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Population Contributions to Global Income Inequality: A Fuller Account

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ABSTRACT

Population processes are expected to contribute to global income inequality but so far, studies have mostly documented the contributions of changing population size. Such studies typically decompose global inequality trends into *population size vs. income* effects. We expand decomposition to cover *population size, age structure and worker productivity*, thus giving a fuller account of demographic influences. This expansion reveals a larger influence of population factors than previously recognized. Further, age structure (not population size) wields the larger influence and its acknowledgment helps consider international differences in dependency ratios. The implications and extensions of these findings are discussed.

Key words*: Demographic transitions, population size, age structure, decomposition, global inequality, population growth.*

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1. INTRODUCTION

Social scientists have a long-standing interest in understanding how population processes affect socioeconomic inequality, whether across generations (Mare 2010), within countries (Zhao 2009), or between countries (Firebaugh and Goesling 2004). In particular, recent evidence of global economic convergence between nations[2] has raised questions about its drivers, including the possible role of population trends. Although several population variables deserve attention, past studies have focused on population size. Such studies typically decompose global inequality trends into the influences of national changes in (a) population size and (b) income levels. This basic decomposition yields a crisp and convenient breakdown but, we argue, it narrows the scope of demographic influences while also obscuring theoretically meaningful variables such as population age structure or worker productivity.

To address this limitation, we expand analysis and decompose trends in global income inequality into (a) population size, (b) population age structure, and (c) labor productivity effects. The value of this extension is threefold. First, it gives a fuller account of demographic influences by covering both population size and population age structure; second, it recognizes labor productivity, a central variable in development theory (Easterly 2002); third, it adjusts the record on the economic contributions of nations facing higher dependency rates: Because current decompositions focused on income per capita commingle the effects of labor productivity and age structure, they obscure the productivity gains achieved by these high-dependency countries. Overall, the new framework clarifies how key demographic and economic influences shape global income inequality.

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[2] The direction of this trend is still debated. Early findings were inconsistent, as they ranged from convergence (Radetzki and Johnsson 2001, Sala-i-Martin 2002, Firebaugh and Goesling 2004) and divergence (Korzeniewicz and Moran 1997; Pritchett 1997; Bourguignon and Morrison 2002, and Milanovic 2002) to stability (Schultz 1998; Melchior and Telle 2001) and fluctuation (Boltho and Toniolo 1999). The emerging story is one where global inequality between countries is high but declining (Sala-i-Martin 2002; Firebaugh and Goesling 2004). Studies also suggest going beyond income to examine consumption or wellbeing (Neumayer 2003; Kenny 2005; Goesling and Baker 2008; Decanco et. al. 2009).

2. **BACKGROUND**

The last half-century has been a time of profound but uneven demographic change. Central among these was a halving of world fertility, from 5.3 in 1962 to roughly 2.5 today. Combined with lower mortality, this decline in birth rates has altered the size, growth, and age structure of the world population. Because trends varied across world regions, they led to a gradual concentration of demographic growth in developing countries, and ageing in more developed countries (UNFPA 2009).

Such regional differences can fuel global income inequality, for reasons that are both substantive and mechanical. Substantively, cogent arguments suggest how the size, growth, and age structure of national populations might impinge on savings, investment and –ultimately— economic growth (NRC 1986; Bloom et al. 2002). Mechanically, the size and structure of national populations feature prominently in calculations of income per capita and worker productivity. Despite these expectations, studies of how population affects global income inequality remain hindered by theory and design issues. Unlike inequality within countries (Kuznets 1955), few theories have been propounded to explain trends in global inequality, outside the possible influence of globalization (Birdsall 2002; Stiglitz 2003; Firebaugh and Goesling 2004; Bhagwati 2004). In addition, since they take the world as unit of analysis, studies of global inequality lack a comparison group. Analysts must thus rely on weak designs that compare global inequality over time.

Short of fully explaining global inequality, researchers can at least *account* for it, i.e., estimate how much its trends are driven by specific countries or by proximate processes such as economic or population growth. This accounting relies on decomposition methods. Some apportion global inequality into "within vs. between region" components (Peacock et al. 1988)[3] while others attempt to investigate "within vs. between country" components (Sala-i-Martin 2002). The former suffer from lack of detail while the latter suffer from lack of data (Deininger and Squire 1996). Accordingly, studies usually focus

[3] Peacock *et al* (1988) draw on world systems theory to compare the contributions of "core," "periphery," and "semi-periphery" countries. Using purchasing power parity data for 1950-1980, they decompose the Theil index based on population and Real GDP per capita. They find an increase in between zone inequality, which they attribute to differential changes in population and to India's slow growth. Because their study uses a small and selected sample (53 countries, former socialist countries excluded), their findings should be taken with caution.

on inter-country comparisons,[4] looking at the contributions of "economic" and "demographic" factors (Bourguignon and Morrisson 2002; Firebaugh 1999; and Firebaugh and Goesling 2004).

This simple decomposition in terms of population size and income per capita ("PI decomposition" hereafter) is quite useful as a starting point. It is computationally easy; it gives a parsimonious account based on two familiar variables; and it yields an intuitive interpretation where world inequality evolves as a result of changing income differences between the average citizens of different countries versus changing distribution of world population across countries. Put simply, inequality can grow because people in rich countries become richer on average or because rich countries are housing a bigger share of the world's population, compared to middle income countries.

