Technical Appendix: Income Taxation and Dual Job Labour Supply

Chung Choe
Konkuk University

Ronald L. Oaxaca
University of Arizona

Francesco Renna
Lynn University

April 16, 2023

This appendix documents the Gauss-Seidel algorithm used to simulate the labour supply responses to increases in marginal tax rates on labour earnings in the presence of dual job holding and constraints on hours supplied to the main job. For each individual annual nominal taxable income $Y_{tax_{it}}$ is used to determine their marginal tax rates. Nominal income is converted to real income using the cost of living deflator P_t.

Definitions of the tax system variables are given below.

A_{it}: Tax Allowance

$A_{p_{ait}}$: Personal Tax Allowance (UK_income_allowance.xls)

$A_{spa_{it}}$: Single Parent Additional Tax Allowance (UK_income_allowance.xls)

$A_{mca_{it}}$: Married Couple Additional Tax Allowance (UK_income_allowance.xls)

$ATC_{sp-mc_{it}}$: Additional Tax Allowance for Single Parent and Married Couple changed to tax credits (UK_income_allowance.xls)

ADC_{it}: Adult Credit (taxcredits.xls)

CB_{it}: Child Benefits (childben.xls)

$CCFC_{it}$: Child Credit for Family Credit Policy (taxcredits.xls)

$CCWFTC_{it}$: Child Credit for Working Family Tax Credit (taxcredits.xls)

CTC_{it}: Child Tax Credit (taxcredits.xls)

$CTC_{max_{it}}$: Maximum Child Tax Credit (taxcredit.xls)

$CTCUB_{it}$: Upper Bound Income Threshold on Maximum Child Tax Credit (taxcredit.xls)

$CHILD_{it}$: Indicator for presence of dependent children

$CHILD12_{it}$: Indicator for presence of dependent children under 12 years

$CHR30_{it}$: 30-hour Credit (taxcredits.xls)

DP_{it}: Number of dependent children

$DP11_{it}$: Number of dependent children under 11 years

$DP12_{it}$: Number of dependent children under 12 years

$DP11\_15_{it}$: Number of dependent children between 11 and 15 years

$DP16\_17_{it}$: Number of dependent children between 16 and 17 years

$DP18_{it}$: Number of dependent children aged 18 years

$DP11\_16_{it}$: Number of dependent children between 11 and 16 years

$DP17\_18_{it}$: Number of dependent children between 17 and 18 years

$DWTC_{it}$: Indicator variable for receipt of Working Tax Credits

FC_{it}: Family Credit (FamilyCredit_UK)

$FC_{max_{it}}$: Maximum Family Credit (taxcredits.xls)

$FCUB_{it}$: Upper Bound Income Threshold for Maximum Family Credit (referred to as "Applicable Amount" (taxcredits.xls)

$H16^{+}_{it}$: Indicator for 16 or more hours worked per week

$H30^{+}_{it}$: Indicator for 30 or more hours worked per week

YNI_{it}: Net Income after taxes (includes Child Benefits)

YNI_FC_{it}: Threshold Net Income beyond which Family Credits are eliminated

YNI_WFTC_{it}: Threshold Net Income beyond which Working Tax Credits are eliminated

YNI_WTC_{it}: Threshold Working Family Net Income beyond which Working Family Tax Credits are eliminated

YNI_CTC_{1it}: First Threshold Working Family Net Income beyond which Maximum Child

Tax Credits are reduced

YNI_CTC_{2it}: Second Threshold Working Family Net Income beyond which Child Tax Credits are eliminated

$WFTC_{max_{it}}$: Maximum Working Family Credit (referred to as "Applicable Amount" (taxcredits.xls)

$WFTCUB_{it}$: Upper Bound Income Threshold for Maximum Working Family Tax Credit (taxcredits.xls)

$WFTC_{it}$: Working Family Credit (taxcredits.xls)

WTC_{it}: Working Tax Credit

$WTCUB_{it}$: Upper Bound Income Threshold for Maximum Working Tax Credit (taxcredits.xls)

$WTC_{max_{it}}$: Maximum Working Tax Credit

$T_{c_{it}}$: Tax Credits (includes Child Benefits even though these are not technically tax credits)

SP_{it}: Indicator for single parent

MS_{it}: Marital status indicator for married

$Y91_{it}$ - $Y08_{it}$: Yearly indicators for 1991 to 2008

$M1_{it} - M12_{it}$: Monthly indicators

$$
\begin{aligned}
A_{p_{ait}} = \left(\frac{1}{52}\right) * \Bigg[& 3295 * \left(Y91_{it} * \sum_{m=4}^{12} Mm_{it} + Y92_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 3445 * \left(Y92_{it} * \sum_{m=4}^{12} Mm_{it} + Y93_{it} + Y94_{it} + Y95_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 3525 * \left(Y95_{it} * \sum_{m=4}^{12} Mm_{it} + Y96_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 3765 * \left(Y96_{it} * \sum_{m=4}^{12} Mm_{it} + Y97_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 4045 * \left(Y97_{it} * \sum_{m=4}^{12} Mm_{it} + Y98_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 4195 * \left(Y98_{it} * \sum_{m=4}^{12} Mm_{it} + Y99_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 4335 * \left(Y99_{it} * \sum_{m=4}^{12} Mm_{it} + Y00_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 4385 * \left(Y00_{it} * \sum_{m=4}^{12} Mm_{it} + Y01_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 4535 * \left(Y01_{it} * \sum_{m=4}^{12} Mm_{it} + Y02_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 4615 * \left(Y02_{it} * \sum_{m=4}^{12} Mm_{it} + Y03_{it} + Y04_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 4745 * \left(Y04_{it} * \sum_{m=4}^{12} Mm_{it} + Y05_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 4895 * \left(Y05_{it} * \sum_{m=4}^{12} Mm_{it} + Y06_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 5035 * \left(Y06_{it} * \sum_{m=4}^{12} Mm_{it} + Y07_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 5225 * \left(Y07_{it} * \sum_{m=4}^{12} Mm_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 6035 * \left(Y08_{it} \sum_{m=4}^{12} Mm_{it} \right) \Bigg]
\end{aligned}
$$

Note that $A_{spa_{it}} = A_{mca_{it}}$.

$$A_{spa_{it}} = \left(\frac{1}{52}\right) * 1720 * \left(Y91_{it} * \sum_{m=4}^{12} Mm_{it} + Y92_{it} + Y93_{it} + Y94_{it} \sum_{m=1}^{3} Mm_{it}\right)$$

$$SP_{it} = (1 - MS_{it}) * CHILD_{it}$$

$$A_{it} = A_{p_{ait}} + MS_{it} * A_{mca_{it}} + SP_{it} * A_{spa_{it}}$$

$$\begin{aligned} ATC_{sp-mc_{it}} = \left(\frac{1}{52}\right) * \Bigg[& 0.20 * 1720 * \left(Y94_{it} * \sum_{m=4}^{12} Mm_{it} + Y95_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\ & + 0.15 * 1720 * \left(Y95_{it} * \sum_{m=4}^{12} Mm_{it} + Y96_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\ & + 0.15 * 1790 * \left(Y96_{it} * \sum_{m=4}^{12} Mm_{it} + Y97_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\ & + 0.15 * 1830 * \left(Y97_{it} * \sum_{m=4}^{12} Mm_{it} + Y98_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\ & + 0.15 * 1900 * \left(Y98_{it} * \sum_{m=4}^{12} Mm_{it} + Y99_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\ & + 0.10 * 1970 * \left(Y99_{it} * \sum_{m=4}^{12} Mm_{it} + Y00_{it} * \sum_{m=1}^{3} Mm_{it}\right) \Bigg] * (SP_{it} + MS_{it}) \end{aligned}$$

$$SP_{it} = 1(\text{single parent})$$

$$MS_{it} = 1(\text{married})$$

$$
\begin{aligned}
CB_{it} = & \Bigg\{ MS_{it} * CHILD_{it} * [8.25 + 7.25 * (DP_{it} - 1.0)] \\
& + SP_{it} * [13.85 + 7.25 * (DP_{it} - 1.0)] \Bigg\} * Y91_{it} * \sum_{m=4}^{9} Mm_{it} \\
& + \Bigg\{ MS_{it} * CHILD_{it} * [9.25 + 7.50 * (DP_{it} - 1.0)] \\
& + SP_{it} * [14.85 + 7.50 * (DP_{it} - 1.0)] \Bigg\} * \left(Y91_{it} * \sum_{m=10}^{12} Mm_{it} + Y92_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \Bigg\{ MS_{it} * CHILD_{it} * [9.65 + 7.80 * (DP_{it} - 1.0)] \\
& + SP_{it} * [15.50 + 7.80 * (DP_{it} - 1.0)] \Bigg\} * \left(Y92_{it} * \sum_{m=4}^{12} Mm_{it} + Y93_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \Bigg\{ MS_{it} * CHILD_{it} * [10.00 + 8.10 * (DP_{it} - 1.0)] \\
& + SP_{it} * [16.05 + 8.10 * (DP_{it} - 1.0)] \Bigg\} * \left(Y93_{it} * \sum_{m=4}^{12} Mm_{it} + Y94_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \Bigg\{ MS_{it} * CHILD_{it} * [10.20 + 8.25 * (DP_{it} - 1.0)] \\
& + SP_{it} * [16.35 + 8.25 * (DP_{it} - 1.0)] \Bigg\} * \left(Y94_{it} * \sum_{m=4}^{12} Mm_{it} + Y95_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \Bigg\{ MS_{it} * CHILD_{it} * [10.40 + 8.45 * (DP_{it} - 1.0)] \\
& + SP_{it} * [16.70 + 8.45 * (DP_{it} - 1.0)] \Bigg\} * \left(Y95_{it} * \sum_{m=4}^{12} Mm_{it} + Y96_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \Bigg\{ MS_{it} * CHILD_{it} * [10.80 + 8.80 * (DP_{it} - 1.0)] \\
& + SP_{it} * [17.10 + 8.80 * (DP_{it} - 1.0)] \Bigg\} * \left(Y96_{it} * \sum_{m=4}^{12} Mm_{it} + Y97_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \Bigg\{ MS_{it} * CHILD_{it} * [11.05 + 9.00 * (DP_{it} - 1.0)] \\
& + SP_{it} * [17.10 + 9.00 * (DP_{it} - 1.0)] \Bigg\} * \left(Y97_{it} * \sum_{m=4}^{12} Mm_{it} + Y98_{it} * \sum_{m=1}^{3} Mm_{it} \right)
\end{aligned}
$$

$$
\begin{aligned}
&+ \Bigg\{ MS_{it} * CHILD_{it} * [11.45 + 9.30 * (DP_{it} - 1.0)] \\
&+ SP_{it} * [17.10 + 9.30 * (DP_{it} - 1.0)] \Bigg\} * \left(Y98_{it} * \sum_{m=4}^{12} Mm_{it} + Y99_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \Bigg\{ MS_{it} * CHILD_{it} * [14.40 + 9.60 * (DP_{it} - 1.0)] \\
&+ SP_{it} * [17.10 + 9.60 * (DP_{it} - 1.0)] \Bigg\} * \left(Y99_{it} * \sum_{m=4}^{12} Mm_{it} + Y00_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \Bigg\{ MS_{it} * CHILD_{it} * [15.00 + 10.00 * (DP_{it} - 1.0)] \\
&+ SP_{it} * [17.55 + 10.00 * (DP_{it} - 1.0)] \Bigg\} * \left(Y00_{it} * \sum_{m=4}^{12} Mm_{it} + Y01_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \Bigg\{ MS_{it} * CHILD_{it} * [15.50 + 10.35 * (DP_{it} - 1.0)] \\
&+ SP_{it} * [17.55 + 10.35 * (DP_{it} - 1.0)] \Bigg\} * \left(Y01_{it} * \sum_{m=4}^{12} Mm_{it} + Y02_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \Bigg\{ MS_{it} * CHILD_{it} * [15.75 + 10.55 * (DP_{it} - 1.0)] \\
&+ SP_{it} * [17.55 + 10.55 * (DP_{it} - 1.0)] \Bigg\} * \left(Y02_{it} * \sum_{m=4}^{12} Mm_{it} + Y03_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \Bigg\{ MS_{it} * CHILD_{it} * [16.05 + 10.75 * (DP_{it} - 1.0)] \\
&+ SP_{it} * [17.55 + 10.75 * (DP_{it} - 1.0)] \Bigg\} * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \Bigg\{ MS_{it} * CHILD_{it} * [16.50 + 11.05 * (DP_{it} - 1.0)] \\
&+ SP_{it} * [17.55 + 11.05 * (DP_{it} - 1.0)] \Bigg\} * \left(Y04_{it} * \sum_{m=4}^{12} Mm_{it} + Y05_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \Bigg\{ MS_{it} * CHILD_{it} * [17.00 + 11.40 * (DP_{it} - 1.0)] \\
&+ SP_{it} * [17.55 + 11.40 * (DP_{it} - 1.0)] \Bigg\} * \left(Y05_{it} * \sum_{m=4}^{12} Mm_{it} + Y06_{it} * \sum_{m=1}^{3} Mm_{it} \right)
\end{aligned}
$$

$$
\begin{aligned}
&+ \Big\{ MS_{it} * CHILD_{it} * [17.45 + 11.70 * (DP_{it} - 1.0)] \\
&+ SP_{it} * [17.55 + 11.70 * (DP_{it} - 1.0)] \Big\} * \left(Y06_{it} * \sum_{m=4}^{12} Mm_{it} + Y07_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ (MS_{it} * CHILD_{it} + SP_{it}) * [18.10 + 12.10 * (DP_{it} - 1.0)] \\
&* \left(Y07_{it} * \sum_{m=4}^{12} Mm_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ (MS_{it} * CHILD_{it} + SP_{it}) * [18.80 + 12.55 * (DP_{it} - 1.0)] * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it} \right)
\end{aligned}
$$

