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Hearing on "*China's Challenges and Capabilities in Educating and Training the Next Generation Workforce*"

Education plays an important role in China's continued economic modernization. Prior to the pandemic, China sustained an incredibly fast rate of economic growth for four decades–an average annual gain in GDP per capita of close to 9 percent. Rapid growth was due in part both to the size of China's working-age labor force as a proportion of the size of its population as well as to improvements in labor productivity. Improvements in labor productivity were in turn due both to the reallocation of labor to more efficient sectors (rural to urban migration and the increased role of privatization in the economy) and to improvements in human capital (education and on-the-job-training). Because the size of its working-age labor force as a proportion of the population has decreased considerably and because the country has already reallocated much of its labor force efficiently (rural to urban migration has plateaued with the vast majority of able-bodied, working-age rural persons already working in urban areas; China now has a substantial private sector and state-owned enterprises have adopted many of the labor practices of private firms), further improvements in labor productivity will depend to a large extent on continued improvements in human capital. Therefore, education will play an even more important role than it has in the past in China's continued economic modernization.

Today, China's education system is one of the largest and most complex in the world.[1] To better understand its role in developing human capital throughout the country, it is helpful to look at education in urban and rural areas separately. It is also helpful to separately examine China's regular K-12 education system as well as its systems of vocational education and higher education.

In K-12 schooling, urban students have more opportunities and achieve better educational outcomes than rural students. In particular, students in China's urban areas appear to have high levels of language, math, and science achievement by the end of K-12 schooling. For example, according to the 2018 and 2015 Programme for International Student Assessment (PISA) fifteen-year-old urban residents in economically advanced provinces (Beijing, Shanghai, Guangdong, Zhejiang and Jiangsu together) scored higher than students from any of the other 70-plus participating countries in reading, mathematics, and science.[2] A large proportion of urban students in these economically advanced provinces also performed at the highest levels of

[1] According to the Ministry of Education of China, in 2021, China had approximately 108 million students in primary school (grades 1-6), 50 million students in junior high school (grades 7-9), and 39 million students in senior high school (grades 10-12).[1] China also had 48 million students enrolled in some form of early childhood education (including public and private kindergartens and nursery classes for ages 0-5).

[2] The United States ranked 8th, 30th, and 11th in reading, mathematics, and science in the PISA 2018.

proficiency in at least one subject in the PISA exams, indicating that these students had acquired knowledge, skills, and abilities to perform tasks of substantial complexity. While there is less representative evidence about the performance of urban students in less economically advanced provinces in China and there is undoubtedly substantial variation in achievement among urban students across China, a substantial proportion of urban students in these provinces also have high levels of achievement.[3] This plus the large number of urban students in China (61 million urban students alone in primary school and junior high school, i.e. grades 1-9, in 2020) implies that the country has a large pool of educated talent in urban areas alone.

Turning to K-12 education in rural areas, it is important to note that rural students still comprise the majority of students (61%) in the country.[4] Ensuring that the population of rural students receives education of sufficient quality thus remains a major issue in thinking about China's continued economic growth as well as its future economic equality and social mobility. The issue of educating rural students is complicated by the household registration (*hukou*) system in China, which often allocates opportunities to attend higher-resourced schools on the basis of household residential status.[5] The issue of educating rural students is also complicated by the fact that they have to compete for opportunities to attend higher levels and more elite categories of schooling with more resourced urban students that often perform better on competitive high school and college entrance exams.

Researchers have assumed but seldom documented that there is a substantial gap in math and language achievement between rural and urban students in K-12 education. According to somewhat crude measures of math and language achievement used in a nationally representative household survey in 2018, there is indeed a moderate-size gap in math and language between rural and urban students.[6] At the same time, there is evidence that students in rural primary and junior high schools appear to be making steady achievement gains in school.[7] This indicates that the quality of primary and junior high school in rural China is relatively high compared with other developing countries where achievement gains are low or negligible.[8]

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[3] For example, Loyalka et al. (2019) assess the math and science achievement levels of a nationally representative sample of entering college students selectively admitted into computing and electrical engineering majors in China (a large proportion of which are urban students from a range of provinces) and find that their achievement levels are very high - much higher than their counterparts in India and Russia.

[4] The number of primary and junior high school students (grades 1-9) in China in 2020 was approximately 156 million and 95 million of these students were from rural areas. Source: Ministry of Education in China. China's Education Situation in 2020.

