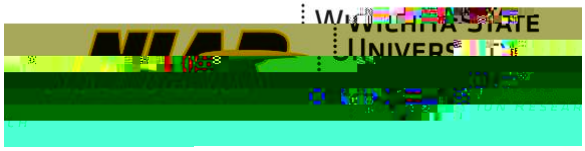

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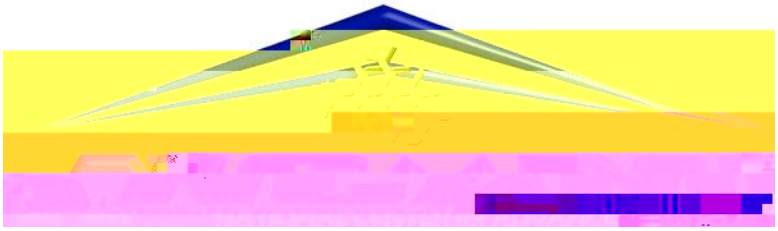

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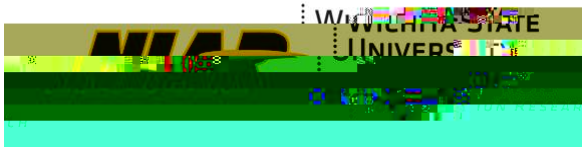

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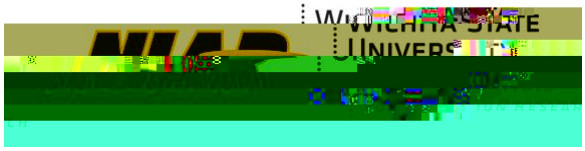

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8QQRWFKHG &RPSUHVVLRQ 81&3URSHUWLHV

- 4XDVL ,VRWURSLF 8QQRWFKHG &RPSUHVVLRQ 81&
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6 W G ' H Y $S = \sqrt{\frac{1}{n}\sum_{i}^{n} X_i - \bar{X}}$ (T X D W L R Q

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$$b_B \quad f \quad \frac{}{\sqrt{f}} \quad \frac{}{f} \quad \frac{}{f\sqrt{f}} \qquad (\text{TXDWLRQ}$$

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

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

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

0RGLILHG &RHIILFLHQW RI 9DULDWLRQ

7KH FRHIILFLHQW RI YDULDWLRQ GLVSHUVLRQ PHDVXUH IRU WKH IROORZLQ

$$CV \quad \begin{cases} -\infty & \text{if } CV \\ CV & R \text{ if } G\ CV\ L \quad I\ d(\text{TXLDWLRQ} \quad G \\ \infty & \text{if } CV\ t \end{cases}$$

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

&9 LV XVHG WR FRPSDUH GLVSHUVLRQ DURXQG GLIIHUHQW PHDQV

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

7R FRPSXWH WKH SRROHG VWDQGDUG GHYLDWLRQ EDVH

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

7KH $ EDVLV DQG % QEGDHVLWWKEHODXVHVXEPSOLQJ&RQQRWWKRSH DRG
FRPSXWHG E\ UHSODFLQJ 6 ZLWK 6

7UDQVIRUPDWLRQ RI GDWD EDVHG RQ 0RGLILHG &9

,Q RUGHU WR GHWHUPLQH ZRUNLQHV SDWWKHWKEXQGDHUQWKWLDFVWXHPSWLP
PRGLILHG &9 WKH GDWD PXVW EH HWDUQVIRUPLHGWXHFKDWPKHD
VWDQGDUG GHYLDWLRQ RI WUDQVIRUPHGLGEDWDDQGGDEGWGH

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- D Q X D U \

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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
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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 \

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$$OSL \frac{}{e^{\text{ADQ}\ \text{AD}}} \quad AD \quad \frac{\S}{\sqrt{n}\copyright} AD \quad \cdot \quad (TXDWLRQ$$

7KLV 26/ PHDVXUHV WKH SUREDELOLW\ RI REVHUYLQJ DQ
H[WUHPH DV WKH YDOXH FDOFXODWHG IURP WKH GDWD LQ RXU
,I 26/ ! WKH GHDUWHG LVVXHUHQLVHGWRPDFKLQHOHDUQLQJ

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

/HYHQH¶V WHVW SURFHGXUHDQDO\WLFDOO\HQVXUHVWKDWLWLV
VDPSOH PHGLDQV 7KH DEVROXWHGDWDOHYLDWLRIWKHVHGL
HDFK GDWDMDyYDyOXHQ) WHVW LV WKHQ SHUIRUPHGRQ GDV
DV IROORZV

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

,I WKLV FRPSXWHG) VWDWLVWLFWLKVHO)HGVLVWKDEXWKLRQF
QXPHUDWRU DQG Q N GHQRPLQDWRHUGHJUHHVRIHHGRP
GDWD LV QRW UHMHFWHGDWWELHLQWHUSUHWRIWKHUFRDWLR
LV XVHG WR FKHFNQZKHWKLWURGLPHQVGEHFSQRRLOWLGQ)VRVK
LQIRUPDWLRQ RQ WKLV SURFHGXUH VHH UHIHUHQFH

67$7

7KLV VHFWLRQ FRQWDLQV WKH GHWXDLHOW LQWKH FSHFXLWV

7KH EDVLF GHVFUWSKWLPYH[LPXPQRWPLHG UHVLGXDO 015 WH
$QGHUVRQ 'DUOLQJ .EDDWFSKOYHDWHPEWLDRVWZLDWKH$WSK3H±VDHH VH
DQG

2XWOLHUV PXVW EH GLVSRVLWLRQVXOEHMRU7HKHFKUHFWLQWVDQ
$QGHUVRQ 'DUOLQJ NVWPSOHDS$W.FK7HTXLDOHQF\ PXVW EH
SDVVHV WKH $'. WRVWLDWKHGLWKHUDEXWLRQ LV GHWHUPLQH
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WKDW PHHW WKH0HHTX*LUHPHQVR\WRHFKHEW XWKHGDVXPSV
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'LVWULEXWLRQ 7HVWV

,Q DGGLWLRQ WR WHVWLQJ IRU QRUPDOLW\ WHVWV VKRXOG DOV
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7 K H W Z R S D U D P H W H U X W H E Q X O O F R Q V W U L E X W L R Q I X Q F W L R Q G H W H U P L Q H V W K H F R P S X W D W L R Q
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UHIHUHQFH

