RATES, SHARES, GAPS AND GINIS: ARE WOMEN CATCHING UP WITH MEN WORLDWIDE? ***DRAFT***

ABSTRACT

This research measures global trends in gender inequality—disparity between the world's women and men—from 1970 to 2000 using population-weighted indicators of gender inequality in a economic, political, educational and health domains. Fueled by a disproportional rise in female rates, difference-in-share gender gaps declined for all indicators but life expectancy. There was considerable variation in the rate of change among the indicators for which gender inequality decreased. The decline was greatest in higher education, where the gender gap effectively disappeared by 1995. The gender gap was largest among national legislators in 2000, where men still comprised over seventy percent of the world's national legislators in 2000. Compared to international income inequality, gender inequality was lower for all indicators but national legislators. Counterfactual simulations suggest the effect of rapidly declining within-nation gender inequality on *global* inequality has been partially offset by rapid growth in countries where gender inequality is high.

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WHAT IS GENDER INEQUALITY?

Increasingly, demographers and other researchers have turned attention to benchmark measures of the status of women in order to document gains and losses for women throughout the world. This benchmarking is called for in light of conferences such as the 1994 International Conference on Population and Development sponsored by United Nations Division for the Advancement of Women and the 1995 World Conference on Women in Beijing – conferences that signaled a major shift in population policies away from a narrow focus on the curbing of population growth to a broader focus on advancing the status of women as a means of improving women's lives (Ashford 2001; Riley 1997). The mission statement of the Fourth World Conference on Women in 1995 states:

> The Platform for Action is an agenda for women's empowerment. It aims at accelerating the implementation of the Nairobi Forward-looking Strategies for the Advancement of Women and at removing all the obstacles to women's active participation in all spheres of public and private life through a full and equal share in economic, social, cultural and political decision-making. This means that the principle of shared power and responsibility should be established between women and men at home, in the workplace and in the wider national and international communities. Equality between women and men is a matter of human rights and a condition for social justice and is also a necessary and fundamental prerequisite for equality, development and peace (United Nations 1995a).

Consequently, much recent scholarship has turned attention to answering the question of whether or not women are 'catching up' to men in education, wages, and other important aspects of daily life. By women 'catching up' with men we are referring to reduction in gender inequality.

The empirical work on global gender inequality to date can be grouped into three broad categories: 1) predictive models using countries (weighted and non-weighted) as units, 2) tabular reports of gender inequality by region or country, and 3) trend analyses of summary statistics (such as means) derived from within-country gender inequality scores, where countries are the unit of analysis. In this paper, we take aim at the latter two categories and argue they have not adequately detailed trends in global gender inequality. Tabular reports and averages derived from country scores fail to account for populations and give undue weight to small population countries while ignoring the contribution of highly populous countries to world trends. Most studies claiming to report world trends in gender inequality have used country-weighted[1], rather than of population-weighted, data (Apodaca 1998; Bardhan and Klasen 2000; Charmes and Wieringa 2003; United Nations 2000b). Rather than telling us about *global* gender inequality, these studies tell us about gender inequality differences *between countries*. We propose that a

[1] By country-weighted, we mean that each country is weighted equally (sometimes referred to as unweighted, or unweighted between-country analysis), irrespective of its population size. Doing so suggests that all people are not equal. In country weighted analysis, low population countries are given the same weight as high population countries. Analytically, this suggests, for example, that the women and men of China, who comprise about 20% of the world's adult population, are of less importance than are the women and men of Monaco.

study of global gender inequality must consider the condition of the world's women relative to the world's men and to do so, within-nation differences between men and women must be adjusted for each country's share of the world's population.

Careful consideration needs to be given to the issue of weights when considering global trends in gender inequality. Country-weighted data assigns countries equal weight, which means countries with very different populations contribute equally to the global mean of Y. Under the country-weighted approach, if the world were comprised of just two countries, say India, where gender inequality and population growth are high, and Monaco, where gender inequality and population growth are low, the observed level of gender inequality in the two countries would be averaged together to give us a world mean. The average would suggest world gender inequality was moderate and stable. If, on the other hand, we weighted the two countries by population our conclusion would be that gender inequality is high and rising. The more appropriate approach for measuring global trends is to weight Y by the number of females and males in each country.

Another benefit of the population weighted approach is it introduces a second important source of global change—population growth—into the analysis. Considerable attention has been directed to a select few countries, such as Sweden, where women have achieved near parity with men in many domains (REFERENCES). Yet countries such as these comprise a very small portion of the world's population and for many, population growth is low. Significant gains for women in countries such as these will have little impact on the world's women, while stagnation of within-nation gender equality in large countries with rapidly expanding populations, such as Nigeria or India, will negatively impact a great many more of the world's women. So, if the gender regime in which most of the world's women are born is extremely unequal, then we should expect that global gender inequality is rising. We will discuss this in more detail later, when we disaggregate the effects of change in Y and population on global change in gender inequality.

The conceptualization and measurement of gender inequality requires a multidimensional approach (Bradley and Khor 1993; Mason 1986) and in this regard, we break from previous research in that we rely on neither a univariate approach (see for example some of the more recent work on the relationship between economic growth and gender inequality (REFERENCES) nor on multivariate scales such as the United Nations Gender Empowerment Index (GEM) or the Gender Development Index (GDI) (Apodaca 1998; Dijkstra 2002; Ogwang and Abdou 2003; United Nations 1995b; United Nations 2003). An obvious shortcoming of indexes such as the GEM or GDI is they mask divergent trends in the several composite indicators used in their construction. Also, there has been considerable criticism regarding their construction (Bardhan and Klasen 2000; Charmes and Wieringa 2003). Finally, indexes often make it difficult to get adequate population 'coverage' because they require cumulative listwise completion of the data. Essentially, with indexes, you need to have complete data for all indicators comprising the index. This often results in the exclusion of many developing nations from analysis.

Our interest here, then, is in the changing status of women and men for the whole world, and so we examine world or global gender inequality – the disproportionate distribution of Y across men and women for all the world's citizens. We consider global change in gender inequality

separately for nine indicators in four domains of gender inequality: work, political participation, education, and health. The nine indicators are paid adult labor, national legislators, adult literacy, gross enrollment in primary, secondary and tertiary education, total years of schooling completed, adult survival and life expectancy.

