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Does inequality matter for intergenerational equity in India?
Evidence based on National Transfer Accounts
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ABSTRACT

Using the National Transfer Accounts (NTA), this paper develops an inequality-adjusted intergenerational equity framework for India. This framework focuses on (a) measurement of intergenerational equity by zero Lifecycle Deficit across ages and generations, and (b) relationship between this inter-generational equity and income and consumption inequalities. The entire analysis is based on benchmark year 2004-05 and a comparative analysis between 2004-05 and 2011-12. Main results show that higher inequalities result in larger inter-generational inequity in general but differential impacts on the nature and magnitude of inequity across ages and generations. In particular, income inequality has bigger effects on increasing inter-generational inequity than consumption inequality. These results offer unambiguous evidence for inequality effects on inter-generational equity, both cross-sectional and over time, and have important implications for design of policies for promotion of distributional and growth objectives.

Keywords: Intergeneration equity, Lifecycle deficit, National Transfer Accounts, Income inequality, Consumption inequality, Gini coefficient

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NATIONAL TRANSFER ACCOUNTS
Understanding the generational economy

1. INTRODUCTION

In general, construction of National Transfer Accounts (NTA) has been aggregate at national level including India. Analyses of NTA by socio-economic status of population are best examples of uses of NTA for disaggregate analyses. Lee (2018) has identified these disaggregation by household type in Taiwan; income/consumption quintile in China and Philippines;[1] rural/urban residence in China, Philippines and Timor-Leste; regional discrepancies in South Korea and Indonesia; formal/informal labour income in India; and gender in many countries. In addition, socio-economic inequalities in the distribution of public transfers (e.g. education) in Brazil and racial inequality in income and consumption profiles in South Africa are important approaches to disaggregate analysis of NTA. The diversified evidence from the above studies is available in NTA (2019) by presentations in regional and global NTA conferences and workshops and research publications related to NTA. The above evidence explicitly shows the importance and usefulness of age-specific analyses of socio-economic inequalities but do not connect with the concept and measure of inter-generational equity.

Most recently, Kufenko et.al. (2019) links inequality in a lifecycle context with wage income: "because wage incomes are unevenly distributed over the lifecycle, with the less-experienced young earning lower wages than older workers, a shift in population age structure automatically translates into a change in measured inequality at any given point in time" (p.1). Further, Kufenko et.al. (2019) note the effects of inequality on demography in terms of longevity and ageing. For instance, given a tendency for lower income individuals to invest less in health, lack decent health insurance coverage, eat less healthy food, exercise less, and work in more physically demanding occupations, the poor tend to die much earlier than the rich. This indicates a possibility of a bi-directional causal effect between age structure and inequality. In a non-lifecycle context, Cruz and Ahmed (2018) show the empirical association between the demographic changes (i.e. increase in working-age population share and reduction in child dependency ratio) and increase in GDP per capita growth and poverty reduction.

Current global debates above on linking age structure and inequality in lifecycle contexts are relevant for India because the country has been experiencing remarkable demographic changes through age structure transitions which may have important distributional

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[1] For instance, Feng et.al. (2019) analysed the inequalities in receiving public transfers' beneficiaries by income quintiles. These public transfers include education, health care and pensions.

implications. For instance, using Census of India reports from 1961 through 2011, **Figure 1a** shows the past transition by four age groups or generations: Young (0-14 years), Youth (15-24 years), Adults (25-60 years) and Elderly (60 years and above). It is apparent that over these 50 years, the share of young population had declined by 10.18 percentage points and that of all other age groups have increased. In particular, increase in share of adult population was highest (6.13 percentage points) and elderly population was lowest (1.50 percentage points). Further, available long term projection of India's annual population by single year age up to 2100 (United Nations, 2017) shows a continued age structure transition but a remarkable population ageing (**Figure 1b**). This is evident by a decline in share of population in age groups between 2015 and 2100: young (-13.69 percentage points), youth (-7.76 percentage points) and adult (-1.32 percentage points). At the same time, India's population ageing is shown by a rise in share of elderly population by 22.77 percentage points. If these generations, now and in future, are characterized by their unique income and consumption size and patterns, then distribution of welfare may vary across ages and over time. A new way of capturing these distributional implications of age structure transition for India is by determination of inter-generational equity, if income and consumption by age is measurable. A plausible methodology for this purpose is NTA (Mason and Lee, 2011).

Further, impact of age structure on income distribution through changes in age-specific inequality remains a neglected area of policy research in India. This is evident by recent estimates and discussions on India's inequality which are devoid of implications for inter-generational equity and lack of research focus on inequality by age. For instance, the latest review of levels and trends in inequality in India by Himanshu (2019) has disaggregation of inequality by many descriptions except age. India Ageing Report 2017 (United Nations Population Fund, 2017) has no explicit reference to inequality issues for elderly generation. India's Voluntary National Review Report (United Nations, 2017) has no highlights on the approach and attainments of the targets and indicators by age. This implies that introduction of age into inequality and relating it to inter-generational equity is a policy imperative for India. However, this paper fills in these gaps by integrating inequality into intergenerational equity, using NTA methodology.

In the light of above discussion, the main objective of this paper is to answer the following research questions. (i) How useful is the NTA methodology to define and measure intergenerational equity? (ii) How to relate the standard measure of inequality (e.g. Gini coefficient) to the NTA-based concept and definition of Lifecycle Deficit (LCD) as a measure

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of intergenerational inequity? (iii) How do inequality-adjusted/discounted distributions of labour income and consumption impact on inter-generational equity? (iv) Why does inequality-adjusted intergenerational equity matter for economic policy analyses? These questions are answered by calculating the NTA-based age profiles of labour income and consumption for 2004-05 and 2011-12. Sen's (1973) welfare measure of adjusting/discounting per capita income for inequality is used to calculate inequality-adjusted labour income, consumption and inter-generational inequity in terms of lifecycle deficit (LCD). This adjustment is an essential methodological link between intergenerational equity in NTA and inequalities in distribution of labour income and consumption. Analytical and policy implications from these empirical results are analyzed from the perspectives of attainment of SDGs, distributional policies and economic growth. These implications are of general relevance and applicability for other developing countries in Asia and Africa.

Rest of the paper is organized as follows. Section 2 presents the methodology of this paper on measurement of intergenerational equity and inequality by age and generations. Section 4 includes variables and data descriptions. Main results are analyzed in section 5. Major conclusion and implications are summarized in section 6.

2. METHODOLOGY

Methodology of this study is related to measurement of (a) NTA-based inter-generational equity, (b) inequality in income and consumption by age and generations and (c) inequality-adjusted inter-generational equity. A framework for these measurements is presented below.

2.1. Measurement of NTA-based intergenerational equity

To start with, NTA's Flow Account Identity, (suffix "f" stands for private sector, "g" for public sector and "i" refers to individual or age group), is defined by:

$$\mathbf{Y_{L,i}} + \mathbf{Y_{A,i}} + (\mathbf{T_{f,i}}^+ + \mathbf{T_{g,i}}^+), = (\mathbf{C_{f,i}} + \mathbf{C_{g,i}}) + \mathbf{S_i} + (\mathbf{T_{f,i}}^- + \mathbf{T_{g,i}}^-), \qquad (1)$$

where $\mathbf{Y_{L,i}}$ is labour income, $\mathbf{Y_{A,I}}$ is non-labour or asset income, $\mathbf{T_{f,i}}^+$ and $\mathbf{T_{f,i}}^-$ are private transfer inflows and outflows respectively; $\mathbf{C_{f,i}}$ is private consumption expenditure, $\mathbf{C_{g,i}}$ is public (government) consumption expenditure, $\mathbf{S_i}$ is savings, and $\mathbf{T_{g,i}}^+$ and $\mathbf{T_{g,i}}^-$ are public transfer inflows and outflows respectively. The left hand side of equation (1) shows total inflows and the right hand side shows total outflows. Net exports are indirectly introduced in

(1) by including Rest of World's net compensation of employees in $Y_{L,i}$ and net entrepreneurial income in $Y_{A,i}$.

Flow Account is useful to calculate the lifecycle deficit (LCD) as a difference between total value of goods and services consumed and produced by i-th individual or age group.

$$LCD_i = (C_{f,i} + C_{g,i}) - Y_{L,i} \qquad (2)$$

This measures which age group/s has/have surplus ($LCD_i<0$) or deficit ($LCD_i>0$) in an accounting year.

At a given point in time, nature and magnitude of LCD between generations, identified by age groups, such as, young (0-14 years), youth (15-24 years), adults (25-60 years) and elderly (60 years and above), may be a measure of intergenerational inequity. In a generational economy,[2] inter-generational equity is attainable by inter-age allocations (i.e. public and private transfers and asset-based reallocations) such that LCD is equal to zero for all ages in (2).[3] Thus, the definition of inter-generational equity in this paper is as follows.

$$LCD_i = 0, \text{ for all i.} \qquad (3)$$

2.2. Measurement of inequality-adjusted inter-generational inequity

Sen's (1973) welfare function is defined by: $W=Y(1-G)$, where Y is per capita income and G is a measure of relative inequality. Or, W is a measure of inequality-discounted per capita income or "that level of per capita income which, if shared by all , would produce the same welfare (W) as the value of W generated by actual distribution of income" (Sen, 1973: p.42).

