A Brief Survey of Risk-Appetite Indexes

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The risk appetite of investors may prove to be an important concept in the analysis of financial stability. Most macroeconomic and asset-pricing models incorporate an assumption about risk appetite. The phenomenon is also often cited in the media and by public figures as a factor influencing financial markets.[1]

Theory suggests that a low appetite for risk translates into a higher cost of capital, potentially limiting business investment, while a high appetite for risk can produce booms in credit and asset prices, sowing the seeds of eventual recessions and stress on the financial system. The Asian financial crisis of 1997, the aftermath of the Russian debt default of 1998, and the collapse of high-technology share prices in 2000 are a few examples of events that appear to be related to systemic changes in investors' appetite for risk.

Not surprisingly, a growing number of financial institutions and organizations have been developing measures of risk appetite in an effort to quantify this phenomenon. These range from the International Monetary Fund's risk appetite index, used for market surveillance (IMF 2003), to indexes developed by private financial institutions to enhance trading returns.

In this article, we provide an overview of the methodologies underlying various measures of risk appetite available in the public domain. Using simple qualitative criteria, we find that these measures do not always tell the same story, even though all purport to be measuring the same thing. We therefore conclude that the measurement of risk appetite is highly sensitive to the chosen methodology and underlying theory. Consequently, it seems premature to rely on any particular index when assessing risk appetite in the financial system.

Concepts

Investors can display various attitudes towards a given level of risk: disliking risk (risk averse), being neutral to risk (risk neutral), or loving risk (risk loving). These attitudes are summarized by the Arrow-Pratt coefficient of risk aversion in classical economics.

Although most economists equate risk appetite with the Arrow-Pratt coefficient, a broader definition posits that risk appetite also incorporates risk *perceptions* (i.e., the degree of risk that investors believe they are faced with).[2] The empirical challenge arises from the fact that both attitudes and perceptions are intangibles and must therefore be inferred from the data. This typically requires making some strong assumptions.

Empirical Approaches

Most of the indexes surveyed treat risk appetite as a combination of attitudes and perceptions. Various frameworks are used to assess the changes in risk appetite typically inferred by changes in a representative risk premium or by changes in portfolio holdings. Since price data are more readily available than portfolio data, changes in risk premiums are usually taken to be the primary indicator of changing risk appetite.

Although the indexes surveyed have different titles, the concept of risk appetite is implicit in

1. See Dodge (2003), Kennedy (2002), Greenspan (1999, 2004), and Bernanke (2003).

* The authors would like to thank Miroslav Misina for contributing to our discussions and understanding of risk appetite.

2. See Cochrane (2001), Gai and Vause (2004), and Misina (2003) for a more detailed development of these concepts.

their methodology and interpretation. These measures are variously referred to as indexes of "risk aversion," "risk appetite," "investor confidence," and "investor sentiment." Generally, they measure risk appetite either by looking at a specific aspect of markets (and sometimes a specific market) or by combining information from various markets into a composite measure. They all purport to describe risk appetite in equity markets, or in all markets including the equity market. We categorize the indexes into two groups: *atheoretic* and *theory-based*.

Atheoretic indexes aggregate information from various financial markets using statistical methods. These include: the JPMorgan Liquidity, Credit, and Volatility Index (LCVI), the UBS Investor Sentiment Index (UBS), the Merrill Lynch Financial Stress Index (ML), and the Westpac Risk Appetite Index (WP).

Since these measures combine many different types of risk (liquidity, credit, and market risks), the subcomponents do not always move together. The stated benefit of combining the components is to capture overall risk appetite. Box 1 contains a list of each index's components and a brief description of their methodologies.

Theory-based indexes originate from economic or financial models and typically focus on specific markets. These include: the Tarashev, Tsatsaronis, and Karampatos Risk-Appetite Index, developed at the Bank for International Settlements (BIS); the Gai and Vause Risk-Appetite Index, developed at the Bank of England (BE); the Credit Suisse First Boston Risk-Appetite Index (CSFB); the Kumar and Persaud Global Risk-Appetite Index (GRAI), used by both the IMF and JPMorgan; the State Street Investor-Confidence Index (ICI); and the Goldman Sachs Risk-Aversion Index (GS). A brief description of each is given in Box 2.

