

# Redistribution Effects of Transfers

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# Objectives of the Paper

- Existing literature assessing the impacts of transfers on low income households assumes that transfer program participants benefit by the full amount of cash transfers received.
- Tax back arrangements accompany most transfer programmes, and endogenous participation decisions (regime choices) are involved, a money-metric measure of the utility generated by transfers will typically be less than the cash value of transfers.
- Wage rate effects will also come into play as low-income households withdraw their labour from the market and raise their wage rates relative to those of other groups.
- A conditional choice general equilibrium model of the UK, calibrated to literature based labour supply and labour demand elasticities, with a leisure-consumption choice for households and production involving heterogeneous labour inputs.

## Summary of Findings

- In the model, households face non-convex budgets set due to tax-back schemes in transfer programmes.
- Household demands for leisure and consumption goods are evaluated numerically using optimization techniques within a larger equilibrium structure including the production side of the economy, since demands are non analytic.
- Model results suggest that a money-metric measure of the utility equivalent of transfers received by the bottom deciles of UK households in the early 2000s is 17 percent of cash transfers received due to the conditionality in these programmes and the increase in the reservation wage rate of participants in the benefit programme up to 85 percent.

# Literature on Redistribution Effects of Transfers

- Shoven J.B. and J. Whalley (1973) , Heckman J. (1974) ,Browning E. K. (1973) Masters S. and I. Garfinkel (1977) Strauss J. (1977), Garfinkel I. and R.H. Haveman (1977) ,
- **Brown C. V. (1980)** Danziger S., R. Haveman and R.Plotrick (1981) [Moffitt R.](#) (1983),
- Killingsworth M. (1983),Browning E.K. and W.R. Johnson (1984) Hausman A. J. (1984)
- Ballard, C. L., D. Fullerton , J.B. Shoven and J.Whalley (1985) Betson D.M and D. Greenberg (1986) Browning E.K. and J.M. Browning (1987) Fry V. and F. Stark (1987) ,Moffitt R. (1992) Hamermesh D. S. (1993) , Hoynes H.W. (1993) ,Atkinson A.B. (1996) Dilnot A. and Duncan Alan (1992) Shoven J.B. and J. Whalley (1992)
- Dickert S., S. Houser and J.K. Scholz (1994),Yelowitz A.S. (1995) ,Dex S., A.Clark and
- M.Taylor (1995),Dirkse S. P. and M. C. Ferris (1995), Blank R.M. and P. Ruggles (1996)
- Office of the National Statistics (2001, 1996) ,Greenberg D. H. (1997)
- Bhattarai K and J. Whalley (1997) Blundell R. V. Fry and I. Walker (1988)
- Brook, A K., D. Kendrick, A.Meeraus(1992), Hutton J. and Roucco A. (1999)
- Balestrino A. (1999) ,Office of the National Statistics (2000) ,Benabou, R . (2002)
- Rutherford T., D. Tarr and O. Shepotylo (2004), Böhringer C., M. Boeters, and M. Feil (2005) ,Creedy J. and G. Kalb (2005)

# Consumer Choice Under Conditional Benefit Choice Model

$$U_B(p, w) > U_{NB}(p, w) \quad (1)$$

$$\text{MAX} \quad U_i(C_i, L_i^e) \quad (2)$$

$$i = (H, L)$$

Subject to

$$P_c C_i = \max \left[ \left\{ w_i (1 - t_1) (\bar{L}_i - L_i^e) + R_i \right\}, \left\{ w_i (1 - t_2) (\bar{L}_i - L_i^e) + B_i + R_i \right\} \right] \quad (3)$$

# Production and Market Clearing Under Conditional Benefit Choice Model

$$C = F(L_H, L_L)$$

$$C = C_H + C_L$$

$$\bar{L}_H = L_H^e + L_H$$

$$\bar{L}_L = L_L^e + L_L$$

# Public Sector Balance Under Conditional Benefit Choice Model

$$\sum_{i=H,L} B_i N_i + \sum_{i=H,L} R_i = \sum_{i=H,L} (1 - N_i) t_1 w_i L_i + \sum_{i=H,L} N_i t_2 w_i L_i$$

$$\sum_i B_i + \sum_i Tr_i = VAT + IT + TB$$

# Benefit entitlements differ by individual

- the number children at home,
- lone parent or married couple status,
- hours of work being either less than or exceeding 30 hours per week,
- cost of child care or
- non-labour income of the household or
- the labour market experience

# Calculations of Benefit Entitlements

The CTC and WFTC components of benefit entitlements for a family with dependent children can be calculated as

$$E_i = E_{F,i} + E_{CH,i}N_{CH,i} - 0.7CC_i + E_{B,i} + (E_{CP,i} \text{ or } E_{LP,i}) + E_{30h,i}$$

where  $E_{F,i}$  is the family entitlement,  $E_{CH,i}$  the entitlement per child,  $N_{CH,i}$  the number of dependent children in the family,  $CC$  child care cost,  $E_B$  entitlement for family,  $E_{CP,i}$  or  $E_{LP,i}$  the entitlement for couples or lone parent and  $E_{30h,i}$  the entitlement for working more than 30 hours.

# Calculations of Benefit Entitlements

For instance for a family with  $y_i^{hs}$  equal to £15,000,  $y_i^w$  equal to £10,000 and net  $y_i^o$  of £60 with three dependent children the DWP's benefit entitlement for fiscal year 2007 is calculated as

$$\begin{aligned} E_i &= E_{F,i} + E_{CH,i} N_{CH,i} - 0.7 CC_i + E_{B,i} + (E_{CP,i} \text{ or } E_{LP,i}) + E \\ &= 545 + 3 \times 1690 + 1620 + 1595 + 660 = \text{£}9490 . \end{aligned}$$

