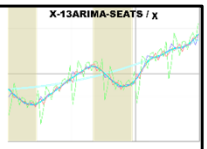
A development of software for adjustment of World's major holiday factors. Holiday factors are not fully detected by official holiday regressors in our experiences. Currently, we are designing holiday adjustment modules to build in X-13-ARIMA-SEATS. The aim is to detect major holiday factors from any time series of the world.



Hideki Furuya

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Hideki Furuya is Vice President and Chief Economist of SKANIOGLOS Investment Advisory Company Limited. SKANIOGLOS Investment Advisory is a Registered Financial Instruments Business Operator in Tokyo, which provides macro economics driven investment strategies on global securities currencies portfolios.

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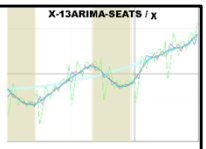

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- This presentation adopts software under development. Results of calculations may be different from those of the futures.

The cores of holiday adjustment are under construction.

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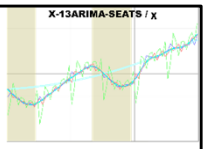

Contents

1. Our main econometric tools
   - Enhanced version of X-13ARIMA-SEATS
   - International input-output tables

2. Examples of holiday, not exactly official holiday, adjustments
   - Visually apparent holiday effect of Taiwan and others.
   - Lunar new year effects in foreign industrial productions (DE, JP, US).
   - ECB Working day (wd_2023-24.xlsx, June 2022) adjustment and holiday adjustment of tourist accommodations (EUROSTAT series).

3. Plans of coming enhanced X-13ARIMA-SEATS
   - Generator of holiday regressors.
   - Detector of holiday effects.

Contents of this slide; One, before holiday adjustment, two of our econometric tools are introduced: Enhanced version of X-13ARIMA-SEATS and international input output tables. Two, examples of holiday adjustments are shown, but not exactly official holidays: industrial production of Taiwan, lunar new year effects in Germany, Japan, and US industrial productions, and holiday effects on EUROSTAT tourist accommodations. Three, current plans of enhancements to X-13ARIMA-SEATS. From our experiences, automatic detection of holiday effects is necessary.

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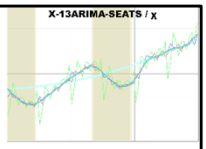

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Necessity for the world's major holiday adjustment

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Introduction of our main econometric tools. In other words, reasons of necessity for the world's major holiday adjustment.

ΣΚΑΝΔΥΛΟΣ
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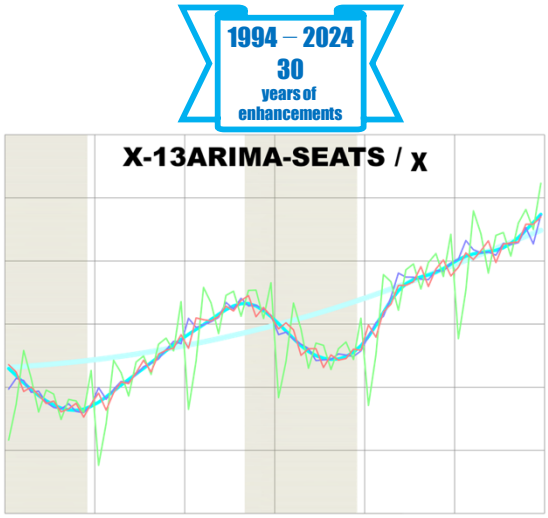
1. Our main econometric tools

Enhanced versions of X-13ARIMA-SEATS

International input-output table



The census methods, X-11, X-12-ARIMA, and X-13ARIMA-SEATS have been my main seasonal adjustment programs. It was 1994 that I found my personal computer could access internet and search engines in my home. Latest version which was downloaded at that time was beta 0.3 of X-12-ARIMA. Soon I began to change the program according to my usage.

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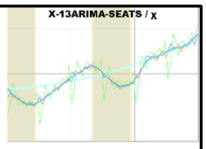
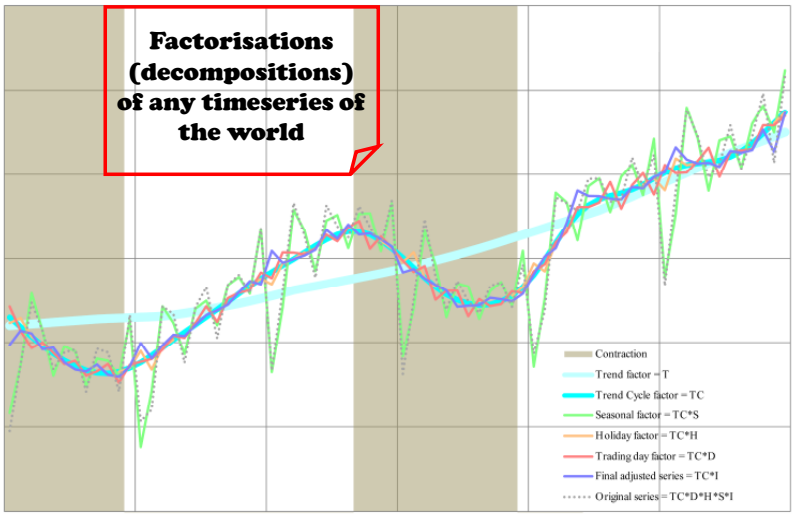
Enhanced versions of X-13ARIMA-SEATS





My usage is factorisation. From the original series, estimate holiday factor, trading day factor, seasonal factor, and so on, to get final adjusted series. Furthermore, trend cycle factor, long term trend, determination of expansions and contractions. Factorisations would be adopted to any timeseries, sometimes meteorological series of the world.

ΣΚΑΝΙΟΓΛΟΣ
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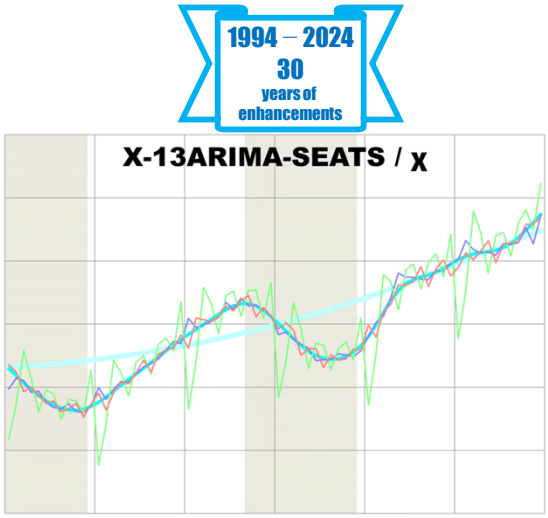
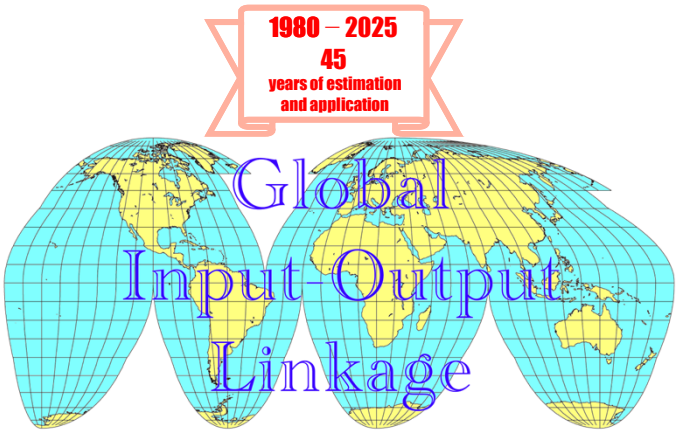
1. Our main econometric tools

Enhanced versions of X-13ARIMA-SEATS



International input-output table



Another tool is international input output tables. I first studied under doctor Iwao Ozaki from 1980 to 1982, estimating Japan – US – EU6 linked input output table. After this, information from input output analyses have been used for international securities investment. Effects from foreign holidays would be estimated by international input output tables.