Finally, the Chicago Board Options Exchange Volatility Index (VIX) is included in the analysis. The VIX is commonly treated as a quick and easy proxy for risk appetite, because it is derived from S&P 500 options, which investors buy and sell to change the amount of risk to which they are exposed. The VIX is also a component of all four atheoretical indexes and is based on the same underlying data as the BIS and BE indexes.

Qualitative Assessment

In Chart 1, the various indexes are rebased to a common scale.[3] Higher values can be interpreted as indicative of greater risk appetite. Most of the indexes are available only from late-1998 onwards. Nonetheless, this five-year period witnessed several interesting episodes of extreme investor optimism and pessimism that widely affected the global financial system.

Specifically, one would expect the indexes to signal a high degree of risk appetite during the bull markets of the late 1990s and 2003. Conversely, a signal of low risk appetite should appear during the 1998 Russian debt crisis, the bear market of 2000 to 2002, and the aftermath of 11 September 2001. Table 1 lists the indexes and their respective signals of risk appetite during these five episodes.[4]

All of the indexes identify the Russian crisis as a period of low risk appetite. Also, as expected, most of the indexes indicate high risk appetite at some point in 2003. The results for the other episodes are less consistent, with the BE, BIS, GRAI, and WP each giving at least one contradictory signal. On the other hand, the CSFB, ML, and UBS give the expected signal in four or more cases. It should be noted that some of the indexes were designed to perform well "in sample" with respect to recent financial crises, but their value in anticipating new crises may be limited.

Despite this apparent conformity, most of the indexes are volatile and, as a result, often give multiple signals in a given period and seemingly spurious signals during periods where no systemic events can be identified. The timing of the signals is also highly variable across the indexes, with some reacting more quickly than others.

Most of the measures are positively, but not highly, correlated with one another (Table 2).[5] This suggests that even if the indexes generally

3. The units of each index are arbitrary, so these transformations do not change their interpretations.
4. The signal thresholds are based on one standard deviation from the mean of each index (for the period 1999 to 2004) and are scored as being correct if they crossed this threshold during the term of the specific episode.
5. The correlations are statistically significant at the 5 per cent confidence level in 34 of the 55 pairs.

Box 1

Methodologies of Atheoretic Indexes

The components of the four atheoretic risk-appetite indexes considered in this article are listed in the accompanying table. For a complete description of each variable and the justification for its inclusion in a particular index, we refer the interested reader to the references listed at the end of this article.

Generally speaking, these variables are common measures of broad financial market risks (such as bond spreads, implied volatilities, and swap rates). Others are anecdotally suggestive of risk appetite. For example, one often reads that the price of gold, the value of the Swiss franc, or the Treasury-eurodollar spread increase when investors are "fleeing to safety." Similarly, during such episodes, low-risk assets tend to perform better, in terms of returns, than high-risk assets.

The obvious criticism of the atheoretic approach is that these variables are influenced by numerous factors in addition to changes in investors' risk appetite.

A further complication is how to aggregate the variables and interpret the final values of the indexes. All four indexes transform their underlying data so that each variable has roughly the same variance and, therefore, a more or less equal weight in the final index.

The UBS (Germanier 2003) and ML (Rosenberg 2003) approach is to subtract a rolling mean from each variable and divide this term by a rolling standard deviation (this is sometimes called a "σ–score"). The LCVI (Kantor and Caglayan 2002) transforms each variable into a percentile based on its historical distribution. The WP (Franulovich 2004) converts each variable to a daily percentage change, averages these values, backwardly iterates an index based on these average changes, and then converts the index into a σ–score.

