

# SIC

2

1

..

Schwarz

SIC

.Information Criterion(SIC)

(30,50,100)

MA(2) AR(2) MA(1) AR(1)

. SIC

SIC

## Study in Behavior of SIC Criterion by Using Simulation

### Abstract

Models play a critical role in statistical data analysis. Once a model has been identified, various forms of inferences such as

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prediction, control and information extraction can be established, there is no doubt the information criterion play a great role to identify the correct model. One of the known information criterions is the SIC , within this research a study of the SIC criterion behavior and it's empirical power to identify the correct model out of many adapted different samples with sample sizes (30,50,100) and with wide range of allowed parameter values for models, Hence the generated time series data are from AR(1) ,MA(1) ,AR(2) and MA(2) to discover the influence factors that affect the accuracy of this criterion .Since the criterion would be considered the best trusted choice for identifying the correct model in time series.

Searching for the weak points of this criterion overcome what that is beyond it, regarded as an important stage to reach reliable results.

To reach this target simulation techniques was used in studying the behavior of SIC criterion

The outcome results from models parameters values effects SIC criterion performance. Hence it was identified. Hence wrong models were identified, which researcher most probable would choose and fall for it.

[1]

.(Konishi & Kitagawa, 2008)

Partial

ARMA

Autocorrelation Functions (ACF)

Autocorrelation functions (PACF)

adequate

Model

.(Wei, 1990) Information Criteria

Selection Criteria

.1974 Akaike

AIC

BIC (1978)

. H-Q (1979) Hannan–Quinn

SIC (1978)

SIC AIC

.

[2]

SIC

SIC

.AR(1), AR(2), MA(1), MA(2) :

**Some of Information Criteria**

[3]

ARMA

(Wei, 1990)

Candidate

Measures of divergence

True model

model

(2010 )

$$Cr = \ln(\sigma_e^2) + C_n \phi(p, q)$$

:  
..... (1)

-:

:  $\sigma_e^2$

:  $C_n$

:  $\phi(p, q)$

Lack of fit

(1)

Penalty function (1)

(Tsay, 2002; Lütkepohl & Kratzig, 2004; Zivot &

$\sigma_e^2$  .wang, 2006)

.(Shumway & Stoffer, 2011)

:

**Akaike's Information Criterion (AIC)**

:

.AIC

1974 Akaike

(h)

AIC

AIC

.(Wei, 1990)

AIC

:

AIC

.(Makridakis, et al., 1998)

$$AIC = n \ln(\sigma_e^2) + 2h$$

..... (2)

:

n

:

\*

(Yaffee & McGee,2000)

$$\sigma_e^2 = MSE = \frac{1}{n-h} (SSe) = \frac{1}{n-h} \sum_{t=1}^n (Y_t - \hat{Y}_t)^2 \dots\dots\dots (3)$$

h  
Y<sub>t</sub>  
Ŷ<sub>t</sub>

h = p + q + 1  
p,q (Yaffee & McGee, 2000) h = p + q  
(MA) (AR)  
AIC

Wrong Model  
over (2010) (∞)  
Akaike (Sampson,2001) q, p estimates  
AIC  
(Wei, 1990) BIC

**Schwarz Information Criterion (SIC)** :  
Gideon E. Schwarz 1978  
Schwarz [18] Schwarz  
(Faraway & Chatfield, 1998) BIC  
(Wei, 1990) Akaike BIC  
(Everitt & Skron dal, 2010) .SIC SC SBIC SBC  
SIC . SIC (Shumway & Stoffer, 2011)  
:  
SIC = n ln(σ<sub>e</sub><sup>2</sup>) + h ln(n) ..... (4)

.AIC  
 Penalty ( ) AIC  
 .[18] AIC  
 $q, p$  SIC  $h \ln(n)$   
 (Zivot & Wang,2006; Shumway & Stoffer,2011)  $q_{max}, p_{max}$   
 (Lütkepohl & Kratzig, 2004)  
 $\hat{P}(SIC) \leq \hat{P}(AIC)$  SIC AIC  
 SIC  
 )  
 AIC SIC (2010  
 SIC  
 .(Zivot & Wang,2006; Shumway & Stoffer,2011)

[4]

**Type I error :**



(Yaffee & McGee,  
 ( ) 2000)  
 %5  
 .(لجنة التأليف و الترجمة،2007).  $\alpha$  ( $\alpha$ -level)

**Type II error**



Yaffee & McGee, )  
 ( ) (2000)  
 Cohen (1992) (لجنة التأليف و الترجمة،2007)  
 ( $\beta$ -Level)  $\beta$  %20

**Empirical Power : :<sup>1</sup>**

( )  
 لجنة التأليف و الترجمة،(2007). Yaffee & McGee  
 (لجنة التأليف و (1-β)  
 (1992 1988) Cohen (الترجمة،2007)  
 0.2  
 .%80 [(1-0.2)=0.8]  
 (β=0.2 ) %80 α= 0.05  
 [17].-0.2-β 0.05 α

α=0.01 (Eng, 2003)<sup>1</sup> %90  
 .[17] %95

( )  
 (Vasishth & : Broe,2011)

(H<sub>0</sub>) : :(1)

(-H<sub>0</sub>)

| -H <sub>0</sub>   | H <sub>0</sub>   | Reality |
|-------------------|------------------|---------|
| Power = 1 - β     | Type I error = α | ( )     |
| Type II error = β | 1 - α            | ( )     |

Sample Size : حجم العينة: ↘

(1978 )

SIC

[8]

(30)

Yaffee & ) (60)

(50)

(100 50 30)

.(McGee, 2000

SIC

[5]

SIC

.AIC

SIC

(Zivot & Wang, 2006; Shumway & Stoffer, 2011)

:

( )

(1

%.80

(2

(3

:

[6]

SIC

SIC



:  
 AR(2) MA(1) AR(1) (35 55 105) MA(2)  
 .1  
 MA(1) AR(1) .  
 .01 0.9 -0.9  
 (-1.8) MA(2) AR(2)  
 AR(2) (0.1) (-0.1)  
 (0.1) (1.8) (0.1) MA(2)

AR(1)=1, :  
 AR(2)=2, MA(1)=3, MA(2)=4, ARMA(1,1)=5, ARMA(1,2)=6, ARMA(2,1)=7,  
 SIC ARMA(2,2)=8.

SIC

SIC 1000

SIC

: [7]

AR(1) MA(1) :  
 $|\theta_1|$   $|\phi_1|$  SIC -1

(2) (1)

: %80 -2

|     | MA(1)                       | AR(1)                   | n          |
|-----|-----------------------------|-------------------------|------------|
| (2) | $ \theta_1  = 0.8$<br>AR(1) | $ \phi_1  = 0.9$<br>(1) | <b>30</b>  |
| (2) | $ \theta_1  = 0.6$<br>AR(1) | $ \phi_1  = 0.7$<br>(1) | <b>50</b>  |
| (2) | $ \theta_1  = 0.5$<br>AR(1) | $ \phi_1  = 0.5$<br>(1) | <b>100</b> |