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International Input-Output Linkage and Foreign Moving Holidays
— Two series of international I-O tables we use

1. OECD ICIO

https://oe.cd/icio

81 areas × 45 sectors = 3,645 sectors

from 1995 to 2020

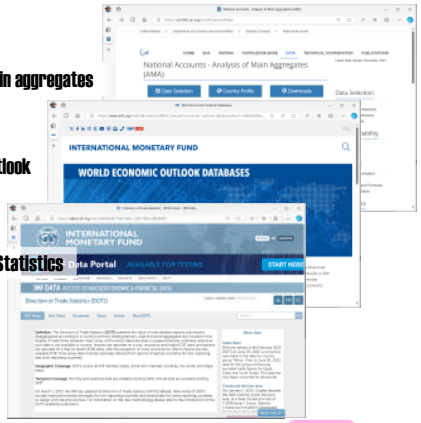
November 2023 edition

2. In-house pseudo global I-O named "Brenthos"

UN National account main aggregates

IMF World Economic Outlook

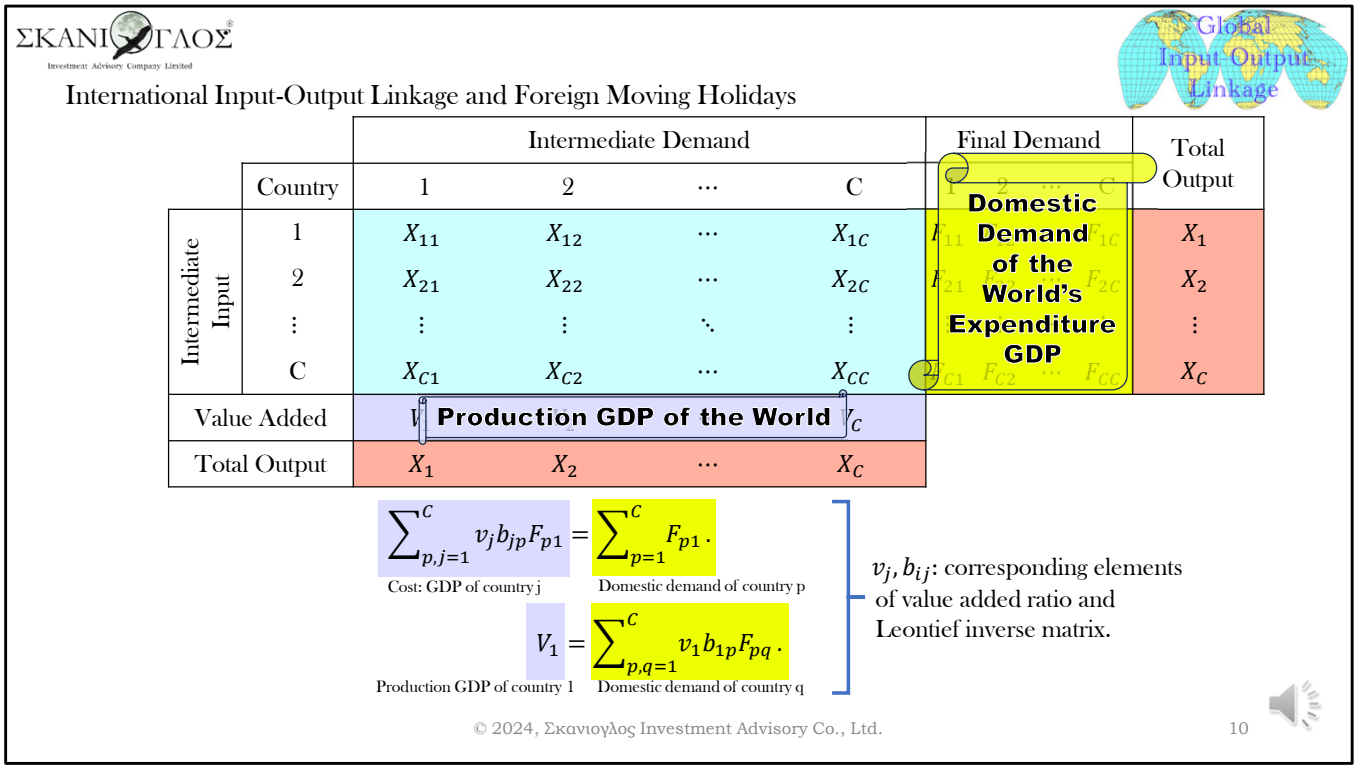
IMF Direction of Trade Statistics



228 areas × 1 sector = 228 sectors, from 1995 to 2024

UN AMA: Dec 2023, IMF WEO: Oct 2024, DOTS: Nov 2024.

We use two series of international input output tables. One is OECD's inter country input output tables. I would like to show the deepest respect for continuous releases of such laborious statistics. Latest release of OECD I-O is 2020. Then, how about after COVID-19? We use pseudo global input output tables named "Brenthos" for such analyses. Brenthos tables are compiled from United Nations National Account Main Aggregates, International Monetary Fund World Economic Outlook, and Direction of Trade Statistics. The latest figures are for 2024 midyear estimates.



In an international input output table, final demand is equivalent to world total of domestic demand within expenditure GDP's. Domestic demand deflator of each country can be pro rated into value added of all countries. This is import of value added. At the same time, value added of the world is equivalent to world total of production GDP's. Production GDP of each country can be pro rated into domestic demand of all countries.

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International Input-Output Linkage and Foreign Moving Holidays

— OECD ICIO area code and selected holiday descriptions in Google Calendar.