Thus the annual amount of benefit is

$$B_i = E_i - t_b (y_i - \bar{y}) = 9490 - 0.37 (25060 - 5220) = \text{£}2149$$

which amounts to £41.33 per week

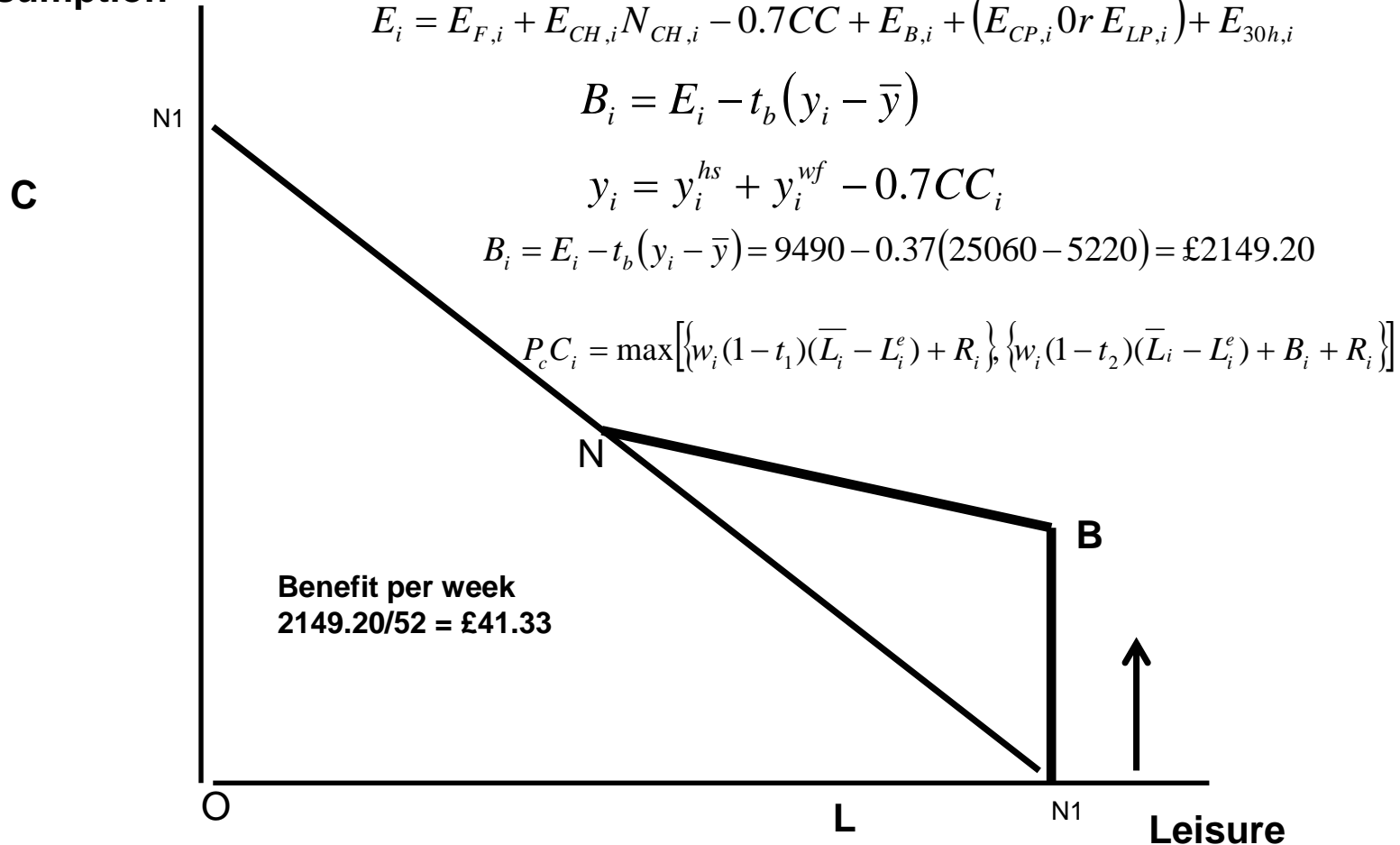
Generally WFTC provides more benefits to a couple with many children and implicitly encourages at least one parent to remain at home to take care of children

# The DWP administers other benefits

- Armed force allowance (£62.25-£41.65)
- bereavement entitlement (£84.25)
- care taker allowance (£46.95)
- disability allowance (£62.25)
- housing benefit (7.5% to 25%)
- incapacity benefit (£78.50)
- income support (single £57.45)
- couple £90.10)
- hospital rates (£46.75)
- industrial injuries (£127.10)
- job seekers' allowance (£34.60 to £45.58)
- maternity allowance (£108.85)
- pension credit (£114.05)
- state pension (£84.25)
- severe disablement allowance (£47.45)
- widow benefit (£84.25)