Yet the PI decomposition has four shortcomings. First, it reduces demographics to population size. In so doing, it ignores age structure, a central theoretical variable in population-development debates (Bloom et al. 2002; Merrick 2002; Ross 2004; Mason and Lee 2005). Second, it artificially constrains the size of the population effect: because the population variable being used (national shares of global population) fluctuates very little in the short-run for most countries, analyses will predictably find modest influences for population. Third, by lumping worker productivity and age structure together (under the umbrella of income per capita), the PI decomposition obscures the specific effects of each of these two variables. This is unfortunate because population age structure and worker productivity are key variables in development theory (Easterly 2002). Fourth and finally, omitting age structure biases comparison of countries' economic contributions to global income inequality. It specifically understates the economic contributions of countries that have high age-dependency ratios. In other words, it obscures the fact that these countries' aggregate economic output is produced by a comparatively smaller working-age population.

These shortcomings can be addressed with a slight extension. Instead of focusing on the "population size –income" binome, the idea is to decompose inequality trends in terms of (a) population size, (b) age structure, and (c) labor productivity effects. This approach

[4] Global inequality is the sum of "within country" and "between country" inequality, but Sala-i-Martin (2002) estimates the latter component represents 70% of total inequality.

(PAL decomposition hereafter) is almost as succinct as the PI decomposition, but it is substantively richer. It has better theoretical grounding because it focuses on labor productivity and population age structure, two key concepts in the economic and demographic literature on development. Indeed, even analysts using the PI decomposition have recognized the importance of age structure and productivity but believed "*these [variables] could not be addressed with standard decomposition techniques*" (Firebaugh and Goesling 2004:300). This is the problem we address.

3. THE EXTENSION

Formally, global inequality between countries can be described as a function of countries' population (p_j) and incomes (i_j). Income here is specifically the national income ratio, i.e., the country's income per capita relative to the world's average. Population size likewise is the share of global population found in the index country j. Common measures of inequality (the Theil index, coefficient of variation, Gini coefficient, and Mean Logarithmic Deviation (MLD)) can be expressed in terms of these two factors (Firebaugh 1999). If one picks the MLD as a measure of inequality, then global income inequality during year t is given as

$$MLD_t = \sum p_{jt} * \ln\left(\frac{1}{i_{jt}}\right) \qquad [1]$$

The change in global income inequality between two years, under the PI decomposition, is obtained as

$$\Delta MLD \cong \underbrace{\left[\sum\left(\bar{i}_j - \overline{\ln(i_j)}\right) * \Delta p_j\right]}_{\textit{Pop size effect}} + \underbrace{\left[\sum\left(\overline{p_j i_j} - \bar{p}_j\right) * \Delta \ln(i_j)\right]}_{\textit{Income effect}} \qquad [2]$$

where barred values represent averages, and Δ marks change between two time periods. For instance, when studying change in global inequality between 1980 and 1990, $\bar{i}_j$ $=(i_{j(1980)}+i_{j(1990)})/2$, *and* $\Delta p = p_{1990} - p_{1980}$. This formula is an approximation. Although an exact formulation can be developed, the approximation is preferable for the purposes of this study: Among others, it facilitates comparison with previous studies and it makes it possible to clearly separate population and income effects (see Appendix note 2).

Our proposed expansion simply recognizes how countries' incomes per capita (i_j) are the product of their labor productivity (π_j) and population age structure (α_j). In other words

$$i_j = g_j/n_j = (g_j/a_j) * (a_j/n_j) = \pi_j \alpha_j \qquad [3]$$

where *g*, *n*, and *a* are the national income, the total size of the national population, and the size of the working age population, respectively.

Plugging [3] into [2] yields a fuller decomposition of inequality in terms of countries' population size (p_j), share of population in working ages (α_j), and labor productivity (π_j).

$$\Delta MLD \cong \underbrace{[\sum(\bar{i}_j - \overline{\ln(i_j)}) * \Delta p_j]}_{\textit{Pop size effect}} + \underbrace{[\sum(\overline{p_j i_j} - \bar{p}_j) * \Delta \ln(\alpha_j)]}_{\textit{Pop age structure effect}} + \underbrace{[\sum(\overline{p_j i_j} - \bar{p}_j) * \Delta \ln(\pi_j)]}_{\textit{Productivity effect}} \qquad [4]$$

With appropriate data, one can apply this PAL decomposition and examine the substantive differences with conclusions reached under the simpler PI approach.

4. DATA AND METHODS

Our empirical analysis draws on the World Bank's Development Indicators, a database containing over 850 economic, environmental and social variables for 209 countries and territories spanning the years since 1960. The World Bank compiles these data from various sources including United Nations Population Division's World Population Prospects, national statistical offices, household surveys conducted by national agencies, and Macro International. To study trends in global inequality, we used two population variables (total population, and proportion of national population aged between 15 and 64) along with income measures, specifically GDP per capita, adjusted for purchasing power parity (PPP) and derived at constant 2005 international dollars.

Although the database is extensive, it is plagued by missing data which raise concern about small sample size and selection bias. At the time of our analysis, the data satisfactorily covered only 139 countries and territories and the period from 1980 to 2008. Fortunately, this sample of countries represents about 90% of the 2008 global population. Some of the missing income data (1.2% of the cases) was imputed by linear interpolation.

The corresponding countries and years are listed in appendix 1. If the omitted countries tend to be unusually poor, our measure of inequality will be distorted. This bias is likely small however, because most missing countries had very small population sizes (see appendix 1).

