

DISCUSSION PAPER SERIES

IZA DP No. 16397

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by Gender, 1990-2019**

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ABSTRACT

Youth Labor Force Participation, Education, and Human Capital in Asia, by Gender, 1990-2019

Of great importance to the future World economy is the future labor force of Asia, as Asia is by far the most populous region in the World. Expected future levels of education, very young and youth population, youth employment and unemployment, dependency rates, human capital per capita, and the sources of growth in the potential future labor force are described in this paper with an emphasis on differences by gender and differences across regions. Some comparisons between China and India and between Asia and selected other regions and aggregates are also included. Gini human capital coefficients are constructed for regions in Asia and the selected other regions and aggregates are constructed to reinforce the importance of recognizing gender in any analysis.

JEL Classification: I21, J16, J21, J24, O53

Keywords: labor, education, employment, human capital, Asia

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Education is expected to continue to rise among the working age population in Asia, but it is unclear to what extent labor markets will be able to absorb or take advantage of this more highly skilled workforce and whether changes in the skill level of jobs, labor force participation, or unemployment will reflect the higher levels of education. Will there be sufficient and adequate jobs for all of Asia's large potential labor force, even those with fewer skills? A forward to a book on labor markets in Asia by the Chief Economist of the Asian Development Bank states:

"...if countries in the region cannot provide employment to their workers, an employment crisis may arise." p. xiii, Ali (2006). In addition, how many, particularly the youth, will participate in the labor force?

Whatever evidence I had about Asian labor markets first arose from casual observations and conversations with Chinese students, as well as from some newspaper articles. Recent articles in the press highlighted issues with unemployment in China and India; several articles were published when India's total population was about to surpass that of China.¹ There is a possible pitfall of relying on the earlier articles (He 2022, Kumar 2022, Shagun 2022, Xie 2022) or on the casual observations and conversations. Accordingly, this paper relies on published publicly available data, or estimates from the Inclusive Wealth Report (United Nations Environment Programme - UNEP- forthcoming, United Nations Economic, Scientific, and Cultural Organization - UNESCO - forthcoming), which are derived from publicly available data.² The emphasis in this paper is on the size and expected education levels of the current and potential future labor force, the very young, those aged 0-4, and on youth, those aged 15-24, as well as human capital. Asia is broken out into five regions: Southern Asia, South-Eastern Asia, Eastern Asia, Central Asia, and Western Asia, sometimes by China and India, and sometimes by all of Asia versus some selected aggregates.³ Each of these are by gender as levels and trends often differ significantly by gender. The last year examined varies, but it is sometimes 2019 to avoid complications, hopefully temporary, created by the covid pandemic.

This paper will first look at future expected average years of school completed in combination with population trends among the very young, then continue on to examine other labor market-related data and human capital.

Rising levels of education, the potential future and youth labor force in Asia, and dependency

The good news for the future of Asian countries is that in almost all countries, the level of expected years of school completed has risen between 1990 and 2019, both for males and females. Expected years of school (EYS) is a measure that is used by the United Nations Development Programme's Human Development Index (UNDP 2019) and by the Inclusive Wealth Report (UNEP forthcoming, UNESCO forthcoming). The EYS presented in this paper,

¹ Li (2023), Mashal (2023), and Travelli (2023).

² Online data comes from the World Bank, and directly or indirectly from the International Labour Organization.

³ A list of the countries in each Asian region and in each aggregate is in Appendix I. Only two Asian countries: Lebanon and Timor-Leste, and one de facto separate self-governing entity: Taiwan, is not included in the analysis in this paper.

developed as part of the Inclusive Wealth Report effort, is determined for those aged 5-24.⁴ It is forward-looking measure compared to a Barro-Lee years of school currently completed as it considers how many years of school will eventually be completed (Barro and Lee, 2013, 2018). For example, a fifteen-year-old, who is included in the Barro-Lee data set at his/her current years of school completed in a specific year, may proceed, and complete more years of education in the future. EYS gives a better sense of future labor markets.

Figure 1 shows EYS by gender by Asian region and all of Asia from 1990-2019 for every five year except for the last period, 2019. In this paper, EYS is weighted by the population of a country aged one to four.⁵ If years of school completed is increasing, EYS so weighted will to some extent understate the future expected years of education completed if current trends are not reversed. The regions are arrayed by the EYS level in 2019 to give a clearer sense of how the regions differ from each other. Although Southern Asia has both the lowest initial and ending EYS for both genders, the increase for females between 1990 and 2019 is very large at 75 percent, which is the second largest increase of all regions, and the EYS for males and females are almost identical in 2019. By contrast, in Western, Asia female EYS is always smaller than male EYS, but the gap has narrowed considerably over time. In South-Eastern and Eastern Asia female EYS became higher than that for males during the 1990 to 2019 period: in South-Eastern Asia by 2010 and in Eastern Asia by 2005. In Central Asia, EYS for males and females are quite similar for the years shown, although the male EYS is always at least slightly higher than for females. The Central Asia growth in EYS is the lowest for both genders than that of any other region: 13 percent for males and 14 percent for females. The Eastern Asia EYS growth rate for both genders is the largest of that for any region: 51 percent for males and 84 percent for females. The two largest economies, whether measured by total population or population aged one to four, are India in Southern Asia and China in Eastern Asia. Although female EYS in China is almost one percentage point higher than male EYS, given the declining birth rate in China, the All Asia female EYS is only slightly higher than that for males by 2019.⁶

⁴ The expectation of EYS is given by $e_x^i = \frac{T_x^i}{l_x}$. Where e_x^i indicates the length of life expectancy of the life stage, the first stage ($i = 1$) represents the period of childhood during which one receives education, with the upper age limit for this stage assumed to be 24 years. The second stage ($i = 2$) represents the adult population generally engaging in the work stage. Educational attainment, training, or work skills in adulthood are assumed to be age-specific properties rather than a product of public education. The term $T_x^i = \sum_x^\infty s_x^i * L_x^n$ represents the number of person-years spent alive and enrolled in education or work at age x or older, s_x^i denotes the school enrollment rate in childhood if $i=1$ and labor participate rate in adulthood if $i=2$. L_x^n indicates the cohort's number of years lived within the indicated age interval ($x, x+n$). Term l_x represents the age-specific survival rate, indicating the number of individuals alive at the beginning of the age interval.

⁵ EYS is from the Inclusive Wealth Report (UNEP forthcoming, UNESCO forthcoming). The population of individuals aged one to four is from the World Population Prospects (United Nations, 2022).

⁶ In figures 1, 2, 4, 9, 10, 11, 14, and 15 the color blue indicates males and the color orange indicates females.

Figure 1. EYS by gender, every five years (until 2019), 1990-2019

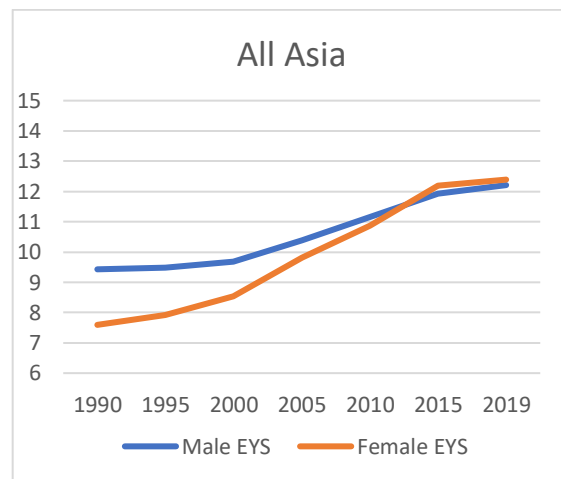
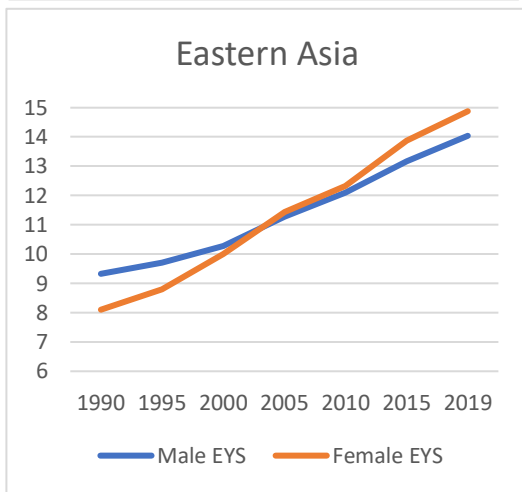
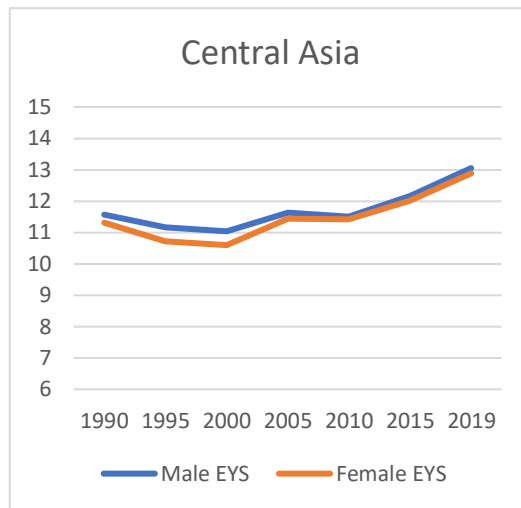
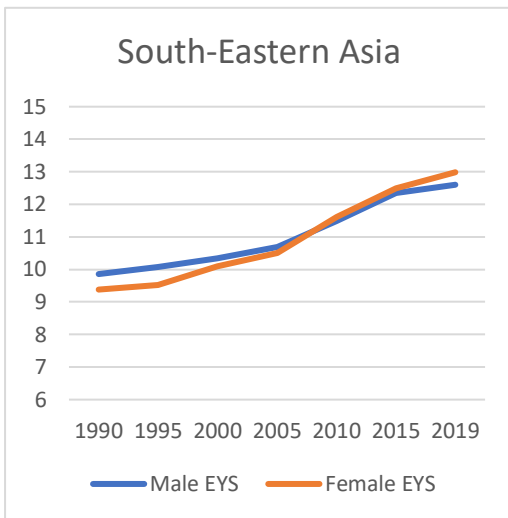
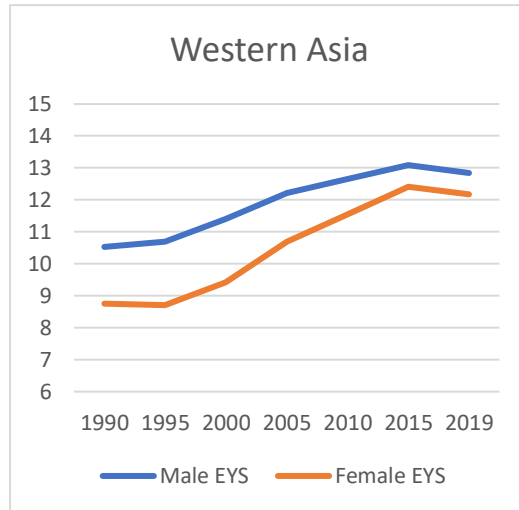
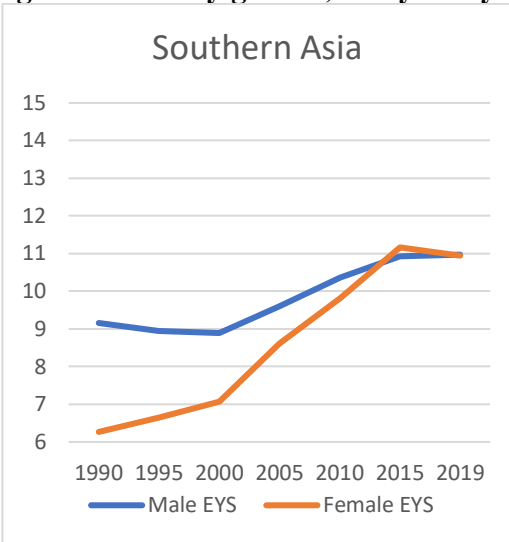