Using the above Sen's methodology, NTA's per capita labour income (YL) is adjusted for income inequality by age (YL*) as follows.

$$YL_i^* = YL_i(1-G_{yi}) \qquad (4)$$

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[2] Features of NTA's generational economy include (a) economic flows across generations or age groups and (b) intergenerational distribution of income or consumption that results from these flows. (United Nations, 2013)

[3] The concept of intergenerational equity is contextual. For instance, Generational Accounting methodology defines and measures it by Generational Balance between current and future generations by fiscal policy instruments (e.g. taxes and subsidies). This is a case for inter-generational equity in inter-temporal context (Narayana, 2017).

Where G_{yi} is a measure of inequality in labour income distribution at age i.

In the same way, inequality-adjusted per capita consumption (C*) results in

$$C_i^* = C_i (1-G_{ci}) \qquad (5)$$

Where $C_i = (C_{f,i} + C_{g,i})$, is total consumption and G_{ci} is a measure of inequality in distribution of total consumption at age i.

Thus, inequality-adjusted LCD is equal to

$$LCD_i^* = C_i^* - LY_i^* \qquad (6)$$

Equation (6) is a general empirical basis for inequality-adjusted LCD or intergenerational inequity for India. Apparently, (6) is different if either of the inequality is included. That is, if $LCD_i^* = (C_i^* - LY_i)$, or $LCD_i^* = (C_i - LY_i^*)$.

2.3. Measurement of inequality by age and generations

Measurement of inequality in income distribution by age and generations is essential for calculations in (3) to (6). This inequality is measured by standard Gini coefficient. Details of data for empirical measurements of income and consumption inequality are given below in section 3.2 and 3.3 respectively.

3. VARIABLES AND DATA DESCRIPTIONS

Calculation of age profiles of variables in (1) is essential for construction of NTA. Methodology and data requirements for these calculations are given in United Nations (2013). Data for calculation of age profiles of labour income, consumption, LCD, poverty and inequality by age and generations are described below.

3.1. Age profiles of labour income and consumption

Table 1 gives a description of variables and data sources for calculation of NTA-based age profiles of labour income and consumption in 2004-05 and 2011-12. The age profiles

(aggregate and per capita) are calculated for the benchmark year (2004-05) and up-scaled for aggregate controls in 2011-12. This implies that profiles are different by levels but not by shapes. This is plausible due to short interval of the reference years for calculation of these profiles.

3.2. Measurement of income inequality by age

Age profile of income inequality is calculated by distribution of total labour income from wages and salaries of individual workers from all types of employment.[4] That is, standard Gini coefficient is calculated by each age (0 to 90 years) and by age groups [young (0-14 years), youth (15-24 years), adults (25 to 60 years) and elderly (60 + years)]. Databases for the calculations of income inequality are NSS 61st Round (2004-05) and NSS 68th Round (2011-12) on Employment and Unemployment Situation in India.

3.3. Measurement of consumption inequality by age

Consumption inequality (or Gini coefficient) is calculated by distribution of monthly per capita household consumption expenditure (MPCE) by age. MPCE at i-th age is calculated by total household consumption expenditure divided by household size and assigning this per capita household consumption expenditure equally to all household members regardless of their age.[5] This measure of MPCE by age has a limitation of including few expenditures which are not relevant for all ages. For instance, education expenditure may not be relevant to working adults and elderly persons. However, use of MPCE is consistent with India's official reporting

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[4] An alternate data for income inequality measurement for elderly individuals is UNFPA's sample survey on the Status of Elderly in Select States of India, 2011. (UNFPA, 2012), conducted in March-April 2011. The sample size comprised 8329 elderly households (i.e. having at least one elderly member aged 60+) or 9852 elderly individuals in seven states (Himachal Pradesh, Kerala, Maharashtra, Odisha, Punjab, Tamil Nadu and West Bengal) in May-September 2011. These sample states were selected by the criterion of higher percentage of elderly population above the national average. The survey results showed the total personal income (total income from labour and non-labour sources (e.g. salary and wages, farm income, social security income (pensions) and others)] distribution of elderly individuals: Bottom 40 per cent of elderly population had no income; about 50 per cent received 0.43 per cent of income; and top 10 per cent of the population receives 64.21 per cent of total personal income. Our calculation of Gini coefficient for this personal income distribution is 0.78. This UNFPA survey data is not suitable for NTA analysis because (a) personal income cannot be equivalent to labour income and (b) the sample is not nationally representative.

[5]In this simple measure, consumption expenditure is not adjusted for age-specific consumption requirements. This is in contrast with NTA methodology which calculates age-specific profiles for education, health and other consumptions, and uses Equivalent Scale approach to calculate age profile of private consumptions other than education and health.

of consumption inequality.[6] Further, MPCE can be calculated by data on two reference periods: Uniform Recall Period (URP) and Mixed Recall Period (MRP).[7] We use both MRP and URP data to measure consumption inequality by age and generations because URP (or MRP) based consumption data is relevant for official measure of MPCE in 2004-05 (or 2011-12). Databases for consumption inequality calculations are NSS 61st Round (2004-05) and NSS 68th Round (2011-12) on Consumer Expenditure in India.

4. MAIN RESULTS

Main results are presented by a (a) description of inequality by age and generations and (b) comparison between inequality unadjusted and adjusted LCD, by age and generations in the benchmark year (2004-05) and comparisons between 2004-05 and 2011-12.

4.1. Labour income inequality by age and generations

Inequality in distribution of total labour income by age is shown in **Figure 2a** and by generations in **Figure 2b**.

Figure 2a shows that inequality is positive in younger ages (≤ 14 years), possibly due to the presence of child labour, and rises from younger to youth ages and to working adult ages. Inequality starts declining for elderly ages (≥ 60 years). Thus, inequality exhibits a remarkable variation across ages in a lifecycle context. These age patterns of inequality are comparable between 2004-05 and 2011. In general, inequality shows a decline in 2011-12 for all ages except a rise for few ages around 70 years.

Figure 2b shows that inequality for all ages has remained around 0.51, but there are marked variations in decline in inequality between generations. For instance, the highest (or lowest) decline in inequality is evident for adult (or elderly) generation from 0.576 (or 0.45) in 2004-05 to 0.527 (or 0.42) in 2011-12. Thus, in intergenerational context, the level and decline in inequality in distribution of total labour income is remarkable for elderly generation.

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[6] This is evident, for instance, by India's Planning Commission estimates of poverty levels and Lorenz ratios in 2011-12: http://planningcommission.gov.in/data/datatable/data_2312/DatabookDec2014%20101.pdf (accessed on 29 September 2019).

[7] Uniform Recall Period refers to household consumption expenditure over 30 days recall period on all items. Mixed Recall Period refers to household consumption expenditure over 365 days recall period on five infrequently purchased non-food items [clothing, footwear, education, medical care (institutional), and durable goods] and 30 days recall period on rest of items.

4.2. Consumption inequality by age and generations

Consumption inequality by age, measured by the MRP and URP data, is given in **Figure 3a** for 2004-05 and in **Figure 3b** for 2011-12. In general, inequalities rise by age in both years and are higher if URP data than MRP data is used.[8] Further, consumption inequality is positive for all ages with degree of inequality (or value of Gini coefficient) greater than 0.30 (or 30 percent).

Comparison of consumption inequality by generations is given in **Figure 4**. Invariably, consumption inequality by the MRP data is lesser than the URP data for all generations. Further, between 2004-05 and 2011-12, consumption inequality by MRP data has increased for young from 0.305 to 0.322 and elderly generation from 0.346 to 0.384 and declined for other generations. In the same way, by URP data, consumption inequality has increased for young from 0.325 to 0.346 and elderly generation from 0.362 to 0.409. In particular, consumption inequality is highest for elderly generation by MRP data as well as URP data. Thus, inequality for elderly generation is higher regardless of types of data used for measurement. Or, in intergenerational context, a higher level and increase in inequality in distribution of MPCE is remarkable for elderly generation. This result is in contrast with the inequality in distribution of total labour income for elderly generation in Figure 2b.

In sum, over the period 2004-05 to 2011-12, income and consumption inequalities are positive for all ages and show remarkable inter-age and intergenerational differences. For instance, adult (or elderly) generation is characterized by higher (or lower) labour income inequality and a lower (or higher) consumption inequality. This implies that inequality effects are relevant for all ages and generations for calculations in equation (6) for India.

4.3. Inequality-adjusted LCD

Income and consumption inequality adjusted LCD is important to calculate the impact of inequality on inter-generational equity. Given the results in Figures 2 to 4, impact of inequality-adjusted labour income and consumption on LCD by age is calculated using Equation (4) through equation (6). This inequality adjusted LCD is calculated by per capita and aggregate

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[8]Deaton (2005) offers a plausible explanation for inequality measured by MRP data is substantially less than URP data. That is, "because the mean falls and the bottom tails increases, measured dispersion in these purchases is much reduced, and this carries through to total expenditure" (p.183).

in 2004-05 and 2011-12. For comparative analysis, however, results of unadjusted LCD for inequality are calculated and analyzed at first.

4.3.1. Unadjusted LCD

Figure 5a shows the age profiles of per capita LCD in 2004-05 and 2011-12 which are unadjusted for inequality in income and consumption. The deficit age group is from age 0 to 25 years, and from 60 to 90 years. Consequently, the period of surplus generation is 33 years from age 26 to 59 years. Given the assumptions in the calculation of income and consumption profiles in section 3.1, the LCD profiles in Figure 5a show the difference in levels of income and consumption due to bigger size of income and consumption as well as population in 2011-12. In particular, the lifecycle surplus for adults and deficit for younger and older generations are higher in 2011-12 than 2004-05.

