

3DUWKD *DQJRSO G K DG KDUWK -DLQ

\$E VWU DFW

7KLV VWXG\ H[DPLQHV WKH VKRUW UXQ DQG WKH ORQJ UXQ UHODWLRQVKLSV E

URXS 30 HVWLPDWRU WR ILQG WKDW DQ LQFUHDVH LQ LQFRPH *LQL LQFUHDVH
UXQ +RZHYHU ZH DOVR QRWH WKDW WKH LQFRPH @ KpWQGRVfLR Lz• W '0` € T →€J

RI WKH PHGLDQ YRWHU K\SRWKHVLV RQ WKH FRQVHTXHQFHV RI LQFRPH GLVWUL
*'3 UDWLR EHFDXVH RI WKH JUHDWHU UHGLVWULEXWLRQ WKDW LV VRXJKW E\ WK

.H\ZRUGOHTXDOLW\ 7D[HV 3RROHG 0HDQ *URXS 30* \$XWRUHJUHVVLVH 'LVWULE

:HVWHUQ 6\GQH\ 8QLYHUVLW\ LQ WASH DC #ZHWU DUDV(BDHO HGX DX
:HVWHUQ 6\GQH\ 8QLYHUVLW\ LQ WASH DC #ZHWU DUDV(BDHO HGX DX

H-RXUQDO RI 7D[5HVHDFRKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$& ,

,1752'8&7,21

2YHU WKH SHULRG UHPDUNDEOH HFRQRPLF DFKLH
± GHVSLWH WKH \$VLDQ)LQDQFLDO &ULVLV DQG WKH *O
UHJLRQDO HFRQRPLHV ± DV WKH UHJLRQ JUHZ DW SHU
7KH SRYHUW\ UDWL GHFOLQHG IURP LQ WR DERXW
\$JDLQVW WKLV EDFNGURS RI HFRQRPLF VXFFHVVH
ZLWQHVVHG ULVLQJ LQFRPH LQHTXDOLWLHV VLQFH JU
KDV EHHQ KLJKHU LQ \$VLD WKDQ IRU WKH UHVV RI WKH Z
SS DQG)LJXUH)XUWKHU LQFUHDVHV LQ L
SHULRG LPSDFWHG \$VLDQ LQHTXDOLWLHV DV WKH SRSXO
WR VHH =KXDQJ .DQEXU ODOLJDOLF S 7
\$6(\$1 DORQJ ZLWK &KLQD DQG ,QGLD KDYH H[SHULHQFH
LQHTXDOLWLHV LQ WKH UHJLRQ ZKLFK PRWLYDWHV XV
LQHTXDOLWLHV RQ WD[HV IRU WKH SRSXORXV QDWLRQV R
FDOOHG WKH \$& , HFRQRPLHV

:LWK WKH XQSUFHGHQWHG *'3 JURZWK \$& , HFRQRPL
WHFKQRORJLFDQ FDKQJHV LQFUHDVHV LQ ODERXU IRUFH
GHFOLQLQJ WRS PDUJLQDO LQFRPH WD[UDWLHV ZLGHQLQ
HFRQRPLHV DQG SUHVXUHV IURP JOREDOLVDWLRQ DQG
SURGXFW PDUNHWV 7KXV FDKQJHV DUH KHOG UHVSQV
7KH LPSDFWV RI LQHTXDOLW\ RQ RWKHU HFRQRPLF
VWXGLHG LQ WKH Q[WLNWDOWLFDWZHHHN WR HVWDEO
FDQ GULYH ILVFDO WD[RXWFRPHV 2XU SULPDU\ PRWLY
XSRQ WKH SRVLELOLW\ WKDW LQHTXDOLW\ FDQ VLJQLIL
DQG WKHUHE\ ILVFDO RXWFRPHV LQ D VRFLHW\ ,W LV D
JRYHUQPHQWV H[LVW IRU WKH SURYLVLHQ RI SXEOLF JR
FRQVHTXHQFHV RI PLVVLQJ PDUNHWV LPSHUIHFV LQIR
*URVVPDQ *RYHUQPHQWV DOVR RIIHU JURZWK VWI
LQYHVWPHQW WKDW LQ WXUQ SURPRWHV SURGXFWLYLW
7KXV HIIHFWLYH JRYHUQDQFH FDOOV IRUWK DGHTX
JRYHUQPHQWV ZKHUWKHU LQ GHYHORSQJ RU GHYHORSH
VKRUW WHUP QHHGV RI LWV SRSXODWLRQ EXW DOVR LWV
1DP /H S 2QH RI WKH PDLQ GHYHORSPHQW JR
GLVWULEXWLRQ WR ILJKW SRYHUW\ VHH *RGD *DORU
RWKHUV