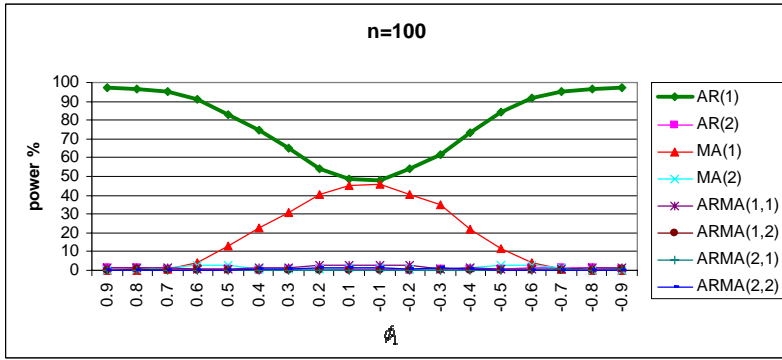
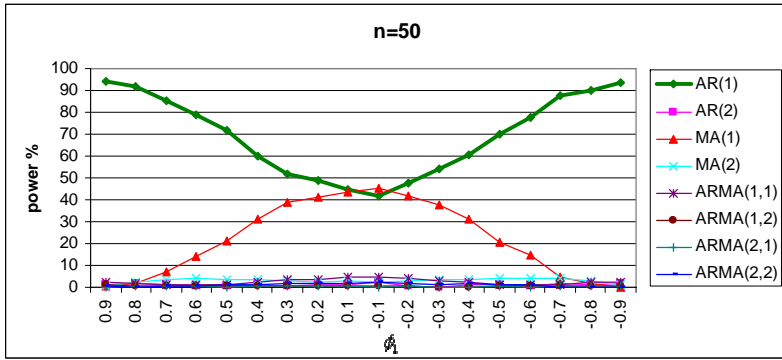
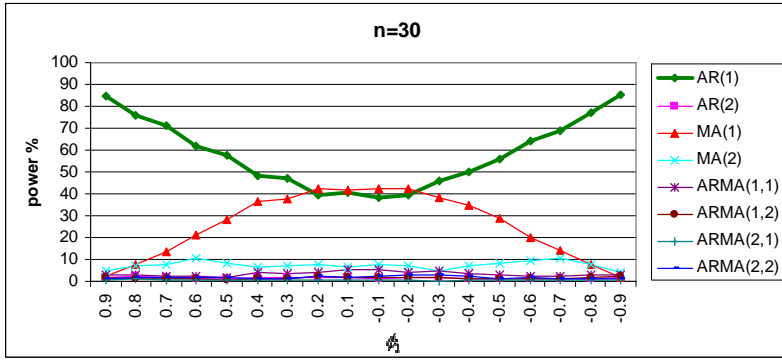
%80

: -3

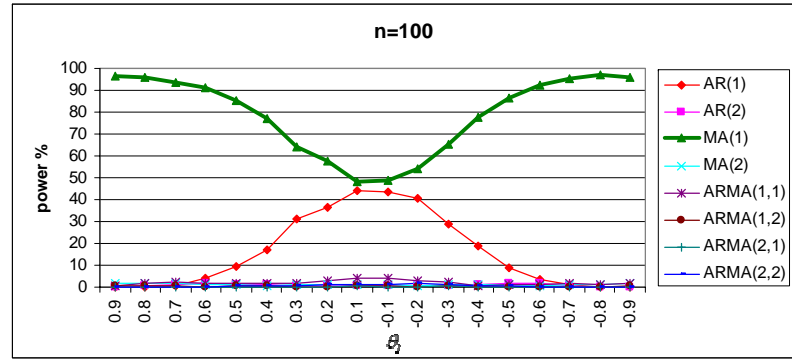
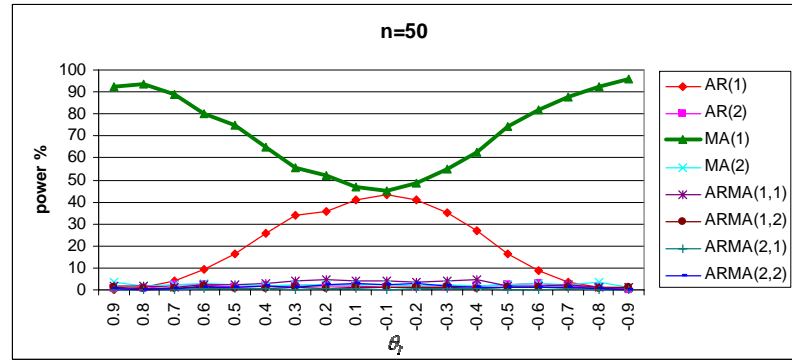
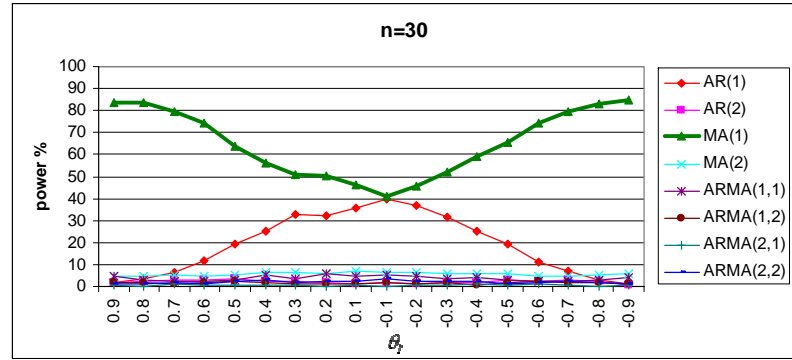
| MA(1)                               | AR(1)                                 |
|-------------------------------------|---------------------------------------|
| AR(1)<br>$ \phi_1  = 0.1, 0.2, 0.3$ | MA(1)<br>$ \theta_1  = 0.1, 0.2, 0.3$ |

(2) (1)

.%10 MA(1) AR(1)



