P1.4   MANAGING BUSINESS RISKS ARISING FROM SEASONAL CLIMATE VARIABILITY

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1. INTRODUCTION

In a 1992 paper presented to the 5th International Meeting on Statistical Climatology (Stern, 1992), the author introduced a methodology for calculating the cost of protecting against the onset of global warming.

The paper, 'The likelihood of climate change: A methodology to assess the risk and the appropriate defence', was presented to the meeting held in Toronto, Canada, under the auspices of the American Meteorological Society (AMS).

In this first application of what later was to become known as 'weather derivatives' (Dawkins and Stern, 2003 & 2004; Stern and Dawkins, 2003 & 2004; Stern, 2001a, b, & c; Stern, 2002, 2005, 2006, 2007, & 2008) the methodology used options pricing theory from the financial markets to evaluate hedging and speculative instruments that may be applied to climate fluctuations.

Use of these financial instruments leads to those concerned being compensated provided they are on the correct side of the contract. Conversely, those on the wrong side of the contract would have to provide that compensation.

2. DISCUSSION

The application of some of these strategies on a shorter time scale is explored, namely, the management of business risks related to seasonal climate variability in the southeastern Australian State of Victoria.

To this end, Wolter and Timlin (1993) developed the Multivariate ENSO Index (MEI) as a tool to monitor ENSO on various variables observed over the tropical Pacific, namely, sea-level pressure, surface wind, sea surface temperature, surface air temperature, and cloudiness.

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The MEI is computed for each of twelve sliding bi-monthly seasons.

The current work developed statistical relationships between the MEI, the Indian Ocean Dipole, and rainfall, minimum temperature, and maximum temperature, in various Victorian Districts during the three-month season following.

These relationships may be used to automatically generate the fair value of contracts that could be utilised by businesses whose earnings are sensitive to seasonal climate variability in the management of associated risks (Figures 1, 2, 3, 4, 5, 6, 7, & 8).

