II. STRATEGIC AND GENERAL EQUILIBRIUM MODELS IN POVERTY MEASUREMENT STUDIES

Keshab BHATTARAI*

Abstract

Incentive compatibility in poverty alleviation game for the most efficient and just allocation of resources and maximisation of social welfare requires cooperation from both rich and poor households, governments and the global community. Non-cooperation among them only deepens poverty with socially, economically and morally unacceptable magnitudes of malnutrition, hunger-disease-illness, tensions and conflicts, illiteracy and lack of education and skills. Scientific analyses and systematic implementation of poverty reduction initiatives require strategic and multi-household general equilibrium models to compliment standard Booth-Rowntree, Sen-Atkinson and FGT or Jenkins-Lambert type absolute, relative, chronic or intensity measures of poverty in order to evaluate dynamic impacts actions taken for alleviation of poverty. Bad game results in poverty and good game results in prosperity. No analyses of poverty can be considered complete without evaluating income and substitution effects on welfare of these households based on the price mechanism and allocation of resources in the wider economy.

Keywords: poverty, redistribution, dynamic model
JEL Classification: D63, O15

1. Introduction[1]

Poverty is measured relatively and absolutely. Adam Smith (1776) was absolutist, for him it meant being ashamed to appear in public due to inability to afford necessary things according to the custom and standards of the country: "*... A linen shirt is strictly speaking not a necessity of life. The Greeks and Romans lived very comfortably*

* *Business School, University of Hull, Cottingham Road, HU6 7RX, email: K.R.Bhattarai@hull.ac.uk, Phone 44-1482-463207, Fax: 44-1482-463484*

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though they had no linen. But in the present time ... a creditable day-laborer would be ashamed to appear in public without a linen shirt..." Marx followed Adam Smith in thinking that necessary wants of the workers were products of historical development that depended to a great extent on the degree of civilization of the country [Marx and Engles (1848)]. Rowntree (1902) in a study of minimum living standards for a respectable life in York in Britain considered a family to be living in poverty if its total earnings were insufficient to obtain the minimum necessaries for the maintenance of merely physical needs; the minimum requirements of protein and calories, housing, thermal comforts, basic health and education. Based on expenditure on porridge and skim milk for breakfast, bread and cheese for lunch, vegetable broth, bread, cheese, dumpling for dinner, and bread and porridge for supper he set a poverty threshold and determined the number of poor households below that line [Glennester, Huills, Piachaud and Webb (2004)]. Beveridge (1942) took these facts into account while designing social insurance programs. Orshansky (1965) did similar study for the United States. Townsend (1969) revisited them for the UK. Sen (1976), Foster and Shorrocks (1985), Basu (1985), Vaughan (1987), Preston (1995), Shorrocks (1995) and Chakravarty (1997), Davidson and Duclos (2000) then focused on theoretical issues relating to definition and relative and absolute measurement of poverty. Sen's (1976) note on inadequacy of the head count ratio and a need for poverty gap to measure the depth of poverty that would fulfill axioms of monotonicity, transfer, relative equity and ordinal rank to capture severity of deprivation of households under the poverty line has been extended to cases of temporary and chronic poverty adjusting the poverty gap for its duration by Foster-Greer-Thorbecke (1984). Importance of Pigou-Dalton transfer axiom and first and second order stochastic dominance properties indicated by Atkinson (1970 and 1987) were implemented by Beckerman (1979) and using subjective method by Praag, Goedhard and Papeyn (1980) and Jenkins (1991) and Jenkins and Lambert (1997) showing how transfers could eliminate poverty among low income households. Blundell *et al*. (2000) applied that to evaluate the impacts of income tax credit in consumption and income inequality in UK[2].

