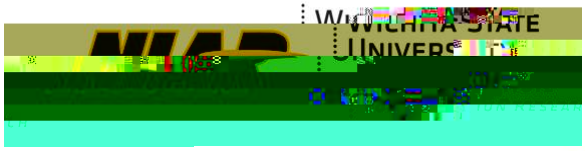

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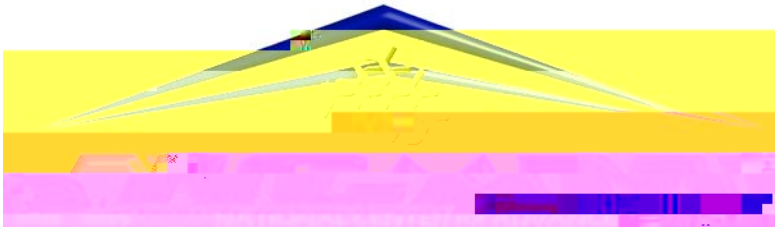
5HSRUW 'DWH -DQXDU\



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)RUPHUO\ NQRZQ DV $GYDQFHG &RP

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)$$ 6SHFLDO 3URMHFW 1XPEHU 63

1&$03 5HSRUW 1XPEHU 1&3 53 5HY %

5HSRUW 'DWH -DQXDU\

1DWLRQDO &HQWHU IRU $GYDQFHG 0DWHULDOV 3HUIRUPD
1DWLRQDO ,QVWLWXWH IRU $YLDWLRQ 5HVHDUFK
:LFKLWD 6WDWH 8QLYHUVLW\
:LFKLWD .6

7HVWLQJ)DFLOLW\
1DWLRQDO ,QVWLWXWH IRU $YLDWLRQ 5HVHDUFK
:LFKLWD 6WDWH 8QLYHUVLW\
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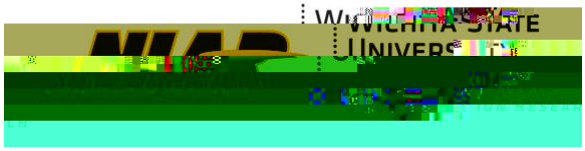

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Date: 2024.04.08 10:27:09 -05'00'
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5HYLHZHG E\ Sylvina Castillo Digitally signed by Sylvina Castillo
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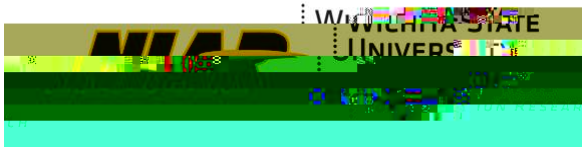

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5HY % \	'DWH	5HY3DJHV 5HYLVHG RU $GGHG $SSURYHG %\

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&ODUNVR

7DEOH RI &RQWHQWV

,QWURGXFWLRQ

- 4XDVL ,VRWURSLF 8QQRWFKHG 7HQVLRQ 817
- ³6RIW´ 8QQRWFKHG 7HQVLRQ 817
- ³+DUG´ 8QQRWFKHG 7HQVLRQ 817

8QQRWFKHG &RPSUHVVLRQ 81&3URSHUWLHV

- 4XDVL ,VRWURSLF 8QQRWFKHG &RPSUHVVLRQ 81&
- ³6RIW´ 8QQRWFKHG &RPSUHVVLRQ 81&
- ³+DUG´ 8QQRWFKHG &RPSUHVVLRQ 81&

/DPLQDWH 6KRUW %HDP 6KHDU 6WUHQJWK 6%6

)LOOHG +RLH 7HQVLRQ)+7)+7)+7 3URSHUWLHV

- 4XDVL ,VRWURSLF)LOOHG +RLH 7HQVLRQ)+7
- ³6RIW´)LOOHG +RLH 7HQVLRQ)+7
- ³+DUG´)LOOHG +RLH 7HQVLRQ)+7

)LOOHG +RLH &RPSUHVVLRQ)+&)+&)+& 3URSHU

- 4XDVL ,VRWURSLF)LOOHG +RLH &RPSUHVVLRQ)+&
- ³6RIW´)LOOHG +RLH &RPSUHVVLRQ)+&
- ³+DUG´)LOOHG +RLH &RPSUHVVLRQ)+&

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&RPSUHVVLRQ $IWHU ,PSDFW 'DWD

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/LVW RI)LJXUHV

)LJXUH %DWFK SORW IRU /7 QRUPDOL]HG FXUUHQW 81 7 L]HG VLWH OHQJWK
)LJXUH %DWFK SORW IRU ,36 6WUHQJWK 81&G HVLJQ DW 6WUDLQ
)LJXUH %DWFK 3ORW IRU 77 VWUHQJWK DV PHDVXUHG
)LJXUH %DWFK 3ORW IRU 7& VWUHQJWK DV PHDVXUHG
)LJXUH %DWFK 3ORW IRU 817 VWUHQJWK QRUPDOL]HG
)LJXUH %DWFK 3ORW IRU 81& VWUHQJWK QRUPDOL]HG
)LJXUH %DWFK SORW IRU 63 VWUHQJWK DV PHDVXUHG
)LJXUH %DWFK SORW IRU ,36 6WUHQJWK DW 6WUDLQ
)LJXUH %DWFK SORW IRU 6%6 DV PHDVXUHG
)LJXUH %DWFK SORW IRU 2+7 VWUHQJWK QRUPDOL]HG
)LJXUH %DWFK SORW IRU 2+7 VWUHQJWK QRUPDOL]HG
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)LJXUH %DWFK SORW RI UHWHVW IRU 3% VWUHQJWK QRUPDOL]HG
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/LVW RI 7DEOHV

7DEOH 7HVW 3URSHUW\ $EEUHYLDWLRQV
7DEOH 7HVW 3URSHUW\ 6\PEROV
7DEOH (QYLURQPHQWDO &ODVVLILFDWLRQ $EEUHYLDWLRQV
7DEOH . IDFWRU IRU QRUPDO GLVWULEXWLRQ
7DEOH :HLEXOO 'LVWULEXWLRQ 9DOXH)DFWRUV
7DEOH % %DVLV +DQVRQ .RRSPDQV 7DEOH
7DEOH $ %DVLV +DQVRQ .RRSPDQV 7DEOH
7DEOH % %DVLV IDFWRUV IRU VPDOO GDWDVHWV XVLQ
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7DEOH 1&$03 UHFRPPHQGHG %DVLV IRU /DPLQD 'DWD
7DEOH 1&$03 UHFRPPHQGHG %DVLV IRU /DPLQDWH 'DWD
7DEOH 6XPPDU\ RI 7HVW 5HVXOWV IRU /DPLQD 'DWD
7DEOH 6XPPDU\ RI 7HVW 5HVXOWV IRU /DPLQDWH 'DWD
7DEOH 6WDWLVWLFV DQG %DVLV 9DOXHV IRU 817 GDW
7DEOH 6WDWLVWLFV IURP /7 PRGXOXV
7DEOH 6WDWLVWLFV DQG %DVLV 6WUHQJWK IURP 81& QRUPDOL]
7DEOH 6WDWLVWLFV IURP /& PRGXOXV
7DEOH 6WDWLVWLFV DQG %DVLV 6WUHQJWK GDWD
7DEOH 6WDWLVWLFV IURP 77 0RGXOXV GDWD
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7DEOH 6WDWLVWLFV DQG %DVLV 9DOXHV IRU 81& 6W
7DEOH 6WDWLVWLFV IURP 81& 0RGXOXV GDWD
7DEOH 6WDWLVWLFV DQG %DVLV 6WUHQJWK GDWD
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7DEOH 6WDWLVWLFV DQG %DVLV 9DOXHV IRU 817 6W
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7DEOH 6WDWLVWLFV DQG %DVLV 9DOXHV IRU 81& 6W
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7DEOH 6WDWLVWLFV IURP 81& 0RGXOXV GDWD
7DEOH 6WDWLVWLFV DQG %DVLV 9DOXHV IRU 81& 6W

7DEOH 6WRPW8L1V&W L0FRVG XUO XV 'DWD
7DEOH 6WDWLVWLFV 9DOXHV DQG RU %6D%6L 6WUHQJWK
7DEOH 6WDWLVWLFV 9DOXHV DQG RU %+D7V L6WUHQJWK GDWD
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7DEOH 6WDWLVWLFV 9DOXHV DQG RU %3D%V L JW2KI VGHDWWD6WUHQ
7DEOH 6WDWLVWLFV IURP &$, VWUHQJWK GDWD
7DEOH /LVW RI RXWOLHUV

-DQXDU\

,QWURGXFWLRQ

7KLV UHSRUW FRQDWQDLOQ\VLVWRDIW$&*WL0F7DVP ,05: PDWHULDO SURSHUW\ GDWD SXE7OHLVVWKH5GHSLRQUW1&$$3 Y3% 7KH 5OHDPLQD D ODPLQDWH PDWHULDO SURSHUW\ GDWD KDYH EHHQ JHQHU 3URMHFW 1XPEHU 63R P:,HH4WDQWOKHDOUHTHXGLULHQPH1Q$W0V3 R6XWDQLGQ 2SHUDWLQJ 3URFHGXUH 163 7KHQWGHWWHVSWDQYHHOWXSWKHV FRQIRUPHG E\ WKHW)L$QJDKQDGV EHKHHQW)E$LVWQHVVHG E\ WKH

% %DVLV YDOXHV $ HVWLPDWHV DQG D% YHDVUWLHPWD\WRHIVWZHHFKHQ DUH GHWDLOHG LQ VHFWLRQ WZR 4XDOLILFDWLRQ PDWH PDWHULDO VSHFLILFDWLRQ &$&300DWHUWLDRQ6SHFLILFD 7KH TXDOLILFDWLRQ WHVW SDQHOV ZHUH IDEULFDWHG SHU $

7HVW 3URSHUW\		6\PERO
/RQJLWXGLQDO &RPSUHVVLRQ	6WUHQ	
/RQJLWXGLQDO &RPSUHVVLRQ	0RGXOXV	(
/RQJLWXGLQDO &RPSUHVVLRQ	3RLVVRQ¶V 5DWLR	
/RQJLWXGLQDO 7HQVLRQ	6WUHQ	
/RQJLWXGLQDO 7HQVLRQ	0RGXOXV	
7UDQVYHUVH &RPSUHVVLRQ	6WUHQ	
7UDQVYHUVH &RPSUHVVLRQ	0RGXOXV	(
7UDQVYHUVH &RPSUHVVLRQ	3RLVVRQ¶V 5DWLR	
7UDQVYHUVH 7HQVLRQ	6WUHQ	
7UDQVYHUVH 7HQVLRQ	0RGXOXV	
,Q 3ODQH 6KHDU 0RGXOXV		)
,Q 3ODQH 6KHDU 6WUHQJWK		)
,Q 3ODQH 6KHDU 0RGXOXV		

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, Q V R P H F D V H V D W U D Q V I R U P D W L R Q R R M W K H P R G L I D W G R & 9 L W
W K H W U D Q V I R U P H G G D W D S D V V L Q J E W K S R R ' O H W H V R Q O D \ Q R U W K X
& 9 P H W K R G