1RQSDUDPHWULF%DVLV 9DOXHV IRU VPDOO VDPSOHV

7KH +DQVRQ .RRSPDQV FRQVWDQWV UHODWLQJ DR%UEDVLV YDOX
VDPSOH VL]HV QRW H[FHHGLQJ DQGVOSHVEDWLKDQDOXHV7KHRU
UHTXLUHV WKH DVVXPSWLRQ WKDW WKH REVHUYDWLRQV DU
WKH ORJDULWKPHRGLWKHUEXWRWORQLXQFWLRQSWERQFWLRQV
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ZKHUHL[V WKH ODUJHVLW GDWDVDPSOHWKDWHDVRQDEOHGW GDWD YDOX
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WKH Y$DFFXUHUNVSRQGLQJ WR WKH VDPSOHY YDO]HXQH SQE7DEOHVKHD
DFFRUGLQJ WR WKH VWDQGDUGV RI&YOH EDW*FKWHVHUHSUXHVWW
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UHTXLUHPHQWV 7KH VXPPDU\ WDEOHV SURYLGH EDVLS\OH
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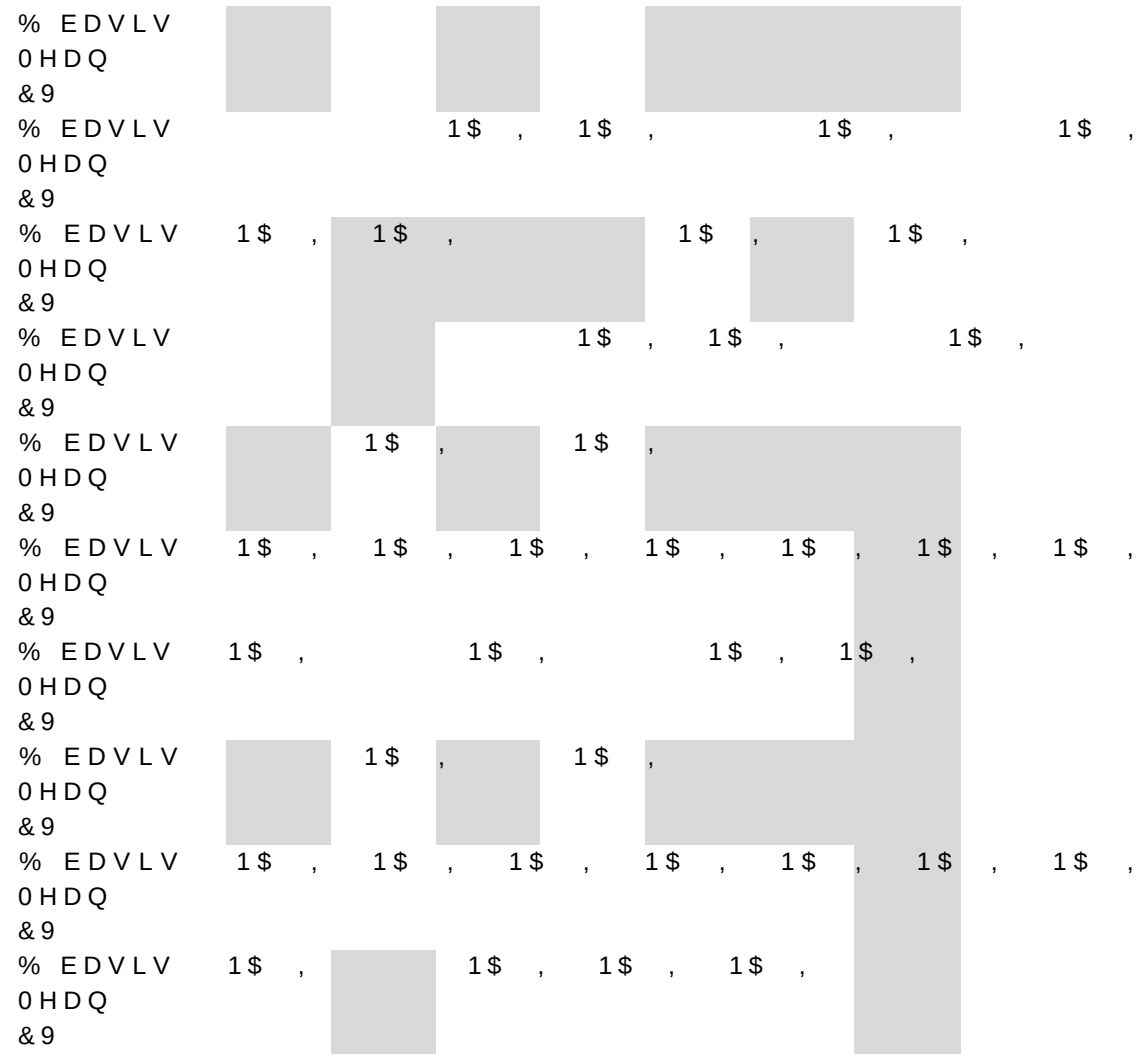

1RWHV 7KH PRGLILHG &9 % EDVLV YDOXH LV UHFRPPHQGHG ZKHQ DYDLOD
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/DPLQD DQG /DPLQDWH 6XPPDU\ 7DEOHV

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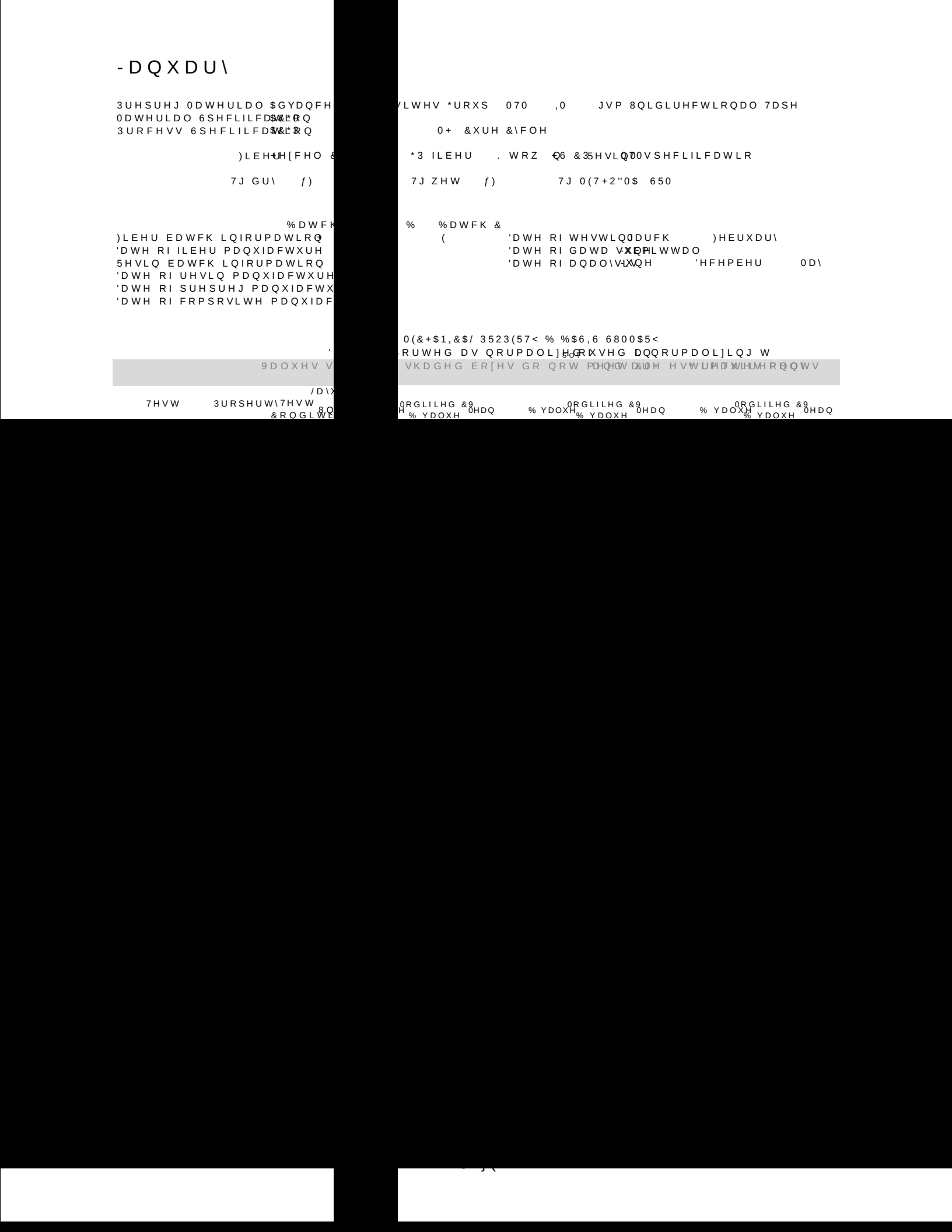
5HVLQ EDWFK LQIRUPDWLRQ ;;* '& ;;* '% *9 <
'DWH RI UHVLQ PDQXIDFWXUH
'DWH RI SUHSUHJ PDQXIDFWXUH
'DWH RI FRPSOLWH PDQXIDFWXUH WR

'DWH RI WHVWLQJ 0DUFK WR)HEUXDU\ WR
'DWH RI GDWD VXEPLWWDO
'DWH RI DQDO\VLV -XQH 'HFHPEHU 0D\



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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

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/RQJLWXGLQDO ž 7HQVLRQ 3URSHUWLHV /7

7KH ORQJLWXGLQDO WHQVLRQ VWUHQJWKSVHEDUHHQRPSXDWHG
VSHFLILHG LQ VHFWLRQ 7KHXUHZHUHDQRYDOOXHVUZH
E\ SRROLQJ DFURVV HQYLURQPHQWVLYHQDVWLFHQDJQG
DQG IRU WKH PRREGXHDXV G7DKWHGDQWD DQG WKH % E

