

Mathematical Models for Complex Systems Optimization

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Abstract: LWKPDVVLYHSRSXODWLRQH[SDQVLRQDQGDID VWHFRQRPLF GHYHORSHPHQW LQ ODVW GHFDGH XUEDQ ODQG KDV LQFUHDVLRQJ\ H[SDQGHG DQGIRUPHGKJLQIRUPDOGHYHORSHPHQWVHUUWLRU\ LQ.DEXOFLW\7KLV SDSHULQYHVWLJDWHVLRQWHJUDWHGXUEDQLJDWLRQ WUHQQVLRQ.DEXOFLW\VLQFH WKHIRUPDWRQRIRWKHEDVLFVWUXFWXUHRIWKHSUH VHQWFLW\XVLQJ*,6DQG UHPRWH VHQLVLRQJ 7KLV VWXG\ H[SORUHV WKH VSDWLDQ DQG WHPSRUDO GLIIHUHQFHRI XUEDQODQGH[SDQVLRQDQGDQGGXVHF DWHJRULHVDPHQJ GLIIHUHQWVWLPPLQWHUYDOVDQGIURPWR LQ.DEXOFLW\XUWKHUPRUHWKHJRORIWKLVSDSHUL VWRXQGHUVWDQGWKH H[WHQW RI XUEDQ ODQG H[SDQVLRQ DQG WKH IDFWRUV GULYLQJ XUEDQ ODQG H[SDQVLRQLQ.DEXOFLW\ODQ\IDFWRUVOLNHSRSXODW LRQH[SDQVLRQWKH UHWXUQ RI UHIXJHHV IURP QHLJKERULQJ FRXQWULHV DQG VLJQLILFDQW HFRQRPLFJURZWKRIWKHFLW\DIHFVHGXUEDQODQGH[SDQVLRQ\$FURVV DOO WKH VWXG\DUHD XUEDQODQGH[SDQVLRQ UDWK SRSXODWLRQ H[SDQVLRQ UDWDHQGHFRQRPLFJURZWKUDWHKDYHEHHQFRPSDU HGWRDQDO\]HWKH UHODWLRQVWKLRSRIGULYLQJIRUFHVZLWXUEDQODQGH [SDQVLRQ%DVHGRQ XUEDQODQGGFKDQJHGWDGHWHFHGE\QWHUSUHW LQJODQGXVHPDSVLWZDV IRXQG WKDW LQ WKH HQWLUH VWXG\ DUHD WKH XUEDQ WHUULWUR\ KDV EHHQ H[SDQGHGE\WLPVHEHWZHHQDQG

Keywords:*,6 .DEXO FLW\ ODQG XVH XUEDQ ODQG H[SDQVLRQ XUEDQLJDWLRQ

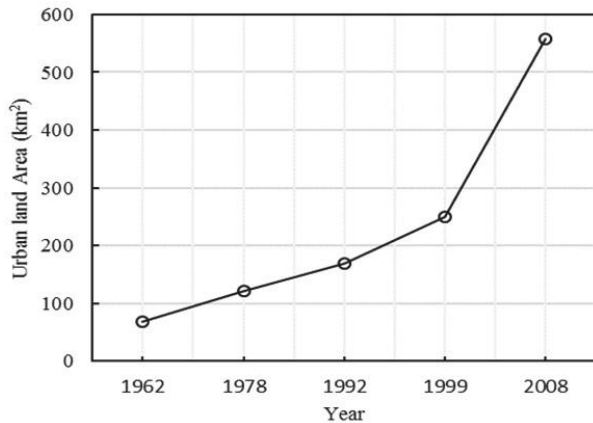
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\$1'XVHV\WVHPVDUHG\QDPLF8VHVH[SDQGDQGFQRW UDFW RULJLQDOO\ GHVLJQHG IRU DURXQG SHRSOH GXULQJ

SKPDG6KDULISKPDGL*UDGXDWHVWVXGHQWRI&LYLO(QJLQHH ULQJHSDUWPHQW 8UEDQDQGG7UDQVSRUWDWLRQSODQQLQJ7RNDL8QLYHUWLVW\ -DSDQSKRQH HPDLODKPDGKVDULIDKPDGL#JPDLOFRP <RVKLWDND.DMLWDSVVRFLDWHHSURIHVVURU'HSDUWPHQW RI&LYLO(QJLQHULQJ)DFXOW\ RI (QJLQHULQJ 7RNDL 8QLYHUWLVW\+LUDWVXND .DQJDZD -DSDQ