code		OECD name	Carnaval	Easter	Pascha	Lunar New Year	Eid al Fitr	Deepavali
AUS	✓	Australia	0	1	0	0	0	0
AUT	✓	Austria	0	1	0	0	0	0
BEL	✓	Belgium	0	1	0	0	0	0
CAN	✓	Canada	0	1	0	0	0	0
CHL	✓	Chile	0	1	0	0	0	0
COL	✓	Colombia	0	1	0	0	0	0
CRI	✓	Costa Rica	0	1	0	0	0	0
CZE	✓	Czechia	0	1	0	0	0	0
DNK	✓	Denmark	0	1	0	0	0	0
EST	✓	Estonia	0	1	0	0	0	0
FIN	✓	Finland	0	1	0	0	0	0
FRA	✓	France	0	1	0	0	0	0
DEU	✓	Germany	1	1	0	0	0	0
GRC	✓	Greece	0	0	1	0	0	0
HUN	✓	Hungary	0	1	0	0	0	0
ISL	✓	Iceland	1	1	0	0	0	0
IRL	✓	Ireland	0	1	0	0	0	0
ISR	✓	Israel	0	0	0	0	0	0
ITA	✓	Italy	1	1	0	0	0	0
JPN	✓	Japan	0	0	0	0	0	0
KOR	✓	Korea	0	0	0	1	0	0
LVA	✓	Latvia	0	1	0	0	0	0
LTU	✓	Lithuania	1	1	0	0	0	0
LUX	✓	Luxembourg	0	1	0	0	0	0
MEX	✓	Mexico	1	1	0	0	0	0
MX1	✓	Mexico - excluding Global Manufacturing	1	1	0	0	0	0
MX2	✓	Mexico - Global Manufacturing activities	1	1	0	0	0	0
NLD	✓	Netherlands	0	1	0	0	0	0
NZL	✓	New Zealand	0	1	0	0	0	0
NOR	✓	Norway	0	1	0	0	0	0
POL	✓	Poland	0	1	0	0	0	0
PRT	✓	Portugal	1	1	0	0	0	0
SVK	✓	Slovakia	0	1	0	0	0	0
SVN	✓	Slovenia	0	1	0	0	0	0
ESP	✓	Spain	1	1	0	0	0	0
SWE	✓	Sweden	0	1	0	0	0	0
CHE	✓	Switzerland	0	1	0	0	0	0
TUR	✓	Türkiye	0	0	0	0	1	0
GBR	✓	United Kingdom	1	1	0	0	0	0
USA	✓	United States	0	1	0	0	0	0
ARG		Argentina	1	1	0	0	1	0
BGD		Bangladesh	0	0	0	0	1	1
BLR		Belarus	0	1	1	0	0	0
BRA		Brazil	1	1	0	0	0	0
BRN		Brunei Darussalam	0	0	0	1	1	0
BGR		Bulgaria	0	0	1	0	0	0
KHM		Cambodia	0	0	0	0	0	0
CMR		Cameroon	0	1	0	0	1	0
CHN		China (People's Republic of)	0	0	0	1	0	0
CN1		China - excluding export processing	0	0	0	1	0	0
CN2		China - Export processing activities	0	0	0	1	0	0
CIV		Côte d'Ivoire	0	0	0	0	1	0
HRV		Croatia	0	1	1	0	0	0
CYP		Cyprus	0	0	1	0	0	0
EGY		Egypt	0	0	1	0	1	0
HKG		Hong Kong, China	0	1	0	1	0	0
IND		India	0	1	0	0	1	1
IDN		Indonesia	0	1	0	1	1	1
JOR		Jordan	0	1	1	0	1	0
KAZ		Kazakhstan	0	0	0	0	0	0
LAO		Lao (People's Democratic Republic)	0	0	0	0	0	0
MYS		Malaysia	0	1	0	1	1	1
MLT		Malta	0	1	0	0	0	0
MAR		Morocco	0	0	0	0	1	0
MMR		Myanmar	0	0	0	0	0	1
NGA		Nigeria	1	1	0	0	1	0
PAK		Pakistan	0	1	0	0	1	1
PER		Peru	0	1	0	0	0	0
PHL		Philippines	0	1	0	1	1	0
ROU		Romania	0	0	1	0	0	0
RUS		Russian Federation	0	0	0	0	0	0
SAU		Saudi Arabia	0	0	0	0	1	0
SEN		Senegal	0	0	0	0	1	0
SGP		Singapore	0	1	0	1	1	1
ZAF		South Africa	0	1	0	0	0	0
TWN		Taiwan	0	0	0	1	0	0
THA		Thailand	0	0	0	1	0	1
TUN		Tunisia	0	0	0	0	1	0
UKR		Ukraine	0	0	1	0	0	0
VNM		Viet Nam	0	1	0	1	0	0
WXD		Rest of the World	0	0	0	0	0	0

Source: Google Calendar, OECD ICIO November 2023 edition.
1: described as holiday or observance during the years from 2020 to 2024. 0: no descriptions.
Regional holidays are omitted, while non-working days of Argentina are included.
Google calendar holds holidays of at least 135 countries, from 2019 to 2029, as of November 29, 2024.

This time, holidays of each country were taken from Google Calendar. Six holidays were chosen here: Carnival, Easter of Western Christianity, Pascha of Eastern Christianity, Lunar New Year of Chinese or its variants of lunisolar calendar, Eid-al-Fitr after Ramadan, and Deepavali of Hindu new year.

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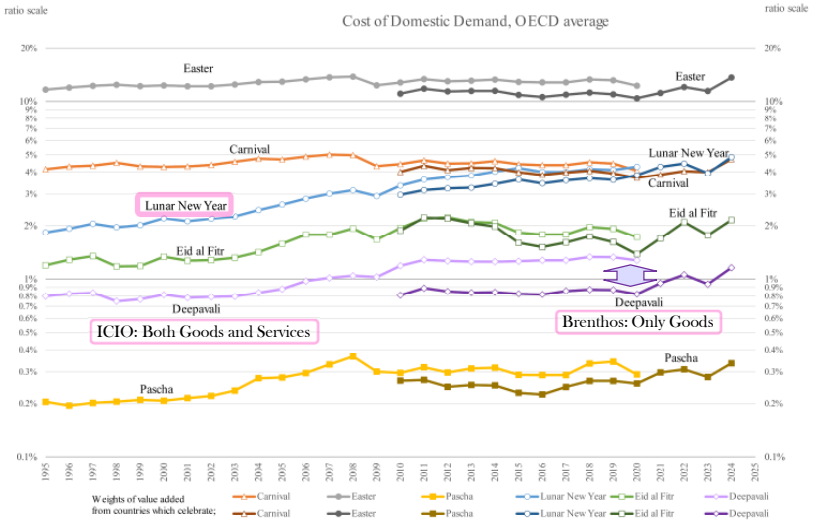
Global Input-Output Linkage

International Input-Output Linkage and Foreign Moving Holidays

— Import of value added / Domestic Demand



Holiday	I-O	1995	2020	2024	1995 ⇩ 2020	2020 ⇩ 2024	1995 ⇩ 2024
Carnival	ICIO	4.2%	4.1%		-0.1%		+0.9%
	Brenthos		3.7%	4.7%		+1.0%	
Easter	ICIO	11.6%	12.2%		+0.6%		+3.7%
	Brenthos		10.4%	13.6%		+3.2%	
Pascha	ICIO	0.2%	0.3%		+0.1%		+0.2%
	Brenthos		0.3%	0.3%		+0.1%	
Lunar New Year	ICIO	1.8%	4.3%		+2.5%		+3.5%
	Brenthos		3.8%	4.9%		+1.0%	
Eid al Fitr	ICIO	1.2%	1.7%		+0.5%		+1.3%
	Brenthos		1.4%	2.1%		+0.8%	
Deepavali	ICIO	0.8%	1.3%		+0.5%		+0.8%
	Brenthos		0.8%	1.2%		+0.3%	

This is the import of value added over domestic demand for OECD, calculated with ICIO. Weights of Lunar New Year rose by 2.5 percentage points from 1995 to 2020. The largest among these six holidays. This is the same chart with Brenthos to see after 2020 until 2024 estimate. Difference between two I-O's mainly caused by scope of international trades. ICIO uses both goods and services, while Brenthos uses only goods. However, both lines show upward trends. For the recent twenty years, import from the countries where celebrate moving holidays seems to rose the weights over domestic demand.