$$
CHILD_{it} = 1(\text{dependent children})
$$

$$
\begin{aligned}
FCUB_{it} = 62.25 &* \left(Y91_{it} * \sum_{m=4}^{12} Mm_{it} + Y92_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 66.60 * \left(Y92_{it} * \sum_{m=4}^{12} Mm_{it} + Y93_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 69.00 * \left(Y93_{it} * \sum_{m=4}^{12} Mm_{it} + Y94_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 71.70 * \left(Y94_{it} * \sum_{m=4}^{12} Mm_{it} + Y95_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 73.00 * \left(Y95_{it} * \sum_{m=4}^{12} Mm_{it} + Y96_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 75.20 * \left(Y96_{it} * \sum_{m=4}^{12} Mm_{it} + Y97_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 77.15 * \left(Y97_{it} * \sum_{m=4}^{12} Mm_{it} + Y98_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 79.00 * \left(Y98_{it} * \sum_{m=4}^{12} Mm_{it} + Y99_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 80.65 * \left(Y99_{it} * \sum_{m=4}^{9} Mm_{it} \right)
\end{aligned}
$$

$$
YNI\_FC_{it} = FCUB_{it} + \frac{FC_{max_{it}}}{0.7}
$$

$$
\begin{aligned}
FC_{max_{it}} &= CHILD_{it} * H16^{+}_{it} * \left(ADC_{it} + H30^{+}_{it} * CHR30_{it} + CCFC_{it}\right) \\
&\quad * \left(Y91_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=92}^{98} Y_{\tau_{it}} + Y99 * \sum_{m=1}^{9} Mm_{it}\right) \\
CHILD_{it} &= 1(\text{dependent children}) \\
H16^{+}_{it} &= 1(h_{1it} + h_{2it} \geq 16) \\
H30^{+}_{it} &= 1(h_{1it} + h_{2it} \geq 30) \\
ADC_{it} &= \Bigg[38.30 * \left(Y91_{it} * \sum_{m=4}^{12} Mm_{it} + Y92_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 41.00 * \left(Y92_{it} * \sum_{m=4}^{12} Mm_{it} + Y93_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 42.50 * \left(Y93_{it} * \sum_{m=4}^{12} Mm_{it} + Y94_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 44.30 * \left(Y94_{it} * \sum_{m=4}^{12} Mm_{it} + Y95_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 45.10 * \left(Y95_{it} * \sum_{m=4}^{12} Mm_{it} + Y96_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 46.45 * \left(Y96_{it} * \sum_{m=4}^{12} Mm_{it} + Y97_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 47.65 * \left(Y97_{it} * \sum_{m=4}^{12} Mm_{it} + Y98_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 48.80 * \left(Y98_{it} * \sum_{m=4}^{12} Mm_{it} + Y99_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 49.80 * (1 - MS_{it}) * (1 - SP_{it}) * \left(Y99_{it} * \sum_{m=4}^{12} Mm_{it} + Y00_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 52.30 * (MS_{it} + SP_{it}) * \left(Y99_{it} * \sum_{m=4}^{12} Mm_{it} + Y00_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + 53.15 * (MS_{it} + SP_{it}) * \left(Y00_{it} * \sum_{m=4}^{12} Mm_{it} + Y01_{it} * \sum_{m=1}^{5} Mm_{it}\right)
\end{aligned}
$$

$$
\begin{aligned}
&+ 59.00 * (MS_{it} + SP_{it}) * \left(Y01_{it} * \sum_{m=6}^{12} Mm_{it} + Y02_{it} * \sum_{m=1}^{5} Mm_{it} \right) \\
&+ 62.50 * (MS_{it} + SP_{it}) * \left(Y02_{it} * \sum_{m=6}^{12} Mm_{it} + Y03_{it} * \sum_{m=1}^{3} Mm_{it} \right) \Bigg] \\
CHR30_{it} = \Bigg[&10.00 * \left(Y95_{it} * \sum_{m=7}^{12} Mm_{it} + Y96_{it} \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 10.30 * \left(Y96_{it} * \sum_{m=4}^{12} Mm_{it} + Y97_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 10.55 * \left(Y97_{it} * \sum_{m=4}^{12} Mm_{it} + Y98_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 10.80 * \left(Y98_{it} * \sum_{m=4}^{12} Mm_{it} + Y99_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 11.05 * \left(Y99_{it} * \sum_{m=4}^{12} Mm_{it} + Y00_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 11.25 * \left(Y00_{it} * \sum_{m=4}^{12} Mm_{it} + Y01_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 11.45 * \left(Y01_{it} * \sum_{m=4}^{12} Mm_{it} + Y02_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ 11.65 * \left(Y02_{it} * \sum_{m=4}^{12} Mm_{it} + Y03_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \left(\frac{620}{52} \right) * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \left(\frac{640}{52} \right) * \left(Y04_{it} * \sum_{m=4}^{12} Mm_{it} + Y05_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \left(\frac{660}{52} \right) * \left(Y05_{it} * \sum_{m=4}^{12} Mm_{it} + Y06_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \left(\frac{680}{52} \right) * \left(Y06_{it} * \sum_{m=4}^{12} Mm_{it} + Y07_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \left(\frac{705}{52} \right) * \left(Y07_{it} * \sum_{m=4}^{12} Mm_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&+ \left(\frac{735}{52} \right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it} \right) \Bigg]
\end{aligned}
$$

$$
\begin{aligned}
CCFC_{it} = & \Bigg(9.70 * DP11_{it} + 16.10 * DP11\_15_{it} + 20.05 * DP16\_17_{it} \\
& + 27.95 * DP18_{it} \Bigg) * \Bigg(Y91_{it} * \sum_{m=4}^{12} Mm_{it} + Y92_{it} * \sum_{m=1}^{3} Mm_{it} \Bigg) \\
& + \Bigg(10.40 * DP11_{it} + 17.25 * DP11\_15_{it} + 21.45 * DP16\_17_{it} \\
& + 29.90 * DP18_{it} \Bigg) * \Bigg(Y92_{it} * \sum_{m=4}^{12} Mm_{it} + Y93_{it} * \sum_{m=1}^{3} Mm_{it} \Bigg) \\
& + \Bigg(10.75 * DP11_{it} + 17.85 * DP11\_15_{it} + 22.20 * DP16\_17_{it} \\
& + 31.00 * DP18_{it} \Bigg) * \Bigg(Y93_{it} * \sum_{m=4}^{12} Mm_{it} + Y94_{it} * \sum_{m=1}^{3} Mm_{it} \Bigg) \\
& + \Bigg(11.20 * DP11_{it} + 18.55 * DP11\_15_{it} + 23.05 * DP16\_17_{it} \\
& + 32.20 * DP18_{it} \Bigg) * \Bigg(Y94_{it} * \sum_{m=4}^{12} Mm_{it} + Y95_{it} * \sum_{m=1}^{3} Mm_{it} \Bigg) \\
& + \Bigg(11.40 * DP11_{it} + 18.90 * DP11\_15_{it} + 23.45 * DP16\_17_{it} \\
& + 32.80 * DP18_{it} \Bigg) * \Bigg(Y95_{it} * \sum_{m=4}^{12} Mm_{it} + Y96_{it} * \sum_{m=1}^{3} Mm_{it} \Bigg) \\
& + \Bigg(11.75 * DP11_{it} + 19.45 * DP11\_15_{it} + 24.15 * DP16\_17_{it} \\
& + 33.80 * DP18_{it} \Bigg) * \Bigg(Y96_{it} * \sum_{m=4}^{12} Mm_{it} + Y97_{it} * \sum_{m=1}^{3} Mm_{it} \Bigg) \\
& + \Bigg(12.05 * DP11_{it} + 19.95 * DP11\_15_{it} + 24.80 * DP16\_17_{it} \\
& + 34.70 * DP18_{it} \Bigg) * \Bigg(Y97_{it} * \sum_{m=4}^{12} Mm_{it} + Y98_{it} * \sum_{m=1}^{3} Mm_{it} \Bigg) \\
& + \Bigg(12.35 * DP11_{it} + 20.45 * DP11\_16_{it} + 25.40 * DP17\_18_{it} \Bigg) \\
& * \Bigg(Y98_{it} * \sum_{m=4}^{10} Mm_{it} \Bigg)
\end{aligned}
$$

$$+\left(14.85 * DP11_{it} + 20.45 * DP11\_16_{it} + 25.40 * DP17\_18_{it}\right)$$
$$* \left(Y98_{it} * \sum_{m=11}^{12} Mm_{it} + Y99_{it} * \sum_{m=1}^{3} Mm_{it}\right)$$
$$+\left(15.15 * DP11_{it} + 20.90 * DP11\_16_{it} + 25.95 * DP17\_18_{it}\right) * \left(Y99_{it} * \sum_{m=4}^{9} Mm_{it}\right)$$

$$WFTCUB_{it} = \left(CHILD_{it} * H16_{it}^{+}\right) * (MS_{it} + SP_{it})$$
$$* \left[90.00 * \left(Y99_{it} * \sum_{m=10}^{12} Mm_{it} + Y00_{it} * \sum_{m=1}^{3} Mm_{it}\right)\right.$$
$$+ 91.45 * \left(Y00_{it} * \sum_{m=4}^{12} Mm_{it} + Y01_{it} * \sum_{m=1}^{3} Mm_{it}\right)$$
$$+ 92.90 * \left(Y01_{it} * \sum_{m=4}^{12} Mm_{it} + Y02_{it} * \sum_{m=1}^{3} Mm_{it}\right)$$
$$\left.+ 94.50 * \left(Y02_{it} * \sum_{m=4}^{12} Mm_{it} + Y03_{it} * \sum_{m=1}^{3} Mm_{it}\right)\right]$$
$$WFTC_{max_{it}} = \left(CHILD_{it} * H16_{it}^{+}\right) * (MS_{it} + SP_{it}) * (ADC_{it} + CHR30_{it} + CCWFTC_{it})$$

$$
\begin{aligned}
CCWFTC_{it} &= \left(CHILD_{it} * H16^{+}_{it}\right) * (MS_{it} + SP_{it}) \\
&\quad * (19.85 * DP11_{it} + 20.90 * DP11\_16_{it} + 25.95 * DP17\_18_{it}) \\
&\quad * \left(Y99_{it} * \sum_{m=10}^{12} Mm_{it} + Y00_{it} * \sum_{m=1}^{5} Mm_{it}\right) \\
&\quad + [25.60 * (DP11_{it} + DP11\_16_{it}) + 26.35 * DP17\_18_{it}] \\
&\quad * \left(Y00_{it} * \sum_{m=6}^{12} Mm_{it} + Y01_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + [26.00 * (DP11_{it} + DP11\_16_{it}) + 26.75 * DP17\_18_{it}] \\
&\quad * \left(Y01_{it} * \sum_{m=4}^{12} Mm_{it} + Y02_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad + [26.45 * (DP11_{it} + DP11\_16_{it}) + 27.20 * DP17\_18_{it}] \\
&\quad * \left(Y02_{it} * \sum_{m=4}^{12} Mm_{it} + Y03_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
YNI\_WFTC_{it} &= WFTCUB_{it} + \frac{WFTC_{max_{it}}}{0.55} \\
WFTC_{max_{it}} &= \left(CHILD_{it} * H16^{+}_{it}\right) * (MS_{it} + SP_{it}) * (ADC_{it} + CHR30_{it} + CCWFTC_{it}) \\
WTCUB_{it} &= \left(\frac{1}{52}\right) * \left[5060 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} * \sum_{m=1}^{3} Mm_{it}\right)\right. \\
&\quad + 5220 * \left(Y06_{it} * \sum_{m=4}^{12} Mm_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad \left. + 6420 * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\right]
\end{aligned}
$$

$$
\begin{aligned}
WTC_{max_{it}} = \left(\frac{1}{52}\right) * H16_{it}^{+} * \Bigg\{ & \left[1525 + 1500 * (MS_{it} + SP_{it}) + 620 * H30_{it}^{+}\right] \\
& * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
& + \left[1570 + 1545 * (MS_{it} + SP_{it}) + 640 * H30_{it}^{+}\right] \\
& * \left(Y04_{it} * \sum_{m=4}^{12} Mm_{it} + Y05_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
& + \left[1620 + 1595 * (MS_{it} + SP_{it}) + 660 * H30_{it}^{+}\right] \\
& * \left(Y05_{it} * \sum_{m=4}^{12} Mm_{it} + Y06_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
& + \left[1665 + 1640 * (MS_{it} + SP_{it}) + 680 * H30_{it}^{+}\right] \\
& * \left(Y06_{it} * \sum_{m=4}^{12} Mm_{it} + Y07_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
& + \left[1730 + 1700 * (MS_{it} + SP_{it}) + 705 * H30_{it}^{+}\right] \\
& * \left(Y07_{it} * \sum_{m=4}^{12} Mm_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
& + \left[1800 + 1770 * (MS_{it} + SP_{it}) + 735 * H30_{it}^{+}\right] \\
& * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right) \Bigg\}
\end{aligned}
$$

