METHODOLOGY OF SERVICES TRADE BAROMETER

Introduction

This document outlines the methodology used to produce the Services Trade Barometer, a composite indicator of world services trade and companion to the WTO's Goods Trade Barometer. The overall Services Trade Barometer index is calculated as a weighted average of six component indices representing various aspects of world services trade, including purchasing managers' indices, financial services transactions, telecommunication services production and employment, passenger air transport, container port throughput and construction activity. Data releases also include a services trade activity index, which provides an approximate measure of the volume of world commercial services trade and serves as a point of comparison to the Services Trade Barometer.

The Services Trade Barometer is a *coincident* indicator, with fluctuations that coincide with (rather than anticipate) shifts in actual services activity, but it can be seen as slightly leading since it will usually be released ahead of conventional services trade statistics. As such, the Services Trade Barometer provides an additional perspective on the state of world trade and its short-term outlook.

Rationale for a Services Trade Barometer

Statistics on both merchandise trade and commercial services trade tend to be released with long lags and at relatively low frequencies while policy makers, businesses and the general public are usually more interested in the most recent developments. The WTO's main objective in developing trade barometers for both goods and services was to gain insights on the current state of world trade (i.e. whether it is above or below trend, gaining or losing momentum, etc.) and to disseminate this information in an accessible form.

The Services Trade Barometer is not intended as a forecast although it does provide clues about the trajectory of trade in the near future. Its main contribution is to identify turning points and to gauge momentum in global services trade. As such, it complements conventional commercial services trade statistics.

Another data need addressed by the Services Trade Barometer is that of a real measure of services trade. Data on commercial services trade are usually reported in nominal currency terms, but these statistics do not lend themselves to representation in volume terms due to the general lack of export and import prices for services. The services trade activity index addresses this gap by adjusting aggregate world services trade statistics in US dollar terms to account for inflation and exchange rate fluctuations.

What data are included in the Services Trade Barometer?

As noted above, the Services Trade Barometer combines several component indices into a single composite indicator that tracks changes in the volume of world services trade. Component indices may represent developments in a particular sector (e.g. transport) or they may signal global trends (e.g. purchasing managers' indices). Where underlying data in component indices are reported earlier than services trade statistics, data may be time-shifted to make the component index more leading.

The Services Trade Barometer's component indices include:

- A Global Services Purchasing Managers' Index (PMI) derived from monthly business surveys covering companies in both developed and developing economies from IHS-Markit.

- An index of global financial transaction messages from SWIFT.

- An information, computer and telecommunication (ICT) services index based on data on production in China, the European Union, and the United Kingdom, and sectoral employment in United States, all derived from national sources.[1]
- An index of revenue passenger kilometres (RPK) from the International Air Transport Association (IATA), used as a proxy for travel expenditure.

- An index of container throughput of major international ports from the Institute of Shipping Economics and Logistics (ISL).

- An index of construction activity based on national statistics from China, France, Germany, Japan and the United States.

Methodology for the Services Trade Barometer

The Services Trade Barometer is a monthly index but is released on a biannual basis. The component indices measure short-run deviations from recent (i.e. medium term) trends. Recent trends serve as baselines for each index, which are normalized to be equal to 100.

The first step in calculating the barometer is the selection of data to be included. In addition to correlations with services trade and timeliness of data, each indicator was chosen based on the economic rationale, and the representation of major services sectors. Once a variable has been chosen, its performance will be re-evaluated from time to time to ensure that it continues to perform as expected. In the future, the WTO may enrich the Services Trade Barometer with additional data as new information becomes available.

The second step is data collection. All the data currently used in the Services Trade Barometer are of monthly frequency. The data used in calculating the index are expressed in real terms or physical units, e.g. revenue passenger kilometres from IATA, production of telecommunication services volumes, container port throughput etc.