[5] For example, only children with a *hukou* in a specific district are entitled to go to a public school in that district. The quality of schooling children receive therefore depends on whether on their (urban or rural) *hukou* status.

[6] The gap was 0.44 standard deviations in math and 0.32 standard deviations in language (based on an analysis of the China Family Panel Survey data from 2018 as detailed in a research paper written by Dr. Yue Ma at the Stanford Center for China's Economy and Institutions and his co-authors). Researchers unfortunately do not have access to enough data to interpret how large the achievement gap is in terms of number of years-of-education or some other easily interpretable measure.

[7] For example, one unpublished study describes administering vertically scaled math tests to thousands of rural students in less developed counties of Henan, Shaanxi, and Gansu provinces as they were progressing through junior high school. Importantly, students made steady gains in math achievement, regardless of their family's economic background and regardless of whether they were low or high achieving students.

[8] World Bank. (2017). *World development report 2018: Learning to realize education's promise*. The World Bank.

The rural-urban gap in achievement does not appear to be due to gaps in government financing for rural versus urban education. Per student expenditures for primary and junior high school do not appear to differ substantially between rural and urban areas. As of 2020, expenditures per rural student were $3,147 for primary school, and $4,245 for junior high school.[9] This is comparable to the national average of $3,370 for primary school and $4,870 for junior high school.[10] Moreover, policymakers substantially increased expenditure per student in rural areas from 2020 to 2021 (an increase of 10% for primary school and 16% for junior high school).[11]

The above figures for expenditures per student do not include parental investments in education which differ considerably for rural and urban households. To give some sense of these differences, in 2017, urban households spent approximately three times more on their primary school children's education than did rural households ($2,049 compared to $659).[12] This does not include investments in early childhood or investments of parental time which are also likely considerable larger in urban areas compared to rural areas. Gaps in parent's financial investments, which had been growing over time, may have diminished somewhat after a national policy to regular private tutoring in July 2021. Due to the competitiveness of the country's entrance exam system, however, it may be that the policy did not really work to diminish gaps in parental investment.[13] Rather, inequalities in household investments into education as well as related inequalities in educational opportunities and outcomes between rural and urban students in K-12 schooling will likely to persist far into the future.

After rural and urban students finish compulsory schooling (grade 9, the last year of junior high school), they can choose to take a high school entrance exam. Performance on the high school entrance exam largely determines whether students are tracked into academic high school or not. Students are eager to get into academic high school as most of academic high school students end up taking the college entrance exam and going to college. The vast majority of urban children enter academic high school while only some rural students do.[14] Rural students, in fact, frequently end up in vocational high school or drop out of the educational pipeline altogether.

In prior years, to provide rural students with greater opportunities for a high school education and labor market prospects beyond those associated with going to academic high school and college, policymakers had invested substantially in vocational high schools. Around 2010, for example, policymakers mandated a 50:50 split in academic and vocational high school enrollments. They also made vocational high school free for rural students and invested in

[9] All expenditure amounts in the report are in US PPP-adjusted dollars. Source: China Education Expenditure Statistical Yearbook, 2021

[10] The national average includes both rural and urban students—official data are unavailable for urban students alone.

[11] For the sake of comparison, US still spends much more per student than China – approximately three times as much at $14,000 per student. https://nces.ed.gov/programs/coe/indicator/cmd/education-expenditures-by-country

[12] China Education Finance Household Survey, 2017.

[13] https://www.scmp.com/tech/policy/article/3186924/year-after-chinas-private-tutoring-crackdown-classes-have-moved

[14] Loyalka, P., Chu, J., Wei, J., Johnson, N., & Reniker, J. (2017). Inequalities in the pathway to college in China: when do students from poor areas fall behind?. *The China Quarterly*, *229*, 172-194.

special "model" or elite vocational high schools that would be of higher quality. Expenditures per student in academic and vocational high school were also comparable.[15] Despite these efforts, the quality of vocational high school education was extremely poor. Students learned few vocational skills and few if any academic skills. Dropout rates were high and morale among students and teachers was low. Likely due to the poor quality of vocational schooling as well as parallel efforts of the government to expand academic high school and college slots, the percentage of students attending academic high school increased markedly by 2021 to 66.5% (~26 million students), while the percentage of students attending vocational high school decreased to 34.5% (~13 million students). Vocational high schooling is therefore not a major contributor to human capital development in China today.