Components of Atheoretic Indexes

Variables	LCVI	UBS	ML	WP
Fixed-income market				
Spreads on U.S. high-yield bonds	X	X	X	X
U.S. swap rates	X		X	X
U.S. Treasury-eurodollar spread			X	
U.S. Treasury bid/ask spreads	X			
Spreads on emerging-market bonds	X	X		X
Equity market				
VIX[a]	X	X	X	X
Low-risk/high-risk equity price ratio		X	X	
U.S. equity put/call ratio			X	
U.S. equity short sales/open interest			X	
Foreign exchange market				
Implied currency volatilities	X	X		X
Swiss franc/Australian dollar ratio			X	
Other market variables				
Gold price		X	X	
Treasury/equities total returns ratio		X	X	
GRAI[b]	X			

a. Chicago Board Options Exchange (2004) implied volatility index for the S&P 500
b. Global Risk Appetite Index (Kumar and Persaud 2002)

Box 2

Methodologies of Theory-Based Indexes

Tarashev, Tsatsaronis, and Karampatos (2003) Risk-Appetite Index, developed at the Bank for International Settlements (BIS)

The BIS method begins by estimating the statistical distribution of future asset returns from the historical patterns of asset prices using a GARCH model. Implied volatilities are then calculated using option prices with different exercise prices. From this, a volatility "smile" is mapped into a "subjective" probability distribution of the future payoffs.

The value of the index is the ratio of the left tails of the two distributions (i.e., the ratio of the statistical downside risk to the subjective downside risk). The BIS uses monthly equity market data.

Gai and Vause (2004) Risk-Appetite Index, developed at the Bank of England (BE)

The BE approach is very similar to the BIS method. The key difference is that the BE uses the ratio of the full distributions rather than just the ratio of the left tails.

Kumar and Persaud (2002) Global Risk-Appetite Index (GRAI)

To construct the GRAI, assets are first ranked by their riskiness (proxied by the variance of past returns) and then ranked by their excess returns (proxied by the difference between future and spot prices measured at a single point in time). The key premise is that the correlation between the ranking of risk and the ranking of excess returns should be close to zero for changes in asset riskiness. This correlation should be positive for increasing risk appetite and negative for decreasing risk appetite. The GRAI uses daily foreign exchange rate data. The index methodology is used by both the IMF and JPMorgan in their respective risk-appetite indexes.

The Credit Suisse First Boston Risk-Appetite Index (CSFB) (Wilmot, Mielczarski, and Sweeney 2004)

The CSFB is similar to the GRAI. The index compares risk (past price volatility) and excess returns across assets. The value of the CSFB on a given day is the slope coefficient obtained from the cross-sectional linear regression of risk and excess returns. The more positive the slope, the greater the risk appetite. The CSFB is based on daily data for 64 indexes of bonds and equities in developed and emerging markets. Daily indexes of local currencies are used for developed markets, while daily U.S.-dollar indexes are used for emerging markets.

State Street Investor-Confidence Index (ICI) (Froot and O'Connell 2003)

The ICI is also similar to the GRAI but is applied to quantities rather than prices. Higher risk appetite should be observed through increased holdings of risky assets and vice versa. These portfolio shifts can occur in times of increasing or decreasing prices. Hence, the ICI claims to be able to differentiate between changes in risk appetite and changes in risk. The index is calculated monthly using State Street's proprietary database of institutional investor portfolios.

Goldman Sachs Risk-Aversion Index (GS)