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7KH ORQJLWXGLQDO FRPSUHVVLRQ PRUHQHQJWKVSDHFLPHQV
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E\ SRROLQJ DFURVV HQYLURQPHQWV +RZHYHU WKHUH Z
UHTXLUHPHQWV RI &0HWKRGV RE SDWWHUQ E\ XHG DU

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

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&RPSUHVVLRQ GDWD FRXOG EH SRRUO\ DIIHFWHG E\ WKH
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7KHUH ZHUH QR RXWOLHUV XWHRGU E\WSHRRWOLQJ DD
HQYLURQPHQWV 6WDWLVWLFV DQG GEDWDVLYQD7DXEHDUHDJQ
PRGXOXV GDWD LQ 7DEOH 7KH QYRUFXDHVLDHUGH GVRWZDQDJQC
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JXLGHOLQHV UHTXLUHG XVLQJ WKH SE1D2WSFKHQVDOWKLW L:LWFR
HVWLPDWH $OO GDWDVHWV SDVVHG DSKSHURDFWHZDW DISHU
PRGLILHG &9 EDYLGWHGY DORXGHIVHDUFRXSDGRQVRWDGEXHSURY
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GDWDVHW ZDV EDQWRKWROXLHDQGRWKEHR7KH FRQGLWLY DOX
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WKH (7: FRQGLWLRQ $OO RXWOLHUV ZHUH UHWDLQHG IRU

6WDWLVWLFV DQG EDVLV YDOXHVXUDHUGH LQ Y7DQE OHU VWDHQJW
GDWD DV PHDVXUHKGH LDQV 7PDHEDVHXUHGHGDQG % EDVWLLP DWDO XHV
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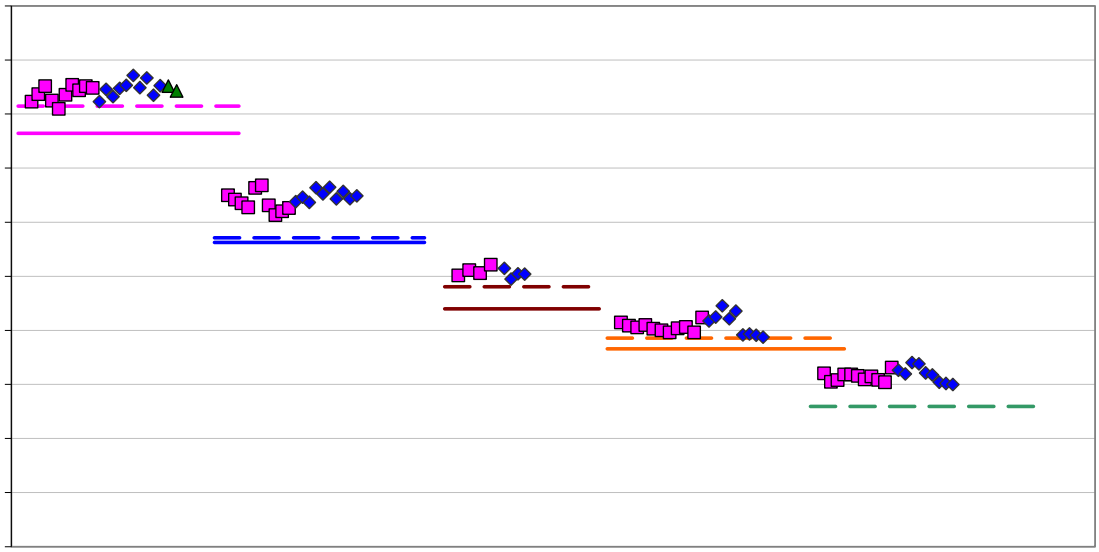

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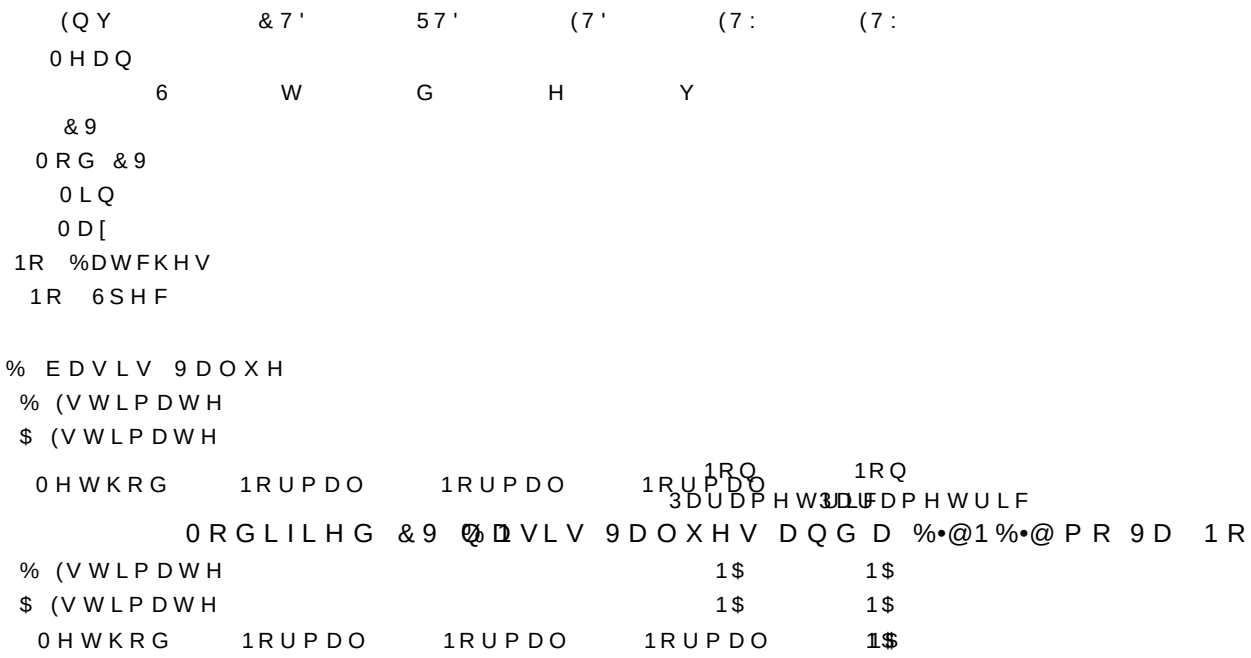
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0DQ\ RI WKH ODPLQDWH WHVWV ZHUH SHUIRUPHG LQ DFFRUGDQFH ZLWK RQH
LQVXIILFLHQW GDWD WR SURGXFH D YDOLG &YDOXH 7KHVH WHVWLQJ
HVWLPDWHV DUH SURYLGHG :KHQ SRVVLEOH RYHUODSSLQJ GDWDVHWV
PXOWLSOH HVWLPDWHV DUH SURYLGHG

8VLQJ WKH $6$3 SURJUDP WR SRROV D FUHGLW VPRRWKHG
&9 YDOXHV IURP WKLV SURJUDP DUH SURYLGHG
7KH /DPLQD 9DULDELOLW\ PHWKRG SURYLGHV VXSHULRU
&9 RI WKH /& GDWDVHWV PRGLILHG WKH &9 7KLV DQDO
(7: FRQGLWLRQV GXH WR WKH ODUJH &9 RYHU RI