Beyond missing data, global comparative studies such as ours must worry about the comparability of national statistics. One of our key variables, GDP per capita, could contain some inconsistencies because it is derived from national accounts and balance of payment data from two sources; the World Bank's country management units and from local government sources. However, there are deliberate efforts to ensure consistency, and these should increase confidence in the international comparability of the data.[5] Another concern is the sensitivity of inequality trends to the measures of GDP used. This question has been raised in previous studies, given the early inconsistent findings reported by different studies using different measures[6]. Much of this inconsistency reflected methodological differences, such as failure to adjust incomes for purchasing power, to weigh countries by population size, to distinguish between-country from within-country inequality, or to consider differences in sample composition (Firebaugh and Goesling 2004; Birdsall 2002; Svedberg 2004). For instance, divergence is most likely found in studies using income ratios and not weighing by population (e.g., Pritchett 1997; UNDP 1999; World Bank 2000/1) and those using foreign exchange based income data (e.g., Korzeniewicz et al. 1997).

By adjusting for purchasing power parity, by covering a large share of global population, and by weighing by population size, we conform to current best practice. More importantly, our paper's primary objective is to compare results under the PI and PAL decompositions. In that perspective, the specific GDP measure used is less of a concern, as

[5] The World Bank's General Data Dissemination System (GDDS) is a framework that assesses national statistical systems, encourages countries to improve the quality of official statistics, and helps evaluate data improvement needs while setting priorities for statistical development. In collaboration with the International Monetary Fund, the World Bank also developed the Data Quality Assessment Framework (DQAF), to assess data quality and bring together best practices and internationally accepted concepts and definitions in statistics. Together, these initiatives increase confidence on key published economic and population statistics.

[6] See footnote 1

long as the same measure is used in both decompositions. A more critical variable in that regard might be age structure, since it enters the PAL but not the PI decomposition. Fortunately, this variable is among the most basic variables collected by administrative sources and surveys. Cases of age heaping are certainly common in low literacy settings (A'Hearn, Baten and Crayen 2006) but they are most problematic in situations where – unlike here—researchers study single years of age.

5. FINDINGS

5.1.Trends in global inequality

Figure 1 and appendix table 1 summarize the study findings about global inequality trends between 1980 and 2008. Trends are shown for several measures of inequality (the Theil, CV^2, MLD, and Gini coefficient).[7] The graph shows a fairly steady decline, ranging from -15% to -41%, depending on the measure used. This variation across measures is expected and consistent with previous studies. Detailed analysis over successive five-year periods shows a monotonic –albeit non linear—decline. At any rate, the convergence here reproduces other recent findings (Firebaugh and Goesling 2004; Salai~Martin 2002) and the main challenge here is to account for these trends.

[Figure 1 about here]

Before turning to this task, we examine our earlier claim that the effects of population size (countries' share of global population) are likely to be small because this variable does not change much in the short run. To this end, Appendix Table 2 shows the 1980-2008 changes in population shares and compares these to changes in relative incomes, relative age structure, and relative productivity, respectively. As the table indicates, the changes in population shares averaged 0.001 units, with only two countries (China (.03) and India (.015)) exceeding 0.01 units. Confirming this constancy, top rankings moved little, with the most populous countries [China, India, United States, Indonesia, Brazil] maintaining

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[7] These measures are all derived from income ratios (i_j) and population shares (p_j) as follows: MLD= $\sum_j p_j \ln(1/i_j)$; Theil= $\sum_j p_j i_j \ln i_j$; CV^2= $\sum_j p_j (i_j - 1)^2$; The Gini is likewise expressed as Gini= $\sum_j (p_j * i_j * (q_j - Q_j))$ where qj and Qj represent the share of the world population living in countries poorer (or richer, respectively) than the index country.

their ranking throughout the study period (data not shown). In contrast, the change in relative incomes averaged 0.67 units, i.e., nearly 60 times the average change in population shares. Further, the rankings on this variable were reshuffled, as the top five countries changed from (United Arab Emirates, Brunei, Kuwait, Saudi Arabia, Switzerland) in 1980 to (Luxembourg, United Arab Emirates, Macao, Norway, and Kuwait) in 2008 (data not shown). Similar variability is observed for relative worker productivity and age structure. Ultimately, because national shares of global population vary so little in the short-run, this restricts how much they can influence change in global inequality.

5.2. Accounting for global inequality trends

5.2.1. Substantive contributions. Table 1 shows the study findings about the contributions of population and economic factors to the decline in global inequality between 1980 and 2008. The table compares the findings under PI and PAL decompositions. The differences, if any, are examined for the entire 1980-2008 period and for each five-year periods indicated in the left-most column. The next column shows the total change in inequality for the entire study period and for individual 5-year periods. They confirm data in the earlier chart showing a steady decline through the entire period. Each of the 5-year periods shows a negative trend, although the magnitude of the decline in MLD is greater for 1980-85 (-.091), 1990-95 (-.098), and 2000-08 (-.150) than it is for 1985-90 (-.044) or 1995-2000 (-.037).