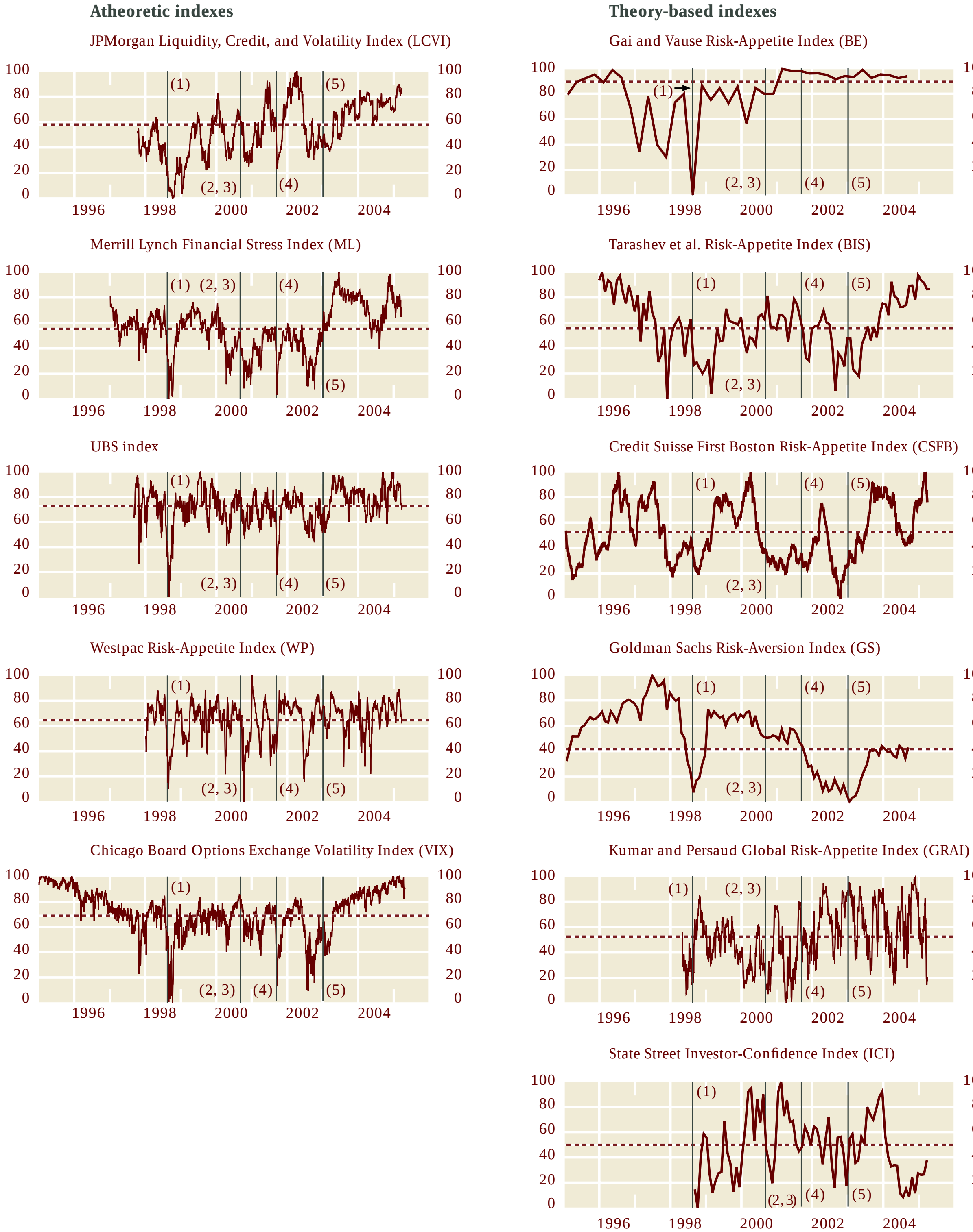
The GS uses a standard consumption model of capital-asset pricing, where the Arrow-Pratt coefficient of risk aversion is allowed to vary over time. The premise derives from the observation that the "volatility of excess returns from holding stocks over bonds appears to be substantially higher than the volatilities of T-bills and consumption, and only a time-varying risk aversion level can explain such [a] differential" (Goldman Sachs 2003). The GS uses monthly data on real U.S. per-capita consumption, the real rate on 3-month U.S. Treasury bills, and the inflation-adjusted S&P 500 Index.

Characteristics of Theory-Based Indexes

	BIS	BE	GRAI	CSFB	ICI	GS
Interpretation of values:						
Level	X	X			X	X
Change			X	X		
Underlying data from[a]:						
Equity	X	X		X	X	X
Fixed income				X		X
Foreign exchange			X			
Frequency[b]:						
Quarterly		X				
Monthly	X				X	X
Daily			X	X		

a. The methodologies could be equally applied to other asset markets, provided the requisite data existed.
b. The BIS and BE methodologies could be applied to daily data, although this would be computationally intensive.