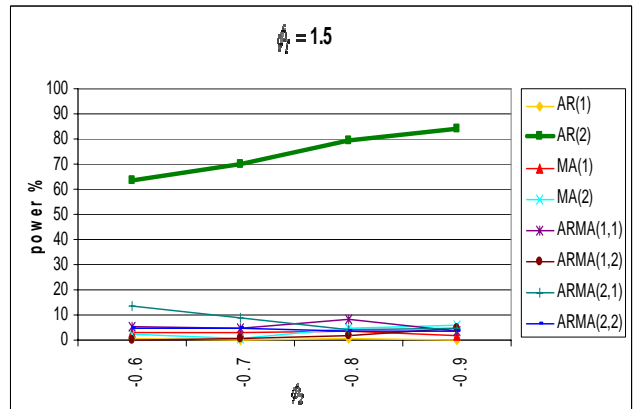
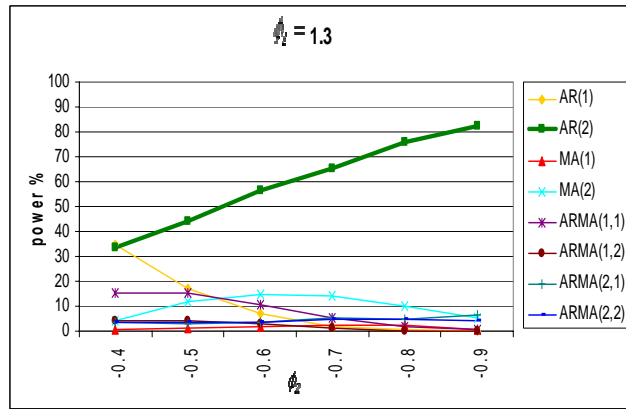
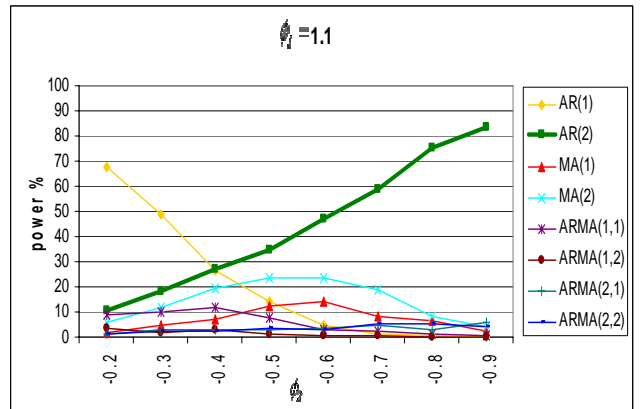
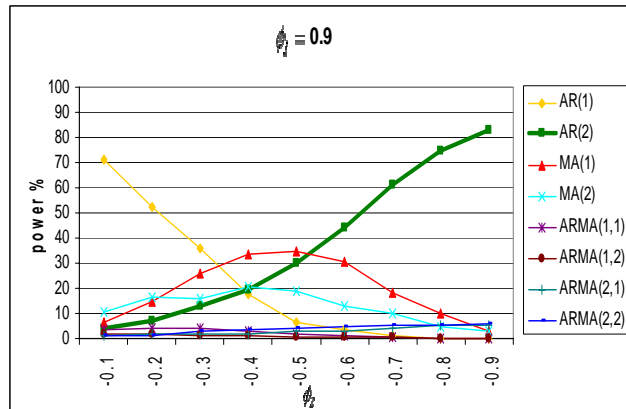
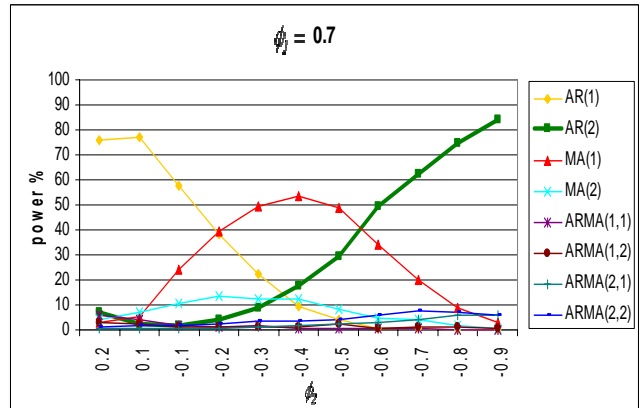
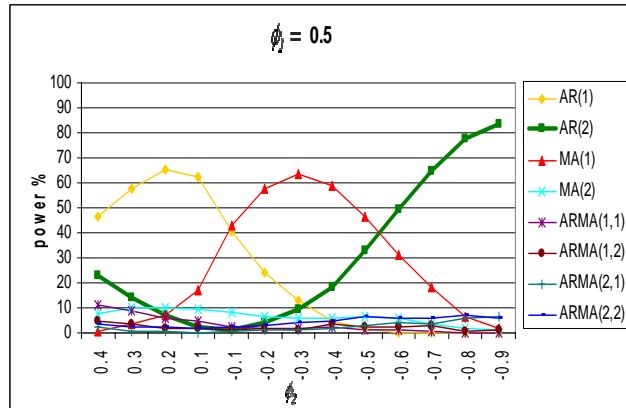
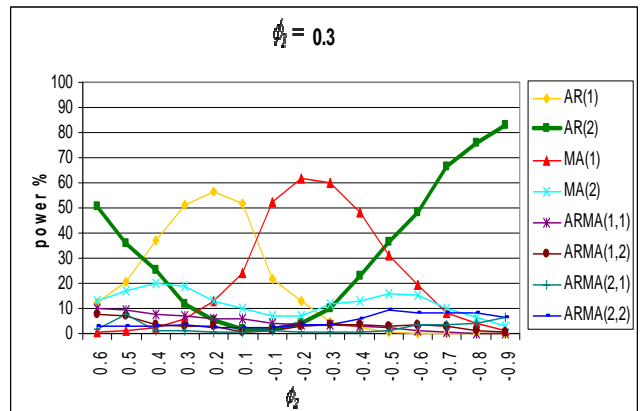
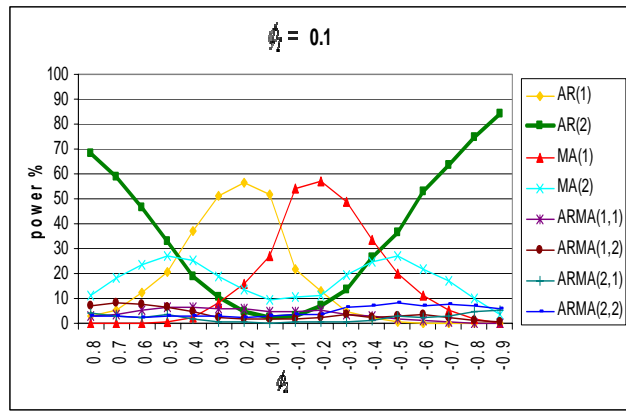
SIC : (1)  
AR(1)