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

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7KH RQO\ WHVW IDLOXUH LV IRU WKH WQHUQDOOLF]HG L(W\ WGHDW
WKH QRUPDOLW\ RI WKH SRROHGRGPHWQDWVHWDLQV EHFFSHRSRVODEGO
RXWOLHUV 7KH (7: HQYLURQPHQW ZQJWKHREQDWFKL[KVDSVHELQF
GDWD WR SURGXFH D SXEOLVKDEOHL% EDKVLSRYDOHXGH GDXWD
HVWLPDWHV DUH SURYLGHG 6WDRWL2VWLFVWDEHQJJDWKVIGVDWDOL
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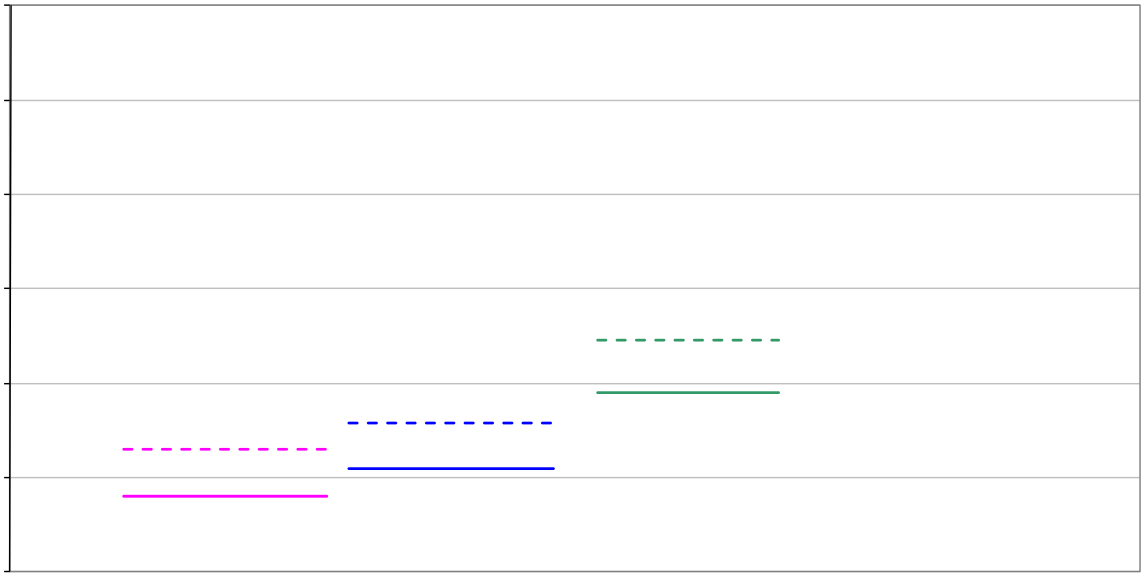

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2QO\ WKH &7' HQYLURQPHQW KDV VXIILFLHQW GDWD % EDV
* 7KH 57' DQG (7: GDWDVHWV HDFK KDG YLHOGHG RQH \HDU
ZHUH SUHSDUHG IRU WKRVH HQYLURQPHQWV XVLQJ WKH OD

7KHUH ZHUH WZR RXWOLHUV LQ WKH &7' GDWD RI 2EQDHWFXWOL
RXWOLHU LQ ERWK WKH QRUPDOL]HG UEQDQG VDPHEDVXSRHGOG
EDWFKHV 7KH VHFRQG RXWOLHU ZDV RQ WKH KLJH
PHDVXUHG GDWD DQG RQO\ DIWHU WKRURHUQJWKH WKWEHQ
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7KH &7' GLG QRW SDVV WKH QRUPDQJLW\ RXWOLHU7KLQ ZDV
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7KHUH LV LQVXIIRLGHQFLHQW%GDWDDVWRDSHXVWDQGDUGPHWK &0+
WKH (7: HQYLURQPHQW VR RQO\ HVWLPDWHV SUHSDUHG XVLQJ WKH ODPLQD YDOLGLQRW\SH-VWKRGH
'DUOLQJ N VDPSOH WHVW IRU EDWFKWKRE$1\SK PHDVLRGL
UHTXLUHG WR FRPSXWH EDVLV YDOXHV DZKLFK EDVLVHV DOOW
WKH 57' GDWD GLG SDVV WKH $'. WHVWV DQG LV FRQVLVWHQW
PRGLILHG &9 YDOXHV DUH SURYLGHG

7KHUH ZHUH WZR RXWOLHUV LQ WKLHJK2+V&L GHDWDWKHWK
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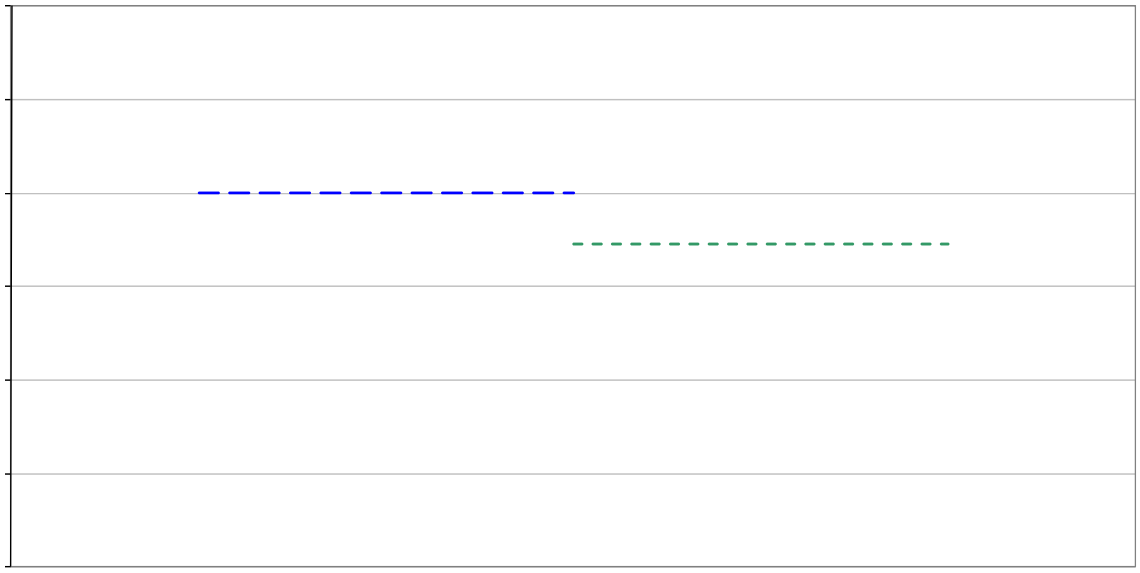
7KHUH LV LQVXIILFLHQW %EDVHOLQH GDWD DYDLODEOH WR GHWHUPLQH &0+ WKH 57' HQYLURQPHQW VR RQO\ HVWLPDWLRQ SUHSDUHG XVLQJ WKH ODPLQD YDULDEOH YDOXHV DUH JLYHQ IRU 2+& VWUHQJWK GDWD DQG EWKH YDOXHV DUH VKRZQ JUDSKLFDOO\ LQ)LJXUH



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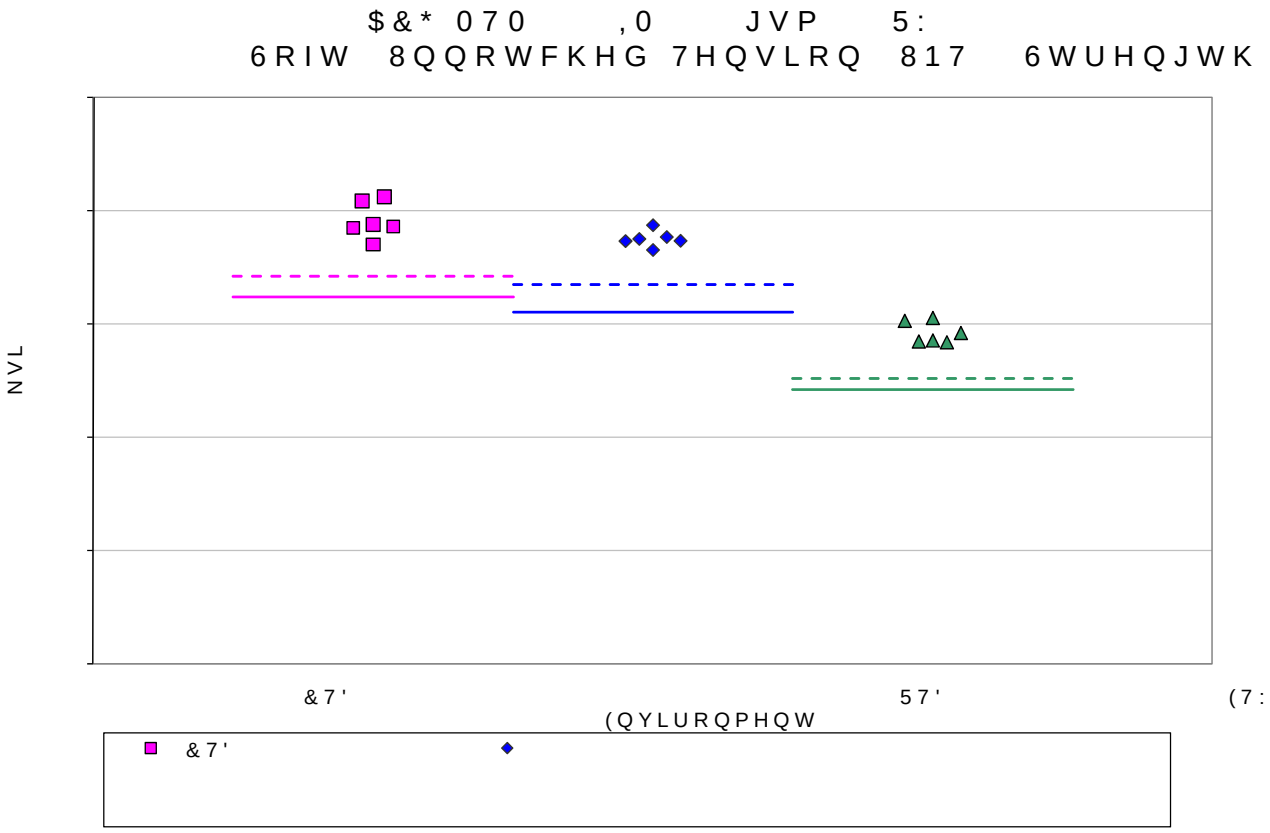
³6RIW´ 8QQRWFKHG 7HQVLRQ 817