## Non-Convex Budget Set in the Presence of Conditional Transfers

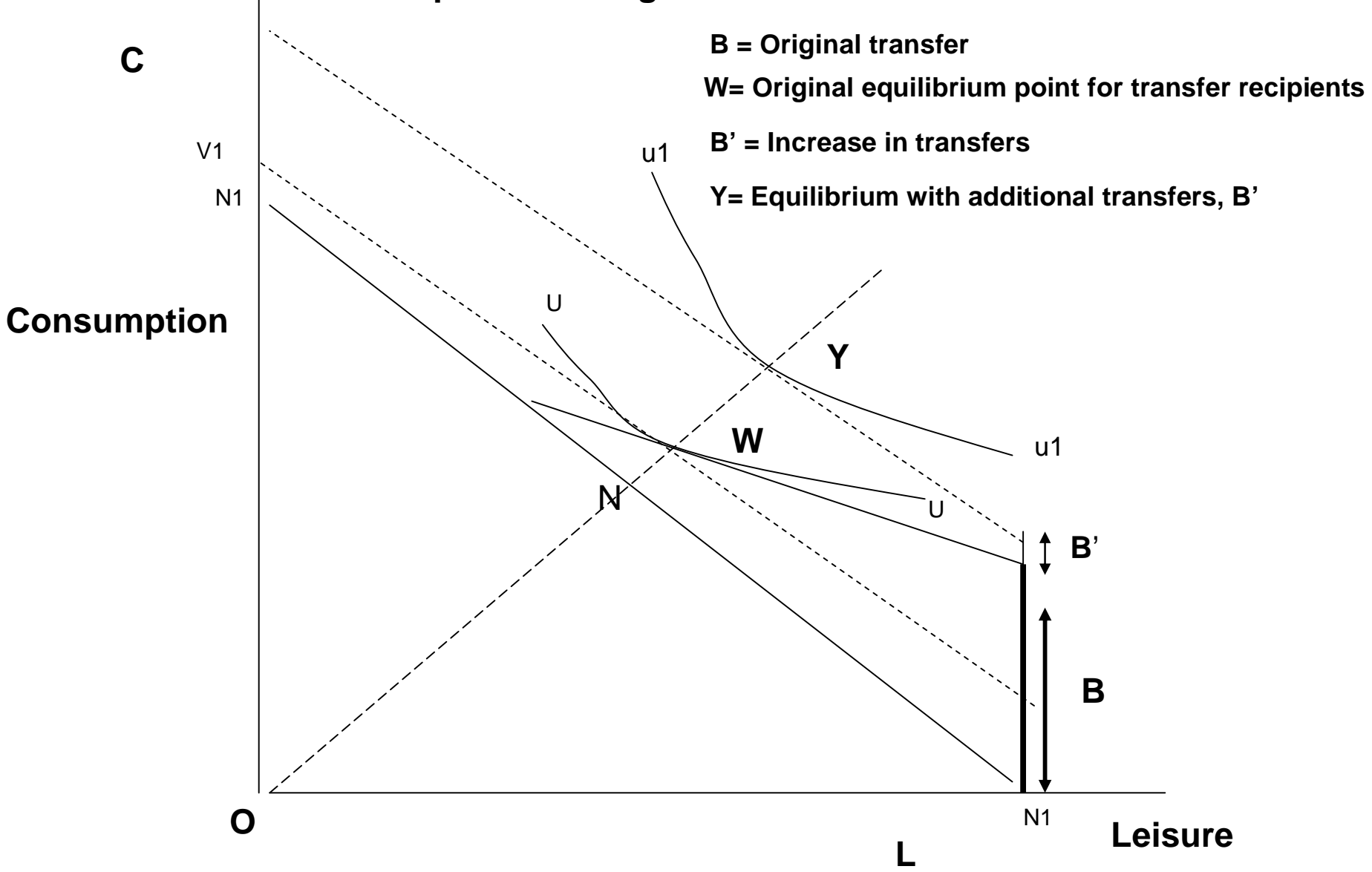
**Consumption**



$$E_i = E_{F,i} + E_{CH,i}N_{CH,i} - 0.7CC_i + E_{B,i} + (E_{CP,i}0r E_{LP,i}) + E_{30h,i} = 545 + 3 \times 1690 + 1620 + 1595 + 660 = £9490.$$



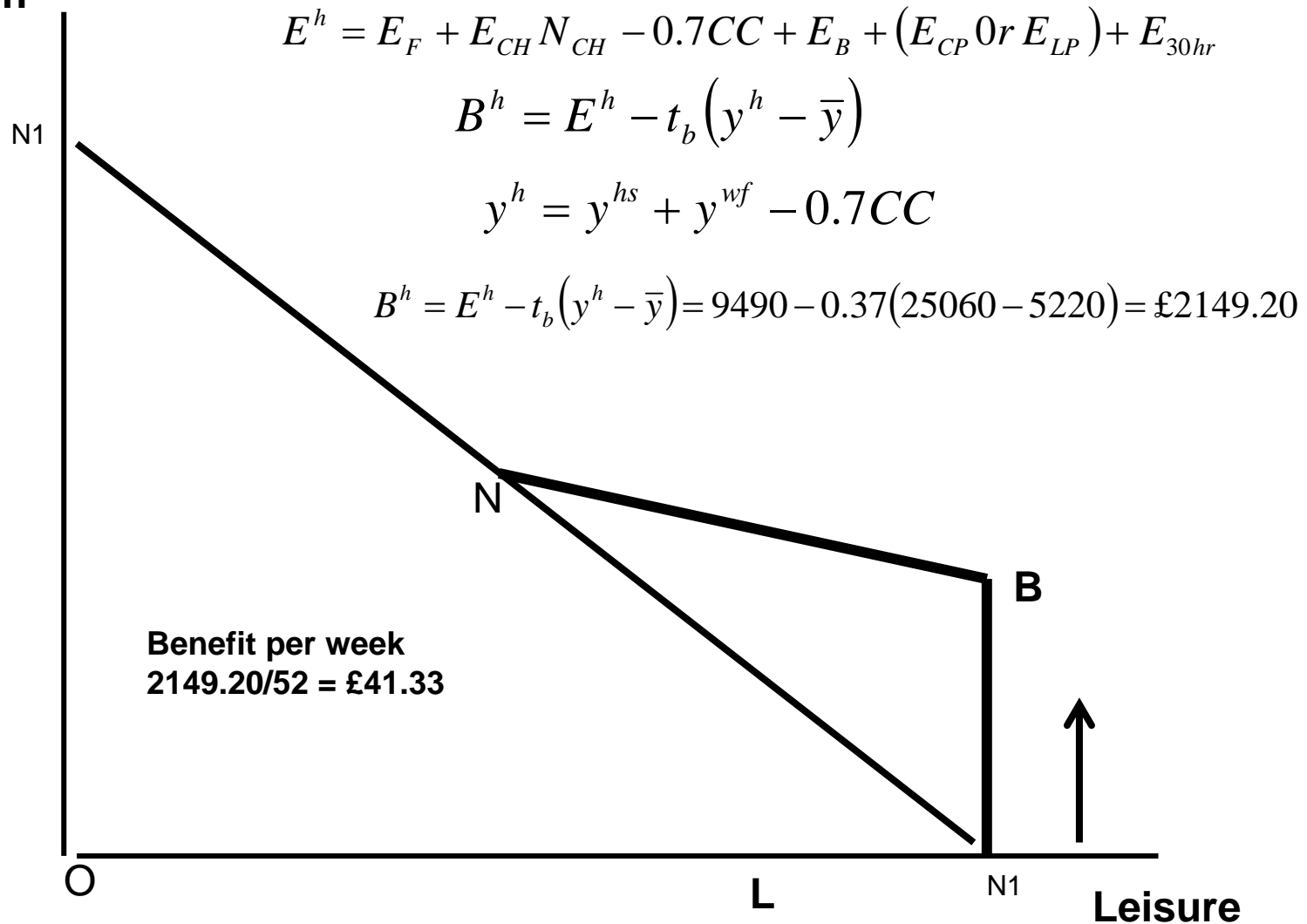
# Impacts of Marginal Increase in Transfers