TWO WAYS TO MEASURE GENDER INEQUALITY

There are two ways to measure gender inequality. The first is the ratio-of-rates method. The second is the difference-of-shares method. Prior studies of gender inequality generally rely on the ratio-of-rates method, or jump back and forth between the methods with no apparent appreciation for how they differ[2]. In this section we note a key advantage of the difference-of-shares method over the ratio-of-rates, and argue that difference-of-shares is a better method to use in the typical case where the population consists of a roughly equal number of men and women.

Ratio-of-Rates Method

As the name suggests, the ratio-of-rates method looks at one rate divided by another rate. In the case of gender inequality, one rate is the rate for women (for example, the proportion of women who are literate) and the other rate is the rate for men (proportion of men who are literate). Because the rate for women is usually the smaller of the two[3], it is often convenient to use the women's rate as the numerator and the men's rate as the denominator (hereafter, r_F refers to the rate for female and r_M refers to the rate for males). Gender inequality is declining, then, when r_F/r_M is moving toward 1.0, and gender inequality is increasing when r_F/r_M is moving away from 1.0.

The method is simple and intuitive. For the world as a whole, literacy rates are lower for women. Hence when literacy is increasing at a *faster rate* for women than for men, gender inequality *by definition* is declining. On the other hand, when literacy is increasing at a faster rate for men, gender inequality is increasing. We can determine immediately which is occurring by looking at the ratio (*not the difference*) of the rates. Movement of the ratio toward 1.0 tells us that gender inequality is declining and movement of the ratio away from 1.0 tells us that gender inequality is rising.

Difference-of-Shares Method

The difference-of-shares method takes advantage of the observation that the world's sex ratio has remained nearly constant at about 50 percent female and 50 percent male over recent decades

[2] See for example, the United Nations Millennium Development Goals (MDG's) own call for measuring the MDG's. The second MDG—achievement of universal primary education—indicates it is to be measured using indicators of net primary enrollment *ratios* and literacy *rates*. The third MDG—promotion of gender equality and empowerment of women—uses as its indicators the *ratio* of girls to boys in primary, secondary, and tertiary education, the *ratio* of literate women to men, the *share* of women in non-agricultural wage employment, and the *proportion* of seats held by women in national parliaments. So we have ratios, rates, shares, and proportions to measure two of the eight MDG's.

[3] The exceptions are life expectancy and adult survival, where women already hold the advantage. In that case, the issue is whether men are catching up with women.

(see Appendix B). (We warn readers at the outset that the difference-of-shares inequality method we present below is appropriate only in special cases, such as gender, where the population consists of two equal-sized groups.) Because half of the world's citizens are female, there is gender equality on some characteristic *Y* when females constitute half of those with *Y*.[4] By the same logic, there is gender equality on ~*Y* when females constitute half of those without *Y*.[5]

Gender *inequality* occurs, then, when the observed female and male shares deviate from 0.50. Obviously the shares must sum to 1.0 – if 40% of workers are women, we know that 60% of workers must be men – so it would be a simple matter to try to gauge inequality by the absolute value of the observed difference between men's share and women's share, that is:

$$\text{Difference-of-shares} = |s_F - s_M|, \quad (1)$$

where:

s_F (female share) = # of females with Y in female population / total population
s_M (male share) = # of males with Y in male population / total population (2)

An obvious advantage of the ratio-of-rates and difference-of-shares methods is they effectively standardize our indicators, such that we can compare the magnitude of observed gender inequality across indicators irrespective of the unit of measure. This is desirable because while we can safely assume some degree of gender inequality on all of our indicators beforehand—complete equality is very rare, no matter what we are investigating—without some form of standardization, we have no good way of assessing the magnitude of change in gender inequality across all of our indicators. To put this in practical terms, if we used a simple gender gap ($r_F - r_M$) to measure the disparity between females and males in literacy and life expectancy, we would get two very different numbers because while N=2 for both indicators, the unit of measure is different (literacy is measured as a percentage and life expectancy is measured in years). How do we know which represents the greatest inequality when the gender gap in adult literacy is fifteen percent and life expectancy gap is four years? Ratio-of-rates and difference-of-shares both solve this problem, but what if we want to compare the special case of gender inequality, where N = 2, with other types of inequality where N > 2? As normally understood, then, ratios and gaps cannot be compared to other types of inequality commonly calculated using measures such as the Theil or Mean Log Deviation. Somewhat surprisingly, it turns out that the difference-of-shares

[4] We use the term "female" here to include girls as well as women.
[5] As Kenney
Kenny, Charles. 2005. "Why are We Worried About Income? Nearly Everything That Matters is Converging." *World Development* 33:1-19.) observes, the trend in the ratio of *illiteracy* rates may tell a different gender inequality story than the trend in the ratio of *literacy* rates. The trend in the ratio of mortality rates may tell a different story than the trend in the ratio of survival rates. The trend in the ratio of women's and men's labor force participation rates may tell a different story than the trend in the ratio of women's and men's non-participation rates. In other words, when the criterion variable *Y* has a complement ~*Y* (not *Y*), the trend in inequality for ~Y is often in the opposite direction of the trend for Y. As a result, a researcher's conclusion about whether *women's rate of improvement exceeds men's* might depend on whether she examines mortality rate or survival rate, literacy or illiteracy, percentage who did not attend school or percentage who did, and so on. Kenney's solution is to report only the results for positive *Y* (for example, report results for survival rates, not for death rates) and provides several reasons for doing so. We do the same here.

equation given in (1) is the Gini coefficient for N = 2 (below), so equation 1 is indeed a measure of gender inequality.