SKRQHID[HPDLO\RNDML#WRNDLXMS 7KH EDVLF VWUXFWXUH RI WKH SUHVHQW .DEXO FLW\ZDV HVWDEOLVKHG LQ WKH ¶V DQG ¶V GXULQJ ZKLFK XUEDQ GHYHORSHPHQW DFWLYHO\ WRRN SODFH DQG WKH PDLQ VWUHHW RI -DGD\LODZDQG ZDV FRQVWUXFWHG WRJHWKHU ZLWK WKH .DEXO 8QLYHUWLVW\ KRVSLEWDOV DQG ED]DDUV&RPPHUFLO DUHDV 7KH H[SDQVLRQRIWKHVWUHHWV\WVHPDQGWKHUHVLG HQWLDQGHYHORSHPHQW FRQLQXHGDIWHUWKH¶VDQGG.DEXOEHFDPHWKHO DUJHVWFLW\ LQWHUQDOO\GLVSODFHGSHRSOH,3V7KHVHLQGLFD WRUVKDGDLWDO LPSDFW RQ VSDWLDQ DQG WHPSRUDO FKDQJHV RI XUEDQ ODQG H[SDQVLRQDQGVSDWLDQGLVWULEXWLRQRIODQG XVHSDWVWUHQ)LQDOO\ RYHU WKLV SHULRG WKH XUEDQ DUHD KDV H[SDQGHG WLPV WR NPLQ \$OWKRXJKVRPHUHSRUWVDQGSDSHUVLOOXVWU DWHGXUEDQLJDWLRQ VHWVWOPHQW DQG VSDWLDQ VWUXFWXUH RI .DEXO FLW\ UHODWLYHO\ OHVV DWWHQWLRQ KDV EHHQ SDLG RQ XUEDQLJDWLRQ WUHQQ VSDWLDQ DQG WHPSRUDO GLIIHUHQFH RI XUEDQ ODQG H[SDQVLRQ DQG ODQG XVH FKDQJHRYHUWKHVWXG\SHULRGRIWLP7KHVSDWL DOGLVWULEXWLRQ RIODQGXVHLQ.DEXOFLW\KDVVEHHQFKDQJLQJWGLI IHUHQWVVDJHV RIJURZWKDQGLGHQWLILHVYDULRXVSDWLDQDQGGXVHSDWVWUHQQLQWKH KLVWRU\RIXUEDQLJDWLRQLQ.DEXOFLW\ 7KHREMHFWLYHVRIWKHSUHVHQWVWXG\DUH 7R H[SORUH DQG HYDOXDWH WKH WHPSRUDO FKDUDFWHULVWLFV RI XUEDQODQGH[SDQVLRQRHYU\HDUVRIVWXG\SHULR G 7R GHWHFW DQG DQDO\]H WKH VSDWLDQ GLIIHUHQFH RI ODQG XVH SDWVWUHQ DQG HYDOXDWH WKH VSDWLDQ GLIIHUHQFH RI XUEDQ WHUULWRULHV 7R DQDO\]HWKH PDLQ GULYLQJIRUFHVJRYHUQLQJ XUEDQLJDWLRQDQGXUEDQODQGH[SDQVLRQLQWK HFLW\ ,,(6&5,37,212)7+(678'<\$5(\$ \$IJKDQLVWDQ LV D VHPDULG ODQGORFNHG FRXQWU\ VLWXDWHG LQ WKH VRXWK FHWUDO SDUW RI WKH \$VLDQ PDLQDQGG JHQHUDOO\



)LJ7HPSRUDOFKDQJHVRIXUEDQODQGH[SDQVLRQLQ.DE
XOFLW\

/LNHZLVHWKHVFRQJURZWKSHULRGKDVVLPLO
DU
WHPSRUDOFKDQJHV,QWKLVAHDUSHULRGWKHFLW\D
UHDSXVKHG RXW WR NP\HDU H[SDQVLRQ UDWH
ZLWK DQ HTXLYDOHQW SHUFHQWDJH RI DQXDO
XUEDQ ODQG JURZWK UDWH ,Q WKLW JURZWK
VWDJH WKH XUEDQ ODQG DUHD MXULVGLFWLRQ
H[WHQG E\