[Table 1 about here]

The next two columns in the table show results under a PI decomposition, which breaks the total change in global inequality into the influences of relative population size and income per capita. For the entire study period, the "economic" component accounts for almost all the trend in inequality (98.5%), with "population" accounting for a minuscule percentage (1.5%). A detailed analysis by 5-year periods confirms this basic story. Additionally, it reveals some historical changes in the contributions of population size. Throughout the 1980s, the global population changes worked to reduce global income inequality, reflecting the global demographic convergence posited by Wilson (2001). Indeed in 1985-90, change in population size accounted for as much as 13% of the total trend in global income inequality. Since the mid-1990s however (and particularly since

2000), population trends have raised, rather than reduce global income inequality between countries. Altogether, the contributions of population size to global inequality changed in magnitude and direction during the study period, but they remained much smaller than the contributions of changes in relative incomes per capita. Insofar as countries' incomes converged, this was mostly a result of economic, rather than demographic, convergence.

The expanded (PAL) decomposition shows a more nuanced story. Although the "economic" factor remains dominant, it is not as overpowering as in the simpler PI decomposition. For the entire study period, it accounts for 85% (as against 98.5%) of the total change. Indeed, there are periods when demographic variables account for a full quarter (1995-2000) or even a third (1985-90) of the total change. Interestingly, age structure --not population size— emerges as the more influential demographic factor. At no point during the study period (except 1980-85 when the two influences were virtually identical) did the effects of population size exceed those of age structure. In addition, the effect of age structure was steadier, and worked to reduce global income inequality throughout the study period. In clear, by reducing population to its size, one ignores population's leading factor. When age structure is included into the analysis, we gain a fuller account of the total influences of population. We gain a finer understanding of economic contributions as well. Instead of income per capita, the analyses focus on productivity, thus providing a less proximate and tautological explanation of global income inequality.

5.2.2. Regional contributions: After looking at processes, we now examine which regions contributed most to the observed decline in global inequality. We also specify how each region contributed, i.e., whether through economic or demographic processes. The results are shown on Table 2.

[Table 2 about here]

Confirming previous findings, East Asia and sub-Saharan Africa (SSA) were the main regional drivers of recent trends. East Asia accounted for 95% of the decline, while SSA contributed -29%: inequality would have declined even further had it not been for SSA, the only world region not converging. Other regions such as Western Europe (17%)[8] and South Asia (13%) contributed as well. Looking at how regional contributions evolved in recent decades, the super-dominance of East Asia has ebbed in the last decade in favor of more balanced contributions from several regions, namely South Asia (20%), Western Europe (19%), North America (17%), and SSA (-16%). While East Asia's contributions exceeded the 100% mark in the first twenty years of the study period, they fell to 62% in the 2000-2008.This new trend deserves attention.

Finally, we looked at the sources of influence within each world region. For instance, which processes account for East Asia's dominant role? The most influential processes throughout the entire study period include productivity gains in East Asia (-0.28), productivity gains in South Asia (-0.09), relative population growth in SSA (0.07), relative population decline in East Asia (-0.07), relative population decline in Western Europe (-0.06), and relative population growth in South Asia (0.05). These six influences remained fairly steady during the study period, but the influence of Africa's population appears to be rising.

Findings vary depending upon unit of analysis. When countries are used as units, age structure --not populations shares—is the dominant influence (see earlier Table 1). The reverse is true when regions are used as units: the region's shares of the global population –not age structure—become the dominant influence. The reason for this reversal in findings has to do with the mathematical properties of these two variables. Within a region, the population shares of member nations add up, while their age structures do not. This ecological fallacy, where findings vary depending on aggregation level (Robinson 1950; Berry and Martin 1974), is noteworthy. Studies using the simpler (PI) decomposition had often reported their findings at the regional but not the country level. Such aggregate reporting easily fails to note the artificially low contributions of population size to global inequality, as well as the reversal in findings when shifting from country-level to regional analysis.

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[8] We use the label Western Europe to refer to countries belonging to Europe and Central Asia but Russia and other former Soviet Union states (Appendix list of countries included). These countries are not included because of data availability.

6. **CONCLUSIONS**

Studies of how population affects global income inequality often focus on the contributions of changing population size. Typically, they account for trends in global income inequality by decomposing these into the effects of changes in nation's population size and income per capita, respectively (PI decomposition). We broaden analysis by considering both the size and age structure of national populations, in addition to economic productivity (PAL decomposition).

This broader formulation generates several new insights. First, it captures two theoretically important variables, age structure and productivity. Explanations of global income inequality using these two variables are much less tautological than those based on income per capita alone. Second, the PAL decomposition gives a fuller account of population influences, by going beyond the PI's exclusive focus on population size. Indeed, it suggests that age structure, not size, may be the more influential population variable. Third, the PAL framework clarifies the record on national contributions via the "economic" component. What is labeled "economic" component under the PI framework is in fact a mix of economic and demographic influences. Instead of commingling the effects of age structure and productivity, the PAL framework separates them. Separation is warranted because productivity is theoretically important, but also because failure to do so biases estimation of the "economic" component. In short, the broader PAL decomposition reveals a greater role for population than assumed under the simpler decomposition. It further suggests age structure (not population size) as the more influential variable. Beyond clarifying the influence of population processes, the framework further advances understanding of economic contributions, by avoiding an under-estimation of the gains in economic productivity achieved by countries plagued by higher dependency ratios. The findings ultimately suggest that a PI decomposition biases understanding of both population and economic contributions to trends in global inequality. Importantly, the direction and extent of this bias vary across countries, regions and time periods. The bias is downward (under-estimating the economic contributions) in countries with rising dependency ratios, and upward in the reverse case. Insofar as poorer countries experience slower declines in fertility, this under-estimates their economic contributions. Similar under-estimation affects ageing nations

