

1. Project

To devise robust methods for detecting, measuring and correcting for the **Easter proximity**** effect under the regARIMA framework.

****NOTE:** This project has evolved to consider all possible types of calendar-related proximity effects. Not only Easter. Where a reference is made to Easter in this document, we really mean it in a general sense that also considers Chinese New year, Easter, Father's day, Ramadan and other user-defined effects.

1.1 Project Overview

The current method for correcting the Easter Proximity (EP) effect in SEASABS (as well as a number of other calendar related effects) involves using the final X11 irregulars from the D13 table. The EP effect can cause the final irregulars to systematically deviate from one, the neutral line of irregulars. The irregulars are regressed on a model parameterized in terms of the fraction of "before" and "during" Easter holiday days that fall in March. A set of coefficients for these two periods are computed and tested for non-zero significance to ascertain whether an EP effect was present. The major drawback of using the D13 irregulars for EP diagnostic tests is the following:

- They have been distorted by the iterative seasonal adjustment process that may or may not be related to Easter.
- The irregulars have not been corrected for outliers prior to testing for the effect. Outliers may lead one to accept an EP effect which would otherwise not be significant if they were appropriately accounted for.
- Statistical tests based on the X11-D13 irregulars are not robust enough to discriminate between regressor models under the regARIMA modelling framework. This makes "regressor fine-tuning" exceedingly difficult.

1.2 Background

An initial study of selecting an appropriate Easter proximity regressor for regARIMA modelling which uses diagnostics based exclusively on the X11-D13 irregulars is outlined in: [📄] (Subject: A Study of Easter Proximity Regressors for REGARIMA Modelling; Database: Time Series Analysis WDB; Author: Frank Masci) . As the research described in this proposal proceeds, results will be appended to the following documents: [📄 Subject: Easter Proximity Diagnostics using regARIMA Residuals] and [📄 Subject: Estimating Easter Proximity under regARIMA (version 4)] .

For an overview and in-depth benchmark study of methods used by other statistical agencies, see the paper by C. McLaren & C. Leung, 1999 [📄].

2. Description of Project

2.1 Goals

In lieu of the problems described in Section 1.1, we plan to exclusively use ARIMA (and regARIMA) modelling to diagnose and correct for systematics introduced by the EP effect. In particular, we will:

- provide more powerful statistical tests for the presence of an EP effect.
- provide robust criteria on selecting the best EP regressor under regARIMA for any particular series with an EP signature.
- explore the sensitivity from outliers on the significance of an EP effect.
- explore the coupling between ARIMA-specific and regressor-specific parameters and optimise their selection in the fitting procedure. The sensitivity of regARIMA residuals will allow better separation of dependencies on the full parameter space.
- incorporate these improvements in the X12-ARIMA/SEASABS software interface so they can be used in production work by TSA.
- implement an infrastructure for storing EP (and other) regressors in production/analysis software for flexibility in their selection and optimal usage.

2.2 Outputs and Deliverables

- updates to X12-ARIMA/SEASABS production software interface for either manually or automatically selecting appropriate EP regressors for use in regARIMA modelling.
- infrastructure for storing and selecting EP (and other) regressors in production/analysis software.
- summary of statistical tests and diagnostics for the presence of EP effects (before and after their correction).
- Easter proximity charts exclusively in terms March/April regARIMA model residuals (before and after correction).
- overall, provide an improved understanding of the magnitude of Easter-related systematic effects to clients using robust methods not currently available in the production environment.

2.3 Risk assessment

Work is contingent on suitability and robustness of proposed methods.


2.4 Doclinks








See section 1.2

3. Stakeholders

Time Series Analysis Section and its clients (all subject matter areas).