Figure 2 shows EYS for selected regions and aggregates: Africa, All Asia, Latin America, European Union (EU) and G20.⁷ A consistent pattern exists between the three regional EYS and the two association EYS. Female and male EYS rise from a low of 5.7 and 7.4 for Africa in 1990 to a high of 11.7 and 12.2 in 2020 for Latin America. The lowest values and the highest values rise between each region. The only case in which the 1990 EYS is higher than the 2020 EYS is for males in Latin America. In addition, the female EYS increases relative to the male EYS. The Africa female EYS is always less than that for males, the Asia EYS catches up to that of males and surpasses it, and the female Latin America EYS is always greater than that of males, except in 1990 when it is slightly less. The European Union (EU) EYS is always greater than the G20 EYS, and the EU female EYS is always higher than the EU male EYS, although by 2010, the G20 female EYS is greater than that of G20 males. For purposes of comparison, the World EYS is shown. It looks very similar to that of Asia because the two most populous countries in the World: China and India, are in Asia. 1990 World male EYS is almost identical to that of Asia, but the 1990 World female EYS is higher than the Asia female EYS. Subsequently, Asia EYS for both males and females rise somewhat faster than that of the World.⁸

To get a sense of the size of the labor force available to a country in the future and its quality, both the size of the working force and its education matters. Accordingly, the population of a country aged 0-4 is multiplied by its EYS. For any country, the question is: Is it the number of people in the potential future labor force or its education level which are the primary contributors to the potential future labor force? To answer this question, the number of individuals aged 0-4 is multiplied by EYS, separately by gender, and growth rates calculated by component.⁹ Note that in all regions, the female share is 46 to 49 percent of the population aged 0-4. The region share of the total population aged 0-4 in Asia is trending upward slightly in Central, Western, and South-Eastern Asia over time (figure 3). The shares for Eastern and Southern Asia are almost mirror images of each other, with the relatively low birth rates in China foretelling India becoming the most populous region in Asia. Figure 4 shows the product of the population aged 0-4 and EYS by Asian region by gender, where as before the blue line is for males and the orange line is for females.¹⁰ This measure of the future potential labor forces is almost identical for males and females in central Asia. In all other regions that for males is greater than that for females, however, the difference between the two genders has narrowed over time. The majority of the potential future labor force is in Eastern and Central Asia because of the very large populations in China and India. The next largest potential future labor force is in South-Eastern Asia, followed by Western and Central Asia. Overall, as the All Asia figure shows, after a decline in the potential future labor force, it has now increased due to the rising levels of EYS.

⁷ Countries in Latin America are those in the Americas where Romance languages—languages derived from Latin—are predominantly spoken.

⁸ The covered countries account for at least 97 percent of the population of the World; the term World is used to refer to all covered countries.

⁹ Certainly, not everyone in the potential future labor force will end up performing market work. However, the personal benefit of education to an individual, to society, and to offspring has been well documented. See for example Chen and Li (2008), OECD (2001), and Sutherland (2015). Later in this paper the unemployment and employment rates of youth will be presented and discussed.

¹⁰ Note that the vertical axes dimensions change in this figure because of the impact of larger (Southern and Eastern Asia) versus smaller (South-Eastern, Central, and Western Asia) populations aged 0-4.

To get a better sense of what has contributed to the changes over time, in Figure 5 the logarithmic rate of growth of the population aged 0-4 and ESY between 1990 and 2019 are shown separately. In all regions from 1990 to 2019, the female growth in EYS shown in figure 5

Figure 2. Expected years of schooling (EYS) by gender, every five years, 1990-2020

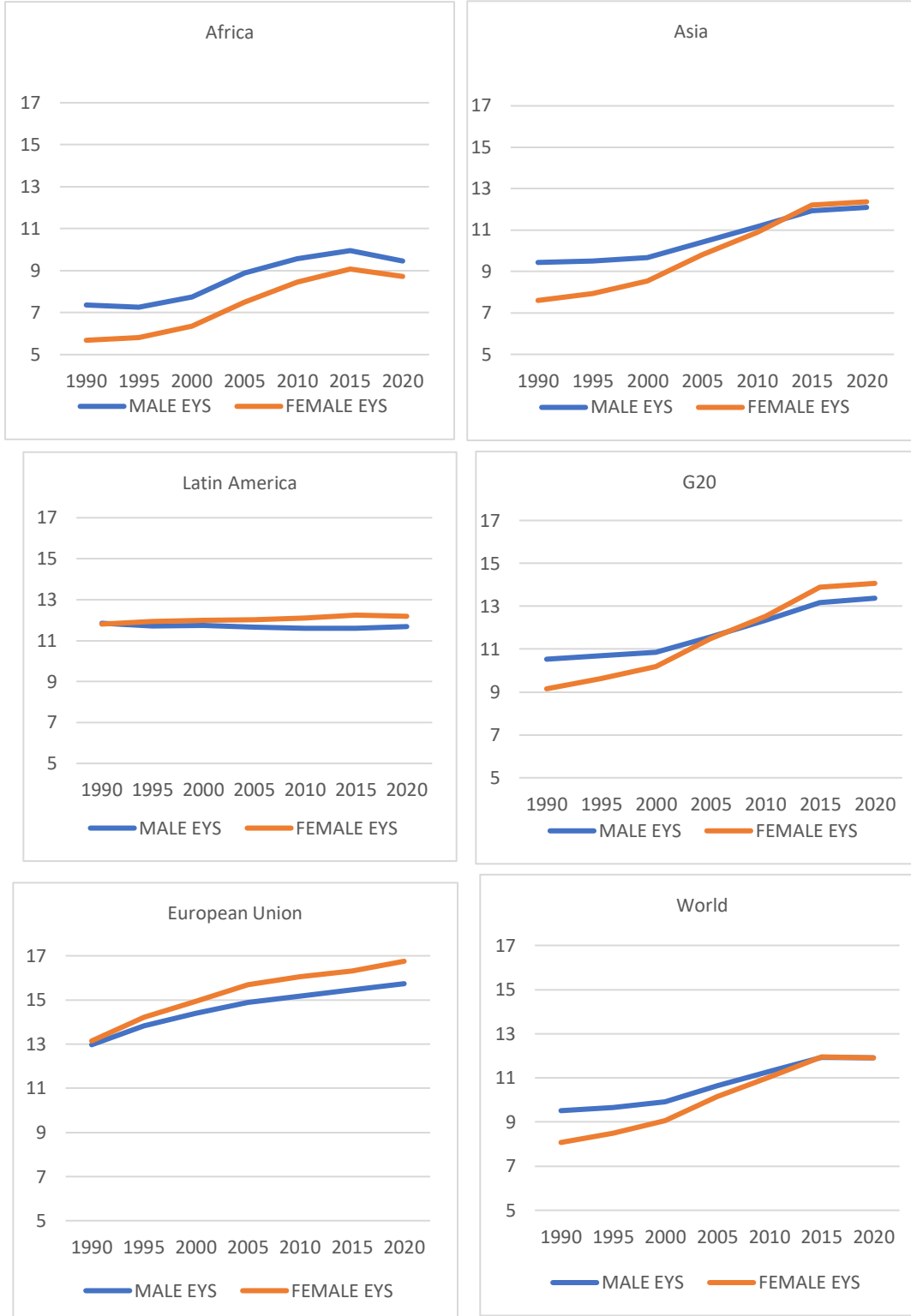
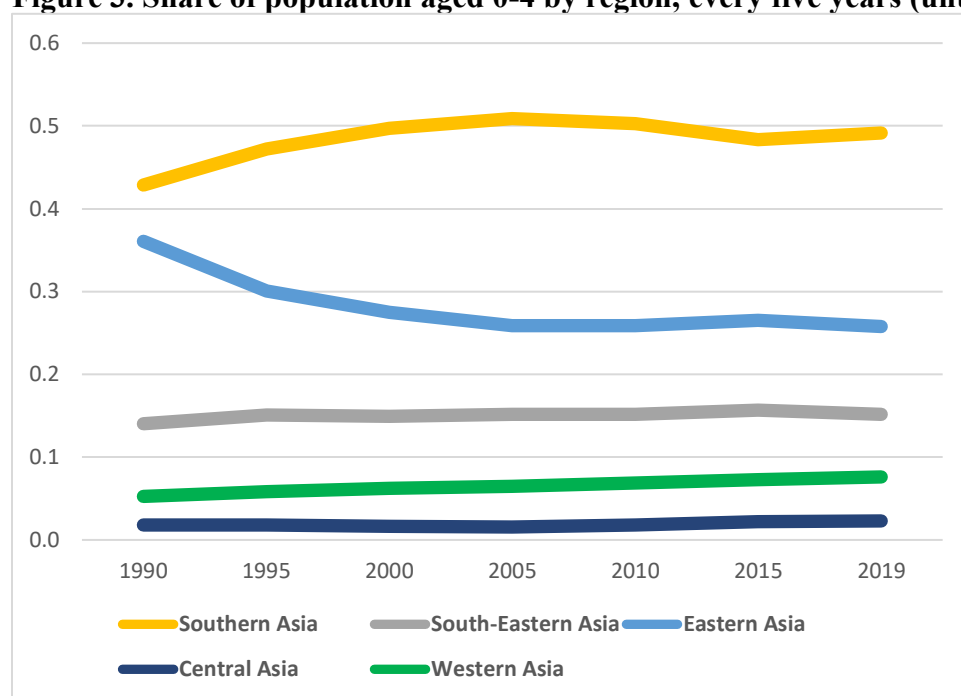


Figure 3. Share of population aged 0-4 by region, every five years (until 2019), 1990-2019



is larger than that of males except in Central Asia, expected by looking at figure 1, but male growth in EYS is always positive. Male population aged 0-4 growth is always larger (or less negative) than that of females. In Eastern Asia, the level of the 2019 potential future labor force is barely above that in 1990, but the shape in figure 3 is a mild U shape, with the size of the potential future labor force initially declining, but then increasing by 2005 (males) or 2000 (females). The increase in EYS offsets the declining birth rate, notably in China. For the years shown, the potential future labor force in all other regions are generally upward trending. Growth in the potential future labor force in South-Eastern and Central Asia are very similar, but the distribution of the growth between the contribution of EYS and the population aged one to four are quite different. In South-Eastern Asia the positive growth all comes from EYS, in Central Asia the growth is split between both sources of growth. Central Asia is the only region in which male growth between 1990 and 2019 is greater than that of females. The female increase in Southern Asia is driven by the growth in female EYS, where India is the primary source of this change. Western Asia has the highest growth in the total potential future labor force of all the regions primarily because of the strong contribution of both males and females. In the All Asia aggregate, population aged 0-4 is a drag on growth, with growth in EYS positive and strong.

Figure 6 shows the potential future labor force separately for China and India. It highlights the importance of increases in EYS in China, which offsets the decline in the population aged 0-4, the impact of the increase of female EYS in India, the increase in the potential labor force in China starting in 2010 versus the decline in the potential future labor force over the same time period in India, and the extent to which differences in the size of the potential labor force have narrowed between China and India by 2019.