Figure 5b summarizes the aggregate LCD by generations. Aggregate LCD for all generations increases from INR2015 billion in 2004-05 to INR2052 billion in 2011-12. This change is result of remarkable changes in LCD by all generations. For instance, aggregate LCD for young (or elderly generation) increases from INR4908 (or INR1054) billion in 2004-05 to INR12751 (or INR 2600) billion in 2011-12. The rise in lifecycle surplus for adult generation is from INR-7186 in 2004-05 to INR-21379 billion in 2011-12.

Will the above surpluses or deficits by age and generations change if adjusted for income and/or consumption inequality? This is answered below.

4.3.2. Income inequality adjusted LCD

If age profiles in Figure 5a are adjusted for income inequality, the resultant age profiles of per capita LCD in 2004-05 and 2011-12 are as shown in **Figure 6a**. Surprisingly, LCD is evident for all ages. This is mainly due to high degree of inequality (Gini coefficient value above 0.48) for all surplus generation ages (26 to 59 years) in Figure 5a. Consequently, income inequality adjusted aggregate LCD shows a big jump in **Figure 6b** (as compared to unadjusted aggregate LCD in Figure 5b) in 2004-05 and 2011-12. This jump in aggregate LCD in 2004-05 (or 2011-12) is equal to INR 4081 (or INR12832) billion for young generation, INR3438 (or INR10108) billion for youth generation, INR2595 (or INR4223) billion for adult generation, INR1093 (or INR3400) billion for elderly generation and INR11206 (or INR30563) billion for all generations. Thus, other things being, the nature and size of

intergenerational inequity is drastically increased in both years and for all generations, if LCD is exclusively adjusted for labour income inequality.

4.3.3. Consumption inequality adjusted LCD

If age profiles in Figure 5a are adjusted for consumption inequality (URP data), the resultant age profiles of per capita LCD and aggregate LCD by generations in 2004-05 and 2011-12 are as shown in **Figure 7a and Figure 7b** respectively. If these calculations are replicated using MRP data, the per capita LCD by age and aggregate LCD by generations in 2004-05 and 2011-12 are shown in **Figure 8a** and **Figure 8b** respectively. These results are in contrast with income inequality adjusted LCD in Figure 5. That is, reduced deficit for young, youth and elderly age groups or generations and increased surplus for adult ages or generation.

Surprisingly, there is lifecycle deficit for all generations in 2011-12 using URP data or MRP data. This result can be explained as follows. Given labour income, and other things being equal, a positive and higher consumption inequality in 2011-12 (Figure 3b) increases the magnitude of LCD by age and generations. For instance, using the MRP data, the consumption inequality adjusted aggregate LCD in 2004-05 (or 2011-12) is equal to INR2719 (or INR8763) billion for young generation, INR-384 (or INR7165) billion for youth generation, INR-22005 (or INR1397) billion for adult generation and INR-230 (or INR2182) billion for elderly generation.

The results on age profile of consumption inequality adjusted LCD in Figure 7a and Figure 8a are in contrast with income inequality adjusted LCD in Figure 6a and unadjusted LCD in Figure 5a. These contrasting results have unique effects on the nature and size of LCD or intergenerational equity by ages and generations.

4.3.4. Income and consumption inequality-adjusted LCD

If adjusted for income inequality as well as consumption inequality, per capita LCD profiles in 2004-05 and 2011-12 are as shown in **Figure 9** (consumption inequality based on MRP data) or in **Figure 10** (if consumption inequality based on URP data). These profiles show a decline in surplus for adults and deficits for younger, youth and elderly as a result of combined impacts of the income and consumption inequalities on LCD.

To quantify the impact of inequality on LCD by generation, changes in aggregate LCD is calculated with and without inequality adjustments in 2004-05 and 2011-12. The results are

given in **Table 2**. Three interesting results are as follows. First, the absolute size of lifecycle surplus for adults and deficit for younger, youth and elderly generations has increased over the years, whether or not the LCD is adjusted for inequality. For instance, over the period 2004-05 to 2011-12, the annual growth rate (or CAGR) of LCD for elderly generation was 13.77 percent year if unadjusted for inequality and 12.42 (or 12.31) percent if adjusted for inequality with MRP (or URP) data. Second, the surplus for adults and deficit for other generations decline in 2004-05 as well as in 2011-12, if adjusted for inequality. For instance, if adjusted for inequality with MRP (or URP) data, the decline in LCD for elderly generation in 2004-05 is about 32.47 (or 36.92) percent in 2004-05 and 37.85 (or 42.37) percent in 2011-12. Third, if adjusted for inequality, the ratio of LCD of other generations to LCD of elderly generation increases over time. For instance, the ratio of LCD for younger to elderly generation increases from 4.66 in 2004-05 to 4.90 in 2011-12 if unadjusted for inequality, and from 4.80 (or 4.98) to 5.35 (or 5.56) if adjusted for inequality with MRP (or URP) data. Thus, the size and growth of lifecycle deficit and surplus by generations are sensitive to adjustments for inequality in general and measurement of inequality in particular.

In short, main results above show that higher inequalities result in bigger inter-generational inequity in general but differential impacts on the nature and magnitude of inequity across ages and generations. In particular, income inequality has bigger effects on increasing inter-generational inequity for all generations than consumption inequality. These results offer unambiguous evidence for inequality effects on inter-generational equity, both cross-sectional and over time, and may have important implications for design of policies for promotion of distributional and growth objectives.

5. FINANCING FOR INTERGENERATIONAL EQUITY

NTA methods provide with an empirical framework for financing LCD or for intergenerational equity in equation (6). The instruments of financing are implied in the Flow Account Identity in equation (1). These instruments are called age reallocations in terms of public and private transfers and asset-based reallocations (United Nations, 2013). Public transfers are distinguished by inflows and outflows of cash and in-kind transfers. Private transfers are distinguished by inflows and outflows of inter-household and intra-household transfers. Asset-based reallocations are calculated by public and private sectors. Public (or private) asset based reallocations are difference between public (or private) asset income and

public (or private) savings. A detailed calculation of inequality adjusted age reallocations is essential to determine the nature and extent of financing LCD by age and generations. However, these inequality-adjusted age reallocations are beyond the scope of this paper.[9]

6. CONCLUSION AND IMPLICATIONS

This paper provides an empirical framework to incorporate distribution considerations (e.g. inequality) into intergenerational equity in India based on the NTA methodology. Intergenerational equity is measured by the concept of LCD and per capita and aggregate LCD is calculated with and without adjustment for inequality in income and consumption in 2004-05 and 2011-12. The main conclusions and implications from these analyses are as follows.

Historically, measurements of consumption inequality in India are not by age and generations. In this context, the approach and results of this paper on inequality by age and generations are contributory to existing policy knowledge in India.

Inequality in distribution of labour income and consumption is important for NTA-based inter-generational equity through changes in LCD. These inequalities have differential impacts on inter-generational equity. In particular, income inequality has a bigger impact on increasing inter-generational inequity than consumption inequality. Further, inequality-adjusted LCD profiles are sensitive for data and measurement of inequalities. Nevertheless, inequalities do matter for attainment of inter-generational equity in India. However, calculation of intergenerational equity and its analyses with redistributive policy interventions in regard to inequality is new for India. The results and evidence of this paper are supportive for policy interventions to reducing the intergenerational inequity by reductions in income and consumption inequalities.

It is important to note that changes in inequality-adjusted labour income and consumption profiles have implications for determination of magnitude and duration of NTA-based demographic dividend through changes in Economic Support Ratio. Thus, reduction in inequality may be useful for attainment of inter-generational equity as well as realization of

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[9]Few papers on NTA research in India have focused on calculation of age reallocations in 2004-05 without adjustment for inequalities. These papers include public age reallocations (Narayana, 2011), private transfers (Ladusingh and Narayana, 2011a) and complete age reallocations (Ladusingh and Narayana, 2011b).

higher economic growth through realization of potential demographic dividend. Estimation of inequality-adjusted demographic dividend in NTA framework is a topic of future research for India.

United Nations Sustainable Development Goal 2 aims at reduction in inequality within and among countries. That target for attainment of this goal is: *By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.* The indicator for attainment of this target is: *Proportion of people living below 50 per cent of median income, by age, sex and persons with disabilities.* Thus, reduction in inequalities is important for India's higher attainment of intergenerational equity, economic growth and SDGs.

Subject to comparability of socio-economic structures, demographic changes and patterns of income distribution, the approach and results of this paper are of general relevance and applicability for developing countries in Asia and Africa.

The results and conclusions in this paper may be qualified by underlying assumptions of NTA model, measurement of income and consumption inequality by age and generations, and data limitations. Hence, they are indicative and subject to refinement with availability of more recent and refined methods and data.