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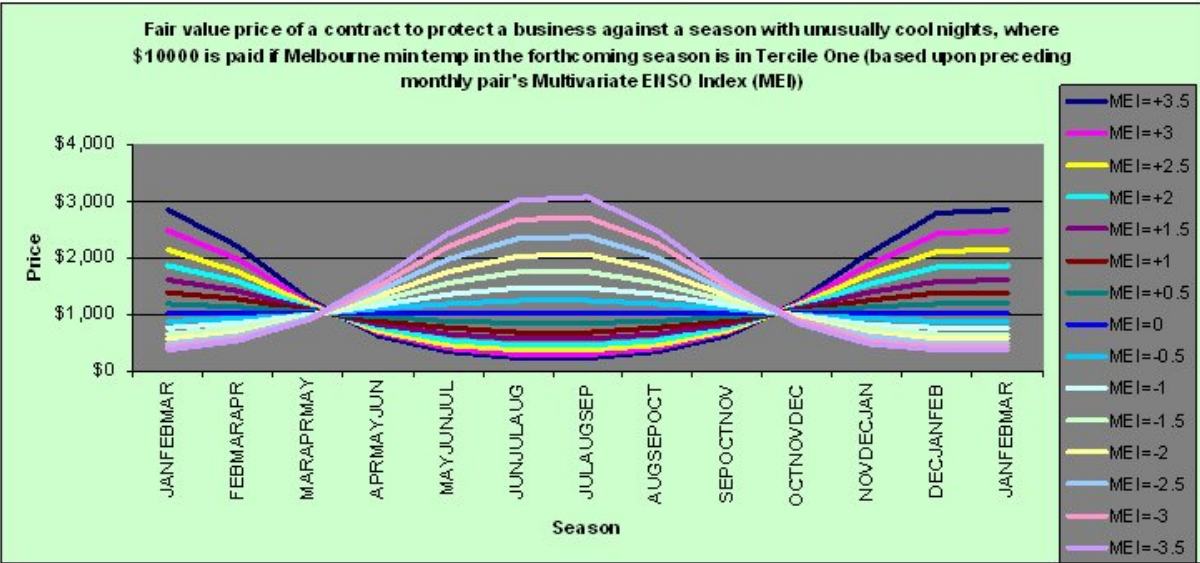
Figure 1 Relationship between the preceding monthly pair's Multivariate ENSO Index (MEI) and the fair value of a contract to protect against an unusually dry season.
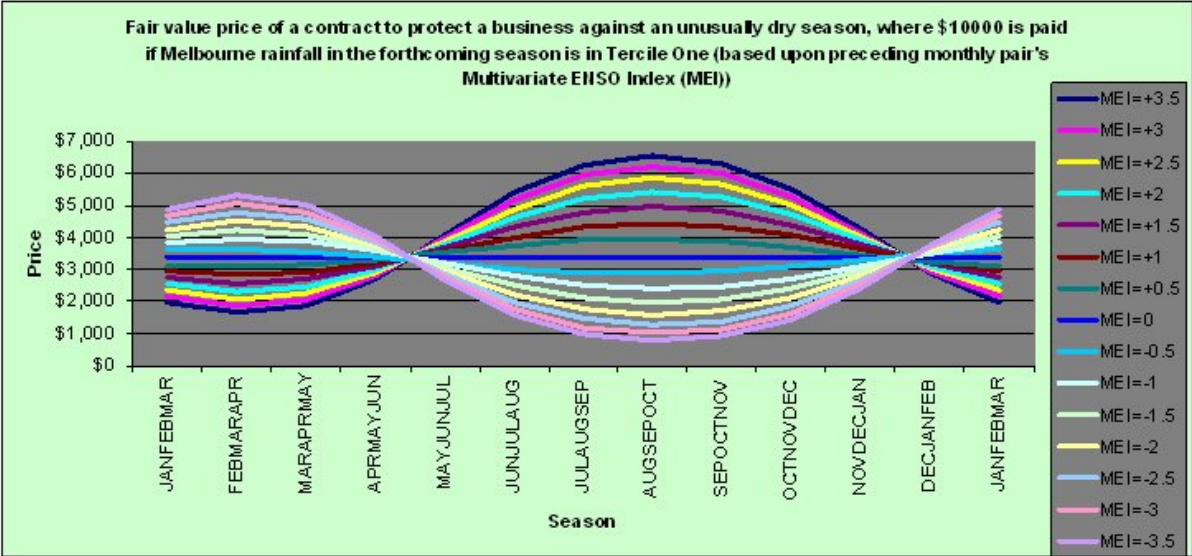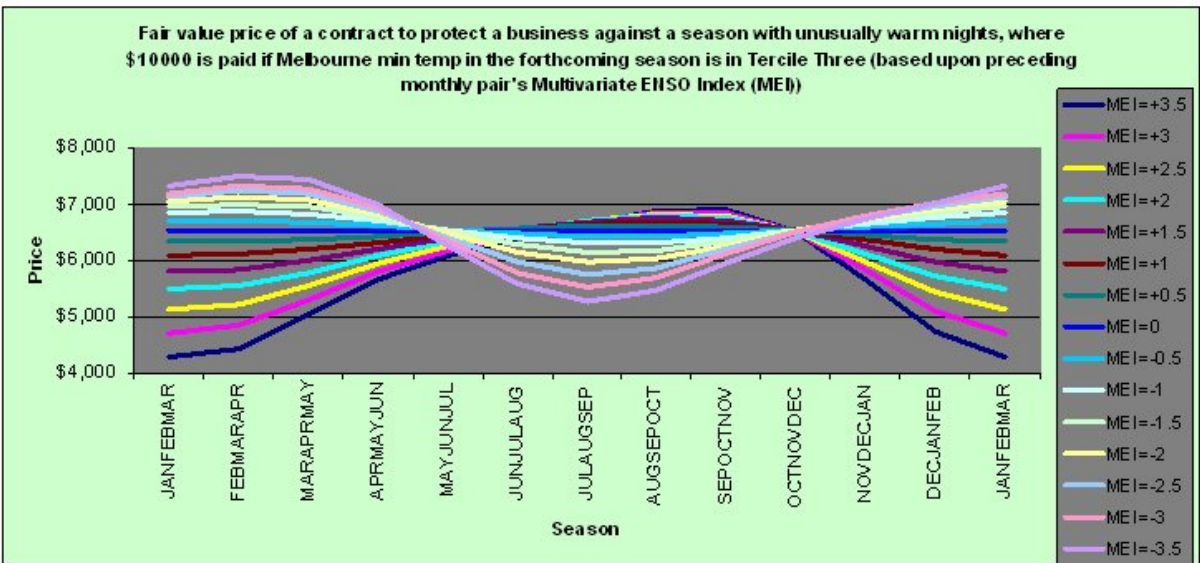