The present and future impact of higher and rising birth rates in Africa are evident in Table 1 as

Figure 4. Population aged 0-4 times EYS by gender, every five years (until 2019), 1990-2019

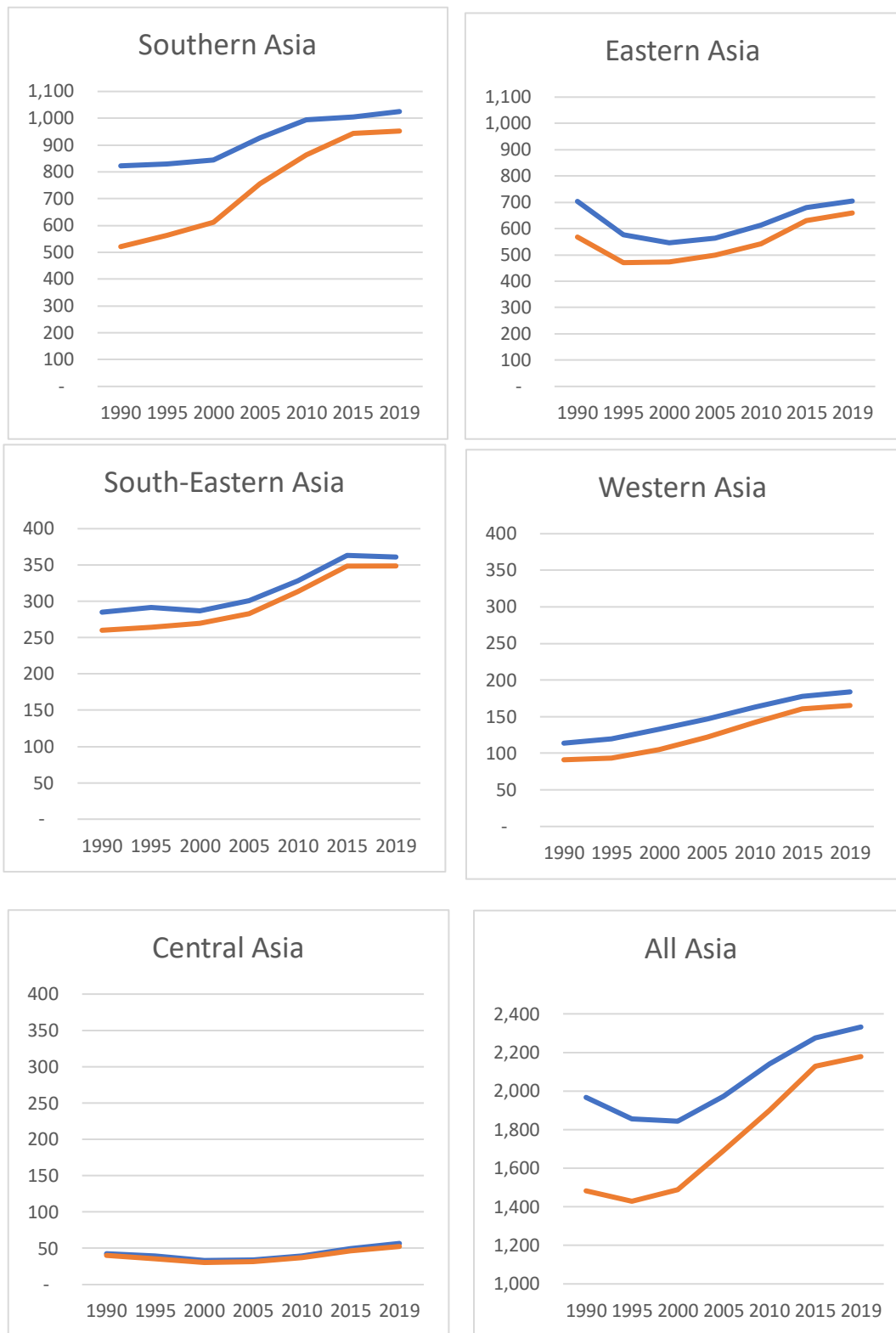
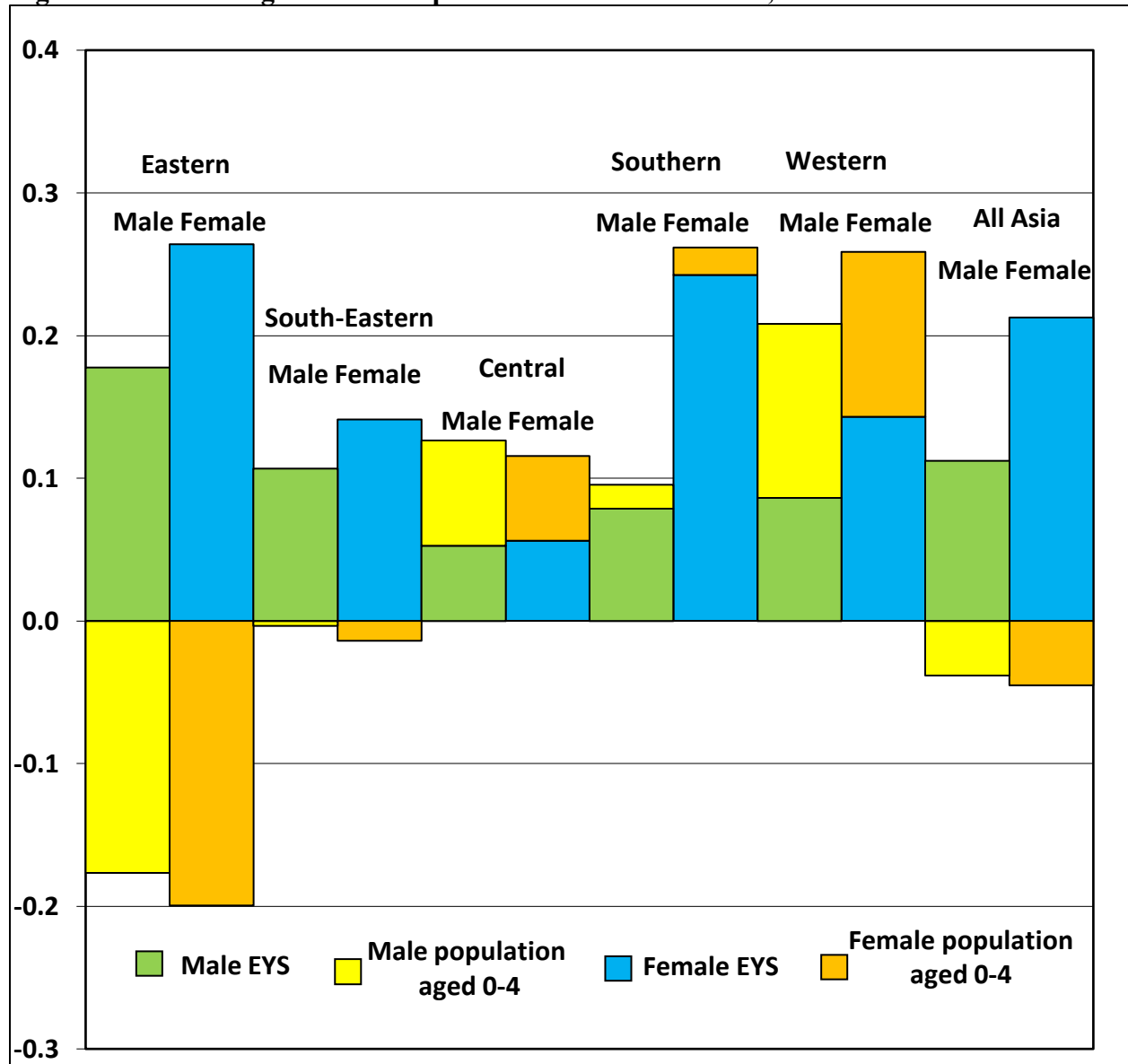


Figure 5. Sources of growth in the potential future labor force, 1990-2019



Africa is the only region or aggregate for which the World share of those aged 0-4 of the covered population has risen between 1990 and 2020. The decrease in the birth rate in China is the primary reason for the decrease in the Asia share. The percentage decline in the share of those aged 0 to 4 for Latin America is about half that for the G20 and the EU.

Attention is now turned to youth, those aged 15-24, with figure 7. The notable increase in the Asian share of youth in Southern Asia and the decrease in the share of youth in Eastern Asia is as

Figure 6. Population aged 0-4 times EYS by gender, every five years (until 2019), 1990-2019, China and India

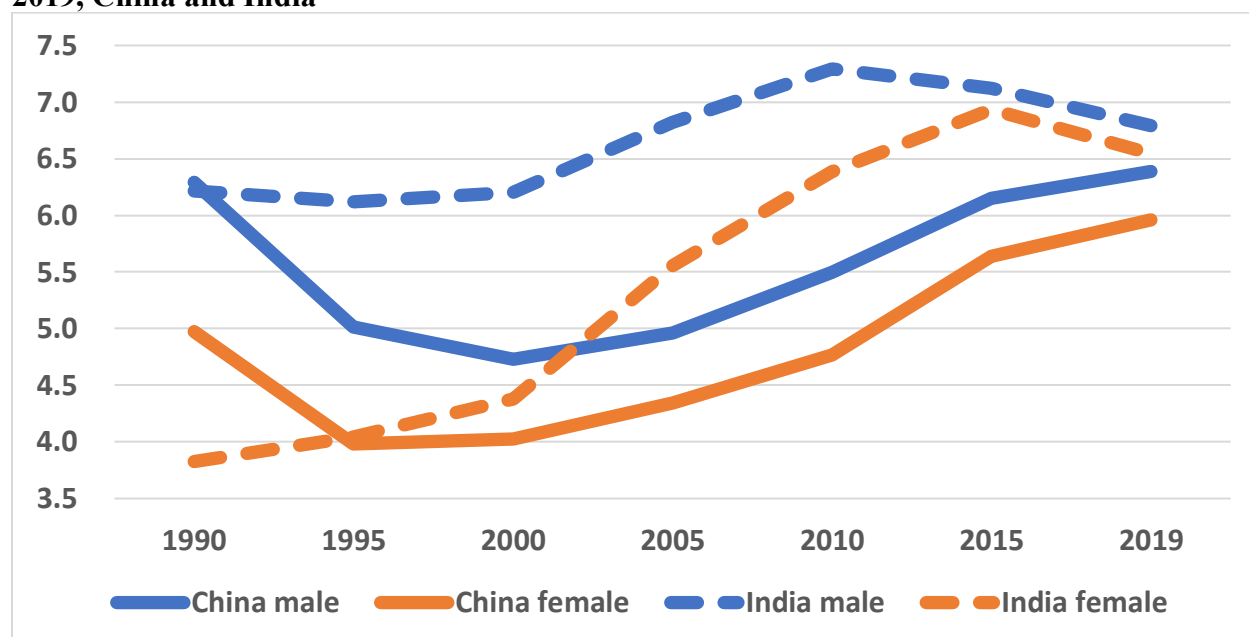


Table 1. Share of age 0-4 population in the World and by aggregates and gender (%), 1990 and 2020

	1990		2020		1990	2020	Number of covered countries
	Male	Female	Male	Female	Total	Total	
	% of covered population*		% of covered population*		% of covered population*		
Africa	16.3	16.8	28.3	29.3	16.6	28.8	46
Asia**	64.9	64.1	55.2	54.1	64.5	54.7	48**
Latin America	8.8	9.0	7.7	7.8	8.9	7.8	22
G20	63.9	63.1	51.1	50	63.5	50.6	43
EU	4.0	4.0	3.2	3.2	4.0	3.2	27
	% of covered World				% of covered World		
	97.0	97.1	97.9	97.9	97.1	97.9	167

*The shares do not add up to one as all EU countries are in the G20 and some Africa, Asia, or Latin America countries are in the G20.

**Palestine is included in this table

expected, with the shares of the other regions either increasing slightly or holding about the same between 1990 and 2021. Figure 8 shows that the 0-4 aged and youth Asian share trends in the Southern and Eastern region are different until 2015, and essentially offsetting.