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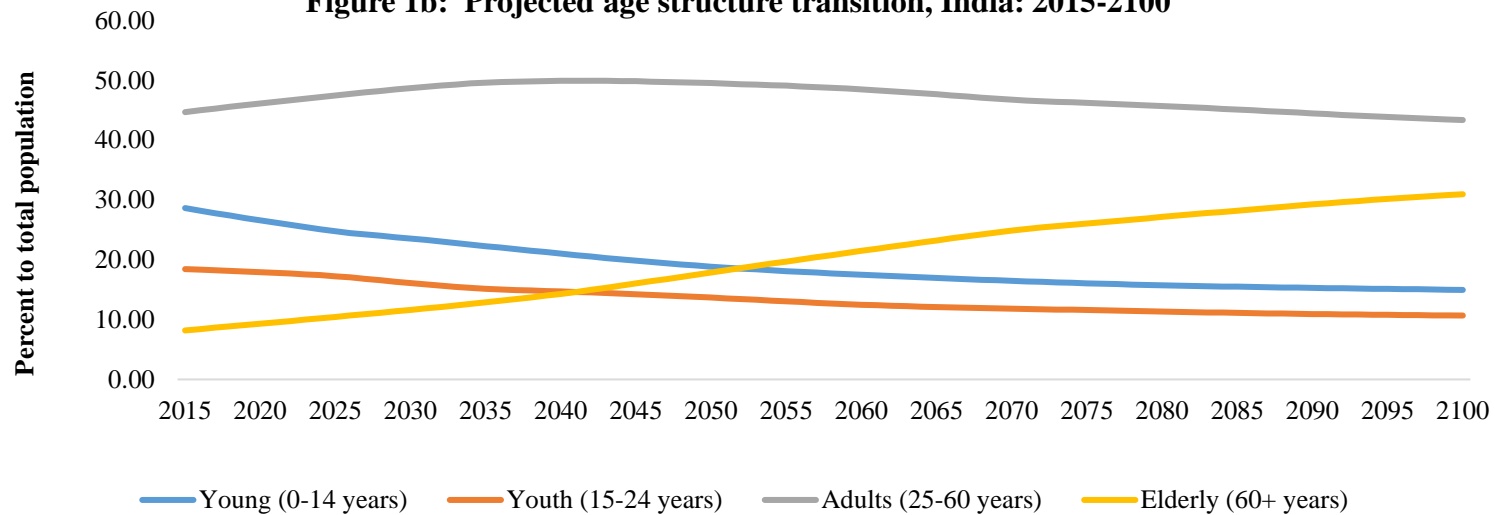
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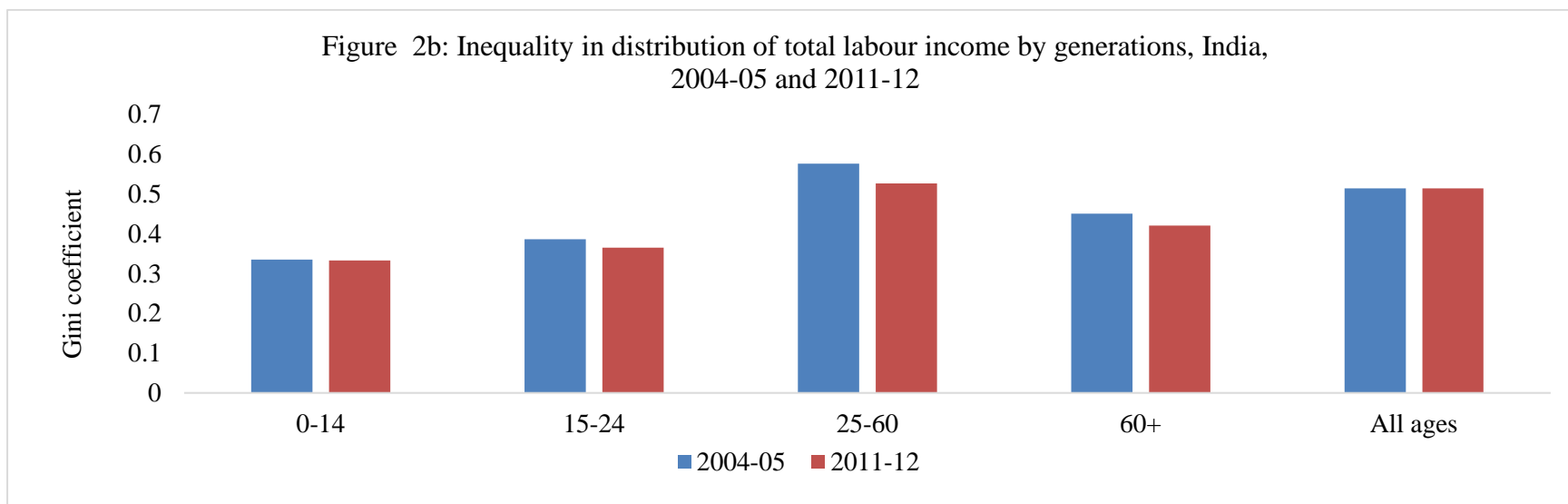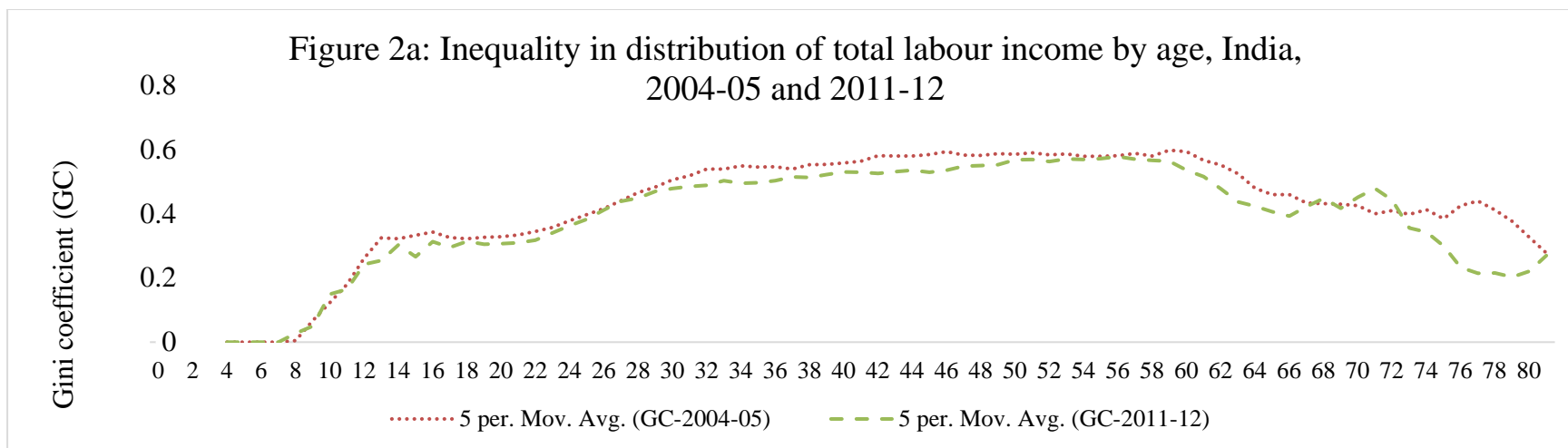
Figure 1a: Age structure transition, India, 1961-2011

Young (0-14 years) — Youth (15-24 years) — Adults (25-60 years) — Elderly (60+ years)
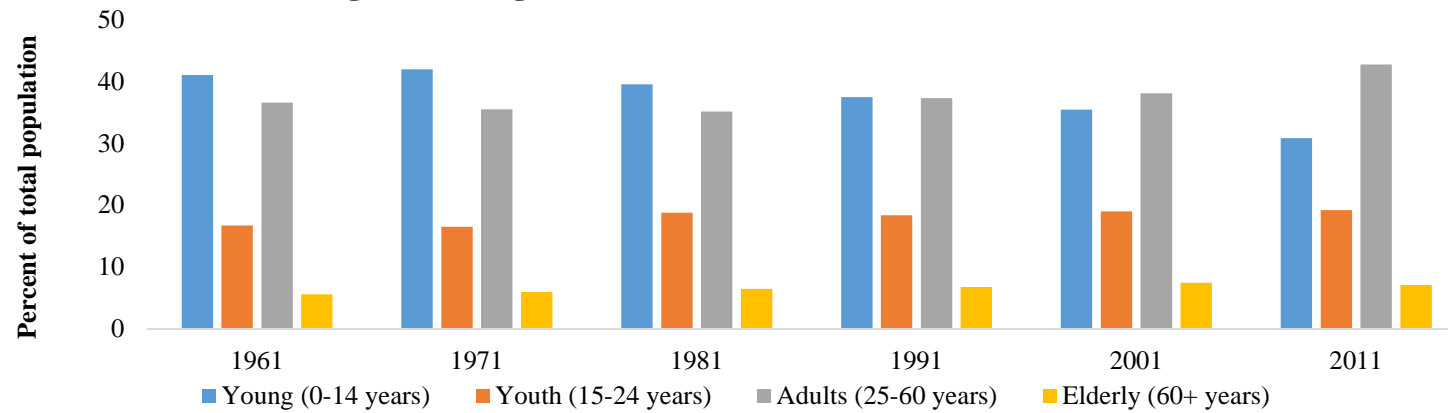
Figure 1b: Projected age structure transition, India: 2015-2100
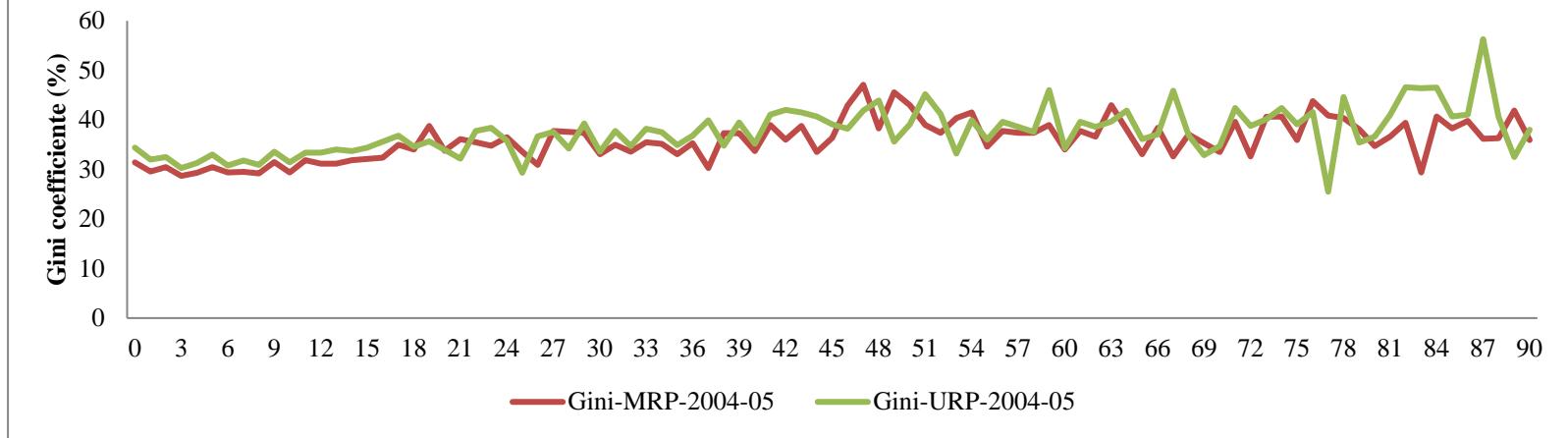
Young (0-14 years) — Youth (15-24 years) — Adults (25-60 years) — Elderly (60+ years)

Source: Author's calculation using Census of India reports from 1961 to 2011 and United Nations (2017).