$$
\begin{aligned}
CTCUB_{it} = (1 - DWTC_{it}) * \left(\frac{1}{52}\right) \Bigg[& 13230 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 13480 * \left(Y04_{it} * \sum_{m=4}^{12} Mm_{it} + Y05_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 13910 * \left(Y05_{it} * \sum_{m=4}^{12} Mm_{it} + Y06_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 14155 * \left(Y06_{it} * \sum_{m=4}^{12} Mm_{it} + Y07_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 14495 * \left(Y07_{it} * \sum_{m=4}^{12} Mm_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + 15575 * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it} \right) \Bigg] \\
& + DWTC_{it} * WTCUB_{it}
\end{aligned}
$$

$$
DWTC_{it} = 1(WTC_{it} > 0)
$$

$$
\begin{aligned}
CTC_{max_{it}} = & \left(\frac{1}{52}\right) * CHILD_{it} * (545 + 545 * CHILD12_{it}) \\
& + \left(\frac{1}{52}\right) * \left\{ \left[1445 * (DP11_{it} + DP11\_15_{it} + DP16\_17_{it}) \right] \right. \\
& * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \left[1625 * (DP11_{it} + DP11\_15_{it} + DP16\_17_{it}) \right] \\
& * \left(Y04_{it} * \sum_{m=4}^{12} Mm_{it} + Y05_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \left[1690 * (DP11_{it} + DP11\_15_{it} + DP16\_17_{it}) \right] \\
& * \left(Y05_{it} * \sum_{m=4}^{12} Mm_{it} + Y06_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \left[1765 * (DP11_{it} + DP11\_15_{it} + DP16\_17_{it}) \right] \\
& * \left(Y06_{it} * \sum_{m=4}^{12} Mm_{it} + Y07_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& + \left[1845 * (DP11_{it} + DP11\_15_{it} + DP16\_17_{it}) \right] \\
& * \left(Y07_{it} * \sum_{m=4}^{12} Mm_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
& \left. + \left[2085 * (DP11_{it} + DP11\_15_{it} + DP16\_17_{it}) \right] * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it} \right) \right\}
\end{aligned}
$$

$$YNI\_CTC_{1it} = \left[CTCUB_{it} + \left(\frac{CTC_{max_{it}} - \frac{545}{52}}{0.37} \right) \right]$$
$$* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right)$$
$$+ \left[CTCUB_{it} + \left(\frac{CTC_{max_{it}} - \frac{545}{52}}{0.39} \right) \right] * Y08_{it} * \sum_{m=4}^{12} Mm_{it}$$

$$YNI\_CTC_{2it} = \frac{1}{52} * \left(50000 + \frac{545}{0.067} \right)$$

Simulation equations for each labour supply regime are assembled below. The first set of equations determine the control (historical) solution, and the second set of equations determine the policy solution. The γ parameters in the Q_{kit} variables are replaced by their estimated values.

The historical values of the tax band indicator, tax bands, and marginal tax rate variables common to all regimes are specified below:

$$D_{1it} = 1(0 < Y_{tax_{it}} \leq Y_{U1_{it}})$$

$$D_{2it} = 1(Y_{U1_{it}} < Y_{tax_{it}} \leq Y_{U2_{it}})$$

$$D_{3it} = 1(Y_{U2_{it}} < Y_{tax_{it}})$$

$$\tau_{wit} = \tau_{w_{1it}} D_{1it} + \tau_{w_{2it}} D_{2it} + \tau_{w_{3it}} D_{3it}$$

$$\tau_{Iit} = \tau_{I_{1it}} D_{1it} + \tau_{I_{2it}} D_{2it} + \tau_{I_{3it}} D_{3it}$$

We impose a menu of exogenous changes in the marginal tax rate schedule for labour income:

$$\begin{aligned}
\tau_{wit}^{p(0)} =& (1+\delta)\tau_{wit} \\
=& (1+\delta)\left(\tau_{w_{1it}} D_{1it}^{p(0)} + \tau_{w_{2it}} D_{2it}^{p(0)} + \tau_{w_{3it}} D_{3it}^{p(0)}\right) \\
=& \tau_{w_{1it}}^{p} D_{1it}^{p(0)} + \tau_{w_{2it}}^{p} D_{2it}^{p(0)} + \tau_{w_{3it}}^{p} D_{3it}^{p(0)} \\
=& 1(0 < Y_{tax_{it}}^{p(0)} \leq Y_{U1_{it}})\tau_{w_{1it}}^{p} + 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(0)} \leq Y_{U2_{it}})\tau_{w_{2it}}^{p} + 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(0)})\tau_{w_{3it}}^{p},
\end{aligned}$$

where $\delta = 0.10, 0.15, 0.20$.

Regime 1 (unconstrained dual job holders)

The historical values of the variables are expressed in terms of estimated parameters and residuals:

$$
\begin{aligned}
Y_{tax_{it}} &= 52 * (W_{1it}h_{1it} + W_{2it}h_{2it} + I_{it} - A_{it}) \\
YNI_{it} &= W_{1it}h_{1it} + W_{2it}h_{2it} + I_{it} \\
&\quad - \frac{1}{52}\Bigg\{ D_{1it}\left[\tau_{w1it}\left(Y_{tax_{it}} - 52I_{it}\right) + 52\tau_{I_{1it}}I_{it}\right] \\
&\quad + D_{2it}\left[\tau_{w1it}Y_{U1_{it}} + \tau_{w2it}\left(Y_{tax_{it}} - 52I_{it} - Y_{U1_{it}}\right) + 52\tau_{I2it}I_{it}\right] \\
&\quad + D_{3it}\left[\tau_{w1it}Y_{U1_{it}} + \tau_{w2_{it}}Y_{U2_{it}} + \tau_{w3it}\left(Y_{tax_{it}} - 52I_{it} - Y_{U2_{it}}\right) + 52\tau_{I3it}I_{it}\right]\Bigg\} \\
&\quad + CB_{it} \\
FC_{it} &= 1\left(YNI_{it} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&\quad + 1\left(FCUB_{it} < YNI_{it} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * \left(YNI_{it} - FCUB_{it}\right)\right] \\
&\quad + 1\left(YNI_{it} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it} &= 1(YNI_{it} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&\quad + 1(WFTCUB_{it} < YNI_{it} < YNI\_WTFC_{it}) * \\
&\quad [WFTC_{max_{it}} - 0.55 * (YNI_{it} - WFTCUB_{it})] \\
&\quad + 1(YNI_{it} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it} &= 1(YNI_{it} \leq WTCUB_{it}) * (H16^{+}_{it} * WTC_{max_{it}}) \\
&\quad + 1(WTCUB_{it} < YNI_{it} < YNI\_WTC_{it}) * H16^{+}_{it} \\
&\quad * \Bigg[WTC_{max_{it}} - 0.37 * (YNI_{it} - WTCUB_{it}) \\
&\quad * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad - 0.39 * (YNI_{it} - WTCUB_{it}) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] + 1(YNI_{it} \geq YNI\_WTC_{it}) * 0
\end{aligned}
$$

$$
\begin{aligned}
CTC_{it} &= 1(YNI_{it} < CTCUB_{it}) * CTC_{max_{it}} \\
&\quad + 1(CTCUB_{it} \leq YNI_{it} < YNI\_CTC_{1it}) * \\
&\quad \left\{ CTC_{max_{it}} - \left[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \right. \right. \\
&\quad \left. \left. + 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it} \right] * (YNI_{it} - CTCUB_{it}) \right\} \\
&\quad + 1 \left(YNI\_CTC_{1it} \leq YNI_{it} < \frac{50000}{52} \right) * \frac{545}{52} \\
&\quad + 1 \left(\frac{50000}{52} \leq YNI_{it} < YNI\_CTC_{2it} \right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it} - \frac{50000}{52} \right) \right] \\
&\quad + (YNI\_CTC_{2it} < YNI_{it}) * 0
\end{aligned}
$$

$$
\begin{aligned}
T^r_{cit} &= \frac{ATC_{sp-mc_{it}} + FC_{it} + WFTC_{it} + WTC_{it} + CTC_{it} + CB_{it}}{P_t} \\
Q_{1it} &= \tilde{\gamma}_3 - \left[D_{2it} \left(\tau_{w2it} - \tau_{w1it} \right) - D_{3it} \tau_{w3it} \right] y^r_{u1_{it}} - D_{3it} (\tau_{w3it} - \tau_{w2it}) y^r_{u2_{it}} \\
&\quad - (1 - \tau_{Iit}) I^r_{it} - \tau_{wit} A^r_{it} - (1 - \tau_{wit}) (\tilde{\gamma}_1 W^r_{1it} + \tilde{\gamma}_2 W^r_{2it}) - T^r_{cit} \\
\hat{u}_{11it} &= (1 - \tau_{wit}) W^r_{1it} \left(h_{1it} - \tilde{\gamma}_1 \right) - \hat{\alpha}_1 Q_{1it} - \hat{\theta}_{11} \hat{\lambda}_{1it} - \bar{Z}_{1i} \hat{\pi}_{11} \\
\hat{u}_{21it} &= (1 - \tau_{wit}) W^r_{2it} \left(h_{2it} - \tilde{\gamma}_2 \right) - \tilde{\alpha}_2 Q_{1it} - \tilde{\theta}_{21} \hat{\lambda}_{1it} - \bar{Z}_{1i} \hat{\pi}_{21}
\end{aligned}
$$

$$
\begin{aligned}
y^r_{it} &= \sum_{m=1}^{2} W^r_{mit} h_{mit} + I^r_{it} - D_{1it} \left[\tau_{w1it} \left(\sum_{m=1}^{2} W^r_{mit} h_{mit} - A^r_{it} \right) + \tau_{I1it} I^r_{it} \right] \\
&- D_{2it} \left[\tau_{w1it} y^r_{u1_{it}} + \tau_{w2it} \left(\sum_{m=1}^{2} W^r_{mit} h_{mit} - A^r_{it} - y^r_{u1_{it}} \right) + \tau_{I2it} I^r_{it} \right] \\
&- D_{3it} \left[\tau_{w1it} y^r_{u1_{it}} + \tau_{w2it} y^r_{u2_{it}} + \tau_{w3it} \left(\sum_{m=1}^{2} W^r_{mit} h_{mit} - A^r_{it} - y^r_{u2_{it}} \right) + \tau_{I3it} I^r_{it} \right] + T^r_{cit}.
\end{aligned}
$$

The first iteration yields

$$Q_{1it}^{p(1)} = \Bigg\{ \tilde{\gamma_3} - \Big[D_{2it}^{p(0)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(0)} \tau_{w3it}^{p} \Big] y_{u1_{it}}^{r} - D_{3it}^{p(0)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(0)} A_{it}^{r} - (1 - \tau_{wit}^{p(0)}) (\tilde{\gamma}_1 W_{1it}^{r} + \tilde{\gamma}_2 W_{2it}^{r}) - T_{cit}^{rp(0)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(1)} = \hat{\alpha}_1 Q_{1it}^{p(1)} + \hat{\theta}_{11} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{11} + \hat{u}_{11it}$$

$$\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(1)} = \tilde{\alpha}_2 Q_{1it}^{p(1)} + \tilde{\theta}_{21} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{21} + \hat{u}_{21it}$$

$$h_{1it}^{p(1)} = \tilde{\gamma}_1 + \frac{\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(1)}}{(1 - \tau_{wit}^{p(0)}) W_{1it}^{r}}$$

$$h_{2it}^{p(1)} = \tilde{\gamma}_2 + \frac{\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(1)}}{(1 - \tau_{wit}^{p(0)}) W_{2it}^{r}}$$

$$Y_{tax_{it}}^{p(1)} = 52 * (W_{1it} h_{1it}^{p(1)} + W_{2it} h_{2it}^{p(1)} + I_{it} - A_{it})$$

$$D_{1it}^{p(1)} = 1(0 < Y_{tax_{it}}^{p(1)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(1)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(1)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(1)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(1)})$$

$$\tau_{wit}^{p(1)} = \tau_{w_{1it}}^{p} D_{1it}^{p(1)} + \tau_{w_{2it}}^{p} D_{2it}^{p(1)} + \tau_{w_{3it}}^{p} D_{3it}^{p(1)}$$

$$\tau_{Iit}^{p(1)} = \tau_{I_{1it}} D_{1it}^{p(1)} + \tau_{I_{2it}} D_{2it}^{p(1)} + \tau_{I_{3it}} D_{3it}^{p(1)}$$

$$YNI_{it}^{p(1)} = W_{1it} h_{1it}^{p(1)} + W_{2it} h_{2it}^{p(1)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(1)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(1)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(1)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(1)} &= 1\left(YNI_{it}^{p(1)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(1)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(1)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(1)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(1)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(1)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(1)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(1)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(1)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(1)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(1)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(1)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(1)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(1)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(1)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(1)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(1)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(1)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(1)} + WFTC_{it}^{p(1)} + WTC_{it}^{p(1)} + CTC_{it}^{p(1)} + CB_{it}}{P_t}$$

$$\begin{aligned} y_{it}^{rp(1)} = & \sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(1)} + I_{it}^{r} - D_{1it}^{p(1)} \left[\tau_{w1it}^{p} \left(\sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(1)} - A_{it}^{r} \right) + \tau_{I1it} I_{it}^{r} \right] \\ & - D_{2it}^{p(1)} \left[\tau_{w1it}^{p} y_{u1_{it}}^{r} + \tau_{w2it}^{p} \left(\sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(1)} - A_{it}^{r} - y_{u1_{it}}^{r} \right) + \tau_{I2it} I_{it}^{r} \right] \\ & - D_{3it}^{p(1)} \left[\tau_{w1it}^{p} y_{u1_{it}}^{r} + \tau_{w2it}^{p} y_{u2_{it}}^{r} + \tau_{w3it}^{p} \left(\sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(1)} - A_{it}^{r} - y_{u2_{it}}^{r} \right) + \tau_{I3it} I_{it}^{r} \right] + T_{cit}^{rp(1)}. \end{aligned}$$