Figure 9 plots youth employment rates and unemployment rates, both as a percent of those aged 15-24 by gender. All of the declines in youth employment rates can be quite closely approximated by a linear trend line. The regions are ordered by the region having the lowest

Figure 7. Share of population aged 15-24 by region, 1991-2021

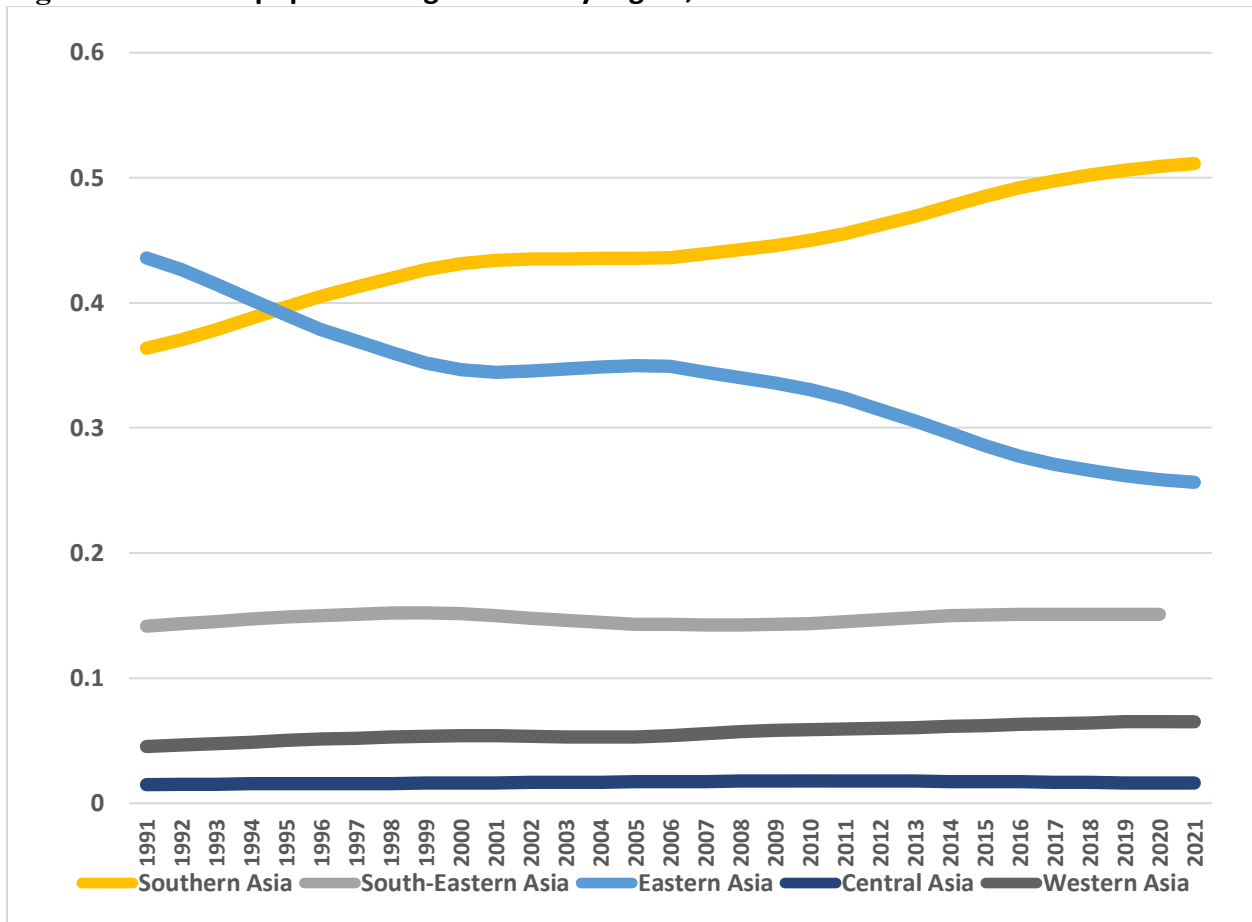


Figure 8. Comparison of population share trends, Southern Asia and Eastern Asia, ages 0-4 and 15-24, every five years, 1990-2020

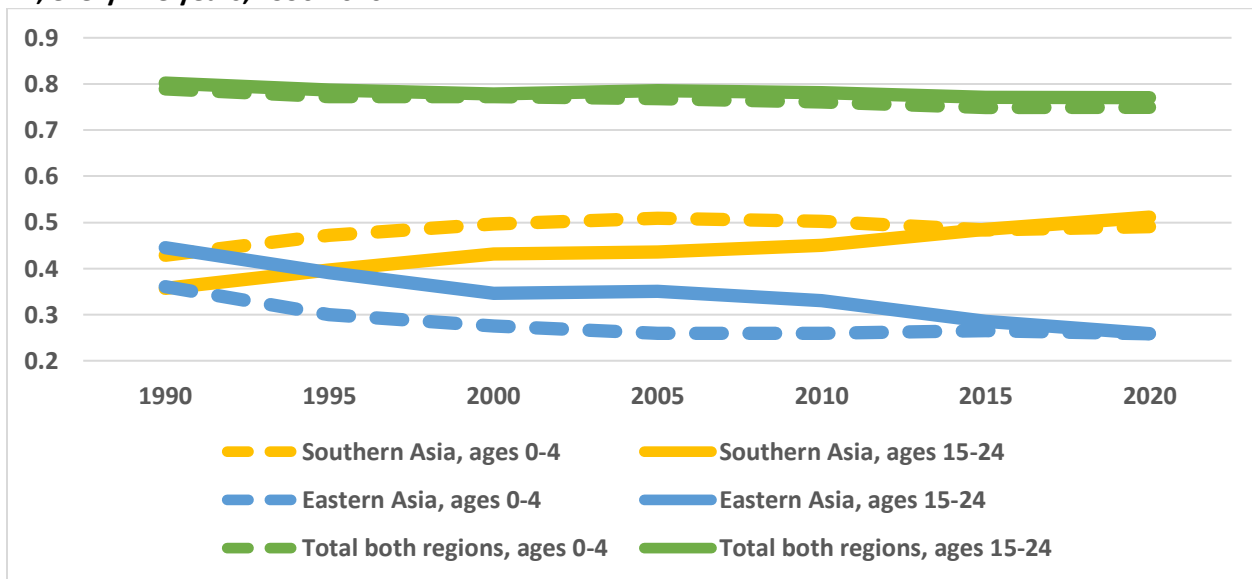
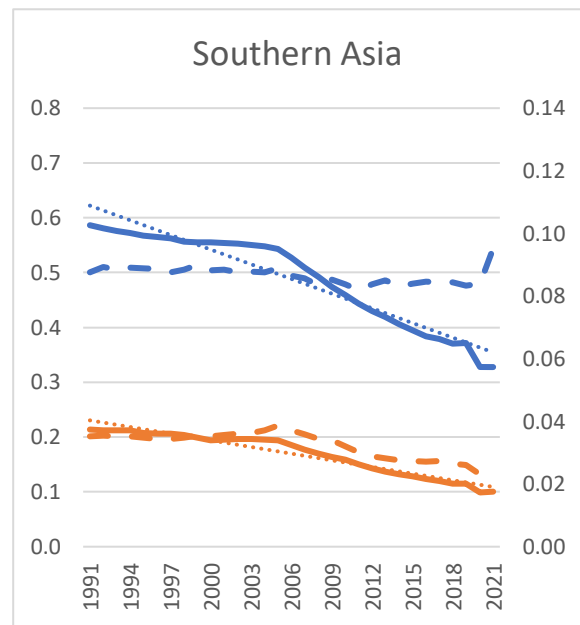
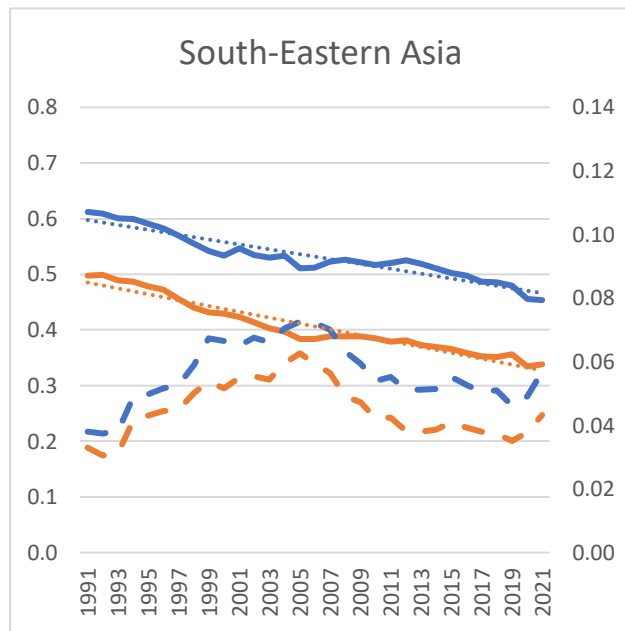
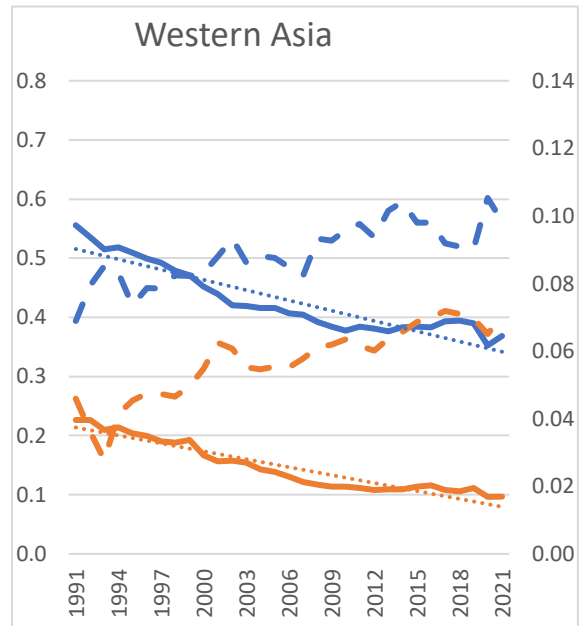
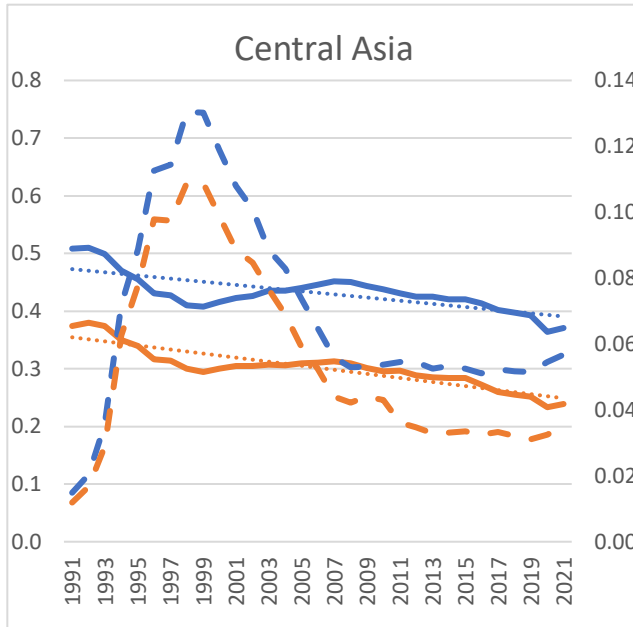
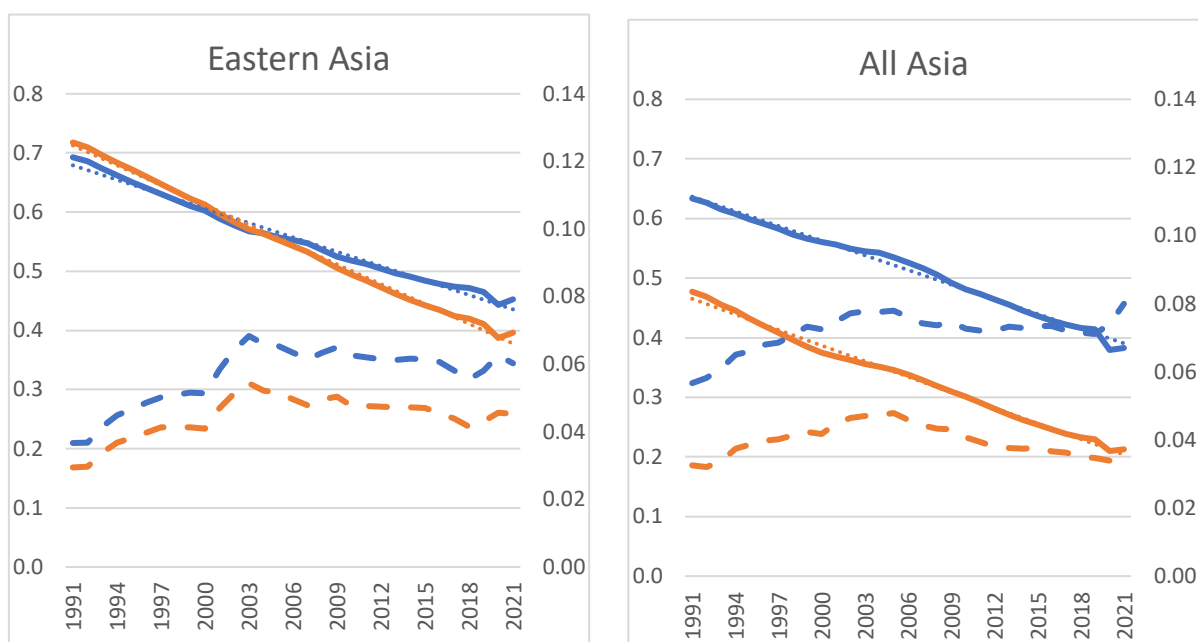