In its reduced form the Gini index is equivalent to the difference-of-shares gender gap and thus, in this form the gender gap, with a slight adjustment, is a true inequality measure. A general expression for the Gini is (Allison 1978):

$$G = (1/N^2)\ \Sigma_j \Sigma_k\ |x_j - x_k| / 2\mu, \qquad (3)$$

where N is the number of cases, r_j is the value of X for the j^{th} unit, r_k is the value of X for the k^{th} unit, $|r_j - r_k|$ is the absolute value of r_j minus r_k, and μ is the average value of X for all units. In the case of gender inequality N=2 (F and M) and—as noted earlier—for this analysis X is a rate or a share. Thus j = F, k = F, and equation 3 can be reduced such that:

$$G = |\ x_j - x_k\ |\ /\ (x_j - x_k)^6 \qquad (4)$$

Recalling that our X's of interest here are s_F and s_M such that $(s_F + s_M) = 1.0$, we can drop the denominator from equation 4 and the adjusted Gini reduces simply to $|s_F - s_M|$. It turns out then, that when the population is roughly equal and the X of interest in measured using shares, the difference-of-gaps *is* the Gini coefficient. Using 1970 labor force market share data from Table 2, where the female labor force market share was 37.76, the male market share was 62.24, and the gender gap was 24.48, allows us to illustrate the point. Substituting these shares into formula gives us the following:

Labor Force Participation Gini = |37.76 - 62.24| / (37.76 + 62.24)
= 24.48 / 100
= .2448

Thus we see that market share gender gap is equal to the gender Gini and in 1970 the gender Gini in paid adult labor force participation was .245. The advantages of the Gini, such as meeting the central conditions for inequality measures (Firebaugh 2003, chapter 4) and its frequent use in studies of other types of inequality, are well known.

We see, then, that the ratio-of-rates and difference-of-shares methods are both appropriate measures of gender inequality and allow us to compare the magnitude of gender inequality across indicators in our study. But because the difference-of-shares gender gap has the additional

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[6] In full form, the gini equation breaks down as follows:

$$G = (1/N^2)\ \Sigma_j \Sigma_k\ |x_j - x_k| / 2\mu$$
$$= (1/4)\ [|x_j - x_k| + |x_j - x_k|] / 2\mu$$
$$= |x_j - x_k| / 4\mu$$

Appendix B shows that for the world's population is approximately 50/50 female and male, so the overall average μ is (for all practical purposes) the simple average of x_j and x_k. In that case the Gini is:

$$= (1/2)\ |x_j - x_k| / (x_j - x_k)$$

Finally, we adjust the gender inequality Gini so that it ranges from 0 for perfect equality to 1.0 for maximum inequality. The upper limit for the Gini is 1 – (1/N), or 1/2 in the case of gender inequality. To adjust the upper limit to 1.0, then, we multiply equation (5) by 2 to arrive at equation 4.

desirable property of also being a Gini, we report results using gaps, rather than ratios. Using the difference-of-shares method allows us to compare the observed magnitude of inequality and change in inequality across all of the indicators in this research and also to make comparisons with other types of inequality relying on the Gini index. Thus to summarize, we will use population-weighted rates for males and females and gender gaps to document global trends gender inequality for nine indicators in four domains of gender inequality, namely, paid labor, political participation, education and literacy, and health. We measure change in rates and gaps and then compare global gender inequality to other kinds of inequality. Finally, we disaggregate the effects of change in Y and change in populations on global gender inequality.

THE DATA

The nine indicators used in this analysis to measure global change in rates and gaps, the structure of their measurement, and the data sources from which they were drawn are listed in Appendix A. The range of years for which sufficient data were available for our indicators and the population coverage for each indicator are listed in Appendix B. The data roughly cover the years 1970 to 2000 and were measured in either five or ten year intervals. We conducted all analysis for first and last year as well as all available intervening years, but because the reported trends were monotonic (with a few noted exceptions) we only present results for the first and last year for each indicator. To consider world trends using population weighted data, we need a significant portion of the world's population. Because of the sizable population representation of just a few countries such as China and India, it would be difficult to make claims about the world's women without having data for these few highly populous countries that comprise such a significant portion of the world's population (approximately 60 percent of the world's people live in just ten countries). This necessarily limits the number of variables for which adequate data are available over time. Numerous indicators for measuring the status of women have been employed, such as access to contraception, labor force participation, wage parity, school enrollment rates, violence against women, household autonomy, political participation, and various health measures (Ashford 2001; Bradley and Khor 1993; Mason 1986; United Nations 1995a; United Nations 2000a; United Nations 2000b). For this analysis, we focus primarily on the variables comprising the GEM and the GDI, which include labor force participation, political participation, life expectancy at birth, and adult literacy rates. We also measure adult survival, educational enrollment rates, and total years of school attainment to better assess education and health inequalities[7]. The GEM also uses data on gender rates in managerial and professional positions, but because of the lack of data for developing nations, they were not included in this analysis.

The measures used to assess the condition of women relative to men are indicators of several important domains, namely, economic (labor force participation) political (parliamentary participation), health (life expectancy at birth and adult survival rates), and educational (adult

[7] We conducted the same analysis for a number of other indicators not reported here, including: youth literacy, primary, secondary, and tertiary years of school attainment, and infant mortality. Analysis of the excluded indicators produced results similar to those of the indicators we reporting our tables here. The literacy and education variables mentioned here were excluded because we already present results for five other literacy and schooling measures and the overall findings were the same with, or without, the additional indicators. We felt that the population coverage for infant mortality, at just under 50%, was so low that we did not have confidence in the results.

literacy rates, educational enrollment and years of school completed) domains. In their raw form, years of schooling completed and life expectancy are continuous scale measures, political participation[8] is in market share form, and all other indicators are rates. Regrettably absent from the list are measures of household power and female autonomy. While we acknowledge the importance of these private sphere indicators, they either lack sufficient coverage or time intervals to include in this analysis.