The second iteration follows next with

$$Q_{1it}^{p(2)} = \Bigg\{ \tilde{\gamma_3} - \Big[D_{2it}^{p(1)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(1)} \tau_{w3it}^{p} \Big] y_{u1_{it}}^{r} - D_{3it}^{p(1)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(1)} A_{it}^{r} - (1 - \tau_{wit}^{p(1)}) (\tilde{\gamma}_1 W_{1it}^{r} + \tilde{\gamma}_2 W_{2it}^{r}) - T_{cit}^{rp(1)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(2)} = \hat{\alpha}_1 Q_{1it}^{p(2)} + \hat{\theta}_{11} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{11} + \hat{u}_{11it}$$

$$\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(2)} = \tilde{\alpha}_2 Q_{1it}^{p(2)} + \tilde{\theta}_{21} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{21} + \hat{u}_{21it}$$

$$h_{1it}^{p(2)} = \tilde{\gamma}_1 + \frac{\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(2)}}{(1 - \tau_{wit}^{p(1)}) W_{1it}^{r}}$$

$$h_{2it}^{p(2)} = \tilde{\gamma}_2 + \frac{\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(2)}}{(1 - \tau_{wit}^{p(1)}) W_{2it}^{r}}$$

$$Y_{tax_{it}}^{p(2)} = 52 * (W_{1it} h_{1it}^{p(2)} + W_{2it} h_{2it}^{p(2)} + I_{it} - A_{it})$$

$$D_{1it}^{p(2)} = 1(0 < Y_{tax_{it}}^{p(2)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(2)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(2)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(2)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(2)})$$

$$\tau_{wit}^{p(2)} = \tau_{w_{1it}}^{p} D_{1it}^{p(2)} + \tau_{w_{2it}}^{p} D_{2it}^{p(2)} + \tau_{w_{3it}}^{p} D_{3it}^{p(2)}$$

$$\tau_{Iit}^{p(2)} = \tau_{I_{1it}} D_{1it}^{p(2)} + \tau_{I_{2it}} D_{2it}^{p(2)} + \tau_{I_{3it}} D_{3it}^{p(2)}$$

$$YNI_{it}^{p(2)} = W_{1it} h_{1it}^{p(1)} + W_{2it} h_{2it}^{p(2)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(2)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(2)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(2)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(2)} &= 1\left(YNI_{it}^{p(2)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(2)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(2)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(2)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(2)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(2)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(2)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(2)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(2)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(2)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(2)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(2)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(2)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(2)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(2)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(2)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(2)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(2)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(2)} + WFTC_{it}^{p(2)} + WTC_{it}^{p(2)} + CTC_{it}^{p(2)} + CB_{it}}{P_t}$$

$$\begin{aligned} y_{it}^{rp(2)} = & \sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(2)} + I_{it}^{r} - D_{1it}^{p(2)} \left[\tau_{w1it}^{p} \left(\sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(2)} - A_{it}^{r} \right) + \tau_{I1it} I_{it}^{r} \right] \\ & - D_{2it}^{p(2)} \left[\tau_{w1it}^{p} y_{u1_{it}}^{r} + \tau_{w2it}^{p} \left(\sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(2)} - A_{it}^{r} - y_{u1_{it}}^{r} \right) + \tau_{I2it} I_{it}^{r} \right] \\ & - D_{3it}^{p(2)} \left[\tau_{w1it}^{p} y_{u1_{it}}^{r} + \tau_{w2it}^{p} y_{u2_{it}}^{r} + \tau_{w3it}^{p} \left(\sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(2)} - A_{it}^{r} - y_{u2_{it}}^{r} \right) + \tau_{I3it} I_{it}^{r} \right] + T_{cit}^{rp(2)}. \end{aligned}$$

Iterations continue until convergence at the nth iteration:

$$Q_{1it}^{p(n)} = \Bigg\{ \tilde{\gamma}_3 - \left[D_{2it}^{p(n-1)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(n-1)} \tau_{w3it}^{p} \right] y_{u1_{it}}^{r} - D_{3it}^{p(n-1)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(n-1)} A_{it}^{r} - (1 - \tau_{wit}^{p(n-1)}) (\tilde{\gamma}_1 W_{1it}^{r} + \tilde{\gamma}_2 W_{2it}^{r}) - T_{cit}^{rp(n-1)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(n)} = \hat{\alpha}_1 Q_{1it}^{p(n)} + \hat{\theta}_{11} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{11} + \hat{u}_{11it}$$

$$\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(n)} = \tilde{\alpha}_2 Q_{1it}^{p(n)} + \tilde{\theta}_{21} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{21} + \hat{u}_{21it}$$

$$h_{1it}^{p(n)} = \tilde{\gamma}_1 + \frac{\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(n)}}{(1 - \tau_{wit}^{p(n-1)}) W_{1it}^{r}}$$

$$h_{2it}^{p(n)} = \tilde{\gamma}_2 + \frac{\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(n)}}{(1 - \tau_{wit}^{p(n-1)}) W_{2it}^{r}}$$

$$Y_{tax_{it}}^{p(n)} = 52 * (W_{1it} h_{1it}^{p(n)} + W_{2it} h_{2it}^{p(n)} + I_{it} - A_{it})$$

$$D_{1it}^{p(n)} = 1(0 < Y_{tax_{it}}^{p(n)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(n)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(n)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(n)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(n)})$$

$$\tau_{wit}^{p(n)} = \tau_{w_{1it}}^{p} D_{1it}^{p(n)} + \tau_{w_{2it}}^{p} D_{2it}^{p(n)} + \tau_{w_{3it}}^{p} D_{3it}^{p(n)}$$

$$\tau_{Iit}^{p(n)} = \tau_{I_{1it}} D_{1it}^{p(n)} + \tau_{I_{2it}} D_{2it}^{p(n)} + \tau_{I_{3it}} D_{3it}^{p(n)}$$

$$YNI_{it}^{p(n)} = W_{1it} h_{1it}^{p(n)} + W_{2it} h_{2it}^{p(n)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(n)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(n)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(n)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(n)} &= 1\left(YNI_{it}^{p(n)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(n)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(n)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(n)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(n)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(n)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(n)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(n)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(n)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(n)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(n)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(n)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(n)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(n)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(n)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(n)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(n)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(n)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(n)} + WFTC_{it}^{p(n)} + WTC_{it}^{p(n)} + CTC_{it}^{p(n)} + CB_{it}}{P_t}$$

$$\begin{aligned} y_{it}^{rp(n)} = & \sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(n)} + I_{it}^{r} - D_{1it}^{p(n)} \left[\tau_{w1it}^{p} \left(\sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(n)} - A_{it}^{r} \right) + \tau_{I1it} I_{it}^{r} \right] \\ & - D_{2it}^{p(n)} \left[\tau_{w1it}^{p} y_{u1_{it}}^{r} + \tau_{w2it}^{p} \left(\sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(1)} - A_{it}^{r} - y_{u1_{it}}^{r} \right) + \tau_{I2it} I_{it}^{r} \right] \\ & - D_{3it}^{p(n)} \left[\tau_{w1it}^{p} y_{u1_{it}}^{r} + \tau_{w2it}^{p} y_{u2_{it}}^{r} + \tau_{w3it}^{p} \left(\sum_{m=1}^{2} W_{mit}^{r} h_{mit}^{p(n)} - A_{it}^{r} - y_{u2_{it}}^{r} \right) + \tau_{I3it} I_{it}^{r} \right] + T_{cit}^{rp(n)}. \end{aligned}$$

The tax policy values of the labour supply and tax variables are

$h_{1it}^{p} = h_{1it}^{p(n)}, h_{2it}^{p} = h_{2it}^{p(n)}$, $\tau_{wit}^{p} = \tau_{wit}^{p(n)}, \tau_{Iit}^{p} = \tau_{Iit}^{p(n)}$, and $y_{it}^{rp} = y_{it}^{rp(n)}$.

Therefore, the tax policy effects in levels are $\Delta^{p} h_{1it} = h_{1it}^{p} - h_{1it}, \Delta^{p} h_{2it} = h_{2it}^{p} - h_{2it}$, $\Delta^{p} \tau_{wit} = \tau_{wit}^{p} - \tau_{wit}, \Delta^{p} \tau_{Iit} = \tau_{Iit}^{p} - \tau_{Iit}$, and $\Delta^{p} y_{it}^{r} = y_{it}^{rp(n)} - y_{it}$.

In terms of percentage changes, the tax policy effects are

$\frac{\Delta^{p} h_{1it}}{h_{1it}}, \frac{\Delta^{p} h_{2it}}{h_{2it}}, \frac{\Delta^{p} \tau_{wit}}{\tau_{w_{it}}}, \frac{\Delta^{p} \tau_{Iit}}{\tau_{I_{it}}}$ and $\frac{\Delta^{p} y_{it}^{r}}{y_{it}^{r}}$. ***The tax policy values of the labour supply and tax variables are

$h_{1it}^{p} = h_{1it}^{p(n)}, h_{2it}^{p} = h_{2it}^{p(n)}, Y_{tax_{it}}^{p} = Y_{tax_{it}}^{p(n)}$, $\tau_{wit}^{p} = \tau_{wit}^{p(n)}$, $T_{c_{it}}^{p} = T_{c_{it}}^{p(n)}$, and $y_{it}^{p} = y_{it}^{p(n)}$.

Therefore, the tax policy effects in levels are $\Delta^{p} h_{1it} = h_{1it}^{p} - h_{1it}, \Delta^{p} h_{2it} = h_{2it}^{p} - h_{2it}$, $\Delta^{p} Y_{tax_{it}} = Y_{tax_{it}}^{p} - Y_{tax_{it}}$, $\Delta^{p} \tau_{wit} = \tau_{wit}^{p} - \tau_{wit}$, $\Delta^{p} T_{c_{it}} = T_{c_{it}}^{p} - T_{c_{it}}$, and $\Delta^{p} y_{it} = y_{it}^{p} - y_{it}$.

In terms of percentage changes, the tax policy effects are

$\frac{\Delta^{p} h_{1it}}{h_{1it}}, \frac{\Delta^{p} h_{2it}}{h_{2it}}, \frac{\Delta^{p} Y_{it}}{Y_{it}}, \frac{\Delta^{p} \tau_{wit}}{\tau_{w_{it}}}, \frac{\Delta^{p} T_{c_{it}}}{T_{c_{it}}}$, and $\frac{\Delta^{p} y_{it}}{y_{it}}$.

Regime 2 (unconstrained unitary job holders) The historical values of the variables are expressed in terms of estimated parameters and residuals:

$$
\begin{aligned}
Y_{tax_{it}} &= 52 * (W_{1it} h_{1it} + I_{it} - A_{it}) \\
YNI_{it} &= W_{1it} h_{1it} + I_{it} \\
&\quad - \frac{1}{52} D_{1it} \Bigg\{ \left[\tau_{w1it} \left(Y_{tax_{it}} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right] \\
&\quad + D_{2it} \left[\tau_{w1it} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right] \\
&\quad + D_{3it} \left[\tau_{w1it} Y_{U1_{it}} + \tau_{w2_{it}} Y_{U2_{it}} + \tau_{w3it} \left(Y_{tax_{it}} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\} \\
&\quad + CB_{it} \\
FC_{it} &= 1 \left(YNI_{it} \leq FCUB_{it} \right) * FC_{max_{it}} \\
&\quad + 1 \left(FCUB_{it} < YNI_{it} < YNI\_FC_{it} \right) * \left[FC_{max_{it}} - 0.7 * \left(YNI_{it} - FCUB_{it} \right) \right] \\
&\quad + 1 \left(YNI_{it} \geq YNI\_FC_{it} \right) * 0 \\
WFTC_{it} &= 1 (YNI_{it} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&\quad + 1 (WFTCUB_{it} < YNI_{it} < YNI\_WTFC_{it}) * \\
&\quad [WFTC_{max_{it}} - 0.55 * (YNI_{it} - WFTCUB_{it})] \\
&\quad + 1 (YNI_{it} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it} &= 1 (YNI_{it} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&\quad + 1 (WTCUB_{it} < YNI_{it} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&\quad * \Bigg[WTC_{max_{it}} - 0.37 * (YNI_{it} - WTCUB_{it}) \\
&\quad * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \\
&\quad - 0.39 * (YNI_{it} - WTCUB_{it}) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it} \right) \Bigg] + 1 (YNI_{it} \geq YNI\_WTC_{it}) * 0
\end{aligned}
$$

$$
\begin{aligned}
CTC_{it} &= 1(YNI_{it} < CTCUB_{it}) * CTC_{max_{it}} \\
&\quad + 1(CTCUB_{it} \leq YNI_{it} < YNI\_CTC_{1it}) * \\
&\quad \left\{ CTC_{max_{it}} - \left[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \right. \right. \\
&\quad \left. \left. + 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it} \right] * (YNI_{it} - CTCUB_{it}) \right\} \\
&\quad + 1 \left(YNI\_CTC_{1it} \leq YNI_{it} < \frac{50000}{52} \right) * \frac{545}{52} \\
&\quad + 1 \left(\frac{50000}{52} \leq YNI_{it} < YNI\_CTC_{2it} \right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it} - \frac{50000}{52} \right) \right] \\
&\quad + (YNI\_CTC_{2it} < YNI_{it}) * 0
\end{aligned}
$$

$$
\begin{aligned}
T^r_{cit} &= \frac{ATC_{sp-mc_{it}} + FC_{it} + WFTC_{it} + WTC_{it} + CTC_{it} + CB_{it}}{P_t} \\
Q_{2it} &= \tilde{\gamma}_3 - \left[D_{2it} \left(\tau_{w2it} - \tau_{w1it} \right) - D_{3it} \tau_{w3it} \right] y^r_{u1_{it}} - D_{3it} (\tau_{w3it} - \tau_{w2it}) y^r_{u2_{it}} \\
&\quad - (1 - \tau_{Iit}) I^r_{it} - \tau_{wit} A^r_{it} - \tilde{\gamma}_1 (1 - \tau_{wit}) W^r_{1it} - T^r_{cit} \\
\hat{u}_{12it} &= (1 - \tau_{wit}) W^r_{1it} \left(h_{1it} - \tilde{\gamma}_1 \right) - \left(\frac{\hat{\alpha}_1}{1 - \hat{\alpha}_2} \right) Q_{2it} - \hat{\theta}_{12} \hat{\lambda}_{2it} - \bar{Z}_{12i} \hat{\pi}_{12}
\end{aligned}
$$

$$
\begin{aligned}
y^r_{it} &= W^r_{1it} h_{1it} + I^r_{it} - D_{1it} \left[\tau_{w1it} \left(W^r_{1it} h_{1it} - A^r_{it} \right) + \tau_{I1it} I^r_{it} \right] \\
&- D_{2it} \left[\tau_{w1it} y^r_{u1_{it}} + \tau_{w2it} \left(W^r_{1it} h_{1it} - A^r_{it} - y^r_{u1_{it}} \right) + \tau_{I2it} I^r_{it} \right] \\
&- D_{3it} \left[\tau_{w1it} y^r_{u1_{it}} + \tau_{w2it} y^r_{u2_{it}} + \tau_{w3it} \left(W^r_{1it} h_{1it} - A^r_{it} - y^r_{u2_{it}} \right) + \tau_{I3it} I^r_{it} \right] + T^r_{cit}.
\end{aligned}
$$

