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46A%, % W46%, %&\$A9&A\$, % (996A7& )6\$ ( <(\$E, \$ )\$(9&#67 6) &4, #5 (<A, K 34#% , 5#', 79, %AEE, %&& &4 (& ' , (&4\\$, <(& , ' ' #96A7& % \$, \_ , 9& -66\$ . (#7&, 7(79, 6) 46A%, % /D 6<' , \$ %, <\ , \$ %? W4#<, / (7P\$A-&9D\\$, <(& , ' ' #96A7& % ( -- , (\$ . 6\$, 9<6%, <D \$, <(& , ' &6 &4, A\$E, 79D 6) %(<, #. . , ' #(&, <D )&, \$ / (7P\$A-&9DK

bA\$ . (#7 #7&, \$, %& #7 )6\$, 9<6%A\$, %K U, a7' <(\$E, )6\$, 9<6%A\$, ' #96A7&? (/6A& 02[ 67 (5, \$ (E, K 34, %, ' #96A7& % (\$, 76& 4#E4<D %, 7%#&5, &6 &4, &D-, 6) 46A%#7E? /A& &4, D (\$, <(\$E, \$ )6\$ 46A%, % W#&4 <6W\-\$#9, ' 94 (\$ (9&, \$%#&#9% #7 <6W\-\$#9, ' 7, #E4/6\$ \ 466' %K 34#% %AEE, %&& &4 (& &4, )6\$, 9<6%A\$, ' #96A7& % \$, <(& , ' &6 5(7' (<#%. ? &4\$6AE4 &W6 -6%#< /<, 94(77, <%K " #96A7& )6\$, 9<6%, ' 46A%, % . (D 4(5, / , , 7 ' ( . (E, ' / , )6\$, &4, D 9(7 / , %6<' K +, 967' ? . 6\$&E(E, <, 7' , \$% . A&& -\$6&, 9&)6\$, 9<6%, ' 46A%, % W4#<, &4, D (\$, 5(9(7&j &4, &4\$, (& 6) 5(7' (<#%. . (D / , E\$, (& \$ #7 / ( ' 7, #E4/6\$466' %? (7' 96%&& 6) -\$6&, 9&#67 <P, <D (996A7& )6\$ ( <(\$E, \$ )\$(9&#67 6) &4, 5(<A, 6) ( <6W\-\$#9, ' 46A%, K 34, 96%&& 6) -\$6&, 9&#67 #7' A9, . 6\$&E(E, <, 7' , \$% &6 %, < )6\$, 9<6%, ' 46A%, % A\$E, 7&<D? <, ( ' #7E &6 ' #96A7& % #7 #<#` A# ' 46A%#7E . (\$P, &%K

34, #79#', 79, 6) )6\$, 9<6%A\$, %(<, % #4#E4<D 5(\$#(/<, 65, \$ &#. , (7' %- (9, ? /A& #7 %6. , (\$, (% (& %6. , &#. , %)6\$, 9<6%A\$, % (996A7& )6\$ ( <(\$E, )\$(9&#67 6) &6&(< %(<, %K 34#% (<<6W% A% &6 %&A' D &4, \$, <(&#67% / , &W, , 7 )6\$9, ' %(<, % - \$#9, % (7' &4, %A/%, `A, 7& &\$ (7%(9&#67% - \$#9, % 6) 6&4, \$ 46A%, % #7 &4, %(<. , 7, #E4/6\$466' K

U, 967&\$(%& &W6 , ]&\$, . , 5#, W% 6) &4, \$, <(&#67 / , &W, , 7 )6\$9, ' (7' A7)6\$9, ' %(<, % - \$#9, % )6\$ 46A%, %K 34, a\$%& 5#, W #% &4 (& A7)6\$9, ' &\$ (7%(9&#67% &(P, -<(9, (& , ^9# 7& - \$#9, %? W4#94 , 56<5, )6<<6W#7E ( \$ (7' 6. W(<P? W4#<, )6\$9, ' %(<, % &(P, -<(9, (& <6W, \$ - \$#9, %K S) &4, 46A%#7E . (\$P, & W, \$, ( ' , < , \$ . (\$P, & W#&4 ( /# ' \(%P %- \$, ( ' ? W, 96A<' &4#7P 6) A7)6\$9, ' &\$ (7%(9&#67% (% \$, 5, (<7E &4, , ^9# 7& - \$#9, (& &4, . # ' -6#7& 6) &4, %-\$, ( ' ? W4#<, )6\$9, ' &\$ (7%(9&#67% \$, 5, (< &4, <6W, \$ /# ' - \$#9, K S) &4, /# ' \(%P %- \$, ( ' #5 (\$#(/<, 65, \$ &#. , ? &4, 7 <(\$E, ' #96A7& % 6) )6\$9, ' )6\$. A7)6\$9, ' %(<, % - \$#9, % %46A<' - \$, ' #9& #79\$, (% , % #7 )6\$9, ' %(<, % - \$#9, %? /A& %46A<' 4(5, 76 #. -<#9(&#67% )6\$ )A&A\$, - \$#9, % 6) A7)6\$9, ' &\$ (7%(9&#67%K 34 (& #? /# ' \(%P /6A79, dJ 6<< ! : 2Te (Y, 9& &4, - \$#9, % 6) )6\$9, ' %(<, % /A& 76& &46%, 6) A7)6\$9, ' %(<, %K

34, 6--6%#&, , ]&\$, . , 5#, W #% &4 (&)6\$9, ' %(<, % 9675, D #7)6\$. (&#67 (/6A& &4, )A&A\$, - \$#9, % 6) A7)6\$9, ' &\$ (7%(9&#67%K 34, \$, (\$, %, 5, \$(< \$, (%67% W4D &4#% . #E4& / , &4, 9(% , K " #96A7& )6\$9, ' %(<, % . (D - , \$)6\$. &4, )A79&#67 6) - \$#9, ' #965, \$D? \$, 5, (<7E &4, - \$#9, % (& W4#94 /AD, \$ (\$, W#<#7E &6 , 7&, \$ &4, . (\$P, &K Q(\$&#9A<(\$<D #7 ' 6W7 . (\$P, &%? 46. , 6W7, \$% W#&46A& A\$E, 7& . 6&#5, % &6 %, <. (D %, & A7\$, (<#&#9(<<D 4#E4 - \$#9, %? - , \$4 (- % / , 9(A%, &4, # \$ , ] - , 9&(&#67% <(E &4, . (\$P, & 6\$ / , 9(A%, &4, D A%, &4, # \$ - A\$94(% , - \$#9, (% (\$, ), \$, 79, - \$#9, dO, 7, %65, (7' 8(D, \$ 011! eK S7 &4#% #&A(&#67? A7)6\$9, ' &\$ (7%(9&#67%

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, ^9#, 7& -\$#9, (& &4, . #' -6#7& 6) &4, %-\$, (' ? W4#<, A7)6\$9, ' &\$(7%(9&#67% \$, 5, (< &4,  
4#E4,\$ (%P -\$#9,K S) &4, /#'\(%P %-\$, (' 5(\$#, % 65,\$ &#. ,? ( <(\$E, ' #96A7& 6) )6\$9, '  
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34,\$, 96A<' (<6 / , 9(A#(< , Y, 9&# 6) )6\$9, ' %(<, % 67 &4, E, 7, \$(< <, 5, < 6) 46A%,  
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, <, % \$A%, (% g96. -(\$(/<, %h W4, 7 &4, D 7, E6&#(&, -\$#9, %K S7 &4, 9(% , 6) )6\$, 9<6%A\$, %?  
&4, \$, #W#', %-\$, (' 9679, \$7 &4(& &4, \$, . (D / , ' #\$, 9& 7, E(&#5, , Y, 9&# 6) )6\$, 9<6%A\$, %  
67 7, #E4/6\$466' %K "6\$, 9<6%A\$, % &D-#9(<D #756<5, - , \$#6' % ' A\$#7E W4#94 46A%, % &&(7'  
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8(%%(94A%, &&% 4(% /6&4 LA' #9#(< (7' 767\LA' #9#(< )6\$, 9<6%A\$, %K F LA' #9#(< )6\$, 9<6\ %A\$, #% -\$69, %, , ' &4\$6AE4 &4, 96A\$&#? / , E#77#7E W#&4 <, 7' , \$ a<#7E (7' \$, 96\$' #7E ( 76&#9, W4#94 #79<A' , % &4, ( . 6A7& 6) 6A&#&(7' #7E ' , /& (7' \$, (%67%)6\$ )6\$, 9<6%A\$, K H67\LA' #9#(< )6\$, 9<6%A\$, %? #7 967&\$ (%&? (\$, -\$69, %, , ' W#&46A& 96A\$& #7&, \$5, 7&#67? (7' &4, )6\$, 9<6%A\$, \$, `A\$#, . , 7&% (\$, , %&(/<#4, ' /D %&(&, %&(&A&, %K S7 , #&4, \$ 9(% , ? W#&4 (%%#%&(79, )\$6. &4, <69(< %4, \$%Yf% 6^9, ? &4, a\$%& (&&, . -& (& %, <#7E &4, -\$6-, &#D #5#( (7 (A9&#67K 34, &\$A%&, , 6\$ (&&6\$7, D 4(7' <#7E &4, )6\$, 9<6%A\$, %, &% &4, 6-, 7#7E /# ' (7' &4#% #% A%A(<<D (' 5, \$&#%, ' #7 &4, )6\$, 9<6%A\$, 76&#9, K 34, &D-#9(< 6-, 7#7E /# ' #% &4, /(<(79, 6) &4, . 6\$&E(E, -<A% -, 7<#&#%? A7-(# ' #7&, \$, %&? (&&6\$7, D ), , %? (7' 6&4, \$ 96%&% &4(& &4, <, 7' , \$ 4(% #79A\$\$, ' ' A\$#7E &4, -\$69, %K S7 8(%%(94A%, &&%? &4, ' , -6%&& &6 -(\$&#9#-(&, #7 &4, (A9&#67 #% A%A(<<D IR?111 (7' 46. , 6W7, \$% (\$, 76& 6/<#E(&, ' &6 (<<6W /# ' , \$% &6 #75, %&#E(&, #7#% ' , &4, -\$6-, &\$DK 34, . (#7 #&, . (9&A(<<D (A9&#67, ' )

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34, - \$6- , \$&D , #&4, \$ # %6<' &6 &4, 4#E4, %& /# ' , \$ 6\$ # %A\$7, ' 65, \$ &6 ( &\$A%&, , &6 <#`A# ' (&, &4, - \$6- , \$&D (7' - (D &4, <, 7' , \$? 6\$ &4, (A9&#67 # %A7%A99, %)A<K + #79, 8 (%%(\ 94A%, &&% ' 6, % 76& 4(5, ( \$, ' , . -&#67 - , \$6' W4, \$, ( 46. , 6W7, \$ \$, &(#7% &4, \$ #E4& &6 /AD / (9P &4, - \$6- , \$&D /D - (D#7E &4, )A<< ( . 6A7& 6) &4, <6(7 (<67E W#&4 &[ , %? #7&, \$ \ , %&? (7' - , 7(<#%, %? &4, &\$ (7%), \$ 6) 6W7, \$ %4#- / , 96. , % 96. -<, &, (& ( 9<6%#7E )6<<6W#7E &4, )6\$, 9<6%A\$, (A9&#67K 34, - \$, 5#6A% 6W7, \$ %? #) %&#<< - \$, %, 7&? (\$, (A&6. (&#9(<<D 967\ 5, \$&, ' &6 &4, 7(7&? (7' &4, 7, W 6W7, \$ . A%&)6<<6W 8 (%%(94A%, &&% <, E(< - \$69, ' A\$, %)6\$ , 5#9&#67K<sup>T</sup> + A99, %)A< (A9&#67% \$, - \$, %, 7& ! 2[ 6) 6A\$ 9(% , %K U, # ' , 7&#)D &4, %, (% 9(% , % W4, \$, &4, (9`A#\$, \$ # % (7 7' #5# ' A(< 6\$ \$, (&D &\$A%&? 6\$ &(P, % 6A& ( . 6\$&E(E, &6 a7(79, &4, - A\$94(% , K

S) 76/6' D /# ' % 4#E4, \$ &4(7 &4, 6- , 7#7E /# ' ? 967&\$6< # % 4(7' <, ' 65, \$ &6 &4, <, 7' , \$K S7 &4#% 9(% , ? &4, <, 7' , \$ # % \$, % - 67%# / <, )6\$ &4, % (<, 6) &4, - \$6- , \$&D? (7' A%A(<<D &\$ (7% \ ), % &4, - \$6- , \$&D &6 #&% \$, (< , %&(&, 6W7, ' dJ > be ' , - (\$&. , 7&? W4#94 - \$, - (\$, % #&)6\$ % (<, &D - #9(<<D 67 &4, 6- , 7 . (\$P, &K b99(%#67(<<D? J > b% 7, E6&#(&, % (<, % ' # \$, 9&<D W#&4 #75, %&6\$% \$ (&4, \$ &4(7 - <(9, &4, - \$6- , \$&D 67 &4, . (\$P, &? (7' 9(7 , 5, 7 6Y, \$ - A\$94(% , % - (9P(E, % 6) - \$6- , \$&#, %K " 6\$ &4, %, 20[ 6) 9(% , % #7 6A\$ ' (&(% , &? W, &\$, (& &4, %A / %, `A, 7& % (<, 6) &4, - \$6- , \$&D /D &4, . 6\$&E(E, <, 7' , \$ (% (7 A\$E, 7& 6\$ )6\$9, ' % (<, K

S7 9(% , % W4, \$, ( % (<, # % /6&4 )6\$, 9<6%A\$, \ \$, <(&, ' (7' <#7P, ' &6 ( ' , (&4 6\$ / (7P\ \$A - &9D? W, \$, &(#7 &4, )6\$, 9<6%A\$, 9<(%%#a9(&#67K S) ( % (<, # % <#7P, ' &6 /6&4 ( ' , (&4 (7' ( / (7P\$A - &9D? W, A%, - \$6\$#&D \$A<, %? / (% , ' 67 . (&94 `A(<#&D (7' , 5, 7& ' (&, %? &6 9<(%%#)D #& (% , #&4, \$ ' , (&4\ \$, <(&, ' 6\$ / (7P\$A - &9D\ \$, <(&, ' K

34, &6- - (7, < 6) 3(/<, 0 \$, - 6\$&% &4, )\$, `A, 79D 6) , (94 &D - , 6) )6\$9, ' % (<, )6\$ , (94 D, (\$ #7 6A\$ ' (& ( % , &K 34, a\$%& 96<A. 7 6) &4, &(/<, %46W% &4, &6&(< 7A. / , \$ 6) 46A%#7E &\$ (7%(9&#67% #7 &4, U (\$\$, 7 O\$6A - ' (& ( #7 , (94 D, (\$K U, 4(5, LA%& 65, \$ 00 D, (\$% 6) ' (& ( 7' ( &6&(< 6) ! ? i 2G?Gc1 &\$ (7%(9&#67%? )6\$ (7 (5, \$(E, 6) LA%& 65, \$ 2! ? 111 &\$ (7%(9&#67% - , \$ D, (\$K b) &4, %, ? RkC[ (\$, )6\$9, ' &\$ (7%(9&#67%\* GK! [ \$, <(&, '