There is no magic wand to eliminate massive poverty that exists around the world. It depends on strategic interactions among players of the poverty game. Effective implementation of poverty alleviation programmes requires thinking of strategies and actions available to major players in the poverty game - poor themselves who are often considered beneficiaries of aids, grants and transfers; rich individuals who bear the burden of taxes to pay for those transfers; the governments that are involved not only in measuring the depth of poverty and setting up objectives, targets and programmes that aim to eliminate poverty but also are subject to

[2] The head-count ratio and the income-gap ratios are still widely used in eempirical studies to justify and monitor programmes aimed at reducing poverty, such as the poverty reduction strategy framework under the Millennium Development Goals (OECD (1976), UNDP (1991), Slesnick (1996), World Bank (1990), Ravallion (1996)) including big push ideas for foreign aid and investment [Besley and Burgess (2003), Sach (2005)]. Limitations of one time transfers to end poverty have made alleviation of poverty one of the major global agenda in recent years (of Live 8 concerts in 2005, G8 Meetings, poverty alleviations programmes of many developing economies including China and India, the OECD, Brown's appeal to the UN in July 2007).

distortions arising from corruption and misuse of public money; and the global community that can provide a natural and fair playing fields for these players. Designing an effective incentive structure in dynamic contexts and balancing economic and political power over the benchmark equilibrium path of these economies is essential.

Ideally high income individuals would like to see the end of poverty as has been campaigned by public and private sectors in advanced countries in recent years but it is logical for them to expect that poor who receive benefits make good efforts to get out of the poverty trap by investing their time and resources in education, skill and training and health care and economically productive initiatives with a clear foresight of progress over a horizon rather than doles for daily consumptions. Government, made of representatives of both poor and rich people, may propose very ideal programmes, rules and regulations but they become ineffective in reducing poverty without active cooperation from tax payers and the transfer recipients. It may create nany-state syndrome and drag on overall growth as in many EU economies in 1990s.

Inclusion of strategic and behavioural aspects of poverty game discussed above is apparently missing from the existing literature and forms the major content of the current paper. A numerical example is provided in the next section to summarise basic concepts existing in the literature to set a background for a dynamic cooperative and non-cooperative game of poverty in Section III and a brief reference to the dynamic multi-household general equilibrium model in Section IV with conclusions and references in the last section.

2. A Numerical Example on the Measurement and Transfer for Alleviation of Poverty

Consider an economy inhabited by *N* number of individuals where income of each is denoted by y_i for each *i* = 1,2, …, *N*. Income vary among individuals for economic, social, political, cultural or many other less obvious reasons; $y_i \neq y_j$ for all $\forall_i$. A strict ordering implies $y_1 < y_2 < .. < y_N$, with corresponding ordering of welfare with lower income individuals having lower level of welfare. Infinite numbers of income configurations (distributions) are possible which often are summarised by their mean and variances as in Jenkins (1991) or Preston (1995). Distributions, with lower variances are more equal than with higher ones.

Poverty line relates income of individuals to average incomes, $\bar{y} = \sum_i^N \frac{y_i}{N}$; the ratio of people below this line in relation to N individuals in society is the head count measure of poverty. Many countries adopt one half of the average income as a cut-off point for absolute poverty line; $z = \frac{1}{2}\bar{y}$, which is then used to come up with either the head count ratio, which is the ratio of number of people below the poverty line divided by the total number of individuals in the population or the income gap ratio more

preferably measure of the depth of poverty which indicates the deficiency of income in relation to poverty line $I = \frac{\sum_{i}^{n}(y_i - z)}{z.n}$. Sen (1976) requires further modification to poverty gap to capture the income inequality to achieve monotonicity as well as the transfer axiom to reflect increase in poverty when resources are transferred from poorest poor to less poor persons as:

$$P = H.I + H(1 - I)G \quad (1)$$

here *P* is a composite index of poverty, *H* the headcount ratio, *I* the income gap ratio, *G* the Gini coefficient; higher values of *H*, *I*, and *G* mean higher degree of poverty.

Numerical example in Table 1 and associated Figure 1 can illustrate these concepts more accurately and effectively.