The first iteration yields

$$Q_{2it}^{p(1)} = \Bigg\{ \tilde{\gamma}_3 - \Big[D_{2it}^{p(0)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(0)} \tau_{w3it}^{p} \Big] y_{u1_{it}}^{r} - D_{3it}^{p(0)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(0)} A_{it}^{r} - \tilde{\gamma}_1 (1 - \tau_{wit}^{p(0)}) W_{1it}^{r} - T_{cit}^{rp(0)} \Bigg\}$$

$$\big[\big(1 - \tau_w\big) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \big]_{it}^{p(1)} = \left(\frac{\hat{\alpha}_1}{1 - \hat{\alpha}_2} \right) Q_{2it}^{p(1)} + \hat{\theta}_{11} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{11} + \hat{u}_{11it}$$

$$h_{1it}^{p(1)} = \tilde{\gamma}_1 + \frac{\big[\big(1 - \tau_w\big) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \big]_{it}^{p(1)}}{(1 - \tau_{wit}^{p(0)}) W_{1it}^{r}}$$

$$Y_{tax_{it}}^{p(1)} = 52 * (W_{1it} h_{1it}^{p(1)} + I_{it} - A_{it})$$

$$D_{1it}^{p(1)} = 1(0 < Y_{tax_{it}}^{p(1)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(1)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(1)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(1)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(1)})$$

$$\tau_{wit}^{p(1)} = \tau_{w_{1it}}^{p} D_{1it}^{p(1)} + \tau_{w_{2it}}^{p} D_{2it}^{p(1)} + \tau_{w_{3it}}^{p} D_{3it}^{p(1)}$$

$$\tau_{Iit}^{p(1)} = \tau_{I_{1it}} D_{1it}^{p(1)} + \tau_{I_{2it}} D_{2it}^{p(1)} + \tau_{I_{3it}} D_{3it}^{p(1)}$$

$$YNI_{it}^{p(1)} = W_{1it} h_{1it}^{p(1)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(1)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(1)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(1)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(1)} &= 1\left(YNI_{it}^{p(1)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(1)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(1)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(1)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(1)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(1)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(1)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(1)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(1)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(1)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(1)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(1)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(1)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(1)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(1)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(1)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(1)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(1)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(1)} + WFTC_{it}^{p(1)} + WTC_{it}^{p(1)} + CTC_{it}^{p(1)} + CB_{it}}{P_t}$$

$$\begin{aligned} y_{it}^{rp(1)} = {} & W_{1it}^{r} h_{1it}^{p(1)} + I_{it}^{r} - D_{1it}^{p(1)} \left[\tau_{w1it}^{p} \left(W_{1it}^{r} h_{1it}^{p(1)} - A_{it}^{r} \right) + \tau_{I1it} I_{it}^{r} \right] \\ & - D_{2it}^{p(1)} \left[\tau_{w1it}^{p} y_{u1_{it}}^{r} + \tau_{w2it}^{p} \left(W_{1it}^{r} h_{1it}^{p(1)} - A_{it}^{r} - y_{u1_{it}}^{r} \right) + \tau_{I2it} I_{it}^{r} \right] \\ & - D_{3it}^{p(1)} \left[\tau_{w1it}^{p} y_{u1_{it}}^{r} + \tau_{w2it}^{p} y_{u2_{it}}^{r} + \tau_{w3it}^{p} \left(W_{1it}^{r} h_{1it}^{p(1)} - A_{it}^{r} - y_{u2_{it}}^{r} \right) + \tau_{I3it} I_{it}^{r} \right] + T_{cit}^{rp(1)}. \end{aligned}$$

The second iteration follows next with

$$Q_{2it}^{p(2)} = \Bigg\{ \tilde{\gamma}_3 - \Big[D_{2it}^{p(1)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(1)} \tau_{w3it}^{p} \Big] y_{u1_{it}}^{r} - D_{3it}^{p(1)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(1)} A_{it}^{r} - \tilde{\gamma}_1 (1 - \tau_{wit}^{p(1)}) W_{1it}^{r} - T_{cit}^{rp(1)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(2)} = \left(\frac{\hat{\alpha}_1}{1 - \hat{\alpha}_2} \right) Q_{2it}^{p(2)} + \hat{\theta}_{11} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{11} + \hat{u}_{11it}$$
$$+ \tilde{\theta}_{21} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{21} + \hat{u}_{21it}$$

$$h_{1it}^{p(2)} = \tilde{\gamma}_1 + \frac{\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(2)}}{(1 - \tau_{wit}^{p(1)}) W_{1it}^{r}}$$

$$Y_{tax_{it}}^{p(2)} = 52 * (W_{1it} h_{1it}^{p(2)} + I_{it} - A_{it})$$

$$D_{1it}^{p(2)} = 1(0 < Y_{tax_{it}}^{p(2)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(2)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(2)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(2)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(2)})$$

$$\tau_{wit}^{p(2)} = \tau_{w_{1it}}^{p} D_{1it}^{p(2)} + \tau_{w_{2it}}^{p} D_{2it}^{p(2)} + \tau_{w_{3it}}^{p} D_{3it}^{p(2)}$$

$$\tau_{Iit}^{p(2)} = \tau_{I_{1it}} D_{1it}^{p(2)} + \tau_{I_{2it}} D_{2it}^{p(2)} + \tau_{I_{3it}} D_{3it}^{p(2)}$$

$$YNI_{it}^{p(2)} = W_{1it} h_{1it}^{p(1)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(2)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(2)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(2)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(2)} &= 1\left(YNI_{it}^{p(2)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(2)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(2)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(2)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(2)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(2)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(2)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(2)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(2)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(2)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(2)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(2)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(2)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(2)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(2)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(2)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(2)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(2)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(2)} + WFTC_{it}^{p(2)} + WTC_{it}^{p(2)} + CTC_{it}^{p(2)} + CB_{it}}{P_t}$$

$$\begin{aligned} y_{it}^{rp(2)} = & W_{1it}^r h_{1it}^{p(2)} + I_{it}^r - D_{1it}^{p(2)} \left[\tau_{w1it}^p \left(W_{1it}^r h_{1it}^{p(2)} - A_{it}^r \right) + \tau_{I1it} I_{it}^r \right] \\ & - D_{2it}^{p(2)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p \left(W_{1it}^r h_{1it}^{p(2)} - A_{it}^r - y_{u1_{it}}^r \right) + \tau_{I2it} I_{it}^r \right] \\ & - D_{3it}^{p(2)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p y_{u2_{it}}^r + \tau_{w3it}^p \left(W_{1it}^r h_{1it}^{p(2)} - A_{it}^r - y_{u2_{it}}^r \right) + \tau_{I3it} I_{it}^r \right] + T_{cit}^{rp(2)}. \end{aligned}$$

Iterations continue until convergence at the nth iteration:

$$Q_{2it}^{p(n)} = \Bigg\{ \tilde{\gamma}_3 - \left[D_{2it}^{p(n-1)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(n-1)} \tau_{w3it}^{p} \right] y_{u1_{it}}^{r} - D_{3it}^{p(n-1)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(n-1)} A_{it}^{r} - \tilde{\gamma}_1 (1 - \tau_{wit}^{p(n-1)}) W_{1it}^{r} - T_{cit}^{rp(n-1)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(n)} = \left(\frac{\hat{\alpha}_1}{1 - \alpha_2} \right) Q_{1it}^{p(n)} + \hat{\theta}_{11} \hat{\lambda}_{1it} + \bar{Z}_{1i} \hat{\pi}_{11} + \hat{u}_{11it}$$

$$h_{1it}^{p(n)} = \tilde{\gamma}_1 + \frac{\left[\left(1 - \tau_w\right) W_1^r \left(h_1 - \tilde{\gamma}_1 \right) \right]_{it}^{p(n)}}{(1 - \tau_{wit}^{p(n-1)}) W_{1it}^{r}}$$

$$Y_{tax_{it}}^{p(n)} = 52 * (W_{1it} h_{1it}^{p(n)} + I_{it} - A_{it})$$

$$D_{1it}^{p(n)} = 1(0 < Y_{tax_{it}}^{p(n)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(n)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(n)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(n)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(n)})$$

$$\tau_{wit}^{p(n)} = \tau_{w_{1it}}^{p} D_{1it}^{p(n)} + \tau_{w_{2it}}^{p} D_{2it}^{p(n)} + \tau_{w_{3it}}^{p} D_{3it}^{p(n)}$$

$$\tau_{Iit}^{p(n)} = \tau_{I_{1it}} D_{1it}^{p(n)} + \tau_{I_{2it}} D_{2it}^{p(n)} + \tau_{I_{3it}} D_{3it}^{p(n)}$$

$$YNI_{it}^{p(n)} = W_{1it} h_{1it}^{p(n)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(n)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(n)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(n)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(n)} &= 1\left(YNI_{it}^{p(n)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(n)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(n)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(n)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(n)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(n)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(n)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(n)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(n)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(n)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(n)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(n)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(n)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(n)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(n)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(n)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(n)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(n)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(n)} + WFTC_{it}^{p(n)} + WTC_{it}^{p(n)} + CTC_{it}^{p(n)} + CB_{it}}{P_t}$$

$$\begin{aligned} y_{it}^{rp(n)} &= W_{1it}^r h_{1it}^{p(n)} + I_{it}^r - D_{1it}^{p(n)} \left[\tau_{w1it}^p \left(W_{1it}^r h_{1it}^{p(n)} - A_{it}^r \right) + \tau_{I1it} I_{it}^r \right] \\ &- D_{2it}^{p(n)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p \left(W_{1it}^r h_{1it}^{p(1)} - A_{it}^r - y_{u1_{it}}^r \right) + \tau_{I2it} I_{it}^r \right] \\ &- D_{3it}^{p(n)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p y_{u2_{it}}^r + \tau_{w3it}^p \left(W_{1it}^r h_{1it}^{p(n)} - A_{it}^r - y_{u2_{it}}^r \right) + \tau_{I3it} I_{it}^r \right] + T_{cit}^{rp(n)}. \end{aligned}$$

The tax policy values of the labour supply and tax variables are

$h_{1it}^p = h_{1it}^{p(n)}$, $\tau_{wit}^p = \tau_{wit}^{p(n)}$, $\tau_{Iit}^p = \tau_{Iit}^{p(n)}$, and $y_{it}^{rp} = y_{it}^{rp(n)}$.

Therefore, the tax policy effects in levels are $\Delta^p h_{1it} = h_{1it}^p - h_{1it}$, $\Delta^p \tau_{wit} = \tau_{wit}^p - \tau_{wit}$,

$\Delta^p \tau_{Iit} = \tau_{Iit}^p - \tau_{Iit}$, and $\Delta^p y_{it}^r = y_{it}^{rp(n)} - y_{it}$.

In terms of percentage changes, the tax policy effects are

$\frac{\Delta^p h_{1it}}{h_{1it}}$, $\frac{\Delta^p \tau_{wit}}{\tau_{w_{it}}}$, $\frac{\Delta^p \tau_{Iit}}{\tau_{I_{it}}}$ and $\frac{\Delta^p y_{it}^r}{y_{it}^r}$. The tax policy values of the labour supply and tax variables are

$h_{1it}^p = h_{1it}^{p(n)}$, $Y_{tax_{it}}^p = Y_{tax_{it}}^{p(n)}$, $\tau_{wit}^p = \tau_{wit}^{p(n)}$, $T_{c_{it}}^p = T_{c_{it}}^{p(n)}$, and $y_{it}^p = y_{it}^{p(n)}$.