1 & $ 0 3 U H F R P P H Q G V W K D W L I D X V W K D W H D F L H G H D O W R O D W
P H D V U H G & 9 W K H V P H F L I F D W L R Q O D W H L V W D L Q H G V R & 9 W D R O
6 L P L O D U O \ L I D X V H U G H F L G H D F W O D R W K H R G D L
V P H F L I F D W L R Q O L P L W V D Q G F R Q W R O O L P L W V E H F D O F X
W K H O L Q N E H W Z H H Q P D W H U L D O D F R Q R W D E O H V L P L W H F L L F D W

-DQXDU\

%DFNJURXQG

6WDWLVWLFDO FRPSXWDWLRQV DUH QDSHUVLRUW 3HRJUDPK $6$3
SRRO LQJ DFURVV HUPLVVLRQ HQ DWFRUGLQJ WR &0+ JXLGH
SHUPLVVLEOH D VLQJOH SRLQW DQDIRUWLHVDFKV LHQQY6$7RP
FRQGLWLRQ ZLWK KVXOWLFLHQW WKH GDWD KHG &0+V QRUWH PXLUHPH
VLQJOH SRLQW DQDO\VLV HVWLPDWHG DUH SHFLHGLQJ RQ E\ZK
DSSURSULDWH IRU DEWKH 6SHFLDLVH SURFHGXUHV XVHG DUH
VHFWLRQV ZKHUH WKH GDWD LV SUHVHQWHG

$6$3 6WDWLVWLFDO)RUPXODV DQG &RPSXWDWL

7KLV VHFWLRQ FRQWDLQV VSHFLILF GHWDLOV RQ DQ $6$3 FRPSXWDWL

%DVLF 'HVFULSWLYH 6WDWLVWLFV

7KH EDVLF GHVFULSWLYH VWDWLVWLFV FDOFXODWLRQ IRUPXOD
DUH VKRZQ EHORZ

0HDQ $$\bar{X} = \sum_{i}^{n} \frac{X_i}{n}$$ (

6WG 'HY $$S = \sqrt{\frac{1}{n} \sum_{i}^{n} (X_i - \bar{X})}$$ (TXDWLRQ

Ñá'9Bs, “ a ¦

- D Q X D U \

: K H W H U H I H U V W R W K H Q X P E H U R V E W K H V D P S O H

3 R R O H G & R H I I L F L H Q W R I 9 D U L D W L R Q

6 L Q F H W K H P H D Q G H U G D W K H Q U P D U H D F K F R Q G L W L R Q W K K D V D P H D Q R I R Q H 7 K H F R H I I L F L H Q W R I D U L Y H G U L G D W L R Q V I R U K V W D Q G D U G G H Y L D W L R Q E G Y P L G H Q E \ V W L K Q H T X D W L R Q

-DQXDU\

$$b_B \quad f \quad \frac{}{\sqrt{f}} \quad \frac{}{f} \quad \frac{}{f\sqrt{f}}$$ (

$$c_B \quad f \quad \frac{}{\sqrt{f}} \quad \frac{}{f} \quad \frac{}{f\sqrt{f}}$$ (TXDWLRQ

$$b_A \quad f \quad \frac{}{\sqrt{f}} \quad \frac{}{f} \quad \frac{}{f\sqrt{f}}$$

$$c_A \quad f \quad \frac{}{\sqrt{f}} \quad \frac{}{f} \quad \frac{}{f\sqrt{f}}$$ (TXDWLRQ

0RGLILHG &RHIILFLHQW RI 9DULDWLRQ

7KH FRHIILFLHQWRIGLILYLHGLDFWLRQGLVQJ WR WKH IROORZLQJ

$$CV \; \begin{cases} CV & \text{if } CV \\ \frac{CV}{} & \text{if } CV \\ CV & \text{if } CV \; t \end{cases}$$ R G L I d(TXDWLRQ G

7KLV LV FRQYHUWHG WR SHUFHQW E\ PXOWLSO\LQJ E\

&9 LV XVHG WR FRPSXWH WKH SRROHG VWDQGDUG GHYLDWLRQ 6

$$S \quad CV \; \bar{X} \quad \sim$$

7R FRPSXWH WKH SRROHG VWDQGDUG&9G GHYLDWLRQ EDVH

$$S_p \; \sqrt{\frac{\sum_{i}^{k} n_i \; CV_i \; \bar{X}_i}{\sum_{i}^{k} n_i}} \quad \sim$$ (TXDWLRQ

7KH $ EDVLV DQG % EDVLV ... FRPSXWHG E\ UHSODFLQJ 6 ZLWK 6

7UDQVIRUPDWLRQ RI GDWD EDVHG RQ 0RGLILHG &9

,Q RUGHU WR GHWHUPLQH ... PRGLILHG &9 WKH GDWD PXVW EH ... VWDQGDUG GHYLDWLRQ RI WUDQVIRUPHG GDWD ...

- D Q X D U \

- D Q X D U \

, I 0 1 5 ! & W K H D Q W K H 0 1 5 L V F H D W H G Z L W K W K H 0 1 5 L V R Q W O L G H U U H G
H [L V W V X W K H Q R W L K D W H G Z L W K W K H 0 1 5 L V G U R S S H

- D Q X D U \

: L W K

a g k g S

b g k Tk g T S T g

c T g k T g k T S T

d T k Tk

S $\sum_{i}^{k} \_\_ n_i$

T $\sum_{i}^{n} \_ i$

g $\sum_{i}^{n} \sum_{j\ i}^{n} \_\_\_\_\_ n\ i\ j$

7 K H G D W D L V F R Q V L G H U H G W R K D Y H U H D Q R W G P W R S R V W H D W L R
Z K H Q W K H W H V W V W D W L V W L F L V R U H D Q H U W K D Q R Q K R F W L W
V H H U H I H U H Q F H

7 K H $ Q G H U V R Q H V W U R L Q J 1 R U P D O L W \

1 R U P D O ' L V W U L W H X W L R Q U D P H W H U 1 I D P L O \ R I S U E D E L O

OSL e ADQ AD AD §: AD √n© ¸1 (TXDWLRQ

7KLV 26/ PHDVXUHV WKH SUREDELOLW\ RI REVHUYLQJ DQ
H[WUHPH DV WKH YDOXH FDOFXODWHG [illegible]
,I 26/ ! WKH GDWD [illegible]

/HYHQH¶V 7HVW IRU (TXDOLW\ RI &RHIILFLHQW RI 9DULD

/HYHQH¶V WHVW [illegible]
VDPSOH PHGLDQV 7KH DEVROXWH [illegible]
HDFK GDWD w_{ij} y_{ij} [illegible]) WHVW LV WKH [illegible] GDW
DV IROORZV

$$F = \frac{\sum_{i}^{k} n_i (\bar{w}_i - \bar{w})^2 / (k-1)}{\sum_{i}^{k}\sum_{j}^{n_i} (w_{ij} - \bar{w}_i)^2 / (n-k)}$$

,I WKLV FRPSXWHG) VWDWLVWLF [illegible]
QXPHUDWRU DQG Q N GHQRPLQDWRU [illegible]
GDWD LV QRW [illegible]
LV XVHG WR FKHFN [illegible]
LQIRUPDWLRQ RQ WKLV SURFHGXUH VHH UHIHUHQFH

67$7

7KLV VHFWLRQ FRQWDLQV WKH GHWDLOV [illegible]

7KH EDVLF GHVFULSWLYH [illegible] UHVLGXDO 015 WH
$QGHUVRQ 'DUOLQJ [illegible] $QGHUVRQ 'DUOLQJ [illegible] VH
DQG

2XWOLHUV PXVW EH GLVSRVLWLRQ [illegible]
$QGHUVRQ 'DUOLQJ [illegible] 7HTXLYDOHQF\ PXVW EH
SDVVHV WKH $'. WR [illegible] LV GHWHUPLQH
WHVW WKHQ WKH $12 9$ [illegible]
WKDW PHHW WKH0HHTX [illegible] WKH DVVXPSW
HTXDO YDULDQFHV ZKHQ XVLQJ DQ 129 DQDO\VLV

'LVWULEXWLRQ 7HVWV

,Q DGGLWLRQ WR WHVWLQJ IRU [illegible]
WR VHH LI WKH [illegible] ILW I

- D Q X D U \

(D F K G L V W U L E X W L R Q I X Q F W L R Q I R U W F K H P G L V F U H S D Q F L H V W K H G D W D

$ Q R E V H U Y H G V L J Q L I L F D Q F H O H Y H O I R U H D F K W H V W D W O H D V W D V H [W U H P H D V W K H X Q G H U O \ L Q J G L V W U L E X W L R Q I R U W K H W H V W V W D W L V W L F R I W K H D F W X D O \ I U R P W K H G D W D S R S X O D W L R Q Z L W K W K L V G L V W U L E X W L R Q V K D S H Q R 2 6 / W K H Q R U P D O G L V W U L E X W L R Q V K D S H D Q G W K H G D W D

, I W K H Q R U P D O G L V W U L E X W L R Q W K D Q W K H G D W D S R S X O D W L R Q Z L W K W K L V G L V W U L E X W L R Q V K D S H D Q G W K H G D W D

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V L] H L V J U H D W H U W K D Q

7 K H H [D F W F R S Y D W D X W L R Q V R I

-DQXDU\

6WDW VROYHV WKH HTXLOLEULXP FRQGLWLRQ RUGHU WR FRPSXWH EDVL

*RRGQHVV RI ILW: HWLEXWLRQ RI GLVWULEXWLRQ

7KH WZR SDUDPHWHU :HLEXOO GLVWULEXWLRQ FRQVLVWLQJ RI WKH GLVWULEXWLRQ FXP XODWLYH FRPSDULVRQ
:HLEXOO GLVWULEXWLRQ RI WKH GLVWULEXWLRQ IXQFWLRQ DQG WKH GDWD

-DQXDU\

9 LV WKH YDOXH LQ 7DEOH ZKHQ RQ WKH VDPSOH VL]H LV
ODUJHU D QXPHULFDO WR WKH 9 SURJUDP H[SODLQ HTXLYDOHQW UHDO JHQHUDWLRQ WKH LPPHG
EHORZ

H[S @ 0p

- D Q X D U \

Z K H UL HL Ψ ΨK H L

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7KH % EDVLV %WK YDORZH VLW RWKHVH UYDWLRQ LQ WKH $GEDWDOHWHYDO
$WK ORZHVW REVHUYDWLRQ RLQ HW[KPSOHDWLRQ D VDPSOH WKH PRZHV
REVHUYDWLRQ LV WKH % EDVLV YDOXHG)XUWKHU EH LQIRUPDWLRQ
UHIHUHQFH

1RQ SDUDPHWULF %DVLV 9DOXHV IRU VPDOO VDPSOHV

7KH +DQVRQ .RRSPDQV PHWKRG UHDLQVHG IRU % EDVLV YDOX
VDPSOH VL]HV QRW H[FHHGLQJ DQG $ EDVLV YDOXHV IRU
UHTXLUHV WKH DVVXPSWLRQ WKDW WKH REVHUYDWLRQV DU
WKH ORJDULWKP RI WKH FXPXODWLYH GLVWULEXWLRQ IXQFWLRQ LV
ODUJH FODVV RI SUREDELOLW\ GLVWULEXWLRQV WKH PHWKRG
FRPSRVLWH VWUHQJWK GDWD DV D VVXPSWLRQ

7KH +DQVRQ .RRSPDQV % EDVLV YDOXH LV

B x_r ... (TXDWLRQ

7KH $ EDVLV YDOXH LV

A x_n ...