Table 1

Measuring poverty in a hypothetical economy

y	N	Cy	cp	Yshre	cyshre	Pshre	cpshre	Triangle	Rectangle	Area	ygap
10	1	10	1	0.01	0.01	0.1	0.1	0.0005	0.000	0.0005	-90
20	1	30	2	0.02	0.03	0.1	0.2	0.001	0.001	0.0020	-80
30	1	60	3	0.03	0.06	0.1	0.3	0.0015	0.003	0.0045	-70
40	1	100	4	0.04	0.10	0.1	0.4	0.0020	0.006	0.0080	-60
50	1	150	5	0.05	0.15	0.1	0.5	0.0025	0.010	0.0125	-50
60	1	210	6	0.06	0.21	0.1	0.6	0.0030	0.015	0.0180	-40
90	1	300	7	0.09	0.30	0.1	0.7	0.0045	0.021	0.0255	-10
100	1	400	8	0.10	0.40	0.1	0.8	0.0050	0.030	0.0350	0
200	1	600	9	0.20	0.60	0.1	0.9	0.0100	0.040	0.0500	100
400	1	1000	10	0.40	1.00	0.1	1.0	0.0200	0.060	0.0800	300

Column **y** gives the income by households, ***N*** the number of households in each income category, **cy** and **cp** are cumulative income and population; **yshre** and **cyshre** columns present income share of each decile and cumulative shares; **pshre** and **cpshre** columns present income share of each decile and cumulative shares; area under the Lorenz curve can be approximated using triangles and rectangles.

The total income is 1000; with 10 households, average income is 100. Area under the Lorenz curve is 0.236, that between the Lorenz curve and equality line is 0.264; this implies a Gini coefficient of 0.528; higher ***G*** reflecting more unequal distribution.

By the headcount ratio seventy percent of population is poor if the accepted poverty line is set at the average income $\bar{y} = 100$ but only 40 percent is poor when absolute poverty line is established as the half of this average income $z = \frac{1}{2}\bar{y} = 50$ as only four individuals are below the poverty line. As stated above, this head count ratio does not indicate the depth of poverty as it ignores the income gap ratio,

$I = \frac{\sum_{i}^{n}(y_i - z)}{z.n} = \frac{40+30+20+10}{50 \cdot 4} = \frac{100}{200} = 0.5$. Sen's poverty index in this economy is 0.464 as

$$P = H.I + (1-I)G = 0.4 \times 0.5 + (1-0.5)0.528 = 0.20 + 0.264 = 0.464$$

and is illustrated in Figure 1 (actual income distribution from BHPS is in Figure 2):

Figure 1

Poverty with Income Inequallity

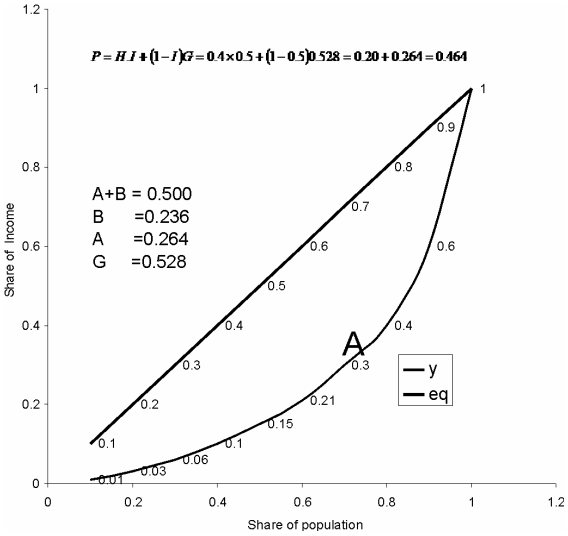
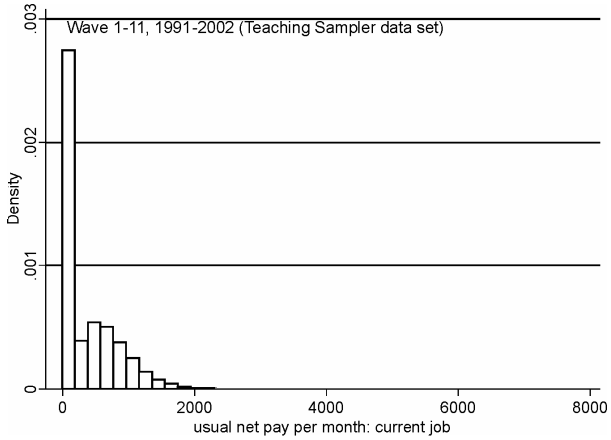


Figure 2

Income Distribution from the British Household Panel Survey



The elimination of the absolute poverty in this example requires transfers of 100 to poor individuals with $T_1 = 40$ for the poorest household and $T_2 = 30, T_3 = 20$ and $T_4 = 10$ accordingly to other three households below the poverty line. This transfer can be funded by a 10 percent and 20 percent tax on the income of 9th and 10th deciles raising 20 and 80, respectively. This brings *H* to zero and *I* to 1 making *P* to zero.