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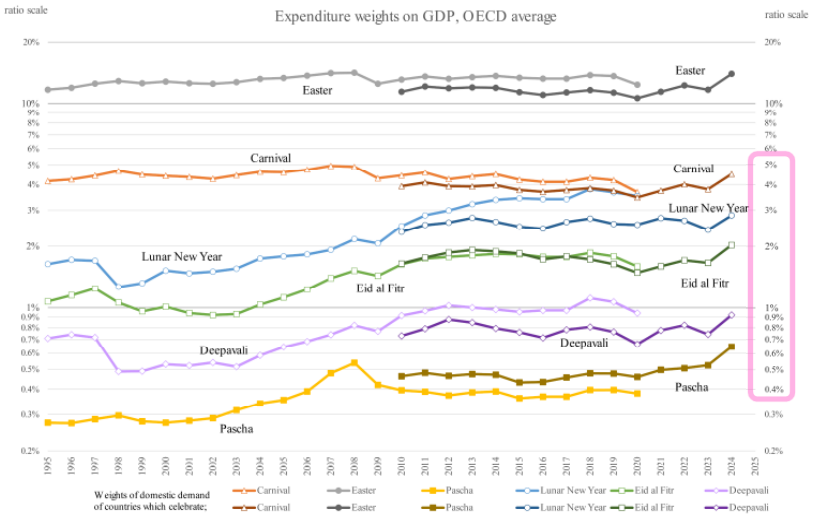
Global Input-Output Linkage

International Input-Output Linkage and Foreign Moving Holidays

— Export of value added / Total value added (similar to GDP in national account)



Holiday	I-O	1995	2020	2024	1995 ⇩ 2020	2020 ⇩ 2024	1995 ⇩ 2024
Carnival	ICIO	4.2%	3.7%		-0.5%		+0.6%
	Brenthos		3.5%	4.5%		+1.0%	
Easter	ICIO	11.7%	12.3%		+0.7%		+4.0%
	Brenthos		10.6%	13.9%		+3.3%	
Pascha	ICIO	0.3%	0.4%		+0.1%		+0.3%
	Brenthos		0.5%	0.6%		+0.2%	
Lunar New Year	ICIO	1.6%	3.5%		+1.9%		+2.2%
	Brenthos		2.5%	2.8%		+0.3%	
Eid al Fitr	ICIO	1.1%	1.6%		+0.5%		+1.1%
	Brenthos		1.5%	2.0%		+0.5%	
Deepavali	ICIO	0.7%	0.9%		+0.2%		+0.5%
	Brenthos		0.7%	0.9%		+0.3%	

This chart is export of value added to countries where these holidays are celebrated, as percentages over value added of OECD. Results are the same as import. For the recent twenty years, export to the countries where celebrate moving holidays seems to rose the weights over GDP. Frequently asked question here is “what matters only one or two percent of GDP?” Note that these ratios are annual averages, while large holidays induce concentrations of demand once in a year and declines of demand after holidays.

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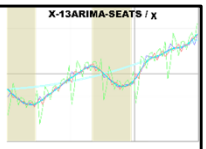

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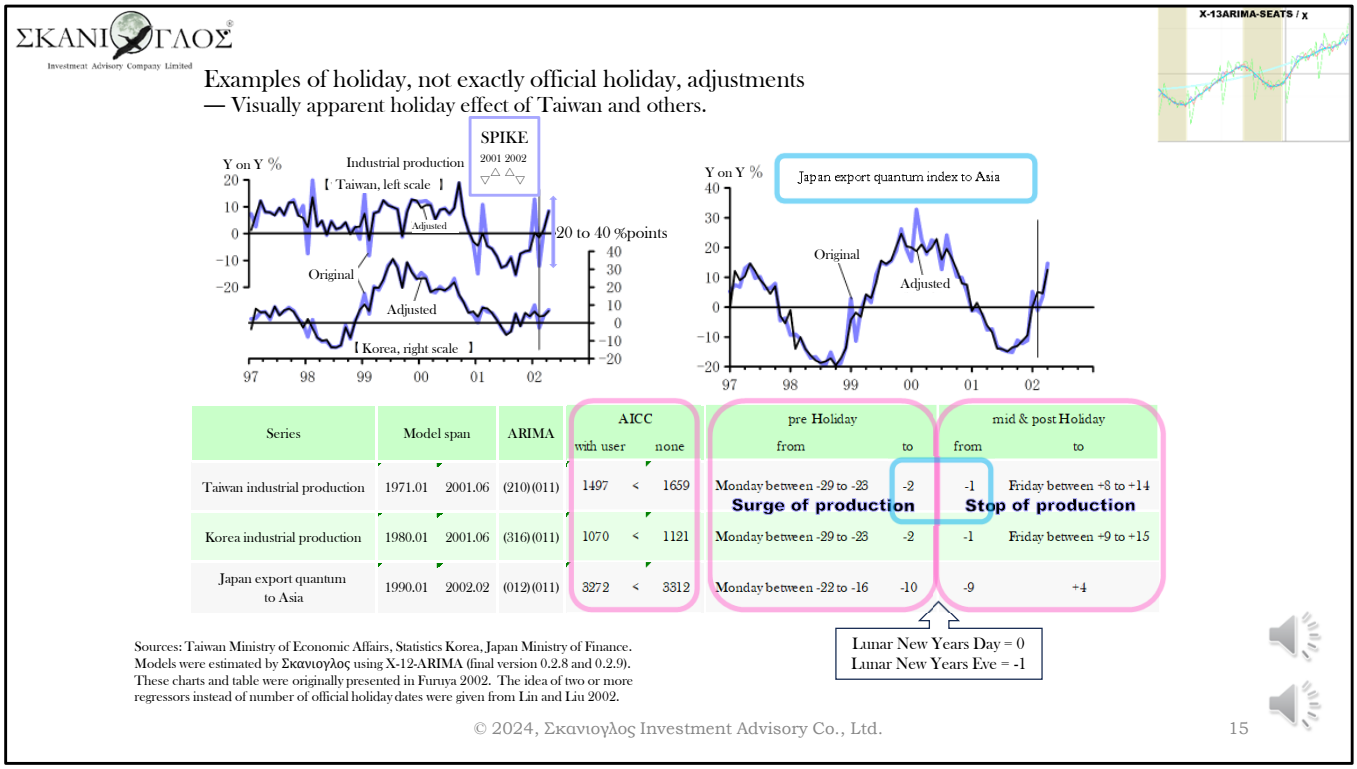
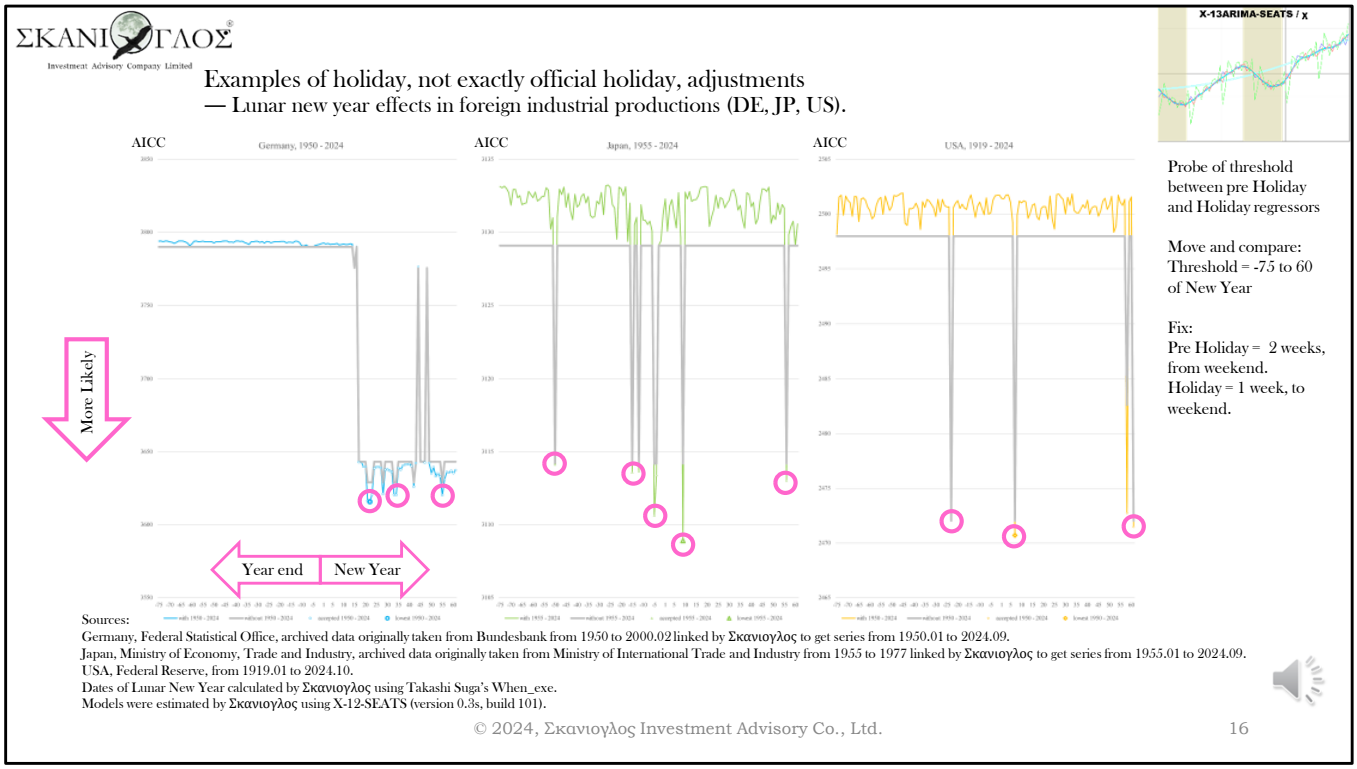
3. Plans of coming enhanced X-13ARIMA-SEATS
   - Generator of holiday regressors.
   - Detector of holiday effects.