## Non-Convex Budget Set in the Presence of Conditional Transfers

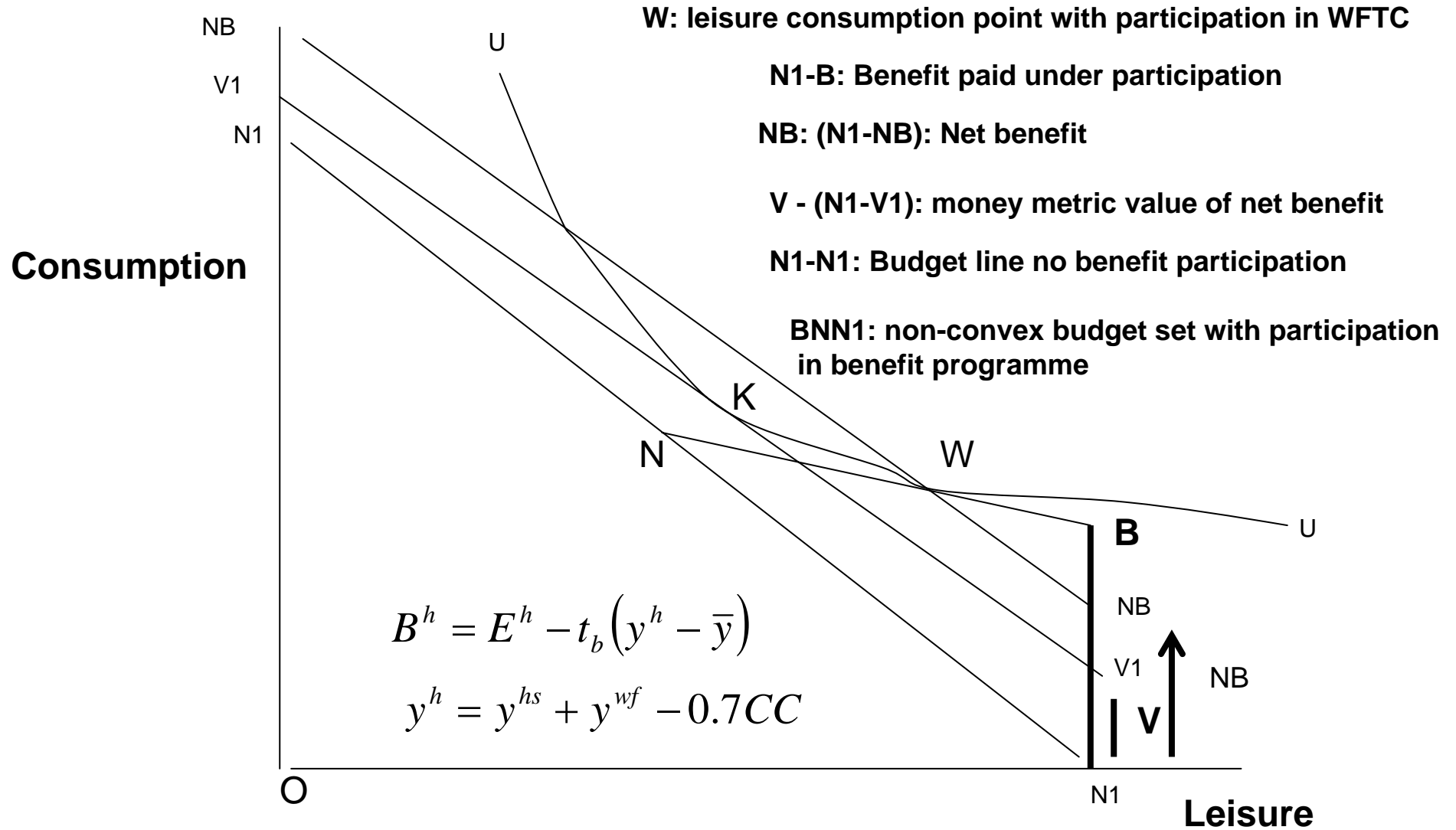
**Consumption**

**C**



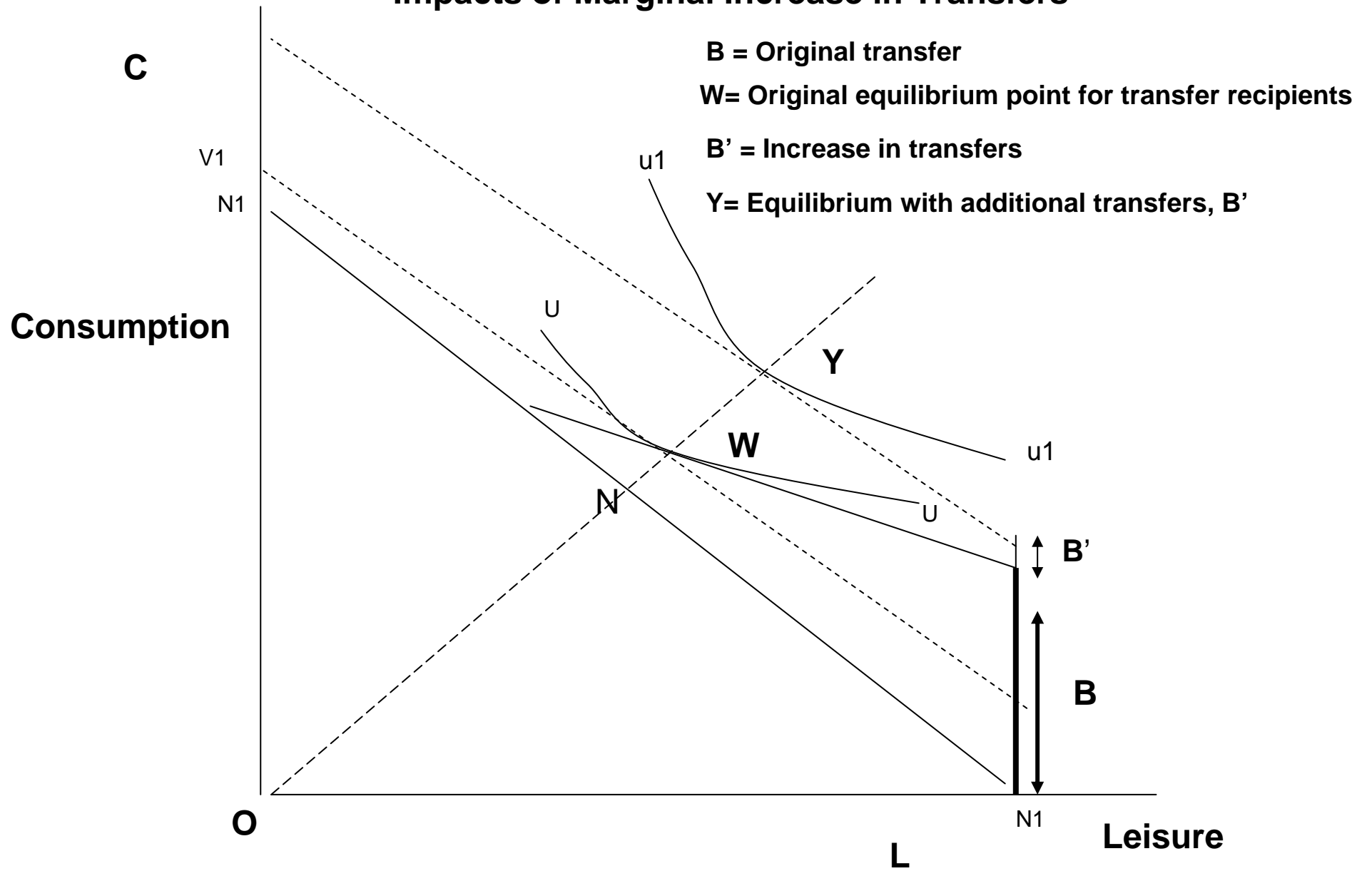
$$E^h = E_F + E_{CH} N_{CH} - 0.7CC + E_B + (E_{CP} \text{ Or } E_{LP}) + E_{30hr} = 545 + 3 \times 1690 + 1620 + 1595 + 660 = \text{£}9490.$$