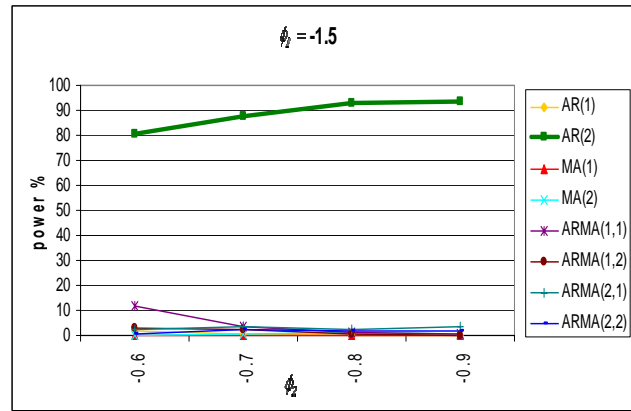
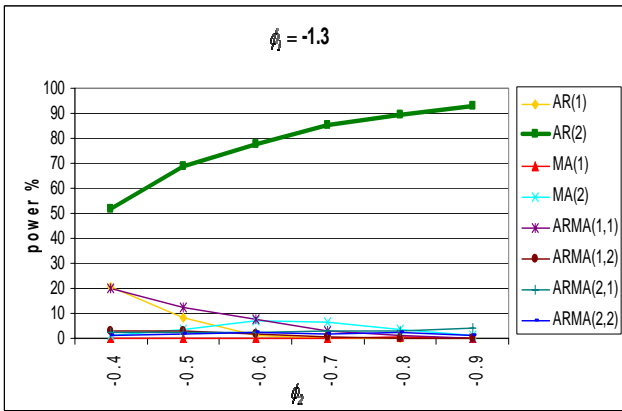
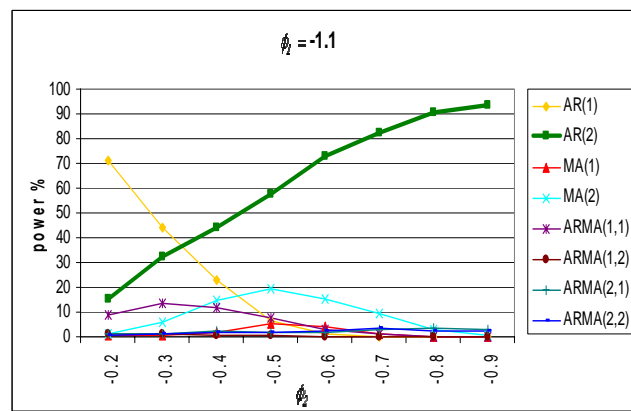
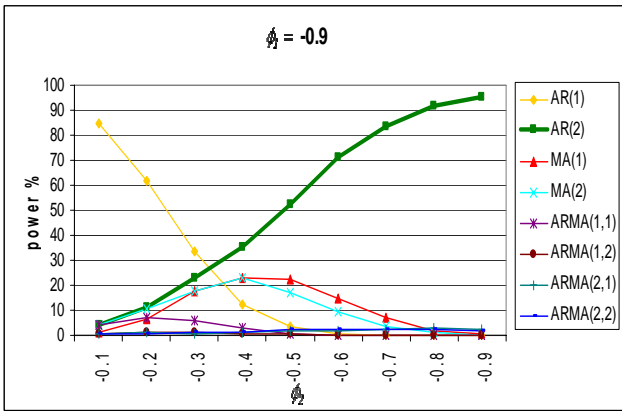
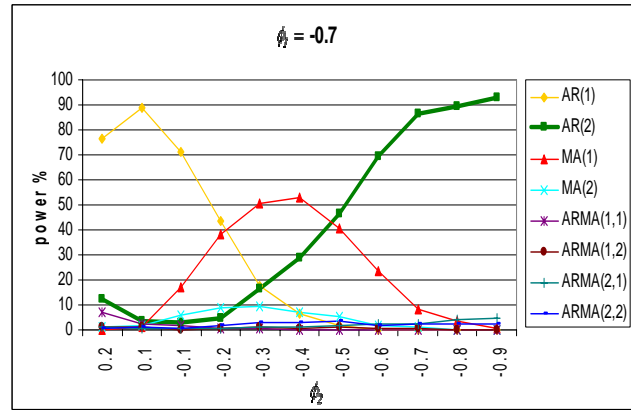
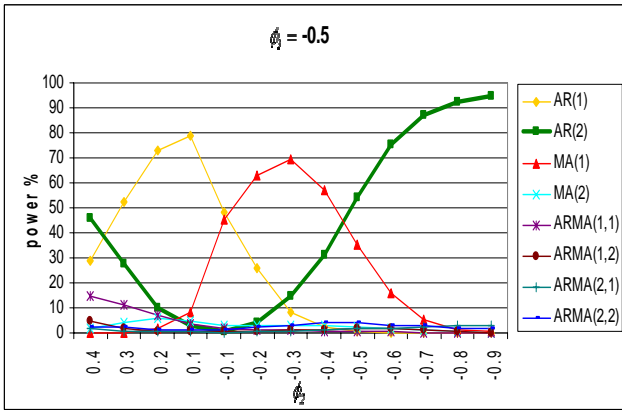
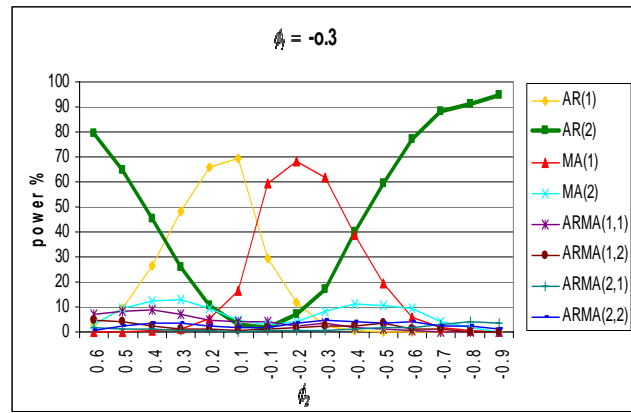
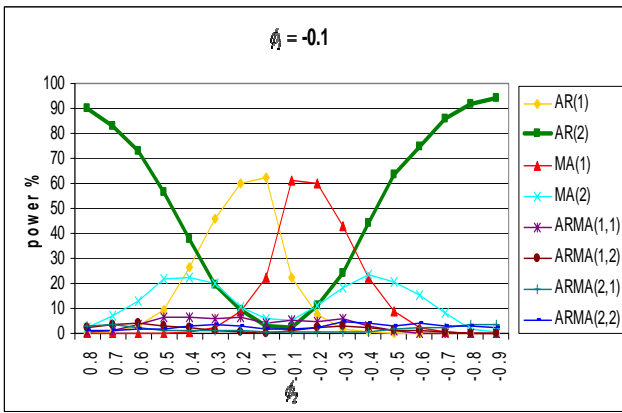