ZKHUH LV WKH ODUJHVW GDWD YDOXH DQG [GDWD YDOX
YDOXHV RI U DQG N GHSHQG RQ Q DQG OLVWHG LQ 7DEOH
YDOXH ZKHQ [

7KH +DQVRQ .RRSPDQV PHWKRG FDQ EH XVHG IRU VPDOO VDPSOHV
WKH Y$DOXH N VSRQGLQJ WR WKH VDPSOH VL]H LQ 7DEOH
DFFRUGLQJ WR WKH VWDQGDUGV RI &0+ EDVLV UHTXLUHPHQWV
GDWD DQG DW OHDVW D % EDVLV DUH WKUHH E
UHSUHVHQWHG LQ WKH GDWD DQG DW OHDVW GDWD SRLQ

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$ %DVLV +DQVRQ .RRSPDQV 7DEOH						
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&DOFXODWLRQ RI EDVLV YDOXHV XVLQJ 129

7KH IROORZLQJ FDOEDXODWLRQEVDWGKUHDVLDELOLW\ ,Q RWK
LV GXH WR EDWFKHV DQG WKH N VDPSOH $QGHUVRQ 'DUOL
WR EDWFK YDULDELOLWRLVRRV WKRRG GDWD 7KH PHWKRG LV E
YDULDQFH UDQGRP HIIHFWV PRGHO DQG WKH SURFHGXUH

129 VHSDUDWHV WKH WRWDO YDULDWLRQGDWDOQWRWKZR
EHWZHHQ EDWFKLWKLQEDWFKHQDGU LDWLRQ
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6XPPDU\ 7DEOHV

7KH EDVLV YDOXH [illegible] 7KH 1&$03 UHFRP
% EDVLV YDOXHV PHHW DOO UHTXLUHPHQWV [illegible] *PH
UHTXLUHPHQWV 7KH VXPPDU\ WDEOHV [illegible]
HVWLPDWHV RI EDVLV YDOXHV [illegible] +QRW [illegible]
LQ VKDGHG ER[HV DQG ODEHOHG DV HVWLPDWHV %DVLV YD

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/DPLQDWH 6WUHQJWK 7HVWV

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1RWHV 7KH PRGLILHG &9 % EDVLV YDOXH LV UHFRPPHQGHG ZKHQ DYDLOD
0 € 0 0€P HG ðZKHQ € t4Y `ODHG HG H HQG
EDVLV YD€O@XHV0IRUP/HDPLQDWHG'HDWDZK • H' @IwC@I3 p0

/DPLQD DQG /DPLQDWH 6XPPDU\ 7DEOHV

3UHSUHJ 0DWHUQDO &RPSOLFDWLRQV *URXS 070 ,0 JVP 8QLGLUHFWLRQDO 7DSH
0DWHUQDO 6SHFLILFDWLRQ RU 106
3URFHVV 6SHFLILFDWLRQ RU 136 0+ &XUH &\FOH

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7J GU\ f) 7J ZHW f) 7J 0(7+2''0$ 650

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5HVLQ EDWFK LQIRUPDWLRQ ;;* '& ;;* '% *9 <
'DWH RI UHVLQ PDQXIDFWXUH
'DWH RI SUHSUHJ PDQXIDFWXUH
'DWH RI FRPSOLWH PDQXIDFWXUH WR

'DWH RI WHVWLQJ 0DUFK WR)HEUXDU\ WR
'DWH RI GDWD VXEPLWWDO
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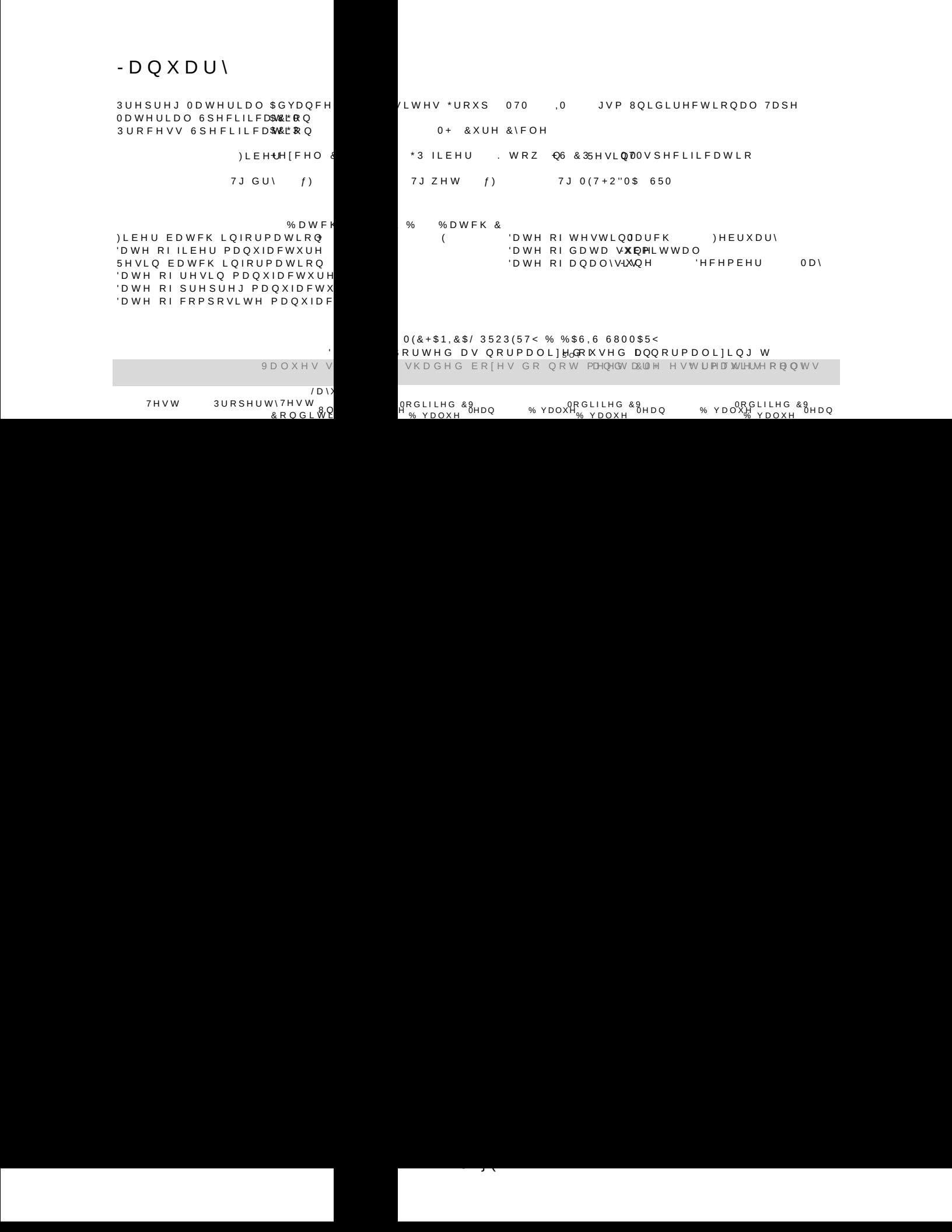

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/DPLQD 7HVW 5HVXOWV 6WDWLVWLFV %DVLV 9D

7HVW GDWD IRU ILEHU GRPLQDWHG QSJUPVSHUQMRLPHLVQDZDVFXQUR
WKLFNQHVV %RWK QRUPDOL]HG DXQGHDGVLPHWYKXHWEVOWDWI
QRUPDOL]HG GDWD YDOXHV ZHUH JGDSHGQDZLWRQVDLOX
FRPSXWDWLRQDO FKRLFHV ZHUH QRWKHVLQWKH DFFRPSDQ

$OO LQGLYLGXDO VSHFLPHQ UHVXOWV DUH JUDSKHG IRU H
ZLWK D OLQH LQGLFDWLQJ WKH UHYFLRUPRQHQHQGHGDEDFVRQGYLDWLX
LV MLWWHUHG PRYHG VOLJKWO\ WR WKH OHIW RU ULJKW

Longitudinal – Tension Properties LT

The longitudinal tension strength [illegible] specified in section [illegible] by pooling across environments [illegible] and for the modulus data [illegible] and the B b

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& 9								

/RQJLWXGLQDO ž &RPSUHVVLRQ 3URSHUWLHV

7KH ORQJLWXGLQDO FRPSUHVVLRQ MURPH 8.&WKV SDUHPHFRPS
HTXDWLRQ VSHFLILHG LQ VHFWLRQ 7KHUH ZHUH QR V
E\ SRROLQJ DFURVV HQYLURQPHQWV +RZHYHU WKHUH Z
UHTXLUHPHQWV RI &0+VWLPDWHV RQH EDVLV YDOXHV DU

7KHUH ZDV RQH RXWOLHU ,W ZDV LQ WKH (7: FRQGLWLR

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[redacted]

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7 U D Q V Y HžU V H

7UDQVYHUVH ž &RPSUHVVLRQ 3URSHUWLHV 7

7KH 7UDQVYHUVH &RPSUHVVLRQ GDWD QRWH ...
&RPSUHVVLRQ GDWD FRXOG EH SRROHG ...
GDWD EDWFK ...

7UDQVYHUVH &RPSUHVVLRQ 7& 6WUHQJWK NVL
%DVLV 9DOXHV DQG 6WDWLVWLFV $V 0HDVXUHG

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%DVLV 9DOXHV DQG RU (VWLPDWH

% EDVLV YDOXH
$ (VWLPDWH

0HWKRG	SRROHG	SRROHG	SRROHG	SRROHG

0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWH

% EDVLV 9DOXH
$ (VWLPDWH

0HWKRG	SRROHG	SRROHG	SRROHG	SRROHG

ƒ ž 8QQRWFKHG 3URSHQVLWLHV 817

7KHUH ZHUH QR RXWOLHUV XWHRGU E\WSHRRWLQJ DD HQYLURQPHQWV 6WDWLVWLFV DQG GDWD DQDO\VLV 7DEOHV DUH DJQ PRGXOXV GDWD LQ 7DEOH 7KH YROXPH IUDFWLRQ DQG DVVRFLDWHG VWUHVV DUH VKRZQ DQG LQ)LJXUH

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8QQRWFKHG &RPSUHVVLRQ 81& 6WUHQJWKWLVWLFV%DVLV 9DOXHV DQG 6W											
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7DEOH 6WDWLVWLFDO 9DOXHV DQG 5HVXOWV &RPSDULVRQ 6WUHQJWK GDWD

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,Q 3ODQH 6KHDU 3URSHUWLHV ,36

7KH ,Q 3ODQH 6KHDU GDWD LV QRWWKQRUHUPDSOLR]HGUWDLWHDV LV
6WUHQJWK 6WUHQJWK DW 6WUDLQDDFQNG VRGLKFOLXHVQWKVHS(
FRPSXWH % EDVLV% YHDVOWXLHPVD WVHRV RDQDOHW SFRURQYGLLGWHLGR QRU WK

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JXLGHOLQHV UHTXLUHG XVLQJ WKH $E1D2V9$FKDHQVDOW\KLV L:VWFKR
HVWLPDWH $OO GDWDVHWV SDVVHG9 DWKSHU$DFNWHZVDW DISWSHU
PRGLILHG &9 EDVLVDGYDOHRVEGLDIVHGU&FRXJDOGRLQRYWDEHXHSVURY
(7: 6WUHQJWK DW 6WUDLQ GDWDVHW GXH WR QRQ QRUP