It is obvious that the value of poverty index in above example as in real life is influenced by the choice of the poverty line; when income is perfectly equally distributed no one is below the poverty line; *H* is zero and *G* also is zero with no poverty, *P* = 0; but these are extreme cases only of theoretical possibility. In a real world situation, values of *P* range between zero and one, $0 < P < 1$, with higher *P* indicating to the higher level of poverty. Empirically this poverty index varies across countries and over time according to characteristics of income distribution functions; it would have a larger value if the income distribution was more unequal or when the poverty line is set at the higher level. Thus the relative measure of poverty is sensitive to the choice of the poverty line; it is high in an economy when the mean of the income is taken as a poverty line than when only the half of the mean income is taken for it and when it is more unequal than its comparator. More fundamentally the degree and depth of poverty can be changed by influencing the choices of individuals and households and by adopting economic programmes that are more efficient and generate better outcomes. This means when looked from this relative sense there are poor in every economy, it can never be abolished. Variations in relative poverty arise from the basic structure of the socio-economic model adopted by the country. For this reason Sen focused on minimum capability view in his subsequent works. Foster-Greer-Thorbecke (1984) have normalised poverty gap ratio to capture the severity of poverty $FGT = (1/n)\sum_{i}^{m}(1 - y_i/z)^2$ for $y_i < z$ and see the importance of duration of the poverty spell in the poverty index by average poverty index given by the mean gap over time and individuals $A_{FGT}(T) = (1/N)\sum_{t=1}^{T}\sum_{i}^{m}(1 - y_{i,t}/z)^2; N = nT$ and chronic measures of poverty as $C_{FGT}(T) = (1/n)\sum_{i}^{m_y}(1 - Y^*_{t,I}/z)^2$ taking gap from the permanent income $Y^*_{t,I}$. Three 'I's Incidence, intensity and inequality (TIP) measure in Jenkins and Lambert (1997) obtained by cumulative ranking of people from poorest to richest is another smarter way of visualising poverty graphically across time, countries or regions or households.

It is often argued that poverty can be eliminated by means of tax and transfer as illustrated in the numerical example in Table 1 above and in Beckerman (1979). Broader questions arise regarding the impact of such transfer programme. First relates to its impact on labour supply of rich and poor individuals. Higher taxes may discourage rich individuals to work and transfer receipts may reduce the need to work

to earn for living for the poor. Secondly, higher taxes may discourage incentives of saving and investment. Third, modality of transfer payment may be crucial for long term growth. Providing in kind transfer in the form of education and health spending may be better than cash transfers to empower productive capacity of the poor. Fourth, in addition to transfer payments governments need to provide public goods for the entire population. As everyone consumes these public goods these should be provided by taxing on income of both rich and the poor. Alleviation of poverty can better be studied in terms of a strategic model as illustrated in the next section.

3. Game of Poverty

Allocations should be incentive compatible for rich and poor households and the governments to interact cooperatively in the poverty alleviation game. The solutions of the game when cooperative strategies are incentive compatible for them are consistent to poverty alleviation objectives while the catastrophic results may occur when non-cooperative strategies become optimal for individual players. In a utility or welfare maximising world, model results will be based on comparison of expected welfare continent on their strategies [Vaughan (1987), Pryatt (1987), Desai and Shah (1988), Myles (2001)].