<sup>G</sup>F996\$' #7E &6 8 (%%(94A%, &&% <(W? #) &4, a\$%& . 6\$&E(E, )6\$9, % &4, )6\$, 9<6%A\$, ? (7' &4, \$, # % 76 . 67, D <,) & ()&, \$ &4, % (<, 6) &4, 46A%, &6 - (D &4, %, 967' . 6\$&E(E, ? &4, <, 7' , \$ 6) &4, %, 967' . 6\$&E(E, %&#<< 4(% ( 9<(#. (E(#7%& &4, /6\$6W, \$? /A& 9(776& &(P, &4, 46A%, (7D. 6\$, K B6W, 5, \$? #) #& # % &4, %, 967' <, 7' , \$ W46 # %)6\$9#7E &4, )6\$, 9<6%A\$, ? &4, - \$6- , \$&D W#<< / , %6<' W#&4 ( <#, 7 )\$6. &4, a\$%& . 6\$&E(E, K

<sup>T</sup>34#% 9(7 \$A7 (7DW4, \$, )\$6. c W, , P% &6 c . 67&4%? W#&4 &4, (5, \$(E, (/6A& ! 1 W, , P% d4&&- \*mmWWWK<(W-#/K%&(&, K. (KA%#)6\$, 9<6%A\$, K4&. <? g" 6\$, 9<6%A\$, "Fnhek

&6 )6\$,9<6%A\$,,%? !Ki [ \$,<(&,' &6 ' ,(&4%? (7' 1K2[ \$,<(&,' &6 /(7P\$A-&9#,%K 34,  
)\$(9&#67 6) )6\$9,' %(<,% #% 4#E4<D 5(\$#(/<, 65,\$ &#. ,K F& &4, 5,\$D ,7' 6) &4, %( . -<,  
&4#% #% ' A, &6 &4, )(9& &4(& W, 9(776& . (&94 %(<,% &6 )A&A\$, ' ,(&4% 6\$ /(7P\$A-&9#,%K  
86\$, E,7,\$(<D? #& \$,\_,9&% ( E\$(' A(< #79\$, (% , #7 ' ,(&4\\$,<(&,' %(<,% 65,\$ &#. ,? (7' (7  
A-W(\$' %4#)& #7 &4, #79#',79, 6) /(7P\$A-&9D #7 &4, <(& !::1% (7' ,(\$<D 0111% /,)6\$,  
/(7P\$A-&9D \$,)6\$. #79\$, (% , ' &4, 96%& 6) -,\$%67(< /(7P\$A-&9D #7 011R<sup>R</sup> B6W,5,\$  
&4, . 6%& #. -6\$&(7& &#. ,\5(\$#(&#67 #% ' \$5,7 /D &W6 W(5,% 6) )6\$,9<6%A\$,,% ' A\$#7E &4,  
46A%#7E ' 6W7&A\$7% 6) &4, ,(\$<D !::1% (7' 011i\12K 34, #79#',79, 6) )6\$,9<6%A\$,,\  
\$,<(&,' )6\$9,' %(<,% W(% 7,E#E#</, #7 !:2i? \$6%, &6 :Ki [ #7 !::G? &4,7 \$,9,' , ' &6  
A7' ,\$ ! [ #7 &4, . #' \0111f% /,)6\$, \$%#7E (E(#7 &6 \$, (94 ( \$,96\$' <,5,<6) !OKi [ #7 &4,  
a\$%& `A(\$&,\$ 6) 0112K

34, /6&&6. -(7,<6) 3(/<, 0 9(&E6\$#Z,% )6\$9,' %(<,% (996\$' #7E &6 &4, ' (&, 6) &4,  
' ,(&4? /(7P\$A-&9D? 6\$ )6\$,9<6%A\$, #7 \$,<(&#67 &6 &4, 46A%, %(<,% S7 &4, 9(% , 6) ' ,(&4?  
W, a7' &4(& 46A%, %(<,% W#&4#7 67, D, (\$ 6) &4, ' ,(&4 6) ( %,<,\$ (\$ , 6\$, 96. . 67 &4(7  
46A%, %(<,% &W6 6\$ &4\$, , D, (\$ /,)6\$, 6\$ )&,\$ &4, ' ,(&4 6) ( %,<,\$ j 46W,5,\$ %(<,% (\$,  
(<. 6%& , `A(<D 96. . 67 &4, D, (\$ /,)6\$, ( %,<,\$ f% ' ,(&4 (7' &4, D, (\$ )&,\$ K S7 &4, 9(%  
6) /(7P\$A-&9D? W, a7' &4(& 46A%, %(<,% (\$ , \$,<(&#5,<D \$(\$ , ' A\$#7E &4, &4\$, , D, (\$ /,)6\$,  
( /(7P\$A-&9D a#7E? /A& &4, %(<,% #79#',79, %-#P,% A- &4, D, (\$ )&,\$ &4, a#7E (7' &4, 7  
E\$(' A(<D ' ,9#7,%K 34, %9(\$9#&D 6) %(<,% /,)6\$, /(7P\$A-&9D -\$,%A. (/<D \$,\_,9&% &4,  
) (9& &4(& /(7P\$A-&9D a#7E -\$6&,9&% (<< /A& &4, . 6%& , ]-,7%#5, -\$. (\$D \$,%#',79,%  
)\$6. 9\$, ' #86\$% &4\$6AE4 &4, 46. ,%&, (' , ],. -&#67 dU4#&, 0112eK "6\$,9<6%A\$,,\\$,<(&,'  
%(<,% 9(776& 699A\$ /,)6\$, &4, A7' , \$<D#7E )6\$,9<6%A\$,?(7' &,7' &6 &(P, -<(9, \$(-#<D  
&4,\$, )&,\$ K b) &4, GK! [ 6) )6\$,9<6%A\$,,\\$,<(&,' %(<,% #7 6A\$ ' (&(%,&? OKc[ 699A\$ W#&4#7  
67, D, (\$? 1KG[ #7 &4, %,967' D, (\$? 1K! [ #7 &4, &4#'\$ D, (\$? (7' &4, \$, . (#7' , \$ W#&4 ( <67E, \$ <(EK

3(/<, G %46W% 46W 6A\$ &\$ (7%(9&#67% (\$ , ' #5#', ' ( . 67E %#7E<, )( . #<D 46A%,%? . A<\  
&#)(. #<D 46A%,%? (7' 967' 6. #7#A. %? (7' W4(& )\$(9&#67 6) &4, . &(P, -<(9, #7 &4, 9#&D  
6) I 6%&67 (% 6--6%, ' &6 &4, \$,%& 6) &4, %&(&,K U, a7' &4(& #7 &4, 96. -<,&, ' (&(%,&?  
cT[ 6) &\$ (7%(9&#67% (\$ , #7 %#7E<, )( . #<D 46A%,%? !! [ #7 . A<#)(. #<D 46A%,%? (7' OR[  
#7 967' 6. #7#A. %K F. 67E )6\$9,' %(<,%? 46W,5,\$? . A<#)(. #<D 46A%,% (\$ , 6\$, 96. \  
. 67 d01[ e (7' 967' 6. #7#A. % (\$ , <,% 96. . 67 d!2[ eK 34, -(-, \$ \$, -6\$&% \$,%A<&%  
/6&4)6\$ &4, , 7&#\$, ' (&(%,&? (7' )6\$ % , -(\$(&, %A/%( . -<,% )6\$ , (94 46A%#7E &D-,K

<sup>R</sup>86\$E(7? S5,\$%67? (7' I 6&#94 d0112e %AEE,%& &4(& &4, /(7P\$A-&9D \$,)6\$. 6) 011R 967&#\$/A&,' &6  
&4, %A/%, `A,7& #79\$, (% , #7 %A/-\$. , . 6\$&E(E, ' ,)(A<#) /D . (P#7E #& 4(\$' , \$)6\$ /6\$6W,\$% &6 (94#5,  
\$,&, )\$6. A7%,9A\$, ' , /& 6/4E(&#67%K

34, 9#&D 6) I 6%&67 (996A7&% )6\$ 2[ 6) (< %(<, % (7' (<. 6%& !1[ 6) )6\$9, ' %(<, %K I 6%&67f% . 6' , %&<D E\$, (&, \$ %4(\$, 6) )6\$9, ' %(<, % #, 7&#\$, <D 9(A%, ' /D ( 4#E4, \$ #79#', 79, 6) )6\$, 9<6%A\$, % #7 I 6%&67 d! G[ 6) )6\$, 9<6%A\$, % (\$, #7 &4, 9#&DeK =, (&4\ (7' /(7P\$A-&9D\ \$, <(&, ' %(<, % (\$, (9&A(<D <, % 96. . 67 #7 I 6%&67 &4(7 , <%, W4, \$, K " #EA\$, 0 E#5, % ( \$ #94, \$ -#9&A\$, 6) &4, E, 6E\$(-4#9 ' #&A\$/A&#67 6) )6\$9, ' %(<, %? -<6&#7E /D Z#- 96', &4, %4(\$, 6) )6\$9, ' %(<, % #7 &6&(< %(<, %K 34, -(-, \$ \$, -6\$&% (7 (7(<D%#6) &4, , 7&#\$, ' (&(%&? /A& W, 4(5, 5, \$a, ' &4(& &4, \$, %A&% (\$, `A(<#&(&#5, <D %#. #<(\$ W4, 7 W, \$A7 %, -(\$(&, (7(<D%, % )6\$ , (%&, \$7 (7' W, %&, \$7 8(%(94A%, &&%K

3(/<, T %A. . (\$#Z, % &4, ' #&A\$/A&#67 6) 46A%, 94(\$ (9&, \$#&#9%)6\$ )6\$9, ' %(<, %K 34, &6- -(7, <6) &4, &(/<, 4(% , ] (9&<D &4, %(. , )6\$. (& (% 3(/<, !? (7' &4, /6&&6. -(7, < \$, -6\$&% &4, \$(&#6 6) , (94 7A. /, \$ #7 &4, &6- -(7, < &6 &4, 96\$, %-67' #7E 7A. /, \$ #7 3(/<, !K 34, . , '#(7)6\$9, ' %(<, &(P, % -<(9, (& ( - \$ #9, 6) I !!c?111? 67<D &W6 &4#'\$ % 6) &4, . , '#(7 (<, % - \$ #9, \$, -6\$&, ' #7 3(/<, !K 34#% #& \$A, ' , %-#&, &4, ) (9& &4(& &4, . , '#(7)6\$9, ' %(<, % 6) ( %#. #<(\$<D %Z, ' 46A%, 67 ( <6& 21[ 6) &4, %Z, 6) &4, . , '#(7 %(<, K

F& a\$%& %E4&? &4, <6W, \$ . , '#(7 - \$ #9, )6\$ )6\$9, ' %(<, % %AEE, %&% &4(& &4, %, &\$ (7%(9\ &#67% &(P, -<(9, (& ( <(\$E, - \$ #9, ' #&96A7&K B6W, 5, ? 67, 9(776& \$, (94 &4#% 9679<A#67 67 &4, /(%#% 6) 3(/<, T (<67, K 34, #79#', 79, 6) )6\$9, ' %(<, % W(% . A94 E\$, (&, \$ #7 &4, , (\$<D !: : 1f? W4, 7 &4, 65, \$(<< <, 5, <6) - \$ #9, % W(% ' , - \$, %, ' j (7' )6\$9, ' %(<, % (\$, . 6\$, <#P, <D &6 &(P, -<(9, #7 <6W#796. . , #76\$#&D 7, #E4/6\$466' %? W4, \$, - \$ #9, % (\$, <#P, <D &6 /, <6W, \$ )6\$ (7D E#5, 7 %Z, 6) 46A%, K 34, 7, ] %&, - #7 6A\$ (7(<D%#% #& &6 967&\$6<)6\$ &4, %, , Y, 9&% /D A%#7E ( 4, ' 67#9 \$, E\$, %&#67K

C D1% ! "#\$%& ' ()% B/\*\$" - +9

C3? ' 9(9/\$ 1%&" +/\$ #%<#%\*/'" +

B, ' 67#9 \$, E\$, %&#67 #% ( %&(7' (\$' (--\$6(94 )6\$ , %&#. (&#7E &4, \$, <(&#67%4#- /, &W, , 7 &4, - \$ #9, % 6) 46A%, % (7' &4, # \$ 94(\$ (9&, \$#&#9%K 3(/<, % R (7' c \$, -6\$& &4, \$, %A&% 6) \$, E\$, %&#7E &4, <6E 6) , (94 &\$ (7%(9&#67% - \$ #9, 67&6 967&\$6< 5(\$#(/<, % )6\$ &4, 65, \$(<< <, 5, < 6) <69(< - \$ #9, %? &4, , Y, 9&% 6) . , (%A\$, ' 46A%, 94(\$ (9&, \$#&#9%? (7' ' A. . #, % #7' #9(&#7E )6\$9, ' %(<, %K U, #79<A', ( %, -(\$(&, ' A. . D)6\$ , (94 Z#-96', \D, (\$? &4A% 967&\$6<#7E )6\$ (<< 46A%, - \$ #9, 5(\$#(&#67 65, \$ &#. , (& &4, Z#-96', <, 5, <K U, (<% #79<A', ( \$ #94 %, &

6) 46A%, 94(\$ (9&, \$%&#9% #79<A' #7E #7&, \$6\$ (\$, (? <6& (\$, (? 7A. /, \$% 6) \$66. %? /, ' \$66. %? (7' /(&4\$66. %? &4, (E, 6) &4, 46A%, (7' #&% %`A(\$, ? \$, 9, 7& \$, 765(&#67? ( ' A. . D) 6\$ 967' 6. #7#A. %? (7' ' A. . #, %) 6\$ W#7%6\$#Z(&#67 6) &4, %, 94(\$ (9&, \$%&#9%K 36 967&\$6< )6\$ 7, #E4/6\$466' 94(\$ (9&, \$%&#9% W#&4#7 Z#-96' , %? W, #79<A' , ' (& ( 67 &4, 9, 7%A% &\$ (9&% W4, \$, , (94 46A%, #% <69(&, ' ? #79<A' #7E . , ' # (7 #796. , (7' &4, -6-A<(&#67 %4(\$, % 6) B#%- (7#9%? F) \$9(7\F. , \$9(7%? . #76\$%? %, 7#6\$%? ), . (<, \4, (' , ' 46A%, 46<' %? (7' E\$6A- W#&4 ' #Y, \$, 7& <, 5, <9 6) , ' A9(&#67K 34, 96, ^9#, 7&% 67 &4, %, 967&\$6< 5(\$#(<, %? \$, -6\$&, ' #7 3(<, R? 4(5, &4, , ]-, 9&, ' %E7% (7' -<(A%#<, . (E7#&A' , %K "A\$&4, \$ 967&\$6<? 76& \$, -6\$&, ' #7 3(<, R? #79<A' , ' A. . D 5(\$#(<, %) 6\$ &4, &D-, 6) 4, (&#7E (7' %&D<, 6) 46A%, K 34, , 7&\$, <#& 6) 967&\$6< % - \$, %, 7&, ' #7 &4, F-- , 7' #]K

3(<, c \$, -6\$&% &4, 96, ^9#, 7&% 67 6A\$ )6\$9, ' %(<, ' A. . #, %K 34, a\$%& 96<A. 7 \$, -6\$&% \$, %A<&%) 6\$ 6A\$ )A<< %(<. -<, #79<A' #7E (< 46A%#7E &D-, %K U4, 7 W, A%, ( %7E<, ' A. . D) 6\$ (< 9(&, E6\$#, % 6) )6\$9, ' %(<, %? W, a7' ( <(\$E, (7' -\$ , 9#%, <D , %&#. (&, ' 96, ^9#, 7& 6) \1K1! : : ? 96\$ \$, %-67' #7E &6 ( -\$#9, ' #96A7& 6) 1 - exp(-0.199) = 18%.

