Modelling and Forecasting Australian Domestic Tourism

George Athanasopoulos & Rob Hyndman

MONASH University

Outline

1 Background
2 Data
3 Regression models
4 Exponential smoothing via innovations state space models
5 Innovations state space models with exogenous variables
6 Forecasts
7 Conclusions and future research

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1. International Arrivals
2. Outbound
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- Tourism Australia
- STCRC
- Monash University

Outline of presentation:

1. Data
2. Regression framework
3. Exponential smoothing
4. Exp smoothing + Exogenous variables
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6. Conclusions and Further research

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National Visitor Survey - Visitor Nights (1998Q1-2005:Q2)

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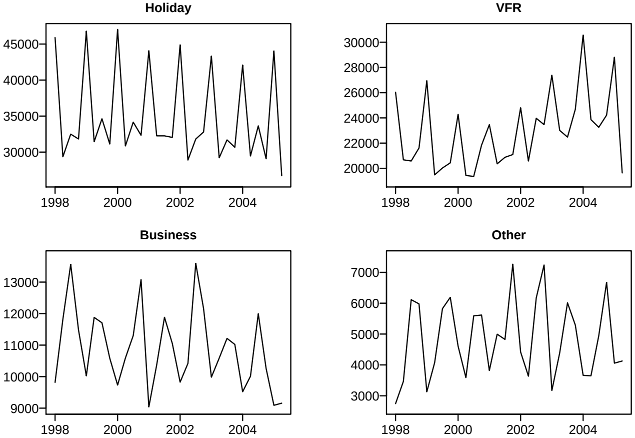
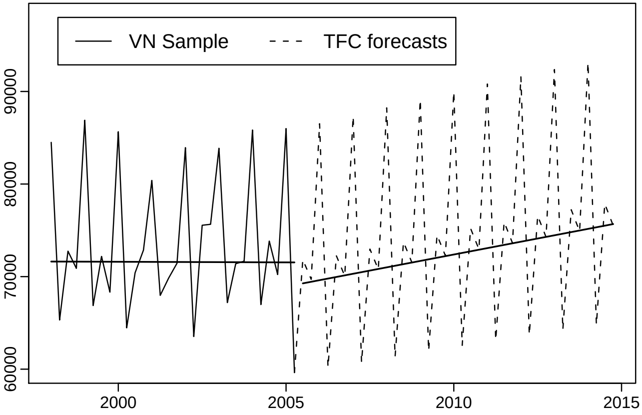


Aggregate Data & TFC Forecasts:



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$$VN_t^i = f(t, DEBT_t, DPI_t, GDP_t, BALI_t, OLYMP_t, MAR_t, JUN_t, SEP_t, \varepsilon_t)$$

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Step 1: Run OLS and test for upto 1 lag of each variable.
Step 2: Sequentially drop insignificant parameters and estimate efficiently using SUR.

Estimated demand system:

Regressor	*Holiday*	*VFR*	*Business*	*Other*
Intercept	7505.57* (13.33)	7020.25* (21.03)	6441.09* (22.84)	5771.92* (47.28)
t	−5.91* (0.50)		−6.17* (0.88)	
D_{t-1}	4.41* (1.23)		5.91* (2.00)	
P_{t-1}	−4.11* (1.64)		7.58* (2.89)	
Y_t	−43.71* (8.14)			
$BALI_t$		56.61* (17.75)		
$OLYMP_t$			148.00* (51.26)	
MAR_t	338.09* (13.06)	170.33* (26.87)	−170.83* (24.28)	−540.23* (64.74)
JUN_t	−43.19* (12.40)	−71.36* (26.87)	−42.57 (24.51)	−460.75* (64.74)
SEP_t	27.78 (14.01)	−33.73 (27.84)	55.03* (25.57)	−109.13 (66.86)
R^2	0.98	0.79	0.86	0.77
$\bar{R}^2$	0.98	0.75	0.82	0.74