Figure 2 Relationship between the preceding monthly pair's Multivariate ENSO Index (MEI) and the fair value of a contract to protect against an unusually wet season.
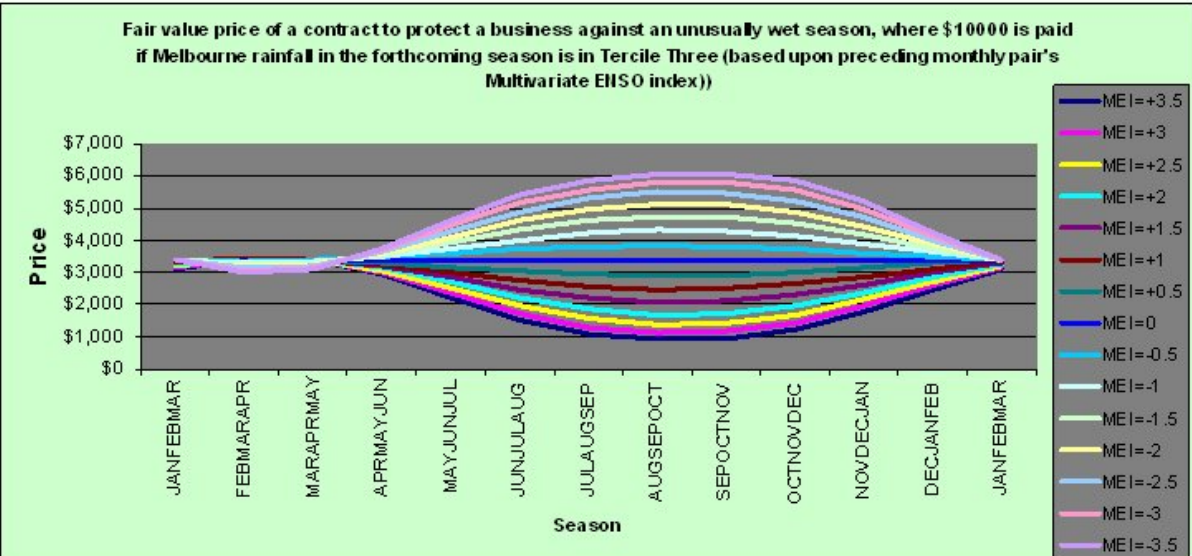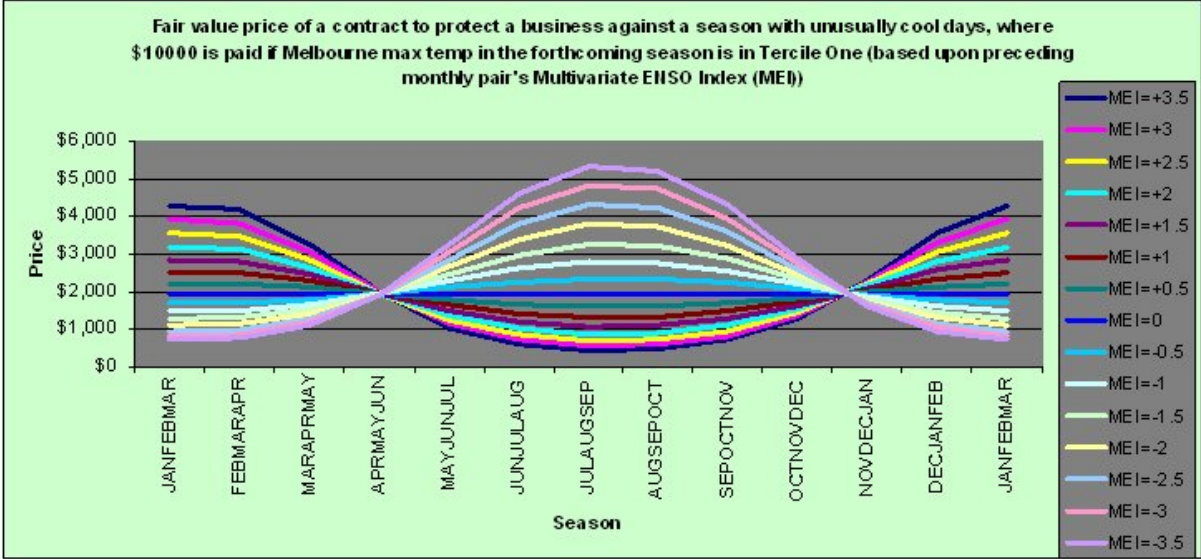
Figure 3 Relationship between the preceding monthly pair's Multivariate ENSO Index (MEI) and the fair value of a contract to protect against a season with unusually cool nights.