Figure 9. Youth employment and unemployment rates by gender, 1991-2021

- Male employment rate as a % of ages 15-24
- Female employment rate as a % of ages 15-24
- - - Male unemployment rate as a % of ages 15-24
- - - Female unemployment rate as a % of ages 15-24
- Linear (Male employment rate as a % of ages 15-24)
- Linear (Female employment rate as a % of ages 15-24)





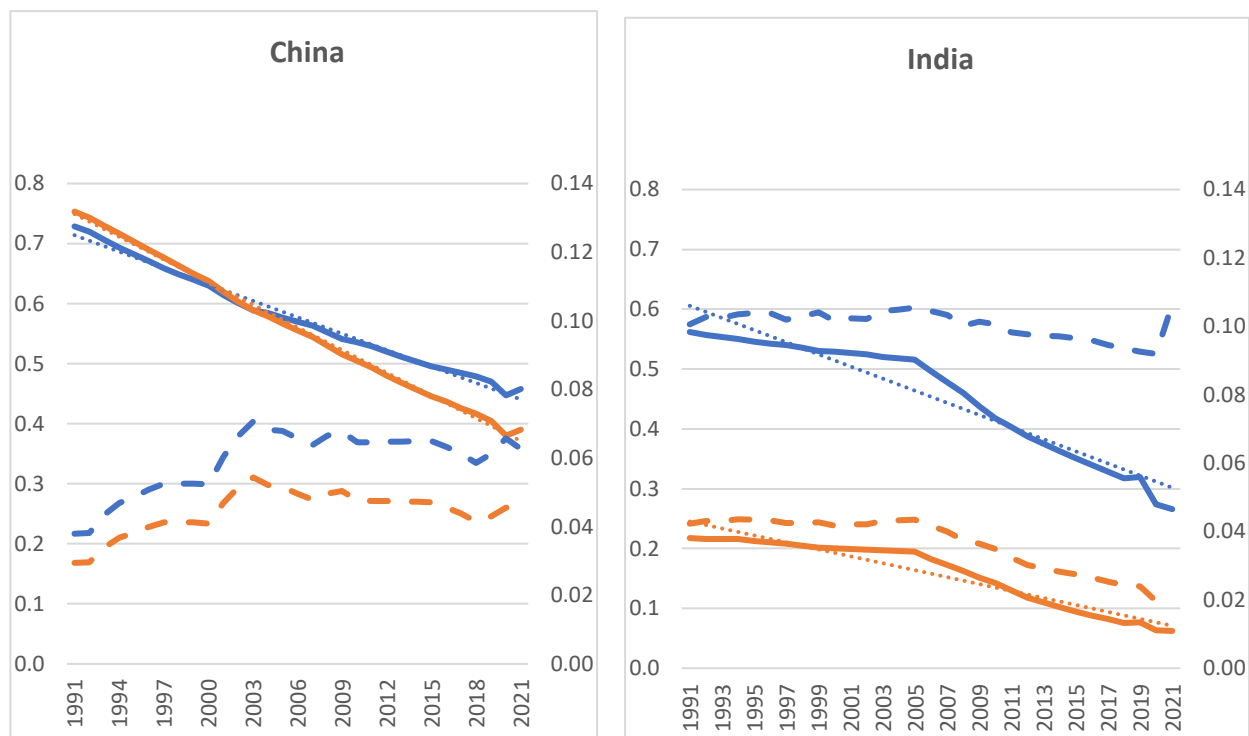
youth employment rate in 1991 (Central Asia) to that having the highest in 1991 (Eastern Asia). As shown in figure 9, there are many differences in youth employment and unemployment rates, as a percentage of those aged 15 to 24.¹¹ Central Asia also has the highest peak unemployment rate for both genders of any region.¹² In all but the Eastern region, the employment rate is higher for males than for females. However, in all regions the unemployment rate is lower for females than for males. Western Asia has the clearest upward trend in unemployment. It also has the lowest 2021 female employment rate, but that of Southern Asia is almost as low. Southern Asia has the lowest 2021 male employment rate, but that of Western Asia is also very low. Eastern and South-Eastern Asia are essentially tied for having the highest 2021 male employment rate; Eastern Asia clearly has the highest 2021 employment rate for females.

In figure 10, only the employment and unemployment rates for China and India are shown. In every year, the employment rate for China for both genders is substantially higher than that for India. Until 2004, the China female employment rate is higher than that of males. In India, the male unemployment rate is quite high, always above nine percent and typically around ten percent. It is double that of China until 2000. The female unemployment rates are much more similar to those of India. Both the male and female China unemployment rates initially rose, but then they both leveled off. India unemployment rates showed the opposite trend, being fairly constant, then beginning to decrease. In the 2000's, the China female unemployment rate became higher than that for India. The biggest labor market concern in the comparison between China and India is the high level of male unemployment rate in India, followed by the low female employment

¹¹. Typically the unemployment rate shown is as a percent of the labor force, however, in this paper instead it is shown as a percent of those aged 15 to 24 to show the status of youth and to facilitate comparisons across regions.

¹² An IMF blog (Ahmed, 2011) gave some possible reasons for this high level of unemployment including a low labor intensity of growth and a skills mismatch.

Figure 10. Youth employment and unemployment rates by gender, 1991-2021, China and India



rate in India.

Ideally, one would want to know what the youth in Asia are doing. Some of the drop in labor force participation over the time period is certainly due to the fact that Asian youth are staying in school longer than they did in 1991. However, it seems unlikely that the full drop in labor force participation can be explained by the trends in years of school completed.¹³ One way to get a sense of what is going on is to look at the not employed, in education or training (NEET) data.¹⁴ Unfortunately, there is very little NEET data available. Table 2 shows the youth NEET rates by gender for the most populous countries in each region, when this data is available. No NEET data is available for China or for enough years to indicate a possible trend for Central Asia. Certainly the much higher NEET rates for females compared to males are because of marriage, household responsibilities, child-bearing or child-rearing while females are young, but even they have declined over time. India is the only country for which there is a not a significant decrease in NEET rates, however, one wonders why the India rate goes from 16 percent to 10 percent twice in five to ten year periods. However, in any of the three most populous countries in

¹³ In the previous figures, labor force participation is equal to the sum of the employment rate and the unemployment rate, as both are as a percent of those aged 15-24.

¹⁴ The not employed, not in education, or training (NEET) youth data is from the online World Bank data sets, where the source data comes from the International Labour Organization database.

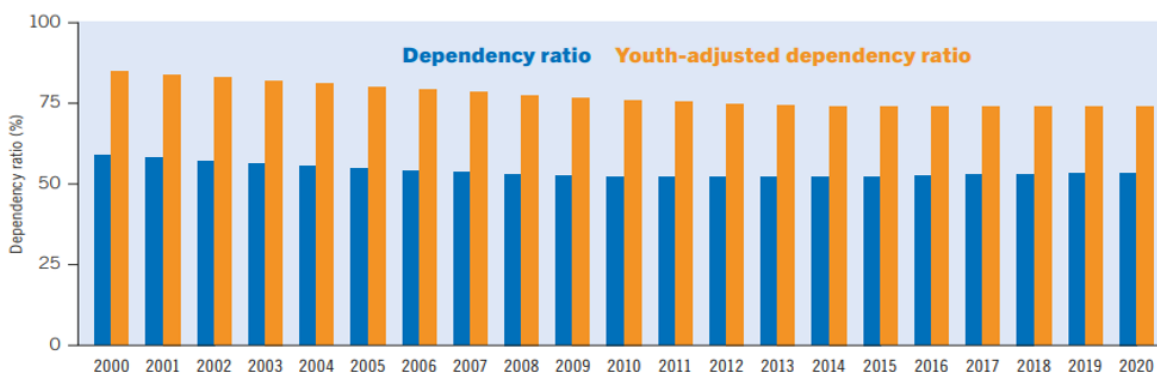
their region, the 2019 NEET rates range from about 15 percent to 18 percent, which indicates that a significant share of the male youth is idle.

Table 2. NEET rates for most populous countries in a region, ages 15-24, by gender, percents, selected years

	Country	1994	2000	2005	2010	2015	2019	Change from 2000 (1994) to 2019
Male								
South Asia	India	16.3	10.3	16.6	9.9		16.0	-1.7
South-Eastern Asia	Indonesia		20.0	23.0	18.7	16.6	15.1	-24.4
Western Asia	Turkey		21.8	26.8	19.6	14.1	18.3	-16.1
Female								
South Asia	India	62.5	57.0	57.2	50.4		47.6	-23.9
South-Eastern Asia	Indonesia		38.5	40.6	34.7	29.4	26.1	-32.1
Western Asia	Turkey		56.8	57.5	44.4	33.7	34.0	-40.1

The final data type to be considered before moving on the human capital measures is the dependency ratio. The dependency ratio is defined as the sum of the total population under age 15 and the total population above age 64 to the total population aged 15-64. The World dependency ratio is shown in figure 11 below so that it can be compared to the dependency ratio in Asia. The World dependency ratio, in blue (not youth adjusted) is always above 50 percent, declining from 58.7 percent in 2000 to 53.4 percent in 2020.¹⁵ The alternative, youth-adjusted dependency ratio is shown, which adds half of the total population aged 15-24 in the numerator, because in the International Labour Organization report notes that youth are postponing labor market entry, except to perhaps work part-time, longer than before.¹⁶

Figure 11. World dependency ratio, 2000-2020

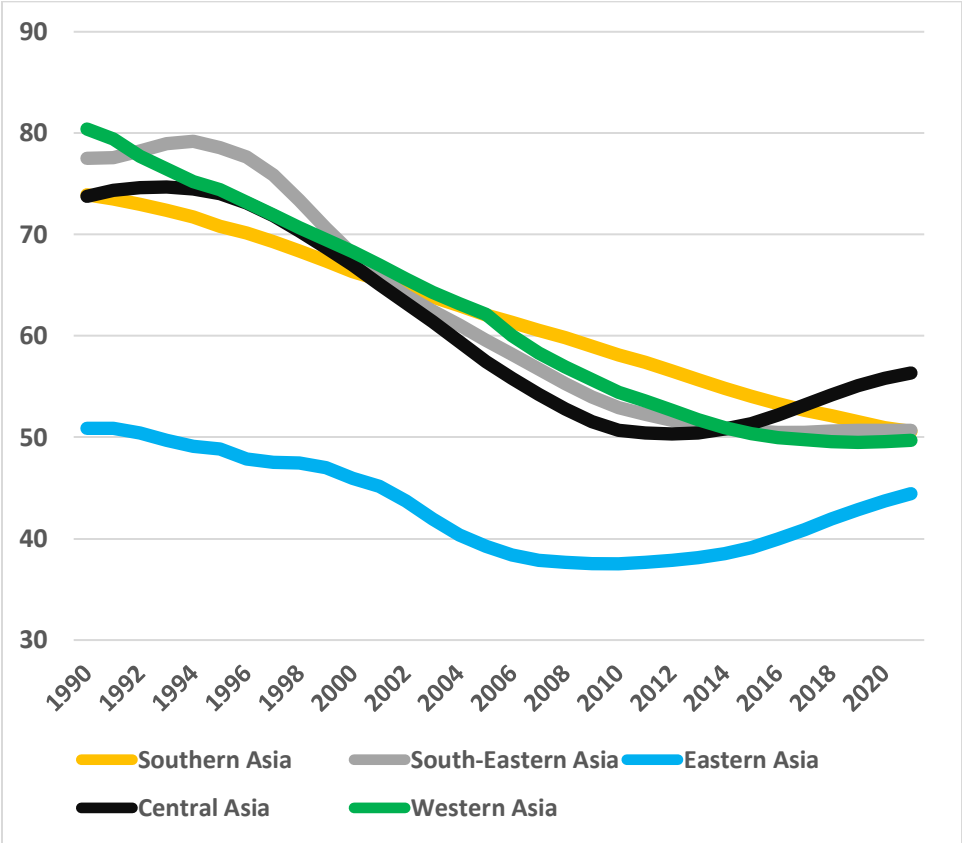


¹⁵ International Labour Organization, ILO - 2017, p. 12. Note that the ILO chart goes through 2020, even though the report was published in 2017.