RATES, SHARES, AND CHANGE IN GLOBAL GENDER INEQUALITY

Table 1 reports change in global rates and shares for women and men on a broad range of indicators covering the years 1970 to 2000[9]. The overall trend in rates for both females and males is positive. The world female labor force rate rose from 34 percent in 1970 to 40.5 percent in 2000, meaning that in 2000, 40.5 percent of all adult women were in the non-agricultural paid labor force. During the same period, the r_M rose from 55.7 to 57.8 percent. Thirty-six percent of women were literate in 1970 compared to 53.1 percent of men, and in 2000, the female and male adult literacy rates were 62.5 and 72.6 percent, respectively. From 1980 to 1995 gross enrollment rates in primary, secondary, and tertiary education and in total years of schooling completed rose for both females and males. Notably, by 1995, the last year for which data covering the majority of the world's population were available, primary gross enrollment rates had risen to 98 percent for females and to 106.7 for men, while secondary enrollment rates for females and males had risen to 58.7 and 65.4 percent, respectively. Much lower still were the gross enrollment rates in higher education (19.6 and 19.1 percent in 1995 for females and males, respectively). The female adult survival rate rose from 77.6 percent in 1970 to 83.6 percent in 2000 while r_M, during the same period, rose more rapidly (from 71 percent to nearly 79 percent). We found that when the average years of total schooling for females and males were weighted by population, the women of the world averaged 3,27 and 4.86 years of completed school in 1975 and 1995, respectively, while men averaged 5.03 and 6.67 years for the same periods. The weighted world average life expectancy for females was 68.3 years in 2000 and men's was 64.68. On every indicator then, r_F and r_M rose from the first year to the last year, suggesting that quality of life for the world's women and men is indeed improving for the indicators measured here.

Turning to shares, we find that s_F rose from the first to the last year for all indicators but adult survival (females represented 52 percent of all surviving adults in 1970 and 51.5 percent in

[8] Political participation is somewhat unique among our indicators because elected office is independent of population size or growth and so it cannot (or should not) be population adjusted. For example Mongolia, with a population of just over 2 million in 1990, had 430 national legislators, while the United States, with about 250 million people in 1990, had 440 legislators. For this reason, we do not adjust national legislators by population. Another obvious difference is that by nature, political participation can only be assessed in market share form because it is always conditional—a one seat gain for women results in a one seat loss for men.

[9] While we only report the first and last year gaps and change in gaps for all nine indicators, we estimated the change for all available intervening years, which were either in five or ten year intervals for all indicators. For all but national legislators, total years of school completed, and life expectancy, the change from the first to last year was monotonic. The life expectancy gender gap was generally quite stable over the period studied, increasing and decreasing slightly from interval to interval). Both among national legislators and total years of school completed, gender gaps increased slightly in 1990 before decreasing again in 1995 and 2000, respectively. The gender gap increase among legislators in 1990 was largely attributable to a sharp decrease in the number of female legislators in former communist countries following the fall of the former Soviet Union.

2000). s_F among paid adult workers rose from 37.7 percent in 1970 to 40.6 percent in 2000. Women's representation in national legislatures, while rising modestly (from 12 percent in 1980 to 14.8 percent in 2000), was considerably lower than men's, where women still comprised less than 15 percent of the world's elected national legislators in 2000. Among literate adults, s_F rose from 40.5 percent in 1970 to 45.7 percent in 2000, and females as a percentage of all students enrolled in school rose for primary, secondary, and tertiary education to 47.4, 46.8 and 50.1 in 1995 for primary, secondary, and tertiary education, respectively. s_M in life expectancy and decreased slightly from 1970 to 2000, while s_M in adult survival rose modestly over the same period.

Using the rates and shares from table 1, we calculated change in rates and difference-of-shares gender gaps and report the results in table 2. Table 1 showed that rates for both women and men increased from the first to the last year, while table 2 shows that the *rate* of change was faster for women on all indicators but years of schooling completed and adult survival. The largest absolute change was in adult literacy, where the adult literacy rate for women rose by 25.97 percentage points and by 19.48 percentage points for men. When we look at the annual rate of change, however, we find that female enrollment in secondary education (.97) had the fastest rate of change (the male rate of change was .79). Adult literacy for both females and males rose at just under a percentage point per year (.87 and .65 for female and males, respectively). The absolute change in years of completed schooling was slightly greater for men (1.64) than for women (1.59), as was the rate of change (.082 and .079 for men and women, respectively). True also with adult survival, where women have the advantage, that the absolute change for men (7.67) was greater than for women (5.99).

Turning to gender gaps we find they were largest among national legislators. In fact, the difference-of-shares gender gap among national legislators was considerably larger than all other gaps in both the first (75.91) and last year (70.37). After national legislators, first year and last year gaps were largest among paid adult workers (24.48 and 18.73 in 1970 and 2000 respectively) and total years of completed schooling (21.98 and 17.22 in 1975 and 1995, respectively). The gap in higher education experienced a cross over, from favoring men in 1980 (8.38) to favoring women in 1995 (.13). Recall however, that male and female enrollment rates in higher education were significantly lower than for other indicators. When we consider change in gaps, we see that gaps decreased for all indicators but life expectancy, which saw a slight up-tick from 1970 to 2000 (0.08). The largest change in gender gaps was among literate adults where the gap fell from 18.96 in 1970 to 8.65 in 2000. The annual rate of change in gaps was greatest in higher education (-.317) followed by literate adults (-.344) and years of schooling completed (-.317). Perhaps most disappointing was the annual rate of change in political representation, which had the largest first and last year gap. The annual rate of decline in the gender gap among national legislators was slower only than the two health indicators, both of which were quite stable from 1970 to 2000. We draw a similar conclusion among paid adult workers, where the annual rate of change (-.192) was only slightly greater than the decline among legislators.

In figures 1 and 2 we graph the Gini across the nine indicators and compare them to trends in international income inequality (Milanovic 2005). Perhaps most striking is how large global gender inequality in political representation is compared to all other inequalities measured,

including income inequality. Another striking conclusion we draw from the figures is that all of the other indicators had a much lower level of inequality than international income inequality (.548 in 1970), with none exceeding .3 at the first year. By the last year gender inequality was below .2 for all indicators but national legislators (.7 in 2000). Not only that, but we see that compared to international income inequality, the rate of decline for most of our indicators was quite rapid. Keeping in mind that a .02 change per decade in the Gini coefficient is considered large, we find that the rate of decline in global gender inequality was large for six of the nine indicators and the rate for paid adult workers (0.019) was just under .02 per decade (see Table 3). Only the two health indicators failed to achieve a large decreasing in inequality. The most rapid change per decade was in enrollment in higher education (-.057), followed by adult literacy (-.034).