All data are seasonally adjusted and smoothed with the X-13 ARIMA program unless already seasonally adjusted, in which case they are only smoothed. Recent trends for each data series are then estimated using the Hodrick-Prescott (HP) filter with conventional smoothing parameters.[2] Deviations from these trends are calculated for each component series as the difference between the smoothed, seasonally adjusted data and the trend established by the HP filter. Large or persistent shocks will shift the trend estimated by the HP filter to varying degrees depending on parameter values. As a result, the trend should be interpreted as a kind of moving average representing average growth over the last few years.

Amplitudes and means of the deviation series are standardized by dividing each series by its mean absolute deviation since January 2007, multiplying by a common scaling factor and adding 100. (The scaling factor and mean are chosen arbitrarily to facilitate interpretation.) Data series that are available earliest are lag shifted by one month to coincide with end points of other data series. Finally, the overall Services Trade Barometer is calculated as a weighted average of the component indices. Weights have been chosen based on the degree of correlation between the component indices and world trade in services. Possible data issues include end-point bias inherent in smoothing algorithms such as X-13 ARIMA and the HP filter. As a result, the latest data points may occasionally be subject to strong revisions in subsequent months.

The process of smoothing and de-trending the data is illustrated by Chart 1 using container port throughput of Singapore. Panel A shows the original, unadjusted data (blue line) plotted against seasonally-adjusted and smoothed data (red line). Panel B also shows the original data series (blue line) compared to the trend estimated by the HP filter (green line). Note that the HP-estimated trend becomes less steep over time in response to recent shocks. Panel C shows the smoothed
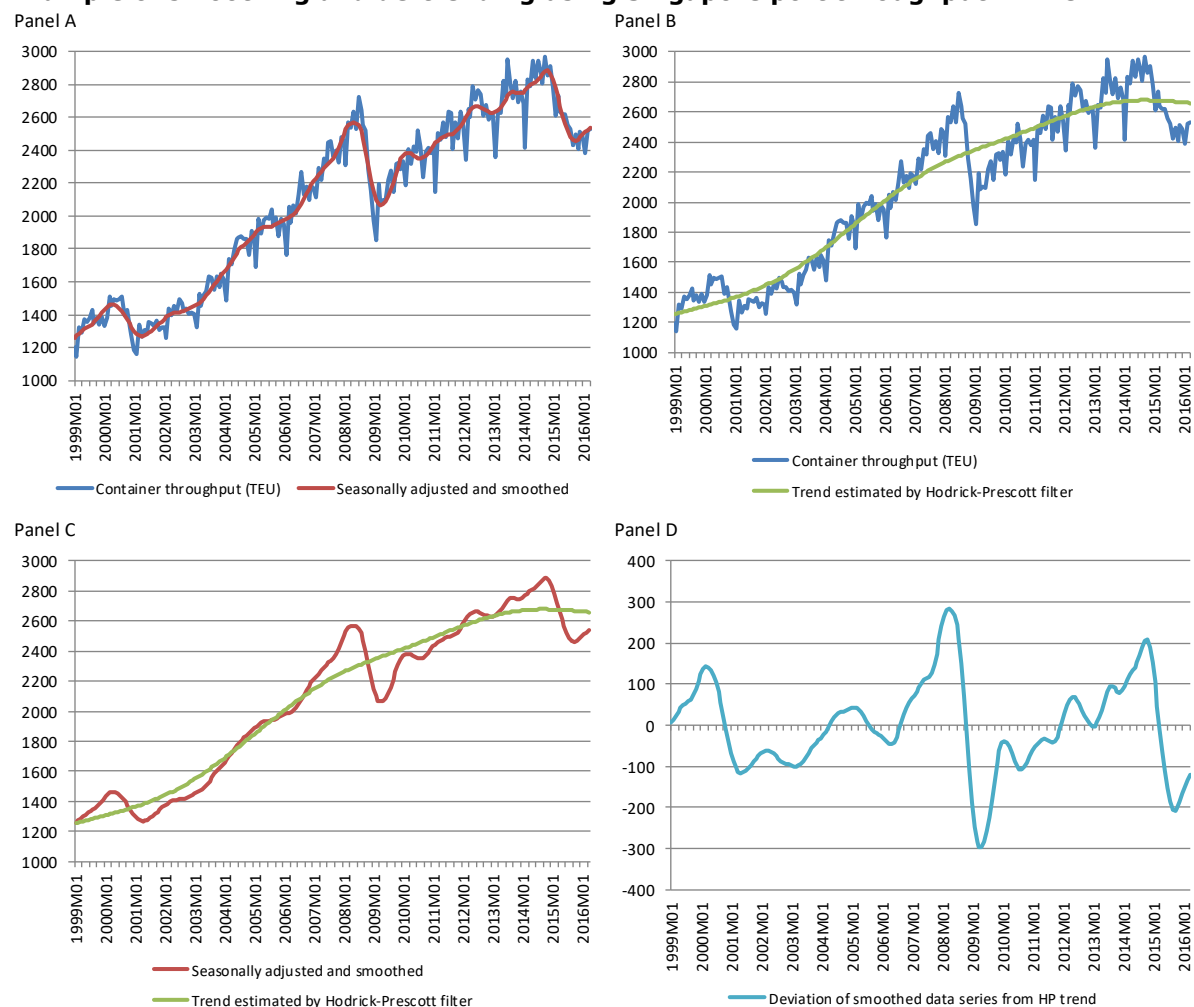
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[1] The federal reserve's Tech Pulse index that used to serve as the ICT indicator for the United States was discontinued. In its place we have substituted employment in related sectors from the U.S. Bureau of Labor Statsitics (2017 NAICS codes 517, 518, 519, 334 and 541.5). The impact of the change is small, with turning points in the component index and overall barometer index largely unaffected.