¹⁶ ILO, 2017, pp. 12-13.

Figure 12 shows Asia dependency ratios, by region, where half of those aged 15-24 are not included in the numerator of the ratio. All of the regions have very similar dependency ratios except for Eastern Asia. In 2000, the dependency ratio for these area are much higher than those for the World shown in the previous figure, however, by 2020 the dependency ratio for all but Central Asia is similar to those for the world. The low birth rates in China are certainly the reason why the dependency ratio for China is so low, however, by 2010 these rates began to increase probably because of the aging Chinese population.

Figure 12. Asia dependency ratios, 1990-2020



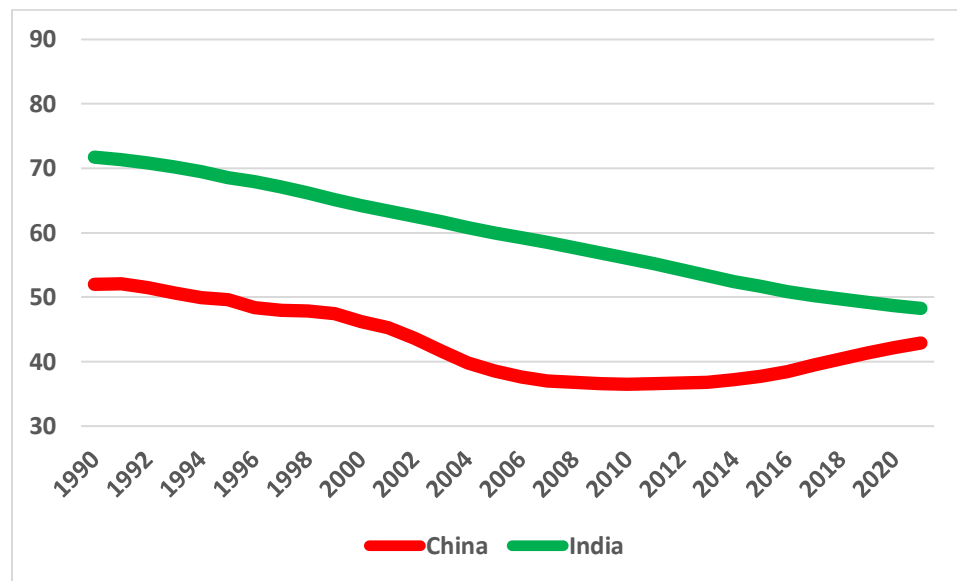
The China and India dependency ratios are shown in figure 13. That for India looks almost linear; that for China shows the trends already described in the previous figure.

Human capital

The human capital estimates, including the Gini coefficient, all come the Inclusive Wealth Report (IWR) data or estimates generated for one of the two forthcoming publications: IWR (United Nations Environment Programme - UNEP- forthcoming and IWR, United Nations Economic, Scientific, and Cultural Organization - UNESCO - forthcoming). Human capital is the predominant wealth for most countries and the World. Human capital benefits both individuals and their countries and gives a strong indication of a country’s future, including its sustainability. IWR includes three types of wealth: produced capital, natural capital, and human

capital for 165 to 167 countries. In 2019, human capital accounted for 58 percent of World wealth.¹⁷

Figure 13. Dependency ratio: China and India



Human capital, HC, is estimated by using the following formula:

$$(1) \quad HC = \underbrace{e^{\rho \cdot Edu}}_{Term_1} \cdot \underbrace{P_{5+Edu}}_{Term_2} \cdot \underbrace{\int_0^T w \cdot e^{-\delta \tau} d\tau}_{Term_3},$$

where ρ is the return to years of schooling, Edu is the average expected years of schooling, P_{5+edu} is the number of individuals who are old enough to have finished the average number of years of education, T is an employee's expected remained working years, w is the average annual labor compensation, and δ is the discount rate.

Term 1 captures the return to schooling, and term 2 the number of individuals who have finished the average expected number of years of education and might be working. Term 3 is the labor compensation received by an individual over their lifetime. Following the underlying model developed by Arrow et al. (2012), w is held constant over the whole period, 1990 to 2020, and because of data limitations, w is the same for men and women. The rate of return to education is set at 8.5 percent as suggested by Klenow and Rodriguez-Clare (1997), as is the discount rate. Human capital is deflated using country-level purchasing power parities.

Figure 14 graphs human capital per capita for regions in Asia and all of Asia. Human capita per capita is equal to the expression in equation 1 divided by the total population of the region. The charts within the figure are arrayed from that having the lowest male human capital per capita

¹⁷ Countries covered in the forthcoming Inclusive Wealth Reports account for at least 97 percent of the World's population. As previously done in this paper, the term "World" is used to refer to all covered countries.

(Southern Asia) to that having the highest human capital per capita (Western Asia). Central Asia human capita per capital is almost identical for males and females; that for South-Eastern Asia is very similar for males and females. Male and female human capital per capita are also quite similar in Eastern Asia, but female human capital is larger than that of males by 2000. By contrast, Western Asia male human capital per capita is much larger for males than for females, where female human capital per capita is only 55 to 60 percent of that of males.

Figure 14. Human capital per capita, by gender, every five years 1990-2020 (thousands, 2015 US\$)

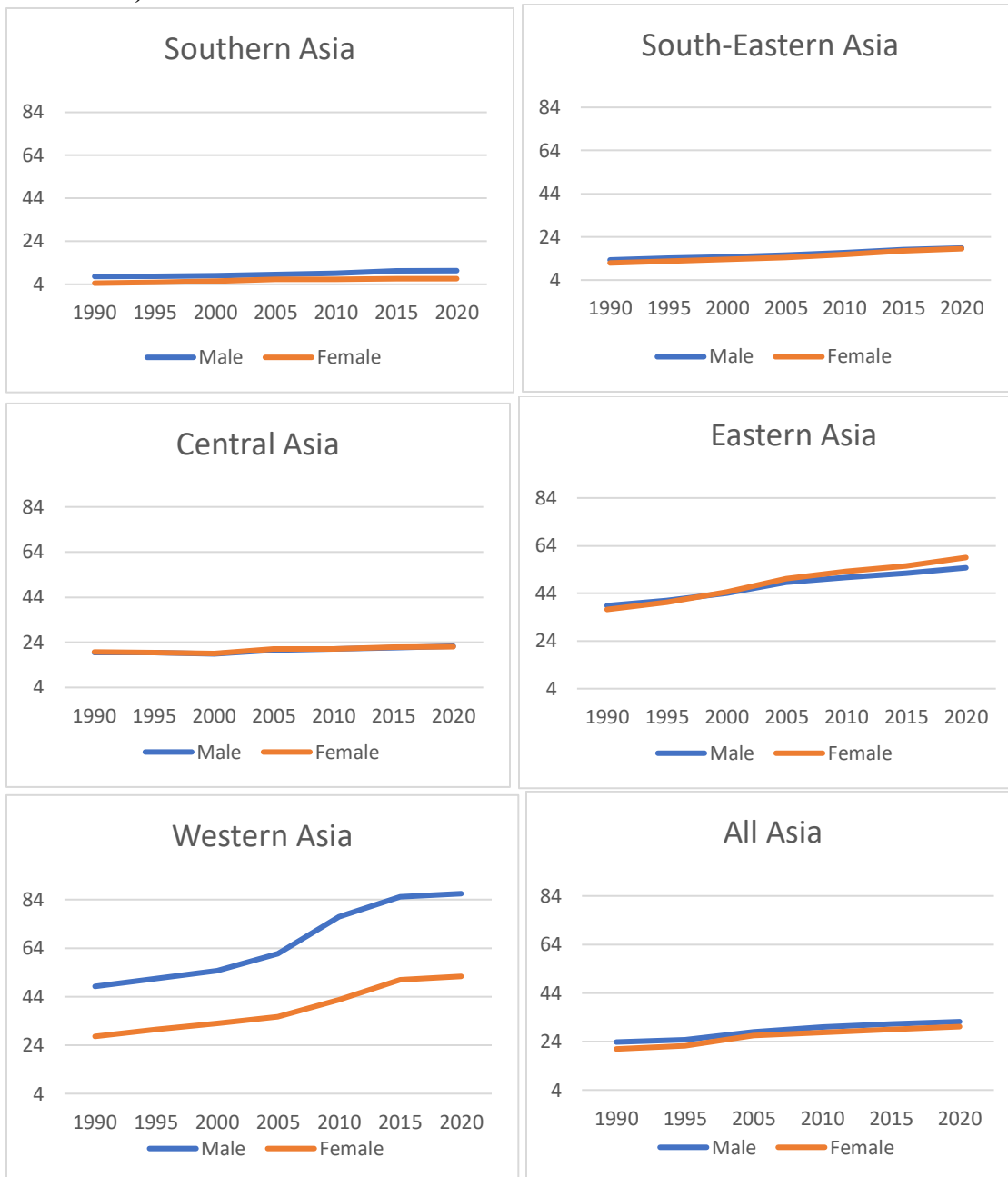


Figure 15 shows human capital per capita for the six aggregates. The y-axis scale for Africa, Asia, Latin America, and the World are identical to facilitate comparison; that for the G20 and the EU differ as their human capital per capita is so much higher than those of the others. There is a consistent pattern between the five aggregates, as human capital per capita rises between Africa and Asia, Asia and Latin America, Latin America and the G20, and the G20 and the EU. Even the 2020 figures are lower than the following shown aggregate 1990 figure. Africa, Asia, and Latin America female human capital per capita are less than that of males in each of the years shown, with the difference between male and female human capital per capita in 2015 US\$ being about \$1,500 for Africa and just over \$2,000 for Asia and \$1,000 for Latin America. Of these three, Latin American female human capital per capita demonstrated the greatest catch-up to males between 1990 and 2020, as the percentage of male human capital female human capital per capita rose 13.9 percentage points compared to 10.4 percentage points for Africa and 5.6 percentage points for Asia. Other factors besides EYS are impacting Latin America's human capital per capita, as female human capital per capita is always less than males even though female EYS is always greater than male EYS. Some of these factors are explored in the section, which breaks out each of the three terms' contribution to growth in human capital. For the years shown, G20 female human capital per capita is always above that of males; World female human capital per capita is above that of males beginning in 1995. The EU is the only aggregate for which there is a crossing point between female and male human capital per capita. After 2000 female human capital per capita is always greater than male human capital per capita. The World figures are all above those for Africa, Asia, and Latin America; the EU figures are above those for the G20, as would be expected given the relative EYS level.

