

## **TIGER: Tracking Indexes for the Global Economic Recovery**

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### **Technical Appendix**

#### **Methodology**

In our analysis, we employ a statistical procedure called Principal Component Analysis (PCA) that is used widely in the physical and social sciences to extract indicators that capture common fluctuations among variables in large datasets. PCA is a transparent and straightforward procedure that can easily handle a large number of variables and enables one to construct indicators of comovement across all variables in a dataset or a subset of them. This procedure is ideal for creating the TIGER indexes as it allows us to combine information from different types of economic variables and multiple countries.

Each variable that enters into the PCA is a priori given an equal weight in the calculations. The procedure then assigns different weights to different variables depending on how important they turn out to be in capturing fluctuations in the entire set of variables. PCA is a special case of a more general technique called factor analysis that captures more complicated patterns of lead and lag correlations across the variables—it is important to note that PCA picks up only contemporaneous correlations.

#### **Dataset**

Our dataset covers most of the G-20 countries and contains a set of key real, financial and confidence variables. The main constraint in expanding our dataset to cover more variables is the lack of consistent data availability at a high frequency, especially among the emerging markets. For example, it is difficult to get good data on employment levels for the emerging markets. Nevertheless, we have assembled a set of variables on which we were able to get reasonably timely and high-quality data. The countries and variables in our dataset are listed below. Note that composite total indexes include only Advanced Economies and Emerging Market Economies groups.

#### **Advanced Economies**

- Australia
- Canada
- France
- Germany
- Italy
- Japan
- Korea
- Netherlands
- Spain
- United Kingdom
- United States

#### **Emerging Market Economies**

- Argentina
- Brazil
- China
- India
- Indonesia
- Mexico
- Russia
- South Africa
- Turkey

#### **Euro Periphery**

- Greece
- Italy (Advanced)
- Ireland
- Portugal
- Spain (Advanced)

#### **Economic Indicators**

##### *Real Activity Indicators*

- Capacity Utilization
- Employment
- Exports
- Industrial Prodn.
- Imports
- GDP
- Manufacturing Orders
- Retail Sales
- Unemployment Rate

##### *Financial Indicators*

- Equity Market Index
- Stock Market Capitalization
- Credit Growth
- Emerging Market Bond Spreads
- TED Spread
- VIX

##### *Confidence Indicators*

- Business Confidence
- Consumer Confidence

**By Country:**

Composite Index – Business Confidence, Consumer Confidence, Capacity Utilization, Employment, Exports, Imports, Industrial Production, GDP Growth, Manufacturing Orders, Retail Sales, Unemployment Rate, Equity Markets, Credit Growth, Ted Spread<sup>1</sup>, VIX

Real Activity Index – Capacity Utilization, Employment, Exports, Imports, Industrial Production, GDP Growth, Manufacturing Orders, Retail Sales, Unemployment Rate

Financial Index – Equity Markets, Market Capitalization, Credit Growth, Emerging Bond Spreads, TED Spread, VIX

Confidence Index – Business Confidence, Consumer Confidence

**By Indicator Variable:**

Advanced Economies, Emerging Market Economies, and Total Indexes are found by aggregating directly across country data. We create composite indexes separately for the groups of advanced economies and emerging markets covering all of the above variables. We also create additional indexes for each of these groups based on each category of variables listed below (real, financial, confidence). Finally, we generate country-specific indicators that cover all the variables for a given country and also variable-specific indicators that cover all countries' data for a given variable.

**Description of Data and Source Information:**

Indicator Variable	Unit	Description	Source
Business Confidence	Index	National confidence indicator	OECD
Consumer Confidence	Index	National confidence indicator	OECD
Capacity Utilization	Percent	Capacity utilization rate for industrial sector	Haver Analytics; National sources
Employment	Percent	12-month growth rate of total employment levels	IMF International Financial Statistics; National sources
Exports	Percent	12-month growth rate of 3 month moving average. Goods. USD	IMF Direction of Trade Statistics
Imports	Percent	12-month growth rate of 3 month moving average. Goods. USD	IMF Direction of Trade Statistics
Industrial Production	Percent	12-month growth rate of 3 month moving average. Seasonally Adjusted Volumes	World Bank, Global Economic Monitor; National sources
GDP Growth	Percent	Quarterly, year-over-year real growth rate. Each month in quarter are equal to quarterly rate	IHS Global
Manufacturing Orders	Percent	12-month growth rate of new manufacturing orders. Seasonally adjusted, local currency or index.	Haver Analytics; National sources
Retail Sales	Percent	12-month growth rate of 3 month moving average. Seasonally adjusted, Volume, Index	World Bank, Global Economic Monitor; National sources
Equity Markets	Percent	12-month growth rate of share price index in national currency	Yahoo Finance; IMF International Financial Statistics
Stock Market Capitalization	Percent	12-month growth rate in national currency	CEIC Data Company, Ltd.