Model of the Poverty Game

There are three players in the poverty game - poor, rich and government; each has three strategies available to it to play, *s*, *l*, and *k* , cooperation, indifference and non cooperation. The outcome of the game is the strategy contingent income for poor and rich, $y_t^p(s,l,k)$ with the probability of being in particular state like this is given by $\pi_t^p(s,l,k)$ and $\pi_t^R(s,l,k)$, respectively and tax and transfer profiles associated to them. The state-space of the game rises exponentially with the length of time period *t*. The objective of these rich and poor households is to maximize the expected utility that is assumed to be concave in income. The government can influence this outcome by choices of taxes and transfers that can be liberal, normal or conservative. More specifically, following propositions should hold in this poverty alleviation game.

Proposition 1: The state contingent expected money metric utility of poor is less than that of rich, which can be expressed as:

$$\sum_{s=1}^{s}\sum_{l=1}^{l}\sum_{k=1}^{k}\sum_{t}^{T}\pi_t^p(s,l,k)\cdot\delta_t^p u\left(y_t^p(s,l,k)\right) < \sum_{s=1}^{s}\sum_{l=1}^{l}\sum_{k=1}^{k}\sum_{t}^{T}\pi_t^R(s,l,k)\cdot\delta_t^R u\left(y_t^R(s,l,k)\right)$$

where $\pi_t^p(s,l,k)$ gives the probability of choosing one of strategies by poor given that the rich and the government has chosen *l* and *k* strategies. Utility is derived from

income as given by $u\left(y_t^p(s,l,k)\right)$ and $\delta_t^p = \frac{1}{\left(1+r_t^P\right)}$ is the discount factors for poor and $\delta_t^R = \frac{1}{\left(1+r_t^R\right)}$ the discount factor for rich.

Proposition 2: Transfer raises money metric expected utility of poor and reduces the utility of rich.

$$\sum_{s=1}^{s}\sum_{l=1}^{l}\sum_{k=1}^{k}\sum_{t}^{T}\pi_t^p(s,l,k)\cdot\delta_t^p u\left(y_t^p(s,l,k)+T_t^p(s,l,k)\right)<\sum_{s=1}^{s}\sum_{l=1}^{l}\sum_{k=1}^{k}\sum_{t}^{T}\pi_t^R(s,l,k)\cdot\delta_t^R u\left(y_t^R(s,l,k)-T_t^p(s,l,k)\right)$$

Proposition 3: Incentive compatibility requires that

$$\sum_{s=1}^{s}\sum_{l=1}^{l}\sum_{k=1}^{k}\sum_{t}^{T}\pi_t^p(s,l,k)\cdot\delta_t^p u\left(y_t^p(s,l,k)+T_t^p(s,l,k)\right)>\sum_{s=1}^{s}\sum_{l=1}^{l}\sum_{k=1}^{k}\sum_{t}^{T}\pi_t^p(s,l,k)\cdot\delta_t^p u\left(y_t^p(s,l,k)\right)$$

and

$$\sum_{s=1}^{s}\sum_{l=1}^{l}\sum_{k=1}^{k}\sum_{t}^{T}\pi_t^R(s,l,k)\cdot\delta_t^R u\left(y_t^R(s,l,k)-T_t^p(s,l,k)\right)<\sum_{s=1}^{s}\sum_{l=1}^{l}\sum_{k=1}^{k}\sum_{t}^{T}\pi_t^R(s,l,k)\cdot\delta_t^R u\left(y_t^R(s,l,k)\right)$$

Proposition 4: Growth requires that income of both poor and rich are rising over time:

$$T_t^p(s,l,k)<T_{t+1}^p(s,l,k)<T_{t+2}^p(s,l,k)<..<T_{t+T}^p(s,l,k)$$

$$Y_t^p(s,l,k)<Y_{t+1}^p(s,l,k)<Y_{t+2}^p(s,l,k)<..<Y_{t+T}^p(s,l,k)$$

$$Y_t^R(s,l,k)<Y_{t+1}^R(s,l,k)<Y_{t+2}^R(s,l,k)<..<Y_{t+T}^R(s,l,k)$$

Proposition 5: Termination of poverty requires that every poor individual has at least the level of income equal to the poverty line determined by the society. When the poverty line is defined one half of the average income this can be stated as:

$$Y_{t+T}^p(s,l,k)\geq\frac{1}{2}\sum_{p=1}^{p}Y_{t+T}^p(s,l,k)$$

Above five propositions comprehensively incorporate all possible scenarios in the poverty game mentioned above. Propositions 2-5 present optimistic scenarios for a chosen horizon *T*. Testing above propositions in a real world situation is very challenging exercise. It requires modelling of the entire state space of the economy. Moreover, in real situation consumers and producers are heterogeneous regarding their preferences, endowments and technology and economy is more complicated than depicted in the model above. In essence, it requires a general equilibrium set up of an economy where poor and rich households participate freely in economic activities taking their share of income received from supplying labour and capital inputs that are affected by tax and transfer system as illustrated in the next section.

4. Multi-firm multi-household dynamic general equilibrium model for poverty

The importance in poverty measurement analyses of a detailed specification of production and consumption sides of the economy and the structure of the markets, government and the foreign sectors had been well noted by Swinton (1996) who thought poverty of an individual in terms of poor performance in the labour market. His model was very parsimonious. An attempt is made in this section for full representation of a dynamic general equilibrium economy with households, firms, government and the rest of the world to measure the evolution of income of households over time based on decisions of households and firms at the micro level and choices of the government at the macro level. In this multi-household multi-sectoral computable dynamic general equilibrium open economy model, the government uses taxes and spending strategies to alleviate poverty, households maximise their life time welfare under various public policy initiatives geared toward redistribution of income and firms adopt constant returns to scale technologies that give them maximum profit. It is impossible to have an explicit analytical closed form solution for a large scale model like this but model is solved using numerical techniques as in Bhattarai (2007). The number of households and structure of taxes differ.

Households maximise the life time utility subject to the budget constraint as following:

$$\text{Max } U_0^h = \sum_{t=0}^{\infty} \beta^t U_t^h \left(C_t^h, l_t^h \right)$$

Subject to

$$\sum_{t=0}^{\infty} R_t^{-1} \left[P_t (1 + t^{vc}) C_t^h + w_t (1 - t_l) l_t^h \right] = \sum_{t=0}^{\infty} \left[(1 - t_l) w_t L_t^h + (1 - t_k) r_t K_t^h + TR_t^h \right]$$

where: C_t^h, l_t^h and L_t^h are respectively composite consumption, leisure and labour supplies of household *h* in period *t*, $R_t^{-1} = \prod_{s=0}^{t-1} 1/(1 + r_s)$ is a discount factor; r_s represents the real interest rate on assets at time *s*; t^{vc} is value added tax on consumption, t^l is labour income taxes, and K_t^h is the composite consumption, which is composed of sectoral consumption goods, P_t is the price of composite consumption (which is based on goods' prices), i.e. $P_t = \vartheta \prod_{i=1}^{n} \alpha_i p_{i,t}^{\alpha_i}$, and $C_t^h = \prod_{i=1}^{n} C_{i,t}^{\alpha_i^h}$.

Industries of the economy are represented by firms that combine both capital and labour input in production and supply goods and services to the market.

$$\Pi_{j,t}^y = [((1 - \delta_i^e) PD_{i,t}^{\frac{\sigma_y - 1}{\sigma_y}} + \delta_i^e PE_{i,t}^{\frac{\sigma_y - 1}{\sigma_y}})]^{\frac{1}{\sigma_y - 1}} - \theta_j^v PY_{j,t}^v - \theta_j^d \sum_i a_{i,j}^d P_{i,t}$$

where: $\Pi^{y}_{j,t}$ is the unit profit of activity in sector *j;* $PE_{j,t}$ is the export price of good *j* $PD_{j,t}$ is the domestic price of good *j;* $PY^{v}_{j,t}$ is the price of value added per unit of output in activity *j;* σ_y is a transformation elasticity parameter ; $P_{i,t}$ is the price of final goods used as intermediate goods; δ^{e}_{j} is the share parameter for exports in total production; θ^{v}_{j} is the share of costs paid to labour and capital; θ^{d}_{j} is the cost share of domestic intermediate inputs; $a^{d}_{i,j}$ are input-output coefficients for domestic supply of intermediate goods. Goods produced at home and foreign countries are considered closed substitutes, Armington assumption, popular in the applied general equilibrium literature and the production process is given by a nested production and trade functions.