Then, the necessity for world holiday adjustment depends on volatilities of holiday effects. Examples of holiday factors continue. Typical lunar new year effect of Taiwan's industrial production, examples of probe of lunar new year effect in Germany, Japan, United States' industrial production, and various holiday effects in tourism series of EUROSTAT.



Series	Model span		ARIMA	AICC with user		AICC none	pre Holiday from	pre Holiday to	mid & post Holiday from	mid & post Holiday to
Taiwan industrial production	1971.01	2001.06	(210)(011)	1497	<	1659	Monday between -29 to -23	-2	-1	Friday between +8 to +14
							Surge of production		**Stop of production**	
Korea industrial production	1980.01	2001.06	(316)(011)	1070	<	1121	Monday between -29 to -23	-2	-1	Friday between +9 to +15
Japan export quantum to Asia	1990.01	2002.02	(012)(011)	3272	<	3312	Monday between -22 to -16	-10	-9	+4

It was mid 1990s when I began to add holiday calendars. Because Lunar New Year regressors based on official holiday were often rejected, and models like this table are accepted as lower AICC, that is, higher likelihood models. The models have two holiday regressors. Pre holiday is to indicate surge of production starting 2 or 3 weeks earlier than new year. Mid and post holiday is to indicate stop of production which last two weeks. Thus adjusted series have smoother chart shown here. Especially Taiwan this case, spikes are significantly eliminated. The volatilities of moving holiday sometimes are so large, 20 to 40 percentage points here, that many trading partners would be affected. Two more comments. One. Japan has no lunar calendar holidays. But lunar new year effect exists. Two. Threshold between pre holiday and mid holiday were set on the new years eve here. That was likely during 20th century. Recent data indicates this threshold moved earlier. I would like to report detection about change of models next time.



Foreign moving holiday effects are not so rare. These charts are the samples. Headline series of industrial production index for Germany, Japan, and USA. Plotted are AICC of models with Lunar New Year regressors in colored lines, and without in gray lines. AICC means the lower, the more likely. Horizontal axis are dates of threshold. Plus means new year. Minus means year end. Lowest of Germany is twenty second day of new year, or about 3 weeks lag to new year. Lowest of both Japan and USA have 1 week lags. Including other troughs, these leads and lags would imply various sectors' supply chains.

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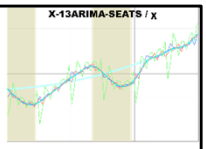
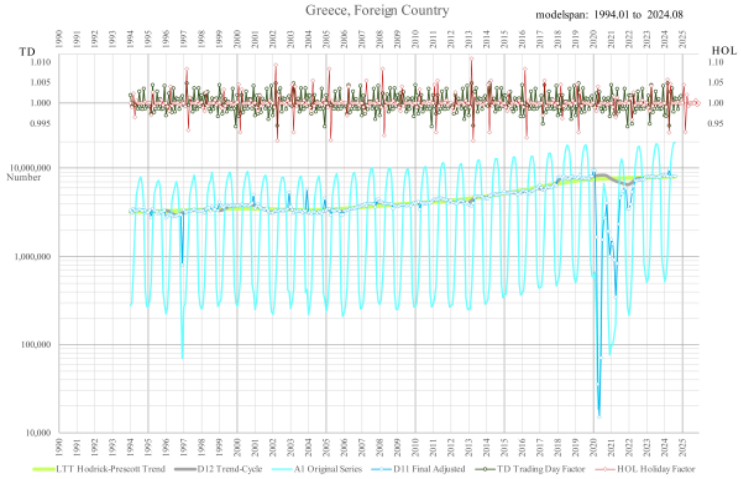


Examples of holiday, not exactly official holiday, adjustments
— ECB Working day (wd_2023-24.xlsx, June 2022) adjustment and holiday adjustment of tourist accommodations (EUROSTAT series).



Source: EUROSTAT [tour_occ_nim] Nights spent at tourist accommodation establishments - monthly data, [I551] Hotels and similar accommodation.
Some of missing values were derived from other series or filled by X-13ARIMA-SEATS statistically.
Working days (TD here) were taken from ECB data. Dates of holidays were calculated by Σκανιογλος using Takashi Suga's When_exe and other sources described in the reference pages.
Models were estimated by Σκανιογλος using X-13ARIMA-SEATS (version 1.1, build 60 or 61).

Manufacturing data should have leads or lags to holidays. How about service data? This chart is original series of Greece, number of hotel accommodation by foreign residents. Adjusted results are here. This model includes trading day factor based on ECBs working day data, and holiday factor derived from seven holidays of the world.