Figure 2a: Inequality in distribution of total labour income by age, India, 2004-05 and 2011-12

.... 5 per. Mov. Avg. (GC-2004-05)   — — 5 per. Mov. Avg. (GC-2011-12)

Figure 2b: Inequality in distribution of total labour income by generations, India, 2004-05 and 2011-12

■ 2004-05   ■ 2011-12

Source: Author's calculations.

Figure 3a: Gini coefficient by age, India, 2004-05

Gini-MRP-2004-05   Gini-URP-2004-05

Figure 3b: Gini coefficient by age, India, 2011-12

Gini-MRP-2011-12   Gini-URP-2011-12
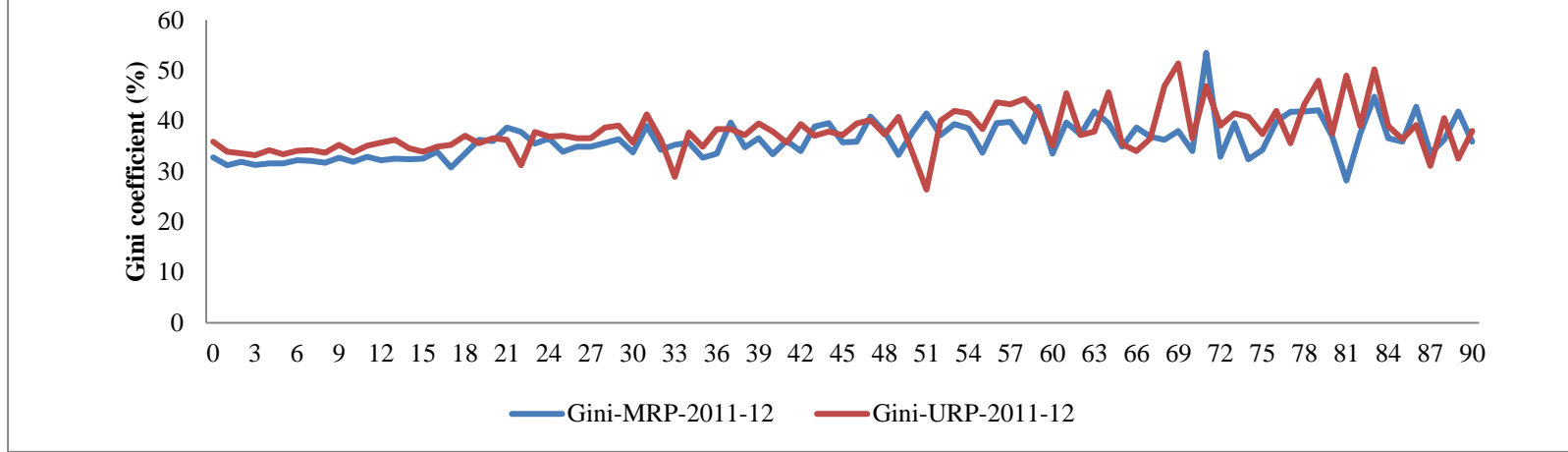
Source: Author's calculations

Figure 4: Consumption inequality by generations, India, 2004-05 and 2011-12
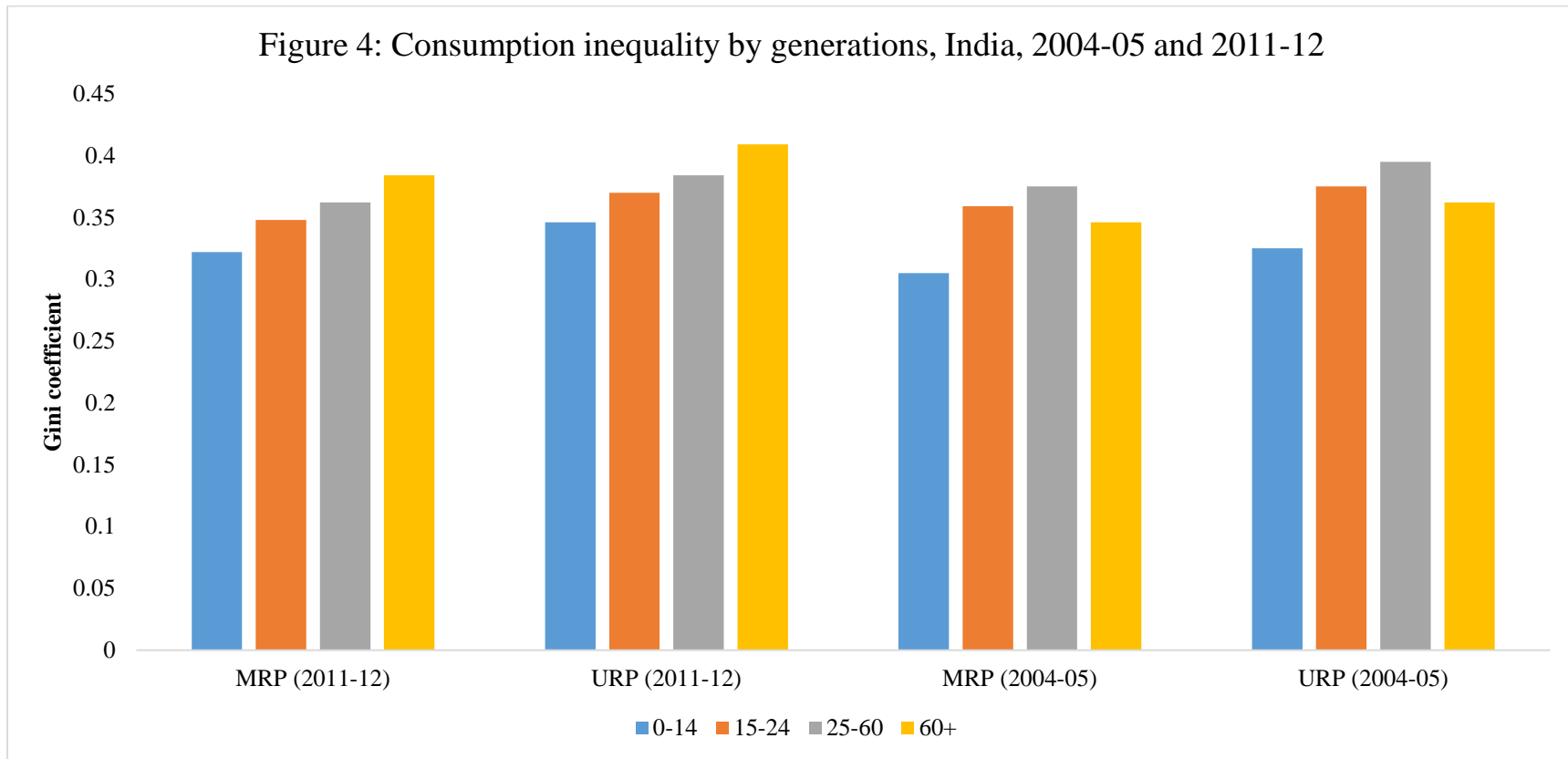
Notes: MRP (or URP) refers to Mixed (or Uniform) Recall Period.
Source: Author's calculations.