* *Significant at the 5% level.*

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No trend	Additive trend	Damped trend
$y_t = l_{t-1} + s_{t-m} + \varepsilon_t$	$y_t = l_{t-1} + b_{t-1} + s_{t-m} + \varepsilon_t$	$y_t = l_{t-1} + b_{t-1} + s_{t-m} + \varepsilon_t$
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$s_t = s_{t-m} + \gamma\varepsilon_t$	$b_t = b_{t-1} + \beta\varepsilon_t$	$b_t = \phi b_{t-1} + \beta\varepsilon_t$
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where: $0 < \alpha < 1, \quad 0 < \beta < \alpha, \quad 0 < \gamma < 1, \quad 0 < \phi < 0.98.$

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$\hat{y}_{n+h} = l_n + s_{n+h-m}$	$\hat{y}_{n+h} = l_n + hb_n + s_{n+h-m}$	$\hat{y}_{n+h} = l_n + (1 + \phi + \cdots + \phi^{h-1})b_n$ $+s_{n+h-m}$

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$$\mathbf{X} = (DEBT, DPI, GDP, BALI, OLYMP, MAR, JUN, SEP)$$

Estimates of the *ETSX* models:

Parameter	*Holiday*	*VFR*	*Business*	*Other*
α	0.13	0.00	0.47	0.01
β	0.01	0.00	0.00	0.00
ϕ	0.98	0.97	0.98	0.76
Variable				
D_{t-1}	6.79		3.78	
P_{t-1}	−7.25		4.21	
Y_t	−67.67			
$BALI_t$		132.09		
$OLYMP_t$			104.05	
MAR_t	661.69	213.54	−95.78	−129.18
JUN_t	−65.52	−72.54	−21.25	−116.15
SEP_t	48.64	−31.95	32.91	−27.51

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VFR	4.8	5.2	5.5	8.5
Business	5.2	9.5	6.4	7.4
Other	7.7	6.5	7.6	17.6
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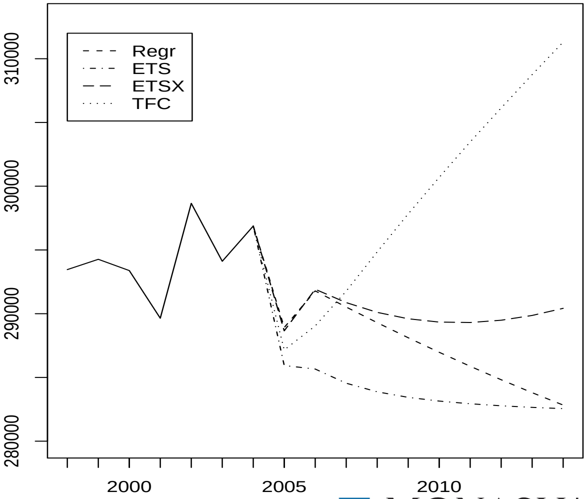
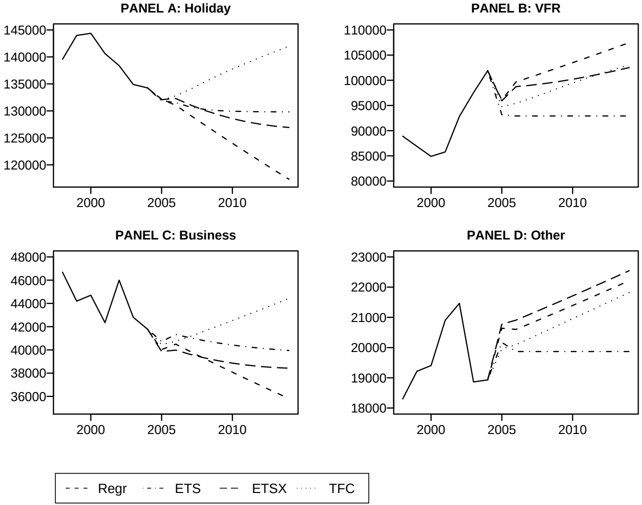
Average	5.9	6.5	6.1	10.1

Long term annual forecasts:



Long term annual forecasts for each component:



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- Hierarchical forecasting - Australia, States, Regional

Thank you!!!