COUNTERFACTUAL SIMULATIONS

Our analysis to this point has documented the magnitude and direction of change in global gender inequality across a number of indicators. To measure change we aggregated within-nation population adjusted gender inequality and arrived at a statistic representing global gender inequality for each of the nine indicators in our study. For policy makers, possibly more telling than the direction and magnitude of global change in gender inequality is the *source* of change. As we have measured it, the two primary sources of change in global inequality are changes in populations and changes in within-countries gender gaps. Global inequality might be decreasing because populations are growing fastest in countries where gender inequality is low. On the other hand, if the within country gender gaps are decreasing across countries, particularly in large countries, then this might be the source of decreasing global inequality. Key to change in global gender inequality is what is happening in high growth and high population countries. Changes in either direction within those countries will be the big contributors to global trends. We can begin to tease out the relationship between population and within-nation gender inequality with counterfactual simulations of change in populations and within-nation inequality. Two key questions the counterfactual simulations address are:

1. What would global gender inequality look like if there had been no change in within-country gender inequality over the last thirty years? In other words, if we hold gender inequality constant at the level observed in the first year and allow population to grow at its observed rate of the last thirty years, how different would global gender inequality be today?

2. In the absence of population change, what might global gender inequality look like in the last year for which estimates were available? If we hold country population shares constant at the first year levels and allow within-country gender inequality estimates to change at their observed rates, how different would global gender inequality look in the last year?

The first question is sometimes referred to as the growth effect, while the latter question has been referred to as the allocation effect (Goesling and Firebaugh 2004)[10]. Granted, these are rough simulations and place some fairly significant assumptions on the data, but doing so allows us to

[10] For another example of counter factual simulations in global change, see:
Alderson, Arthur S. 1999. "Explaining Deindustrialization: Globalization, Failure, or Success? (in National Economic Growth)." *American Sociological Review* 64:701-721.

begin to parse out the twin effects of within-nation gender inequality and population change on global inequality. We can attribute any difference between the observed and simulated gender gaps to changes in the indicator rather than changes in the weights (Lloyd 2005, p. 655). Similarly, when we hold Y constant, the difference between observed and simulated gender gaps represents the effect of population growth on global gender inequality. We do this in Table 5, where we compare the observed change in gender gaps reported in Table 2 with the simulated conditions outlined in questions 1 and 2 above.

Under the "no change in Y" simulation, where we assess the contribution of population change to global change in inequality minus within country change in gender inequality, we see that global gender inequality would have *increased* for all but the health indicators. Between 1970 and 2000 the *observed* change in the market share gender gap among paid adult workers was 5.75. The "no change in Y" simulation produced a gender gap of 25.93, resulting in a 7.2 percentage point difference between the observed (-5.75) and simulated change (1.45) in the gender gap. Larger still was the difference between the observed (8.65) and simulated (22.09) gender gap in adult literacy, which was 13.44. Also of note was the difference between the observed (.13) and simulated (9.99) gender gap in higher education, at 10.12.

Under the "no change in population" simulation we find that for all but the health indicators, gender inequality would have declined even faster than the observed decline if population growth were held constant at 1970 population shares. The difference between the observed last year gender gap and the population simulation is quite similar (generally about 1 to 2 percentage points) across all indicators. The simulations suggest two things. First, most of the decline in global gender inequality across our nine indicators is the result of within-nation declines in gender inequality. And second, population has had a negative effect on change in global gender inequality, though the effect of population is relatively small compared to the effect of within-county change in Y. We can conclude that populations are growing faster in countries where gender gaps are large and this is working against within-nation decline in inequality. We draw this conclusion for all but the health indicators, where the declines in gender gaps were *lower* under the "no change in population" simulation than the observed decreases. So the good news is that on the ground, disparities between men and women are becoming smaller. National policies aimed at decreasing gender disparities are achieving often substantial success. The bad news is that within-country gains in gender equality have been partially offset by population growth for most of the indicators.

DISCUSSION

This research set out to assess global trends in gender inequality using population-weighted indicators of gender inequality in a variety of domains. Recall that we derived difference-in-share gender gaps for the world by multiplying r_F for each country by its female population for nine indicators. By summing all of these country-level products we arrived at the total number of females doing Y (surviving, working, attending school, etc.) and we did this by gender for every interval where data were available. Calculating the number of the world's women and men with Y allowed us to measure *global* change in r_F and r_M and in difference-in-share gender gaps.

When we considered change in population-weighted rates for females and males, we found a disproportionate first to last year rise in rates for both females and males. r_F rose faster than r_M for all but total completed years of school and adult survival. But because r_M was higher for all but the health indicators in the first year, men still held an advantage over women in the last year measured in our analysis. The notable exception was higher education, where the r_F eclipsed r_M in 1995. Another important contribution that rates made is they indicate there is still considerable room for improvement on a number of indicators, where among our dichotomous measures, rates were still below 75 percent for all but primary school enrollment in the last year for both females and males.

Fueled by the disproportional rise in r_F, difference-in-share gender gaps declined for all indicators but life expectancy. The decline was the greatest in higher education, where the gender gap effectively disappeared by 1995. The decline in the adult literacy gender gap was also substantial (10.32), and much more modest was the gender gap decline among paid adult workers. By far the greatest disparity between s_F and s_M in the first and last year was among national legislators (75.91 and 70.37, respectively).

In aggregate then, the position of the world's women and men is improving across all of the indicators measured in our analysis. The greatest gains have been in education, where gross primary enrollment rates are at or near 100 percent, and adult literacy is over 60 percent for women and men. Gender inequality is decreasing for nearly all indicators and not because of losses for men (except among national legislators), but because female gains have outpaced male gains. This is good news for the world's women and men. Additionally, gender equality is rising rapidly among many of our indicators, particularly the education indicators, but still the gap remains large among national legislators.

Comparing the rate of change in gender Gini's to change in international income inequality, we found that population-weighted gender inequality is lower than income inequality among all of the indicators we measured but national legislators. The counterfactual simulations indicate that within-country gender inequality is the major source of change in global inequality and population growth has modestly attenuated the decline in global inequality. Taking together our analysis of change in rates, shares, gaps and Gini's, as well as the counterfactual simulations, we can begin to paint a clearer picture of global trends in gender inequality.