DERXWNPDQGDVDZKROHLQLWVWHUULWRU\
7KHJURZWKSHULRGGRIGHSFWVDPGRHUDWHVSHH
G
VWDJHRIXUEDQODQGXWLOLJDWLRQLQWKHVWXG\
SHULRG,QWKLVVWDJH XUEDQ DUHD KDV H[SDQGHG
WRWDO\ E\ NP LQ WKH
HQWLUHVWDJHDKQWKHDQXDOXUEDQODQGGURZ
WKUDWHZDV NP\HDU ZKLFK FRQWULEXWH RI
DQXDO XUEDQ ODQG H[SDQVLRQ

2QH RI WKH PDLQ UHVRQ RI WKLW JURZWK
LQFUHPHQW FDQ EH
LGHQWLILHG DV WKH UHVRQRIPLJUDQWV2QWKHR
WKHUVLGHWKHUDSLG HFRQRPLF GHYHORSHPHQW RI
SUKDQLVWDQ DIWHU GXH WR WKH
IRUHLJQDQGLQWHUQDWRQDOVFLHW\DVVLVWD
QFHFDEHFRQVLGHUH

LQH[WULFDEOHLQIOXHQFHVRQWKHSURFHVVRIXUE
DQODQGH[SDQVLRQ
)DFWRUVJRYHUQLQJXUEDQODQGH[SDQVLRQLVIXU
WKHUGHVFULHGLQ 'ULYLQJ)RUFHV
ODQLSXODWLQJ 8UEDQ /DQG ([SDQVLRQ SDUW
&RQVHTXHQW\WKHHQWLUHVWXG\DUHDVSUHDG
RXWPRUHE\
NP ZLWK DQG DQXDO VSHHG UDWH RI
NP\HDU7DEOH ,,

7KLVJURZWKH[SUHVVDQXDOODQGH[SDQVLRQUDW
H DVDZKROHSHULRG

B.Spatial and Temporal Difference of Urban Territories

)LJ VKRZV WKH GLVWULEXWLRQ RI FKDQJHV LQ
WKH WHUULWRULHV

WKURXJKRXWWKHFLW\IURPWR7KHILUVWPDVWHUS
ODQ
RIWKHFLW\ZDVSUHSUHDGUXULQJE\SIJKDQLVWDQD
QG

5XVVLDQH[SHUWVIRUWKHSODQGHGSRXODWLRQR
ISHRSO)LJ D >@ 7KXV WKH SODQV FDQ EH
FRQVLGHUHG DV WKH IXQGDPHQWDO DQG
JHQHUDOPDVWHU SODQ IRU WKH FLW\ ZKLFK
LQGLFDWHV WKH LQLWDO SDWWHUQV DQG
MXULVGLFWLRQ RI WKH FLW\ 7KH VSDWDO ODQ
XVH SDWWHUQ RI WKH FLW\ ZDV FDWHJULJHG DV
UHVLGHQWDO SXEOLF XVH DQG FRPPHUFLDO
LQGXVWULDO EDUH ODQ LQFOXGLQJ ULYHU
KLOOV DQG PRXQDLQV DUHDV %DVHG RQ WKH
VSDWDO ODQ XVH SDWWHUQ RI WKH FLW\ LQ
ZKLFK KDV EHHQ JHRUHHUHQFHG DQG GLJLWJHG
E\ *,6 WKH FLW\ KDG

DSSUR[LPDWHO\NPWRWDODUHDLQLWVXUEDQWHU
ULWRU\
PLOORQDGGWLWRQDOSRSXODWLRQVWDQ
NP DUHD ZDV

FRQVLGHUHGIRUWKHFLW\ZLWKWKHWRWDODUHDR
IDERXWNP

'XULQJ WKH FLYLO ZDU SDUWLFXODU\ DIWHU
WKH FROODSVH RI WKH
FRPPXQLVWUHLPHLQ.DEXOZDVGHYDVWDWHGQRW
RQ\LQ LWV XUEDQ LQIUDVWUXFWXUH EXW DOVR
LQ LWV VRFLDO \VWHP IRU HGXFDWLRQ PHGLFO
DQGRWKHU VHUFLFHV +XPDQ GDPDJHV DIWHU
LQFOXGHORVVRIRYHUOLYHVLUQ.DEXOQDQGVHYHU
DO KXQGUHG WKRXVDQG UHIXJHHV WR LWV
VXEXUEV ,W LV UHSRUWHG WKDW
WKHUHH[LVWHGFORVHWRZLGRZVLQLQ.DEXODORQ
H