34% , Y, 9& #% - \$#. (\$#<D ' \$5, 7 /D) 6\$, 9<6%A\$, \\$, <(&, ' %(<, %K U4, 7 W, #79<A' , %, -\ (\$(&, ' A. . #, %) 6\$ ' , (&4\\$, <(&, ' %(<, % /D D6A7E dA7' , \$ (E, i1e (7' 6<' d(E, i1 6\$ (/65, e %, <<, \$%? / (7P\$A-&9D\\$, <(&, ' %(<, %? (7' ) 6\$, 9<6%A\$, \\$, <(&, ' %(<, %? W, a7' 96, ^\ 9#, 7&% 6) \1K1R! ? \1K1c2? \1K1G0? (7' \1KG0G? \$, %- , 9&#5, <D 34, 96, ^9#, 7&) 6\$ ) 6\$, 9<6%A\$, #. -&, % ( <(\$E, -\$#9, ' #96A7& 6) 28%K

S7 3(<, i W, <66P %, -(\$(&, <D (& 46A%, % W#&4 ( %7E<, %, <<, \$ (7' W#&4 &W6 %, <<, \$%K FE(#7? &4, a\$%& 96<A. 7 \$, -6\$&% \$, %A<&%) 6\$ (< 46A%#7E &D-, %K U, a7' ( . A94 <(\$E, \$ ' #96A7&) 6\$ ' , (&4\\$, <(&, ' %(<, % W4, 7 &4, 46A%, 4( % ( %7E<, %, <<, \$ &4(7 W4, 7 #& 4( % &W6 %, <<, %K S7 &4, )6\$. , \$ 9(%, &4, ' #96A7& 96, ^9#, 7&% (\$, \1K120 (7' \1K1: R) 6\$ D6A7E (7' 6<' %, <<, \$% \$, %- , 9&#5, <D? W4#<, #7 &4, <(&&, \$ 9(%, &4, D (\$, \1K1GR (7' \1K1RGK U, (<% a7' ( 967%#', \$(</<D <(\$E, \$ ' #96A7&) 6\$ / (7P\$A-&9D\\$, <(&, ' %(<, % W4, 7 &4, \$, #% 67<D 67, %, <<, \$ d\1K1c!e &4(7 W4, 7 &4, \$, (\$, &W6 d\1K1! TeK

C3A @+9%#6#%9/+< 91% : " # \$ % & \* ( ) % & / \* \$ " - + 9

F P, D 94(<<, 7E, #% &6 A7' , \$%&(7' W4, &4, \$ <6W, \$ -\$#9, %) 6\$ ) 6\$9, ' %(<, % \$, \_\_, 9& #<<#`A# ' \ #&D #7 &4, 46A%#7E . (\$P, &? 6\$ A76/%, \$5, ' 5(\$#(&#67 #7 )A7' ( . , 7&(< 94(\$ (9&, \$%&#9% 6) 46A%, %K " 6\$ , ](<. -<, ? ' , (&4% (\$, . 6\$, 96. . 67 ( . 67E 6<' , \$ %, <<, \$%? W46%, 46A%, % . (D /, -66\$<D . (#7&(#7, ' 6\$ A7)(%4#67(</<D ' , 96\$(&, ' K 34, ) (9& &4(& &4, ' , (&4\ \$, <(&, ' ' #96A7& #% #79\$, (%#7E #7 &4, (E, 6) &4, %, <<, \$ %AEE, %&% &4, \$, <, 5(79, 6) &4#%

!!

-6#7&K +,<,\$% #7 a7(79#(<' #^9A&D . (D (<% )(< &6 . (#7&(#7 &4,#\$ 46A%,% -\$6-,\$<D?  
(7' 46A%,% &4(& 4(5, /,,7)6\$,9<6%, ' . (D 4(5, /,,7 5(7' (<Z, ' W4#<,%&(7' #7E ,. -&D?  
6\$ ,5,7 #7 %6. , 9(%,% 5(7' (<Z, ' /D &4,#\$)6\$. , \$ 6W7,\$%K

36 %4, ' %6. , <E4& 67 &4#% #%%A,? W, , ]-<6\$, 46W &4, )6\$9, ' %(<, ' #96A7& 5(\$#, %  
W#&4 &4, &#. #7E 6) ( %(<, #7 \$,<(&#67 &6 ' ,(&4 6\$ /(7P\$A-&9D? (9\$6%% 46A#7E &D-, %?  
(7' (9\$6%% 46A%,% W46%, 5(<A, #9679,7&\$(&, ' #7 &4, %&\$A9&A\$, 6\$ &4, <(7' K

"#EA\$, G %46W% &4(& ' #96A7&%)6\$ ' , (&4\\$, <(&, ' %(<, % (\$, \$, <(&#5, <D #7%, 7%#&#5, &6  
&4, &#. #7E 6) &4, ' , (&4?)\$6. G D, (\$% /,)6\$, &6 O D, (\$% )&,\$ &4, %(<, K S7 )(9&? W4, 7  
W, #79<A' , ' A. . #,% )6\$ ' , (&4% . 6\$, &4(7 &4\$, , D, (\$% /,)6\$, 6\$ )&,\$ &4, %(<, dW4#94  
W6A<' 76& /, 9<(%#a, ' (%)6\$9, ' %(<, %e? W, a7' &4(& &4,% , (<%6 , 7&,\$ &4, \$, E\$, %&#67  
%#E7#a9(7&<DK 34#% 967a\$. % &4, %A%-#9#67 &4(& &4, , %&#. (&, ' -\$#9, , Y, 9& #76& ' #\$, 9&<D  
\$, <(&, ' &6 &4, A\$E, 79D 6) &4, %(<, ? /A& \$, %A-&%)\$6. A76/%, \$5, ' -66\$ . (#7&, 7(79, K

34, &#. #7E -(&&, \$7)6\$ /(7P\$A-&9D\\$, <(&, ' %(<, % #%. 6\$, %AEE, %&#5, 6) ( &\$A, )6\$9, ' \\  
%(<, , Y, 9&K 34, <(\$E, %& 96, ^9#, 7& #%)6\$ ( %(<, &4(& 699A\$% W#&4#7 67, D, (\$ )&,\$ \$ (  
/(7P\$A-&9D a#7E? (7' &4#% 96, ^9#, 7&? (& \1K1RG? #%. 6\$, &4(7 &W#9, (% <(\$E, (% &46%,  
, %&#. (&, ' )6\$ &4, \$, <(&#5, <D #7)\$, `A, 7& %(<, % &4(& 699A\$ /,)6\$, /(7P\$A-&9DK

S7 &4, 9(% , 6) )6\$, 9<6%A\$, %d76& %46W7 #7 &4, aEA\$, e &4, &#. #7E -(&&, \$7 #% C\%4(-, ' K  
34, 96, ^9#, 7& #% \1KG! R )6\$ )6\$, 9<6%A\$, \\$, <(&, ' %(<, % W#&4#7 67, D, (\$ 6) )6\$, 9<6%A\$, ?  
\1KTRO )6\$ %(<, % ! &6 O D, (\$% )&,\$ )6\$, 9<6%A\$, ? (7' \1Kti O )6\$ %(<, % O &6 G D, (\$% )&,\$  
)6\$, 9<6%A\$, K S7 &4, 9(% , 6) %(<, % . 6\$, &4(7 G D, (\$% )&,\$ )6\$, 9<6%A\$, ? &4, 96, ^9#, 7&  
#% \1KO! cK +#79, . 6\$, &4(7 21[ 6) )6\$, 9<6%A\$, \\$, <(&, ' %(<, % 699A\$ W#&4#7 ( D, (\$ 6)  
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699A\$ W#&4 ( ' , <(D 6) ( D, (\$ 6\$ . 6\$, . (D \$, \_ , 9& ' #^9A& . (\$P, & 967' #&#67% &4(&  
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34, \$E4& 4(7' 96<A. 7% 6) 3(/<, c %46W 46W)6\$9, ' \%(<, ' #96A7& 5(\$D W#&4 46A\  
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. A&#)\). #<D 46A%, %? (7' %. (<<, \$)6\$ %7E<, \). #<D 46A%, %K B6W, 5, \$? ' , (&4\\$, <(&, '  
' #96A7& (\$, <(\$E, %&)6\$ %7E<, \). #<D 46A%, %? %. (<<, \$)6\$ . A&#)\). #<D 46A%, %? (7'  
5, \$D %. (<<)6\$ 967' 6. #7#A. %K +#79, ( <(\$E, -(\$& 6) &4, . (#7&, 7(79, 6) 967' 6. #7#  
A. % #% 4(7' <, ' 96<<, 9&#5, <D &4\$6AE4 &4, 967' 6. #7#A. (%69#(&#67? (7' &, 7(7&# #7  
. A&#)\). #<D 46A#7E , 7)6\$9, . #7#. A. . (#7&, 7(79, %&(7' (\$' %? &4#% -(&&, \$7 #% (<%6  
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6) ( -\$6-, \$&D? (7' %. (<<, \$ W4, 7 &4, <(7' (7' #&% (%69#(&, ' /A#<' #7E \$E4&% (996A7&  
)6\$ ( E\$, (&, \$ %4(\$, 6) 5(<A, K S7 &4, , ]&\$. , 9(% , W4, \$, ( %. (<< 46A%, # %6<' #7 (7  
, ] - , 7%#5, 7, #E4/6\$466' (% ( g&, (\$\ ' 6W7h? &4, \$, %46A<' / , 76 . (#7&, 7(79, \ \$, <(&, '  
' #96A7& (& (<<K 34A% W, 9(7 . , (%A\$, &4, #. -6\$&(79, 6) &4, . (#7&, 7(79, , Y, 9& /D  
<66P#7E (& 5(\$#(&#67 #7 &4, )6\$9, ' %(<, ' #96A7& (9\$6%% 46A%, % W#&4 ' #Y, \$, 7& 4, ' 67#9  
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#7' #9(&6\$%K U, ' , 96. -6%, &4, -\$ , ' #9&, ' <6E -\$#9, 6) , (94 46A%, #7&6 96. -67, 7&%  
, ] -<(#7, ' /D &4, 94(\$ (9&, \$ # % &#9% 6) &4, /A#<' #7E? &4, %Z, 6) &4, <6&? &4, 94(\$ (9&, \$ # % &#9%  
6) &4, 9, 7%A% &\$ (9&? (7' &4, Z#-96' , \D, (\$ #7&, \$ (9&#67K S7 &4, %, 967' %&(E, ? \$, -6\$&, '  
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, (94 6) &4, 5(<A, 96. -67, 7&% %&(7' (\$' #Z, ' &6 4(5, Z, \$6 . , (7 (7' A7#& %&(7' (\$'  
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&4#% #E\$, (&\$ )6\$ 46A%,% #7 ,]-,7%#5, 7,#E4/6\$466' % (7' Z#-96' ,% /,9(A%, &4,%, 46A%,% 4(5, 4#E4,\$ #. -<#9#& \$,7&(< 96%&%K I (7P\$A-&9D\\$,<(&,' ' #96A7&% (\$, 4#E4,\$ )6\$ %A94 46A%,%? (7' 4#E4,\$ W4,7 ( 46A%, #% %6<' &4, D, (\$ )&,\$ / (7P\$A-&9D? /A& \$,<(&#5,<D #7%,7%#&#5, &6 46A%#7E &D-,K

"6\$,9<6%A\$, \\$,<(&,' ' #96A7&% (--, (\$ &6 /, \$,<(&,' /6&4 &6 &4, A\$E,79D 6) %(<,(? (7' &6 5(7' (<#%. K "6\$,9<6%, ' 46A%,% . (D 4(5, /,, 7 5(7' (<#Z,' ' A\$#7E &4, &\$(7%), \$ 6) 6W7,\$%4#- &6 . 6\$&E(E, <,7' ,%#j (7' <,7' ,%#%,< A\$E,7&D /6&4 /,9(A%, ,. -&D 46A%,% ' ,#5,\$ 76 46A%#7E %, \$5#9,%? (7' /,9(A%, #& #%, ]-,7%#5, &6 -\$6&,9& %A94 46A%,% (E(#7%& 5(7' (<#%. K "6\$,9<6%A\$, \\$,<(&,' ' #96A7&% (\$, <(\$E,\$ #7 <6W\-\$#9,' 7,#E4/6\$466' % (7' Z#-96' ,%? (7' <(\$E,\$ )6\$ 94, (-,\$ 46A%,%K 34#% -(&&,\$7 . (D \$,\_,9& ( E\$, (&,\$ &4\$, (& 6) 5(7' (<#%. #7 /(' 7,#E4/6\$466' %? (7' a], ' 96%&% 6) -\$6&,9&#67 &4 (& LA&#)D <(\$E,\$ -\$6-6\$&#67 (<' #96A7&% 67 94, (-,\$ 46A%,%K

C3C . %#\*/9%+\$% ": 91% : "#\$%& \*())% &/\*\$"-+9

U, 4(5, ,%&#. (&,' #E7#a9(7& ,Y,9&% 6) )6\$9,' %(<,% 67 46A%, -\$#9,%K F7 #7&,\$,%&#7E `A,%&#67 #& 6 W4(& ,]&,7& &4,%, ,Y,9&% -, \$%#%&K S) &4, %(<. , 46A%, #% %6<' (E(#7 ()&,\$ ( )6\$9,' %(<,(? '6,% #& 967&#7A, &6 4(5, ( <6W,\$ -\$#9, 6\$ '6,% #&% -\$#9, \$,&A\$7 &6 &4, <,5,<-\$,' #9&,' /D &4, 4,' 67#9 \$,E\$,,%#67o S7 3(/<, : W, \$,\,%&#. (&, 6A\$ 4,' 67#9 \$,E\$,,%#67% #79<A' #7E #7)6\$. (&#67 67 &4, -\$#9, (& W4#94 , (94 46A%, W(% -\$ ,5#6A%-D %6<' K U, a\$%& #' ,7&#)D &4, ' (&, 6) &4, . 6%& \$,9,7& -\$ ,5#6A% %(<, 6) , (94 46A%, #7 6A\$ &\$(7%(9&#67% ' (&(&,%? &4, -\$#9, 6) &4 (& -\$ ,5#6A% %(<,(? (7' W4,&4,\$ &4, -\$ ,5#6A% %(<, W(% )6\$9,' K U, 9\$, (&,' A. . D 5(\$#(/<,% )6\$ -\$ ,5#6A% %(<,% &4 (& &66P -<(9, W#&4#7 &4, D, (\$ /,)6\$, &4, 9A\$\$,7& %(<,(? 67, &6 &4\$, , D, (\$ /,)6\$, &4, 9A\$\$,7& %(<,(? &4\$, , &6 a5, D, (\$ /,)6\$, &4, 9A\$\$,7& %(<,(? (7' a5, D, (\$ 6\$ . 6\$, /,)6\$, &4, 9A\$\$,7& %(<,K 34,7 W, #7&,\$ (9& &4, -\$ ,5#6A% %(<,% -\$#9,? (7' ' A. . #,% #7' #9(&#7E W4,&4,\$ &4, -\$ ,5#6A% %(<, W(% )6\$9,' ? W#&4 &4,%, ' A. . #,% )6\$ &4, &#. #7E 6) &4, -\$ ,5#6A% %(<,K