We know from previous research that country-weighted gender ratios and gaps (as well as unweighted r_F and r_M) are generally rising for a number of indicators of gender inequality (United Nations 2000b) and that the between-county rise in gender inequality has been disproportional (Dorius and Firebaugh 2005). Specifically, when we consider countries, gender equality is rising fastest among countries where gender inequality is generally higher. This has led to a divergence in gender inequality among countries, with lagging countries falling farther behind the leaders. But when we turn to population-weighted inequality, we see that global gender inequality—disparity between the world's women and men—has fallen for nearly all of our indicators. The counterfactual simulations show that the decrease in global inequality was largely due to within-nation change in inequality and that population growth is slowing the decline in global gender equality. This is because gender inequality was, and is, generally lower among countries with rapidly growing populations. The major contributors to the observed

decrease in gender inequality were countries with large populations, where women's gains have outpaced men's over recent decades.

Overall, the status of the world's women is rising in a number of important domains. In the closing decades of the twentieth century the efforts of governments, multinational organizations, and NGO's have resulted in significant gains for women relative to men. Indeed, the condition of the world's women relative to men seems to be improving in similar fashion to cross-national trends in gender attitudes (Ingelhart and Norris 2003). Entering the twenty-first century, women enjoy greater parity with men across a number of critical domains than at any other time in the last 30 years. There is much to celebrate, yet the results also suggest that while battles have been won, there is still considerable room for improvement. In fact, in economic, political, and educational domains, women are still underrepresented, and grossly so in national parliaments. The trend toward disparity reduction is a positive signs for women, but considerable work still lies ahead. Clearly, the negative effect of population growth on global gender inequality has important policy implications for family planning efforts in developing countries. As family planning efforts achieve greater success in slowing population growth rates in developing countries we can expect to see greater acceleration toward parity between the world's women and men. To achieve the ultimate goal of reasonable global gender equality, both national and multination policies must continue to focus on reducing long-standing and deeply entrenched inequalities between men and women.

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Table 1. Global Change in Female and Male Rates and Shares for Nine Indicators[a]

	Rates				Shares			
	% of Females who are…		**% Males Among Males**		**% Female Among Female and Males**		**% Male Among Female and Males**	
	First Year	*Last Year*	*First Year*	*Last Year*	*First Year*	*Last Year*	*First Year*	*Last Year*
Paid Adult Workers (1970-2000)	34.09	40.51	55.74	57.80	37.76	40.64	62.24	59.36
National Legislators (1980-2000)	--	--	--	--	12.04	14.82	87.96	85.18
Literate Adults (1970-2000)	36.52	62.49	53.11	72.59	40.52	45.68	59.48	54.32
Primary School Gross Enrollment (1980-95)	89.32	98.11	104.30	106.68	45.65	47.36	54.35	52.64
Secondary School Gross Enrollment (1980-95)	44.18	58.68	53.60	65.41	44.71	46.75	55.29	53.25
Tertiary School Gross Enrollment (1980-95)	12.24	19.57	14.19	19.06	45.81	50.07	54.19	49.93
Years Total Schooling Completed (1975-95)	**3.27**	**4.86**	**5.03**	**6.67**	39.01	41.39	60.99	58.61
Surviving Adults (1970-2000)	77.64	83.63	71.16	78.83	51.96	51.51	48.04	48.49
Life Expectancy at Birth (1970-2000)	**59.98**	**68.30**	**57.24**	**64.68**	50.91	50.96	49.09	49.04

Source: Calculated from Appendix C.

[a] Years of completed schooling and life expectancy at birth (in **bold**) differ from the other indicators in that they are continuous scale measures and *not* dichotomies. As such, rather than calculate the percentage female and male, for schooling completed and life expectancy, we used population weighted country data to estimate world averages. Thus, statistics for both indicators represent the weighted world average for females and males at time one and time two, respectively.

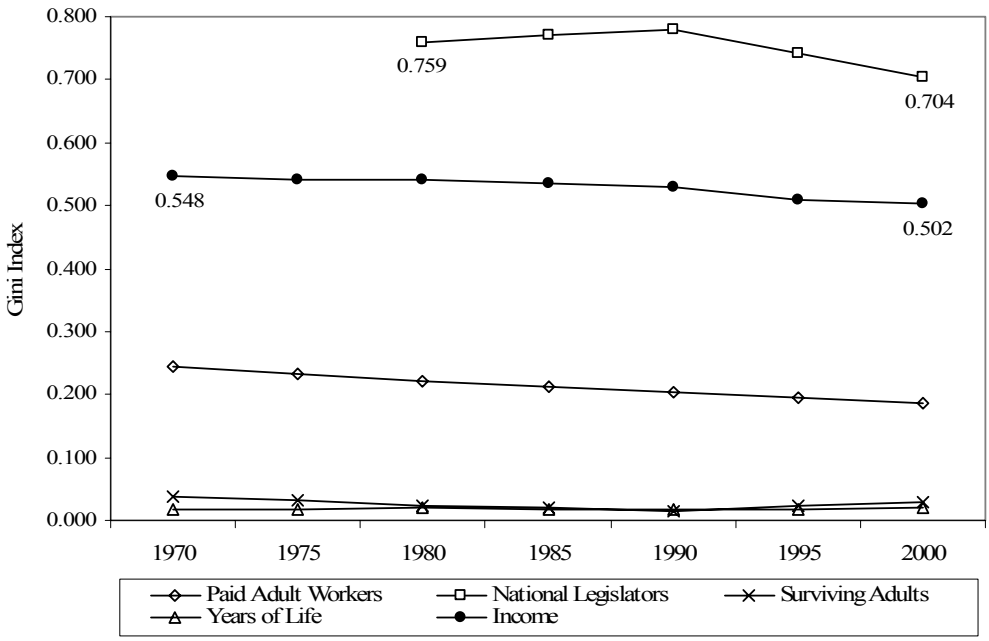
Table 2. Global Change in Rates and Difference-of-Share Gender Gaps: Results for Nine Indicators