Chart 1 Risk-Appetite Indexes



Note: Variables rescaled such that 100 equals maximum “risk appetite” and 0 equals minimum “risk appetite” over the period 1996 to 2004.
The dotted horizontal line depicts the average of each index over this period.

Vertical solid lines correspond to:
(1) 1998 Russian debt default
(2) Peak of 1990s bull market, 2000
(3) Start of 2000–2002 bear market
(4) Terrorist attacks of 11 September 2001
(5) Start of 2003 bull market

provide the expected signal of risk appetite, these signals are not consistently the same across indexes.[6]

Interestingly, the theory-based measures are either orthogonal to one another (having small and non-significant correlations) or negatively correlated. Recall that the BIS, ICI, and GS are all based on equity market data, yet they have some of the lowest cross-correlations. As well, the CSFB measure is orthogonal to the GRAI, even though both use a similar risk-return framework.

Of course, the absence of correlation may simply reflect different information sets and design objectives for the various indexes. One of them may still be an appropriate measure of overall risk appetite even if it is not highly correlated with any of the others.

Conclusions

The ability to measure the appetite of investors for risk is an appealing proposition, given the recent spate of systemic financial shocks (such as the Asian and Russian crises and the bursting of the high-tech bubble). This explains the growing interest in the measurement of risk appetite and the proliferation of indexes. If all of these indexes truly captured changes in risk appetite, however, we would expect them to provide similar signals. Our survey indicates that this is generally not the case. Consequently, it seems premature to rely on any given index when assessing risk appetite in the financial system.

Further research is needed to explore the empirical properties of these indexes and their theoretical underpinnings. The index that proves most useful from a central bank perspective will be the one that establishes a (possibly non-linear) link between the level of risk appetite and changes in the supply of credit, asset prices, business investment, or more broadly, the functioning of the financial system.

6. Many of the measures that are significantly correlated with the VIX include it as a component.

Table 1

Risk-Appetite Signals

This table characterizes the signal given by each index during five periods (L for low, — for neutral, and H for high risk appetite).

	1998 Russian crisis	1990s bull market	2000 bear market	11 Sept. 2001	2003 bull market
Expected signal:	Low	High	Low	Low	High
BE	L	L	—	H	H
BIS	L	—	H	L	H
CFSB	L	H	L	L	H
GRAI	L	L	L	—	H
GS	L	H	—	—	—
ICI	L	H	—	—	H
LCVI	L	—	—	L	H
ML	L	—	L	L	H
UBS	L	H	—	L	H
VIX	L	—	—	L	H
WP	L	—	L	H	—

The signal thresholds are +/- 1 standard deviation from the mean of each index over the period 1999 to 2004.
1998 Russian crisis refers to Russia's debt default and subsequent turbulence in global markets over the August to October period in 1998.
1990s bull market refers to the 15 months leading up to February 2000.
2000 bear market refers to the third quarter of 2000, which marked the start of the broad-based collapse of share prices in the high-tech sector.
11 Sept. 2001 refers to the month following the terrorist attacks of 11 September 2001.
2003 bull market refers to the rebound in equity markets, the prices of emerging-market bonds, and the prices of high-yield corporate bonds during 2003.

Table 2

Correlation Matrix

Per cent

	BE	BIS	CSFB	GRAI	GS	ICI	LCVI	ML	UBS	VIX
BIS	25*									
CFSB	-41**	34**								
GRAI	42**	0	-2							
GS	-60**	24*	43**	-55**						
ICI	21*	15	3	-9	0					
LCVI	54**	29**	19	30**	-55**	10				
ML	16	20	59**	27*	5	-2	54**			
UBS	28**	31**	44**	21*	4	13	54**	75**		
VIX	11	71**	66**	3	27*	4	48**	66**	68**	
WP	24*	2	12	27*	-11	12	40**	32**	57**	23*

Asterisks denote significance at the 5 per cent (*) and 1 per cent (**) confidence levels. The sign of the cross-correlations is adjusted where appropriate such that a positive value indicates positive correlation of risk appetite, and vice versa. Pairwise, correlations involving the BE are calculated quarterly, while all others are monthly.

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