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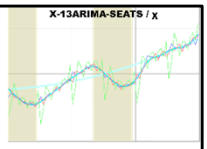
Examples of holiday, not exactly official holiday, adjustments — ECB Working day (wd_2023-24.xlsx, June 2022) adjustment and holiday adjustment of tourist accommodations (EUROSTAT series).



EUROPEAN CENTRAL BANK
EUROSYSTEM

GREECE
Excluded from the number of working days are the following public holidays

	holiday	month or date	description	weighted as 'x' working days
GR	New Year's	01-Jan	like Sundays	0
GR	Epiphany	06-Jan	like Sundays	0
GR	Shrove Monday (last day before Lent)	Feb/Mar	like Sundays	0
GR	National Independence Day	25-March	like Sundays	0
GR	Good Friday (Greek Orthodox Church)	Apr/May	like Sundays	0
GR	Easter Monday (Greek Orthodox Church)	Apr/May	like Sundays	0
GR	Labour Day	01-May	like Sundays	0
GR	Holy Spirit (Pentecoste)	May/Jun	holiday in public sector & banks	0.7
GR	Virgin Mary Holiday	15-Aug	like Sundays	0
GR	World War II Anniversary	28-Oct	like Sundays	0
GR	Christmas Day	25-Dec	like Sundays	0
GR	Second Day of Christmas	26-Dec	like Sundays	0

Source: NCB

Trading day data were taken from “Euro area and EU working days” file compiled by ECB. Greece included in this data contains Good Friday and Easter Monday.

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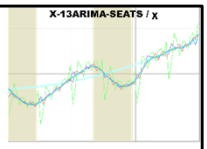
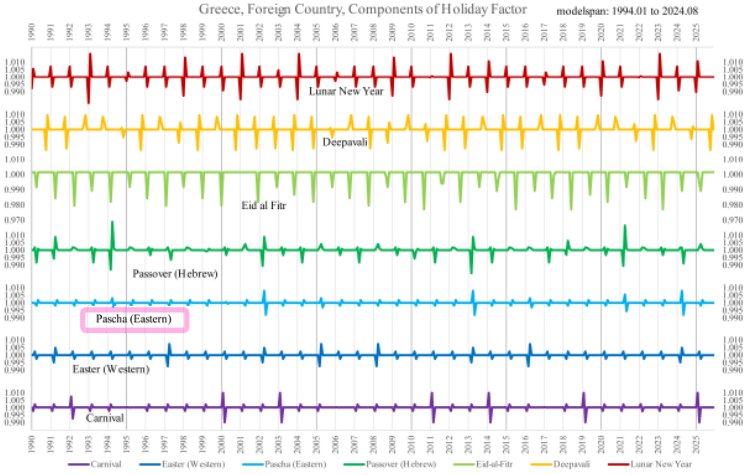
Examples of holiday, not exactly official holiday, adjustments
— ECB Working day (wd_2023-24.xlsx, June 2022) adjustment and holiday adjustment of tourist accommodations (EUROSTAT series).





Holiday Variable	Parameter Estimate	Standard Error	t-value
χ2 test for	Parameters Estimat	χ2	p-value
Working Days:	-0.002 459 467 588	0.001 834 416 577	-1.341
Carnival:	-0.010 730 598 111	0.001 762 563 815	-6.088
Easter:	0.025 061 029 899	0.002 530 074 218	9.905
Pascha:	0.006 408 484 876	0.003 178 360 042	2.016
Passover:	0.006 804 257 753	0.002 273 943 460	2.992
Eid-al-Fitr:	0.000 225 640 467	0.001 138 518 197	0.198
Deepavali:	0.001 250 809 111	0.000 799 556 801	1.564
Lunar New Year:	0.000 147 541 888	0.000 810 140 567	0.182
All User-defined Holiday Regressors:	7	338.3582361	0
All User-defined Regressors:	8	370.2663895	0

Source: EUROSTAT [tour_occ_nim] Nights spent at tourist accommodation establishments - monthly data, [I551] Hotels and similar accommodation.
Some of missing values were derived from other series or filled by X-13ARIMA-SEATS statistically.
Dates of holidays were calculated by Σκανιογλος using Takashi Suga's When_exe and other sources described in the reference pages.
Models were estimated by Σκανιογλος using X-13ARIMA-SEATS (version 1.1, build 60 or 61).

Adding to working days, Easter of Eastern Church, or Pascha in this chart and table was measured as significant for this series. Parameter of working days was minus, therefore, the more weekends or holidays, the more hotel accommodations. However, during Pascha, accommodations increased much more than other weekend and holidays, so that Pascha was accepted as a holiday. Number of official holiday dates within month, or breakdown of official holiday by seven day-of-weeks, are often accepted for many countries many series. But that is not enough for major holidays.

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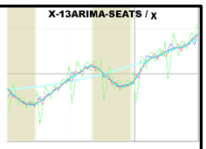

Examples of holiday, not exactly official holiday, adjustments
— ECB Working day (wd_2023-24.xlsx, June 2022) adjustment and holiday adjustment of tourist accommodations (EUROSTAT series).

Holiday regressors:

1. Carnival: From Saturday, 50 days preceding to Easter
   To Ash Wednesday, total 5 days
2. Easter (Western): From Good Friday
   To Easter Monday, 4 days.
3. Pascha (Eastern): Same 4 days as Easter.
4. Passover (Hebrew): From eve of Passover to Saturday next week. 9 to 13 days.
5. Eid-al-Fitr: End of Ramadan festival. Umm-al-Qura calendar was applied.
   From last day of Ramadan (at sunset, next month Shawwal begins)
   To Saturday right after the third day of Shawwal, inclusive.
6. Deepavali: One or two weeks which include three rituals (Naraka Chaturdashi, Lakshmi Puja, Kali Puja) of six cities (Allahabad, Chennai, Delhi, Jaipur, Kolkata, Mumbai), starts in Saturday and ends in Sunday.
7. Lunar New Year: Chinese variant of East Asian lunisolar calendar was applied.
   If New Year's eve is Friday or Saturday, from eve, else,
   From the preceding Saturday of New Year's eve.
   To next Sunday of New Year 3rd (inclusive), 9 or 10 days.

Automatisation is inevitable.

All were seasonally adjusted by subtracting average from 1600 to 2599 Common Era.

Seven holiday regressors were calculated. One, Carnival, from Saturday, 50 days preceding to Easter to Ash Wednesday, total five days. Two, Easter, from Good Friday to Easter Monday, four days. Three, Pascha, or Easter of Eastern Christianity, same four days as Easter. Four, Hebrew Passover. From eve of Passover to Saturday next week was chosen as regressor this time. Five, Eid-al-Fitr, end of Ramadan festival. Common lunar calendar of Umm-al-Qura was applied. From last day of Ramadan to Saturday right after the third day of next month of Shawwal was chosen as regressor this time. Six, Deepavali, One or two weeks from Saturday to Sunday which includes major rituals of major cities. Seven, lunar new year of East Asian lunisolar calendar. 9 or 10 days from Friday or Saturday to Sunday including four days around New Year's day. Note that all these regressors are temporal for this presentation. Goal of this presentation is not to indicate specific indicators holiday factor, but to develop a software which automatically detect holiday factors.