7KLV SURSHUW\ KDG GDWD IURP ZDRVQLOQVRXQHHFEHDQWFKGDDWD
% EDVLV YDOXHV WKDW PHHW VWZKHUHVWLDHQSDUDHUGGXV
ODPLQD YDULDELOLW\ PHWKRG 7KHUHVWZLHPDWQHRGREXDWLVHYDU
IRU 817 VWUHQJWK GDWD LQ 7DEHOOH LQ 7DRECKXOXQVWDDWLLHV
GDWD % HVWLPDWHVDQGH %KERZQLJXDSKLFDO\ LQ



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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
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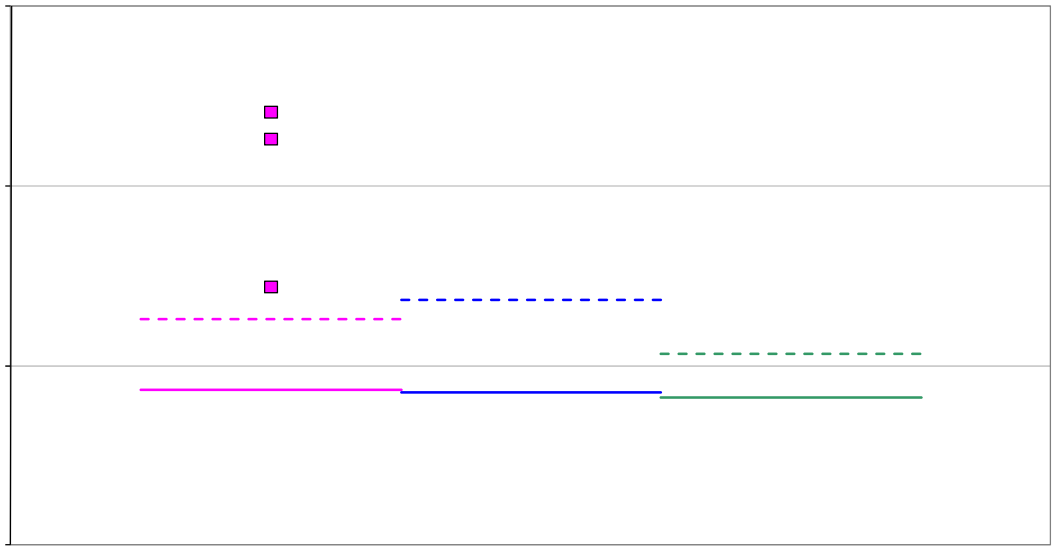

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8QQRWFKHG &RPSUHVVLRQ 81&3URSHUWLHV

4XDVL ,VRWURSLF 8QQRWFKHG &RPSUHVVLRQ 81&

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7KLV SURSHUW\ KDG GDWD IURP ZDRVQLQQ VRXQHFEHQWFKGDWD
% EDVLV YDOXHV WKDW PHHW VWZKHUHVWDUGSGDUGXV
ODPLQD YDULDELOLW\ PHWKRG 7QKGHEEHZLVUYHQRXRVWOHHJLY
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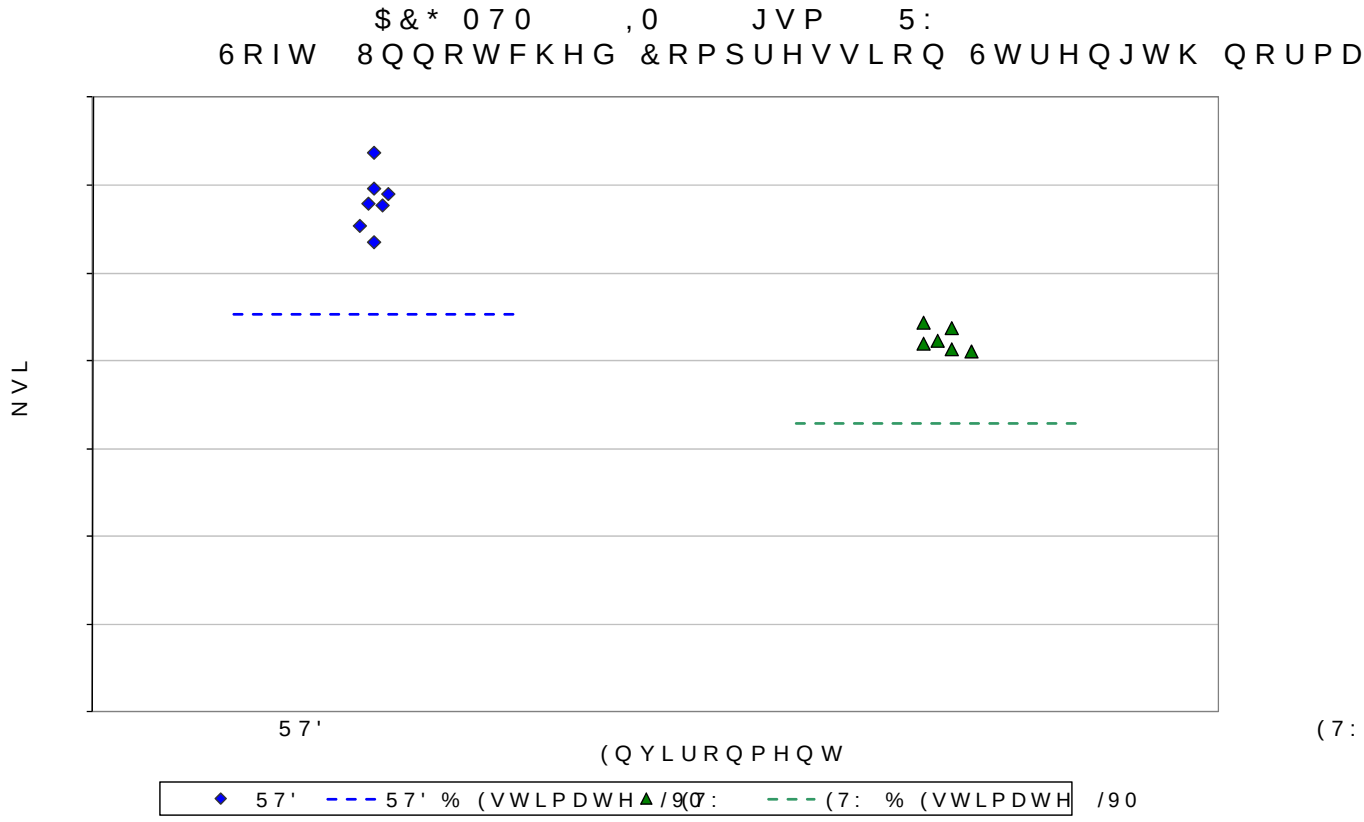