# Participation Choice and the Value of Conditional Transfers

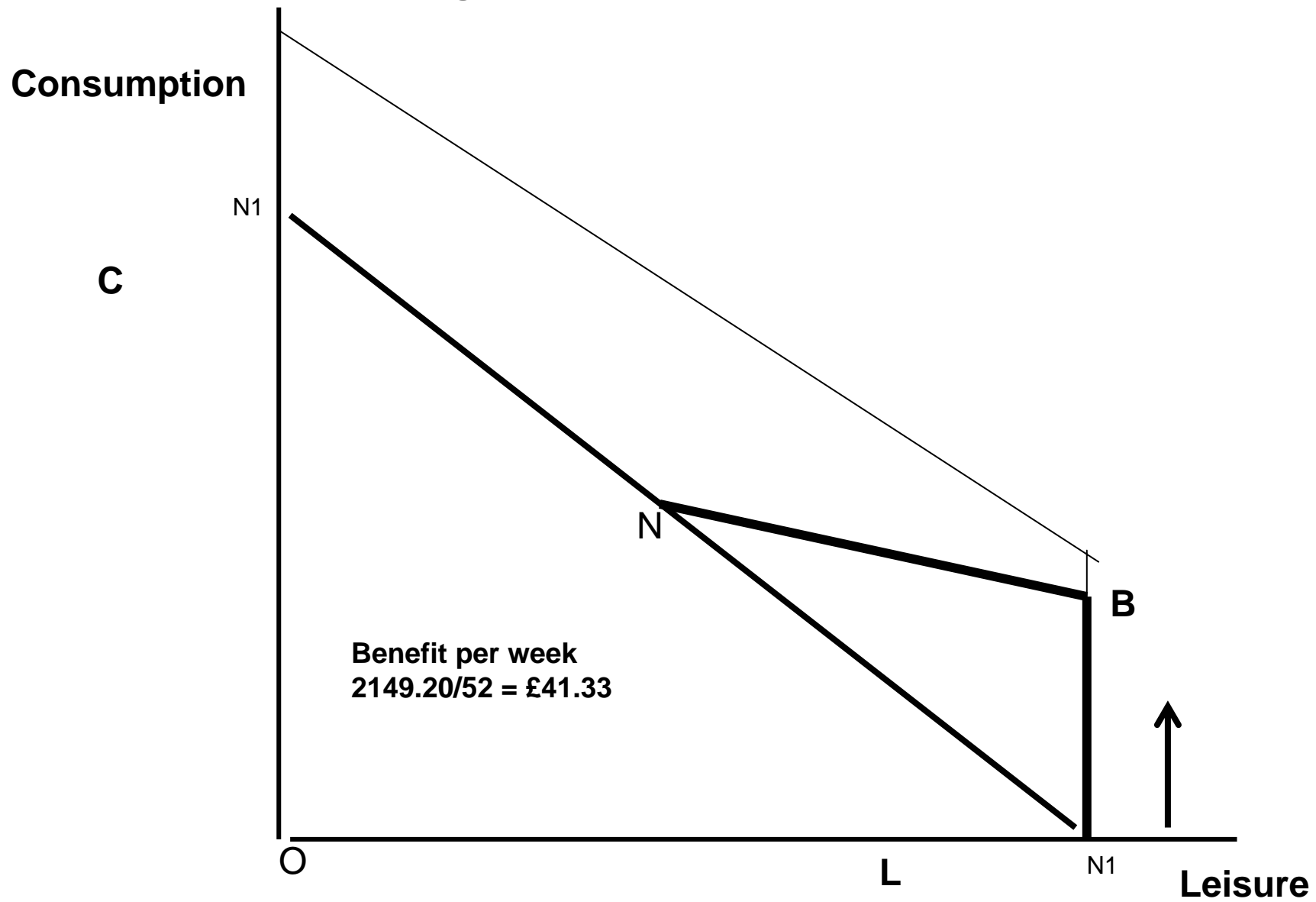


$$E^h = E_F + E_{CH} N_{CH} - 0.7CC + E_B + (E_{CP} \text{ or } E_{LP}) + E_{30hr}$$

# Impacts of Marginal Increase in Transfers



## Non-Convex Budget Set in the Presence of Conditional Transfers



$$E^h = E_F + E_{CH}N_{CH} - 0.7CC + E_B + (E_{CP} \text{ or } E_{LP}) + E_{30hr} = 545 + 3 \times 1690 + 1620 + 1595 + 660 = \text{£}9490.$$