The framework permits two additional insights. Before we discuss these, three important caveats must be recalled. First, this is an accounting, not an explanatory, framework. Knowing that changes in age dependency account for, say, 20% of recent trends in global inequality is useful but insufficient. Results from decompositions must be complemented by insights from other investigations, if one is to explain why the differentiation in dependency occurred. Second and relatedly, our decomposition only covers the *mechanical* effects of population variables, even though population processes may also have *substantive* effects on productivity (NRC 1986; Bloom et al. 2002). If researchers can generate reliable estimates of these substantive effects, they can be incorporated in the analysis, and improve assessments of the total effects of population processes on global income inequality. Third, although the PAL decomposition improves the basic PI decomposition, its components can themselves be seen as the result of other sub-processes that require understanding. For instance, labor productivity reflects a combination of employment rates and productivity; age dependency can be seen as reflecting a combination of young and old-age dependency, changes in population size could be seen as reflecting the contributions of natural growth and immigration.

Fortunately, the decomposition presented here can be extended further. Equation [3] expresses the national income per capita as a function of the productivity of working age populations and the share of working age populations. One can follow the same logic and add employment rates in the mix, so that national incomes per capita now depend on the productivity of the employed, the employment rates, and the share of working age populations[9]. One can likewise subdivide the effects of age dependency into youth versus old age dependency. Assuming good data are available, this finer parsing of the evidence would improve our understanding of how population change has contributed to global

[9] To recall, national incomes per capita (i) were in their crudest form expressed as national GDP (g) divided by the total population (n), i.e., i=g/n. Our first decomposition expanded this formulation to consider the difference between working age groups (a) and others. The resulting formulation was i=(g/a)*(a/n). Following the same logic, one can further separate the working age population between the employed (e) and the rest, giving rise to an even finer description: i=(g/e) *(e/a) *(a/n)

income inequality in recent years. Indeed, the framework can support efforts to project future trends in global inequality, using the UN's demographic projections, and under varied assumptions about GDP growth. The coming decades are interesting in that regard. In the next 40 years, the age dependency ratios of the more developed regions is projected to rise (from about 48 in 2010 to 71 in 2050) due to continued rise in old age dependency while child dependency stabilizes at about 25. In less developed regions (excluding China) on the other hand, dependency is projected to decline steadily because of falling birth rates. Only after 2050, will dependency rise again, under the influence of aging. Therefore, the next decades may continue to see a decline in global between-country inequality, assuming current economic trends are maintained. However, this decline would stall in the middle of this century, as aging take holds in less developed countries. In sum, the fertility and aging transitions under way across the world will likely shape trends in global economic inequality. Understanding this demographic influence requires going beyond an exclusive focus on population size.

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APPENDIX NOTE 1: **STUDY SAMPLE**

- **List of countries in the study sample :**The 139 countries and territories in our study are located in the following regions:

East Asia and Pacific (Australia, China, Fiji, Hong Kong, Indonesia, Japan, Republic of Korea, The Democratic Republic of Korea, Lao DPR, Macao, Malaysia, Mongolia, New Zealand, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Thailand, Tonga and Vanuatu);

Western Europe (Albania, Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Moldova, Netherlands, Norway, Portugal, Romania, Spain, Sweden, Switzerland, Turkey, United Kingdom) ;

Latin America and the Caribbean (Argentina, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Peru; St. Lucia, St. Vincent and Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela);

Middle East and North Africa (Algeria, Bahrain, Egypt, Iran, Israel, Jordan, Kuwait, Malta, Morocco, Oman, Saudi Arabia, Syria, Tunisia, United Arab Emirates);

North America (Canada, and the United States of America);

South Asia (Brunei, Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka);

Sub Saharan Africa (Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, cape Verde, central African Republic, Chad, Comoros, The Democratic Republic of Congo, Congo Republic, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Togo, Uganda, and Zambia).

- **List of countries not included in the sample**: Apart from Russia and its former states (which did not have data for 1980-89, the period before the dissolution of the Soviet Union), the other countries and territories **not included** in our analysis are: American Samoa, Andorra, Antigua and Barbuda, Aruba, The Bahamas, Barbados, Bermuda, Bosnia and Herzegovina, Cambodia, Cayman Islands, Channel Islands, Cuba, Djibouti, Dominica, Eritrea, Faeroe Islands, French Polynesia, Greenland, Guam, Iraq, Isle of Man, Kiribati, Lebanon, Libya, Macedonia, Maldives, Marshall islands, Mayotte, Micronesia Fed. States, Monaco, Montenegro, Myanmar, Netherlands Antilles, New Caledonia, Northern Mariana Islands, Palau, Puerto Rico, Qatar, San Marino, Sao Tome and Principe, Seychelles, Somalia, St. Kitts and Nevis, Tanzania, Timor Leste, Vietnam, US Virgin Islands, West Bank and Gaza, Yemen Republic, and Zimbabwe. Then we have Russia and former Soviet states such as Armenia, Azerbaijan, Belarus, Croatia, Czech Republic, Kazakhstan, Kyrgyz

Republic, Liechtenstein, Lithuania, Poland, Serbia, Slovak Republic, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

- **List of countries and years with interpolated data**

Five years: Angola (1980-1984); Equatorial Guinea (1980-1984); Kuwait (1990-1994).