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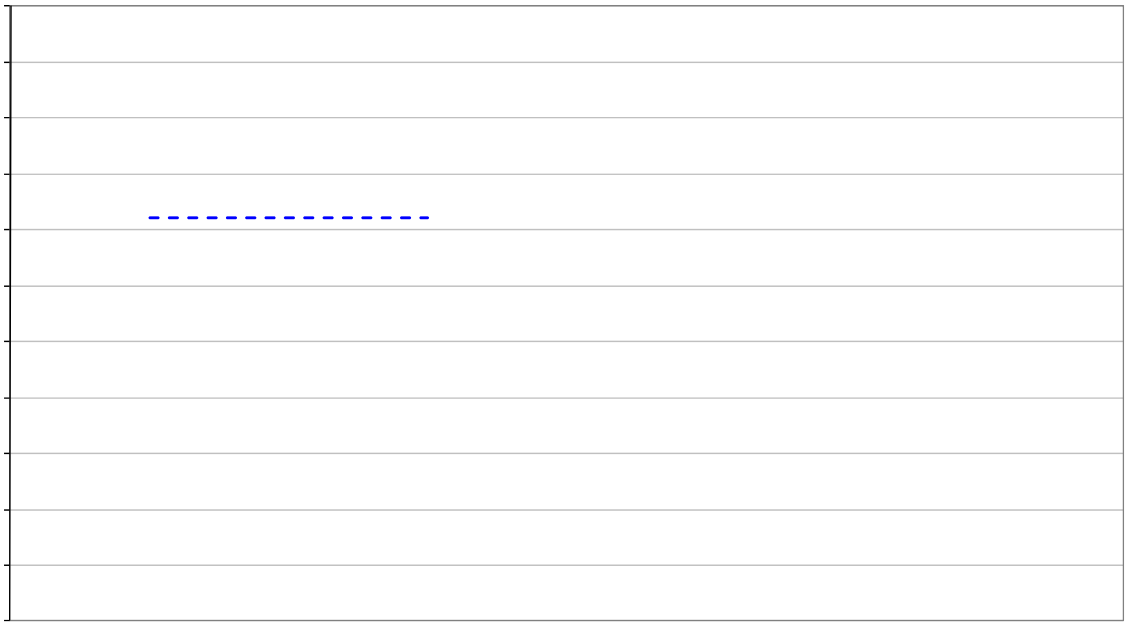

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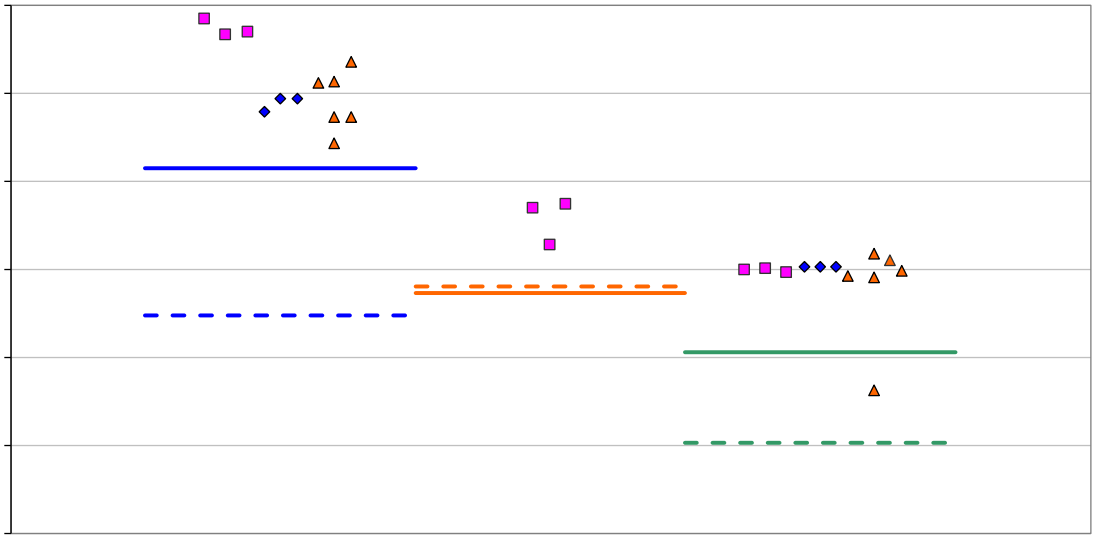
G L I I H U H Q W H Q Y L U R Q P H Q W V D V D S S U R S U L D W H I R U W K H G
$ Q G H U V R Q ' D U O L Q J N V D P S O H W H V W I R U W K H W R P R G H O W
W U D Q V I R U P V R W K D W G D W D V H W D Q G W K H U H V X O W L Q R Y H U
Q R Q S D U D P H W U L F W H V W R U E \ G L V W U L E X W L R Q I U H H P H W K R G
W K H 5 7 ' H Q Y L U R Q P H Q W D Q G W K H F R P S X W H W K H P R G L I I H G & 9 E D V L V Y D O X H V

7 K H U H Z H U H W Z R P D L Q R X W O L H U Z D Y H V L Q W K H R X W O L H U R Q O \ I R U E D W F K W Z R R U F R Q G L W L R Q , W Z D V D Q R X W O L H U U H P R Y H G I U R P W K H 5 W

6 W D W L V W L F V D Q G E D V L V Y D O X H V G D W D D Q G % K R W Q L F K 7 K H G D W D D Q G % K R W Q L F K

ExwSW5˜1¼ "R˜‰€ À–ÙŒE9



-DQXDU\

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

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1R %DWFKHV				
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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

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

)LOOHG +ROH 7HQVLRQ)+7 3URSHUWLHV

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

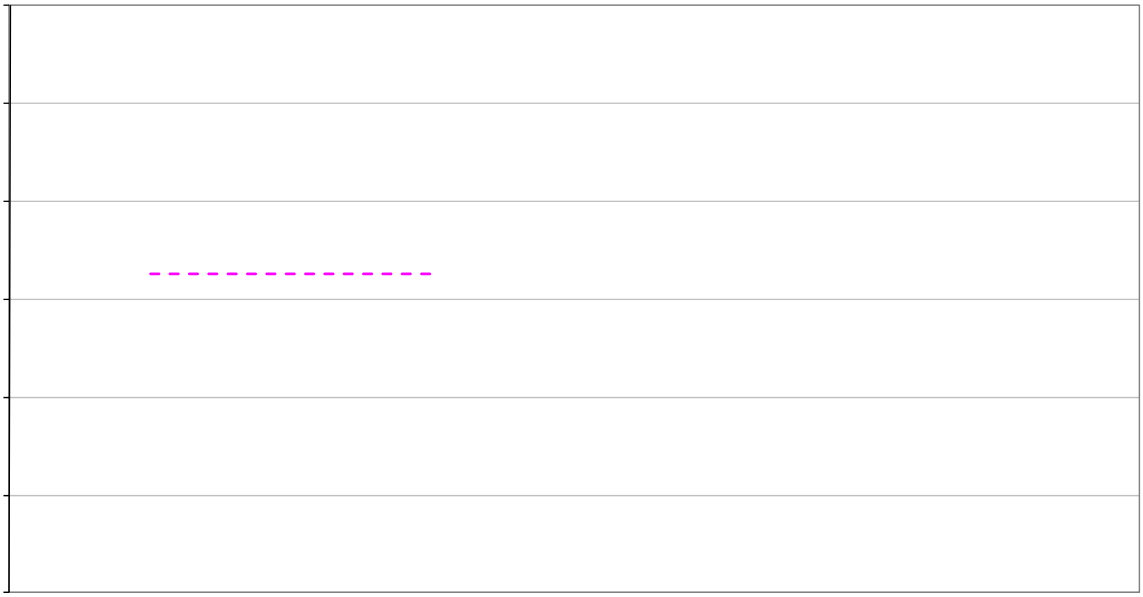
7KHUH LV LQVXIILFLHQW GDWD DYDLODEOH WR GHWHUPLQH &0+
WKLV GDWD 7KH 5HQQHVVHODHU ,QVWLWXWH RI 7HFKQRORJ\ ZKLOH WKH
GDWD IURP RQO\ WZR EDWFKHV (YDOXDWLQJ WKH VHQVLWLYLW\ RI WKH
HQYLURQPHQWV DV DSSURSULDWH IRU WKH GDWD DYDLODE