### Welfare and hours of work with tax back of 80 percent

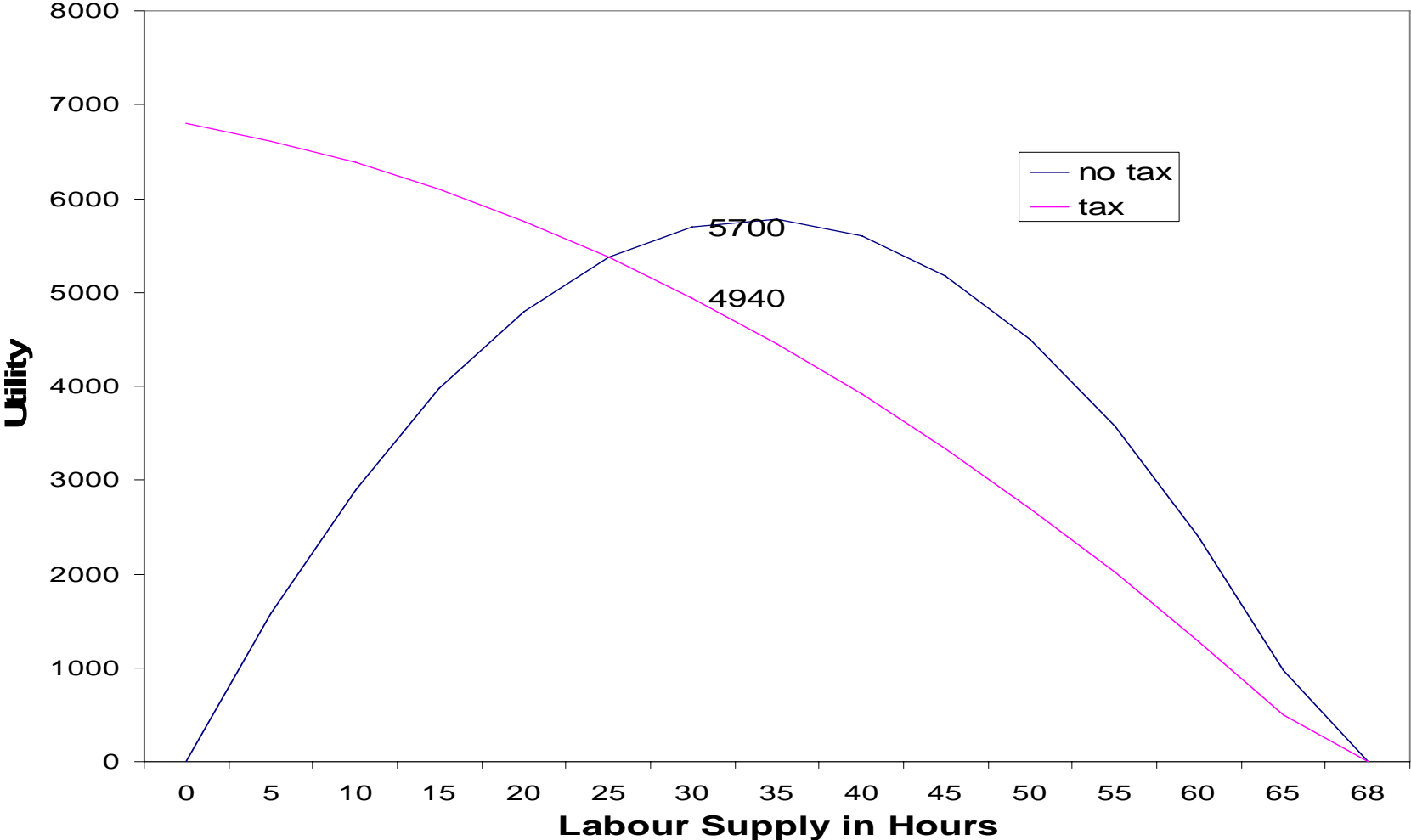


Table 1

**A Simple Numerical Example Illustrating the Evaluation of the Redistributive Effects of Transfer Programmes Using Conditional Choice General Equilibrium Models.**

(a)

No. of Labour Types:	2 (High and Low Wage)
Preferences:	CES with shares 0.86, 0.14 on consumption/leisure for low wage with shares 0.54, 0.46 on consumption/leisure for high wage with substitution elasticities 1.5 for low wage, 1.5 for high wage
Production:	CES production function with share parameters of 0.24, and 0.76 low and high wage labour. The substitution elasticity in production is set at - 1.55. The unit term in the CES function (which controls the position of production function ) is set at 1.3. Labour endowments equal 40 and 60 for low and high income households.
Tax Rates:	Income tax rates 0.4 for high wage and 0.0 for low wage Benefit tax back rate 0.8 for both households.
Benefit Levels:	11 for the low wage worker who participates in the transfer programme (in the with benefit case).
Revenue distribution	Low and high wage households receives 2.3 and 7.4 of the net revenues (tax revenues less transfers paid) as a lump sum redistribution

(b)

Table 1 (b)

Above parameters are derived from the following set of baseline data with low and high income households

	Low income household	High income household
Gross income	10	20
Benefit	11	0
Transfer	2.3	7.4
Income Tax	0	8
VAT	1.3	3.4
Tax Back	8	0
Gross Consumption	14	16
Leisure	30	40
Labour Endowment	40	60

Table 2

<b>Equilibrium in the Presence of Transfer Programme</b>				
	consumption good high wage low wage	1.00 1.00 1.00	B. Regime Choice	high wage does not participate in transfer programme. low wage participates in transfers programme
option:	consumption by high wage 15.8(30) leisure of high wage 40.0(18) consumption by low wage 14.0(11) leisure of low wage 30.0(40)		D. Taxes/Transfer:	Total Tax Revenues Collected 20.6(12) Transfers Paid 11.0(11) Net Tax Revenue Redistributed 9.6(10)
ε:	utility high wage utility low wage (19.92)	51.0 (28.3) 27.7		
<b>Equilibrium in the Absence of Transfer Programme</b>				
	consumption good (1) high wage low wage (1)	1.00 1.6 (1) 0.50	B. Consumption:	consumption by high wage 48.9 (28) leisure of high wage 28.4 (19) consumption by low wage 17.2 (21) leisure of low wage 8.9 (19)
ε:	utility high wage (46.7) utility low wage 24.4(23.0)	76.3	D. Taxes/Transfer:	Total Tax Revenues Collected 12.0 Transfer Paid 0.0 Net Tax Revenue Redistributed 12.0

**Table 2 (b)**  
**Model Equilibria With and Without Conditional Transfer**  
**Programmes for the Numerical Example Specified**  
**in Table 1 (figures in parenthesis for MSM)**

<b>1. Equilibrium in the Presence of Transfer Programme</b>			
A. Prices:	consumption good high wage low wage	1.00 1.00 1.00	B. Regime Choice  high wage does not participate in transfer programme. low wage participates in transfers programme
B. Consumption:	consumption by high wage 15.8(30) leisure of high wage 40.0(18) consumption by low wage 14.0(11) leisure of low wage 30.0(40)		D. Taxes/Transfer: Total Tax Revenues Collected 20.6(12) Transfers Paid 11.0(11) Net Tax Revenue Redistributed 9.6(10)
C. Welfare:	utility high wage 51.0 (28.3) utility low wage 27.7 (19.92)		
<b>2. Equilibrium in the Absence of Transfer Programme</b>			
A. Prices:	consumption good (1) high wage low wage (1)	1.00  1.6 (1) 0.50	B. Consumption: consumption by high wage 48.9 (28) leisure of high wage 28.4 (19) consumption by low wage 17.2 (21) leisure of low wage 8.9 (19)
C. Welfare:	utility high wage 76.3 (46.7) utility low wage 24.4(23.0)		D. Taxes/Transfer: Total Tax Revenues Collected 12.0 Transfer Paid 0.0 Net Tax Revenue Redistributed 12.0