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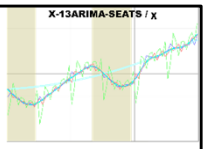

Contents

At the last of this presentation, let me explain about current plan of development. Matters are generator of holiday regressors and detector of holiday effects.

ΣΚΑΝΙΟΓΛΟΣ
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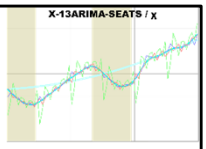
Plans of coming enhanced X-13ARIMA-SEATS
— Generator of holiday regressors.



Design and debug: not yet

```
regression{
 holiday{ korea[08/14 08/16]
        }
}
```

↑ Ex., how to call.

Calendars: ready to built in

Calendars:
- East Asian Lunisolar Calendar
- Thai Buddhist Calendar
- Hijiri Lunar Calendar
- Hebrew Lunisolar Calendar

Holidays:
- Matariki Holiday
- Deepavali

Calculations:
- Easter and ±n day holidays

Other parameters:

Generator of holiday regressors. This is a matter of time.

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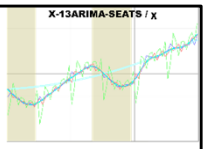
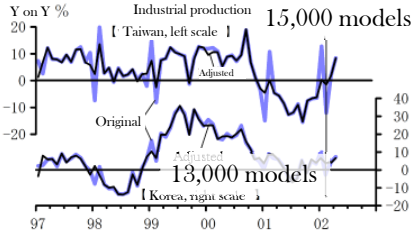
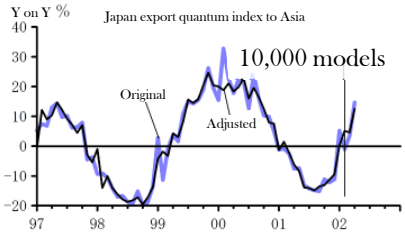
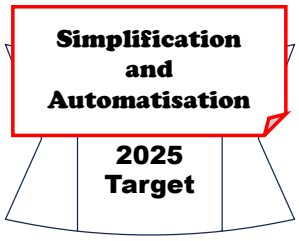
Plans of coming enhanced X-13ARIMA-SEATS
— Detector of holiday effects

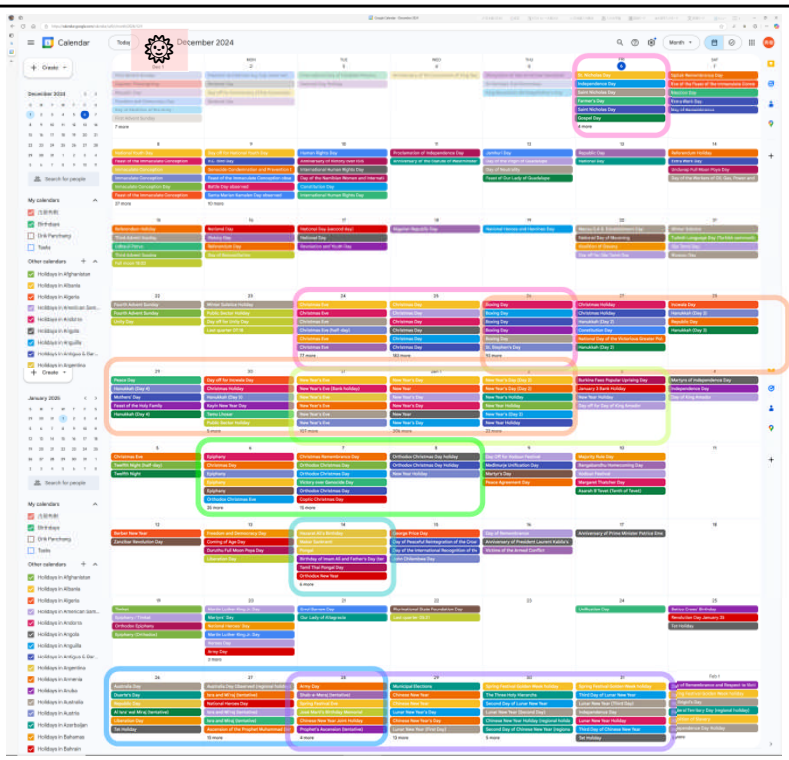








Problem is model selection. As a matter of fact, each line of these charts were based on models selected from more than 10 thousand cases. Adjustment of single series needed half a day or longer. X-12-ARIMA with lunisolar calendars usages were very limited. Therefore, my target of 2025 is This. Of course I hope all of you to enjoy nice holiday season and a happy new year.



Source:
Google Calendar,
all holidays selected

This is a supplement of holidays for a while. Sundays on the left. Today is here. Christmas comes three weeks later. Then, Hebrew holiday Hanukkah, New Year, Orthodox Christmas, Hindu end of winter holiday Markar Sankranti, Islamic celebration Al Isra wal Miraj, Lunar New Year of East Asian Lunisolar calendars on 29th January 2025, and many more.

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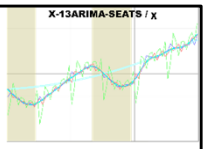
References and links (1)



Softwares;

Census method:

Census Bureau, USA, X-13ARIMA-SEATS Seasonal Adjustment Program https://www.census.gov/data/software/x13as.X-13ARIMA-SEATS.html.

Additional routines:

Gerhard Bry and Charlotte Boschan, "Cyclical Analysis of Time Series: Selected Procedures and Computer Programs", https://www.nber.org/books-and-chapters/cyclical-analysis-time-series-selected-procedures-and-computer-programs.

SUGA, Takashi "When_exe - A multicultural and multilingualized calendar library" Gems for Ruby are here https://github.com/suchowan/when_exe. Usages can be seen on http://hosi.org/. When_exe aims to express and convert the calendar used in all cultures and languages of all ages. This aim kicked off my plan to include almost all the world's statistically significant calendars.

Articles:

1, 3, 4, and 6 measured domestic moving holiday effects. 2 and 3 measured foreign moving holiday effects.

1. Anirban Sanyal, Pratik Mitra, Tucker S. McElroy, and Anindya Roy, August 2017, "Holiday Effects in Indian Manufacturing Series", https://www.census.gov/library/working-papers/2017/adrm/rrs2017-04.html.

2. Australian Bureau of Statistics, November 2005, "Estimating and Removing the Effects of Chinese New Year and Ramadan to Im prove the Seasonal Adjustment Process" https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1350.0Technical%20Note1Nov%202005?OpenDocument .

3. Furuya, Hideki, August 2002, "Chinese New Year Effects Estimated by X-12-ARIMA" https://www.jcer.or.jp/report/research_paper/detail3606.html, sorry written in Japanese and no translations, and pdf here is members only. Draft in Japanese is available.

4. Lin, Jin-Lung and Liu, Tian-Syh July 2002, "Modeling Lunar Calendar Holiday Effects in Taiwan" https://www.census.gov/library/working-papers/2002/adrm/lin-01.html.

5. Matariki Advisory Committee, New Zealand, May 2021, "Matariki Dates 2022 – 2052" https://www.mbie.govt.nz/assets/matariki-dates-2022-to-2052-matariki-advisory-group.pdf

6. Yap, Bee Wah, Norhayati Shuja', and Mohd Alias Lazim, 2007, "Moving Holiday Effects Adjustment for Malaysian Economic Time Series", https://www.academia.edu/20549481/Moving_Holiday_Effects_Adjustment_for_Malaysian_Economic_Time_Series .