7KH 2IIVHW 6WUHQJWK &7' DQG&7'5 75'7' DDQG (67'WU
GDWDVHWV PHW DSRROHOQXLDIHWPHUQ WRUGLIRLHG &9 DSSURDFK

7KHUH ZHUH WZR RXWOLHUV (77KH ODU2UIJVHHWW6WUDHQX
GDWDVHW ZDV EDQWRKFWRXOLH DQIGR URKEHR7(KH FRQGLWLL YDOX
IRXU RI WKH (7: FRQGLWLRQ IRU 6WUHQJWK EDWFK6WURXDLQ
WKH (7: FRQGLWLRQ $OO RXWOLHUV ZHUH UHWDLQHG IRU

6WDWLVWLFV DQG EDVLV YDOXHVXUHHG LQ Y7DEOH ORHU VWDQGJWW
GDWD DV PHDVXUHGKGH LDQV 7DEOHDOVHXUHGHG DWDQG %% EDVLVLP YDOXHV
JUDSKLFDOO\ IRU WKH 2IIVHW 6RUUHFWHG6KWUHQJWK DWLRQ)LJX
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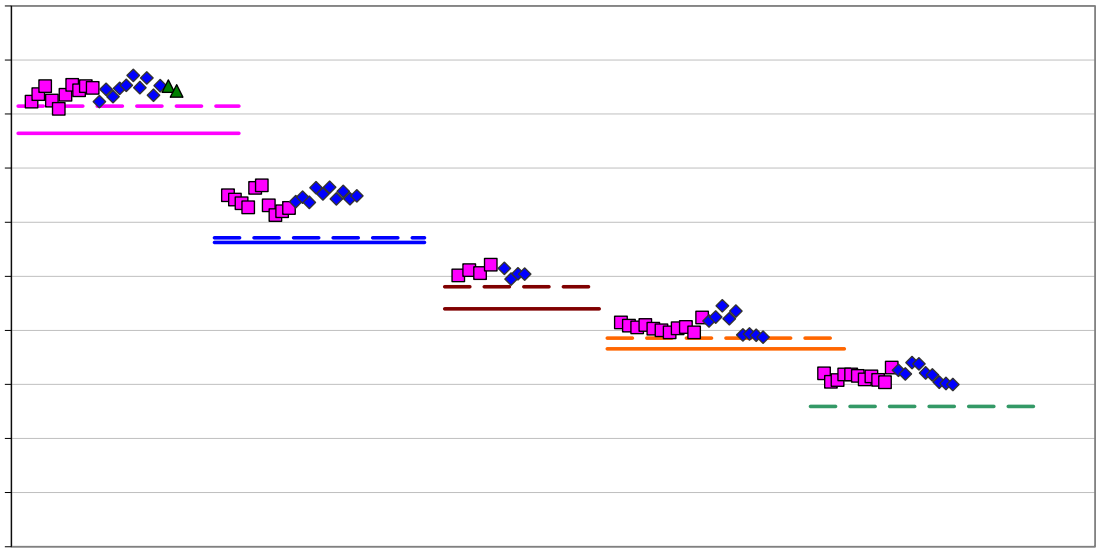

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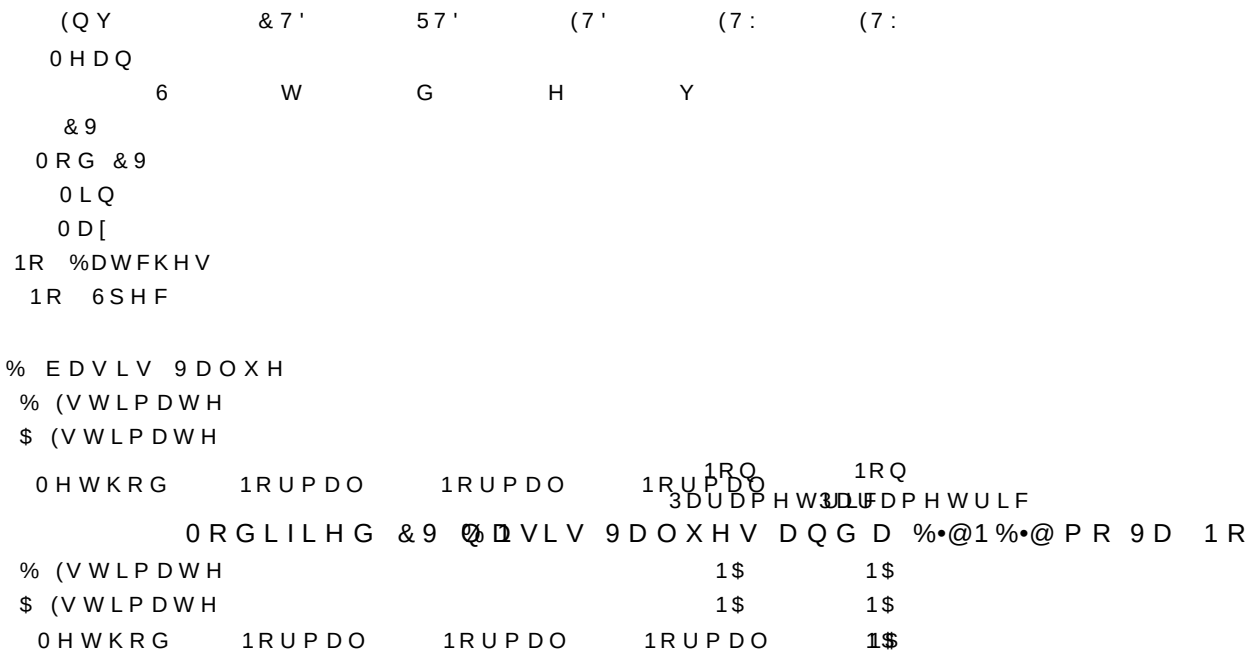
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/DPLQDWH 7HVW 5HVXOWV 6WDWLVWLFV %DVLV

0DQ\ RI WKH ODPLQDWH WHVWV ZHUH ... [overlapping text]
LQVXIILFLHQW GDWD WR SURGXFH ... [overlapping text]
HVWLPDWHV DUH SURYLGHG :KHQ ... [overlapping text]
PXOWLSOH HVWLPDWHV DUH SURYLGHG

8VLQJ WKH $6$3 SURJUDP WR SRRO ... [overlapping text]
&9 YDOXHV IURP WKLV SURJUDP DUH SURYLGHG
7KH /DPLQD 9DULDELOLW\ PHWKRG ... [overlapping text]
&9 RI WKH /& GDWDVHWV PRGLILHG ... [overlapping text]
(7: FRQGLWLRQV GXH WR WKH ODUJH &9 RYHU RI

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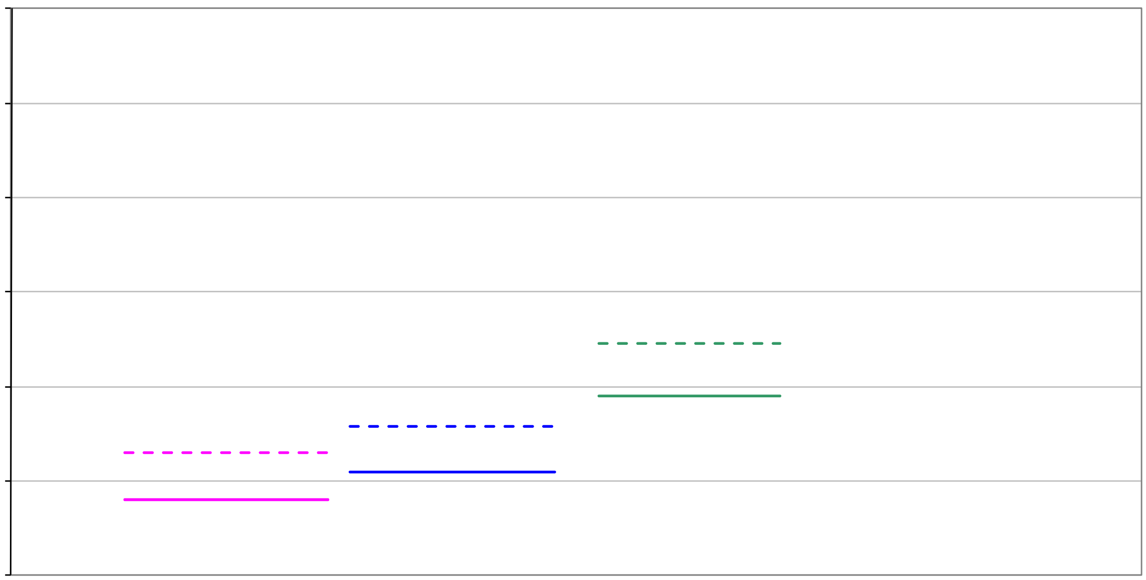
2SHQ +ROH 7HQVLRQ 2+7 2+7 2+7 3URSHUWL

4XDVL ,VRWURSLF 2SHQ +ROH 7HQVLRQ 2+7

7KH RQO\ WHVW IDLOXUH LV IRU WKH WKRUHU PDQRULP]HG L(7: WGHDW
WKH QRUPDOLW\ RI WKH SRROHG QRUPDOL]HG GDWD VHW FDLQV EHFDXVH RI SRWHQWLDO
RXWOLHUV 7KH (7: HQYLURQPHQW ZDV WKH RQO\ FRQGLWLRQ WKDW IDLOHG WKH VWDQGDUG
GDWD WR SURGXFH D SXEOLVKDEOH DQG VHW L% EDVLV YDOXHV ZDV XVHG
HVWLPDWHV DUH SURYLGHG 6WDWLVWLFDO WHVW UHVXOWV DUH JLYHQ LQ WKH WDEOH
7KH QRUPDOL]HG GDWD % HVWLPDWHV DQG % EDVLV ILJXUH



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³6RIW´ 2SHQ +ROH 7HQVLRQ 2+7

2QO\ WKH &7' HQYLURQPHQW KDV VXIILFLHQW GDWD % EDV
 * 7KH 57' DQG (7: GDWDVHWV HDFK KDV
ZHUH SUHSDUHG IRU WKRVH HQYLURQPHQWV XVLQJ WKH OD

7KHUH ZHUH WZR RXWOLHUV LQ WKH &7' GDWD
RXWOLHU LQ ERWK WKH QRUPDOL]HG DQG DV PHDVXUHG
EDWFKHV 7KH VHFRQG RXWOLHU ZDV RQ WKH KLJK VLGH
PHDVXUHG GDWD DQG RQO\ DIWHU
DQDO\VLV

7KH &7' GLG QRW SDVV WKH QRUPDOLW\ WHVW
RYHUULGH RI WKH QRUPDOLW\ WHVW

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2SHQ +ROH &RPSUHVVLRQ 2+& 3URSHUWLHV

4XDVL ,VRWURSLF &RPSUHVVLRQ 2+&

7KHUH LV LQVXIILFLHQW % EDVLV GDWD WR FKDUDFWHUL]H WKH VWUHQJWK &0+
WKH (7: HQYLURQPHQW VR RQO\ HVWLPDWHV DUH SURYLGHG
SUHSDUHG XVLQJ WKH ODPLQD YDULDELOLW\ PHWKRG
'DUOLQJ N VDPSOH WHVW IRU EDWFK WR EDWFK
UHTXLUHG WR FRPSXWH EDVLV YDOXHV
WKH 57' GDWD GLG SDVV WKH $'. WHVW
PRGLILHG &9 YDOXHV DUH SURYLGHG