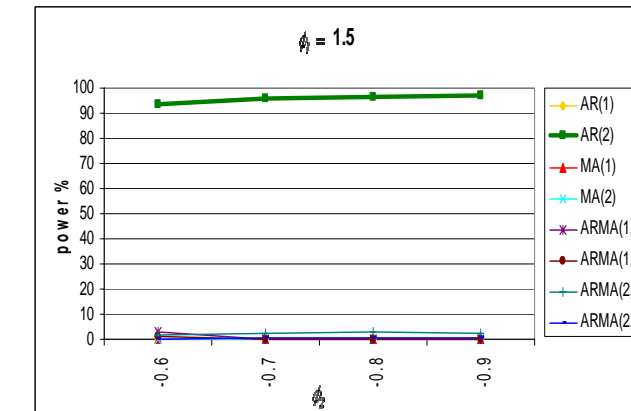
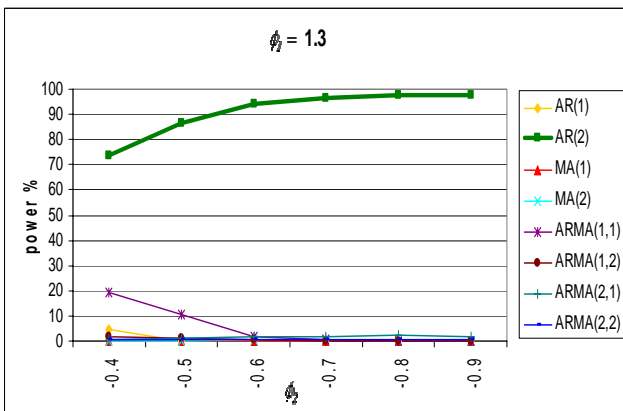
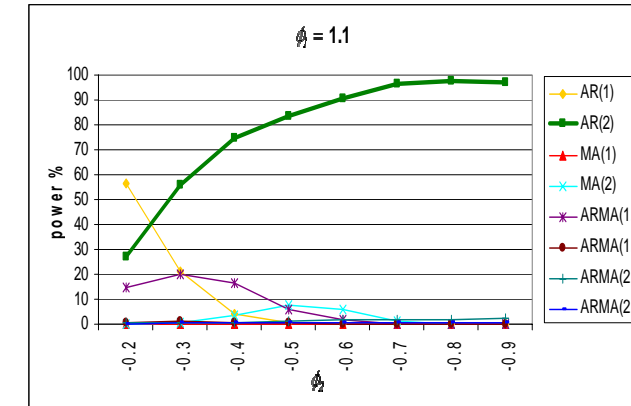
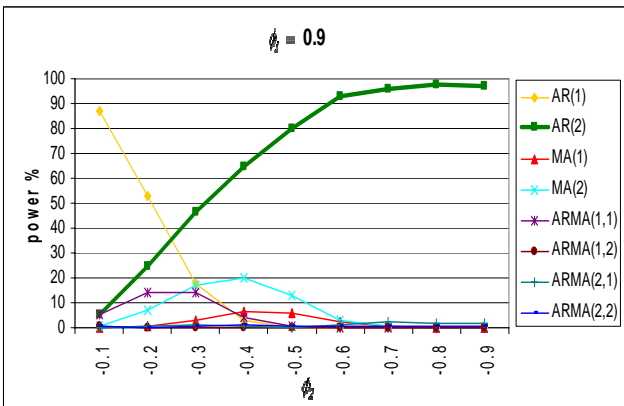
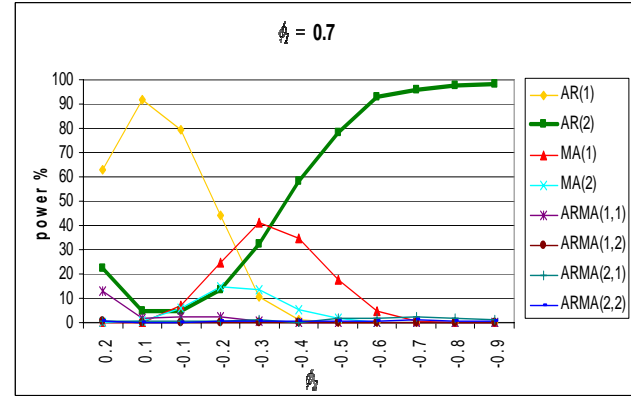
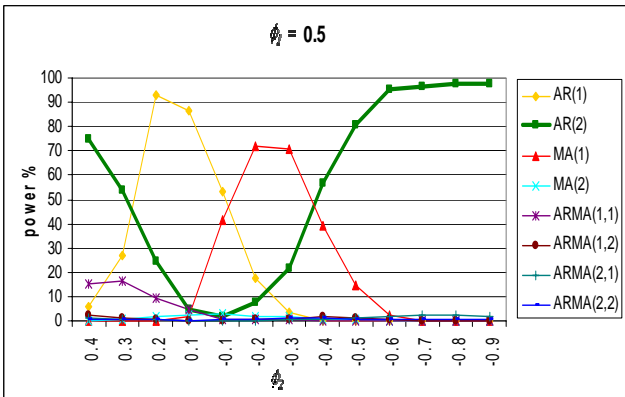
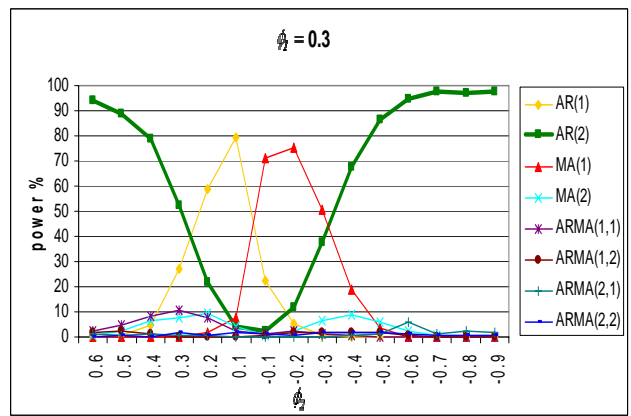
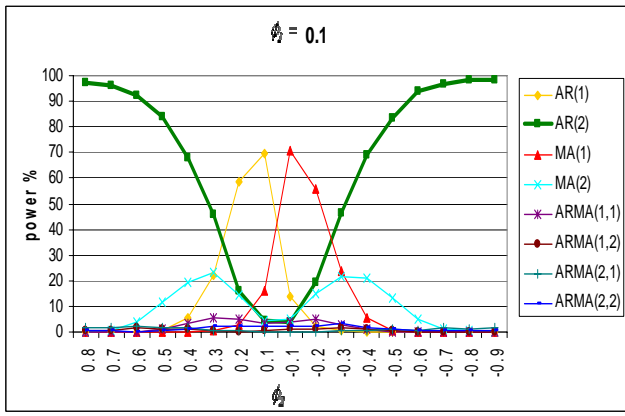
SIC : (2)  
MA(1)



|  |       |               |     |     |              |     |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
|--|-------|---------------|-----|-----|--------------|-----|----------|--|-------|----|--|-----|-----|---------------|---|-----|-------------|---|--|-----|-----|--|--|-----|-----|-----|--|-----|-----|---|--|-----|-----|--|--|--|--|--|-----|-----|-----|-----|--|--|--|--|--|--|--|-------|----|--|--|-------|----|--|---------------|---|--|--|-----|-------------|---|--|--|--|---|--|-----|---|---|--|--|--|-----|-----|-----|-----|-----|--|--|--|--|--|--|--|--|-----|
| :  |       |               |     | -3  |              |     |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
| <b>MA(2)</b>   |       |               |     |     | <b>AR(2)</b> |     |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
| <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%; text-align: center;">MA(1)</td> <td style="width: 15%; text-align: center;">-1</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%; text-align: center;">AR(1)</td> <td style="width: 15%; text-align: center;">-1</td> <td style="width: 15%;"></td> </tr> <tr> <td style="text-align: center;">0.2</td> <td style="text-align: center;">0.3</td> <td style="text-align: center;"><math>- \theta_2 </math></td> <td style="text-align: center;">-</td> <td style="text-align: center;">0.1</td> <td style="text-align: center;"><math>- \phi_2 </math></td> <td style="text-align: center;">-</td> <td></td> </tr> <tr> <td style="text-align: center;">%80</td> <td style="text-align: center;">%70</td> <td></td> <td></td> <td style="text-align: center;">0.1</td> <td style="text-align: center;">0.2</td> <td style="text-align: center;">0.3</td> <td></td> </tr> <tr> <td style="text-align: center;">(7)</td> <td style="text-align: center;">(6)</td> <td style="text-align: center;">.</td> <td></td> <td style="text-align: center;">%80</td> <td style="text-align: center;">%70</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td style="text-align: center;">(8)</td> <td style="text-align: center;">(5)</td> <td style="text-align: center;">(4)</td> <td style="text-align: center;">(3)</td> <td></td> </tr> </table> |       |               |     |     | MA(1)        | -1  |          |  | AR(1) | -1 |  | 0.2 | 0.3 | $- \theta_2 $ | - | 0.1 | $- \phi_2 $ | - |  | %80 | %70 |  |  | 0.1 | 0.2 | 0.3 |  | (7) | (6) | . |  | %80 | %70 |  |  |  |  |  | (8) | (5) | (4) | (3) |  |  | <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%; text-align: center;">AR(1)</td> <td style="width: 15%; text-align: center;">-2</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%; text-align: center;">MA(1)</td> <td style="width: 15%; text-align: center;">-2</td> <td style="width: 15%;"></td> </tr> <tr> <td style="text-align: center;"><math>- \theta_2 </math></td> <td style="text-align: center;">-</td> <td></td> <td></td> <td style="text-align: center;">%70</td> <td style="text-align: center;"><math>- \phi_2 </math></td> <td style="text-align: center;">-</td> <td></td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">.</td> <td></td> <td style="text-align: center;">%70</td> <td style="text-align: center;">%</td> <td style="text-align: center;">%</td> <td></td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">(8)</td> <td style="text-align: center;">(7)</td> <td style="text-align: center;">(6)</td> <td style="text-align: center;">(4)</td> <td style="text-align: center;">(3)</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: center;">(5)</td> </tr> </table> |  |  |  |  | AR(1) | -2 |  |  | MA(1) | -2 |  | $- \theta_2 $ | - |  |  | %70 | $- \phi_2 $ | - |  |  |  | . |  | %70 | % | % |  |  |  | (8) | (7) | (6) | (4) | (3) |  |  |  |  |  |  |  |  | (5) |
|  | MA(1) | -1            |     |     | AR(1)        | -1  |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
| 0.2  | 0.3   | $- \theta_2 $ | -   | 0.1 | $- \phi_2 $  | -   |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
| %80  | %70   |               |     | 0.1 | 0.2          | 0.3 |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
| (7)  | (6)   | .             |     | %80 | %70          |     |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
|  |       |               | (8) | (5) | (4)          | (3) |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
|  | AR(1) | -2            |     |     | MA(1)        | -2  |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
| $- \theta_2 $  | -     |               |     | %70 | $- \phi_2 $  | -   |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
|  |       | .             |     | %70 | %            | %   |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
|  |       | (8)           | (7) | (6) | (4)          | (3) |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
|  |       |               |     |     |              |     | (5)      |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
| MA(1)  | AR(1) |               |     |     | $ \phi_1 $   |     |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
|  |       |               |     |     | AR(2)        |     |          |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
|  |       |               |     |     |              |     | .        |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |
|  |       |               |     |     |              |     | .(8) (3) |  |       |    |  |     |     |               |   |     |             |   |  |     |     |  |  |     |     |     |  |     |     |   |  |     |     |  |  |  |  |  |     |     |     |     |  |  |  |  |  |  |  |       |    |  |  |       |    |  |               |   |  |  |     |             |   |  |  |  |   |  |     |   |   |  |  |  |     |     |     |     |     |  |  |  |  |  |  |  |  |     |