Next contributions to human capital growth are analysed using a decomposition approach. This framework was first employed in IWR (UNEP, forthcoming; Liu, 2021). Since human capital of a country k in an aggregate consisting of K countries is estimated separately for males and females (gender being indexed by $j, j = 1, 2$), one has:

$$(2) \quad HC_{jk} = \prod_i Term_{ijk}, \quad i = 1, 2, 3; j = 1, 2; k = 1, 2, \dots, K,$$

and the total aggregate human capital, HC^R will be:

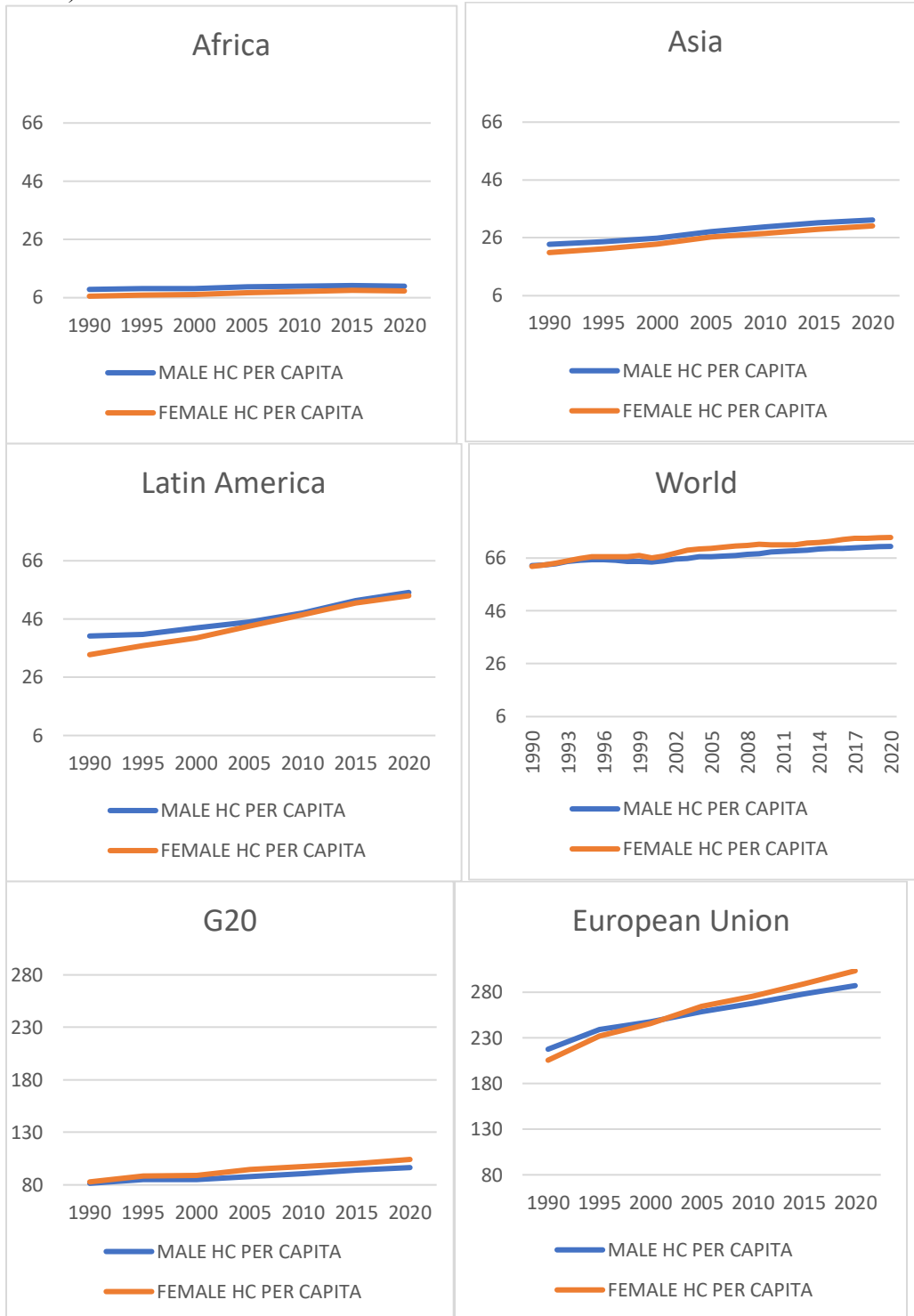
$$(3) \quad HC^R = \sum_{jk} HC_{jk} = \sum_{jk} (\prod_i Term_{ijk}), \quad i = 1, 2, 3; j = 1, 2; k = 1, 2, \dots, K.$$

By using the logarithmic mean function as weights, the (percentage) growth of aggregate human capital defined in equation (3) can be decomposed as:

$$(4) \quad \frac{\Delta HC^R}{HC^R} = \frac{\sum_{jk} \Delta HC_{jk}}{HC^R} = \left(\sum_i \sum_{jk} \frac{\Delta HC_{jk}}{\Delta(\ln HC_{jk})} \Delta \ln Term_{ijk} \right) / HC^R, \quad i = 1, 2, 3; j = 1, 2; k = 1, 2, \dots, K,$$

where Δ stands for the change of variable between two time points.

Figure 15. Human capital per capita by gender, every five years, 1990-2020 (thousands, 2015 US\$)



Formally, the contribution by each factor indexed by Term i , gender j , and country k to regional human capital growth is defined as:

$$(5) \quad \text{Contribution}(i, j, k) = \left(\frac{\Delta HC_{jk}}{\Delta(\ln HC_{jk})} \Delta \ln \text{Term}_{ijk} \right) / HC^R, \quad i = 1, 2, 3; j = 1, 2; k = 1, 2, \dots, K.$$

Contributions are only estimated for China, India, and for selected aggregates.

The next figure, figure 16, shows the contributions for China and figure 17, for India, both by term and by gender. The primary contribution to human capital growth in China is term 1, returns to schooling, in India it is term 2, the number of individuals who have finished the average expected number of years of education. For India, female term 3 is significantly negative, except from 1990-2000. The negative contributions indicate that the average number of years that females are expected to work has decreased over time, and therefore the contribution of lifetime labor compensation to human capital growth is negative. For China, the female contribution to human capital growth is always greater than that of males, with returns to schooling being the primary reason. The contribution of both males and females is greatest in 2000-2010. The contribution of males to human capital growth is the same in 1990-2000 and 2010-2020. By contrast for India, the contribution of males to human capital growth is always greater than that of females. The sum of term 1 and term 2, contribution's returns to schooling and the number of individuals who have finished the average expected number of years of education, respectively, for males in China is almost equal to that for females in India. For India, in 1990-2000, male declines in returns to schooling actually has decreased growth in human capital. The total contribution, summed across males and females, is the highest in 2000-2010 because of the higher contribution of males compared to 1990-2000. The total contribution substantially decreased in 2010-2020.

Figure 16. Contributions to human capital growth by gender, 1990-2020, China

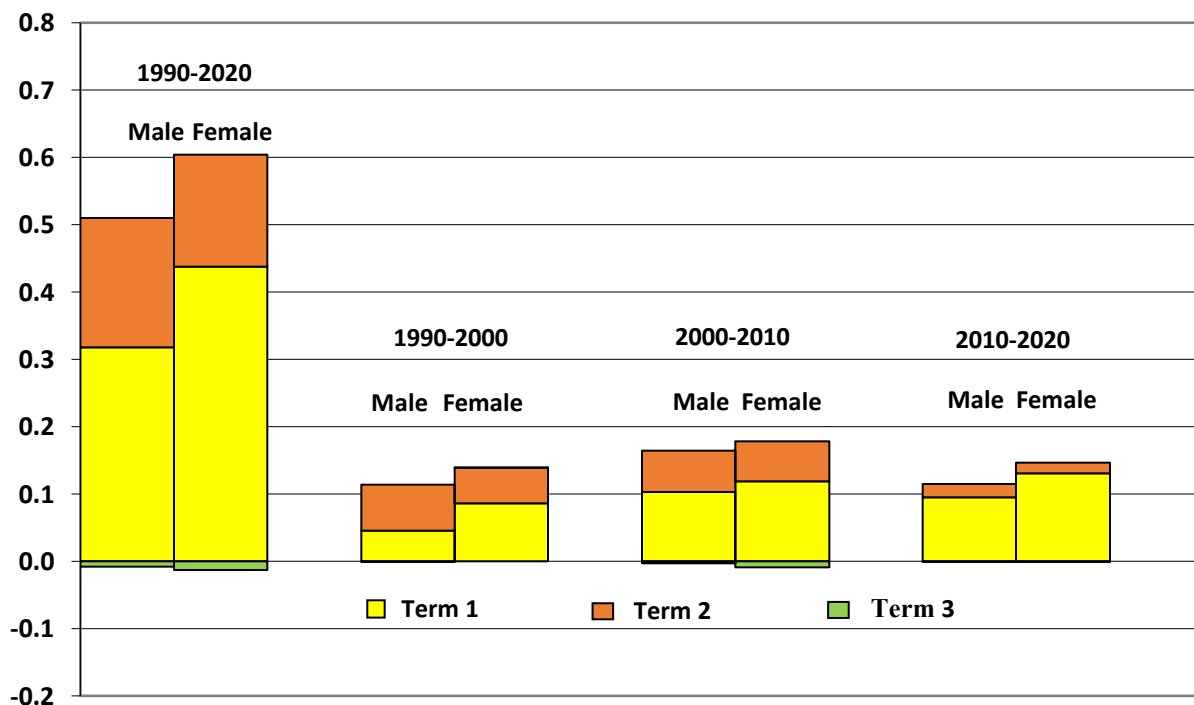


Figure 17. Contributions to human capital growth by gender, 1990-2020, India

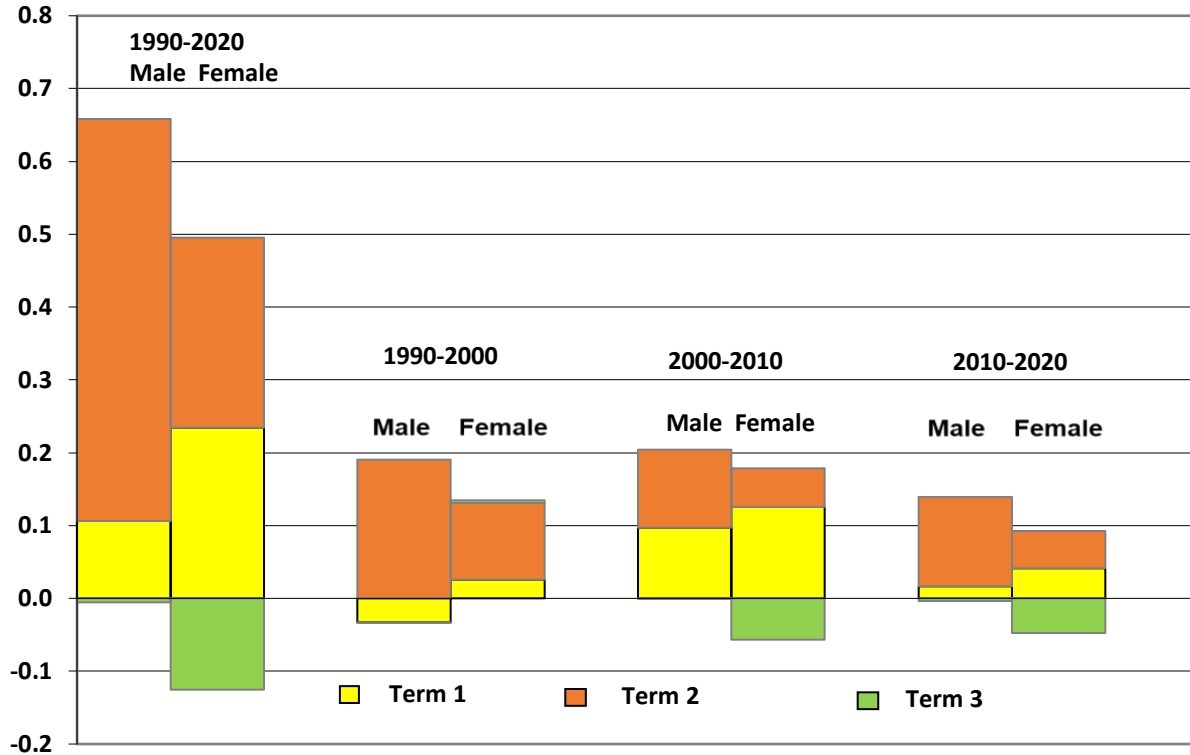
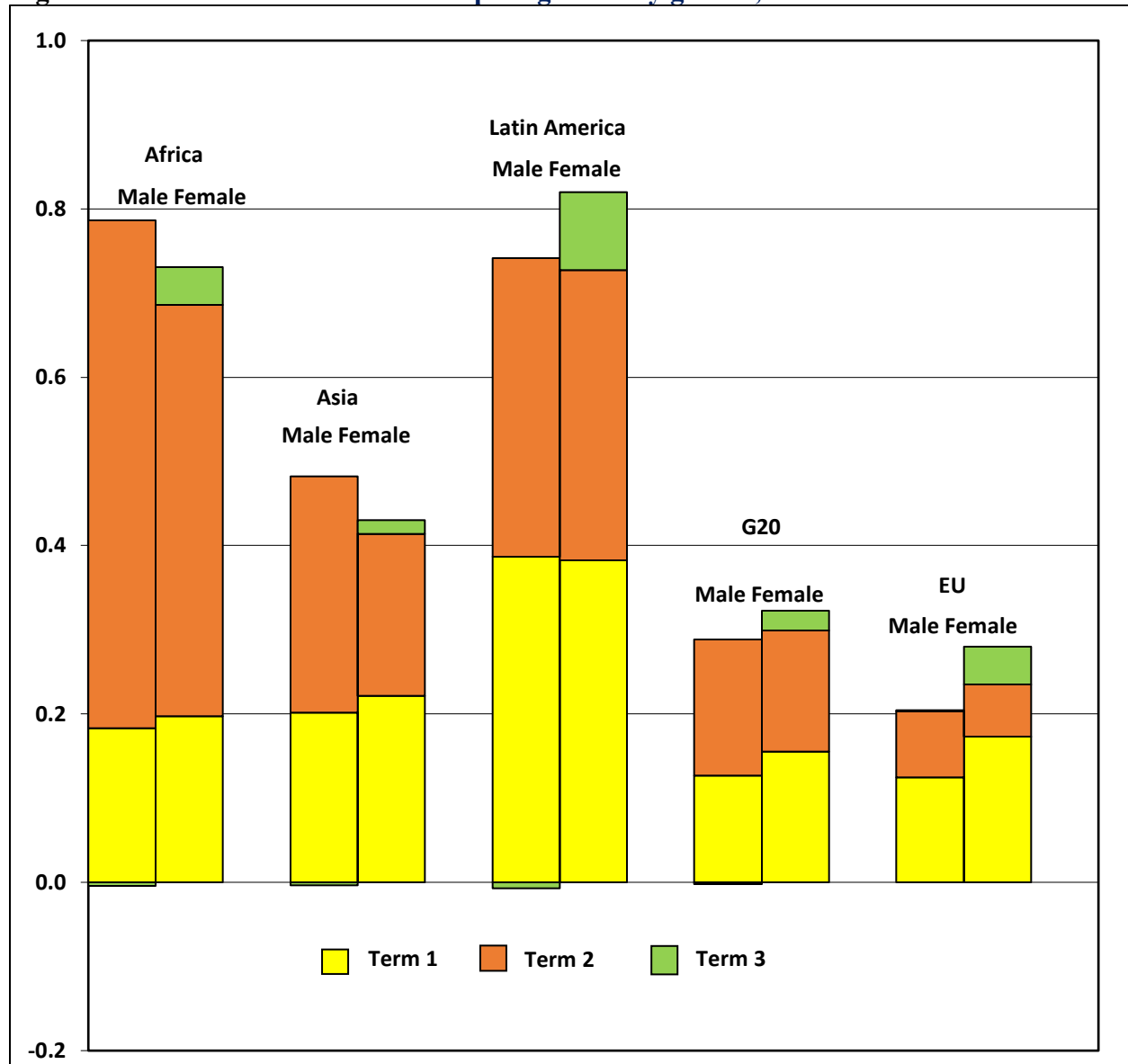