7KHUH ZHUH WZR RXWOLHUV LQ WKH
GDWD RQO\ 2QH RXWOLHU ZDp

/DPLQDWH 2SHQ +ROH &RPSUHVVLRQ 2+& 6WUHQJWK NVI

%DVLV 9DOXHV DQG 6WDWLVWLFV

1RUPDOL]HG $V 0HDVXUHG

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% EDVLV 9DOXH						
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0HWKRG	1RUPDO	/90	1RUPDO	1RUPDO	/90	1RUPDO

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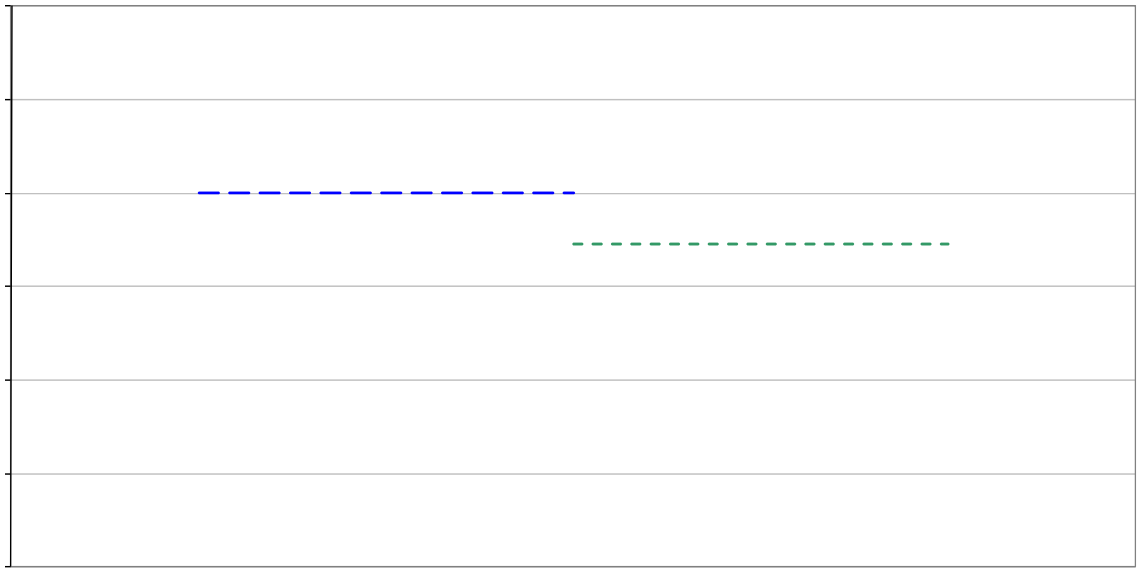
³+DUG´ 2SHQ +RLH &RPSUHVVLRQ 2+&

7KHUH LV LQVXIILFLHQW %EDVHOLQH GDWD DYDLODEOH WR GHWHUPLQH &0+ WKH 57' HQYLURQPHQW VR RQO\ HVWLPDWLRQ SUHSDUHG XVLQJ WKH ODPLQD YDULDEOH YDOXHV DUH JLYHQ IRU 2+& VWUHQJWK GDWD DQG EWKH YDOXHV DUH VKRZQ JUDSKLFDOO\ LQ)LJXUH



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8QQRWFKHG 7HQVLRQ 8187 3URSHUWLHV

4XDVL ,VRWURSLF 8QQRWFKHG 7HQVLRQ 817

7KH QRUPDOL]HG 57DVGVDWWKHG$QGHRWRSQ 'UOLQJ N VDPSOH
YDULDWLRQ 7KDVHPHDQHTXLKDWGRWFR1P2SXSWHEDYRGVWYDOX
PD\ UHVXOW LQ RYHUO\ FRQVHUGYDWLGRRHVDWVDWKHQRWH

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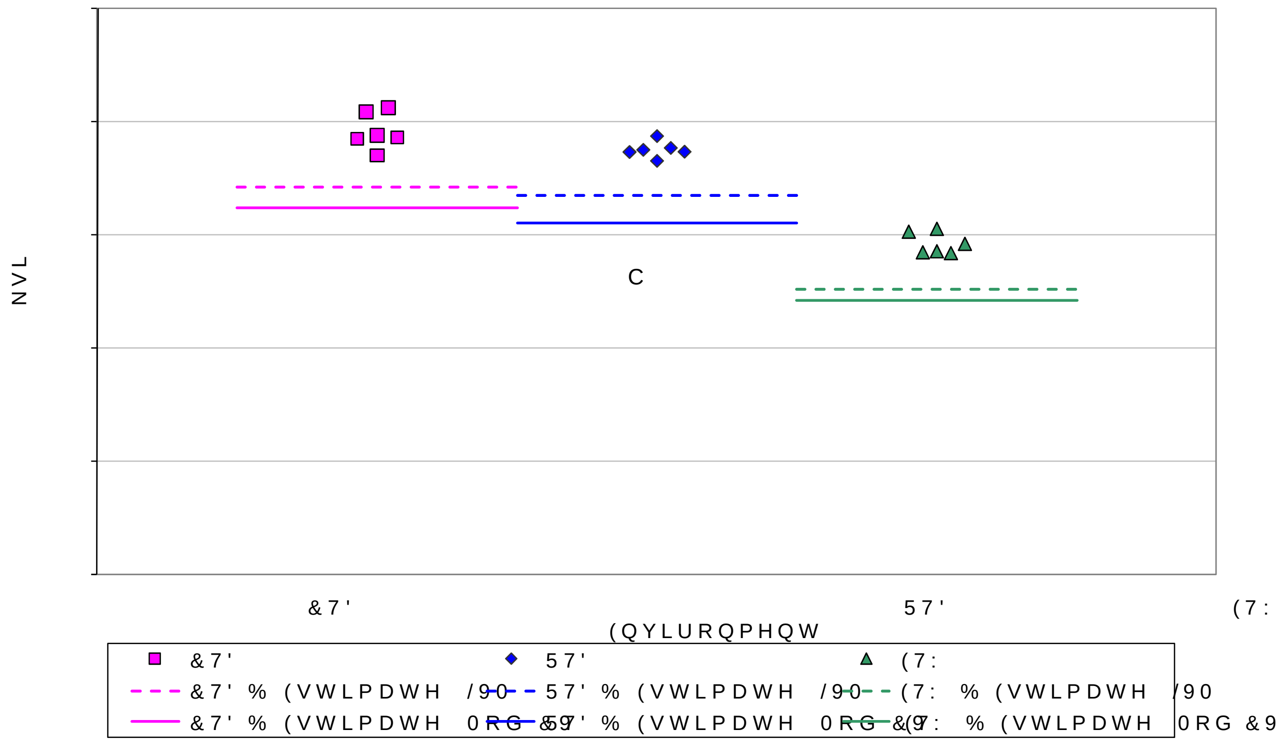
³6RIW´ 8QQRWFKHG 7HQVLRQ 817

7KLV SURSHUW\ KDG GDWD IURP ZDVQ LQ VRXUFH EHQWFK GDWD
% EDVLV YDOXHV WKDW PHHW VWDWLVWLFDO UHTXLUHPHQWV
ODPLQD YDULDELOLW\ PHWKRG 7KH UHVW ZHUH HVWLPDWHG RU EH VWDWLVWLFDO
IRU 817 VWUHQJWK GDWD LQ 7DEOH LQ 70DEOH QRUPDOL]HG
GDWD % HVWLPDWH XVH VDQGH \$ VKRZQ JUDSKLFDOO\ LQ

$&* 070 ,0 JVP 5:
6RIW 8QQRWFKHG 7HQVLRQ 817 6WUHQJWK QRUPDO



)LJXUH %DWFK SORW IRU 817 VWUHQJWK QRUPDOL]H

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/DPLQDWH 8QQRWFKHG 7HQVLRQ 817 6WUHQJWK NVL
%DVLV 9DOXHV DQG 6WDWLVWLFV

	1RUPDOL]HG			$V 0HDVXUHG		
(QY	&7'	57'	(7:	&7'	57'	(7:
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%DVLV 9DOXHV DQG RU (VWLPDWHV

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0HWKRG	/90	/90	/90	/90	/90	/90

0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWHV

% (VWLPDWH						
0HWKRG	/90	/90	/90	/90	/90	/90

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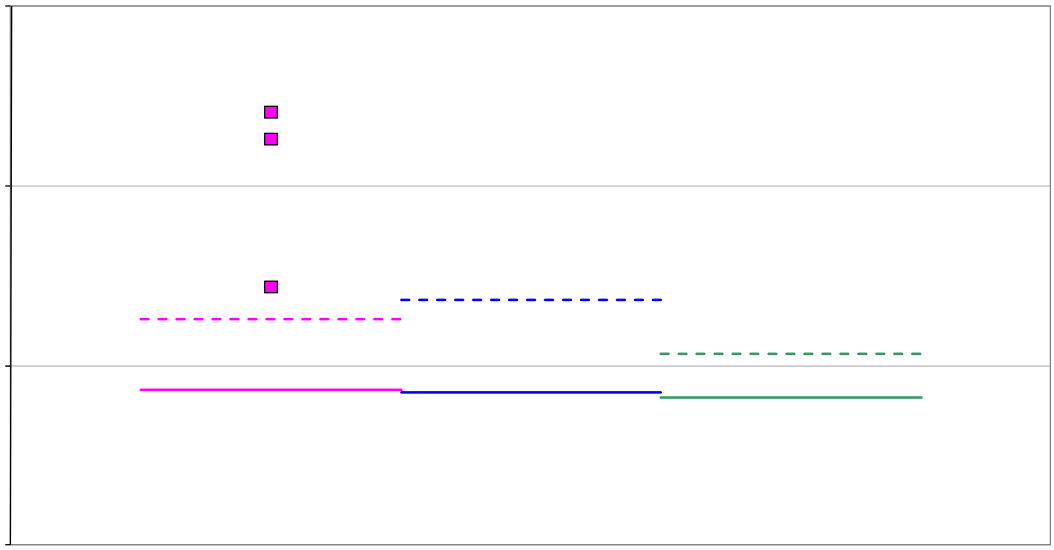
³+DUG´ 8QQRWFKHG 7HQVLRQ 817

7KLV SURSHUW\ KDG GDWD IURPZDRVQLOQVRXQHFEHQWFKGDWD
% EDVLV YDOXHV WKDW PHHW VWZKHUHVWDQGDUGXV
ODPLQD YDULDELOLW\ PHWKRG 7KHEHWZHHQRUHRXOLQHGU&
ZDV UHWDLQHG IRU WKLV DQDO\VLJVLYHQDWRLVW1\ DVQGUEHD
7DEOH 0RGXOXV VWDWLVWLFV DUH JLYHQ LQ 7DEOH
EDVLV YDOXHUDSKHFDKORZ\QL Q)LJXUH