Four years: Estonia (1995-1998); Lao PDR (1980-1983);

Three years: Bahrain (2006-2008);

Two years: Macao China (1980-1981); Samoa (1980-1981); Oman (2007-2008); Uganda (1980-1981); United Arab Emirates (2007-2008); Kuwait (2007-2008)

One year: Bhutan (1980); Brunei Darussalam (2008) Cape Verde (1980); Cyprus (2008); Ethiopia (1980); Malta (2008) Mauritania (2008); Mongolia (1980); Tonga (1980)

Table 1. Decomposition results for the contributions of economic and population factors to the 1980-2008 change in global income inequality: PI and PAL decomposition compared

PERIOD	TOTAL CHANGE	DECOMPOSITION RESULTS				
		PI Decomposition		PAL Decomposition		
		% change in inequality associated with changes in		% change in inequality associated with changes in		
		Population size	Income	Population Size	Age Structure	Labor Productivity
1980-2008	**-0.393**	-0.006	-0.387	-0.006	-0.052	-0.336
		1.5%	*98.5%*	*1.5%*	*13.1%*	*85.4%*
1980-1985	**-0.091**	-0.008	-0.083	-0.008	-0.009	-0.074
		8.7%	*91.3%*	*8.7%*	*9.6%*	*81.6%*
1985-1990	**-0.044**	-0.006	-0.038	-0.006	-0.009	-0.029
		12.9%	*87.1%*	*12.9%*	*20.2%*	*66.9%*
1990-1995	**-0.098**	-0.002	-0.096	-0.002	-0.009	-0.087
		1.9%	*98.1%*	*1.9%*	*8.9%*	*89.1%*
1995-2000	**-0.037**	0.001	-0.039	0.001	-0.010	-0.028
		-3.2%	*103.2%*	-3.2%	27.0%	76.2%
2000-2008	**-0.150**	0.009	-0.159	0.009	-0.021	-0.138
		-5.7%	*105.7%*	-5.7%	14.1%	91.6%

Table 2. Decomposition results for the contributions of various world regions (and their economic and demographic changes) to the 1980-2008 change in global income inequality: PI and PAL decomposition compared

		DECOMPOSITION RESULTS				
		PI Decomposition		PAL Decomposition		
		% change in inequality associated with changes in		% change in inequality associated with changes in		
		Population size	Income	Population Size	Age Structure	Labor Productivity
WORLD (All Regions)	**-0.393**	-0.006	-0.387	-0.006	-0.052	-0.336
		1.5%	*98.5%*	*1.5%*	*13.1%*	*85.4%*
WORLD REGION	**CONTRIBUTION**					
East Asia and Pacific	**-0.372**	**-0.069**	**-0.303**	**-0.069**	**-0.023**	**-0.280**
	94.6%	*17.5%*	*77.1%*	*17.5%*	*5.8%*	*71.2%*
Europe and Central Asia	**-0.065**	**-0.060**	**-0.006**	**-0.060**	**-0.014**	**0.009**
	16.6%	*15.1%*	*1.4%*	*15.1%*	*3.7%*	*-2.2%*
Latin America and the Carribbean	**0.002**	**0.005**	**-0.003**	**0.005**	**0.001**	**-0.004**
	-0.5%	*-1.2%*	*0.7%*	*-1.2%*	*-0.3%*	*1.0%*
Middle East and North Africa	**0.005**	**0.018**	**-0.014**	**0.018**	**0.000**	**-0.014**
	-1.2%	*-4.6%*	*3.4%*	*-4.6%*	*-0.1%*	*3.5%*
Americas	**-0.026**	**-0.023**	**-0.004**	**-0.023**	**-0.019**	**0.015**
	6.7%	*5.8%*	*0.9%*	*5.8%*	*4.8%*	*-3.9%*
South Asia	**-0.049**	**0.048**	**-0.097**	**0.048**	**-0.003**	**-0.095**
	12.5%	*-12.2%*	*24.7%*	*-12.2%*	*0.7%*	*24.1%*
Sub-Saharan Africa	**0.113**	**0.075**	**0.038**	**0.075**	**0.006**	**0.032**
	-28.8%	*-19.0%*	*-9.8%*	*-19.0%*	*-1.6%*	*-8.2%*