	Change in Rates				*Change in Difference-of-Share Gender Gaps*			
	Females		**Males**					
	Absolute Δ in r_F	**Annual Rate of Δ in r_F**	**Absolute Δ in r_M**	**Annual Rate of Δ in r_F**	**First Year Gap**	**Last Year Gap**	**Δ in Gender Gap**	**Annual Δ**
Paid Adult Workers (1970-2000)	6.42	0.21	2.06	0.07	24.48	18.73	*-5.75*	*-0.192*
National Legislators (1980-2000)	**--**	**--**	--	--	75.91	70.37	*-5.54*	*-0.185*
Literate Adults (1970-2000)	25.97	0.87	19.48	0.65	18.96	8.65	*-10.32*	*-0.344*
Primary School Gross Enrollment (1980-95)	8.79	0.59	2.38	0.16	8.71	5.28	*-3.42*	*-0.228*
Secondary School Gross Enrollment (1980-95)	14.50	0.97	11.81	0.79	10.58	6.50	*-4.08*	*-0.272*
Tertiary School Gross Enrollment (1980-95)	7.33	0.49	4.87	0.32	8.38	(0.13)	*-8.51*	*-0.567*
Years Total Schooling Completed (1975-95)	**1.59**	**0.08**	**1.64**	**0.08**	21.98	17.22	*-4.76*	*-0.317*
Surviving Adults (1970-2000)	5.99	0.20	7.67	0.26	(3.93)	(3.01)	*-0.92*	*-0.031*
Life Expectancy at Birth (1970-2000)	**8.31**	**0.28**	**7.44**	**0.25**	(1.83)	(1.91)	*0.08*	*0.003*

Source: Calculated from Table 2.

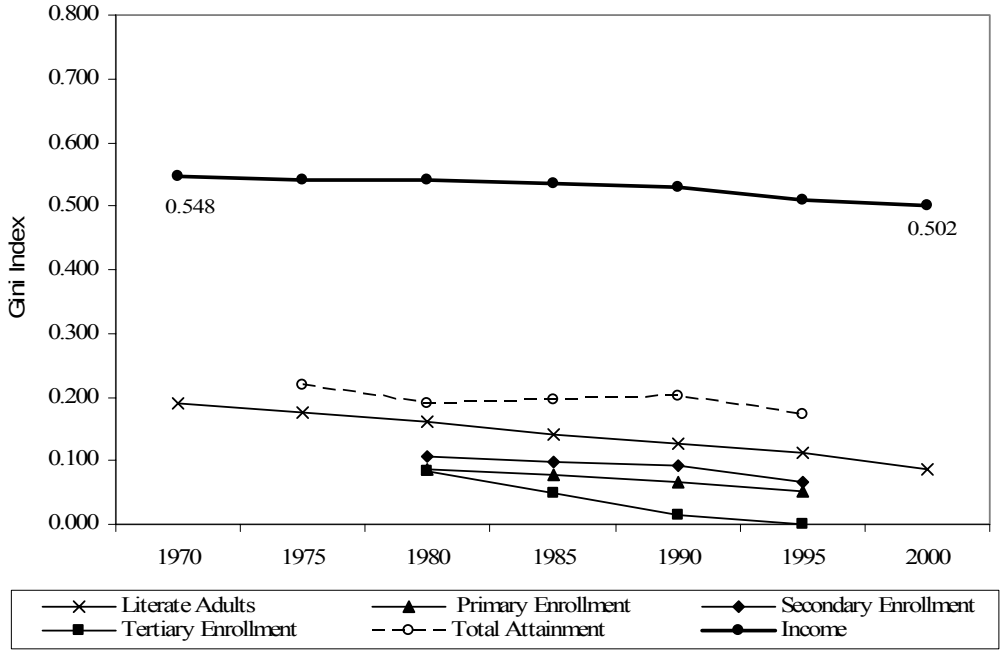
Notes: Parentheses indicate female advantage. Recall from Table 1 that statistics for schooling completed and life expectancy (**bold**) are based on weighted world averages for female and males derived continuous scale measures so the change statistics reported here represent change in weighted world averages of years, not percentages. National Legislators are excluded from the simulations because we do not apply population weights to national legislators in previous analysis.

Figure 1. World Gender Inequality Trends in National Legislatures, the Paid Labor Force, and Health



Source: Calculated from Appendix C Income data taken from Milanovic (2005) Appendix 6.

Figure 2. World Gender Inequality Trends in Literacy, Educational Enrollment, and Educational Attainment



Source: Calculated from Appendix C. Income data taken from Milanovic (2005) Appendix 6.

Table 3. Average Change Per Decade in the Gini

Indicator	*Δ*
Paid Adult Workers (1970-2000)	-0.019
National Legislators (1980-2000)	-0.028
Literate Adults (1970-2000)	-0.034
Primary School Gross Enrollment (1980-95)	-0.023
Secondary School Gross Enrollment (1980-95)	-0.027
Tertiary School Gross Enrollment (1980-95)	-0.057
Years Total Schooling Completed (1975-95)	-0.024
Surviving Adults (1970-2000)	-0.003
Life Expectancy at Birth (1970-2000)	0.000
Income	-0.015

Sources: Income taken from Milanovic (2005) Appendix 6. All others calculated from Table 2.

Table 4. Simulating the Effect of Change in the Observed Level of Female and Male Participation on Nine Indicators (Y) and Population Growth on in Global Market Share Gender Gaps

	First Year Obs.	**Last Year Obs. (Δ)**	**Last Year "No Δ in Y"[a] (Δ)**	**Last Year "No Δ in P"[b] (Δ)**
Paid Adult Workers (1970-2000)	24.48	18.73 (-5.75)	25.93 (1.45)	16.99 (-7.49)
Literate Adults (1970-2000)	18.96	8.65 (-10.32)	22.09 (3.13)	7.35 (-11.62)
Primary School Gross Enrollment (1980-95)	8.71	5.28 (-3.42)	9.36 (0.65)	4.79 (-3.91)
Secondary School Gross Enrollment (1980-95)	10.58	6.50 (-4.08)	11.94 (1.36)	5.62 (-4.96)
Tertiary School Gross Enrollment (1980-95)	8.38	**0.13** (-8.51)	9.99 (1.61)	**1.40** (-9.77)
Years Total Schooling Completed (1975-95)	21.98	17.22 (-4.76)	25.21 (3.23)	15.43 (-6.55)
Surviving Adults (1970-2000)	**3.93**	**3.01** (-0.92)	**2.66** (-1.27)	**4.11** (0.18)
Life Expectancy at Birth (1970-2000)	**1.83**	**1.91** (0.08)	**1.41** (-0.42)	**2.26** (0.43)

Notes: Data for "First Year", "Last Year Observed Population Growth", and "Annual Δ" taken from Columns 5, 6 and 8 of Table 2. Values in **bold** indicate female advantage. Values in parentheses are change scores (last year - first year).