Links to articles, formulae,

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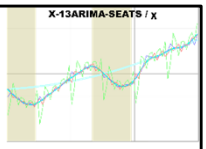

References and links (2)

Formulae:

Christian liturgical calendars:
Western https://en.wikipedia.org/wiki/Date_of_Easter#Anonymous_Gregorian_algorithm
Eastern https://en.wikipedia.org/wiki/Date_of_Easter#Meeus's_Julian_algorithm

Thai traditional Songkran: https://th.wikipedia.org/wiki/สงกรานต์ในประเทศไทย. English wiki seems strange.

Sites:

Hindu festivals: https://www.drikpanchang.com/. Among the panchang sites, span of this site is extremely long.
The author is thankful that this site allowed to retrieve very many times as a free user.
{1001 years from 1600 to 2600 + (10 year backcast span + 10 year forecast span) + (maximum 1 year lead + maximum 1 year lag)} × 6 cities × 4 holidays = 28,872. At least, 28,872 times.

The Gregorian Calendar was introduced to set proper dates of Easter (*ad rectam Paschalis festi*). In the today's title "Inter Gravissimas", Pope Gregory XIII stated as three appropriate that

- first, correct placement of the vernal equinox; **The first condition is, March equinox to fall around March 21st.**
- next, correct placement of the fourteenth day of the moon in the first month, which [fourteenth day] either occurs on the day of the equinox itself or is the next to follow after;
- and lastly, the first Sunday which follows that same fourteenth day of the moon.

Photocopy of *Clavius, Christoph*, **Romani Calendarii A Gregorio XIII. P. M. restitvti explicatio S. D. N. Clementis VIII. P. M. Ivssv edita : accesit confutatio eorum, qui Calendarium aliter instaurandum esse contenderunt**, *1603*
was taken from
https://echo.mpiwg-berlin.mpg.de/ECHOdocuView?pn=53&ws=3&url=/mpiwg/online/permanent/library/YXK9FE9W/pageimg&start=51&viewMode=images&mode=imagepath,
and English translation taken from https://en.wikipedia.org/wiki/Inter_gravissimas.

Euro area and EU working days to build Calendar Adjustment Regressor
https://ec.europa.eu/eurostat/cros/content/euro-area-and-eu-working-days-build-calendar-adjustment-regressor_en

And important sites will be stored in the pdf version of this slide.

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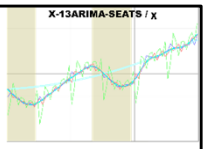


References and links (3)

Further references:

Pew Research Center,

"The Future of World Religions: Population Growth Projections, 2010-2050",
https://www.pewresearch.org/religion/2015/04/02/religious-projections-2010-2050/.

Comment by HF — Although East Asian lunisolar calendars are secular, many moving holidays and their source calendars are rela ted to religions.

% of global population: Christians and Muslims 30% each, Hindus 15%, Buddhists 5%, and so on.

"Umm al Qura" is a variant of Hijili lunar calendar which seems to be broadly adopted (still checking).

R.H. van Gent, "The Umm al-Qura Calendar of Saudi Arabia",

https://webspace.science.uu.nl/~gent0113/islam/ummalqura.htm

Umm al Qura calendar site

https://ummulqura.org.sa/default.aspx

Selection procedure of holiday regressor not by automatic but by manual is described in my slide

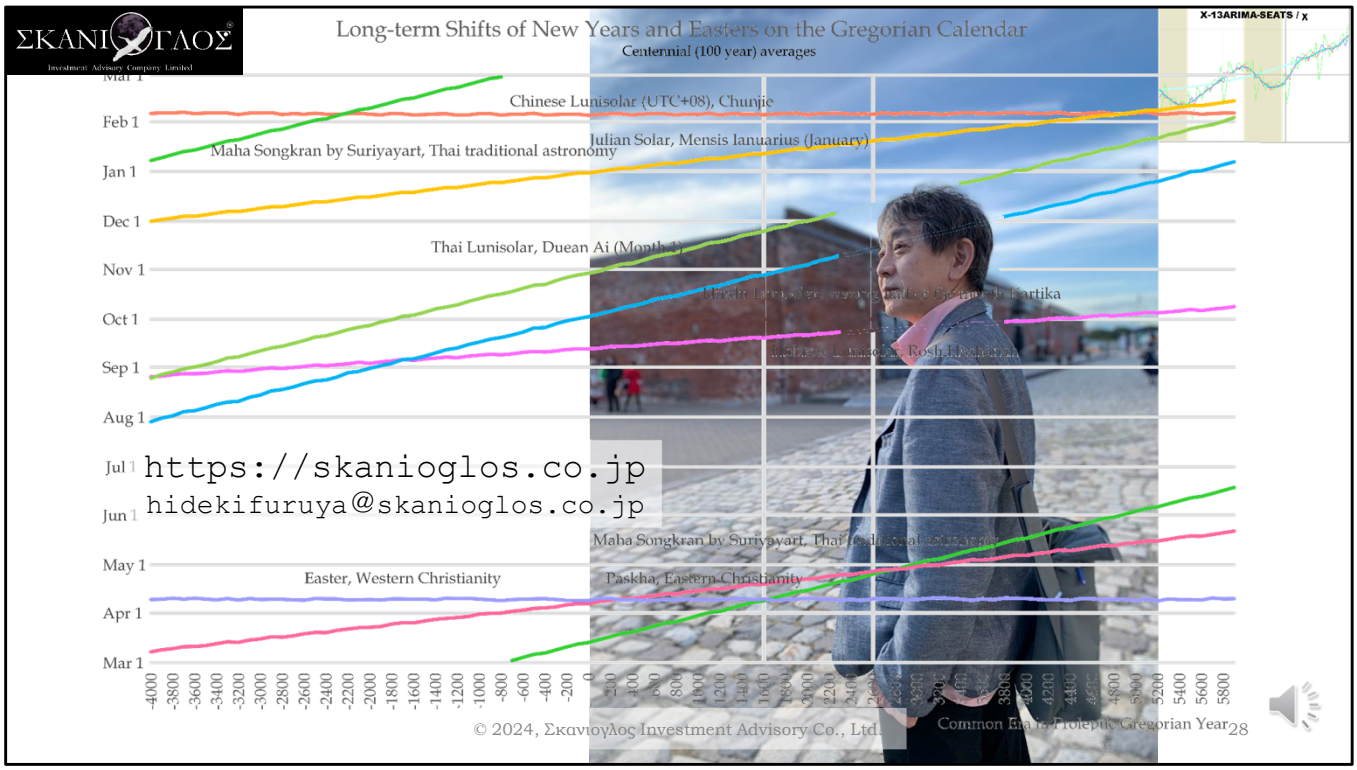
e3 "Holiday Variable Generating Routines Within Our In-House Versions of the Census Method"

https://www.youtube.com/watch?v=l51trrsPa6I

of SAP (Seasonal Adjustment Practitioners) Workshops in Youtube.

https://www.youtube.com/@sapseasonaladjustmentpract3449

Further references



Thank you for your time.