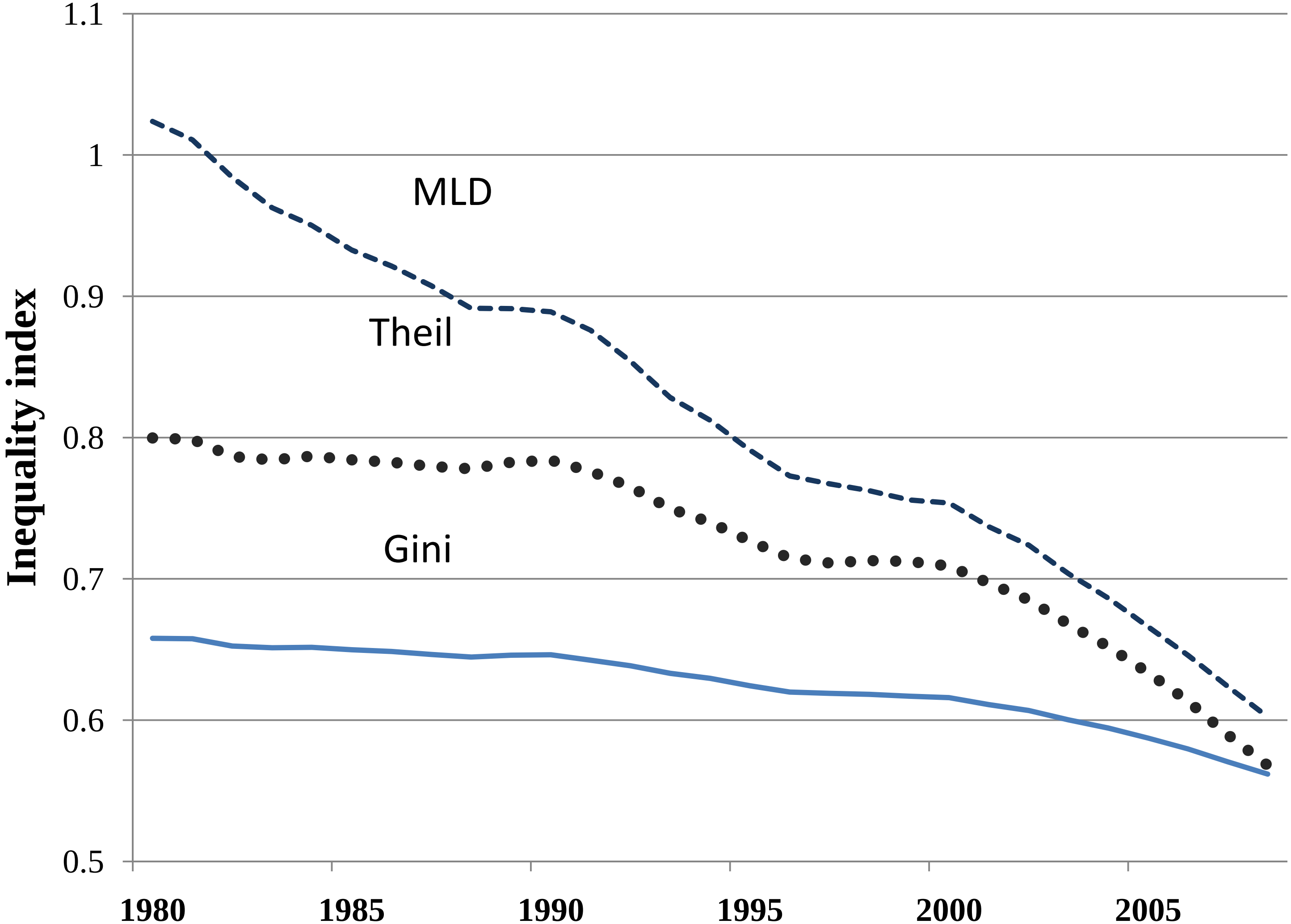
Appendix Table 1. Trends in global income inequality, 1980-2008

YEARS	Gini	MLD	Theil	CV Sq
1980	0.658	1.024	0.800	1.958
1981	0.658	1.011	0.799	1.965
1982	0.652	0.984	0.787	1.922
1983	0.651	0.963	0.784	1.935
1984	0.652	0.950	0.787	1.966
1985	0.650	0.933	0.784	1.975
1986	0.649	0.921	0.783	1.979
1987	0.646	0.907	0.780	1.984
1988	0.645	0.891	0.778	1.999
1989	0.646	0.891	0.782	2.027
1990	0.646	0.889	0.784	2.039
1991	0.642	0.876	0.776	2.016
1992	0.638	0.854	0.765	1.999
1993	0.633	0.828	0.750	1.965
1994	0.630	0.812	0.740	1.949
1995	0.624	0.791	0.727	1.920
1996	0.620	0.773	0.715	1.893
1997	0.619	0.767	0.711	1.890
1998	0.618	0.762	0.713	1.913
1999	0.617	0.756	0.712	1.928
2000	0.616	0.754	0.709	1.918
2001	0.611	0.737	0.697	1.889
2002	0.607	0.724	0.685	1.856
2003	0.600	0.704	0.668	1.810
2004	0.594	0.686	0.652	1.763
2005	0.587	0.666	0.634	1.710
2006	0.580	0.646	0.613	1.648
2007	0.571	0.624	0.590	1.572
2008	0.562	0.602	0.568	1.505
Percent change (1980-	**-14.6%**	**-41.2%**	**-29.0%**	**-23.1%**

Appendix table 2. Historical changes in national population shares versus age dependency