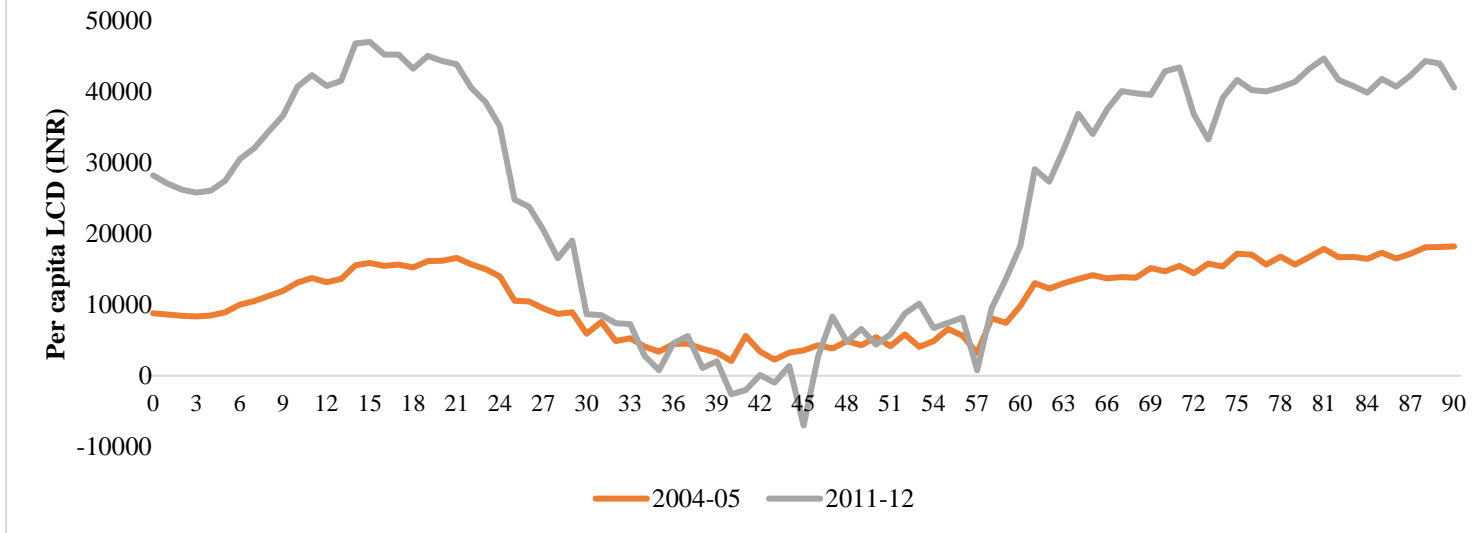Figure 5a: Unadjusted per capita LCD, India, 2004-05 and 2011-12
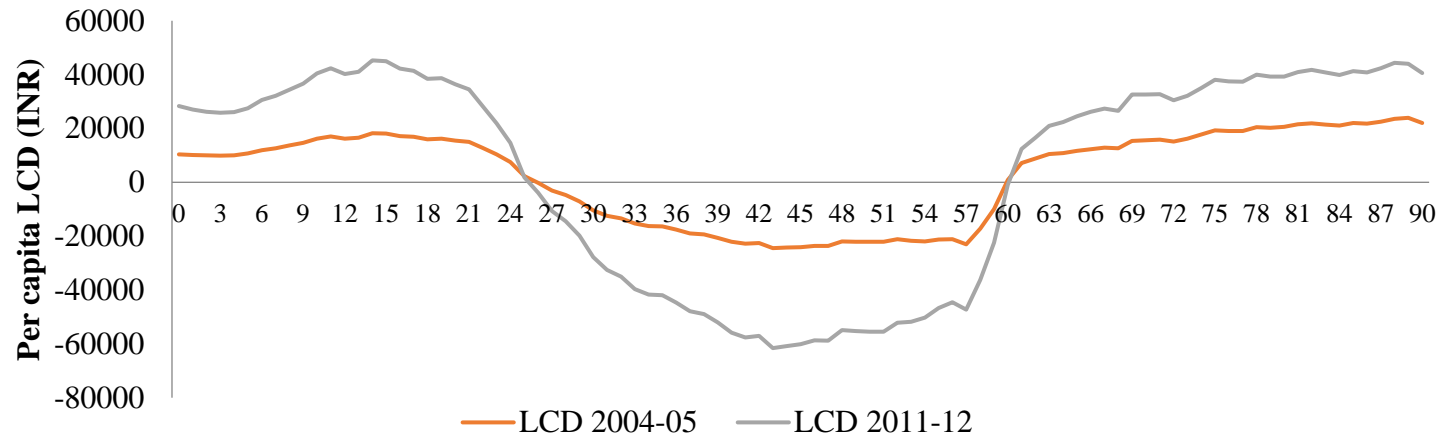
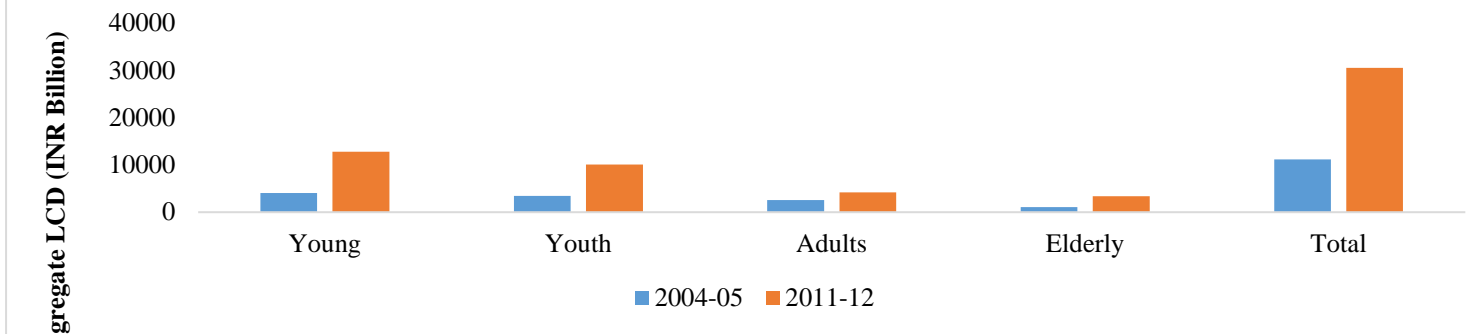Figure 5b: Unadjusted aggregate LCD by generations, India, 2004-05 and 2011-12
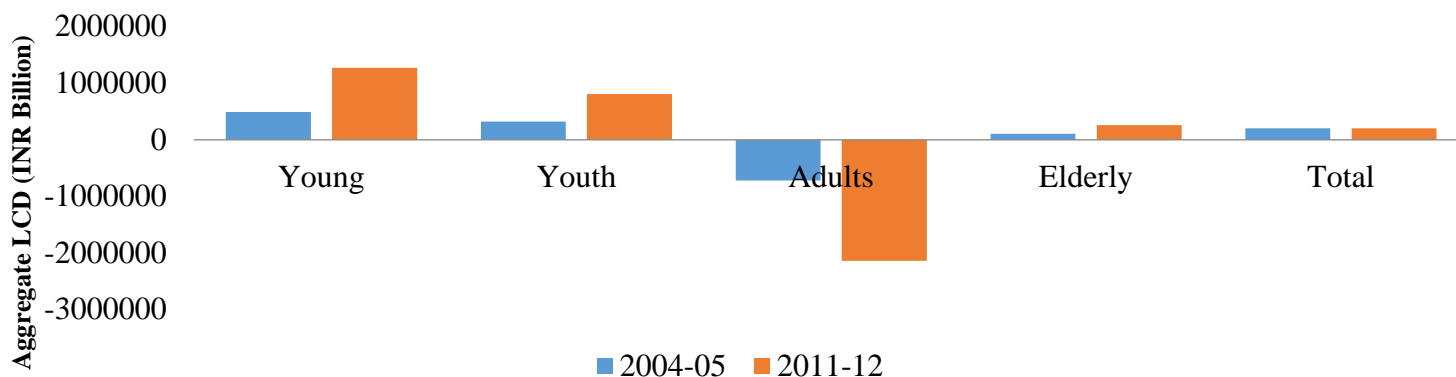
Source: Author's calculations.

Figure 6a: Income inequality-adjusted per capita LCD, India, 2004-05 and 2011-12
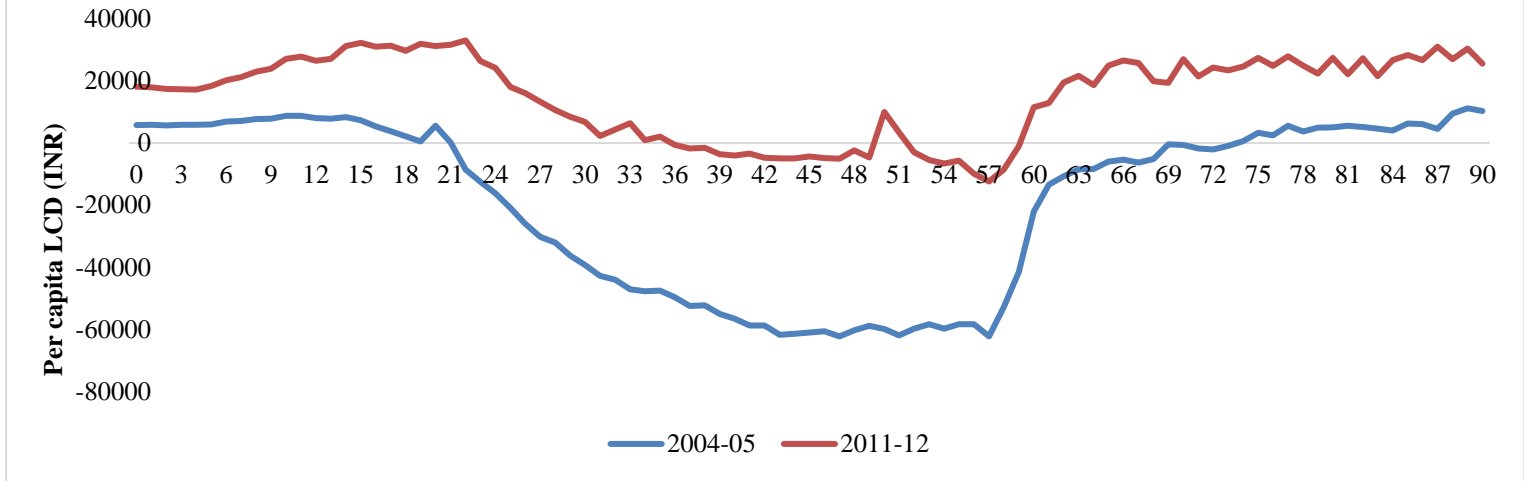