7KHUH ZDV RQH RXWOLHU RQO\ IRU EDWFK 7KH GDWD WKHQ ZDV
ZDV DQ RXWOLHU RQO\ IRU EDWFK DQG QRW IRU WKH &7'
6WDWLVWLFV DQG EDVLV YDOXHV 7DEOH 6XPPDU\ 7KH 6WDWLVWLF
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:
0HDQ						
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0RGLILHG &9						
0LQ						
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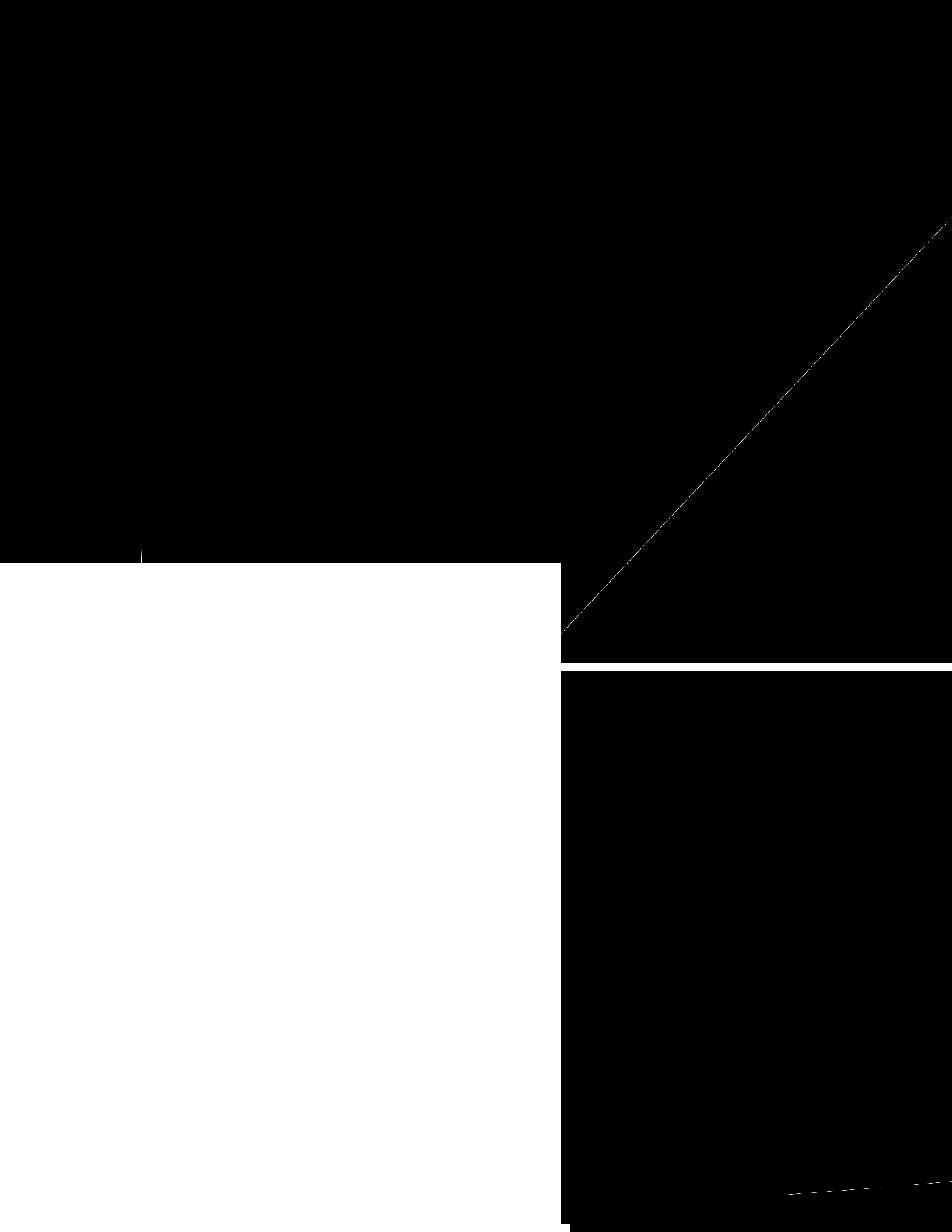
1R %DWFKHV						
1R 6SHF						
%DVLV 9DOXHV DQG RU (VWLPDWHV						
% (VWLPDWH						
0HW K RG / 9 0						
0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWHV						
% (VWLPDWH						
0HW K RG / 9 0						

7DEOH 6WDWLVWLFDO DQG %DVLV 9DOXHV 6WUHQJWK GDWD

-DQXDU\

³+DUG´)LOOHG +RLH 7HQVLRQ)+7

7KLV SURSHUW\ KDG GDWD IURP RQH XUVQSHHEDPWHQKV DIVEPOD
IRU HDFK HQYLURQPHQW VR WKHUH%ZEDVLQVXMDFLHQW GW
VWDQGDUGV RI &0+ * % HVWLPDWHG ZEUHDEULSDWHG WK
ZDV RQH RXWOLHU 7KH ORZHVW YDORXHEQWKKW&7'RDWDO
DV PHDVXUHG GDWD ,W ZDV UHWDLQHG IRU WKLV DQDO\VL



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

%DVLV 9DOXHV DQG 6WDWLVWLFV

1RUPDOL]HG $V 0HDVXUHG

(QY	57'	(7:	57'	(7:
0HDQ				
6WGHY				
&9				
0RGLILHG &9				
0LQ				
0D[				
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$

-DQXDU\

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:
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1R %DWFKHV				
1R 6SHF				

%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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(QY 57' (7: 57' (7:

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- D Q X D U \

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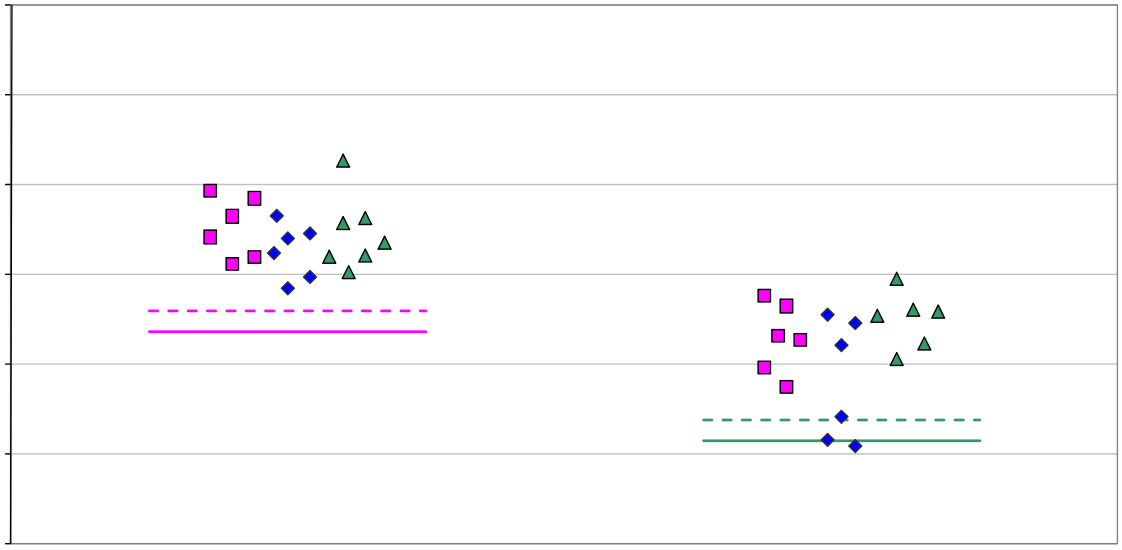
3 L Q % H D U L Q J 3 %

7 K H O D P L Q D W H E H D U L Q J S U R S H U W L H V Y L 3 % R Q P G H D Q W D V Z D V S
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