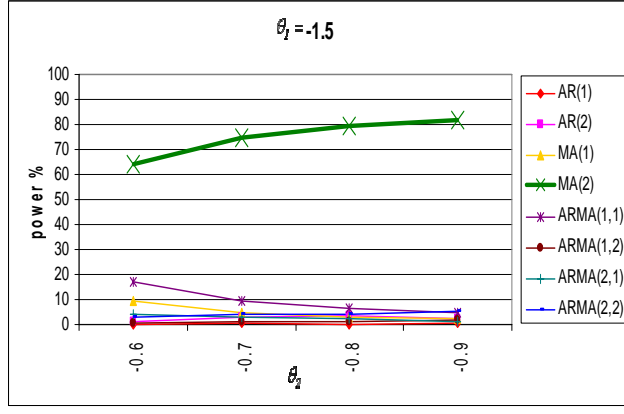
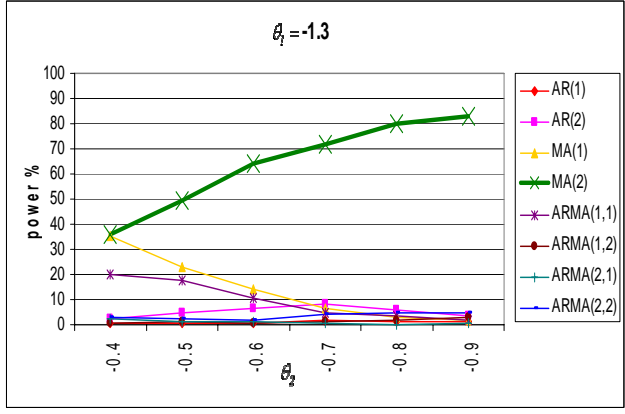
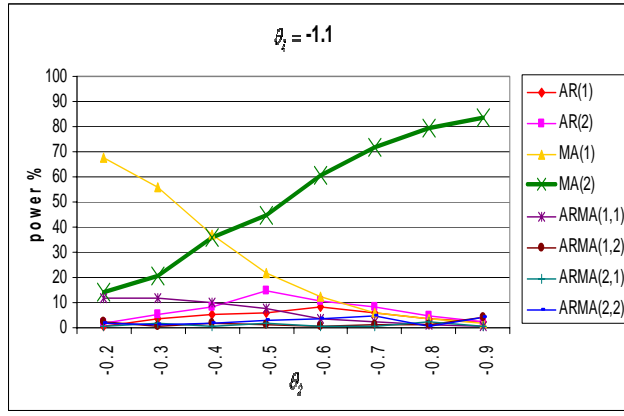
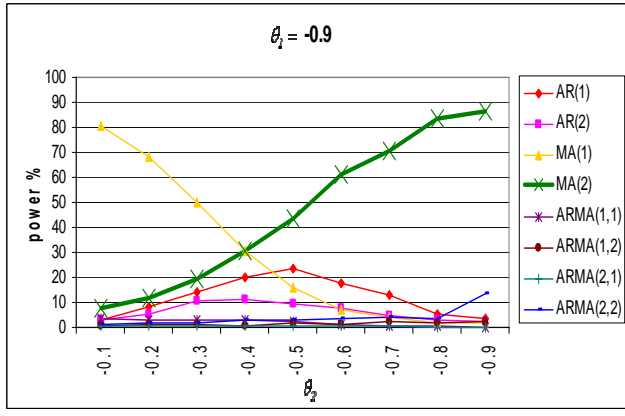
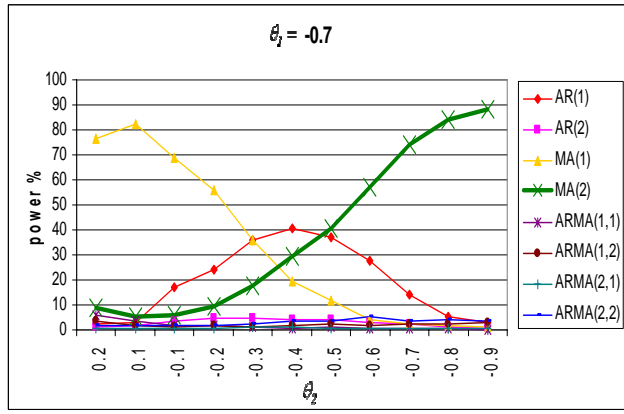
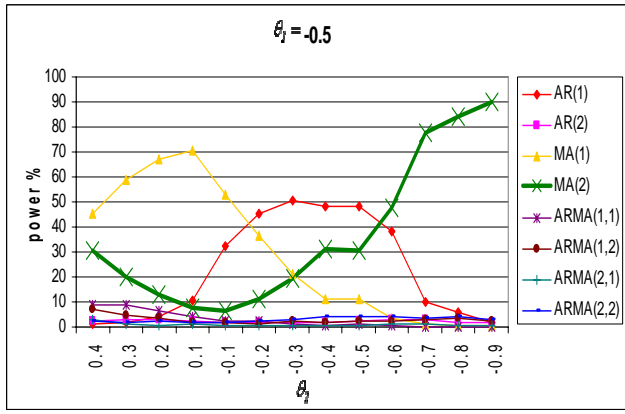
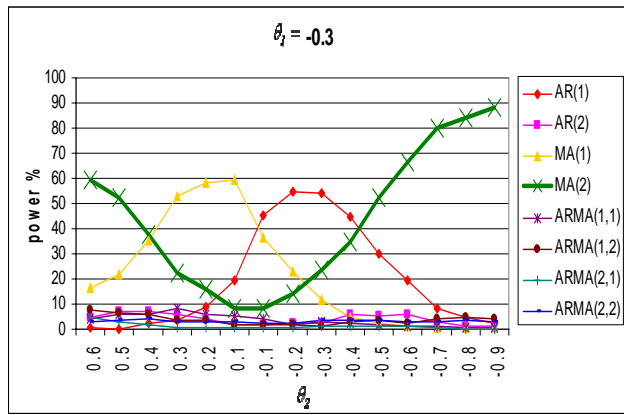
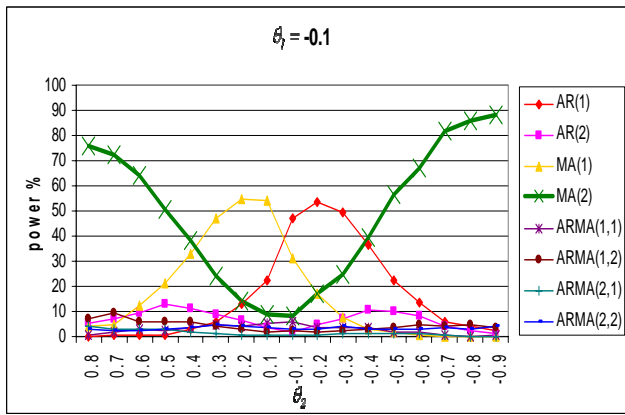
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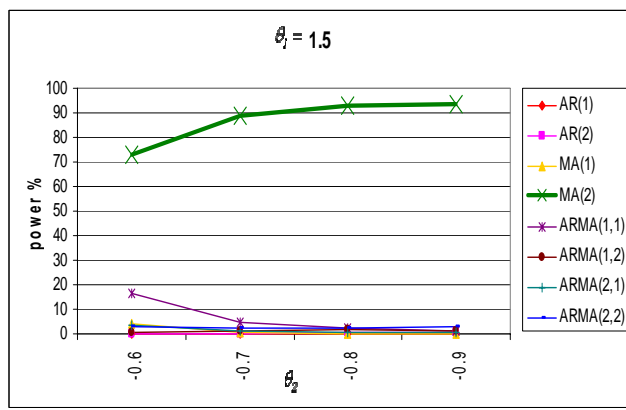
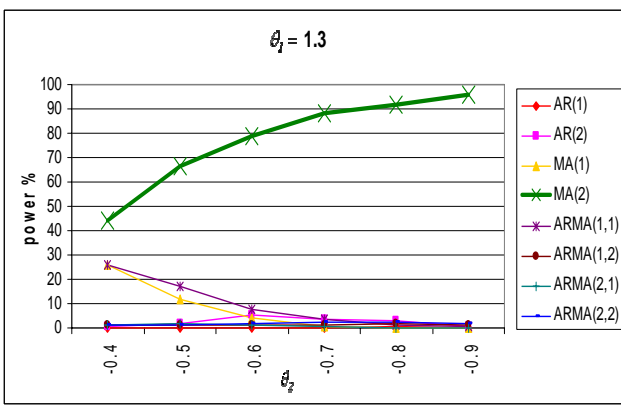
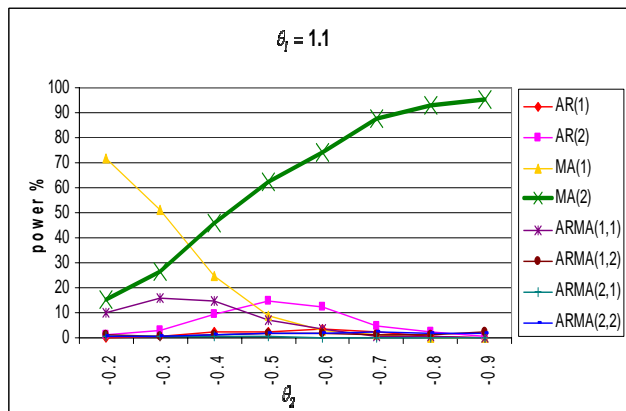