Table 3 (a)

**Comparing Model Based and Conventional Evaluations of the Redistributive Effects of Transfer Programmes Using the Example from Table 1**

**1. Model Evaluation of the Effects of Eliminating Transfers Programme**

	High Wage Household	Low Wage Household
Hicksian EV	49.6% (65.1%)	-11.9% (16.7%)
Hicksian CV	-33.3% (-65.1%)	13.6% (-16.7%)
Wage Rate Changes under programme elimination	High/Low Wage Rate Ratio Before Benefit Elimination	1.00 (1)
	High/Low Wage Rate Ratio After Benefit Elimination	3.09 (1)

## Comparing Model Based and Conventional Evaluations of the Redistributive Effects of Transfer Programmes Using the Example from Table 1

Table 3 (b)

### 2. Conventional Evaluation of Redistributive Impact of Transfers

Gross Cash Benefits received under programme by low wage household	13.3 (11.5)
Taxes paid by low wage household through tax back	8.0 (8)
Net benefit received by low wage household	5.30 (3.5)

**3. Ratio of money metric welfare loss to low wage from transfer elimination to loss in net cash benefit** **25.4% (52.4%)**

Table 4

Base Case 2000/01 UK data for Household Deciles on Household Incomes, Taxes, and Transfers in £ /Year Per Household

A	B	C	D	E	F	G	H	I	J	K	L
Household deciles	Original income <sup>2</sup>	Noncon-tributory Benefits <sup>3</sup>	Direct Cash Benefits <sup>4</sup>	Direct Tax <sup>5</sup>	Indirect Tax <sup>6</sup>	In-Kind Transfers <sup>7</sup>	Earnings per week <sup>8</sup>	Working weeks <sup>9</sup>	Value of Leisure <sup>10</sup>	Total Income <sup>11</sup>	Consumption <sup>12</sup>
Poorest H1	2149	4525	469	930	2139	4647	160	13	14491	16640	8721
H2	4724	4866	782	1194	2183	4007	210	23	17085	21809	11002
H3	9141	3510	963	1880	2759	3765	223	41	14076	23217	12740
H4	13296	2745	746	2815	3213	3561	243	55	11934	25230	14320
H5	17353	2027	704	2831	3572	3266	272	64	10895	28248	16947
H6	21416	1653	603	4745	3957	3276	306	70	10455	31871	18246
H7	24609	1348	522	5531	4266	2755	355	69	12293	36902	19437
H8	28038	1037	447	6576	4362	2304	403	70	13895	41933	20888
H9	33743	788	386	8175	4537	2189	473	84	8190	41933	24394
Richest H10	56065	778	301	15082	5551	1826	543	91	6871	56420	31831

Source: Based on Table 9 (Appendix 1) of Economic Trends, 2000/01, p. 63, and authors' own calculations. Further explanatory notes are given over.

Table 5  
**The Redistributive Effects of Transfers in the Ten Decile Conditional Choice  
 General Equilibrium Model Calibrated to 2000/01 UK Data**

	<u>Case 1</u>		<u>Case 2</u>	
	Production elasticity set close to one <sup>1</sup> : small wage rate effects		Production elasticity at 1.5: larger wage rate effects	
Deciles receiving benefits in the base case	Ratio of real income loss from transfer elimination to cash benefits forgone	% change in wage rate of group	Ratio of real income loss from transfer elimination to cash benefits forgone	% change in wage rate of group
Bottom decile	0.17	-54.4	0.168	-54.7
Next to Bottom decile	0.15	-53.9	0.148	-54.3
Third decile	0.21	-45.8	0.211	-47.3

1. We use a value of 1.05 since computational problems arise as this elasticity asymptotically approaches one.

Table 6

**Impact of Elimination of Benefit on Wage Rates and Shares of Labour income by Decile**

	New Wage	Base Wage	New Share	Old Share
h1	0.147	1.026	0.004	0.008
h2	0.153	0.996	0.006	0.011
h3	0.22	0.92	0.013	0.019
h4	0.299	0.751	0.025	0.031
h5	0.384	0.656	0.044	0.045
h6	0.425	0.588	0.066	0.062
h7	0.445	0.569	0.091	0.082
h8	0.45	0.551	0.117	0.103
h9	0.436	0.505	0.15	0.129
h10	1	1	0.692	0.702

Table 7

**Elasticity Sensitivity of the Redistributive Impact of Transfers**

Elasticity specification		Ratio of real income loss to poorest decile to their cash benefit loss under benefit elimination			% change in wage rate of the lowest group
Demand side ( $\sigma_u$ )	Production side ( $\sigma_p$ )	10 <sup>th</sup>	9 <sup>th</sup>	8 <sup>th</sup>	
1.6	1.50	0.168	0.15	0.21	-85
2.05	1.50	0.168	0.15	0.21	-75
2.50	1.50	0.168	0.15	0.21	-66
2.95	1.50	0.168	0.15	0.21	-59
3.40	1.50	0.168	0.15	0.21	-53
1.6	1.05	0.168	0.15	0.21	17
3.40	1.05	0.168	0.15	0.21	6

Table 8

**Valuing Marginal Increases in Transfers**

	Ratio of incremental real income gain to transfer increase for the poorest decile	% wage change under incremental benefit increase for the poorest decile
Central case specification (1.05)	1.0	0.91
High $\sigma_p$ case (2.0)	1.0	2.88

## Conclusion on Redistribution Effects of Transfers

- The redistributive effects of transfers is the real income equivalent of transfers to recipients that is relevant, and this is typically less than their cash value.
- The transfer recipients are better off by the amount of cash they receive. Because of conditionality in transfer programmes, households face a choice between receiving transfers with an accompanying tax back scheme on additional labour income, and non participation with no tax back.
- The reference point which should be used when evaluating the redistributive effects of transfers is thus the utility level in the no transfer regime.
- For a household indifferent between participating and not participating in such programmes, the value of such transfers is zero, even if participation by them involves receipt of cash.
- Typically, attaching a tax back scheme to a transfer mechanism will lower the real value of transfers to the recipient.

# Conclusion on Redistribution Effects of Transfers in UK

- Numerical examples and an empirical implementation of a conditional choice general equilibrium model based on 2000/02 UK data.
- Results from both of these clearly show that the conventional belief that, through transfer programmes, transfer recipients are made better off by the full cash transfer received does not hold.
- For this UK data, our central case conditional choice general equilibrium model suggests that real gains to transfer recipients in the bottom decile of households may be no more than 87% of cash transfers received.