H-RXUQDO RI 7D[5HVHDFRKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$& ,

HQGRJHQRXV DQG SRVLWLYHO\ UHVSRQGV WR WKH ULVL

H-RXUQDO RI 7D[5HVHDFRKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$& ,

WUXVW LQ SXEOLF LQVWLWXWLRQ\ PLD\HOWXW\DD\ORZHU
LQHTXDOLW\ DV D IDFWRU H[SODLQLQJ WD[LQHIILFLHQFV
7UDQ 1DP DQG /H ILQG WKDW WKH WD[SD\HUV SH
LQFUHDVHV WKH WD[OHYHO QRQ FRPSOLDQFH YLD VHYHU
,Q DQ DQDO\VLV RI WKH LVVXH LQ 2(&' FRXQWULHV F
PHGLDQ YRWHU\DD\XPM\DD\ QRWHG WKDW LQHTXDOL
UDWLRV DQG VXJJHVW WKDW WKH HIIHFV LV PRUH VLJQL
+RZHYHU LQ D VXEVHTXHQW DQDO\VLV RI 2(&' FRXQWU
FXPXODWLRQ\ .XKQ DUJXH V W K D W Y R W H U V S H U F H L
WHQG WR EH PRUH VXSSRUWLYH RI UHGLVWULEXWLYH SR

0 27,9\$7,210(7+2'2/2*< \$1' '\$7\$

,Q ZKDW IROORZV LQ VHFWRQ EHZR ZH SURYLGH W
DQG WKH PDLQ PRWLYDWLRQ EHKLQG WKLV VWXG\

3ROLWLFDO WUDQVDFWLRQ\WV LQHTXDOLW\

:H PDNH D GHSDUWXUH IURP WKH DQDO\VLV LQ SUHYLRXV
SROLWLFDO WUDQVDFWLRQ\WV DQG XQFRYHU WKH SUHF
WD[HV DQG LQHTXDOLWLHV)RU SROLWLFDO PDUNHWV
SROLWLFDO ULJKWV LPSHUIHFV HQIRUFHPHQW DJUHHPH
LQIRUPDWLRQ DV KLJKOLJKWHG E\ WKH 1HZ ,QVWLWXW
E 1\H 3LHUVRQ ORH DPRQJ RWKHUV ± L
DQG UXOHV RI WKH JDPH EHFRPH FUXFLDO GHWHUPLQDQV
RXWSXWV GXH WR SHUYDVLV WUDQVDFWLRQ FRVWV VHH
SROLWLFDO WUDQVDFWLRQ FRVW OLWHUDWXUH WKDW G
µRSDTXH\ DQG µXQFOHDU\ ZLWK OLPLWHG REVHUYDELOLV
UHIOHFWHG LQ DQ HDUOLHU ZRUN RI 'DKOPDQ WKH
RI WD[SROLFLHV FDQ DVVXPH WKUHH IRUPV ILUVW VHD
WD[SROLFLHV 6HFRQGO\ EDUJDLQLQJ DQG QHJRWLWLR
WKH HQIRUFHPHQW PRQLWRULQJ DQG SROLFLQJ FRVWV
GHWHUPLQDQW RI WUDQVDFWLRQ FRVWV WKHQ LQHTXD
SULPDU\ PRWLYDWLRQ RI WKLV VWXG\ LV WR HPSLULFDOO
LQHTXDOLWLHV DQG WD[RXWFRPHV

7D[HIIRUW LV GHILQH DV WKH UDWLR RI DFWXDO WD[HV DQG WKH S
7KH PHGLDQ YRWHU PRGHO LPSOLHV WKDW WKH SROLWLFDO RXWFR
SUHIHUHQFH &RQJOHW RQ 7KH WKHRU\ SUHGLFWV WKDW XQGHU
IRU WKH PDMRULW\ RI WKH YRWHU E\ IRFXVLQJ WKHLU DWWHQWLRQ
ZLWK D PHGLDQ LQFRPH 7KXV DQ H[SHFWHG UHVXOW LV WKDW DV L
LQFUHDVHV LQ WD[HV WR VHUYP WKH GLVWULEXWLYH LQWHUHVW RI WK
7KHVH DXWKRUV FODLP WKDW D ORQJ WHUP GHFOLQH LQ PDUNHW L
UHVXOWHG LQ KLVWRULFDO JURZWK LQ WD[UDWHV KRZHYHU VLQFH V
WD[UHYHQXHV H[HUWLQJ SUHVXUH RQ QDWLRQDO EXGJHV DQG GH
7KH UROH RI WUDQVDFWLRQ FRVWV LQ WKH SROLWLFDO SURFHVV KD
D DQG 'L[LW WKH WUDQVDFWLRQ FRVW WKHRU\ LQ SR
LQIRUPDWLRQ LL VXEMHFWLYH PRGHOV RI GHFLVLRQ PDNLQJ E\ SRO
RI DJUHHPHQWV VHH 1RUWK D S 6XFK FRVWV DULVH IRU WUD
'L[LW 3ROLWLFDO WUDQVDFWLRQ FRVWV DUH DOVR UDPSD
:HLQJDVW 0DUVKDOO (SVWHLQ 2\+DOORUDQ 6SLOOHU 7F