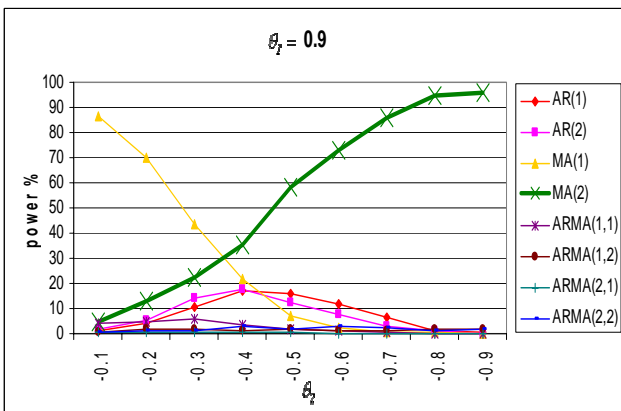
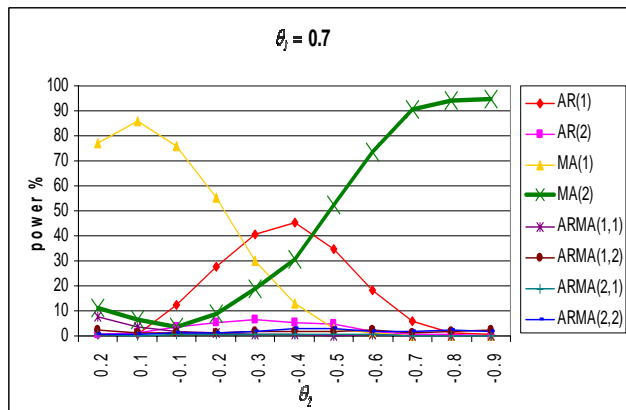
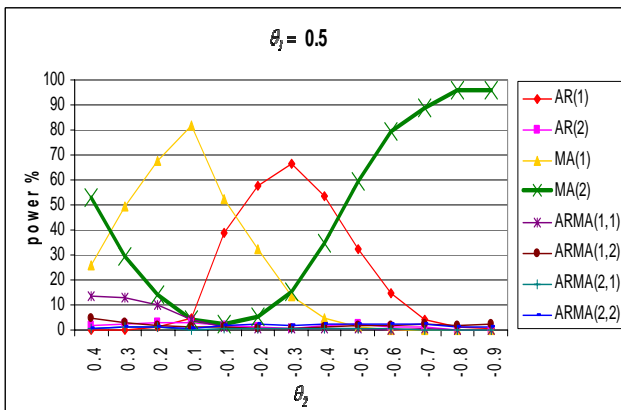
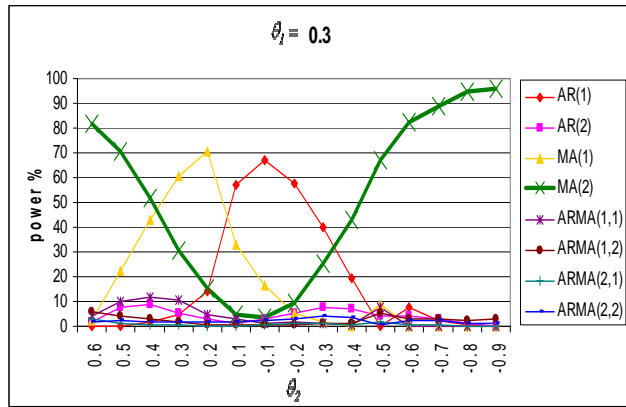
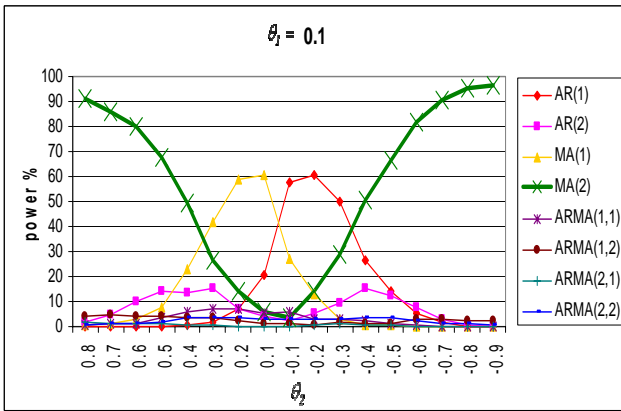
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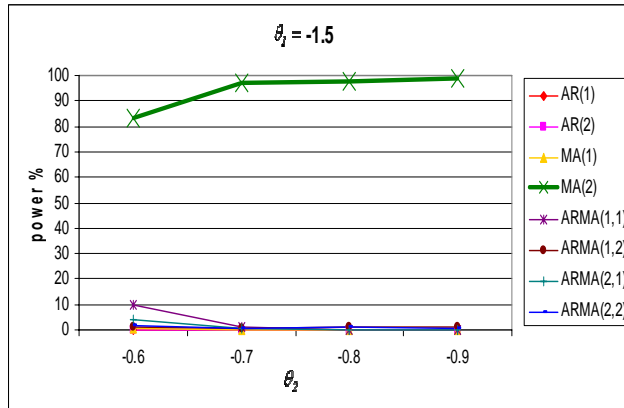
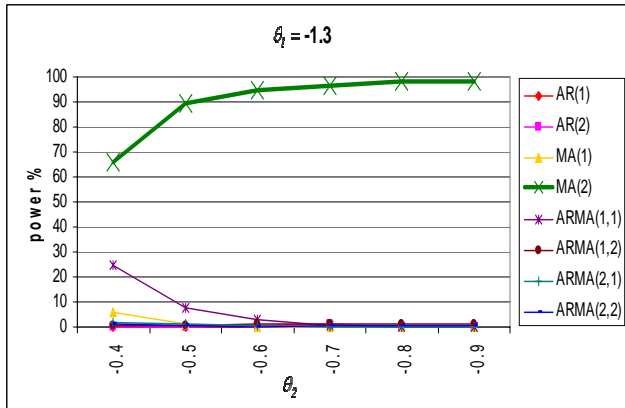
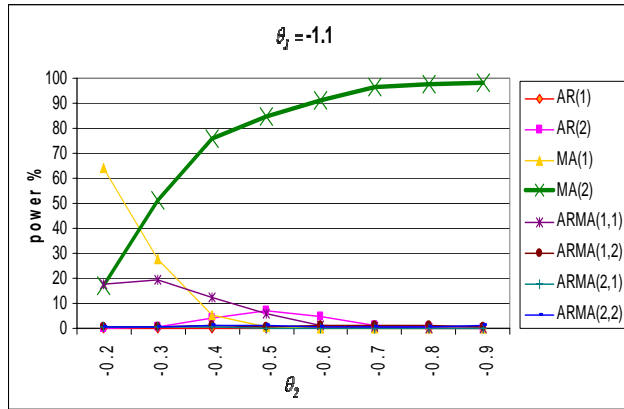
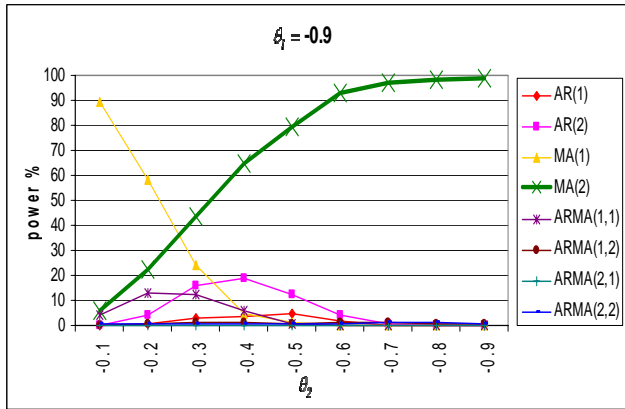
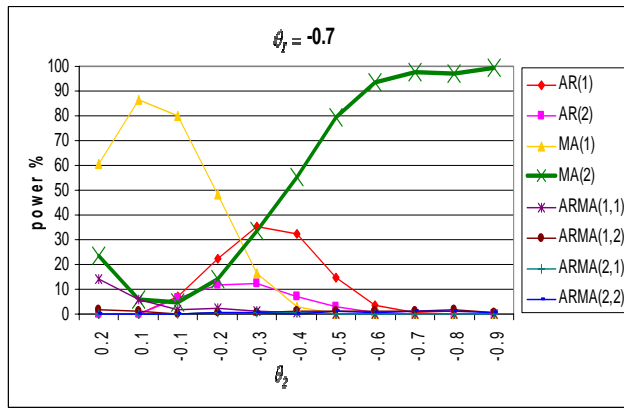
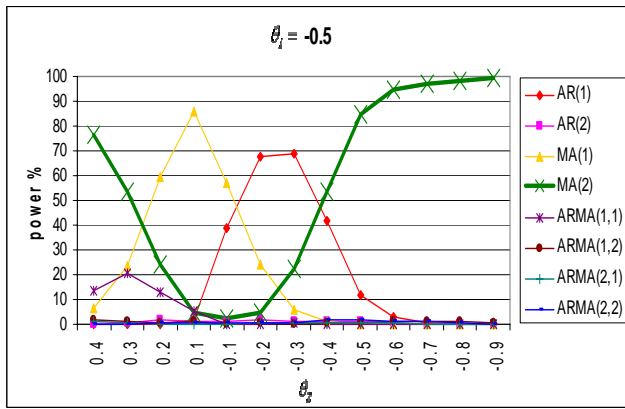