The households pay taxes to the government and government returns part of this income to the poor households and spends rest of it to provide public services.

$$REV_t = \sum_{i,h} t^{k}_{i} r_t K_{i,t} + \sum_{i} t^{vc}_{i} P_{i,t} C^{h}_{i,t} + \sum_{i} t^{vg}_{i} P_{i,t} G_{i,t} +$$

$$+ \sum_{i} t^{vk}_{i} P_{i,t} I_{i,t} + \sum_{i,h} t_{l} wLS^{h}_{t} + \sum_{i} t^{m}_{i} PM_{i,t} M_{i,t} + \sum_{i} t^{p}_{i} P_{i,t} GY_{i,t}$$

where: REV_t is total government revenue and t^{k}_{i} is a composite tax rate on capital income from sector *I*, t^{vc}_{l} is the *ad valorem* tax rate on final consumption by households, t^{vg}_{i} is that on public consumption and t^{vk}_{i} is the ad valorem tax rate on investment, t_l is the tax rate on labour income of the household, t^{p}_{i} is the tax on production, and t^{m}_{i} is the tariff on imports.

The steady equilibrium growth path of the economy is determined in terms of the interest rate, discount factor and relative prices of goods and factors in which the excess demand for goods and factors are eliminated and resource balance condition holds for the economy and each household and the government and rest of the world sectors in each period and over the model horizon. It also shows how the income of each type of household evolves over time as a function of the relative prices of goods and share of households in income. Government transfers can alter this equilibrium.

This class of models, with dynamics, multi-sectoral and multi-household structures are very comprehensive and cannot be presented in details for space reasons but their main advantage over the traditional partial equilibrium measures poverty alleviation are obvious. First, poverty can now be taken to be a part of the efficient and equitable resource allocation problem in the whole economy. It is studied along with the labour-leisure choices of households, skill-based employment decisions of firms, tax and income-based transfer policies by the government, relative prices of goods, services and factors and intertemporal optimisation process of millions of households and firms in the economy. Consequences in poverty of changes in tastes and foresightedness of consumers, adoption of technologies by firms, liberal, conservative or mixed market policies of the government and trade arrangements

under bilateral or multilateral arrangements of trade and subsequent impacts of depth of poverty can clearly be estimated under this modelling framework. It is better to consider all micro and macro economic factors and policy choices while designing redistribution with growth and welfare of different categories of households.

This model is calibrated with micro consistent data contained in the input-output tables of UK, USA and Nepal to the benchmark economies that evolve over time in their reference paths with allocation of resources occurring according to the system of relative prices that ultimately depend on preferences and endowments of households, technology of firms and policy choices of governments. These are applied to find the growth paths of income distributions of households in the model. As sample from these results, see the evolution of welfare for ten categories of households in the model presented in the Appendix (MPSGE/GAMS codes of these models can be provided for interested readers).

5. Conclusions

Incentive compatibility in poverty alleviation game for the most efficient and just allocation of resources and maximisation of social welfare requires cooperation from both rich and poor households, government and the global community. Non-cooperation among them only deepens poverty with socially, economically and morally unacceptable magnitudes of malnutrition, hunger-disease-illness, tensions, conflict, illiteracy and lack of education and skills. Scientific economic analyses and systematic implementation of poverty reduction initiatives require strategic and multi-household general equilibrium models to compliment standard Booth-Rowntree, Sen-Atkinson and FGT or Jenkins-Lambert type absolute, relative, chronic or intensity measures of poverty in the existing literature. Bad game results in poverty and good game results in prosperity. No analyses of poverty can be considered complete without evaluating the income and substitution effects on welfare of these households based on the price mechanism and allocation of resources in the wider economy. Over time bad game results in poverty and good game results in prosperity.

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Appendix

Profiles of Household Income from Tax Transfer in a Multi-household General Equilibrium Model

(More of these results can be provided to the interested readers)