H-RXUQDO RI 7D[5HVHDFRKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$& ,

0HWKRGRORJ\

2XU PHWKRGRORJ\ LV EDVHG RQ D SRVLWLYLVW UHVHDFR
XWLOLVLQJ VHFRQGDU\ GDWD 0RUH VSHFLILFDOO\ ZH SP
GHWHUPLQH E\ LQHTXDOLWLHV DV DSSOLHG E\ ,VODP HV

OQ7\$; OQ7\$; OQ*,1, • D D

ZKHU_{LW}LS; WKH VKDUH RI WD[UHYHQXWLOLV'WKRU FRXQ
PHDVXUH RI LQFRPH LQHQXWLOLV\DRUHFRQRU\FRQWURO
± QDPHO\ XUEDQLV\SHUQFDOLW\$1300QWU'DGH RSHQQHY

OQ75\$ (OQ7\$ WKH QDWXUDORJDULWKPLF WUDQVIRU
GHFLPDO YDOXHVQRWWKDFRXWU\ IL[HG HpKO u „VW@

H-RXUQDO RI 7D[5HVHDFRKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$& ,

7KH UH SDUDPHWHUHQGH\$URU FRUUHFWLRQ PRGHO LV VSH

$$y_j = y_j + x_j + y_j + x_j + \mu_j$$

1RWH LQ

i « 1 tDQG « 7

$$= -(1-)$$

=

$$= - , \quad j= 1,2,\dots,p- 1$$

$$= , \quad j= 1,2,\dots,q- 1$$

,I ZH VWDFN WKH WLPV VHULHV REVHUYDWLRQV IRU HDFK

$$Y = Y + X + Y + X + \mu$$

$i= 1,2,\dots,N$ ZKHU (y_1, \dots, y_p) LV $T \times 1$ YHFWRU RI WKH REVHUYDWLRQV
GSHHQGHQW (x_1, \dots, x_q) LV $T \times q$ PDWUL[RI REVHUYDWLRQV
RQ WKH UHJUHVVURUV WKDW YDU\ $E = (1, 1)$ DEUTD
YHFWRU, RDQG DJSHULRG ODJYHQDORJ R
 $Y, X = X - X, Y, DQG$ DJSHULRG ODJYHQDORJ RI
 $= (\dots)$

3RROHG 0HDQ *URXS 30* HVWLPDWRU

:KHQ DQDO\VLQJ SDQHO GDWD HFRQRPHWULF DSSURDFKH
FDWHJRULHV QDPHO\ WKH 0HDQ *URXS 0* HVWLPDWRU
:KHQ DQ@pP€GpPÀ30: H0°KTE`H7DREV`HG HDQ f1PDWRU

H-RXUQDO RI 7D[5HVHDFRKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$& ,

FDQ EH GUDZQ HYHQ LI WKH SUHVHQFH RI FRLQWHJUDWL
LI YDULDEOHV DUH LQ ORJDULWKPV WKHQ WKH ORQJ U
HODVWLFLWLHV 3HVDUDQ HW DO

&RQVLGHU WKH IROORZLQJ \$5' / **Y** IROORZLQJ W
DW WLPH W

$$Y = Y_1 + X_1 + \mu_1$$

ZKH\ LV ~~nD~~ YHFWRU RI WKH ORJDULWKPV RI WKH H[SOD
OQ75\$'(OQ85%\$1 OQ85%\$1 OQ85%\$1 FRHIILFLHQW DIFRQWUOQBU
FRXQWU\ VSHFLILF HIIHFWV (TXDWLRQ DERYH FDQ EH
PRGHO RI WKH IROORZLQJ IRUP

$$Y = Y_1 - X_1 + X_1 + \mu_1$$

H-RXUQDO RI 7D[5HVHDFRKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$& ,

7DEOH 7KH 3RROHG 0HDQ *URXS 5HVXOWV IRU WKH \$& ,

0RGHO 0RGHO 0RGHO 0RGHO 0RGHO
'HSHQ WQW OQ7\$ OQ*,1 OQ75\$' OQ85% OQ3&*' **1**
9DU DEON (T T * (T (T (T

.OQ7\$;
OQ*,1 ; ñ•ðÀ ; uD,,F v ;