<sup>1</sup> The TED Spread, by construction, is available only as a single variable and is not country-specific.

Credit Growth	Percent	12-month growth rate in national currency. Banking claims on private sector	IMF International Financial Statistics; Federal Reserve; Bank of Japan
Emerging Bond Spreads	Level	Basis points over US treasury	World Bank, Global Economic Monitor
TED Spread	Level	Difference between 3-month LIBOR and U.S. Treasury, basis Points	US Department of Treasury; Federal Reserve (FRED)
Unemployment Rate	Percent	Percent of labor force as defined by country	Official statistics
VIX	Level	Volatility index for national stock markets	Bloomberg

**Data Composition of TIGER Indexes**

The matrix below shows which countries and variables are included across the aggregated TIGER indexes.

	Bus Conf.	Cons. Conf.	Cap. Utilization	Employment	Export	Import	Ind. Prodn	GDP	Man. Orders	Retail Sales	Equity Market	Market Cap	Credit Growth	Emerging Bond Spreads	Unemployment Rate	VIX
<b>Advanced:</b>																
Australia	X	X	-	X	X	X	X	X	-	-	X	X	X	-	X	-
Canada	-	X	-	X	X	X	X	X	-	X	X	-	-	-	X	-
France	X	X	-	X	X	X	X	X	-	X	X	X	X	-	X	X
Germany	X	X	-	X	X	X	X	X	-	X	X	X	X	-	X	-
Italy	X	X	-	X	X	X	X	X	-	X	-	X	X	-	X	-
Japan	X	X	-	X	X	X	X	X	-	X	X	-	X	-	X	X
Korea	X	X	-	X	X	X	X	X	-	X	X	X	X	-	X	X
Netherlands	X	X	-	X	X	X	X	X	-	-	X	-	X	-	X	-
Spain	X	X	-	X	X	X	X	X	-	X	X	-	X	-	X	-
UK	X	X	-	X	X	X	X	X	-	X	X	X	X	-	X	X
US	X	X	-	X	X	X	X	X	-	X	X	-	X	-	X	X
<b>Emerging Markets:</b>																
Argentina	-	-	-	-	X	X	X	X	-	-	X	X	X	-	-	-
Brazil	X	X	-	X	X	X	X	X	-	X	X	X	X	-	-	-
China	X	X	-	-	X	X	X	X	-	X	X	X	X	-	-	-
India	-	-	-	-	X	X	X	X	-	-	X	-	-	-	-	-
Indonesia	-	-	-	-	X	X	X	X	-	-	X	X	-	-	-	-
Mexico	X	X	-	-	X	X	X	X	-	X	X	X	X	-	-	-
Russia	X	-	-	-	X	X	X	X	-	-	X	X	X	-	-	-
South Africa	X	X	-	X	X	X	X	X	-	X	X	-	X	-	-	-
Turkey	X	X	-	X	X	X	X	X	-	X	X	X	X	-	-	-

**Data Availability**

The table below describes the availability of each variable by country. All data are monthly and begin on January 2005 and end in the specified month of 2018.