Figure 4 Relationship between the preceding monthly pair's Multivariate ENSO Index (MEI) and the fair value of a contract to protect against a season with unusually warm nights.
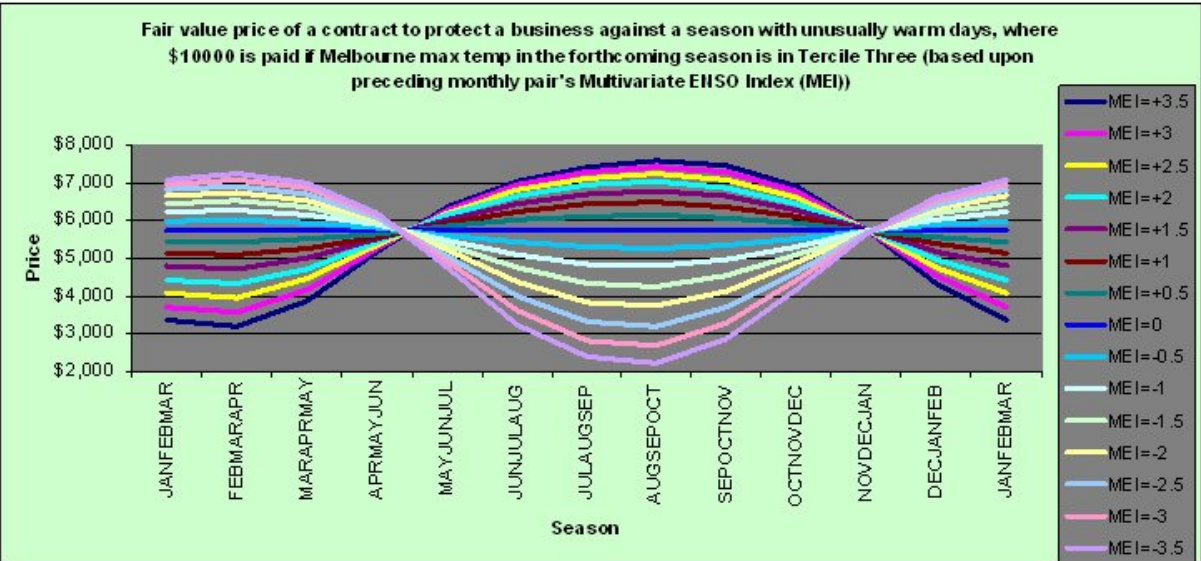
Figure 5 Relationship between the preceding monthly pair's Multivariate ENSO Index (MEI) and the fair value of a contract to protect against a season with unusually cool days.

Figure 6 Relationship between the preceding monthly pair's Multivariate ENSO Index (MEI) and the fair value of a contract to protect against a season with unusually warm days.

Figure 7 Example of an automatically generated Seasonal Climate Outlook (for OCT/NOV/DEC 2008)

The average Indian Ocean Dipole Mode Index for the past week is 0.16, the average Southern Oscillation Index (SOI) for the past 90 days is 7.12, the average SOI for the past 30 days (click here for a picture of recent trends) is 17.14, the latest recorded bimonthly Multivariate ENSO Index (MEI) is -0.206, and the expected MEI, adjusted by the Indian Ocean Dipole Mode Index, for AUG/SEP is -0.15. Such a value of MEI indicates a sea surface temperature distribution that corresponds to a very weak La Niña. This suggests:

RAINFALL: There is a very slightly enhanced chance that total OCT/NOV/DEC rainfall will be above normal in all Victorian Districts.