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	1RUPDOL]HG			$V 0HDVXUHG		
(QY	&7'	57'	(7:	&7'	57'	(7:
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0RGLILHG &9						
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1R %DWFKHV						
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%DVLV 9DOXHV DQG RU (VWLPDWHV						
% (VWLPDWH						
0HWKRG	/90	/90	/90	/90	/90	/90
0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWHV						
% (VWLPDWH						
0HWKRG	/90	/90	/90	/90	/90	/90

8QQRWFKHG &RPSUHVVLRQ 81&3URSHUWLHV

4XDVL ,VRWURSLF 8QQRWFKHG &RPSUHVVLRQ 81&

7KHUH LV LQVXIILFLHQW GDWD WR GHWHUPLQH 81& VR RQO\ HVWLPDWHV DUH SURYLGHG

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1R %DWKHV
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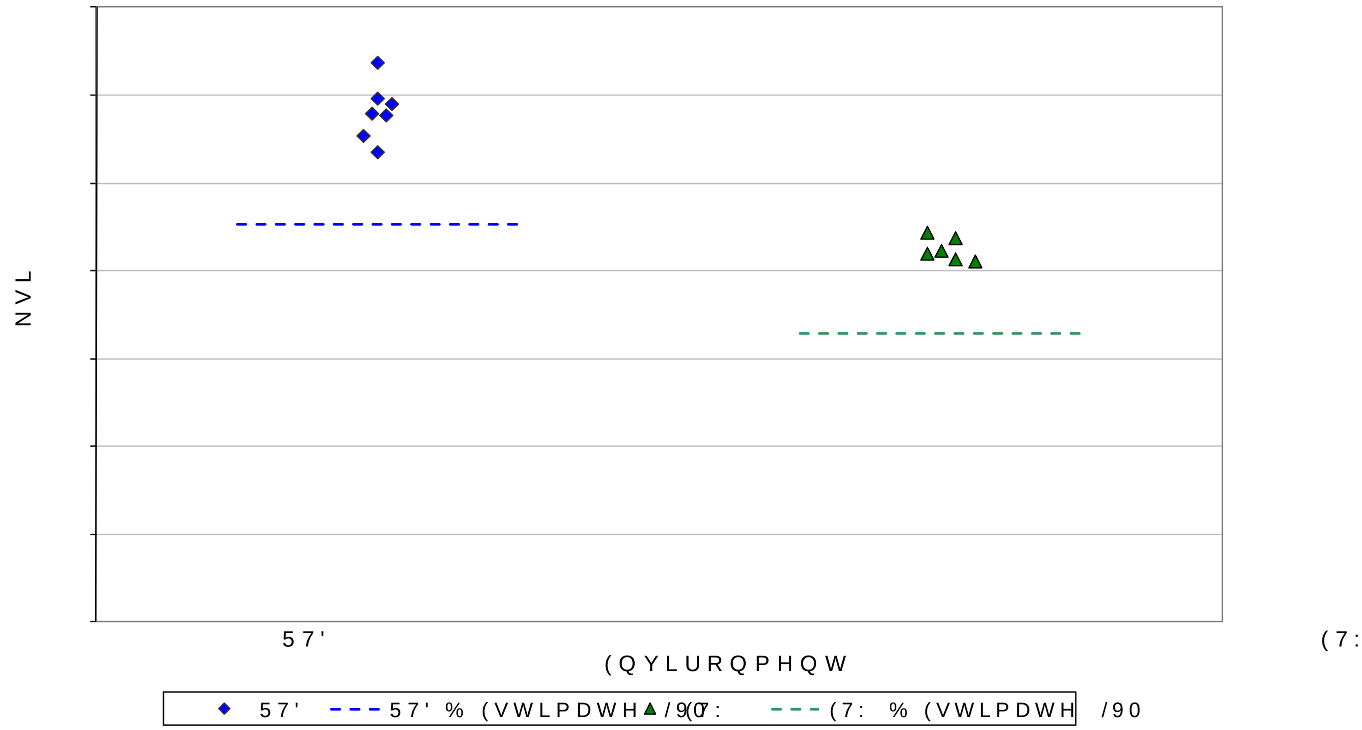
-DQXDU\

³6RIW´ 8QQRWFKHG &RPSUHVVLRQ 81&

7KLV SURSHUW\ KDG GDWD IURP ZDVQLQ VRXQIHFEHQWFKGDWD
% EDVLV YDOXHV WKDW PHHW VWZKHUHV SUHQSDUHUGG XV
ODPLQD YDULDELOLW\ PHWKRG 7QKGH EH VZLHVUYHDQRXHRVXWOOHHUJLY
VWUHQJWK GDWD LQ 7DEOH 0ERGHXOXV 7VKWHD QRUPDOL]HG
% HVWLPDWHV DUH VKRZQ JUDSKLFDOO\ LQ)LJXUH

$&* 070 ,0 JVP 5:
6RIW 8QQRWFKHG &RPSUHVVLRQ 6WUHQJWK QRUPDOL]



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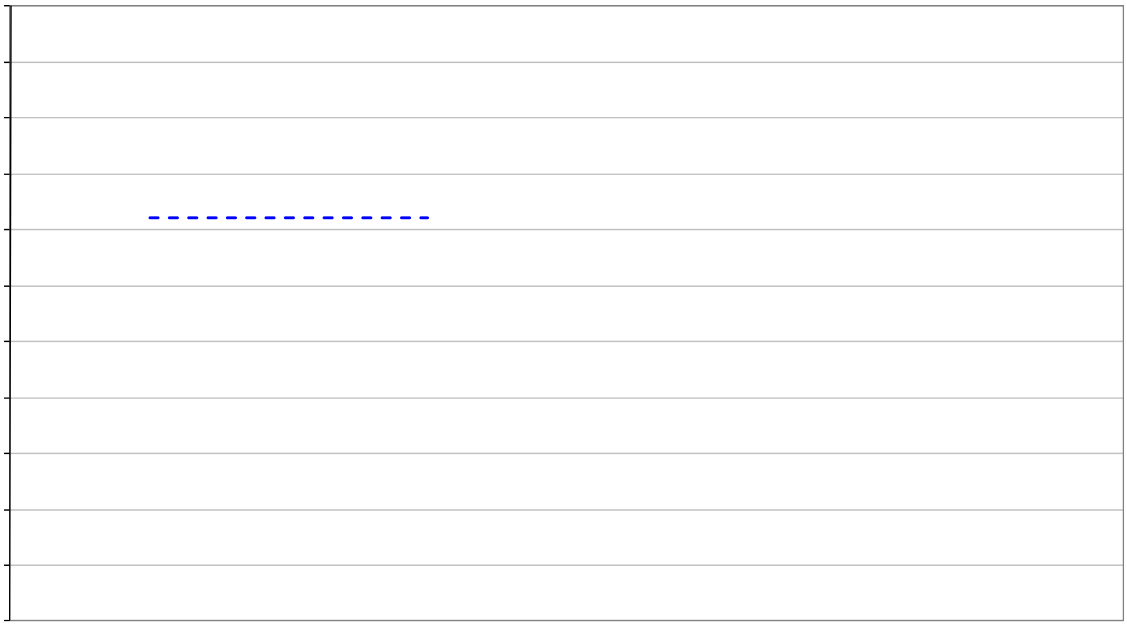
³+DUG´ 8QQRWFKHG &RPSUHVVLRQ 81&

7KLV SURSHUW\ KDG GDWD IURP ZDRVQLQQVRXQHFEHQWFKGDWD
% EDVLV YDOXHV WKDW PHHW VWZKHUHVWUHQSUDHUGGXV
ODPLQD YDULDELOLW\ PHWKRG 7QKGHEHVLVUYHQRXHRXWOHHJLY
VWUHQJWK GDWD LQ 7DEOH 0ERGHXOXV 7KWHQRVWLDEV]EG
% HVWLPDWHV DUH VKRZQ JUDSKLFDOO\ LQ)LJXUH



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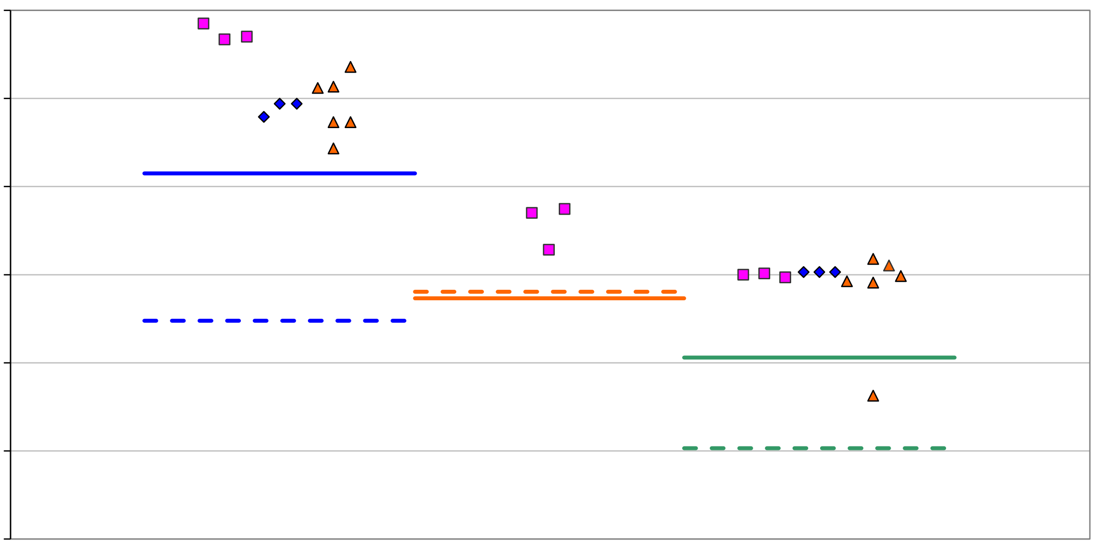
/DPLQDWH 6KRUW %HDP 6KHDU 6WUHQJWK 6%6

7KHUH LV LQVXIILFLHQW %6 GDWD WR DSSO\ WKH FXUUHQW DQG DUDP FRP &0+ 6%6 VR RQO\ HVWLPDWHV DUH SURYLGHG GLIIHUHQW HQYLURQPHQWV DV DSSURSULDWH IRU WKH G $QGHUVRQ 'DUOLQJ N VDPSOH WHVW IRU EDWFK WR FRPELQH WUDQVIRUP VR WKH GDWD DV 1RW $UH WHVW EDVLV VWDQGDUG UHVXOW LQ RYHUDOO YDULDQFH 7KH HYHQW EDVLV D VLQJOH GLVW QRQ SDUDPHWULF)RU WKH 2 PRGLILHG &9 UHVLGXDO PHWKRG WKH $'. WKH 57' HQYLURQPHQW DQG WKH IRU URRP HQYLURQPHQW FRPSXWH WKH PRGLILHG &9 EDVLV YDOXHV

7KHUH ZHUH WZR RXWOLHUV 2QH RXWOLHU ZDV LQ WKH RXWOLHU RQO\ IRU EDWFK WZR RXWOLHU ZLWKLQ 57: FRQGLWLRQ ,W ZDV DQ RXWOLHU IRU EDWFK WKUHH

6WDWLVWLFV DQG EDVLV YDOXHV DUH JLYHQ LQ 7KH GDWD DQG EDVLV YDOXHV DUH VKRZQ LQ)LJXUH

ExwSW5˜1¼ "R˜‰€ À–ÙŒ9



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/DPLQDWH 6KRUW %HDP 6KHDU 6%6 6WUHQJWK NVL
%DVLV 9DOXHV DQG 6WDWLVWLFV $V 0HDVXUHG