[a] The rate or level of Y was held constant in last year at the 1970 rate or level of Y for all indicators for which data were reported in 1970. For all others, data were calculated using the level or rate of Y for the first year that data were available for those indicators. For example, we report on total years of schooling completed beginning in 1975, therefore, years of schooling completed was held constant in 1995 (last year) at the 1975 (first year) level of schooling completed.

[b] Population was held constant in last year at the 1970 population shares for all indicators for which data were reported in 1970. For all others, data were calculated using population shares for the first year that data were available for those indicators. For example, we report on school enrollments beginning in 1980, therefore, population growth was held constant using the 1980 population shares for all school enrollment variables.

Appendix A. Description of Indicators

Indicator (data source)	Description[a]
Paid Adult Workers (WDI)	Percentage of the total labor force that is female and male. Labor force comprises all people who meet the International Labor Organization's definition of the economically active population and shows the extent to which women and men are active in the labor force. Derived from the percent of female workers among females and the percentage of male workers among males.
National Legislators (WDI & WISTAT)	Percentage of elected or appointed seats occupied by women and men in unicameral assembly or lower house of parliament.
Literate Youth (WDI)	Percentage of female and males ages 15-24 who can, with understanding, read and write a short, simple statement on their everyday life.
Literate Adults (WDI)	Percentage of females and males ages 15 and above who can, with understanding, read and write a short, simple statement on their everyday life.
Those Attending Primary, Secondary and Tertiary School (WDI)	Ratio of total females and male enrollment (gross), regardless of age, to the population of the age group that officially corresponds to the level of education shown. Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music. Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more specialized teachers. Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.
Average Years of Total School Completed (Barro and Lee)	Average number of years of total schooling in the female and male populations over age 25.
Surviving Adults (WDI)	Probability of surviving between the ages of 15 and 60--that is, the probability of a 15-year-old surviving to the age of 60, if subject to current age-specific survival rates between ages 15 and 60. Derived from deaths per 1000 among adult male and female population.
Life Expectancy at Birth (WDI)	The number of years a newborn female or male infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.

Sources: World Development Indicators Database, (WDI), United Nations Women's Indicators and Statistics Database version 4.0, 1999 (WISTAT), and (Barro and Lee 2000).

[a] Where possible, the data descriptions are taken directly from the associated data source.

Appendix B. Percentage of World Population by Year and Indicator With Listwise Deletion

	1970	*1975*	*1980*	*1985*	*1990*	*1995*	*2000*
Paid Adult Workers (170)[a]	99.86	99.85	99.85	99.85	99.85	99.84	99.78
National Legislators (89)			72.41		73.04		72.85
Literate Adults (132)	90.66	90.49	90.39	90.40	90.34	90.14	89.83
Primary School Enrollment (124)			87.48	87.55	87.64	87.70	
Secondary School Enrollment (131)			89.19	89.34	89.50	89.59	
Tertiary School Enrollment (92)			74.84	74.74	74.51	74.01	
Years of Total Schooling (101)		83.71	84.02	84.38	84.57	84.79	
Surviving Adults (158)	97.24		97.17		97.02		96.71
Life Expectancy at Birth (164)	94.23	0.94	94.75	95.10	95.41	95.71	95.88
Total Population:							
• *Proportion Female*	*0.502*	*0.501*	*0.501*	*0.501*	*0.501*	*0.501*	*0.502*
• *Proportion Male*	*0.498*	*0.499*	*0.499*	*0.499*	*0.499*	*0.499*	*0.498*
Adult Population:							
• *Proportion Female*	*0.502*	*0.500*	*0.499*	*0.499*	*0.498*	*0.497*	*0.500*
• *Proportion Male*	*0.498*	*0.500*	*0.501*	*0.501*	*0.502*	*0.503*	*0.500*

Source: All population statistics taken from the World Bank's *World Development Indicators Database.*

[a] Number of countries in parenthesis

[b] Adult literacy data were not available for Western Europe, European offshoots, and Japan. Missing data for these countries were set to 1 for both males and females.

Appendix C. Estimated World Trends in the Number of Females and Males (in parentheses) on 9 Indicators[a]

	1970	1975	1980	1985	1990	1995	2000
Paid Adult Workers	355		470		614		760
	(585)		(738)		(928)		(1,110)
National Legislators			**2,438**		**2,288**		**3,095**
			(17,804)		**(18,583)**		**(17,795)**
Literate Adults	345	422	521	641	767	888	1,055
	(506)	(603)	(720)	(854)	(989)	(1,113)	(1,255)
Primary School Enrollment			1,707	1,965	2,195	2,390	
			(2,032)	(2,312)	(2,508)	(2,656)	
Secondary Enrollment			862	988	1,159	1,465	
			(1,607)	(1,208)	(1,392)	(1,668)	
Tertiary Enrollment			197	250	314	395	
			(233)	(276)	(323)	(394)	
Years of Total Schooling		3,173	4,082	4,936	5,937	7,106	
		(4961)	(5,991)	(7,120)	(8,908)	(10,063)	
Surviving Adults	787		1,010		1,276		1,519
	(727)		(961)		(1,236)		(1,431)
Years of Life	103,605	118,480	133,524	149,215	165,917	181,014	196,376
	(99,882)	(114,545)	(128,492)	(143,605)	(159,988)	(174,482)	(189,007)

Sources: World Development Indicators Database (WDI), United Nations Women's Indicators and Statistics Database version 4.0 (WISTAT), and (Barro and Lee 2000).

Notes: The number of females was calculated by multiplying the percentage/rate for females on X by the female population in a given year. The same was done for males. For example, female labor force participation in 1970 was multiplied by the female adult population for 1970 to arrive at the total number of paid adult female workers in 1970 for each country. The sum of the country level figures represents the global female labor force. The same calculation procedure was also applied to males and this was done, by sex, for each year and each indicator in the table.

[a] All statistics are in millions (1,000,000) except Political Participation which is in **bold**. The school enrollment and life expectancy indicators rely on the total female and male populations for each country, while all other indicators rely on the total adult female and male populations for each country.