[2] The Hodrick-Prescott (HP) filter is a standard technique in economics for separating underlying trends in data series from short run fluctuations. If y is a data series, then the trend can be estimate by minimizing over tau the expression $\Sigma_{t=1..T}(y_t - \tau_t)^2 + \lambda \Sigma_{t=2..T} (\tau_{t+1} - 2\tau_t + \tau_{t-1})^2$. In calculating the WTOI, the lambda parameter is set to 129,600 according to the Ravn-Uhlig rule for monthly data.

short-run series and the HP trend together, while Panel D shows deviations of the smoothed series from the trend. Fluctuations in the deviation series are subsequently standardized by dividing by the mean absolute deviation in the series and multiplying by a constant. Finally, the mean is reset to 100 by adding 100 to each value.

Chart 1
Example of smoothing and de-trending using Singapore port throughput in TEU

Panel A

Container throughput (TEU)　　Seasonally adjusted and smoothed

Panel B

Container throughput (TEU)

Trend estimated by Hodrick-Prescott filter

Panel C

Seasonally adjusted and smoothed

Trend estimated by Hodrick-Prescott filter

Panel D

Deviation of smoothed data series from HP trend

Source: Singapore port authority.

Methodology for the services trade activity index

The WTO compiles statistics on commercial services trade by sector in current US dollar terms, which are published on a quarterly basis. These data reflect changes in US dollar exchange rates and price inflation as well as quantity changes. The services trade activity index approximates world services trade volume by deflating world services trade values in US dollar terms by an exchange rate index for the US dollar and core consumer price inflation for the United States.

The first step is data compilation. The trade in commercial services is represented by the average of world exports and imports of commercial services. The deflators are the United States core CPI (all items less food and energy) and the broad nominal effective exchange rate (NEER) for the United States. The trade in commercial services data is in quarterly terms, while the core CPI and NEER data are converted to quarterly averages from monthly data.