H-RXUQDO RI 7D[5HVHDFRKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$&.

x 0RGHO VKRZV WKDW WD[HV GR QRW KDYH D ORQJ WH
ZRUGV WKHUH LV QR HYLGHQFH RI FDXVDOLW\ UXQQ

x 0RGHO VKRZV WKDW WKH LQWHUQDWLRQDOLVDWLR
QDWLRQV ± PHDVXUHG E\ OQ75\$(± KDV EHHQ GULY
LQHTXDOLWLHV ZKLOH WKHUH VHHPV WR EH HYLGH

H-RXUQDO RI 7D[5HVHDUFKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$&

H-RXUQDO RI 7D[5HVHDFK

H-RXUQDO RI 7D[5HVHDFK

H-RXUQDO RI 7D[5HVHDFRKHV LQHTXDOLW\ LPSDFW WD[FROOHFWLRQ" (YLGHQFH IURP \$& ,

3HVDUDQ 0 + 6PLWK 5 μ(VWLDPDWLQJ ORQJ UXQ UHODWLR
SDQH~~XX~~QDO RI (FR~~Q~~PHW~~Q~~RFV SS

3HVVLQR &)HQRFKLHWWR 5 μ'HWH~~H~~PL~~Q~~QD BR~~E~~QW~~L~~H
(VSDxROD 5HYLVWD GHY~~R~~QR~~P~~t~~S~~S3~EOLFD

3LHUVRQ 3 μ,QFUHDVLQJ UHWXUQV SD~~S~~PH~~G~~H~~F~~S~~H~~Q~~G~~R~~I~~Q~~E~~W~~L~~DD~~Q~~
6FLHQFH 5~~H~~Y~~L~~HZ QR SS

5RGULN ' μ:KHUH GLG DOO WKH JURZWK JR" ([WHUQDO VKRFN
-RXUQDO RI (FR~~Q~~R~~R~~OF *U~~R~~ZWK SS

6SLOOHU 3 7 7RPP~~H~~LLQ\WLWXWLRQDO IRXQGDWLRQV RI SXEO
WUDQVDFWLRQV~~&~~DPEULGJH~~S~~SUR~~D~~FKHUVLW\ 3UHVV &DPEULGJH

7UDQ 1DP % /H 7 + μ3RWHQWLDO WD[UDWLR WD[HIIRUW
HPSLULFDO VWXG\ XVLQJ WKH \$~~X~~W~~R~~UK~~D~~OL~~V~~D~~I~~Q~~F~~7~~D~~Q~~I~~RU~~X~~Q~~R~~VLHU PF
SS

8QLWHG 1DWLRQV &RQIHUHQFH RQ 7UDGHR~~D~~QG L~~Q~~Y~~H~~OR~~S~~PH~~Q~~W~~U~~B~~E~~
&URVV ERUGHU PHUJHUV DQG ~~B~~TL~~X~~H~~V~~G~~W~~DR~~V~~OR~~D~~Q~~G~~1~~B~~Z~~Y~~K~~R~~O~~J~~
*HQHYD

:DJQHU \$ μ7KUHH H[WUDFWV RQ SXEOLF ILQDQFH~~↑~~ LQ 0XVJU
LQ WKH 7KHRU\ RI 3XEOLF)LQDQFH 0DFPLOODQ /RQGRQ SS

:DQ * =KXDQJ - μ0DNLQJ JURZWK PRUH LQFOXVLYH~~↑~~ LQ =K~~X~~
HG~~V~~D~~Q~~D~~J~~L~~Q~~J WKH PLGGOH LQFRPH WUDQVLWLRQ &KDOOHQJ
&KLQ~~G~~Z~~D~~UG (OJDU 3XEOLVKLQJ &KHOWHQKDP 8. DQG \$VLDQ

:HLQJDVW % 5 0DUVKDOO : - μ7KH LQGXXWULDO RUJDQL]D~~V~~
OLNH ILUPV DUH QRW-R~~X~~U~~D~~Q~~D~~O~~J~~H~~R~~G~~B~~OR~~L~~D~~V~~OR~~D~~V~~(~~R~~Q~~R~~P~~SS

=KXDQJ - .DQEXU 5 0DOLJDOLF ' μ\$VLD~~↑~~V LQFRPH LQHTXD
5KHH & =KXDQ~~Q~~H~~T~~X~~H~~Q~~W~~\ LQ \$VLD DQG WKH 3DFLILF 7UHC
LPSOLF~~D~~R~~X~~Q~~D~~MGJH /RQGRQ DQG \$VLDQ 'HYHORSPHQW %DQN