0RVWUHIXJHHVUHWXUQHGW.R.DEXODIWHUWKHHV
WDEOLVKPHQWRIWKH
7DOLEDQUHJLPHDQGWKHSRSXODWLRQLQ.DEXOZD
VPLOORQ

LQDFFRUGLQJRWK81SRSXODWLRQVXUYH\LQ 81
5HJLRQDO &RRUGLQDWRQ 2IILFH 3RSXODWLRQ
6XUYH\ 3URMHFW .DEXO -DQXDU\ ,Q WKH FLW\
DUHD ZDV FRQVLVWLQJ RI GLVWULFWV\LVWULFWV
H[FHSW GLVWULFWV
DQG>@>@)LQDOO\GXHWKXJHUHWXUQRIUHIXJHH
VVLQFH UDSLQ HFRQRPLF GHYHORSHPHQW VLQFH
GXH WR LQWHUQDWRQDO VRFLHW\ DVVLVWDQFH
DQG KXJH SRSXODWLRQ
H[SDQVLRQWKHFLW\WHUULWRU\KDVEHHQXSGDWH
G

DUHD RI NP ZKLFK LQGLFDWHV NP XUEDQ DUHD

FKDQJH IURP WKH SODQ 7R VXP XS LQ WKH HQWLUH
VWXG\ SHULRG IURP WR WKH VWXG\ LGHQWLILHV
WKDW WKH XUEDQ
WHUULWRULHVKDVEHQODUJHGWLPHV

C.Distribution and Spatial Changes of Land Use Pattern

7KHUWDLRRIDQXSDOSRSXODWLRQJURZWKUDWH
WRDQXDOXUEDQ
ODQGJURZWKUDWHZDVUHVXOWLQJLQORZHVWUD
WHRI(XUE WLOO 7KH HODVWFLW\ RI XUEDQ ODQG
JURZWK UDWH WR XUEDQ SRSXODWLRQ H[SDQVLRQ
UDWH ZDV SURJUHVVLYHO\ VSHHGHRG WR DQG LQ
DQG UHVSHFWLYHO\ ,W VHHPV IURP WKH
7DEOH,,WKDWDIWHUXUEDQSRXODWLRQWHQGHG
WRLQFUHDVH
VOLJKWO\ WKDQ WKHXUEDQ ODQGUDWH WLOO
+RZHYHU VWLOO WKH
(XUELVLQRSLXPDPYHUDJHYDOXHRIIURPWR

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<H DU	\$QXDOXUEDQOD \$QXSDOSRSXODWL (XU QG JURZWKUDWH RQ JURZWKUDWH E