Figure 6b: Income inequality-adjusted aggregate LCD by generation, India, 2004-05 and 2011-12
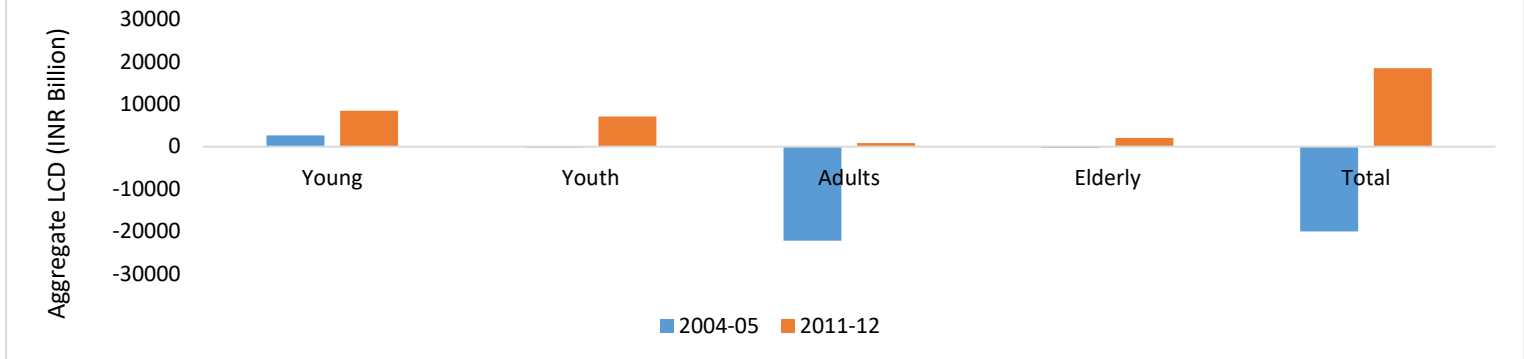
Source: Author's calculations.

Figure 7a: Consumption inequality (URP data)-adjusted per capita LCD, India, 2004-05-2011-12
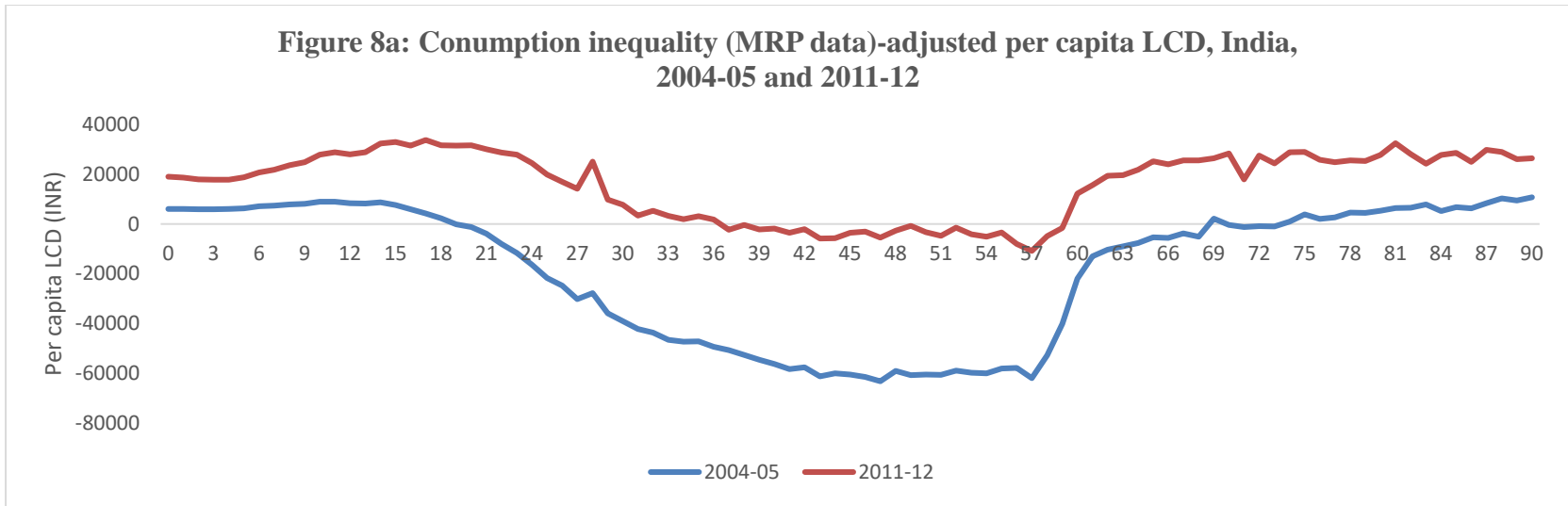
Per capita LCD (INR)

2004-05 ⎯⎯ 2011-12

Figure 7b: Consumption inequality (URP data)-adjusted aggregate LCD by generations, India, 2004-05 and 2011-12

Aggregate LCD (INR Billion)

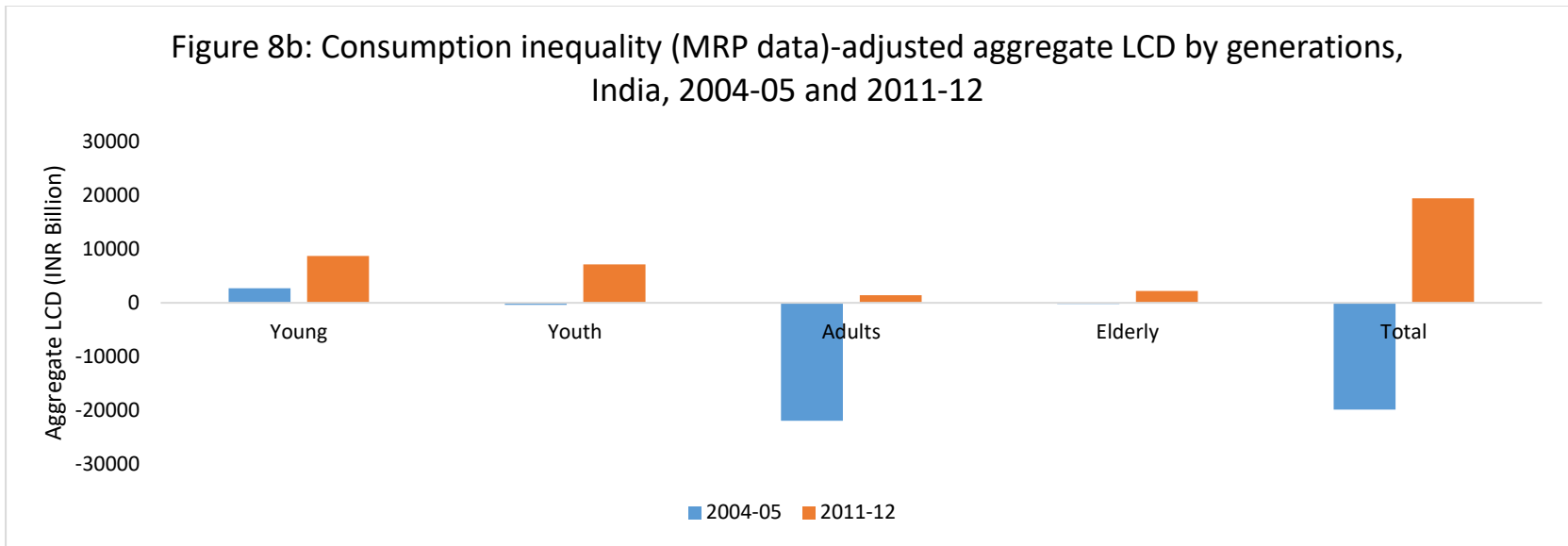Young   Youth   Adults   Elderly   Total

■ 2004-05   ■ 2011-12

Source: Author's calculations.