-DQXDU\

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

%DVLV 9DOXHV DQG 6WDWLVWLFV

1RUPDOL]HG $V 0HDVXUHG

(QY	57'	(7:	57'	(7:
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1R %DWFKHV

1R 6SHF

%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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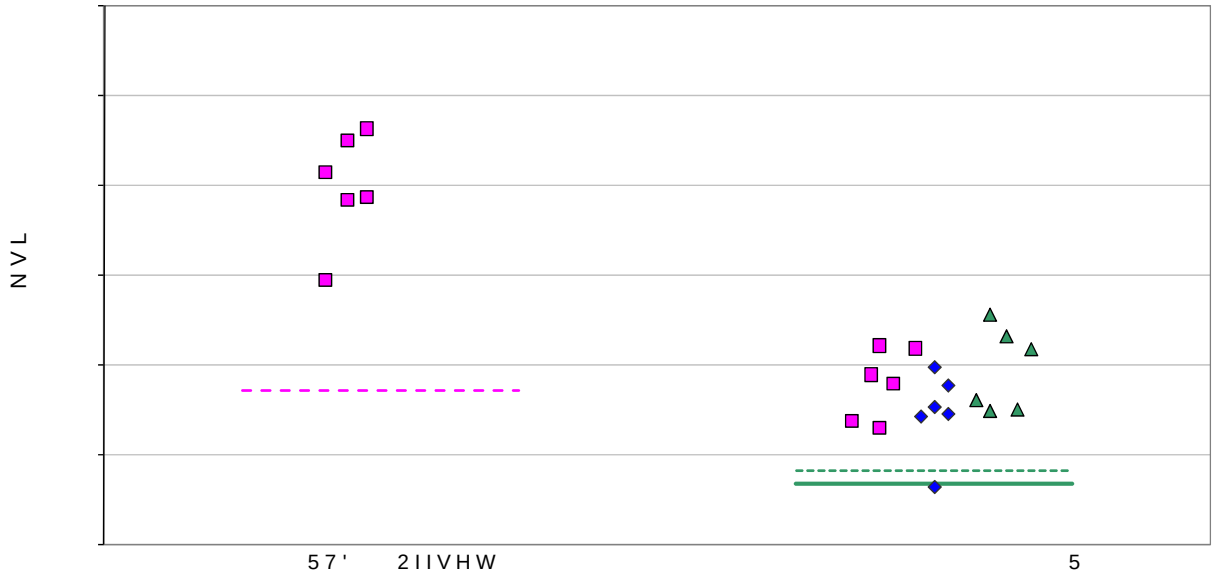
- D Q X D U \

(QY 57' (7: 57' (7:
0 H D Q

-DQXDU\

3LQ %HDULQJ 3%

7KH (7: GDWD PHHWV DOO UHTXLUHPHQWV RI &OHQW *VS)HRF
IURP RQO\ RQH EDWFK %ZHUHPDVWHLPDVWHUHGDVEHQUHWSKUHHSODFHGDXYD
PHWKRG 7KHUH ZHUHQRWUDWQRWRXFWOLQHGLVEYHQLVRYUDOWKHVDUHIIV
GDWD LQ 7DEOH 7KH QRUPDOLVJHGGXWDIR%UHWKHRWDWHI
VKRZQ JUDSKLFDOO\ LQ)LJXUH



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

	1RUPDOL]HG		$V 0HDVXUHG	
(QY	57'	(7:	57'	(7:
0HDQ				
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1R %DWFKHV				
1R 6SHF				
%DVLV 9DOXHV DQG RU (VWLPDWHV				
% EDVLV 9DOXH				
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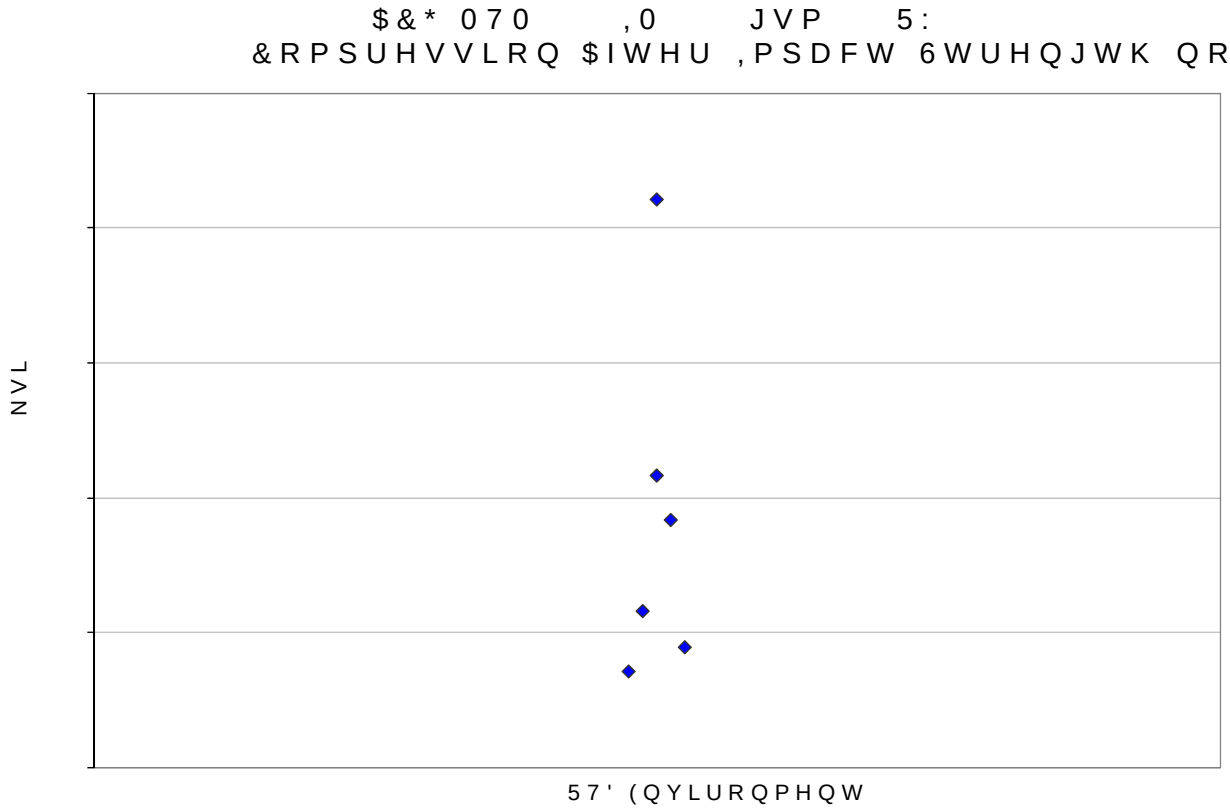
$ (VWLPDWH	1$		1$	
0HWKRG	/90	1RUPDO	/90	1RUPDO
0RGLILHG &9 %DVLV 9DOXHV DQG RU (VWLPDWHV				
% EDVLV 9DOXH	1$		1$	
$ (VWLPDWH	1$		1$	
0HWKRG	1$	1RUPDO	1$	1RUPDO

&RPSUHVVLRQ $IWHU ,PSDFW 'DWD

%DVLV YDOXHV DUH QRW FRPSXWHG IRU W
QRUPDOL]HG DQG DWWHQXDWHG &$, WRUTXH GDWD LQ WDEXODU DQG
JUDSKLFDOO\ LQ)LJXUH



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

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

7DEOH 6WDWLVWLFV RI &$, VWUHQJWK GDWD

2 X W O L H U V

2 X W O L H U V Z H U H L G H Q W L I L H G D F F R U G L Q J W R W K H V W D Q G D U G
D F F R U G D Q F H Z L W K W K H J X L G H O L Q H V G H V F U L E H G L Q W K L V
R X W O L H U L Q W K H Q R U P D O L] H G G H Q W L V W U \ E H I R U H S R R O L Q J
W K H E D W F K R Q O \ E H I R U H S R R O L Q J W K H W K U H H E D W F K R Q O \
D I W H U S R R O L Q J W K H W K U H H E D W F K R Q O \ I R U W K H E D W F K

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

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5 H I H U H Q F H V