Pivovarov D.A. — analysis methods detailing, statistical data analysis, meaningful analysis of the results.
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