4. Timing and Resources

Task	Time (planned)	Start Date	End Date	Status	Doclink (if relevant)	Time (actual)
1. Identify/explore best	10 days	late Sep.	Early	Done	 (Subject: A	20 days

Easter proximity regressors for regARIMA.		05	Nov. 05		Study of Easter Proximity Regressors for REGARIMA Modelling)	
2. Explore nature of ARIMA residuals versus conventional X11-D13 irregulars. Methods to correct for the EP effect in the presence of outliers from ARIMA residuals.	10 days	Early Nov. 05	Early Dec. 05	Done	 (Subject: Easter Proximity Diagnostics using regARIMA Residuals)	5 days
3. Algorithmic design for measuring and correcting for the EP effect under the regARIMA framework.	5 days	Early Dec. 05	mid Dec. 05	Done	 (Subject: Easter Proximity Diagnostics using regARIMA Residuals)	5 days
4. Explore details of how to account for EP-specific outliers in regARIMA model fitting and its storage in the series knowledge DB. Also explore ways of how to minimise revisions in production work due to changes in the EP detection.	10 days	mid Dec. 05	mid Jan. 06	Done	 (Subject: Easter Proximity Diagnostics using regARIMA Residuals: vsn 3)	4 days
5. Isolate a robust/reliable set of EP regressors for use in regARIMA automodelling that cover a wide range of real-world series cases. Also explore criteria on how to select the best regression parameters coupled to the best-fitting ARIMA model.	10 days	mid Jan. 06	late Jan. 06	Done	 (Subject: Estimating Easter Proximity under regARIMA (version 4))	3 days
6. Design of overall processing/algorithmic flow, updates to X12-ARIMA interface. Generalise to not only Easter but all types of calendar-related proximity effects.	4 days	late Jan. 06	Early Feb. 06	Done	 (Subject: Estimating Generalised Proximity Effects under regARIMA (version 5))	4 days
7. Make design more general. In addition to all known proximity effects, but also include a 'generalised' flexible user-defined option.	1 day	mid Mar. 06	mid Mar. 06	Done	 (Subject: Estimating Generalised Proximity Effects under regARIMA (version 6.0))	1 day
8. Service request for TSD.	1 day	mid Mar. 06	mid Mar. 06	Not finalised, under peer review	 (Subject: 887/208: Estimating Generalised Proximity	1 day

5. Project Journal

This section is for any more detailed comments on the project's progress.

Dates	Event/Task	Time spent	Doclink
~Sep 30 - Nov. 2, 2005	- Identify/explore best Easter proximity regressors for regARIMA. - discussed at meeting with C. McLaren, A. Poskitt and M. Zhang	20 days	 (Subject: A Study of Easter Proximity Regressors for REGARIMA Modelling)
Nov. 17, 2005	- TSARF presentation	1 day	 (Subject: Easter Proximity effect under regARIMA (TSARF review 1))
Nov. 18 - Dec 8, 2005	- Nature of ARIMA residuals vesus D13 irregulars - Easter proximity charts in terms of ARIMA residuals - Diagnostic tests for detecting EP effects in the presence of outliers. - Proposed algorithmic design under X12-ARIMA/SEASABS. - direction discussed at meeting with C. McLaren and M. Zhang ()	10 days	 (Subject: Easter Proximity Diagnostics using regARIMA Residuals)
Jan. 15 - Jan 30, 2006	- complete redesign of algorithm to account effects of outliers. Method is generic enough to include and combine any flavour of regressor(s).	5 days	 (Subject: Estimating Easter Proximity under regARIMA (version 4))
Jan 30 - Feb 3, 2006	- generalise to not only Easter but all types of calendar-related proximity effects.	4 days	 (Subject: Estimating Generalised Proximity Effects under regARIMA (version 5))
Mar 13, 2006	- meeting with Mark Zhang. He raised questions on making the design more general with other good questions. See doclink.	1 day	 (Subject: Mark's comments..mtg 13/3/06)

6. Lessons Learnt

- Early stages of this work: following his 2-month probation review, the activity manager was encouraged to provide feedback to the line-management on a more regular basis.
- Also, the first phase of this project involved time spent developing a novel method for constraining EP model parameters. This was not discussed with the line-management prior to commencement and was a significant waste of time.
- Early stages of this work: study the "big picture" more and try to understand the paradigm that is in people's minds. This will give more directionality in a project.