\$YHUDJ
H

9'5,9,1*)25&(60\$1,38/\$7,1*85%\$1/\$1'(;3\$16,21

7KHHFRQRPLFGHYHORSRPHQWRIWKHFLW\FDQEHFR
QVLGHUHGDU
WKHELJHVVWDQGWKHSULPDU\GULYLQJIRUFHIRUPD
QLSXODWLRQJWKH XUEDQ ODQG H[SDQVLRQ 7KH
KLJK HFRQRPLF JURZWK VWLPXODWHG WKH XUEDQ
ODQG H[SDQVLRQ LQ WKH VWXG\ UHJLRQ IURP WKH
IROORZLQJ 7KHUHVSHFWV)LUVWO\ WKH UDSLQ
HFRQRPLF
GHYHORSRPHQWSDYHGWKHZD\IRUVSHHG\H[SDQVLR
QRIWKHFLW\
HVSHFLDOO\LQWKHODVWVSHULRGGXULQJWRLQZKL
FKWKH FLW\ KDV H[SDQGHG WLPHV 6HFRQGO\ WKH
KLJK HFRQRPLF
JURZWKUDWHKDGGLUHFWLQIOXHQFHRQSRXODW
LRQJURZWKZKLFK LQ WKH VDPH SHULRG WKH
SRSXODWLRQ KDG DOVR WKH VLPLODU
HQODUJHPHQW RI WLPHV /DVWO\ GXULQJ WKH
ILQDO SHULRG SDUDOOHO ZLWK WKH
HVWDEOLVKPHQW RI WKH QHZ JRYHUQPHQW WKH
HFRQRPLF LPSURYHPHQWV KDV PRWLYDWHG DQG
IRUFHGWKHUHIXJHVIURPQHILJKERULQJFRXQWULH
VVRUHVVLGHEDFN WR WKH FRXQWU\
6LPXOWDQHRXVO\ WKLW GULYLQJ IRUFH DOVR
DWWUDFWHGHODUJHQPHEHURI,'3VLQWKHFLW\
A.Economic Growth
7KHHFRQRPLFJURZWKVHHPVWREHWKHSULPDUV
QGELJJHVW LQGLFDWRU DQG GULYLQJ IRUFH IRU
VWLPXODWLRQJ WKH XUEDQ ODQG H[SDQVLRQ LQ
WKH FLW\)LJ VKRZV WKDW KRZ WKH HFRQRPLF
WUHQG GXULQJ WKH ZKROH VWXG\ SHULRG
LQIOXHQFQLQJ XUEDQ ODQG JURZWKLQWKHFLW\
B.Population Expansion
3RSXODWLRQ HQODUJHPHQW LV WKH RWKHU
LQGLFDWRU DQG IDFWRU VLPLODU WR HFRQRPLF
JURZWK VLJQLILFDQWO\ DIIHFWHG XUEDQ ODQG
H[SDQVLRQ LQ .DEXO FLW\ \$V WKH UHVXOW VKRZV
SRSXODWLRQ
H[SDQVLRQGLGQRWLFUHDVLRQJH[SDQGGXULQJ
WKHVWXG\SHULRG IURP WR)OXFWXDWLRQ LQ
SRSXODWLRQ JURZWK GXULQJ WKH WLPH KDV
PDMRUO\ LQIOXHQFHG E\ SROLWLFDO VLWXDWLRQ
RI WKH FLW\ \$ VWXG\ DERXW XUEDQ
GLVSODFHPHQW DQG YXOQHUDELOLW\ LQ
.DEXOLOOXVWUDWHVWKHGLVSODFHPHQWRISHRSO
HLQWKHFLW\7KHUHVSHFWV EHHQ VL[PDMRU
SHULRGV RI GLVSODFHPHQW DQG SRSXODWLRQ
PRYHPHQWVLQFHQWV±DOOGLUHFWO\UHODWLRQJ
WRSHULRGVRI
DUPHGFRQIOLFDWQGSROLWLFDOVWDELOLW\WK
H6RYLHWLQYDVLQDQGWXEVHTXHQW FRQIOLFW±
WKH 6RYLHW ZLWKGUDZDO DQG WXEVHTXHQW
LQWHUQDO DUPHG FRQIOLFW± 7DOLEDQ UXOH
±WKHSRVW86OHGLQYDVLQDQGWKH GHIDW RI WKH
7DOLEDQ DQG WKH HVWDEOLVKPHQW RI WKH
LQWHULP JRYHUQPHQW± DQG WKH QHR7DOLEDQ
LQVXUJHQF\ WRWKHSUHVVHQW>@
)LJLQGLFDWHVWKDWWKHVDULDWLRQLQSRXSO
DWLRQJURZWKLVQ
SDUDOOHOZLWKWKHYDULDWLRQLQXUEDQODQGGJ
RZWKLQDOOVWDJHVRI
WKHVWXG\SHULRGXULQJWKHILUVVWDJHVKHSR
SXODWLRQJURZWK KDV EHHQ UDWKHU VSHHG\
WKDQ WKH WZR FRPLQJ SHULRGV
ZKLFKIROORZHGE\XUEDQODQGGJURZWKUDWH7KHU
DSLGHVW
JURZWKIRUERWKSRSXODWLRQDQGXUEDQODQGLV
WKHILQDOSHULRG LQ ZKLFK ERWK KDG FORVH
JURZWK UDWH RI DQG
UHVSHFWLYHO\7KLVJURZWKFRQVWVWHQF\DQGXQLI
RUPLW\H[SUHVV
KRZERWKDUHGLUHFWO\SURSRUWLRQDOWRHDFKR
WKHU
C.Return of Refugees and IDPs
7KH SROLWLFDO VLWXDWLRQ LQ WKH FDSLWDO
FLW\ RI .DEXO KDV
DOZD\VGRPLQDQWLYDULDWLRQRIWKHSRSXODWLR
QDQGGPLJUDWLRQ GXULQJ WKH VWXG\ SHULRG ,Q
YDULRXV SROLWLFDO SHULRGV LQ WKH FRXQWU\
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VSHFLDOO\ LQ .DEXO FLW\ KXJH QXPEHU RI UHVLGHQFH IRUFHG WR OHDYH WKHLU KRPHV E\ HLWKHU PLJUDWLQJ WR QHLJKERXULQJ FRXQWULHV RU PRYH WR RWKHU SDUWV RI WKH FLW\ ,QGHHG WKH PLJUDWLRQ DQG LQWHUQDO GLVSODFHPHQW RI FLW\ LQKDELWDQWV KDV DOZD\ FDKQJHG WKH SRSXODWLRQ WUHQG LQ WKH FLW\