3(/<, : %46W% &4 (& -\$ ,5#6A% %(<,% -\$#9,% ' 6 4(5, ( -, \$%#%&,7& ,Y,9&? W4#94 %, . . % (<. 6%& #75(\$#(7& &6 &4, <,7E&4 6) &#. , %#79, &4, <(%& %(<,K 34, 96, ^9#,7& 67 &4, -\$ ,5#6A% %(<,% -\$#9, 6) (/6A& 1K!R #. -<#,% &4 (& ( !1[ <6W,\$ -\$#9, (& &4, &#. , 6) &4, <(%& %(<,(? A7, ]-<(#7, ' /D &4, 6&4,\$ 5(\$#(/<,% #7 &4, 4,' 67#9 \$,E\$,,%#67? #% (%%69#(&,' W#&4 ( !KT[ <6W,\$ -\$#9, (& &4, &#. , 6) &4, 9A\$\$,7& %(<,K 34#% -, \$%#%&,7& -\$#9, ,Y,9&? W4#94 #%, ]-<6#&,' /D \$, -, (&\%(<,% 46A%, -\$#9, #7' , ],% d; (% , (7' +4#<,\$ !: 2i? !: 2: e? 96A<' \$,\_,9& A7. , (%A\$, ' `A(<#&D ' #Y,\$,7&#(< (9\$6% 46A%,% 6\$ &4, A%, 6) -\$ ,5#6A% -\$#9, (% \$,), \$, 79, -\$#9,% #7 /(\$E(#7#7E /D %, <,\$ (7' /AD,\$%K



; 67&\$6<#7E)6\$ &4, E, 7,\$(< -, \$%%&, 79, 6) 46A%, - \$9,%? W, ' 6 76& a7' &4(& )6\$9, '  
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-\$,5#6A% %(<, W(% ' , (&4\\$, <(&,' ? &4,\$, #% ( . 6' ,%& -6%#&#5, ,Y,9& 67 &4, %A/%, `A, 7&  
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-67, 7& 6) &4, - \$,5#6A% %(<,% - \$9, d1K! R &#. ,% &4, ' , (&4\\$, <(&,' '#96A7&eK 34A%? #)  
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96A7&? #& (--, (\$% &6 /, \$,9&#a, ' /D &4, 7, ]& 6W7,\$ 6) &4, - \$6-, \$&DK B6W, 5,\$? 67,  
. A%& /, 9(A&#6A% (/6A& &4#% 9679<A%#67 E#5, 7 &4, <(\$E, %&(7' (\$' , \$6\$% 67 &4, , %&#\  
. (&,' ,Y,9&%K 34, 96, ^9#, 7&%)6\$ /(7P\$A-&9D\\$, <(&,' (7' )6\$, 9<6%A\$, \\$, <(&,' %(<,%  
' 6 76& %46W (7D %&\$67E 6\$ 967%#%&, 7& - (&,& 7%K

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E3? G/6\$" &%(H)%I %) 6#/\$% &J+(5/\$\*

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6) A7)6\$9, ' %(<,%K U, /, E#7 /D (EE\$, E(&#7E 46A%, - \$9,% &6 &4, Z#-96' , \D, (\$ <, 5, < (7'  
, ](. #7#7E &4, ' D7(. #9% 6) Z#-96' , \, 5, < 46A%, - \$9,%K S7 , (94 Z#-96' , #7 , (94 D, (\$?  
W, W, #E4& , (94 &\$ (7%(9&#67 , `A(<<D (7' 9(<9A<(& , &4, (5,\$(E, - \$9, 6) )6\$9, ' %(<,%? &4,  
(5,\$(E, - \$9, 6) A7)6\$9, ' %(<,%? (7' &4, %4(\$, 6) )6\$9, ' %(<,%K 34, (--, 7' #] \$, -6\$&%  
%A. . (\$D %&(&#%#9%)6\$ &4#% ' (&(% , &K C7%AS-\$#%#7E<D? W, (E(#7 a7' &4(& )6\$9, ' %(<,%  
&(P, -<(9, (& <6W, \$ - \$9,%K 34, ' #%&\$#/A&#67 6) &4, )6\$9, ' \%(<,% %4(\$, #% , ]&\$, . , <D  
\$#E4&\%P, W, ' ? W#&4 ( . , ' # (7 6) 67<D T[ /A& ( :: &4 - , \$9, 7&#<, 6) GT[ K U, W#7%6\$#Z,  
&4, )\$(9&#67 6) )6\$9, ' %(<,% (& &4#% <, 5, <

3(/<, !1 - \$, %, 7&% \$, E\$, %&#67% &4(& ' , %9\$#/, &4, ' D7(. #9% 6) 46A%, - \$9,% (& &4,  
Z#-96' , <, 5, < 36 , <#. #7(&, Z#-96' , a], ' , Y, 9&%? W, ' #Y, \$, 79, &4, <, 5, < 6) <6E - \$9,%  
&6 6/&(#7 46A%, - \$9, E\$6W&4 \$(&, % #7 , (94 Z#-96' , K U, (<% 9\$6%#%, 9&#67 (<<D ' , . , (7  
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bA\$ a\$%& \$, E\$, %&#67 ' 6, % 76& ' %&#7EA#%4 /, &W, , 7)6\$9, ' (7' A7)6\$9, ' %(<,% - \$9,%K  
U 4, 7 - \$9, E\$6W&4 #% \$, E\$, %%, ' 67 <(EE, ' - \$9, E\$6W&4? W, 6/&(#7 ( 7, E(&#5, 96, ^\  
9#, 7& 6) (/6A& -0.44? #7' #9(&#7E &4(& Z#-96' , \, 5, < - \$9, 5(\$#(&#67 %% . , (7\\$, 5, \$&#7EK  
34#% \$, %A< 967&\$(%& W#&4 &4, - \$9, . 6. , 7&A. ? 6\$ -6%#&#5, %, \$#(< 96\$%, <(&#67 6) - \$9,  
94(7E, %? 6/%, \$5, ' #7 9&#DW#', ? %&(&, W#', ? 6\$ 7(&#67(< 46A%, - \$9, #7' , ], % d; (% , (7'

+4#<,\$? !:2: eK B6W,5,\$? &4, , ]-<(7(&6\$D -6W,\$ 6) &4#% \$,E\$,%%#67 #% . 6' ,%&? (/6A&01[ K

H, ]& W, %, -(\$(&, <6E )6\$9,' (7' A7)6\$9,' %(<,% - \$9,%? (7' ,%&#. (&, (7' , \$6\$ \ 96\$ \$, 9&#67 . 6' ,< )6\$ &4, &W6 6) &4, . K 86\$, %-, 9#a9(<D? W, ,%&#. (&, ( a\$%&\6\$' , \$ 5, 9&6\$ (A&6\$, E\$, %%#67 dVFJ e )6\$ &4, 94(7E, #7 <6E )6\$9,' %(<,% - \$9,% (7' &4, <, 5, < 6) &4, )6\$9,' %(<,% ' #96A7&? &4(& #? &4, ' #Y, \$, 79, /, &W, , 7 <6E A7)6\$9,' (7' )6\$9,' %(<,% - \$9,%K 34#% - \$69,' A\$, #% (- \$6- \$(&, #) &4, )6\$9,' %(<,% ' #96A7& #% %&(&#67(\$D? %6 &4(& <6E )6\$9,' (7' A7)6\$9,' %(<,% - \$9,% (\$, 96#7&, E\$(&, ' d; (. -/,<< (7' +4#<,\$ !:2i? >7E<, (7' O\$(7E,\$ !:2i eK 34, ,%&#. (&, ' VFJ #. -<#,% &#. , \%, \$%, % /, 4(5#6\$ )6\$ &4, 6. #&&, ' 5(\$#(<,<? #7 &4#% 9(% , &4, <6E A7)6\$9,' %(<,% - \$9,%K

U, a7' ( %&\$67E &, 7' , 79D)6\$ \$, 5, \$(< #7 )6\$9,' %(<,% - \$9, E\$6W&4K @ (EE, ' )6\$9,' - \$9, 94(7E, % - \$, ' #9& )6\$9,' - \$9, 94(7E, % W#&4 ( 96, ^9#, 7& 6) -0.08K S7 ( ' '#&67? (<(\$E, ' #96A7& 6) )6\$9,' %(<,% - \$9,% )6\$. A7)6\$9,' - \$9,% - \$, ' #9&% &4(& )6\$9,' %(<,% - \$9,% W#< #79\$, (% , K 34, %, &W6 , Y, 9&% &6E, &4, \$ , ]-<(#7 (/6A& Tc[ 6) &4, 5(\$#(&#67 #7 )6\$9,' %(<,% - \$9, E\$6W&4K 34, )6\$9,' %(<,% ' #96A7& #% . , (7\\$, 5, \$&#7E? W#&4 ( 96, ^9#, 7& 6) 0.07 67 #&% 6W7 <(EK 34, ' #96A7& (<#6 4(% ( 96, ^9#, 7& 6) 0.05 67 <(EE, ' )6\$9,' %(<,% - \$9, E\$6W&4? #. -<D#7E &4(& &4, ' #96A7& #% . 6\$, <#P, <D &6 7(\$6W #) #& \$, (94, ' #&% - \$, 5#6A% <, 5, < &4\$6AE4 ( \$, 9, 7& ' , 9<#7, #7 )6\$9,' %(<,% - \$9,%j &4#% #% (76&4, \$ . (7#), %&(&#67 6) \$, 5, \$(< #7 )6\$9,' %(<,% - \$9, E\$6W&4K 34, , `A(&#67%)6\$ &4, %, &W6 5(\$#(<,<,% #. -<D 67<D 5, \$D . 6' , %& - \$, ' #9&(/#<#&D )6\$ A7)6\$9,' %(<,% - \$9,%? W#&4 7, E(&#5, 96, ^9#, 7&% 6) -0.03 67 <(EE, ' )6\$9,' %(<,% - \$9,% (7' -0.09 67 &4, <(EE, ' ' #96A7&? (7' (7 R<sup>2</sup> %&(&#%#9 6) : [ K

34, %, VFJ \$, %A&% #. -<D &4(& /6&4 )6\$9,' (7' A7)6\$9,' %(<,% - \$9,% . 65, #7 %A94 ( W(D (% &6 7(\$6W A7A%A(<D <(\$E, )6\$9,' %(<,% ' #96A7&%K B6W,5,\$? &4, , ]-<(7(&6\$D -6W,\$ 6) &4, \$, E\$, %%#67 #% . A94 E\$, (&, \$)6\$ )6\$9,' %(<,% - \$9,%? (& Tc[ ? &4(7 )6\$ A7)6\$9,' %(<,% - \$9,%? (& : [ K p#-96' , (5, \$(E, % 6) A7)6\$9,' %(<,% - \$9,% (-, (\$ &6 /, . A94 9<6%, \$ &6 ( \$(7' 6. W(<P &4(7 (\$, Z#-96' , (5, \$(E, % 6) )6\$9,' %(<,% - \$9,%K 34#% \$, %A& %A--6\$&% &4, 5#, W &4(& 67 (5, \$(E, W#&4#7 , (94 Z#-96' , ? A7)6\$9,' %(<,% % (P, -<(9, (& (- \$6]#. (&, <D , ^9#, 7& - \$9,%? W4#<, )6\$9,' %(<, - \$9,% (\$, . , (7\\$, 5, \$&#7E /, 9(A%, &4, D \$, \_\_, 9& &#. , \5(\$D#7E #<#` A#` #&D #7 Z#-96' , \<, 5, < 46A%#7E . (\$P, &%K

34, 5(\$#(&#67 65, \$ &#. , #7 &4, #79# , 79, 6) )6\$9,' %(<,% (<<6W% A% &6 (%P W4, &4, \$

<sup>c</sup>S) , 76AE4 <(E% (\$, #79<A' , ' #7 &4, %D%&, . ? &4, #. -<# , ' ' D7(. #9% (\$, &4, %(< , W4, &4, \$ 67, 6. #&% &4, A7)6\$9,' 6\$ &4, )6\$9,' %(<,% - \$9,%K U, 6/&(#7 /\$6(' <D 967%#&, 7& \$, %A&% #) W, ,%&#. (&, ( VFJ )6\$ &4, 94(7E, #7 <6E A7)6\$9,' %(<,% - \$9,% (7' &4, <, 5, < 6) &4, )6\$9,' %(<,% ' #96A7&? #79<A' #7E , #&4, \$ 67, 6\$ &W6 <(E%K

Z#-96' ,\<,5,< 46A%, - \$9, ' D7(. #9% (\$, (Y,9&,' /D &4#% #79#', 79,K S7 &4, a\$%& - (7,< 6) 3(/<, !!? W, (' ' &4, %4(\$, 6) )6\$9,' %(<,% (% ( 5(\$#(/<, #7 &4, VFJ %D%&,. K U, a7' &4(& &4, )6\$9,' %(<,% %4(\$, #% 4#E4<D -, \$%#%&, 7&? W#&4 ( 96, ^9#, 7& 6) 0.52 67 #8% 6W7 <(E? (7' &4(& #& ' , - \$,%,%, )6\$9,' %(<,% - \$9, E\$6W&4 dW#&4 ( 96, ^9#, 7& 6) -0.63e (7' W#', 7% &4, )6\$9,' %(<,% ' #96A7& dW#&4 ( 96, ^9#, 7& 6) 0.61eK b79, (E(#7? &4#% VFJ #. -<#, % 5, \$D <#&&<, - \$, ' #9&(/#<#D #7 &4, E\$6W&4 \$(, 6) A7)6\$9,' %(<,% - \$9,%K

" #7(<D? W, 967%#', \$ &4, -6%#/#<#&D &4(& ( 4#E4 %4(\$, 6) )6\$9,' %(<,% (Y,9&% &4, ' D7(. #9% 6) )6\$9,' %(<,% - \$9,% 76& 67<D /D ' \$,9&<D - \$, ' #9&#7E - \$9, 94(7E,%? /A& /D (&,\$#7E &4, 96, ^9#, 7&% 67 &4, 6&4, \$ 5(\$#(/<,% 6) &4, VFJ %D%&,. K S7 &4, %,967' - (7,< 6) 3(/<, !!? W, \$,E\$,%,% &4, )6\$9,' %(<,% %4(\$,? &4, 94(7E, #7 &4, <6E )6\$9,' %(<,% - \$9,? (7' &4, )6\$9,' %(<,% ' #96A7& 67 &4,#\$ 6W7 <(E (7' &4, #7&,\$(9&#67 6) &4, <(EE,' )6\$9,' %(<,% %4(\$, W#&4 &4, 6&4,\$ &W6 , ]-<(7(&6\$D 5(\$#(/<,%K U, a7' &4(& ( 4#E4 )6\$9,' %(<,% %4(\$, \$, ' A9,% &4, &, 7', 79D )6\$ )6\$9,' %(<,% - \$9, E\$6W&4 &6 \$,5,\$,%? (7' \$,' A9,% &4, \$,%-67%, 6) )6\$9,' %(<,% - \$9, E\$6W&4 &6 &4, )6\$9,' %(<,% ' #96A7&K ; 67%#%&, 7& W#&4 &4#%? ( 4#E4 )6\$9,' %(<,% %4(\$, #79\$, (%,% &4, -, \$%#%&, 79, 6) &4, )6\$9,' %(<,% ' #96A7&K 34, (A&6\$,E\$,%,%#5, 96, ^9#, 7&)6\$ &4, )6\$9,' %(<,% ' #96A7& #79\$, (%,% )6\$. 1K1i? #7 (7 ,75#\$67. ,7& W#&4 (7 (5,\$(E, R[ %4(\$, 6) )6\$9,' %(<,%? &6 1KGi? #7 (7 ,75#\$67. ,7& W#&4 ( %4(\$, 6) )6\$9,' %(<,% (& &4, GT[ W#7%6\$#Z(&#67 -6#7&K S7 6&4,\$ W6\$' %? (<69(&#67 W#&4 ( 4#E4 %4(\$, 6) )6\$9,' %(<,% #% <#P,<D &6 4(5, -, \$%#%&, 7&<D ' , - \$,%,%, ' )6\$9,' %(<,% - \$9,% (7' 4#E4 )6\$9,' %(<,% ' #96A7&%K