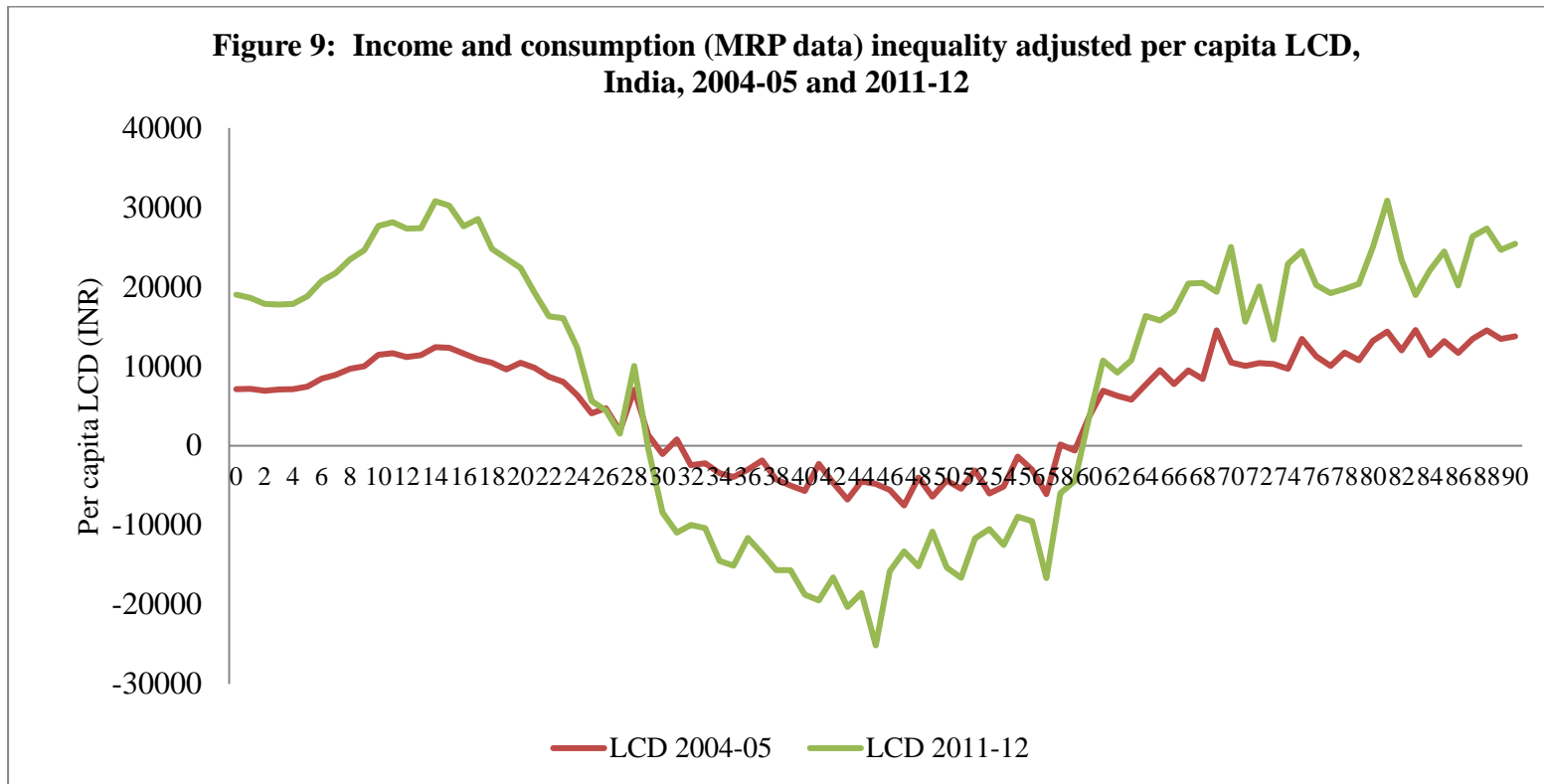Figure 8a: Conumption inequality (MRP data)-adjusted per capita LCD, India, 2004-05 and 2011-12

Figure 8b: Consumption inequality (MRP data)-adjusted aggregate LCD by generations, India, 2004-05 and 2011-12
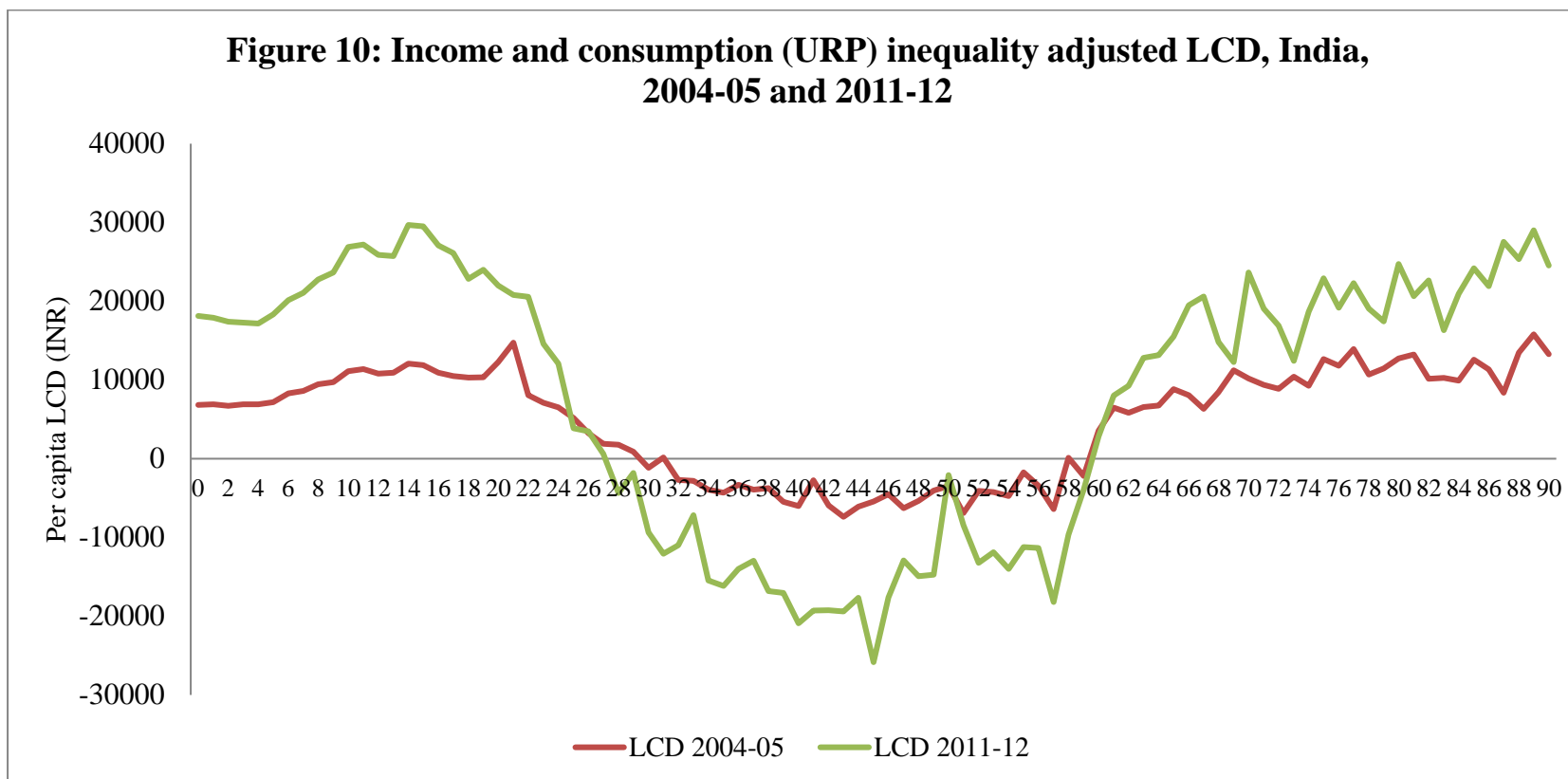
Source: Author's calculations

Figure 9: Income and consumption (MRP data) inequality adjusted per capita LCD, India, 2004-05 and 2011-12

Source: Author's calculations

Figure 10: Income and consumption (URP) inequality adjusted LCD, India, 2004-05 and 2011-12

Source: Author's calculations

Table 1: Aggregate controls, age allocation rules and data sources for calculation of NTA-based age profiles, India: 2004-05 and 2011-12

Variable	Aggregate controls	Age allocation rules and data sources
1. Labour income	Compensation of employees + (2/3) of mixed income + net compensation of employees from rest-of-world	Aggregate and per capita age profiles of labour income are calculated for 2004-05 as in Narayana (2018). That is based on individual income from wages and salaries and household income from self-employment (i.e. farm income and non-farm business income) in the India Human Development Survey 2005 (Desai and Vanneman, 2017). Age profile of self-employment income at household level is calculated by allocating self-employment income of household to individuals in a household who reported as self-employed, using the age profile of mean earnings of employees. Age profile in 2011-12 is calculated by up-scaling the age profile of aggregate labour income in 2004-05 to aggregate control on labour income in 2011-12.
2. Aggregate Consumption (Public and private)	Sum of Government Final Consumption Expenditure and Private Final Consumption Expenditure on education, health and others	Aggregate consumption is equal to sum of public and private consumption by education, health and others. Aggregate and per capita age profiles of public and private consumption by education, health and others is calculated for 2004-05 as in Narayana (2018). Age profile in 2011-12 is calculated by up-scaling the age profile of aggregate consumption in 2004-05 to aggregate control on consumption in 2011-12.

Notes: (a) All aggregate controls are derived and measured by the data in Government of India (2015) and CSO (2018). (b) Except for public education and public health, age allocation rule for all other aggregate controls follows the NTA's general methodology [United Nations (2013)]. (c) UN Population Projections (United Nations, 2017) for India is used for up-scaling and calculation of per capita values.
Source: Author.

Table 2: Size and growth of aggregate LCD in India: 2004-05 to 2011-12

Generation	Unadjusted LCD (INR Billion)		Adjusted LCD (1) (INR Billion)		Adjusted LCD (2) (INR Billion)		Ratio of LCD to elderly LCD					
							Unadjusted LCD (INR Billion)		Adjusted LCD (1) (INR Billion)		Adjusted LCD (2) (INR Billion)	
	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12
Young	4908.43	12751.02	3414.47	8645.56	3310.53	8327.87	4.66	4.90	4.80	5.35	4.98	5.56
Youth	3237.92	8080.10	2177.34	5233.70	2272.45	5194.00	3.07	3.11	3.06	3.24	3.42	3.47
Adults	-7185.50	-21378.82	-955.53	-5400.09	-1177.36	-5931.11	-6.82	-8.22	-1.34	-3.34	-1.77	-3.96
Elderly	1053.97	2599.77	711.73	1615.66	664.89	1498.32	1.00	1.00	1.00	1.00	1.00	1.00
All	2014.82	2052.07	5348.00	10094.84	5070.51	9089.08	1.91	0.79	7.51	6.25	7.63	6.07

Note: (a) Adjusted LCD (1) refers to LCD adjusted to income inequality and consumption inequality (MRP data). (b) Adjusted LCD (2) refers to LCD adjusted to income inequality and consumption inequality (URP data).

Source: Calculated by author.