Data	Unit	Source
Imports and exports of commercial services	Million US dollar	WTO

United States Consumer Price Index for All Urban Consumers: All Items Less Food and Energy (Core CPI)	Base period 1982-1984=100	Federal Reserve Bank of St. Louis
United State Nominal Effective Exchange Rate: Broad indices	Base period 2010 = 100	Bank of International Settlement

The next step involves expressing the services trade activity index as deviations from trend, similar to the treatment of the component indices. First the services trade data is deflated with the core CPI and the NEER. Next the data is log transformed, seasonally adjusted and smoothed with the X-13 ARIMA program. Next the data is indexed with 2015 average as the base value of 100. This is followed by the estimation of recent trends with the Hodrick-Prescott (HP) filter. The deviation series is calculated as the difference between the seasonally-adjusted, smoothed data from the trend established by the HP filter. The deviation series is standardized by dividing with the mean absolute deviation and multiplying by a scaling factor and adding 100. For comparison with the Services Trade Barometer and the component indices, the quarterly services trade activity index is converted to monthly frequency.

Presentation

The level of the Services Trade Barometer in the latest month is represented by a graphical gauge, with a value of 100 indicating growth in line with the trend. Values of the overall index less than or equal to 97.5 are coloured red, indicating growth substantially below trend. Values greater than or equal to 102.5 are coloured green, indicating growth well above trend. Intermediate values are coloured amber, indicating growth roughly in line with recent trends.

Colour	Index range
Red	Index value<97.5
Amber	Between 97.5 and 102.5
Green	Index value>102.5

A separate chart in the document plots the Services Trade Barometer against services trade volume, as measured by the services trade activity index. In this case the quarterly services trade activity index is converted to monthly frequency for comparison with the monthly Services Trade Barometer.

Another chart illustrates the level of the seasonally adjusted services trade activity index as well as year-on-year growth in the index.

Finally, a bar chart shows the value of the component indices in the last two months. The bars for the latest month are also colour coded red, amber and green according to their value indicating the deviation from medium term trend, as indicated in the table above.

Finally, a set of line graphs illustrate monthly developments for the component indices, with readings above 100 indicating above trend growth and readings below 100 suggesting below trend growth.

Release schedule

The Services Trade Barometer is disseminated two times per year, with the precise schedule depending on data availability and the timing of other WTO statistical releases.

Data sources

Underlying data for the Services Trade Barometer and its component indices is obtained from a variety of sources. All the data used are reported on a monthly basis.

Sector	Indicator	Unit	Source
Commercial services	Headline Purchasing Managers Index (PMI) – services	Number from 0 to 100/ 50 means no change	IHS-Markit
Financial Services	SWIFTNet FIN traffic	Average daily FIN messages	SWIFT
ICT Services	Index of services production for telecommunication sector for the European Union	Base period 2015=100	Eurostat
ICT Services	Index of telecommunications services output for the United Kingdom	Base period 2018=100	UK Office of National Statistics
ICT Services	Business volume of telecommunication services for China	100 million yuan	National Bureau of Statistics China
ICT Services	Employees on payrolls in ICT related sectors	Thousands of persons	U.S. Bureau of Labor Statistics
Travel and tourism	Global Revenue Passenger Kilometres	Billions per month	International Air Transport Association (IATA)
Freight Transport	Container Throughput Index	Base period 2010=100	Leibniz-Institut für Wirtschaftsforschung (RWI) and Institute of Shipping Economics and Logistics (ISL)
Construction	Building permits index (floor area) for France	Base period 2015=100	Eurostat
Construction	Building permits index (floor area) for Germany	Base period 2015=100	Eurostat
Construction	Total construction spending for the United States*	Millions of Dollars	Federal Reserve Bank of St. Louis
Construction	Building starts (floor area) for Japan	1000 square metres	Statistics Bureau of Japan
Construction	Floor space of real estate started for China	10,000 square metres	National Bureau of Statistics China

*While this indicator is not expressed in real terms it was chosen based on its comprehensiveness capturing construction activity in the United States and overall correlation with services trade.

Further information and analysis available from IATA can be found as follows:

IATA Monthly Analysis:
https://www.iata.org/publications/economics/Pages/index.aspx