S7 (<< &4, %, %-, 9#a9(&#67%? W, 967&#7A, &6 a7' &4(& A7)6\$9,' %(<,% - \$9, E\$6W&4 #% 4(\$' &6 - \$, ' #9&K 34, R<sup>2</sup> %&(&#%&#9)6\$ A7)6\$9,' %(<,% - \$9, E\$6W&4 #% 7,5,\$ . 6\$, &4(7 !T[ #7 . 6' ,<% W#&4 %#7E<, <(E? (7' ,5,7 #) W, (' ' 67, . 6\$, <(E 6) , (94 5(\$#(/<, &4, R<sup>2</sup> %&(&#%&#9 7,5,\$ , ]9,, ' % 01[ K 34, <#. #&,' - \$, ' #9&(/#<#D 6) Z#-96' ,\<,5,< 46A%, - \$9, . 65, . , 7&%? W4, 7 %(<,% (\$, A7)6\$9,' ? #% ( \$6/A%& \$,%A<& (9\$6%& (<< &4, . 6' ,<% W, ,%&#. (&,K

E3A K" \$( ) %L%\$9\* " : : " #%) " \* - #%\*

>5, 7 &46AE4 )6\$9,' %(<,% ' 6 76& %, ,. &6 ' \$5, <(\$E, - \$, ' #9&(/<, . 65, . , 7&% #7 (5, \$(E, A7)6\$9,' %(<,% - \$9, % W#&4#7 &4, %(. , Z#-96' ,? #& #% -6%#/#<, &4(& &4,\$, (\$, . 6\$, <69(< , Y,9&% 6) )6\$9,' %(<,% 67 7, #E4/6\$#7E 46A%, % &4(& ' 6 76& &46W A- #7 ' (& ( EE\$, E(&, ' &6 &4, Z#-96' , <,5,< F - (\$#9A<(\$ 9679,\$7 #% &4(& 46A%, % 5(9(&, ' ' A\$#7E &4, )6\$, 9<6%A\$, - \$69, % ' \$5, ' 6W7 7, #E4/6\$466' 46A%, - \$9,%K S7 &4#% %, 9&#67 W, A%, ' (& ( 67 &4, - \$, 9#%, <69(&#67 6) , (94 46A%, &\$ (7%(9&#67 #7 6A\$ ' (&(% , & &6 &\$D &6 #', 7&#)D A94 , Y, 9&%K

bA\$ . (#7 (--\$6(94 #% &6 (' ' 5(\$#(/<,% &6 6A\$ 4,' 67#9 \$,E\$,%%#67 &4(& . ,(%A\$, &4, 7A. /,\$ 6) )6\$,9<6%A\$,,%? ' ,a7,' (% 9(%,% #7 W4#94 6W7,\$%4#- 6) 7,#E4/6\$#7E 46A%,% 4(% /,, 7 &\$ (7%),\$\$, ' &6 . 6\$&E(E, <, 7' ,,%? 9(A#7E &4,. &6 , 7&,\$ (7 A\$E, 7& %(<,% - \$69,%%K U, a7' 967%#', \$(/,< , 5#', 79, &4(& )6\$,9<6%A\$,,% W#&4#7 1KOR . #<,(? (7' -(\$#9A<(\$<D W#&4#7 1K! . #<,(? <6W,\$ &4, - \$#9, (& W4#94 ( 46A%, 9(7 / , %6<' K

F 94(<<, 7E, #7 #7&,\$-\$, &#7E &4#% \$,%A<#% &4(& <69(< , 9676. #9 %469P?% A94 (% -<(7& 9<6%#7E? . (D ' \$#5, /6&4 46A%, - \$#9,% (7' )6\$,9<6%A\$,,%K "A\$&4,\$. 6\$,?)6\$,9<6%A\$,,% (\$, , 7' 6E, 76A%&6 46A%, - \$#9,% / , 9(A%, 46. , 6W7,\$ (\$, . 6\$, <#P,<D &6 ' ,)(A<#) &4,D 4(5, 7,E(&#5, , `A#&D? W4#94 #% . 6\$, <#P,<D (% 46A%, - \$#9,% )(<<K S' ,(<D? W, W6A<' <#P, (7 #7%&\$A. , 7& &4(& #7\_A, 79,% )6\$,9<6%A\$,,% /A& &4(& ' 6,% 76& #7\_A, 79, 46A%, - \$#9,% , ]9, -& &4\$6AE4 )6\$,9<6%A\$,,%j 46W,5,\$? W, 4(5, 76& / , , 7 (/,< , &6 a7' %A94 (7 #7%&\$A. , 7&K S7%&, (' ? W, 96. - (\$, &4, , Y, 9& 6) )6\$,9<6%A\$,,% / , )6\$, (7' )&,\$ , (94 &\$ (7%(9&#67? (7' &4, , Y, 9& 6) , ]&\$, . , <D 9<6%, )6\$,9<6%A\$,,% dA7' , \$ 1K! . #< , )\$6. &4, &(\$E, & 46A%, e W#&4 &46%, &4(& 699A\$ )A\$&4,\$ (W(D W#&4#7 &4, 1KOR . #< , \$( ' #A%K

@,#E4 (7' J69P6Y d0112e A%, %A94 ( 96. -(\$#%67 &6 #' , 7&#)D &4, , Y, 9& 6) %, ] 6)\ ), 7' , % 67 46A%, - \$#9,%K 34,D - , )\$6\$. ( ' #Y,\$, 79,\#7\ ' #Y,\$, 79, (7(<D%#%? 96. - (\$#7E 46A%, - \$#9,% / , )6\$, (7' )&,\$ ( %, ] 6Y, 7' , \$ . 65,% #7&6 ( 7,#E4/6\$466' ? (7' 46A%, - \$#9,% 9<6%, \$ &6 &4, %, ] 6Y, 7' , \$f% (' ' \$,% W#&4 &46%, )A\$&4,\$ (W(DK 34, ' #Y,\$, 79, / , &W, , 7 46A%, - \$#9, E\$6W&4 #7 &4, %, ] 6Y, 7' , \$f% #. . , ' #(& , 7,#E4/6\$466' (7' 46A%, - \$#9, E\$6W&4 #7 &4, %, ] 6Y, 7' , \$f% / \$6(' , \$ 7,#E4/6\$466' #% (7 , %&#. (& , 6) &4, , Y, 9& 6) &4, %, ] 6Y, 7' , \$f% (\$\$#5(< 67 46A%, - \$#9,%K U, 4(5, #. #&(& , ' @,#E4 (7' J69P6Yf% . , &46' 6<6ED? &\$, (&#7E )6\$,9<6%A\$,,% (% 7,E(&#5, , 5, 7&% (7(<6E6A% &6 %, ] 6Y, 7' , \$ (\$\ \$f%5(<#? (7' (5, \$(E#7E &4, \$,%# ' A(<#) \$6. 4, ' 67#9 46A%, \- \$#9, \$, E\$, %%#67% ' A\$#7E &4, D, (\$ / , )6\$, (7' )&,\$ , (94 )6\$,9<6%A\$,,%? (7' W#&4#7 (7 #77,\$ 9#9<, 6) \$( ' #A% 1K! . #< , (7' (7 6A&,\$ \$#7E 6/&(#7, ' /D \$, . 65#7E &4, #77,\$ 9#9<, )\$6. (7 6A&,\$ 9#9<, 6) \$( ' #A% 1KOR . #< , K U 4, 7 W, ' 6 &4#%? W, 6/&(#7 ( ' #Y,\$, 79,\#7\ ' #Y,\$, 79, , %&#. (& , &4(& ( )6\$,9<6%A\$, , <6W,\$ &4, - \$#9, 6) 7,#E4/6\$#7E 46A%,% /D (/6A& ! [ K

F <#. #&(&#67 6) &4, ' #Y,\$, 79,\#7\ ' #Y,\$, 79, (--\$6(94 #% &4(& #& ' 6,% 76& \$, (' #<D 4(7' < , &4, )(9& &4(& )6\$,9<6%A\$,,% (\$, 9<A%&,\$ ' ? %6 . (7D 46A%,% (\$, 9<6%, 7,#E4/6\$% 6) . A<#-<, )6\$,9<6%A\$,,%K d34#% #% ( . A94 <,% % , \$#6A% - \$6/< , . #7 &4, 9(% , 6) %, ] 6Y, 7' , %K e S7 &4, - \$, %, 79, 6) 9<A%&,\$#7E? &4, ' #Y,\$, 79,\#7\ ' #Y,\$, 79, , %&#. (& , W#<< . %%&(& , &4, , Y, 9& 6) , (94 )6\$,9<6%A\$,,%? %#79, <6W 46A%, - \$#9,% 9(A%, ' /D . A<#-<, )6\$,9<6%A\$,,% (\$, (&\$# /A& , ' &6 , (94 67, #7' , - , 7' , 7&-Dj 9<A%&,\$#7E (<% 96. -<#9(& , % &4, 9(<9A<(&#67 6) %&(7' (\$' , \$\$6\$%K " 6\$ &4#% \$, (%67? W, \$, &A\$7 &6 6A\$ 4, ' 67#9 \$, E\$, %%#67? #7 W4#94 &4, %(<,% - \$#9, 6) ( 46A%, #% &4, ' , - , 7' , 7& 5(\$#(/<,(? (7' #79<A' , . , (%A\$, % 6)

7, (\$/D )6\$, 9<6%A\$, % ( % , ] -<(7 (&6\$D 5(\$#(/<, %K

3(/<, !0 \$, -6\$&% &4, \$, %A<&%K F<< &4, -\$ , 5#6A% 4, ' 67#9 5(\$#(/<, % (\$, #79<A' , ' #7  
&4, \$, E\$, %67% 6) &4#% &(/<, ? /A& W#&4 &4, , ]9, -&#67 6) &4, ' A. . #, % )6\$, 9<6%A\$, \  
\$, <(&, ' %(<, ? &4, D (\$, 76& \$, -6\$&, ' K S7 &4, a\$%& 96<A. 7? W, (' ' &4, 7A. /, \$ 6)  
)6\$, 9<6%A\$, % &4 (& 4(5, 699A\$ \$, ' W#&4#7 1KOR . #<, 6) , (94 46A%, ' A\$#7E &4, D, (\$ /,)6\$,  
#&% ' (&, 6) %(<, K I , 9(A%, &4, ' #%&\$#/A&#67 6) )6\$, 9<6%A\$, % #%, ]&\$, . , <D \$#E4&\%P, W, ' ?  
W, W#7%6\$#Z, #& (& &4, ::&4 -, \$9, 7&#<, d! 1 )6\$, 9<6%A\$, %e %6 &4 (& ( ), W 6A&#%, % ' 6  
76& ' 6. #7 (&, &4, \$, %A<&%K U, (\$, ? 46W, 5, \$? - (\$&#9A<(\$<D #7&, \$, %&, ' #7 &4, , Y, 9&% 6)  
)6\$, 9<6%A\$, W(5, % 67 46A%, -\$#9, ?% %6 W, #79<A' , ' A. . D 5(\$#(/<, % )6\$ 9(% , % W4, \$, &4,  
7A. /, \$ 6) )6\$, 9<6%A\$, % W#&4#7 1KOR . #<, <#%, /, &W, , 7 &4, ::&4 (7' ::KR&4 -, \$9, 7&#<,  
d! 1! R )6\$, 9<6%A\$, %e? /, &W, , 7 &4, ::KR&4 (7' ::K: &4 -, \$9, 7&#<, d! R\O2 )6\$, 9<6%A\$, %e?  
(7' (/65, &4, ::K: &4 -, \$9, 7&#<, A- &6 &4, %(. -<, . (]# A. d02\i G )6\$, 9<6%A\$, %eK  
I , 9(A%, 20[ 6) 6A\$ &\$ (7%(9&#67% 4(5, 76 )6\$, 9<6%A\$, % W#&4#7 1KOR . #<, ' A\$#7E &4,  
D, (\$ /,)6\$, %(<, ? &4, %, &(<# ' A. . #, % 9(-&A\$, ( . , (7#7E)A< )\$(9&#67 6) &4, 9(% , % W#&4  
)6\$, 9<6%A\$, %K " 6\$ , ] ( . -<, ? 1K1! m1K! 2 6\$ Rkc[ 6) &\$ (7%(9&#67% W#&4 )6\$, 9<6%A\$, % 7, (\$/D  
(\$, (/65, &4, ::&4 -, \$9, 7&#<, 6) &4, )6\$, 9<6%A\$, ' #%&\$#/A&#67K

U, (<% #79<A' , (7 #7' #9(&6\$ 6) , ]&\$, . , <D 9<6%, )6\$, 9<6%A\$, %? ( W, #E4&, ' %A. 6)  
)6\$, 9<6%A\$, % W#&4#7 1K! . #<, 6) &4, &(\$E, & 46A%, ? W4, \$, &4, W, #E4& #% 1K! <, % &4,  
' #%&(79, &6 &4, )6\$, 9<6%A\$, #7 . #<, %? ' #5#', ' /D 1K! K 34#% #7' #9(&6\$ E#5, % ( W, #E4&  
6) ! &6 ( )6\$, 9<6%A\$, (& &4, %(. , <69(&#67 dW4#94 9(7 699A\$ #7 ( 967' 6 96. -<, ]e? ( W, #E4& 6) 1KR &6 ( )6\$, 9<6%A\$, 1K1R . #<, % 6\$ 22 D(\$ % (W(D? (7' ( W, #E4& 6) Z, \$6 &6 ( )6\$, 9<6%A\$, 1K! . #<, % 6\$ ! i c D(\$ % (W(DK S& #% (<% W#7%6\$#Z, ' (& &4, ::&4 -, \$9, 7&#<, d! KT: e? (7' W, #79<A' , ' A. . #, % )6\$, , ]&\$, . , 9(% , % d! KT: \OKTO? OKTO\i K2G? (7' i K2G\ R1K: ReK : O[ 6) 6A\$ &\$ (7%(9&#67% 4(5, 76 )6\$, 9<6%A\$, % W#&4#7 1K! . #<, ' A\$#7E &4, D, (\$ /,)6\$, %(<, ? %6 (% /,)6\$, ? &4, &(<# ' A. . #, % #79<A' , ( . , (7#7E)A< )\$(9&#67 6) &4, 9(% , % W#&4 , ]&\$, . , <D 9<6%, )6\$, 9<6%A\$, %K U, #79<A' , &4#% 5(\$#(/<, /, 9(A%, #& #% -<(A#%/<, &4 (& #-<65, \$, Y, 9&% 6) )6\$, 9<6%A\$, % 67 9\$# . , (7' &4, %69#(< 964, #67 6) 7, #E4/6\$466' % (\$, , ]&\$, . , <D <69(<? . 6\$, %6 &4(7 96. . 67 , 9676. #9 %469P% &4 (& . #E4& ' \$#5, /6&4 )6\$, 9<6%A\$, % (7' 46A%, -\$#9, %K