COUNTRY	*Historical change in* Pop. 15-64 as % of national population [1]	Pop. as share of global population [2]	[1]/[2]
Albania	0.075	0.000	404.1
Algeria	0.175	0.001	187.7
Angola	0.025	0.001	25.0
Argentina	0.037	0.001	70.6
Australia	0.023	0.000	99.5
Austria	0.037	0.001	68.5
Bahrain	0.077	0.000	1949.9
Bangladesh	0.123	0.004	34.0
Belgium	0.020	0.001	26.8
Belize	0.110	0.000	7526.0
Benin	0.028	0.001	52.1
Bhutan	0.116	0.000	6139.2
Bolivia	0.047	0.000	188.6
Botswana	0.118	0.000	1812.8
Brazil	0.093	0.001	81.5
Brunei Darussalam	0.108	0.000	6371.8
Bulgaria	0.033	0.001	33.0
Burkina Faso	0.021	0.001	26.2
Burundi	0.080	0.000	273.5
Cameroon	0.043	0.001	51.5
Canada	0.020	0.001	27.2
Cape Verde	0.108	0.000	11349.3
Central African Republic	0.023	0.000	157.4
Chad	0.016	0.001	23.9
Chile	0.067	0.000	1132.1
China	0.118	0.030	4.0
Colombia	0.098	0.000	201.8
Comoros	0.093	0.000	4233.8
Congo, Dem. Rep.	0.026	0.004	7.2
Congo, Rep.	0.044	0.000	310.3
Costa Rica	0.099	0.000	633.4
Cote d'Ivoire	0.035	0.001	27.4
Cyprus	0.058	0.000	4772.4
Denmark	0.027	0.000	69.6
Dominican Republic	0.080	0.000	627.8
Ecuador	0.090	0.000	380.5
Egypt, Arab Rep.	0.091	0.002	40.2
El Salvador	0.085	0.000	504.1
Equatorial Guinea	0.096	0.000	1774.2
Estonia	0.025	0.000	160.2
Ethiopia	0.018	0.004	4.2
Fiji	0.055	0.000	2098.4
Finland	0.015	0.000	43.6
France	0.023	0.003	6.7
Gabon	0.062	0.000	907.9
Gambia, The	0.007	0.000	61.7
Georgia	0.039	0.001	68.2
Germany	0.037	0.006	5.9
Ghana	0.064	0.001	59.3
Greece	0.042	0.001	71.5
Grenada	0.118	0.000	20171.0
Guatemala	0.022	0.000	45.6
Guinea	0.017	0.000	36.9
Guinea-Bissau	0.031	0.000	629.2
Guyana	0.092	0.000	1288.1
Haiti	0.059	0.000	330.3
Honduras	0.079	0.000	281.6
Hong Kong, China	0.069	0.000	500.9
Hungary	0.043	0.001	40.7
Iceland	0.048	0.000	6684.6
India	0.064	0.015	4.3
Indonesia	0.107	0.000	316.2
Iran, Islamic Rep.	0.190	0.002	94.1
Ireland	0.099	0.000	590.7
Israel	0.040	0.000	169.4
Italy	0.041	0.004	9.2
Jamaica	0.093	0.000	960.6
Japan	0.047	0.009	5.5
Jordan	0.138	0.000	321.1
Kenya	0.076	0.002	33.3
Korea, Rep.	0.101	0.002	61.4
Kuwait	0.162	0.000	959.1
Lao PDR	0.059	0.000	280.5
Latvia	0.034	0.000	125.0
Lesotho	0.054	0.000	3197.4
Liberia	0.021	0.000	85.6
Luxembourg	0.027	0.000	2065.5
Macao, China	0.126	0.000	5358.3
Madagascar	0.032	0.001	32.0
Malawi	0.023	0.001	28.3
Malaysia	0.084	0.001	84.7
Mali	0.021	0.001	36.6
Malta	0.041	0.000	1669.6
Mauritania	0.054	0.000	355.8
Mauritius	0.090	0.000	2559.2
Mexico	0.132	0.001	163.8
Moldova	0.079	0.000	188.9
Mongolia	0.156	0.000	5858.4
Morocco	0.125	0.000	416.9
Mozambique	0.031	0.001	41.4
Namibia	0.099	0.000	996.5
Nepal	0.046	0.001	50.5
Netherlands	0.028	0.001	31.8
New Zealand	0.037	0.000	415.7
Nicaragua	0.098	0.000	849.1
Niger	0.014	0.001	14.4
Nigeria	0.030	0.007	4.2
Norway	0.031	0.000	124.6
Oman	0.129	0.000	797.7
Pakistan	0.070	0.007	10.6
Panama	0.091	0.000	1328.4
Papua New Guinea	0.042	0.000	163.4
Paraguay	0.069	0.000	281.1
Peru	0.091	0.000	233.1
Philippines	0.079	0.003	28.3
Portugal	0.048	0.001	66.7
Romania	0.068	0.002	32.7
Rwanda	0.077	0.000	139.8
Samoa	0.032	0.000	3433.9
Saudi Arabia	0.114	0.002	68.1
Senegal	0.034	0.001	56.1
Sierra Leone	0.010	0.000	64.6
Singapore	0.053	0.000	274.3
Solomon Islands	0.084	0.000	3218.7
South Africa	0.095	0.001	85.4
Spain	0.059	0.002	27.2
Sri Lanka	0.088	0.000	193.2
St. Lucia	0.154	0.000	133010.6
St. Vincent and the Grena	0.153	0.000	20404.3
Sudan	0.047	0.002	28.0
Suriname	0.088	0.000	11653.9
Swaziland	0.085	0.000	1873.0
Sweden	0.019	0.001	32.5
Switzerland	0.021	0.000	62.2
Syrian Arab Republic	0.135	0.001	107.3
Thailand	0.139	0.001	132.1
Togo	0.060	0.000	162.2
Tonga	0.040	0.000	5265.7
Trinidad and Tobago	0.124	0.000	2300.4
Tunisia	0.153	0.000	1065.3
Turkey	0.117	0.001	216.2
Uganda	0.020	0.002	9.5
United Arab Emirates	0.112	0.000	227.7
United Kingdom	0.021	0.004	5.0
United States	0.014	0.007	1.9
Uruguay	0.010	0.000	54.0
Vanuatu	0.060	0.000	6868.4
Venezuela, RB	0.085	0.001	104.3
Zambia	0.023	0.001	36.7
AVERAGE	0.067	0.001	56.1

Figure 1. Trends in global income inequality, 1980-2008



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