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%DVLV 9DOXHV DQG RU (VWLPDWHV

% (VWLPDWH			
$ (VWLPDWH		1$	
0HWKRG	129	/90	1RQ 3DUDPHWULF

0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWHV ZLWK 2Y

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)LOOHG +ROH 7HQVLRQ)+7 3URSHUWLHV

4XDVL ,VRWURSLF)LOOHG +ROH 7HQVLRQ)+7

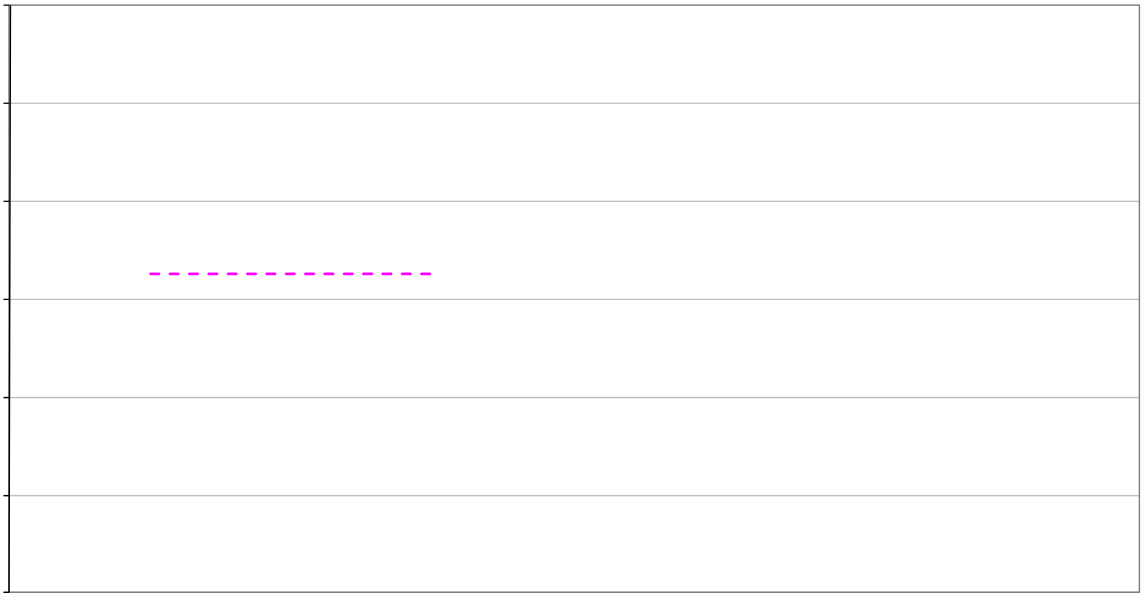
7KHUH LV LQVXIILFLHQW % EDVLV GDWD WR PHHW WKH DQG DW UHOHDVH RI &0+ WKLV GDWD 7KH 57' LQVXIILFLHQW VSHFLPHQV ZKLOH WKH GDWD IURP RQO\ WZR EDWFKHV IHUHLQ DW PHW WKRGH IRU HQYLURQPHQWV DV DSSURSULDWH IRU WKH GDWD DYDLODE

7KHUH ZDV RQH RXWOLHU LQ WKH GDWD 7KH WHVW ZDV DQ RXWOLHU RQO\ IRU EDWFK DQG QRW IRU WKH &7' 6WDWLVWLFV DQG EDVLV YDOXHV DUH JLYHQ LQ 7DEOH)+7 DQG HVWLPDWHV DUH VKRZQ JUDSKLFDOO\ LQ)LJXUH

-DQXDU\

³6RIW´)LOOHG +ROH 7HQVLRQ)+7

7KLV SURSHUW\ KDG GDWD IURP ZDRVQLQ VRXQHFEHQWFKGDWD
% EDVLV YDOXHV WKDW PHHW VWZKHUHVSUHQGHUGXV
ODPLQD YDULDELOLW\ PHWKRG 7KXHUHG Z&D7V RQWDRXHWOL,HU
ORZ VLGH DQG ZDV UHWDLQHG IRUVWYKDOXHQDDUVLVY6HQD
VWUHQJWK GDWD LQ 7DEOH 7KH QRUPDOL]HG GDWD D
)LJXUH



/DPLQDWH)LOOHG +ROH 7HQVLRQ)+7 6WUHQJWK NV %DVLV 9DOXHV DQG 6WDWLVWLFV						
	1RUPDOL]HG			$V 0HDVXUHG		
(QY	&7'	57'	(7:	&7'	57'	(7:
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%DVLV 9DOXHV DQG RU (VWLPDWHV						
% (VWLPDWH						
0HW K RG / 9 0						
0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWHV						
% (VWLPDWH						
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7DEOH 6WDWLVWLFDO DQG %DVLV 9DOXHV 6WUHQJWK GDWD

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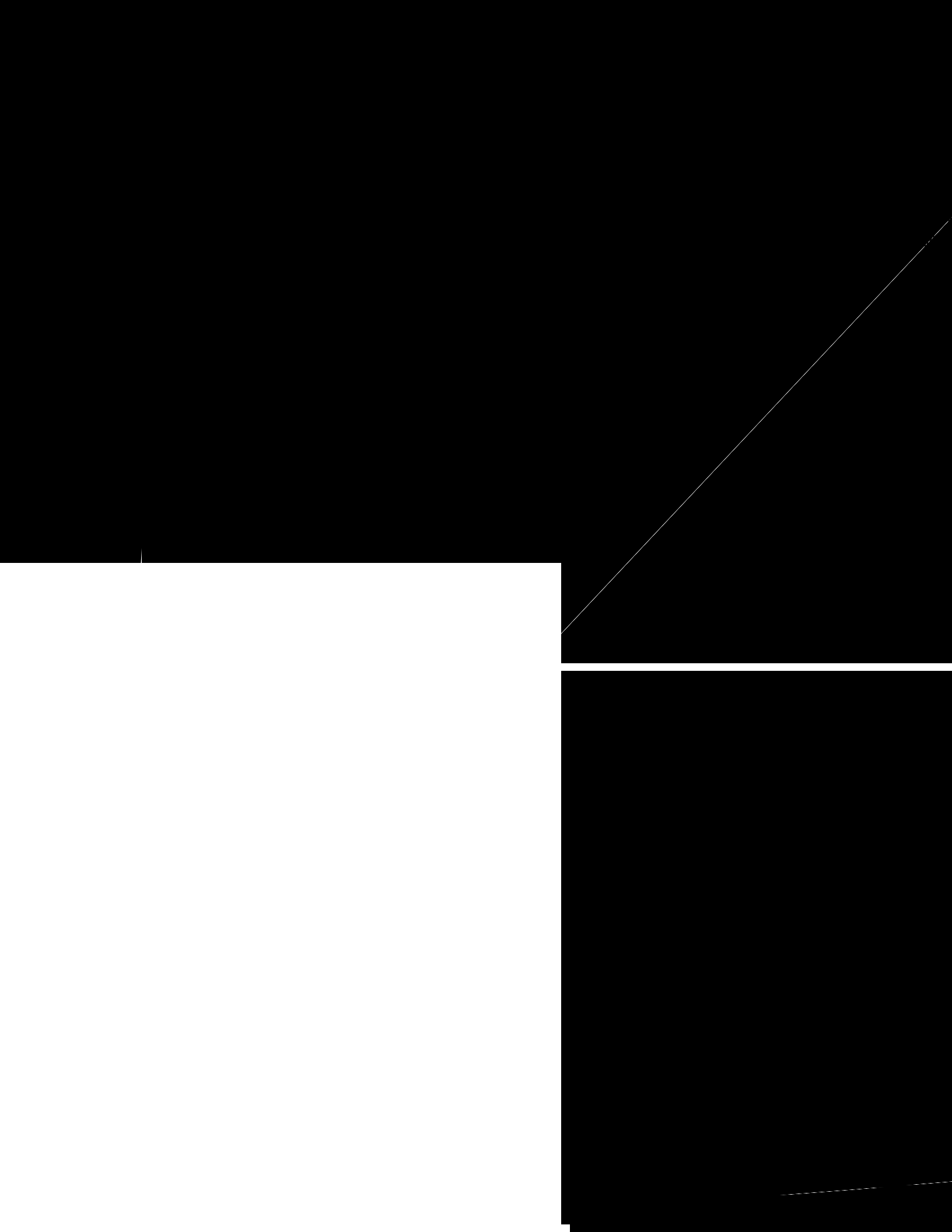
³+DUG´)LOOHG +ROH 7HQVLRQ)+7

7KLV SURSHUW\ KDG GDWD IURP RQH RU PRUH HQYLURQPHQWV
IRU HDFK HQYLURQPHQW VR WKHUH ZDV D VLQJOH YDOXH
VWDQGDUGV RI &0+ * % HVWLPDWHG YDOXHV
ZDV RQH RXWOLHU 7KH ORZHVW YDOXH
DV PHDVXUHG GDWD ,W ZDV UHWDLQHG IRU WKLV DQDO\VLV



/DPLQDWH)LOOHG +ROH &RPSUHVVLRQ)+& 6WUHQJWK

%DVLV 9DOXHV DQG 6WDWLVWLFV

1RUPDOL]HG $V 0HDVXUHG

(QY	57'	(7:	57'	(7:
0HDQ				
6WGHY				
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0RGLILHG &9				
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1R %DWFKHV				
1R 6SHF				

%DVLV 9DOXHV DQG RU (VWLPDWHV

% EDVLV 9DOXH				
% (VWLPDWH				
$ (VWLPDWH	1$		1$	
0HWKRG	/90	1RUPDO	/90	1RQ 3DUDPHWULF

0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWH

% EDVLV 9DOXH	1$		1$	1$
$ (VWLPDWH	1$		1$	1$
0HWKRG	1$	1RUPDO	1$	1$

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³6RIW´)LOOHG +RLH &RPSUHVVLRQ)+&

7KHUH LV LQVXIILFLHQW %DWWHU\ &0+

/DPLQDWH)LOOHG +ROH &RPSUHVVLRQ)+& 6WUHQJWK

%DVLV 9DOXHV DQG 6WDWLVWLFV

1RUPDOL]HG $V 0HDVXUHG

(QY	57'	(7:	57'	(7:
0HDQ				
6	W	G	H	Y
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0LQ				
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1R %DWFKHV				
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%DVLV 9DOXHV DQG RU (VWLPDWHV