S7 &4, %, 967' 96<A. 7? W, 967&\$6< )6\$ (5, \$(E, -\$#9, % 6) A7)6\$9, ' %(<, % W#&4#7 &4, 1KOR . #<, \$( ' #A% ' A\$#7E &4, -\$ , 5#6A% D, (\$K U, 9(<9A<(&, ( W, #E4&, ' (5, \$(E, 6) <6E -\$#9, % d( E, 6. , &\$#9 (5, \$(E, -\$#9, e? A#7E ( <#7, (\$ W, #E4&#7E %94, . , &4 (& E#5, % ( W, #E4& 6) 1KOR <, % &4, ' #%&(79, &6 &4, 46A%, #7 . #<, %? ' #5#', ' /D 1KOR I D 967&\$(%& W#&4 &4, <69(< )6\$, 9<6%A\$, #7' #9(&6\$? &4#% #% ( W, #E4&, ' (5, \$(E, ? 76& ( W, #E4&, ' %A. ? %6 #& ' #5#', % /D &4, %A. 6) &4, W, #E4&%K U, %, & &4, 5(\$#(/<, &6 Z, \$6 #7 9(% , % W4, \$, 76

! :

A7)6\$9,' &\$ (7%(9&#67 4(% 699A\$,\$ ' W#&4#7 1KOR . #<,% ' A\$#7E &4, -\$ ,5#6A% D, (\$? (7' #79<A' , ( ' A. . D )6\$ &4,% , 9(% ,%K

34, &4#\$' (7' )6A\$&4 96<A. 7% \$, -, (& &4, a\$%& &W6 96<A. 7%? ( ' ' #7E )6\$, 9<6%A\$, 5(\$#(/<,% (7' (5,\$(E, 7,#E4/6\$466' 46A%, -\$#9,% ' A\$#7E &4, D, (\$ ()&,\$ , (94 &\$ (7%(9\ &#67K S) A76/%,\$5,' <69(<%469P% ' \$#5, /6&4 -\$#9,% (7' )6\$, 9<6%A\$, %? 6\$ #) )6\$, 9<6%A\$, % \$, (9& &6 -\$#9,% W#&4 ( <(E? W, W6A<' , ]-, 9& &4(& )A&A\$, )6\$, 9<6%A\$, % W6A<' 4(5, (& <, (%& (% . A94 , ]-<(7(&6\$D -6W,\$ )6\$ 46A%, -\$#9,% (% <(EE, ' )6\$, 9<6%A\$, %K

34, \$,%A&% 6) 3(/<, !0 #. -<D &4(& \$, 9, 7& 7, #E4/6\$466' )6\$, 9<6%A\$, % (\$, 4#E4<D \$, <, 5(7& )6\$ -\$ , ' #9&#7E &4, -\$#9, (& W4#94 ( 46A%, W#<< % , <K >(94 )6\$, 9<6%A\$, W#&4#7 ( 1KOR . #<, \$( ' #A% 6) ( E#5, 7 46A%, <6W,\$ % &4, -\$ , ' #9& , ' <6E -\$#9, /D !K2[ #7 96<A. 7 !? 6\$ !K! [ #7 96<A. 7 0 W4, 7 W, 967&\$6< )6\$ &4, (5,\$(E, <, 5, <6) \$, 9, 7& A7)6\$9, ' %(<,% -\$#9,% #7 &4, 7, #E4/6\$466' K "6\$, 9<6%A\$, % W#&4#7 ( 1K! . #<, \$( ' #A% (\$, , 5, 7 %&\$67E, \$ -\$ , ' #9&6\$%? <6W,\$ #7E &4, <6E -\$#9, 6) ( 46A%, /D :K! [ #) &4, )6\$, 9<6%A\$, #% (& Z, \$6 ' #%&(79, ? 6\$ i KG[ W4, 7 W, 967&\$6< )6\$ \$, 9, 7& A7)6\$9, ' %(<,% -\$#9,% ? 7A. /, \$% 9<6%, &6 &46%, 9<(#. , ' \$, 9, 7&D /D &4, b/(<. ( F' . #7#%&\$(&#67 dC+ 3\$, (%A\$D 011: eK "6\$ /6&4 5(\$#(/<,% ? /A& -(\$&#9A<(\$<D &4, <69(< )6\$, 9<6%A\$, #7' #9(&6\$? W, a7' , ]&\$, . , <D -6W,\$ )A< , Y, 9&% #7 &4, \$E4& &(#<6) &4, ' #%&\$#/A&#67K F 46A%, #7 &4, &6- 1K! [ 6) &4, ' #%&\$#/A&#67 )6\$ /6&4 5(\$#(/<,% 4(% ( -\$#9, )6\$, 9(%& &4(& #% <6W,\$ /D (<. 6%& R1[ #7 96<A. 7 !? 6\$ T1[ #7 96<A. 7 OK

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*Panel I: Housing characteristics*

*Panel II: Neighborhood characteristics*

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Table 2 - Frequency of forced sales

*Panel A: Forced transactions by year*

Year	Total Obs	Deaths	Bankruptcies	Foreclosures	Total Forced
1987	89,596	1.0%	0.0%	0.0%	1.0%
1988	79,684	0.9%	0.0%	0.1%	0.9%
1989	66,762	0.9%	0.0%	0.3%	1.2%
1990	54,635	0.9%	0.0%	1.2%	2.1%
1991	57,571	1.1%	0.1%	5.3%	6.4%
1992	68,878	1.2%	0.2%	8.3%	9.8%
1993	74,756	1.6%	0.3%	9.7%	11.6%
1994	81,205	1.8%	0.5%	8.4%	10.7%
1995	76,104	1.8%	0.6%	7.1%	9.4%
1996	84,319	1.6%	0.7%	5.0%	7.3%
1997	90,403	1.8%	0.8%	4.3%	6.9%
1998	99,945	1.9%	0.9%	3.0%	5.7%
1999	103,375	1.8%	1.1%	2.2%	5.2%
2000	95,452	1.9%	1.1%	1.8%	4.8%
2001	89,956	2.0%	1.1%	1.4%	4.5%
2002	92,989	2.2%	1.2%	1.2%	4.6%
2003	94,987	2.3%	1.4%	0.7%	4.5%
2004	106,077	2.5%	1.4%	0.7%	4.5%
2005	102,492	2.1%	1.3%	0.8%	4.2%
2006	86,924	1.8%	1.2%	1.6%	4.5%
2007	78,001	1.6%	0.9%	5.2%	7.7%
2008	9,249	1.0%	0.8%	12.7%	14.5%
Total	1,783,360	1.7%	0.8%	3.1%	5.6%

*Panel B: Timing of forced transactions*

Group	Death	Bankruptcy	Foreclosure
sale 3 yrs before event	0.21%	0.08%	
sale 2 yrs before event	0.26%	0.08%	
sale 1 yr before event	0.35%	0.07%	
sale 1 yr after event	0.50%	0.24%	2.64%
sale 2 yrs after event	0.26%	0.17%	0.29%
sale 3 yrs after event	0.13%	0.13%	0.06%

Notes: data on deaths from the Social Security Death Master file and data on bankruptcies obtained from the MA Bankruptcy Court. Panel A reports the percentage of observations that are classified as deaths, bankruptcies, or foreclosures each year. An observation is assigned to one of the mutually exclusive categories according to the rules described in Appendix A. For deaths and bankruptcies, a sale is considered forced if the sale happens within 3 years before or after the sale. For foreclosures, a sale is considered forced whenever the sale occurs after the auction (or at the auction itself if successful). For each type of forced sale, Panel B reports how the forced sales as a percentage of total observations are distributed before and after the event which forces the sale. Our main housing dataset includes sales up to March 2008.

Table 3 - Other characteristics of forced sales

	% of total obs	Property type (% of firesale type)			% Boston	% of each type also:	
		Single family	Multifamily	Condo		Death	Bankruptcy
All observations	100.0%	64.4%	11.1%	24.5%	8.1%		
Unforced	94.4%	64.6%	10.5%	24.9%	8.0%		
Forced	5.6%	62.2%	19.7%	18.0%	9.7%		
Death	1.7%	76.6%	14.5%	9.0%	5.3%		0.7%
Bankruptcy	0.8%	71.3%	15.3%	13.4%	5.5%	1.1%	
Foreclosure	3.1%	52.1%	23.7%	24.2%	13.2%	0.5%	3.1%

Notes: the first column reports the fraction of observations identified as forced, following the matching process described in the data appendix. The next three columns report the property type composition, while the fifth column reports the fraction of observations in Boston. The last two columns report, for each category, how many matches were also matched as another type of forced sale before applying the rules we use to classify the transaction in these cases.

Table 4 - Descriptive statistics for forced sales

*Panel A: Characteristics of forced sales*

	Min	Max	Mean	Stdev	1%	25%	50%	75%	99%
<i>Panel A.I: Housing characteristics</i>									
Price (\$1000)	7.15	1,675.00	151.46	126.82	13.50	68.00	116.00	197.00	600.00
Total rooms	2	16	7.18	3.06	3	5	6	8	16
Full bathrooms	0	4	1.60	0.73	1	1	1	2	4
Half bathrooms	0	2	0.34	0.50	0	0	0	1	2
Bedrooms	1	9	3.37	1.57	1	2	3	4	9
Lotsize	0	261,360	16,524	31,105	0	3,825	7,508	16,117	185,086
Interior Square Feet	509	4,627	1,713	850	509	1,090	1,480	2,128	4,374
House age	0	341	58.97	40.38	0	53	91	106	341
<i>Panel A.II: Neighborhood characteristics</i>									
Median Income	7,271	200,001	50,613	19,766	15,268	37,143	48,269	61,047	115,456
% Hispanic	0.00	0.96	0.07	0.12	0.00	0.01	0.02	0.08	0.59
% Black	0.00	0.95	0.07	0.15	0.00	0.01	0.02	0.05	0.83
% 0-17 years old	0.00	0.49	0.24	0.07	0.05	0.21	0.24	0.28	0.40
% 65+ years old	0.00	0.71	0.14	0.07	0.03	0.09	0.13	0.17	0.37
% Female-headed HH	0.00	0.48	0.08	0.06	0.01	0.04	0.06	0.09	0.29
% with Bachelor's degree	0.00	0.73	0.17	0.10	0.01	0.10	0.15	0.23	0.43
% with graduate degree	0.00	0.72	0.10	0.09	0.00	0.04	0.08	0.14	0.44
% with less than high school degree	0.00	0.83	0.17	0.12	0.01	0.08	0.14	0.24	0.55

*Panel B: Ratio of characteristics of forced sales to all sales*

	Min	Max	Mean	Stdev	1%	25%	50%	75%	99%
<i>Panel B.I: Ratio of housing characteristics of forced sales to all sales</i>									
Price (\$1000)	1.05	0.92	0.67	0.75	0.57	0.58	0.66	0.68	0.70
Total rooms	1.00	1.00	1.06	1.19	1.00	1.00	1.00	1.00	1.00
Full bathrooms	-	1.00	0.98	1.04	1.00	1.00	0.50	1.00	1.00
Half bathrooms	-	1.00	0.76	0.95	-	-	-	1.00	1.00
Bedrooms	1.00	1.00	1.07	1.20	1.00	1.00	1.00	1.00	1.13
Lotsize	-	1.00	0.80	0.85	-	1.33	0.79	0.73	0.80
Interior Square Feet	1.00	1.00	0.99	1.03	1.00	0.97	0.96	0.99	0.99
House age	-	0.96	1.22	0.95	-	3.79	2.39	1.36	1.85
<i>Panel B.II: Ratio of neighborhood characteristics of forced sales to all sales</i>									
Median Income	2.91	1.00	0.86	0.85	0.91	0.86	0.87	0.87	0.88
% Hispanic	-	0.96	1.50	1.26	1.07	1.15	1.37	1.94	1.20
% Black	-	1.00	1.71	1.52	-	1.32	1.43	1.72	1.41
% 0-17 years old	-	1.00	1.04	0.95	1.15	1.06	1.01	1.01	1.06
% 65+ years old	-	1.00	0.99	0.98	1.04	0.99	0.99	1.00	0.96
% Female-headed HH	-	1.00	1.33	1.31	1.54	1.19	1.27	1.40	1.12
% with Bachelor's degree	-	1.00	0.81	0.96	0.53	0.74	0.76	0.82	0.94
% with graduate degree	-	1.00	0.71	0.78	-	0.68	0.68	0.69	0.84
% with less than high school degree	-	0.83	1.33	1.17	-	1.40	1.42	1.37	1.10

Notes: sample is subset of transactions which are deaths and bankruptcies within 3 year from the sale, plus foreclosures. Panel A is analogous to Table 1. Panel B reports the ratio of values in Panel A with the corresponding values in Table 1. Whenever the value in Table 1 is 0, we do not report the number, as the ratio cannot be computed.



Table 5 - Hedonic regression coefficients

Variable	Estimate	Standard Error
Lot size (x10,000)	0.001	(0.000)
Bedrooms	0.023	(0.000)
Total number of rooms	0.013	(0.000)
Full Bathrooms	0.098	(0.001)
Half Bathrooms	0.094	(0.001)
Interior Square Feet (x10,000)	0.764	(0.010)
House Age (x10)	-0.016	(0.000)
House Age Squared	0.0005	(0.000)
Condominium	-0.204	(0.002)
High number of Rooms Indicator	-0.083	(0.004)
High number of Bedrooms Indicator	-0.076	(0.004)
High number of Full Bathrooms Indicator	-0.089	(0.003)
High number of Half Bathrooms Indicator	-0.082	(0.003)
High square feet Indicator	-0.027	(0.005)
Low square feet Indicator	-0.225	(0.008)
Renovated in the last 10 years	0.056	(0.002)
Renovated 10 to 20 years before	0.010	(0.003)
Renovated 20 to 30 years before	0.007	(0.003)
Renovated more than 30 years before	0.005	(0.004)
% Hispanic	-0.220	(0.008)
% Black	-0.136	(0.008)
% Less than 17 years old	-0.204	(0.011)
% More than 65 years old	0.386	(0.007)
% Female-headed household	-0.066	(0.015)
Median Income	0.018	(0.000)
% Bachelor Degree	0.225	(0.006)
% Graduate Degree	0.346	(0.006)
% Less than High School Diploma	-0.102	(0.007)
Number of Observations	1,783,360	
R-squared	0.718	

Notes: the table reports the coefficients and standard errors (in parenthesis) of a regression of log house price on house and census characteristics and forced sale indicators as in Table 6, panel B. The regression includes zip code-year fixed effects.