# Conclusion on Redistribution Effects of Transfers in UK

- The general equilibrium wage effects from changes in transfer programmes can come into play in potentially a major way, reflecting induced low wage labour withdrawal attributable to tax back schemes.
- These effects further modify the redistribution attributable to transfers.
- Numerical examples show how the value of transfer are less than 50 percent when full general equilibrium impacts are considered than when the traditional utility maximising partial equilibrium leisure demand or labour supply models are used for analyses.
- Both of the effects we emphasize in the paper appear to be neglected in current literature on the evaluation of the redistributive effects of transfer programmes and worth pursuing further.

# Sample Programme in GAMS

\$TITLE Redistributin effects of transfers, calibrated to the UK data set

\*option solprint=off  
option decimals =3;

SET H /h1\*h10/;

Alias (h,hh);

Table base data for tax back and vat 2002

	Grinc	benefit	Transf	inctax	VAT	tback	congrs	Leisure	inctrt	indtrt	tbackrt
H1	2587	10052	0	0	1696	0	10286	16107	0.000	0.197	0
H2	3803	14395	0	0	1524	0	15935	16200	0.000	0.106	0
H3	6699	14891	0	0	2179	0	18247	14049	0.000	0.136	0
H4	11796	0	13221	1916	2790	0	18395	12103	0.194	0.179	0
H5	18627	0	9259	2914	3427	0	18631	10760	0.185	0.225	0
H6	26837	0	6762	4194	4179	0	21032	9996	0.185	0.248	0
H7	36106	0	5790	5703	4828	0	25662	12390	0.188	0.232	0
H8	46189	0	5514	7256	5552	0	31639	14042	0.186	0.213	0
H9	60047	0	5490	9558	6535	0	39886	9500	0.189	0.196	0
H10	111296	0	4950	17874	8199	0	72299	6981	0.191	0.128	0

;

\*Data source: Economic Trends, Tabel 9 (Appedix 1) Office of National Statistics UK, April 2001; pp. 63.

CH.L(H)=0.1;  
IH.L(H)=0.1;  
L1H.L(H)=0.1;  
LS1H.L(H)=0.1;  
P.L=0.001;  
P.FX=1;  
w1.fx("h10")=1;  
TRH.L=1;  
UH.L(H)=0.1;  
w1.L(H)=0.1;  
trh.L=0;  
tlab.l=0.01;  
yh.L=0.1;  
lshare.l(h)=0.000001;

parameter cdifer, ldifer;

MODEL SHIFT /  
PRICE.w1  
price1.p

Parameters

Y0 base year output  
B0 benefit in the base year  
BA0 restore benefit for later use  
Tback tax back amount  
c0(h) consumption  
tran0(h) transfer  
tax(h) income tax  
leisure(h) leisure  
ls0 labour supply  
LW1 tb(h) tax rate  
18694 tfrate(h) transfer rate  
20003 pl0(h) base year price of labor  
20748 t0(h) income tax rate  
21983 VAT0(H) value added tax rate  
26473  
32639  
42793  
52975

PARAMETERS

100403 LW1(H) endowments  
ALPHAC(H) share of spending on consumption  
ALPHA1(H) share of spending on leisure  
DELTA(H) share of labour type h in production  
t1 tax rate  
t  
tbackr tax back rate  
VT(H) value added tax rate  
RS(H) transfer rate  
sigma(h) elasticity of substitution in consumption  
SIGMAL elasticity of substitution in production  
unit unit term in production function  
ben index for hh receiving benefits  
noben index for hh not receiving benefits

;

parameter IO,output, cons0, alphc(h), alphl(h), delt(h),  
sumalph(h), sumdelt, p0, w10(h), idefer, cbal;

# Sample Programme in GAMS

```

IHE(H)..
    Ih(h) - w1(h)*((1-tb(h)-tbackr(h)$b0(h))*Iw1(h))
            -rs(h)*trh-b0(h)$b0(h) =e=0;

CHEc(H)..
    C0(H) =E=(ALPHCa(H)*I0(H))
            /((
            (
            ((P0*(1+VT(H)))**sigma(h))
            *(
            (ALPHCa(H)*(P0*(1+VT(H)))**(1-sigma(h)))
            +((1-ALPHcA(H))*(w10(H)*(1-tb(h)-tbackr(h)$b0(h)))**(1-sigma(h)))
            )
            )
            )
            );

Leic(H)..
    Leisure(H) =E=(ALPHcA(H)*I0(H))
            /((
            (
            ((w10(H)*(1-tb(h)-tbackr(h)$b0(h)))**sigma(h))
            *(
            (ALPHCa(H)*(P0*(1+VT(H)))**(1-sigma(h)))+
            (ALPHlcA(H)*(w10(H)*(1-tb(h)-tbackr(h)$b0(h)))**(1-sigma(h)))
            )
            )
            )
            );

alphsum(h)..
    alphca(h) +alphlca(h) =e= 1;

PRICEc(H)..
    w10(h) =e= p0*((unitc)**((1-sigma)/sigma))*((deltca(h))*(y0/ls0(h))**((sigma-1)/sigma));
deltsum..
    sum(h,deltca(h)) =e= 1;

UHE(H)..
    UH(H) - (((ALPHAc(H)**(1/sigma(h)))*(CH(H)**((sigma(h)-1)/sigma(h))))+((ALPHA1(I
CHE(H)..
    CH(H) - (ALPHAc(H)*IH(H))
            /((
            (
            ((P*(1+VT(H)))**sigma(h))
            *(
            (ALPHAc(H)*(P*(1+VT(H)))**(1-sigma(h)))
            +((1-ALPHAc(H))*(w1(H)*(1-tb(h)-tbackr(h)$b0(h)))**(1-sigma(h)))
            )
            )
            )) =e=0;

L1HE(H)..
    L1H(H) - ((1-ALPHAc(H))*IH(H))
            /((
            (
            ((w1(H)*(1-tb(h)-tbackr(h)$b0(h)))**sigma(h))
            *(
            (ALPHAc(H)*(P*(1+VT(H)))**(1-sigma(h)))+
            ((1-ALPHAc(H))*(w1(H)*(1-tb(h)-tbackr(h)))**(1-sigma(h))))
            )
            )
            ) =e=0;

LS1HE(H)..
    LS1H(H) - (LW1(H)-L1H(H))=e=0;

YHE..
    sum(h,ls1h(h)) =g= sum(h, lw1(h)-l1h(h));
    *
    tlab - sum(h, lw1(h)-l1h(h)) =e=0;
    tlab - sum(h, ls1h(h)) =e=0;

```