% (VWLPDWH				
$ (VWLPDWH	1$		1$	
0HWKRG	/90	129	/90	129

0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWHV

% EDVLV 9DOXH	1$		1$1$	
$ (VWLPDWH	1$		1$	1$
0HWKRG	1$	1RUPDO	1$	1$

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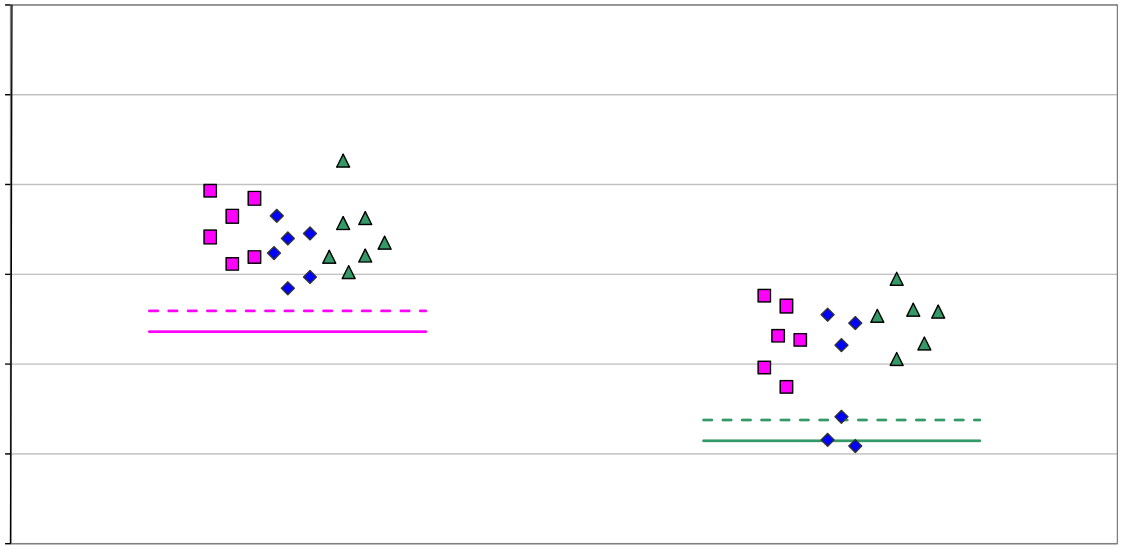
S U R J U D P Z D V X V H G W R F R P S X W H E D V L Y D O X H V 7 K H U Q G Z H R
R X W O L H U V 6 W D W L V W L F V D Q G E D W W L W W D E Q H W K D G E D W Y L Q 7
Q R U P D O L] H G G D W D D Q G W K H % E D \ L \ X U H O X H V D U H V K R Z Q



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/DPLQDWH 3LQ %HDULQJ 3% 2IIVHW 6WUHQJWK NVL

%DVLV 9DOXHV DQG 6WDWLVWLFV

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1R %DWFKHV

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%DVLV 9DOXHV DQG RU (VWLPDWH

% EDVLV 9DOXH				
$ (VWLPDWH				
0HWKRG	SRROHG	SRROHG	SRROHG	SRROHG

0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWHV

% EDVLV 9DOXH				
$ (VWLPDWH				
0HWKRG	SRROHG	SRROHG	SRROHG	SRROHG

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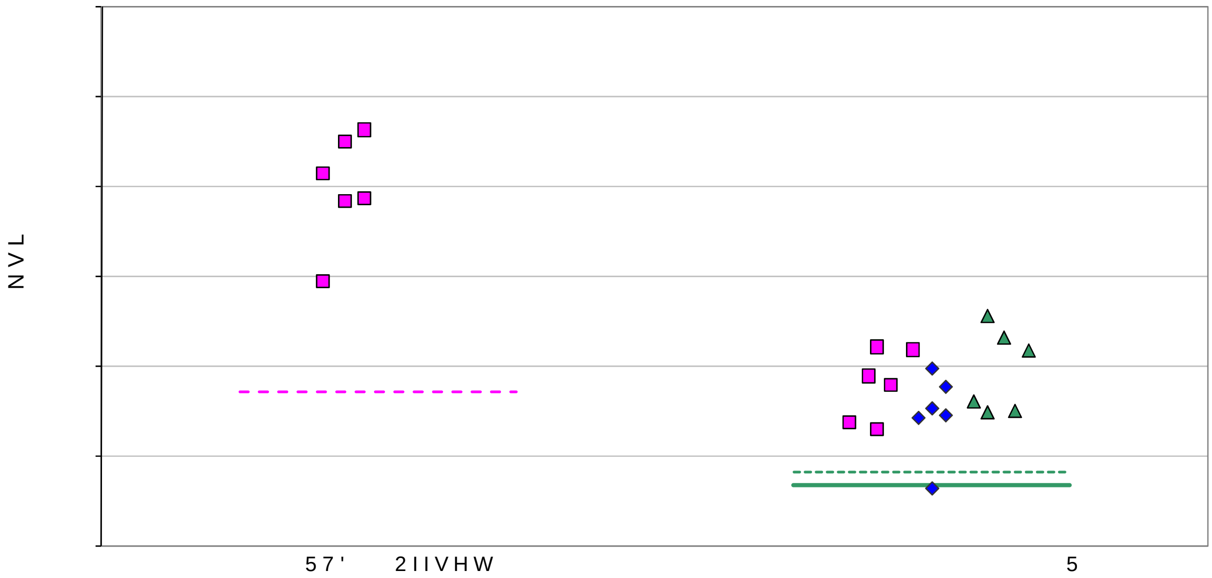
3LQ %HDULQJ 3%

7KH (7: GDWD PHHWV DOO UHTXLUHPHQWV IRU &0HQW *V SHFRP
IURP RQO\ RQH EDWFK %HWZHHQ SDUDPHWHU HVWLPDWHV EHWZHHQ SODWH WR SODWH DQG DYD
PHWKRG 7KHUH ZHUH QR VLJQLILFDQW GLIIHUHQFHV EHWZHHQ VSHFLPHQV RI DOO WKH DUR IIV
GDWD LQ 7DEOH 7KH QRUPDOL]HG GDWD IRU HDFK PDWHULDO
VKRZQ JUDSKLFDOO\ LQ)LJXUH



/DPLQDWH 3LQ %HDULQJ 3% 2IIVHW 6WUHQJWK NVL
%DVLV 9DOXHV DQG 6WDWLVWLFV

	1RUPDOL]HG		$V 0HDVXUHG	
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1R 6SHF				
%DVLV 9DOXHV DQG RU (VWLPDWHV				
% EDVLV 9DOXH				
% (VWLPDWH				
$ (VWLPDWH	1$		1$	
0HWKRG	/90	1RUPDO	/90	1RUPDO
0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWHV				
% EDVLV 9DOXH	1$		1$	
$ (VWLPDWH	1$		1$	
0HWKRG	1$	1RUPDO	1$	1RUPDO

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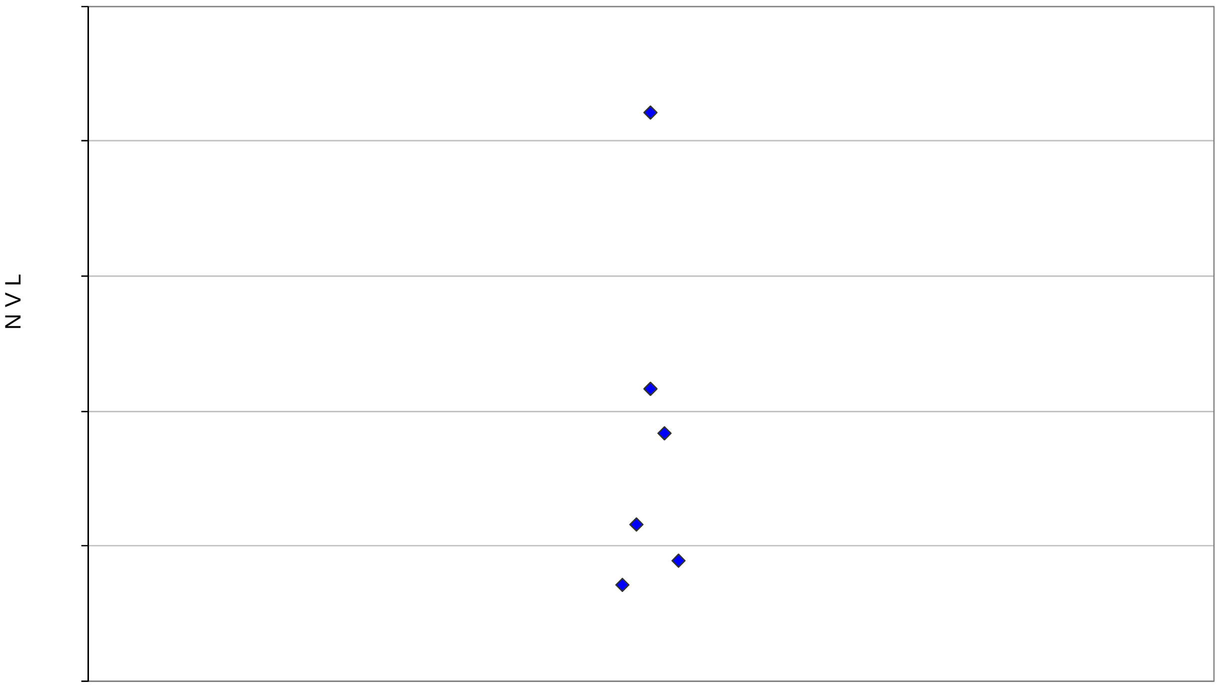
&RPSUHVVLRQ $IWHU ,PSDFW 'DWD

%DVLV YDOXHV DUH QRW FRPSXWHG IRU W
QRUPDOL]HG DQG DVWUHQJWK UHGXFWLRQ GDWD &$, LQ 7DEOH QRUPDOL]HG GDWD
JUDSKLFDOO\ LQ)LJXUH

$&* 070 ,0 JVP 5:
&RPSUHVVLRQ $IWHU ,PSDFW 6WUHQJWK QRUPDOL]HG



)LJXUH %DWFK SORW IRU &$, VWUHQJWK QRUPDOL]HG

&RPSUHVVLRQ $IWHU ,PSDFW &$, 6WUHQJWK NVL 6WDWLVWLFV		
57' (QY	1RUPDOL]HG	$V 0HDVXUHG
0HDQ		
6WGHY		
&9		
0RGLILHG &9		
0LQ		
0D[		
1R %DWFKHV		
1R 6SHF		

7DEOH 6WDWLVWLFV IRU &$, 6WUHQJWK GDWD

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2XWOLHUV

2XWOLHUV ZHUH LGHQWLILHG DFFRUGLQJ LVQHJF WLRQ WKH VWDQGDUG I
DFFRUGDQFH ZLWK WKH JXLGHOLQHV G$HQYHRXRWVSHLGHU LQP D&0+E
RXWOLHU LQ WKH QRUPDOL]HG G$WDSHFWLPHQV P DWH EHVXUHG RX
WKH EDWFK RQO\ EHIRUH SRROLQJ WKH RWKHU VDPSOHV
 DIWHU SRROLQJ WKH WKUHH EDWFKHV ZLWKLQ D FRQGLWL

$SSUR[LPDWHO\ RXW RI VSHFLPHQV GZHUH WKH HQWLUH
YDULDWLRQ RI WKLV GDWDVHW 7KLV LV WR QRWH WKDW HYLGHQFH LQYHVWLJDWHG
WKH H[WUHPH REVHUYDWLRQ 2XWOLHUV UHPDLQ HG YHU\ DQWLFL
WKH\ LQMHFW ELDV LQWR WKH FDOFXODWHG VSHFLPHQ PHDQ WDWD
WKH FRQGLWLRQ DQG LQ ERWK WKH FRQWURO DQG FRPSDUDWLYH
PRUH OLNHO\ WR KDYH D VSHFLILF FDXVH WKDQ DQG RQH RWKHU
6SHFLPHQV WKDW DUH RXWOLHUV RQO\ IRU WKH EDWFK

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