Table 6 - Price Discount for Forced Sales

*Panel A*

	<i>Full sample</i>		<i>Single Family</i>		<i>Multi Family</i>		<i>Condominium</i>	
	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err
Forced (-3 years;+3 years)	-0.199	(0.001)	-0.151	(0.002)	-0.240	(0.003)	-0.235	(0.003)
Number of Observations	1,783,360		1,149,215		197,124		437,021	
R-squared	0.716		0.714		0.742		0.805	

*Panel B*

	<i>Full sample</i>		<i>Single Family</i>		<i>Multi Family</i>		<i>Condominium</i>	
	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err
Death, young seller (-3;+3)	-0.051	(0.005)	-0.063	(0.006)	-0.028	(0.013)	-0.008	(0.012)
Death, old seller (-3;+3)	-0.068	(0.002)	-0.081	(0.003)	-0.058	(0.007)	-0.010	(0.007)
Bankruptcy (-3;+3)	-0.032	(0.003)	-0.040	(0.004)	-0.018	(0.009)	-0.030	(0.008)
Foreclosure	-0.323	(0.002)	-0.253	(0.002)	-0.359	(0.004)	-0.322	(0.003)
Number of Observations	1,783,360		1,149,215		197,124		437,021	
R-squared	0.718		0.715		0.745		0.806	

Notes: table reports the coefficients and standard errors (in parenthesis) of a regression of log house price on house and census characteristics and disaggregated forced sale indicators, on the full sample, and separately for each house type. Coefficients on house and census characteristics for the full sample specification are reported in Table 5. Death, bankruptcy and foreclosure indicators are mutually exclusive. Young seller is defined as a seller younger than 70 at the time of death. There are 5,311 cases of young deaths and 25,100 cases of old deaths. The regression includes zip code-year fixed effects.

Table 7 - Number of sellers effects

	<i>Full sample</i>		<i>Single Family</i>		<i>Multi Family</i>		<i>Condominium</i>	
	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err
<i>One seller</i>								
Death, young seller (-3;+3)	-0.082	(0.009)	-0.087	(0.011)	-0.062	(0.021)	0.009	(0.021)
Death, old seller (-3;+3)	-0.095	(0.004)	-0.103	(0.005)	-0.092	(0.011)	-0.021	(0.011)
Bankruptcy (-3;+3)	-0.061	(0.005)	-0.072	(0.006)	-0.014	(0.013)	-0.054	(0.011)
<i>Two sellers</i>								
Death, young seller (-3;+3)	-0.035	(0.006)	-0.050	(0.007)	-0.006	(0.017)	-0.017	(0.015)
Death, old seller (-3;+3)	-0.053	(0.003)	-0.070	(0.003)	-0.038	(0.008)	-0.004	(0.009)
Bankruptcy (-3;+3)	-0.014	(0.004)	-0.022	(0.005)	-0.021	(0.012)	-0.006	(0.011)

Notes: table reports coefficients and standard errors (in parenthesis) of hedonic regression of log price with interactions of the forced sale variables with indicators for one and two sellers. 42% of the full sample has two sellers. The regression includes the house and census characteristics of Table 5.

	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err
<i>Levels of forced sale effects</i>								
Death, young seller (-3;+3)	-0.052	(0.005)	-0.065	(0.006)	-0.026	(0.013)	0.001	(0.013)
Death, old seller (-3;+3)	-0.069	(0.002)	-0.089	(0.003)	-0.059	(0.007)	-0.009	(0.007)
Bankruptcy (-3;+3)	-0.040	(0.004)	-0.044	(0.004)	-0.023	(0.009)	-0.037	(0.009)
Foreclosure	-0.256	(0.002)	-0.227	(0.003)	-0.267	(0.005)	-0.271	(0.005)
<i>Forced sale effects interacted with building component</i>								
Death, young seller (-3;+3)	-0.017	(0.006)	-0.012	(0.007)	0.028	(0.014)	0.013	(0.014)
Death, old seller (-3;+3)	-0.033	(0.003)	-0.019	(0.003)	0.009	(0.007)	-0.007	(0.008)
Bankruptcy (-3;+3)	0.002	(0.004)	0.005	(0.004)	-0.002	(0.009)	0.000	(0.008)
Foreclosure	0.052	(0.002)	0.029	(0.003)	-0.004	(0.004)	0.046	(0.003)
<i>Forced sale effects interacted with lotsize component</i>								
Death, young seller (-3;+3)	-0.003	(0.006)	-0.009	(0.007)	0.004	(0.016)	-0.008	(0.014)
Death, old seller (-3;+3)	-0.004	(0.003)	-0.024	(0.003)	0.017	(0.008)	0.007	(0.008)
Bankruptcy (-3;+3)	-0.001	(0.004)	-0.004	(0.005)	-0.004	(0.011)	-0.005	(0.009)
Foreclosure	-0.020	(0.002)	0.000	(0.003)	-0.010	(0.005)	-0.011	(0.003)
<i>Forced sale effects interacted with census component</i>								
Death, young seller (-3;+3)	0.001	(0.006)	0.004	(0.007)	0.008	(0.015)	0.016	(0.014)
Death, old seller (-3;+3)	0.006	(0.003)	0.010	(0.003)	0.017	(0.008)	0.014	(0.009)
Bankruptcy (-3;+3)	-0.025	(0.004)	-0.017	(0.005)	-0.033	(0.009)	-0.018	(0.009)
Foreclosure	0.052	(0.002)	0.033	(0.002)	0.086	(0.004)	-0.005	(0.003)
<i>Forced sale effects interacted with zipcode component</i>								
Death, young seller (-3;+3)	-0.012	(0.006)	-0.008	(0.006)	-0.009	(0.014)	-0.046	(0.014)
Death, old seller (-3;+3)	-0.004	(0.003)	-0.001	(0.003)	-0.008	(0.007)	-0.020	(0.008)
Bankruptcy (-3;+3)	-0.015	(0.004)	-0.015	(0.004)	-0.013	(0.009)	-0.003	(0.009)
Foreclosure	0.042	(0.002)	-0.001	(0.003)	0.074	(0.004)	0.033	(0.003)

Notes: table reports coefficients and standard errors (in parenthesis) of hedonic regression of log price with indicators of forced sales, plus the interactions with standardized components of the value of the house.

Table 9 - Previous Forced Sales Effect

Variable	Estimate	Standard Error
<i>Previous price x time between sales</i>		
Less than a year	0.154	(0.001)
Between 1 and 3 years	0.155	(0.001)
Between 3 and 5 years	0.156	(0.001)
More than 5 years	0.156	(0.001)
<i>Previous sale: young death</i>		
Sale within a year before	0.002	(0.023)
Sale within 1 and 3 years before	0.012	(0.018)
Sale within 3 and 5 years before	0.014	(0.019)
Sale more than 5 years before	0.023	(0.014)
<i>Previous sale: old death</i>		
Sale within a year before	0.023	(0.011)
Sale within 1 and 3 years before	0.014	(0.008)
Sale within 3 and 5 years before	0.011	(0.009)
Sale more than 5 years before	0.045	(0.007)
<i>Previous sale: bankruptcy</i>		
Sale within a year before	-0.037	(0.012)
Sale within 1 and 3 years before	-0.004	(0.010)
Sale within 3 and 5 years before	0.006	(0.012)
Sale more than 5 years before	0.022	(0.012)
<i>Previous sale: foreclosure</i>		
Sale within a year before	0.011	(0.005)
Sale within 1 and 3 years before	-0.028	(0.005)
Sale within 3 and 5 years before	-0.018	(0.005)
Sale more than 5 years before	0.033	(0.004)

Notes: table reports coefficients and standard errors (in parenthesis) of hedonic regression of log price with indicators of forced sales in the previous transaction, decomposed into different windows depending on the time since the last transaction. The regression includes the house and census characteristics of Table 5, and the forced sales indicators of the Table 6, Panel B.

Table 10 - VAR for neighborhood house prices

	$\Delta p_t$	$\Delta pf_t$	$pu_t - pf_t$	$\Delta pu_t$
$\Delta pf_{t-1}$		-0.075 (0.012)	0.046 (0.012)	-0.029 (0.004)
$pu_{t-1} - pf_{t-1}$		0.832 (0.015)	0.077 (0.015)	-0.090 (0.005)
$\Delta p_{t-1}$	-0.443 (0.009)			
Observations	9820	6801	6801	6801
R-squared	0.204	0.463	0.220	0.089

Notes: table reports coefficients and standard errors (in parenthesis) of VAR of percentage change in average forced and unforced house prices at the zipcode-year level, cross-sectionally demeaned.  $p$  is the average price of all sales,  $pf$  is the average price of forced sales and  $pu$  is the average price of unforced sales in each zipcode at time  $t$ . Each specification includes neighborhood fixed effects.

Table 11 - Neighborhood VAR with share of forced sales

*Panel A: VAR with lagged forced share*

	$sf_t$	$\Delta pf_t$	$pu_t - pf_t$	$\Delta pu_t$
$sf_{t-1}$	0.519 (0.012)	-0.628 (0.084)	0.609 (0.083)	-0.020 (0.031)
$\Delta pf_{t-1}$	0.000 (0.002)	-0.068 (0.012)	0.040 (0.012)	-0.029 (0.004)
$pu_{t-1} - pf_{t-1}$	0.009 (0.002)	0.850 (0.017)	0.061 (0.017)	-0.090 (0.006)
Observations	6,801	6,801	6,801	6,801
R-squared	0.614	0.468	0.227	0.089

*Panel B: VAR with lagged forced share interactions*

	$sf_t$	$\Delta pf_t$	$pu_t - pf_t$	$\Delta pu_t$
$sf_{t-1}$	0.496 (0.012)	-0.378 (0.086)	0.500 (0.086)	0.120 (0.031)
$\Delta pf_{t-1}$	-0.002 (0.002)	-0.051 (0.012)	0.028 (0.012)	-0.023 (0.004)
$pu_{t-1} - pf_{t-1}$	0.011 (0.002)	0.831 (0.017)	0.072 (0.017)	-0.097 (0.006)
$sf_{t-1} \times \Delta pf_{t-1}$	-0.052 (0.031)	-0.039 (0.219)	-0.460 (0.218)	-0.499 (0.079)
$sf_{t-1} \times (pu_{t-1} - pf_{t-1})$	0.200 (0.035)	-2.432 (0.243)	0.884 (0.242)	-1.548 (0.088)
Observations	6,801	6,801	6,801	6,801
R-squared	0.618	0.479	0.231	0.132

Notes: table reports coefficients and standard errors (in parenthesis) of VAR of percentage change in average forced and unforced house prices at the zipcode-year level, cross-sectionally demeaned.  $pf$  is the average price of forced sales,  $pu$  the average price of unforced sales, and  $sf$  the share of forced sales in each zipcode at time  $t$ . Each specification includes neighborhood fixed effects.

Table 12 - Cross-price effects of foreclosures

	[1]	[2]	[3]	[4]
Far, before	-0.018 (0.000)	-0.011 (0.000)	-0.015 (0.000)	-0.006 (0.000)
Far, after			-0.006 (0.000)	-0.001 (0.000)
Close, before	-0.091 (0.002)	-0.073 (0.002)	-0.082 (0.002)	-0.059 (0.002)
Close, after			-0.062 (0.002)	-0.042 (0.002)
Far 99.0, before	0.021 (0.005)	0.004 (0.005)	0.017 (0.005)	-0.007 (0.005)
Far 99.0, after			0.049 (0.005)	0.014 (0.005)
Far 99.5, before	-0.025 (0.006)	-0.025 (0.006)	-0.030 (0.006)	-0.029 (0.006)
Far 99.5, after			0.060 (0.006)	0.024 (0.006)
Far 99.9, before	-0.109 (0.012)	-0.085 (0.012)	-0.117 (0.012)	-0.070 (0.012)
Far 99.9, after			0.049 (0.012)	0.027 (0.011)
Close 99.0, before	-0.017 (0.005)	-0.016 (0.005)	-0.010 (0.005)	-0.009 (0.005)
Close 99.0, after			0.006 (0.005)	0.002 (0.005)
Close 99.5, before	-0.120 (0.006)	-0.100 (0.005)	-0.092 (0.006)	-0.071 (0.006)
Close 99.5, after			0.004 (0.006)	0.007 (0.005)
Close 99.9, before	-0.258 (0.011)	-0.184 (0.011)	-0.210 (0.012)	-0.121 (0.012)
Close 99.9, after			-0.025 (0.012)	0.012 (0.011)
Average price, before		0.270 (0.001)		0.191 (0.001)
Average price, after				0.207 (0.001)
No transaction before		3.256 (0.012)		2.290 (0.013)
No transaction after				2.520 (0.013)
Sale 1 yr after foreclosure	-0.29 (0.002)	-0.283 (0.002)	-0.287 (0.002)	-0.278 (0.002)
Sale 2 yrs after foreclosure	-0.414 (0.005)	-0.405 (0.005)	-0.41 (0.005)	-0.396 (0.005)
Sale 3 yrs after foreclosure	-0.433 (0.012)	-0.419 (0.012)	-0.429 (0.012)	-0.406 (0.011)
Sale more than 3 yrs after foreclosure	-0.210 (0.008)	-0.186 (0.008)	-0.208 (0.008)	-0.177 (0.008)

Notes: table reports coefficients and standard errors, in parenthesis, of hedonic regression of log price on the unweighted number of foreclosures in the 0.25mi area around the house sold winsorized at the 99th percentile (variable Far), and the linearly weighted number of foreclosures in the 0.1mi area, also winsorized at the 99th percentile (variable Close), for the year before and after the sale. We also add indicators for the 99th, 99.5th and 99.9th percentile of those variables. They are as follows. For Close, before: 1.59 (99%), 2.57 (99.5%) and 8 (99.9%). For Far, before: 10 (99%), 15 (99.5%) and 28 (99.9%). For Close, after: 1.54 (99%), 2.32 (99.5%) and 6.71 (99.9%). For Far, after: 10 (99%), 14 (99.5%) and 26 (99.9%). Finally, columns 2 and 4 add the distance-weighted average log price of neighboring houses (0.25mi), in the year before and after the sale, and an indicator for the cases where there are no transactions in the neighborhood, for that time frame. The regression includes the house and census characteristics in Table 5, and the foreclosure and bankruptcy indicators of Table 6, Panel B.