	Bus Conf.	Cons. Conf.	Cap. Utilization	Employment	Export	Import	Ind. Prodn	GDP	Man. Order	Retail Sales	Equity Market	Market Cap	Credit Growth	Emerging Bond Spreads	Unemployment Rate	VIX
<b>Advanced:</b>																
Australia	Nov '17	Feb	Jun'17	Feb	Dec'17	Dec'17	Jun '17	Q4	-	-	Apr	Feb	Jan	-	Feb	-
Canada	-	Dec'17	Jun'17	Feb	Dec'17	Dec'17	Jan	Q4	Jul'17	Dec'16	Apr	-	-	-	Mar	-
France	Feb	Feb	Aug'17	Dec '17	Dec'17	Dec'17	Jan	Q4	-	Dec'16	Apr	Mar	Jan	-	Dec '17	Apr
Germany	Feb	Feb	Aug'17	Jan	Dec'17	Dec'17	Jan	Q4	Jul'17	Dec'16	Apr	Feb	Jan	-	Mar	-
Italy	Feb	Feb	Jun'17	Feb	Dec'17	Dec'17	Jan	Q4	May'	Dec'16	Apr	Feb	Jan	-	Feb	-
Japan	Dec '17	Feb	Jul'17	Jan	Dec'17	Dec'17	Feb	Q4	Jul'17	Jan	Apr	Aug'17	Feb	-	Feb	Apr
Korea	Feb	Feb	-	Feb	Dec'17	Dec'17	Feb	Q4	-	Dec'16	Apr	Mar	Jan	-	Feb	Apr
Netherlands	Feb	Feb	Jun'17	Dec '17	Dec'17	Dec'17	Jan	Q4	-	Jan	Apr	Aug'17	Jan	-	Feb	-
Spain	Feb	Feb	Jul'17	Dec '17	Dec'17	Dec'17	Jan	Q4	Jul'17	Dec'16	Apr	Aug'17	Jan	-	Dec '17	-
UK	Feb	Feb	-	Dec '17	Dec'17	Dec'17	Jan	Q4	-	Jan	Apr	Feb	Jan	-	Jan	Apr
US	Feb	Feb	Aug'17	Feb	Dec'17	Dec'17	Feb	Q4	Jul'17	Dec'16	Apr	Aug'17	Feb	-	Mar	Apr
<b>Emerging Markets:</b>																
Argentina	-	-	-	-	Dec'17	Dec'17	Aug '17	Q4	-	-	Apr	Mar	Dec'17	May '14	-	-
Brazil	Feb	Feb	-	Feb	Dec'17	Dec'17	Feb	Q4	-	Dec'16	Apr	Mar	Jan	May '14	-	-
China	Feb	Dec'17	-	-	Dec'17	Dec'17	Feb	Q4	-	Feb	Apr	Mar	Jan	May '14	-	-
India	-	-	-	-	Dec'17	Dec'17	Jan	Q4	-	-	Apr	Aug'17	Jun'17	-	-	-
Indonesia	-	-	-	-	Dec'17	Dec'17	Jan	Q4	-	Feb	Apr	Feb	-	-	-	-
Mexico	Jan	Jan	-	Mar'17	Dec'17	Dec'17	Jan	Q4	-	Dec '16	Apr	Jan	Jan	May '14	-	-
Russia	Feb	-	-	-	Dec'17	Dec'17	Feb	Q4	-	-	Apr	Mar	Jan	May '14	-	-
South Africa	Dec '16	Feb	-	Sep'17	Dec'17	Dec'17	Jan	Q4	-	Dec '16	Apr	Aug'17	Jan	May '14	-	-
Turkey	Feb	Feb	-	Sep'17	Dec'17	Dec'17	Jan	Q4	-	Dec '16	Apr	Mar	Jan	May '14	-	-

Note: TED Spread data, not country specific, ranges from January 2005 through April 2018.

### Data Availability for Euro Periphery

The table below describes the availability of each variable for Greece, Ireland, and Portugal. Availability for Italy and Spain are included in the above Advanced Economy group. All data are monthly and begin on January 2005 and end in the specified month of 2018.

	Bus Conf.	Cons. Conf.	Cap. Utilization	Employment	Export	Import	Ind. Prodn	GDP	Man. Order	Retail Sales	Equity Market	Market Cap	Credit Growth	Emerging Bond Spreads	Unemployment Rate	VIX
Greece	Feb	Feb	-	-	Dec '17	Dec '17	Nov '17	Q4	-	Jan	Apr	Aug'17	Jan	-	Dec '17	-
Ireland	-	Jan	-	-	Dec '17	Dec '17	Jan	Q4	-	Jun '17	Apr	Aug'17	Jan	-	Mar	-
Portugal	Feb	Feb	-	-	Dec '17	Dec '17	Feb	Q4	-	Jul '17	Apr	Feb	Jan	-	Feb	-

### Data Composition of Euro Periphery Country Indexes

The matrix below shows which countries and variables are included in the country indexes for Greece, Ireland, and Portugal. Italy and Spain are included in the above Advanced Economy group.

	Bus Conf.	Cons. Conf.	Cap. Utilization	Employment	Export	Import	Ind. Prodn	GDP	Man. Orders	Retail Sales	Equity Market	Market Cap	Credit Growth	Emerging Bond Spreads	Unemployment Rate	VIX
Greece	x	x	-	-	x	x	x	x	-	x	x	-	x	-	x	-
Ireland	-	x	-	-	x	x	x	x	-	x	x	-	x	-	x	-
Portugal	x	x	-	-	x	x	x	x	-	x	x	x	x	-	x	-