7KH 6RYLHW LQYDVLQJ LQ WULJJHUHG WKH IRUFHG GLVSODFHPHQW RI PLOOLRQV RISJKDQV IURP UXUDO DUHDVZKHUH WKH FRQIOLFW EHZZHQ WKH 6RYLHW DUP\ DQG WKH \$IJKDQ UHVLVWDQFH ZDV PRVW LQWHQVH WR WKH UHODWLYH VDIHW\ RI WKH FRXQWU\ PDLQ FLWLHV LQFOXGLQJ .DEXO +HUDW DQG -DODODEDG \$W WKDW WLPH VRPH PLOOLRQ \$IJKDQV ZHUH LQWHUQDOO\

GLVSODFHGDQGDQHVWLPDWHGILYHPLOOLRQRUQH DUO\DIKWKRIWKH SRSXODWLRQ IOHG WR QHLJKERXULQJ FRXQWULHV 7KH IDMLEXOODK DGPLQLVWUDWLRQZDVRSSOHLQDQGWKHVXEV HTXHQWEULHI SHULRG RI UHODWLYH VWDELOLW\ VDZ WKH YROXQWU\ UHWXUQ RI PLOOLRQ \$IJKDQ UHIXJHHV LQ DQG D IXUWKHU LQ E\WKHUHZHUHRYHUPLOOLRQ\$IJKDQUHIXJHHVLQ 3DNLVWDQ DQG MXVW RYHU PLOOLRQ LQ ,UDQ %\ DQ

HVWLPDWHG\$IJKDQVZHUHLQWHUQDOO\GLVSODFH GDQGD PLOOLRQ ZHUH UHJLVWHUHG DV UHIXJHHV E\ 81+&5 %HWZZHQ DQG PRUH WKDQ PLOOLRQ \$IJKDQV UHWXUQHG WR WKH FRXQWU\LQFUHDVLQJWKHSRSXODWLRQE\DOPRVW> @

7KHUHIRUH WKH SRSXODWLRQ JURZWK UHPDUNDEO\ DIIHFWHG E\ PLJUDWLRQ DQG ,3V GXULQJ WKH SROLWLFDO FRQIOLFWV LQ WKH FLW\ &RQVHTXHQWO\ WKH PLJUDWLRQ DQG GLVSODFHPHQW UHVSQVHV GLUHFWO\DIIHFWHGXUEDQODQGH[SDQVLRQLQWK HFLW\

9, &21&/86,21

'XULQJ WKH XUEDQLDWRQ KLVWU\ FLWLHV KDYH DOZD\ WHQGQFH WR FDKQH DQG H[SDQ LQ WKHLU VSDWDO DQG WHPSRUDO GLVWULEXWLRQ LQ UHVSQVH WR SRSXODWLRQ DQG HFRQRPLF JURZWK JRYHUQQHQW DQG SROLWLFDO VLWXDWLRQ 7KLV SDSHU LQYHVLJDWHG LQWHJUDWHG XUEDQLDWRQ WUHQGV H[SORUHG WKH VSDWDO DQG WHPSRUDO GLIIHQFH RI XUEDQ ODQG H[SDQVLRQ DQG ODQG XVH FDWHJRULHIURPWRLQ.DEXOFLW\ 7KHUHVXOWVVKRZWKDWGXULQJWKHHQWLUHVW XG\SHULRGWKHFLW\ KDV H[SHULHQFHG

GLIIHQW XUEDQ ODQG H[SDQVLRQ VWDJHV 5HODWLYHO\VWDEOHDQGVORZJURZWKDQG SHULRGIURPWRIROORZHGE\DVWJURZWKVWDJHWL OO

7KHFLW\KDGUDSLGHVWDYHUDJHDQXDOJURZWKU DWHRI SHUFHQW LQ WKLV VWDJH %HVLGH WKH ODQG H[SDQVLRQ WKH FLW\ WHUULWU\KDVVEHHQH[SDQGHGWLPHVLQLWVSD WLDQGLVWULEXWLRQ