Table 13 - Interaction of spillover effect with value components

	<i>Full sample</i>		<i>Single Family</i>		<i>Multi Family</i>		<i>Condominium</i>	
	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err
<i>Levels of spillover effects</i>								
Far, before - after	0.001	(0.001)	0.000	(0.001)	-0.005	(0.002)	0.002	(0.001)
Close, before - after	-0.009	(0.004)	-0.012	(0.007)	0.016	(0.009)	-0.009	(0.004)
Far 99.0, before - after	0.003	(0.011)	-0.019	(0.029)	0.006	(0.021)	-0.003	(0.011)
Close 99.0, before - after	0.012	(0.010)	0.040	(0.027)	-0.013	(0.024)	-0.025	(0.009)
<i>Spillover effects interacted with building component</i>								
Far, before - after	0.006	(0.001)	0.006	(0.001)	0.005	(0.001)	-0.010	(0.001)
Close, before - after	0.012	(0.003)	0.014	(0.007)	0.003	(0.008)	0.035	(0.004)
Far 99.0, before - after	0.023	(0.007)	-0.051	(0.018)	0.035	(0.014)	0.016	(0.008)
Close 99.0, before - after	0.025	(0.007)	0.024	(0.022)	-0.006	(0.017)	0.011	(0.007)
<i>Spillover effects interacted with lotsize component</i>								
Far, before - after	-0.002	(0.001)	0.002	(0.001)	0.001	(0.002)	-0.001	(0.001)
Close, before - after	-0.007	(0.003)	-0.011	(0.007)	-0.012	(0.010)	0.002	(0.004)
Far 99.0, before - after	-0.033	(0.008)	-0.044	(0.019)	0.000	(0.019)	0.001	(0.009)
Close 99.0, before - after	0.003	(0.006)	0.013	(0.002)	-0.006	(0.022)	-0.010	(0.007)
<i>Spillover effects interacted with census component</i>								
Far, before - after	0.008	(0.001)	0.005	(0.001)	0.007	(0.001)	0.006	(0.001)
Close, before - after	-0.004	(0.003)	-0.015	(0.005)	0.012	(0.008)	-0.003	(0.004)
Far 99.0, before - after	0.020	(0.006)	0.019	(0.013)	0.028	(0.015)	0.030	(0.007)
Close 99.0, before - after	0.003	(0.006)	0.016	(0.014)	0.002	(0.018)	-0.003	(0.006)
<i>Spillover effects interacted with zipcode component</i>								
Far, before - after	-0.001	(0.001)	-0.003	(0.001)	-0.001	(0.001)	0.000	(0.001)
Close, before - after	0.011	(0.003)	0.011	(0.006)	0.012	(0.007)	0.009	(0.004)
Far 99.0, before - after	0.010	(0.006)	-0.003	(0.014)	-0.002	(0.012)	0.047	(0.008)
Close 99.0, before - after	0.013	(0.006)	-0.016	(0.016)	0.006	(0.015)	-0.003	(0.007)

Notes: table reports coefficients and standard errors of hedonic regression of log price on the the unweighted number of foreclosures in the 0.25mi area around the house sold winsorized at the 99th percentile (variable Far), and the linearly weighted number of foreclosures in the 0.1mi area, also winsorized at the 99th percentile (variable Close), for the year before and after the sale. We also add indicators for the 99th percentile of those variables: for Close, before: 1.59 (99%); for Far, before: 10 (99%); for Close, after: 1.54 (99%); for Far, after: 10 (99%). The estimation proceeds in two stages, as in Table 8, by first decomposing the predicted price in four parts and then in a second stage interacting those with the neighborhood foreclosure variables. The second stage regression includes (not shown) levels of the value components and neighborhood prices, before and after the sale.

Table 14 - Lagged foreclosures

	Specification [1] of T12	Only lagged	Adding lagged to [1] of T12	Adding lagged to [2] of T12
Far, before	-0.019 (0.000)		-0.012 (0.000)	-0.007 (0.000)
Lagged far, before		-0.020 (0.000)	-0.013 (0.000)	-0.007 (0.000)
Close, before	-0.088 (0.002)		-0.073 (0.002)	-0.060 (0.002)
Lagged Close, before		-0.093 (0.002)	-0.081 -0.0020	-0.064 (0.002)
Far 99.0 tail, before	-0.022 (0.004)		0.001 (0.005)	-0.009 (0.004)
Lagged Far 99.0 tail, before		-0.014 (0.004)	0.007 (0.005)	0.003 (0.005)
Close 99.0 tail, before	-0.080 (0.004)		-0.041 (0.004)	-0.035 (0.004)
Lagged Close 99.0 tail, before		-0.087 (0.004)	-0.051 (0.004)	-0.042 (0.004)

Notes: table reports coefficients and standard errors, in parenthesis, of hedonic regression of log price on the unweighted number of foreclosures in the 0.25mi area around the house sold winsorized at the 99th percentile (variable Far), and the linearly weighted number of foreclosures in the 0.1mi area, also winsorized at the 99th percentile (variable Close), for the year before the sale. It also adds the same measures for the number of foreclosures occurred between one and two years before the sale ("lagged" variables). The regression also includes a single dummy for the 99th percentile of the distribution of those variables (reported in the note of table 12). The regression includes the house and census characteristics in Table 5, and the foreclosure and bankruptcy indicators of Table 6, Panel B.

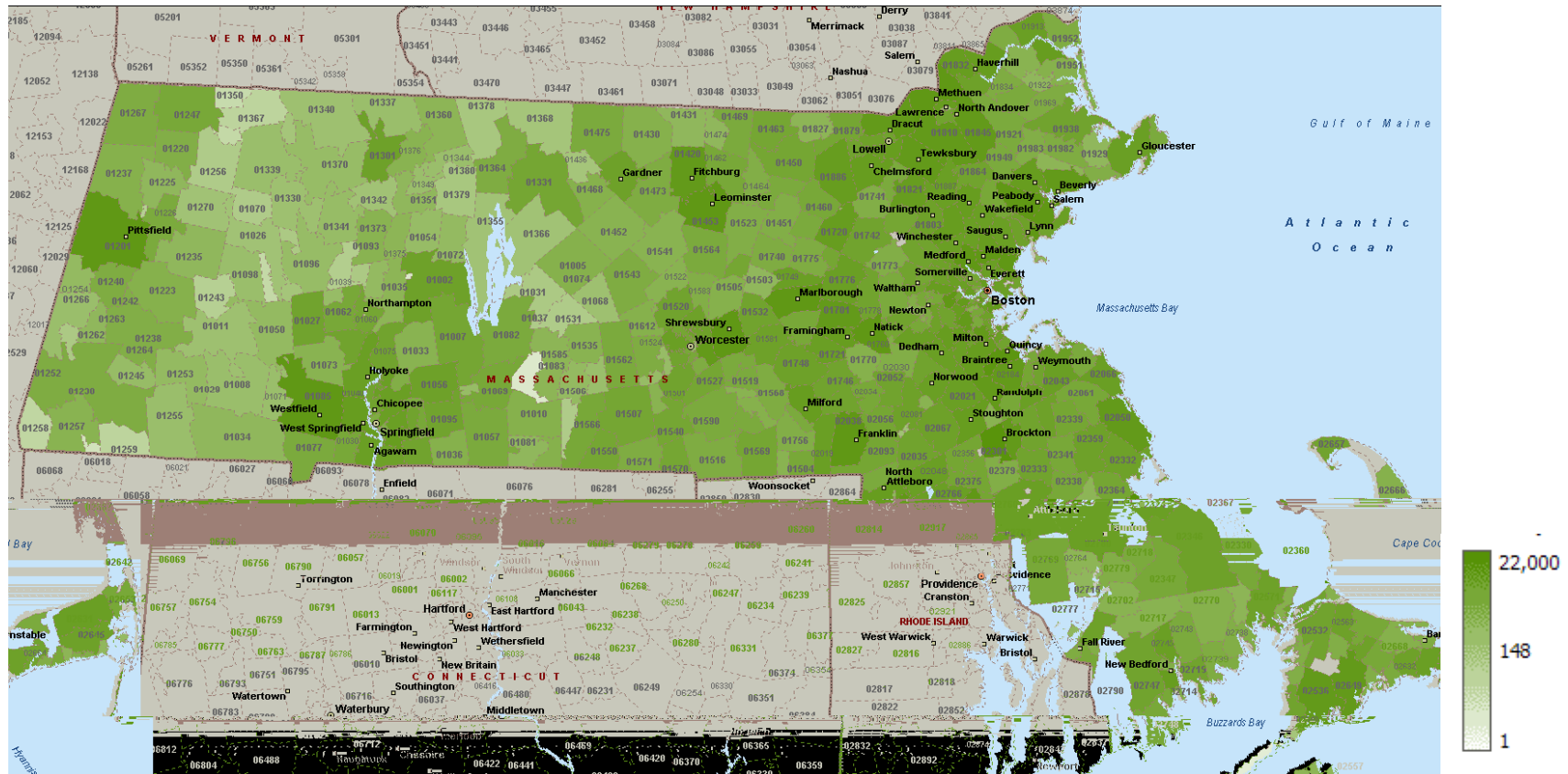


Figure 1: Geographic Distribution of Housing Transactions by Zip Code

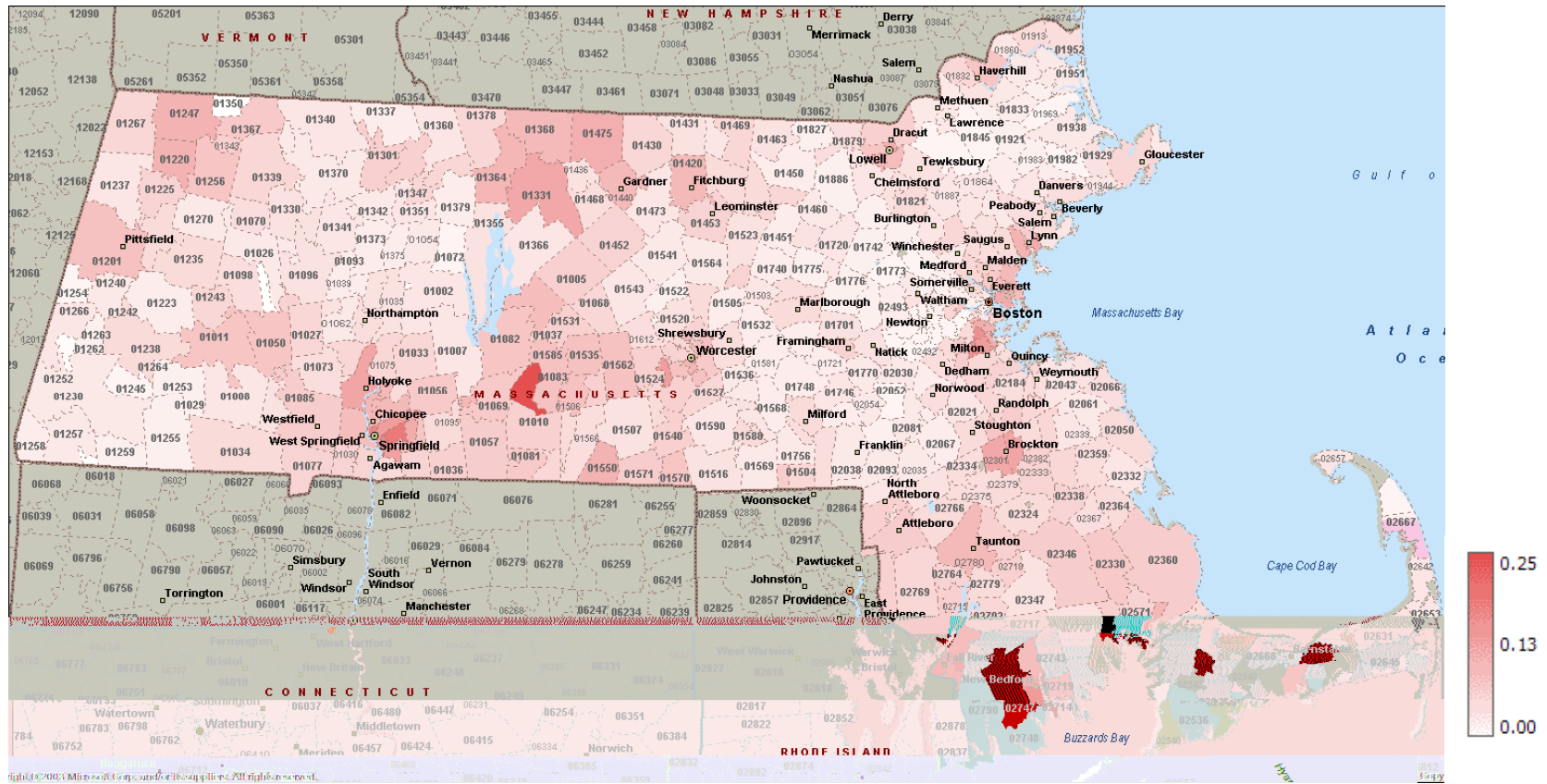


Figure 2: Geographic Distribution of Percentage of Housing Transactions that are Forced Sales by Zip Code

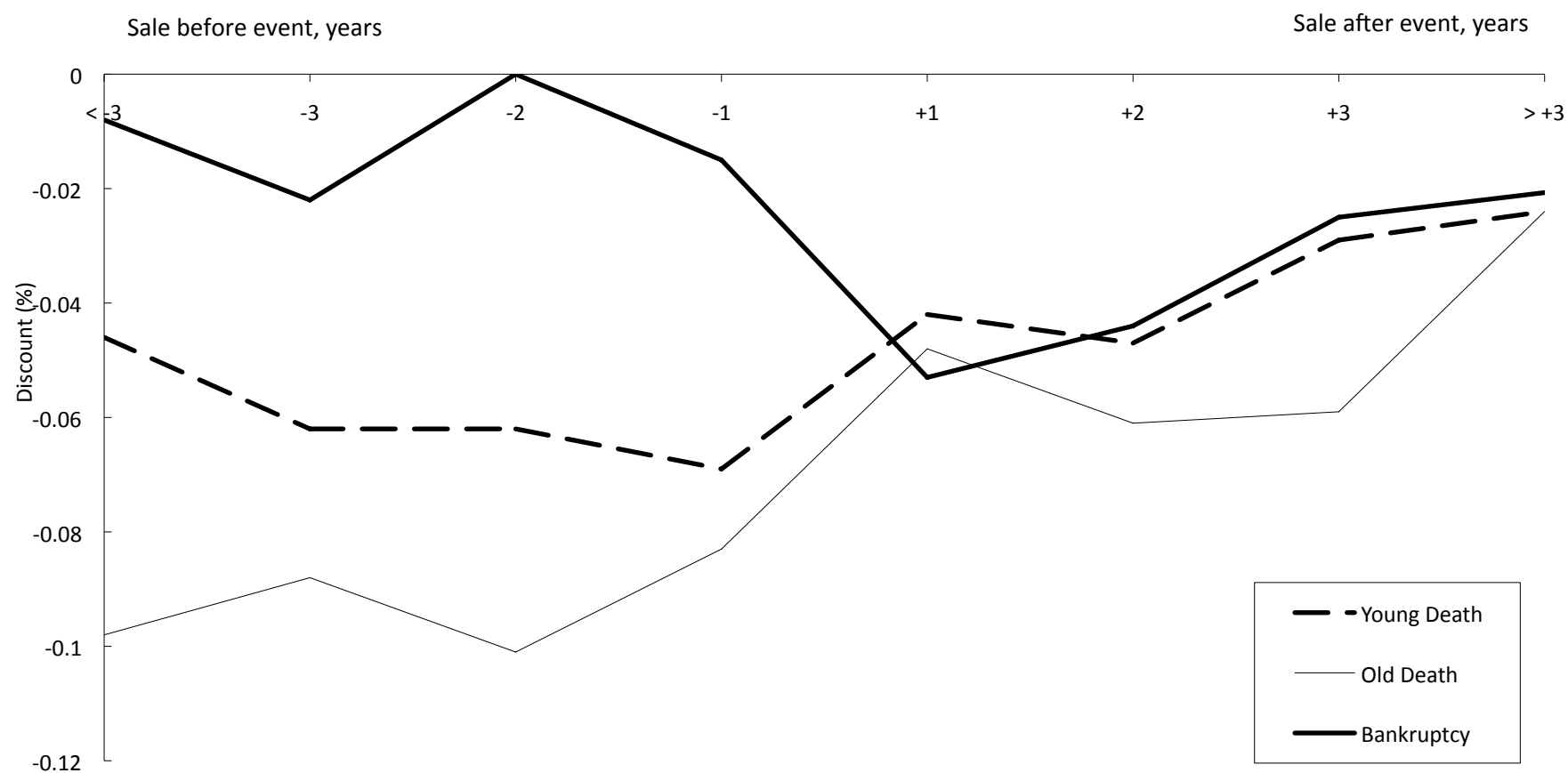


Figure 3: Forced sales discount and time between sale and event