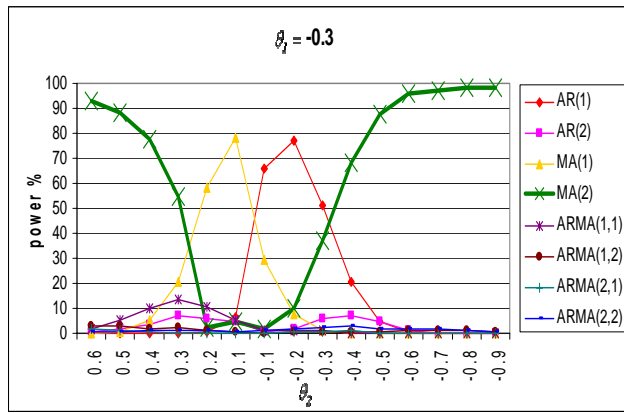
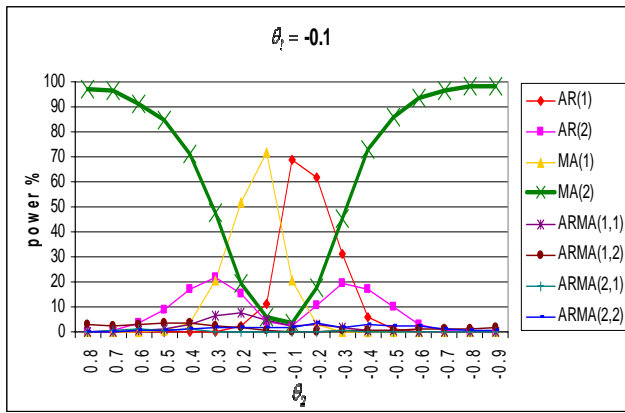
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$|\phi_1|$

MA(1) AR(1)

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$|\phi_1| = 0.9$

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$|\theta_1| = 0.8$

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$|\phi_1| = 0.7$

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MA(2) AR(2)

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