Therefore, the tax policy effects in levels are $\Delta^p h_{1it} = h_{1it}^p - h_{1it}$, $\Delta^p Y_{tax_{it}} = Y_{tax_{it}}^p - Y_{tax_{it}}$,

$\Delta^p \tau_{wit} = \tau_{wit}^p - \tau_{wit}$, $\Delta^p T_{c_{it}} = T_{c_{it}}^p - T_{c_{it}}$, and $\Delta^p y_{it} = y_{it}^p - y_{it}$.

In terms of percentage changes, the tax policy effects are

$\frac{\Delta^p h_{2it}}{h_{2it}}$, $\frac{\Delta^p Y_{it}}{Y_{it}}$, $\frac{\Delta^p \tau_{wit}}{\tau_{w_{it}}}$, $\frac{\Delta^p T_{c_{it}}}{T_{c_{it}}}$, and $\frac{\Delta^p y_{it}}{y_{it}}$.

Regime 3 (overemployed constrained dual job holders)

The historical values of the variables are expressed in terms of estimated parameters and residuals:

$$
\begin{aligned}
Y_{tax_{it}} &= 52 * (W_{1it}\dot{h}_{1it} + W_{2it}h_{2it} + I_{it} - A_{it}) \\
YNI_{it} &= W_{1it}\dot{h}_{1it} + W_{2it}h_{2it} + I_{it} \\
&\quad - \frac{1}{52}\Bigg\{ D_{1it}\left[\tau_{w1it}\left(Y_{tax_{it}} - 52I_{it}\right) + 52\tau_{I_{1it}}I_{it}\right] \\
&\quad + D_{2it}\left[\tau_{w1it}Y_{U1_{it}} + \tau_{w2it}\left(Y_{tax_{it}} - 52I_{it} - Y_{U1_{it}}\right) + 52\tau_{I2it}I_{it}\right] \\
&\quad + D_{3it}\left[\tau_{w1it}Y_{U1_{it}} + \tau_{w2_{it}}Y_{U2_{it}} + \tau_{w3it}\left(Y_{tax_{it}} - 52I_{it} - Y_{U2_{it}}\right) + 52\tau_{I3it}I_{it}\right]\Bigg\} \\
&\quad + CB_{it} \\
FC_{it} &= 1\left(YNI_{it} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&\quad + 1\left(FCUB_{it} < YNI_{it} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * \left(YNI_{it} - FCUB_{it}\right)\right] \\
&\quad + 1\left(YNI_{it} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it} &= 1(YNI_{it} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&\quad + 1(WFTCUB_{it} < YNI_{it} < YNI\_WTFC_{it}) * \\
&\quad [WFTC_{max_{it}} - 0.55 * (YNI_{it} - WFTCUB_{it})] \\
&\quad + 1(YNI_{it} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it} &= 1(YNI_{it} \leq WTCUB_{it}) * (H16^{+}_{it} * WTC_{max_{it}}) \\
&\quad + 1(WTCUB_{it} < YNI_{it} < YNI\_WTC_{it}) * H16^{+}_{it} \\
&\quad * \Bigg[WTC_{max_{it}} - 0.37 * (YNI_{it} - WTCUB_{it}) \\
&\quad * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad - 0.39 * (YNI_{it} - WTCUB_{it}) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] + 1(YNI_{it} \geq YNI\_WTC_{it}) * 0
\end{aligned}
$$

$$
\begin{aligned}
CTC_{it} &= 1(YNI_{it} < CTCUB_{it}) * CTC_{max_{it}} \\
&\quad + 1(CTCUB_{it} \leq YNI_{it} < YNI\_CTC_{1it}) * \\
&\quad \left\{ CTC_{max_{it}} - \left[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \right. \right. \\
&\quad \left. \left. + 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it} \right] * (YNI_{it} - CTCUB_{it}) \right\} \\
&\quad + 1 \left(YNI\_CTC_{1it} \leq YNI_{it} < \frac{50000}{52} \right) * \frac{545}{52} \\
&\quad + 1 \left(\frac{50000}{52} \leq YNI_{it} < YNI\_CTC_{2it} \right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it} - \frac{50000}{52} \right) \right] \\
&\quad + (YNI\_CTC_{2it} < YNI_{it}) * 0
\end{aligned}
$$

$$
\begin{aligned}
T^r_{cit} &= \frac{ATC_{sp-mc_{it}} + FC_{it} + WFTC_{it} + WTC_{it} + CTC_{it} + CB_{it}}{P_t} \\
Q_{23it} &= \tilde{\gamma}_3 - \left[D_{2it} \left(\tau_{w2it} - \tau_{w1it} \right) - D_{3it} \tau_{w3it} \right] y^r_{u1_{it}} - D_{3it} (\tau_{w3it} - \tau_{w2it}) y^r_{u2_{it}} \\
&\quad - (1 - \tau_{Iit}) I^r_{it} - \tau_{wit} A^r_{it} - (1 - \tau_{wit}) (W^r_{1it} \dot{h}_{1it} + \tilde{\gamma}_2 W^r_{2it}) - T^r_{cit} \\
\hat{u}_{23it} &= (1 - \tau_{wit}) W^r_{2it} \left(h_{2it} - \tilde{\gamma}_2 \right) - \left(\frac{\tilde{\alpha}_2}{1 - \tilde{\alpha}_1} \right) Q_{23it} - \tilde{\theta}_{23} \hat{\lambda}_{23it} - \bar{Z}_{3i} \hat{\pi}_{23}
\end{aligned}
$$

$$
\begin{aligned}
y^r_{it} &= W^r_{1it} \dot{h}_{1it} + W^r_{2it} h_{2it} + I^r_{it} - D_{1it} \left[\tau_{w1it} \left(W^r_{1it} \dot{h}_{1it} + W^r_{2it} h_{2it} - A^r_{it} \right) + \tau_{I1it} I^r_{it} \right] \\
&- D_{2it} \left[\tau_{w1it} y^r_{u1_{it}} + \tau_{w2it} \left(W^r_{1it} \dot{h}_{1it} + W^r_{2it} h_{2it} - A^r_{it} - y^r_{u1_{it}} \right) + \tau_{I2it} I^r_{it} \right] \\
&- D_{3it} \left[\tau_{w1it} y^r_{u1_{it}} + \tau_{w2it} y^r_{u2_{it}} + \tau_{w3it} \left(W^r_{1it} \dot{h}_{1it} + W^r_{2it} h_{2it} - A^r_{it} - y^r_{u2_{it}} \right) + \tau_{I3it} I^r_{it} \right] + T^r_{cit}.
\end{aligned}
$$

The first iteration yields

$$Q_{23it}^{p(1)} = \Bigg\{ \tilde{\gamma}_3 - \Big[D_{2it}^{p(0)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(0)} \tau_{w3it}^{p} \Big] y_{u1_{it}}^{r} - D_{3it}^{p(0)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(0)} A_{it}^{r} - (1 - \tau_{wit}^{p(0)}) (W_{1it}^{r} \dot{h}_{1it} + \tilde{\gamma}_2 W_{2it}^{r}) - T_{cit}^{rp(0)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(1)} = \left(\frac{\tilde{\alpha}_2}{1 - \tilde{\alpha}_1} \right) Q_{23it}^{p(1)} + \tilde{\theta}_{23} \hat{\lambda}_{23it} + \bar{Z}_{3i} \hat{\pi}_{23} + \hat{u}_{23it}$$

$$h_{2it}^{p(1)} = \tilde{\gamma}_2 + \frac{\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(1)}}{(1 - \tau_{wit}^{p(0)}) W_{2it}^{r}}$$

$$Y_{tax_{it}}^{p(1)} = 52 * (W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(1)} + I_{it} - A_{it})$$

$$D_{1it}^{p(1)} = 1(0 < Y_{tax_{it}}^{p(1)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(1)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(1)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(1)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(1)})$$

$$\tau_{wit}^{p(1)} = \tau_{w_{1it}}^{p} D_{1it}^{p(1)} + \tau_{w_{2it}}^{p} D_{2it}^{p(1)} + \tau_{w_{3it}}^{p} D_{3it}^{p(1)}$$

$$\tau_{Iit}^{p(1)} = \tau_{I_{1it}} D_{1it}^{p(1)} + \tau_{I_{2it}} D_{2it}^{p(1)} + \tau_{I_{3it}} D_{3it}^{p(1)}$$

$$YNI_{it}^{p(1)} = W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(1)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(1)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(1)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(1)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(1)} &= 1\left(YNI_{it}^{p(1)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(1)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(1)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(1)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(1)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(1)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(1)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(1)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(1)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(1)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(1)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(1)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(1)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(1)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(1)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(1)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(1)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(1)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(1)} + WFTC_{it}^{p(1)} + WTC_{it}^{p(1)} + CTC_{it}^{p(1)} + CB_{it}}{P_t}$$

$$\begin{aligned}
y_{it}^{rp(1)} = & W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(1)} + I_{it}^r - D_{1it}^{p(1)} \left[\tau_{w1it}^p \left(W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(1)} - A_{it}^r \right) + \tau_{I1it} I_{it}^r \right] \\
& - D_{2it}^{p(1)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p \left(W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(1)} - A_{it}^r - y_{u1_{it}}^r \right) + \tau_{I2it} I_{it}^r \right] \\
& - D_{3it}^{p(1)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p y_{u2_{it}}^r + \tau_{w3it}^p \left(W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(1)} - A_{it}^r - y_{u2_{it}}^r \right) + \tau_{I3it} I_{it}^r \right] \\
& + T_{cit}^{rp(1)}.
\end{aligned}$$

The second iteration follows next with

$$Q_{23it}^{p(2)} = \Bigg\{ \tilde{\gamma}_3 - \Big[D_{2it}^{p(1)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(1)} \tau_{w3it}^{p} \Big] y_{u1_{it}}^{r} - D_{3it}^{p(1)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(1)} A_{it}^{r} - (1 - \tau_{wit}^{p(1)}) (W_{1it}^{r} \dot{h}_{1it} + \tilde{\gamma}_2 W_{2it}^{r}) - T_{cit}^{rp(1)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(2)} = \left(\frac{\tilde{\alpha}_2}{1 - \tilde{\alpha}_1} \right) Q_{23it}^{p(2)} + \tilde{\theta}_{23} \hat{\lambda}_{23it} + \bar{Z}_{3i} \hat{\pi}_{23} + \hat{u}_{23it}$$

$$h_{2it}^{p(2)} = \tilde{\gamma}_2 + \frac{\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(2)}}{(1 - \tau_{wit}^{p(1)}) W_{2it}^{r}}$$

$$Y_{tax_{it}}^{p(2)} = 52 * (W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(2)} + I_{it} - A_{it})$$

$$D_{1it}^{p(2)} = 1(0 < Y_{tax_{it}}^{p(2)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(2)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(2)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(2)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(2)})$$

$$\tau_{wit}^{p(2)} = \tau_{w_{1it}}^{p} D_{1it}^{p(2)} + \tau_{w_{2it}}^{p} D_{2it}^{p(2)} + \tau_{w_{3it}}^{p} D_{3it}^{p(2)}$$

$$\tau_{Iit}^{p(2)} = \tau_{I_{1it}} D_{1it}^{p(2)} + \tau_{I_{2it}} D_{2it}^{p(2)} + \tau_{I_{3it}} D_{3it}^{p(2)}$$

$$YNI_{it}^{p(2)} = W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(2)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(2)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(2)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(2)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(2)} &= 1\left(YNI_{it}^{p(2)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(2)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(2)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(2)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(2)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(2)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(2)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(2)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(2)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(2)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(2)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(2)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(2)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(2)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(2)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(2)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(2)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(2)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(2)} + WFTC_{it}^{p(2)} + WTC_{it}^{p(2)} + CTC_{it}^{p(2)} + CB_{it}}{P_t}$$

$$\begin{aligned}
y_{it}^{rp(2)} = & W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(2)} + I_{it}^{r} - D_{1it}^{p(2)}\left[\tau_{w1it}^{p}\left(W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(2)} - A_{it}^{r}\right) + \tau_{I1it}I_{it}^{r}\right] \\
& - D_{2it}^{p(2)}\left[\tau_{w1it}^{p}y_{u1_{it}}^{r} + \tau_{w2it}^{p}\left(W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(2)} - A_{it}^{r} - y_{u1_{it}}^{r}\right) + \tau_{I2it}I_{it}^{r}\right] \\
& - D_{3it}^{p(2)}\left[\tau_{w1it}^{p}y_{u1_{it}}^{r} + \tau_{w2it}^{p}y_{u2_{it}}^{r} + \tau_{w3it}^{p}\left(W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(2)} - A_{it}^{r} - y_{u2_{it}}^{r}\right) + \tau_{I3it}I_{it}^{r}\right] \\
& + T_{cit}^{rp(2)}.
\end{aligned}$$