OVERNIGHT TEMPERATURES: There is a very slightly enhanced chance that average OCT/NOV/DEC overnight temperatures will be above normal in the EAST GIPPSLAND, WEST GIPPSLAND, and WESTERN Districts, there is a very slightly enhanced chance that overnight temperatures will be below normal in the MALLEE and WIMMERA Districts, and there is little indication as to whether overnight temperatures will be below, near or above normal in other Victorian Districts.

DAYTIME TEMPERATURES: There is a very slightly enhanced chance that average OCT/NOV/DEC daytime temperatures will be below normal in all Victorian Districts.

Intra-Seasonal (Madden-Julian) Oscillation (MJO)

The Intra-Seasonal (Madden-Julian) Oscillation (MJO) is presently operating in Phase 6. This is reflected in the near-equatorial enhanced convection being found over the western Pacific. In Victoria, during spring, Phase 6 of the MJO is usually characterised by enhanced southwesterly surface flow around a low over the south Tasman Sea and associated rainfall is significantly above normal in the south and east of the State. Following Phase 6, the region of enhanced convection often moves from the western Pacific to the central Pacific.

Figure 8 Example of an automatically generated statement of risk in relation to the Seasonal Climate Outlook (for OCT/NOV/DEC 2008)

Risk Management

Specifically for Melbourne, the fair value price of a contract to protect a business against an unusually dry season, whereby you are paid $10000 if the rainfall in the forthcoming OCT/NOV/DEC season is in **Tercile One (less than 145.9 mm)**, is $3278

SIMULATED MARKET DEPTH

BUY		SELL	
Number	Price	Price	Number
1	$3246	$3311	1
3	$3213	$3344	3
5	$3180	$3377	5

Also specifically for Melbourne, the fair value price of a contract to protect a business against a season with unusually warm days, whereby you are paid $10000 if the mean maximum temperature in the forthcoming OCT/NOV/DEC season is in **Tercile Three (at least 22.0 °C)**, is $5747

SIMULATED MARKET DEPTH

BUY		SELL	
Number	Price	Price	Number
1	$5689	$5804	1
3	$5632	$5862	3
5	$5574	$5919	5

Also specifically for Melbourne, the fair value price of a contract to protect a business against an unusually wet season, whereby you are paid $10000 if the rainfall in the forthcoming OCT/NOV/DEC season is in **Tercile Three (at least 206.1 mm)**, is $3504

SIMULATED MARKET DEPTH

BUY		SELL	
Number	Price	Price	Number
1	$3469	$3539	1
3	$3434	$3574	3
5	$3399	$3610	5

Also specifically for Melbourne, the fair value price of a contract to protect a business against a season with unusually cool nights, whereby you are paid $10000 if the mean minimum temperature in the forthcoming OCT/NOV/DEC season is in **Tercile One (less than 11.8 °C)**, is $974

SIMULATED MARKET DEPTH

BUY		SELL	
Number	Price	Price	Number
1	$965	$984	1
3	$955	$994	3
5	$945	$1003	5

Also specifically for Melbourne, the fair value price of a contract to protect a business against a season with unusually cool days, whereby you are paid $10000 if the mean maximum temperature in the forthcoming OCT/NOV/DEC season is in **Tercile One (less than 21.4 °C)**, is $1964

SIMULATED MARKET DEPTH

BUY		SELL	
Number	Price	Price	Number
1	$1944	$1984	1
3	$1925	$2003	3
5	$1905	$2023	5

Also specifically for Melbourne, the fair value price of a contract to protect a business against a season with unusually warm nights, whereby you are paid $10000 if the mean minimum temperature in the forthcoming OCT/NOV/DEC season is in **Tercile Three (at least 12.3 °C)**, is $6534

SIMULATED MARKET DEPTH

BUY		SELL	
Number	Price	Price	Number
1	$6469	$6600	1
3	$6404	$6665	3
5	$6338	$6730	5