Figure 18 compares the contribution to human capital of Asia to that of other selected aggregates. Africa and Latin America have much higher contributions to growth in human capital than that of the other three aggregates. The greatest impetus to human capital growth in Latin America is education, through term 1 returns to schooling, whereas in Africa it is term 2, the number of individuals who have finished the average expected number of years of education. The higher income countries included in the G20 and the EU reduce the average contribution to human capital growth in those aggregates. The contribution of Asia is intermediate between those of Africa and Latin America and the G20 and EU.

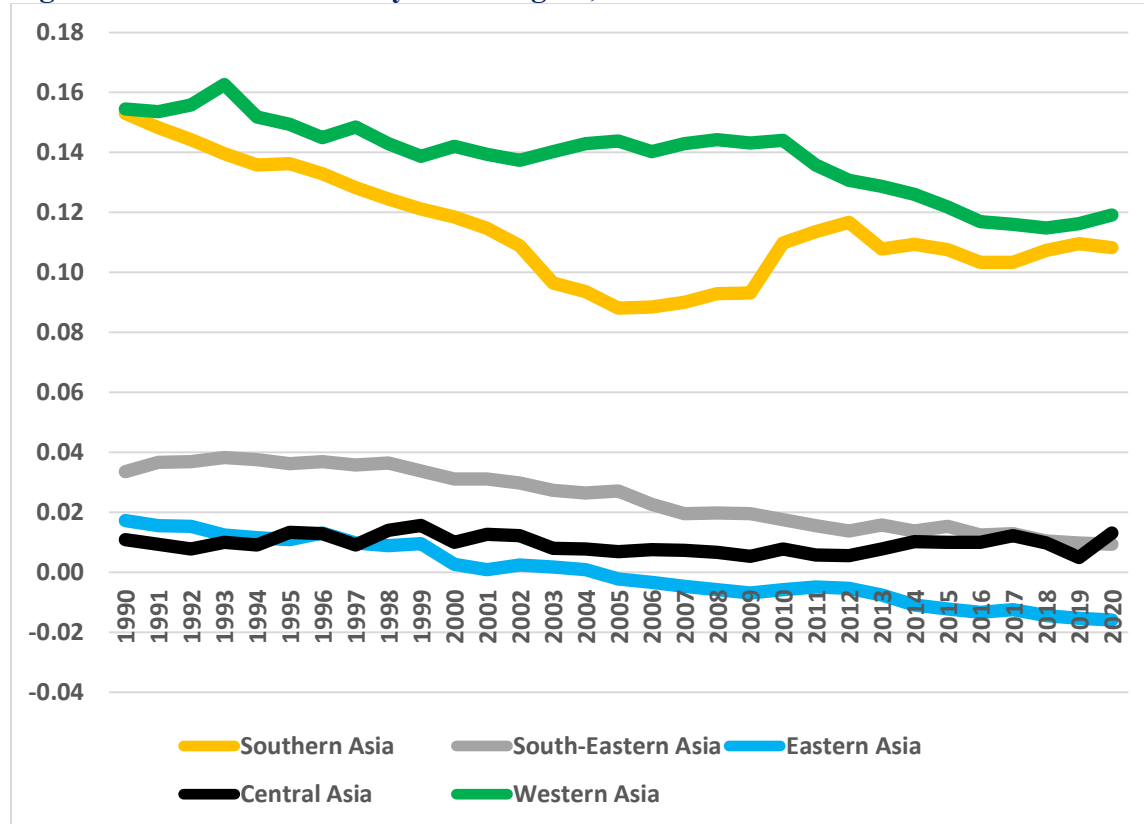
Figure 18. Contributions to human capital growth by gender, 1990-2020



The final concept presented in this paper is a Gini gender coefficient. A Gini gender coefficient is computed to examine the gender distribution of human capital among educated people. A positive value of an estimated Gini gender coefficient indicates that educated males generate or own more human capital than educated females, while a negative value suggests the opposite. The larger the absolute value is, the more unevenly human capital is distributed between genders, and a value of zero implies that human capital is equally distributed among educated males and females. First, figure 19 shows Gini coefficients by regions in Asia. The level of the Gini gender coefficients is about the same in Southern and Western Asia and both are tending lower, which means that the human capital differences between educated males and females is narrowing somewhat. The level of the Gini coefficient of the other three regions are fairly similar, much lower than that of Southern and Western Asia, but there differences among the three. That for Central Asia is approximately equal over time, that for South-Eastern and Eastern Asia are both

declining somewhat over time. Eastern Asia is the only region for which educated females generate or own more human capital than educated males at any point of time; this occurs beginning in 2005 and continues through the end of the period.

Figure 19. Gini coefficient by Asian region, 1990-2020

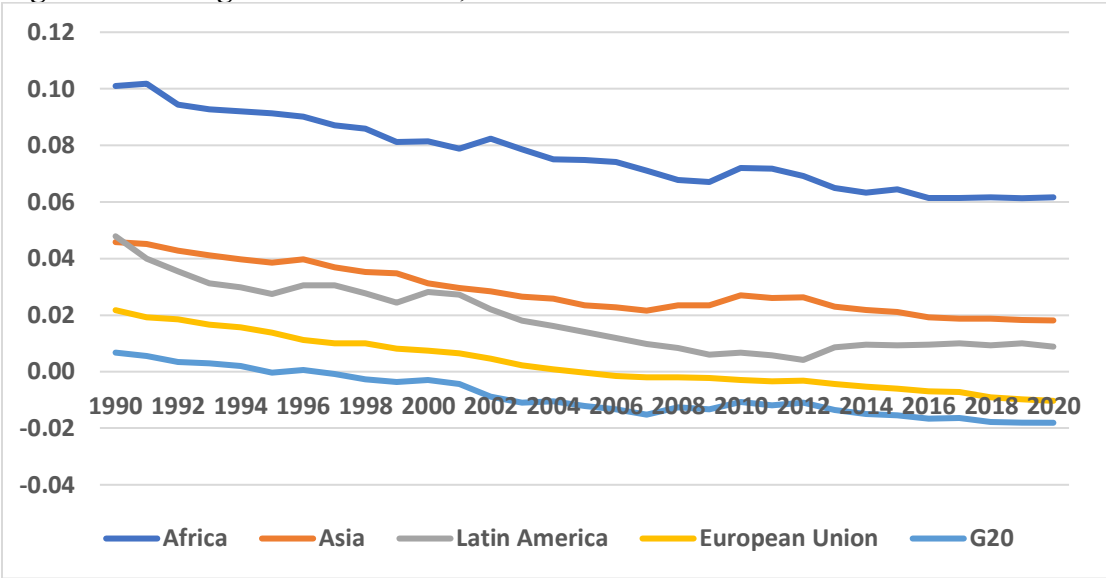


The last figure of this paper, figure 20, shows Gini coefficients for the six aggregates include in this paper. The highest coefficient is for Africa. Asia and Latin America have fairly similar coefficients as do the EU and the G20. The coefficients generally decrease over time, indicating that the extent to which educated males generate/own more human capital than females has reduced over time. The EU and the G20 are the only aggregates for which educated females generate/own more human capital than males by some year. This occurred for the EU beginning in 2006 and the G20 starting in 1997.

Conclusion

Anyone who examines labor force participation and education in Asia knows that there is a great deal of diversity among regions in Asia, most notably for countries in Asia between China and India. The contribution of this paper is four-fold: the size of the potential future labor force is examined, youth employment and unemployment is presented, human capital, including a Gini gender coefficient, is described, and most importantly, all of this is done by gender. In almost all regions there is a clear difference between males and females and these differences and levels are frequently different by region. To miss this is to possibly misunderstand possible challenges facing countries if they wish to enjoy strong economic growth now and in the future.

Figure 20. Gini gender coefficient, 1990-2020



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Appendix I: Countries in Regions or in Other Aggregates

Aggregates:

Africa (46): Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Capo Verde, Cameroon, Central African Republic, Chad, Congo, Congo (Democratic Republic of), Cote d'Ivoire, Djibouti, Egypt, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome, and Principe, Senegal, Sierra Leone, Somalia, South Africa, Tanzania (United Republic of), Togo, Tunisia, Uganda, Zambia, and Zimbabwe.

Asia (47 or 48): Afghanistan, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Cyprus, Georgia, Hong Kong, India, Indonesia, Iran, Iraq (Islamic Republic of), Israel, Japan, Jordan, Kazakhstan, Korea (Democratic People's Republic of), Korea (Republic of), Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Macao, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, Sri Lanka, Syrian Arab Republic, Tajikistan, Thailand, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, and Viet Nam, with Palestine in the EYS section only.

Latin America (22): Argentina, Bolivia (Plurinational State of), Bolivia, Brazil, Belize, Chile, Columbia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela (the Bolivarian Republic of).

European Union (27): Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

G20 (43): All of the members of the European Union listed above, plus Argentina, Australia, Brazil, Canada, China, India, Indonesia, Japan, Korea (Republic of), Mexico, Russia, Saudi Arabia, South Africa, Turkey, United Kingdom of Great Britain and Ireland, United States.

Regions in Asia:

Southern Asia (9 countries): Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, Sri Lanka.

South-Eastern Asia (10 countries): Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.

Eastern Asia (5 countries plus 2 dependencies): China, Hong Kong, Japan, Macao, Mongolia, North Korea, South Korea.

Central Asia (5 countries): Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.

Western Asia (16 or 17 countries): Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Palestine, Iraq, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, Yemen, where Palestine is only available for EYS.

Asian countries not covered (2 countries): Lebanon, Timor-Leste

Asian dependency not covered (1 country): Taiwan