VLQFHSODQ,QWKHMIXULVGLFWLRQRWKHFLW\KDV EHHQ UHDFKHG WR NP 7KH H[WHQVLYH HQODUJPHQW RI XUEDQ ODQGDVEHHQUHODWHGZLWKWKHODQGXVHFKDQ JH\$IWHUWKHWZR

FRPSUHKHQVLYHSODQVRIDQGWKHODQGXVHSDWW HUQRI KDVVEHHQZLWQHVVLDQDPDVVLYHUHGXFWRQDQG FRQYHUVRQ LQ SXEOLF DQG LQGXVWULDO DUHD E\ DQG SHUFHQW

UHVSHFWLYHO\,IZHORNDWWRWKHRWKHUFKDUF WHULVWLVFRIXUEDQ ODQGDOLNHXUEDQODQGSUFDSLWDDQGDQVWVFL WRIXUEDQODQGW XUEDQ SRSXODWLRQ (XUE LW VHHPV WKH FLW\ KDG WKH KLJKHVW YDOXH RI P ODQGD SHU FDSLWD LQ (YHQ WKRXJK WKH XUEDQ ODQGD KDV H[WHQVLYHO\ H[SDQGHG EXW VWLOO WKH ODQGD SHU

FDSLWDWRWDOO\GHFUHDVHGE\SHUFHQW+RZHYHU WKHDYHUDJH YDOXH RI (XUE LV FDOFXODWHG WR EH LQ WKH HQWLUH VWXG\ SHULRG ZKLFK LV FORVH WR RSWLPPX YDOXH RI %XW DIWHU XUEDQ SRSXODWLRQ WHQGQHG WR LQFUHDVH VOLJKWO\ WKDQ WKH XUEDQ ODQGD ZKLFK SUREDEO\ PLJKW FDXVH IXUWKHU UHGXFWRQ RI (XUELQIXWXUH

2Q WKH RWKHU VLGH TXHVWLRQV PD\ ULVH DERXW WKH IRUFHV PRWLYDWLQJXUEDQODQGH[SDQVLRQLQWKHFLW\7 KHSULRUIDFWRU PDQLSXODWLQJ WKH JURZWK RI ODQGD VHHPV WR EH HFRQRPLF LPSURYHPPHQWRIWKHFLW\HVSFLDOO\LQWKHODV WSHULRGEHWZZHQ 7KHKLJKHVWDYHUDJHDQXDOHFRQRPLFJURZWKU DWH

RISDUDOOHOZLWKWKHKLJKHVWDYHUDJHDQXDO XUEDQODQGD H[SDQVLRQ UDWH RI SHUFHQW FDQ SURYH WKLV FODLP 6XEVHTXHQWO\ SRSXODWLRQ LQFUHPHQW GXH WR QRUPDO JURZWK UHWXUQ RI PLJUDQWV DQG,3V GLUHFWO\ GURYH WKH LQFUHDVH RI XUEDQ ODQGD JURZWK UDWH LQ WKH FLW\)RU EHWWHU XQGHUVWDQGLQJ DERXWWKHUODWLRQRIGULYLQJIRUFHVZLWKWK HXUEDQODQGDGSOHDVH UHIHURWKH)LJLQWKH'ULYLQJ)RUFHV6WLPXODW LQJ8UEDQ /DQGD([SDQVLRQVHFWLRQ

\$&.12:/*0(17

7KH DXWKRUV DUH WKDQNXO IURP WKH
&DSLWDO 5HJLRQ
,QGHSHQGHQW'HYHORSPHQW\$XWKRULW\&5,'\$RUJD
QLJDWLRQLQ \$IJKDQLVWDQ IRU SURYLGLQJ
VWDWLWVWLFDO DQG VRPH VSDWLDO GDWD 7KH
DXWKRUV JUDWHIXOO\ WKDQN WZR DQRQ'PRXV
UHYLHZHUV IRU
WKHLUYDOXDDEOHDGYLFHLQLPSURYLQJWKHILUVV
PDQXVFULSW

5)(5(1&6

*,6DQGUHPRWHVHQVLQJ
6DQFWXDU\LQWKHFLW\^"8UEDQGLVSODFHPHQWDQGYXO
QHUDELQW\Q.DEXO