Iterations continue until convergence at the nth iteration:

$$Q_{23it}^{p(n)} = \Bigg\{ \tilde{\gamma}_3 - \left[D_{2it}^{p(n-1)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(n-1)} \tau_{w3it}^{p} \right] y_{u1_{it}}^{r} - D_{3it}^{p(n-1)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(n-1)} A_{it}^{r} - (1 - \tau_{wit}^{p(n-1)}) (W_{1it}^{r} \dot{h}_{1it} + \tilde{\gamma}_2 W_{2it}^{r}) - T_{cit}^{rp(n-1)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(n)} = \left(\frac{\tilde{\alpha}_2}{1 - \tilde{\alpha}_1} \right) Q_{23it}^{p(n)} + \tilde{\theta}_{23} \hat{\lambda}_{23it} + \bar{Z}_{3i} \hat{\pi}_{23} + \hat{u}_{23it}$$

$$h_{2it}^{p(n)} = \tilde{\gamma}_2 + \frac{\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(n)}}{(1 - \tau_{wit}^{p(n-1)}) W_{2it}^{r}}$$

$$Y_{tax_{it}}^{p(n)} = 52 * (W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(n)} + I_{it} - A_{it})$$

$$D_{1it}^{p(n)} = 1(0 < Y_{tax_{it}}^{p(n)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(n)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(n)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(n)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(n)})$$

$$\tau_{wit}^{p(n)} = \tau_{w_{1it}}^{p} D_{1it}^{p(n)} + \tau_{w_{2it}}^{p} D_{2it}^{p(n)} + \tau_{w_{3it}}^{p} D_{3it}^{p(n)}$$

$$\tau_{Iit}^{p(n)} = \tau_{I_{1it}} D_{1it}^{p(n)} + \tau_{I_{2it}} D_{2it}^{p(n)} + \tau_{I_{3it}} D_{3it}^{p(n)}$$

$$YNI_{it}^{p(n)} = W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(n)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(2)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(n)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(n)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(n)} &= 1\left(YNI_{it}^{p(n)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(n)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(n)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(n)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(n)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(2)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(n)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(n)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(n)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(n)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(n)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(n)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(n)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(n)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(n)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(n)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(n)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(n)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(n)} + WFTC_{it}^{p(n)} + WTC_{it}^{p(n)} + CTC_{it}^{p(n)} + CB_{it}}{P_t}$$

$$\begin{aligned} y_{it}^{rp(n)} = & W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(n)} + I_{it}^r - D_{1it}^{p(n)} \left[\tau_{w1it}^p \left(W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(n)} - A_{it}^r \right) + \tau_{I1it} I_{it}^r \right] \\ & - D_{2it}^{p(n)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p \left(W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(n)} - A_{it}^r - y_{u1_{it}}^r \right) + \tau_{I2it} I_{it}^r \right] \\ & - D_{3it}^{p(n)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p y_{u2_{it}}^r + \tau_{w3it}^p \left(W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(n)} - A_{it}^r - y_{u2_{it}}^r \right) + \tau_{I3it} I_{it}^r \right] \\ & + T_{cit}^{rp(n)}. \end{aligned}$$

The tax policy values of the labour supply and tax variables are

$h_{2it}^p = h_{2it}^{p(n)}$, $\tau_{wit}^p = \tau_{wit}^{p(n)}$, $\tau_{Iit}^p = \tau_{Iit}^{p(n)}$, and $y_{it}^{rp} = y_{it}^{rp(n)}$.

Therefore, the tax policy effects in levels are $\Delta^p h_{2it} = h_{2it}^p - h_{2it}$, $\Delta^p \tau_{wit} = \tau_{wit}^p - \tau_{wit}$,

$\Delta^p \tau_{Iit} = \tau_{Iit}^p - \tau_{Iit}$, and $\Delta^p y_{it}^r = y_{it}^{rp(n)} - y_{it}$.

In terms of percentage changes, the tax policy effects are

$\frac{\Delta^p h_{2it}}{h_{2it}}$, $\frac{\Delta^p \tau_{wit}}{\tau_{w_{it}}}$, $\frac{\Delta^p \tau_{Iit}}{\tau_{I_{it}}}$ and $\frac{\Delta^p y_{it}^r}{y_{it}^r}$. The tax policy values of the labour supply and tax variables are

$h_{2it}^p = h_{2it}^{p(n)}$, $Y_{tax_{it}}^p = Y_{tax_{it}}^{p(n)}$, $\tau_{wit}^p = \tau_{wit}^{p(n)}$, $T_{c_{it}}^p = T_{c_{it}}^{p(n)}$, and $y_{it}^p = y_{it}^{p(n)}$.

Therefore, the tax policy effects in levels are $\Delta^p h_{2it} = h_{2it}^p - h_{2it}$, $\Delta^p Y_{tax_{it}} = Y_{tax_{it}}^p - Y_{tax_{it}}$,

$\Delta^p \tau_{wit} = \tau_{wit}^p - \tau_{wit}$, $\Delta^p T_{c_{it}} = T_{c_{it}}^p - T_{c_{it}}$, and $\Delta^p y_{it} = y_{it}^p - y_{it}$.

In terms of percentage changes, the tax policy effects are

$\frac{\Delta^p h_{2it}}{h_{2it}}$, $\frac{\Delta^p Y_{it}}{Y_{it}}$, $\frac{\Delta^p \tau_{wit}}{\tau_{w_{it}}}$, $\frac{\Delta^p T_{c_{it}}}{T_{c_{it}}}$, and $\frac{\Delta^p y_{it}}{y_{it}}$.

Regime 4 (underemployed constrained dual job holders) The historical values of the variables are expressed in terms of estimated parameters and residuals:

$$
\begin{aligned}
Y_{tax_{it}} &= 52 * (W_{1it}\dot{h}_{1it} + W_{2it}h_{2it} + I_{it} - A_{it}) \\
YNI_{it} &= W_{1it}\dot{h}_{1it} + W_{2it}h_{2it} + I_{it} \\
&\quad - \frac{1}{52}\Bigg\{ D_{1it}\left[\tau_{w1it}\left(Y_{tax_{it}} - 52I_{it}\right) + 52\tau_{I_{1it}}I_{it}\right] \\
&\quad + D_{2it}\left[\tau_{w1it}Y_{U1_{it}} + \tau_{w2it}\left(Y_{tax_{it}} - 52I_{it} - Y_{U1_{it}}\right) + 52\tau_{I2it}I_{it}\right] \\
&\quad + D_{3it}\left[\tau_{w1it}Y_{U1_{it}} + \tau_{w2_{it}}Y_{U2_{it}} + \tau_{w3it}\left(Y_{tax_{it}} - 52I_{it} - Y_{U2_{it}}\right) + 52\tau_{I3it}I_{it}\right]\Bigg\} \\
&\quad + CB_{it} \\
FC_{it} &= 1\left(YNI_{it} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&\quad + 1\left(FCUB_{it} < YNI_{it} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * \left(YNI_{it} - FCUB_{it}\right)\right] \\
&\quad + 1\left(YNI_{it} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it} &= 1(YNI_{it} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&\quad + 1(WFTCUB_{it} < YNI_{it} < YNI\_WTFC_{it}) * \\
&\quad [WFTC_{max_{it}} - 0.55 * (YNI_{it} - WFTCUB_{it})] \\
&\quad + 1(YNI_{it} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it} &= 1(YNI_{it} \leq WTCUB_{it}) * (H16^{+}_{it} * WTC_{max_{it}}) \\
&\quad + 1(WTCUB_{it} < YNI_{it} < YNI\_WTC_{it}) * H16^{+}_{it} \\
&\quad * \Bigg[WTC_{max_{it}} - 0.37 * (YNI_{it} - WTCUB_{it}) \\
&\quad * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&\quad - 0.39 * (YNI_{it} - WTCUB_{it}) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] + 1(YNI_{it} \geq YNI\_WTC_{it}) * 0
\end{aligned}
$$

$$
\begin{aligned}
CTC_{it} &= 1(YNI_{it} < CTCUB_{it}) * CTC_{max_{it}} \\
&\quad + 1(CTCUB_{it} \leq YNI_{it} < YNI\_CTC_{1it}) * \\
&\quad \left\{ CTC_{max_{it}} - \left[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it} \right) \right. \right. \\
&\quad \left. \left. + 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it} \right] * (YNI_{it} - CTCUB_{it}) \right\} \\
&\quad + 1 \left(YNI\_CTC_{1it} \leq YNI_{it} < \frac{50000}{52} \right) * \frac{545}{52} \\
&\quad + 1 \left(\frac{50000}{52} \leq YNI_{it} < YNI\_CTC_{2it} \right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it} - \frac{50000}{52} \right) \right] \\
&\quad + (YNI\_CTC_{2it} < YNI_{it}) * 0
\end{aligned}
$$

$$
\begin{aligned}
T^r_{cit} &= \frac{ATC_{sp-mc_{it}} + FC_{it} + WFTC_{it} + WTC_{it} + CTC_{it} + CB_{it}}{P_t} \\
Q_{24it} &= \tilde{\gamma}_3 - \left[D_{2it} \left(\tau_{w2it} - \tau_{w1it} \right) - D_{3it} \tau_{w3it} \right] y^r_{u1_{it}} - D_{3it} (\tau_{w3it} - \tau_{w2it}) y^r_{u2_{it}} \\
&\quad - (1 - \tau_{Iit}) I^r_{it} - \tau_{wit} A^r_{it} - (1 - \tau_{wit}) (W^r_{1it} \dot{h}_{1it} + \tilde{\gamma}_2 W^r_{2it}) - T^r_{cit} \\
\hat{u}_{24it} &= (1 - \tau_{wit}) W^r_{2it} \left(h_{2it} - \tilde{\gamma}_2 \right) - \left(\frac{\tilde{\alpha}_2}{1 - \tilde{\alpha}_1} \right) Q_{24it} - \tilde{\theta}_{23} \hat{\lambda}_{24it} - \bar{Z}_{3i} \hat{\pi}_{24}
\end{aligned}
$$

$$
\begin{aligned}
y^r_{it} &= W^r_{1it} \dot{h}_{1it} + W^r_{2it} h_{2it} + I^r_{it} - D_{1it} \left[\tau_{w1it} \left(W^r_{1it} \dot{h}_{1it} + W^r_{2it} h_{2it} - A^r_{it} \right) + \tau_{I1it} I^r_{it} \right] \\
&- D_{2it} \left[\tau_{w1it} y^r_{u1_{it}} + \tau_{w2it} \left(W^r_{1it} \dot{h}_{1it} + W^r_{2it} h_{2it} - A^r_{it} - y^r_{u1_{it}} \right) + \tau_{I2it} I^r_{it} \right] \\
&- D_{3it} \left[\tau_{w1it} y^r_{u1_{it}} + \tau_{w2it} y^r_{u2_{it}} + \tau_{w3it} \left(W^r_{1it} \dot{h}_{1it} + W^r_{2it} h_{2it} - A^r_{it} - y^r_{u2_{it}} \right) + \tau_{I3it} I^r_{it} \right] + T^r_{cit}.
\end{aligned}
$$

The first iteration yields

$$Q_{24it}^{p(1)} = \Bigg\{ \tilde{\gamma_3} - \Big[D_{2it}^{p(0)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(0)} \tau_{w3it}^{p} \Big] y_{u1_{it}}^{r} - D_{3it}^{p(0)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(0)} A_{it}^{r} - (1 - \tau_{wit}^{p(0)}) (W_{1it}^{r} \dot{h}_{1it} + \tilde{\gamma}_2 W_{2it}^{r}) - T_{cit}^{rp(0)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(1)} = \left(\frac{\tilde{\alpha}_2}{1 - \tilde{\alpha}_1} \right) Q_{24it}^{p(1)} + \tilde{\theta}_{24} \hat{\lambda}_{24it} + \bar{Z}_{3i} \hat{\pi}_{24} + \hat{u}_{24it}$$

$$h_{2it}^{p(1)} = \tilde{\gamma}_2 + \frac{\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(1)}}{(1 - \tau_{wit}^{p(0)}) W_{2it}^{r}}$$

$$Y_{tax_{it}}^{p(1)} = 52 * (W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(1)} + I_{it} - A_{it})$$

$$D_{1it}^{p(1)} = 1(0 < Y_{tax_{it}}^{p(1)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(1)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(1)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(1)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(1)})$$

$$\tau_{wit}^{p(1)} = \tau_{w_{1it}}^{p} D_{1it}^{p(1)} + \tau_{w_{2it}}^{p} D_{2it}^{p(1)} + \tau_{w_{3it}}^{p} D_{3it}^{p(1)}$$

$$\tau_{Iit}^{p(1)} = \tau_{I_{1it}} D_{1it}^{p(1)} + \tau_{I_{2it}} D_{2it}^{p(1)} + \tau_{I_{3it}} D_{3it}^{p(1)}$$

$$YNI_{it}^{p(1)} = W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(1)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(1)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(1)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(1)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(1)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(1)} &= 1\left(YNI_{it}^{p(1)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(1)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(1)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(1)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(1)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(1)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(1)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(1)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(1)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(1)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(1)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(1)} &= 1(YNI_{it}^{p(1)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(1)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(1)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(1)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(1)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(1)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(1)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(1)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(1)} + WFTC_{it}^{p(1)} + WTC_{it}^{p(1)} + CTC_{it}^{p(1)} + CB_{it}}{P_t}$$

$$\begin{aligned}
y_{it}^{rp(1)} = {} & W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(1)} + I_{it}^{r} - D_{1it}^{p(1)}\left[\tau_{w1it}^{p}\left(W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(1)} - A_{it}^{r}\right) + \tau_{I1it}I_{it}^{r}\right] \\
& - D_{2it}^{p(1)}\left[\tau_{w1it}^{p}y_{u1_{it}}^{r} + \tau_{w2it}^{p}\left(W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(1)} - A_{it}^{r} - y_{u1_{it}}^{r}\right) + \tau_{I2it}I_{it}^{r}\right] \\
& - D_{3it}^{p(1)}\left[\tau_{w1it}^{p}y_{u1_{it}}^{r} + \tau_{w2it}^{p}y_{u2_{it}}^{r} + \tau_{w3it}^{p}\left(W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(1)} - A_{it}^{r} - y_{u2_{it}}^{r}\right) + \tau_{I3it}I_{it}^{r}\right] \\
& + T_{cit}^{rp(1)}.
\end{aligned}$$

The second iteration follows next with

$$Q_{24it}^{p(2)} = \Bigg\{ \tilde{\gamma_3} - \Big[D_{2it}^{p(1)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(1)} \tau_{w3it}^{p} \Big] y_{u1_{it}}^{r} - D_{3it}^{p(1)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$
$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(1)} A_{it}^{r} - (1 - \tau_{wit}^{p(1)}) (W_{1it}^{r} \dot{h}_{1it} + \tilde{\gamma}_2 W_{2it}^{r}) - T_{cit}^{rp(1)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(2)} = \left(\frac{\tilde{\alpha}_2}{1 - \tilde{\alpha}_1} \right) Q_{24it}^{p(2)} + \tilde{\theta}_{24} \hat{\lambda}_{24it} + \bar{Z}_{3i} \hat{\pi}_{24} + \hat{u}_{24it}$$

$$h_{2it}^{p(2)} = \tilde{\gamma}_2 + \frac{\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(2)}}{(1 - \tau_{wit}^{p(1)}) W_{2it}^{r}}$$

$$Y_{tax_{it}}^{p(2)} = 52 * (W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(2)} + I_{it} - A_{it})$$

$$D_{1it}^{p(2)} = 1(0 < Y_{tax_{it}}^{p(2)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(2)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(2)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(2)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(2)})$$

$$\tau_{wit}^{p(2)} = \tau_{w_{1it}}^{p} D_{1it}^{p(2)} + \tau_{w_{2it}}^{p} D_{2it}^{p(2)} + \tau_{w_{3it}}^{p} D_{3it}^{p(2)}$$

$$\tau_{Iit}^{p(2)} = \tau_{I_{1it}} D_{1it}^{p(2)} + \tau_{I_{2it}} D_{2it}^{p(2)} + \tau_{I_{3it}} D_{3it}^{p(2)}$$

$$YNI_{it}^{p(2)} = W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(2)} + I_{it}$$
$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(2)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$
$$+ D_{2it}^{p(2)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$
$$+ D_{3it}^{p(2)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(2)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$
$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(2)} &= 1\left(YNI_{it}^{p(2)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(2)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(2)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(2)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(2)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(2)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(2)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(2)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(2)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(2)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(2)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(2)} &= 1(YNI_{it}^{p(2)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(2)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(2)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(2)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(2)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(2)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(2)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(2)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(2)} + WFTC_{it}^{p(2)} + WTC_{it}^{p(2)} + CTC_{it}^{p(2)} + CB_{it}}{P_t}$$

$$\begin{aligned}
y_{it}^{rp(2)} = & W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(2)} + I_{it}^{r} - D_{1it}^{p(2)}\left[\tau_{w1it}^{p}\left(W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(2)} - A_{it}^{r}\right) + \tau_{I1it}I_{it}^{r}\right] \\
& - D_{2it}^{p(2)}\left[\tau_{w1it}^{p}y_{u1_{it}}^{r} + \tau_{w2it}^{p}\left(W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(2)} - A_{it}^{r} - y_{u1_{it}}^{r}\right) + \tau_{I2it}I_{it}^{r}\right] \\
& - D_{3it}^{p(2)}\left[\tau_{w1it}^{p}y_{u1_{it}}^{r} + \tau_{w2it}^{p}y_{u2_{it}}^{r} + \tau_{w3it}^{p}\left(W_{1it}^{r}\dot{h}_{1it} + W_{2it}^{r}h_{2it}^{p(2)} - A_{it}^{r} - y_{u2_{it}}^{r}\right) + \tau_{I3it}I_{it}^{r}\right] \\
& + T_{cit}^{rp(2)}.
\end{aligned}$$

Iterations continue until convergence at the nth iteration:

$$Q_{24it}^{p(n)} = \Bigg\{ \tilde{\gamma}_3 - \left[D_{2it}^{p(n-1)} \left(\tau_{w2it}^{p} - \tau_{w1it}^{p} \right) - D_{3it}^{p(n-1)} \tau_{w3it}^{p} \right] y_{u1_{it}}^{r} - D_{3it}^{p(n-1)} (\tau_{w3it}^{p} - \tau_{w2it}^{p}) y_{u2_{it}}^{r}$$

$$- (1 - \tau_{Iit}) I_{it}^{r} - \tau_{wit}^{p(n-1)} A_{it}^{r} - (1 - \tau_{wit}^{p(n-1)}) (W_{1it}^{r} \dot{h}_{1it} + \tilde{\gamma}_2 W_{2it}^{r}) - T_{cit}^{rp(n-1)} \Bigg\}$$

$$\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(n)} = \left(\frac{\tilde{\alpha}_2}{1 - \tilde{\alpha}_1} \right) Q_{24it}^{p(n)} + \tilde{\theta}_{24} \hat{\lambda}_{24it} + \bar{Z}_{3i} \hat{\pi}_{24} + \hat{u}_{24it}$$

$$h_{2it}^{p(n)} = \tilde{\gamma}_2 + \frac{\left[\left(1 - \tau_w\right) W_2^r \left(h_2 - \tilde{\gamma}_2 \right) \right]_{it}^{p(n)}}{(1 - \tau_{wit}^{p(n-1)}) W_{2it}^{r}}$$

$$Y_{tax_{it}}^{p(n)} = 52 * (W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(n)} + I_{it} - A_{it})$$

$$D_{1it}^{p(n)} = 1(0 < Y_{tax_{it}}^{p(n)} \leq Y_{U1_{it}})$$

$$D_{2it}^{p(n)} = 1(Y_{U1_{it}} < Y_{tax_{it}}^{p(n)} \leq Y_{U2_{it}})$$

$$D_{3it}^{p(n)} = 1(Y_{U2_{it}} < Y_{tax_{it}}^{p(n)})$$

$$\tau_{wit}^{p(n)} = \tau_{w_{1it}}^{p} D_{1it}^{p(n)} + \tau_{w_{2it}}^{p} D_{2it}^{p(n)} + \tau_{w_{3it}}^{p} D_{3it}^{p(n)}$$

$$\tau_{Iit}^{p(n)} = \tau_{I_{1it}} D_{1it}^{p(n)} + \tau_{I_{2it}} D_{2it}^{p(n)} + \tau_{I_{3it}} D_{3it}^{p(n)}$$

$$YNI_{it}^{p(n)} = W_{1it} \dot{h}_{1it} + W_{2it} h_{2it}^{p(n)} + I_{it}$$

$$- \frac{1}{52} \Bigg\{ D_{1it}^{p(2)} \left[\tau_{w1it}^{p} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} \right) + 52 \tau_{I_{1it}} I_{it} \right]$$

$$+ D_{2it}^{p(n)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2it} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} - Y_{U1_{it}} \right) + 52 \tau_{I2it} I_{it} \right]$$

$$+ D_{3it}^{p(n)} \left[\tau_{w1it}^{p} Y_{U1_{it}} + \tau_{w2_{it}}^{p} Y_{U2_{it}} + \tau_{w3it}^{p} \left(Y_{tax_{it}}^{p(n)} - 52 I_{it} - Y_{U2_{it}} \right) + 52 \tau_{I3it} I_{it} \right] \Bigg\}$$

$$+ CB_{it}$$

$$
\begin{aligned}
FC_{it}^{p(n)} &= 1\left(YNI_{it}^{p(n)} \leq FCUB_{it}\right) * FC_{max_{it}} \\
&+ 1\left(FCUB_{it} < YNI_{it}^{p(n)} < YNI\_FC_{it}\right) * \left[FC_{max_{it}} - 0.7 * (YNI_{it}^{p(n)} - FCUB_{it})\right] \\
&+ 1\left(YNI_{it}^{p(n)} \geq YNI\_FC_{it}\right) * 0 \\
WFTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} \leq WFTCUB_{it}) * WFTC_{max_{it}} \\
&+ 1(WFTCUB_{it} < YNI_{it}^{p(n)} < YNI\_WTFC_{it}) * \\
&\left[WFTC_{max_{it}} - 0.55 * (YNI_{it}^{p(2)} - WFTCUB_{it})\right] \\
&+ 1(YNI_{it}^{p(n)} \geq YNI\_WFTC_{it}) * 0 \\
WTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} \leq WTCUB_{it}) * (H16_{it}^{+} * WTC_{max_{it}}) \\
&+ 1(WTCUB_{it} < YNI_{it}^{p(n)} < YNI\_WTC_{it}) * H16_{it}^{+} \\
&* \Bigg[WTC_{max_{it}} - 0.37 * \left(YNI_{it}^{p(n)} - WTCUB_{it}\right) \\
&* \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + Y04_{it} + Y05_{it} + Y06_{it} + Y07_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&- 0.39 * \left(YNI_{it}^{p(n)} - WTCUB_{it}\right) * \left(Y08_{it} * \sum_{m=4}^{12} Mm_{it}\right)\Bigg] \\
&+ 1(YNI_{it}^{p(n)} \geq YNI\_WTC_{it}) * 0 \\
CTC_{it}^{p(n)} &= 1(YNI_{it}^{p(n)} < CTCUB_{it}) * CTC_{max_{it}} \\
&+ 1(CTCUB_{it} \leq YNI_{it}^{p(n)} < YNI\_CTC_{1it}) * \\
&\Bigg\{CTC_{max_{it}} - \Bigg[0.37 * \left(Y03_{it} * \sum_{m=4}^{12} Mm_{it} + \sum_{\tau=04}^{07} Y\tau_{it} + Y08_{it} * \sum_{m=1}^{3} Mm_{it}\right) \\
&+ 0.39 * Y08_{it} * \sum_{m=4}^{12} Mm_{it}\Bigg] * \left(YNI_{it}^{p(n)} - CTCUB_{it}\right)\Bigg\} \\
&+ 1\left(YNI\_CTC_{1it} \leq YNI_{it}^{p(n)} < \frac{50000}{52}\right) * \frac{545}{52} \\
&+ 1\left(\frac{50000}{52} \leq YNI_{it}^{p(n)} < YNI\_CTC_{2it}\right) * \left[\frac{545}{52} - 0.067 * \left(YNI_{it}^{p(n)} - \frac{50000}{52}\right)\right] \\
&+ (YNI\_CTC_{2it} < YNI_{it}^{p(n)}) * 0
\end{aligned}
$$

$$T_{c_{it}}^{rp(n)} = \frac{ATC_{sp-mc_{it}} + FC_{it}^{p(n)} + WFTC_{it}^{p(n)} + WTC_{it}^{p(n)} + CTC_{it}^{p(n)} + CB_{it}}{P_t}$$

$$\begin{aligned} y_{it}^{rp(n)} = & W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(n)} + I_{it}^r - D_{1it}^{p(n)} \left[\tau_{w1it}^p \left(W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(n)} - A_{it}^r \right) + \tau_{I1it} I_{it}^r \right] \\ & - D_{2it}^{p(n)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p \left(W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(n)} - A_{it}^r - y_{u1_{it}}^r \right) + \tau_{I2it} I_{it}^r \right] \\ & - D_{3it}^{p(n)} \left[\tau_{w1it}^p y_{u1_{it}}^r + \tau_{w2it}^p y_{u2_{it}}^r + \tau_{w3it}^p \left(W_{1it}^r \dot{h}_{1it} + W_{2it}^r h_{2it}^{p(n)} - A_{it}^r - y_{u2_{it}}^r \right) + \tau_{I3it} I_{it}^r \right] \\ & + T_{cit}^{rp(n)}. \end{aligned}$$

The tax policy values of the labour supply and tax variables are

$h_{2it}^p = h_{2it}^{p(n)}$, $\tau_{wit}^p = \tau_{wit}^{p(n)}$, $\tau_{Iit}^p = \tau_{Iit}^{p(n)}$, and $y_{it}^{rp} = y_{it}^{rp(n)}$.

Therefore, the tax policy effects in levels are $\Delta^p h_{2it} = h_{2it}^p - h_{2it}$, $\Delta^p \tau_{wit} = \tau_{wit}^p - \tau_{wit}$,

$\Delta^p \tau_{Iit} = \tau_{Iit}^p - \tau_{Iit}$, and $\Delta^p y_{it}^r = y_{it}^{rp(n)} - y_{it}$.

In terms of percentage changes, the tax policy effects are

$\frac{\Delta^p h_{2it}}{h_{2it}}$, $\frac{\Delta^p \tau_{wit}}{\tau_{w_{it}}}$, $\frac{\Delta^p \tau_{Iit}}{\tau_{I_{it}}}$ and $\frac{\Delta^p y_{it}^r}{y_{it}^r}$. The tax policy values of the labour supply and tax variables are

$h_{2it}^p = h_{2it}^{p(n)}$, $Y_{tax_{it}}^p = Y_{tax_{it}}^{p(n)}$, $\tau_{wit}^p = \tau_{wit}^{p(n)}$, $T_{c_{it}}^p = T_{c_{it}}^{p(n)}$, and $y_{it}^p = y_{it}^{p(n)}$.

Therefore, the tax policy effects in levels are $\Delta^p h_{2it} = h_{2it}^p - h_{2it}$, $\Delta^p Y_{tax_{it}} = Y_{tax_{it}}^p - Y_{tax_{it}}$,

$\Delta^p \tau_{wit} = \tau_{wit}^p - \tau_{wit}$, $\Delta^p T_{c_{it}} = T_{c_{it}}^p - T_{c_{it}}$, and $\Delta^p y_{it} = y_{it}^p - y_{it}$.

In terms of percentage changes, the tax policy effects are

$\frac{\Delta^p h_{2it}}{h_{2it}}$, $\frac{\Delta^p Y_{it}}{Y_{it}}$, $\frac{\Delta^p \tau_{wit}}{\tau_{w_{it}}}$, $\frac{\Delta^p T_{c_{it}}}{T_{c_{it}}}$, and $\frac{\Delta^p y_{it}}{y_{it}}$.