As previously mentioned, in contrast to students in vocational high school, students in academic high school have a high probability of entering college after three years. In preparation for the competitive college entrance exam, they take rigorous and demanding college-preparatory courses in math, biology, chemistry, physics, literature, English, and other subjects. Because of the rigor of the curriculum, competition to do well on the college entrance exam, and prior years of investments in schooling, the language, math, and science achievement levels of students at the end of academic high school are quite high. For example, a cross-national study of nationally representative samples of students entering four-year computing and engineering programs in China, India, and Russia (with some baseline comparisons with the United States) showed that students in China were years ahead of their counterparts in other countries in math and science achievement.[16,17]

Having provided background about China's K-12 education system, including its vocational high schools, I would like to now discuss China's higher education system. China's higher education system expanded very rapidly since the late 1990s. That, combined with its decreasing population of college-going youth, means that a higher proportion of college-eligible youth are now being admitted into college. The proportion of 18-24 year olds going to either regular undergraduate programs (typically four-year programs) or vocational higher education programs (typically 2 or 3 year programs) is now approximately 28.5% compared to 40% in the United States. The proportion of 18-24 year olds going to regular four-year undergraduate programs is 16% in China compared to 31% in the United States. Even though the gross enrollment rate for regular undergraduate programs is almost twice as large in the United States, it is important to keep in mind that approximately 19 million students are enrolled in these programs in China compared to approximately 11 million in the United States.[18] In other words, China has a much larger pool of college educated youth than the United States, which has implications for its ability to modernize and innovate.

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[15] Even in 2021, academic high school expenditure per student was $4,492, while vocational high school expenditure per student was $4,083. Source: China Education Expenditure Statistical Yearbook, 2022.

[16] Loyalka, P., Liu, O. L., Li, G., Kardanova, E., Chirikov, I., Hu, S., ... & Li, Y. (2021). Skill levels and gains in university STEM education in China, India, Russia and the United States. *Nature human behaviour*, *5*(7), 892-904.

[17] Carnoy (2013) compare the college entrance exam score levels of the universe of students entering engineering majors with students entering other majors in regular undergraduate programs in China in 2010 and show that the score levels are very similar.

[18] Source for China: http://en.moe.gov.cn/documents/reports/202209/t20220924_664436.html. Source for the United States: https://nces.ed.gov/programs/digest/d21/tables/dt21_303.70.asp

While, as discussed, students enter college with high levels of language, math, and science achievement, during college they appear to learn very little in terms of academic skills and higher order thinking skills such as critical thinking. Cross-national studies confirm that students in China's four-year public universities make few, if any, gains in math skills and, in fact, lose science skills in the first two years. Furthermore, by the end of four years, graduates in China have comparable levels of major-specific skills and critical thinking skills as graduates in India and Russia and considerably lower major-specific and critical thinking skill levels than graduates in the United States.[19] The lack of learning in these four-year public universities, which are the top tier 1 and 2 universities in the country, implies that the quality of education is perhaps even worse in less-resourced and less-well-managed lower tier colleges (including tier 3 private four-year universities and tier 4 vocational colleges).

Why are undergraduate students in China's university system not learning skills and perhaps even forgetting skills they developed in the K-12 system? It is true that China spends a lot less than the United States per undergraduate student (with China spending approximately $10,000 per student and the United States spending approximately $35,000 per student). A more likely possibility is that students in China are for the most part guaranteed to graduate on-time in four years. They are not allowed to fail their courses in most cases; as part of this, students have little incentive to study for courses and faculty have little incentive to teach well. Once students in China graduate, potential employers are unable to compare students by their college transcripts and instead use the college they were admitted into as a high school graduate as a signal for their ability.

There have been no high-quality studies, that I know of, that look at the quality of graduate education (master's and doctoral programs). Suffice it to say that China produces a very large number of graduate students (from 2012-2021, it produced 6.5 million master's graduates and 600,000 doctoral graduates).[20] Policymakers in China have also been giving considerable attention in the last few years to improving the quality of graduate education. One effort has been to concentrate attention on improving the quality of a smaller proportion of "dual excellence" programs at universities. According to China's Ministry of Education, these programs currently train 60% of master's students and 80% of doctoral students in the country.[21] Whether these programs are currently training high quality graduate students is somewhat doubtful considering the low-quality of the undergraduate experience. However, it is quite possible that the quality of higher education – both at the graduate and undergraduate levels – can improve quite quickly if China invests the requisite resources and effort.

In summary, China has a vigorous education system that is improving in size, accessibility, and quality. The country still faces considerable challenges, however, in addressing rural-urban gaps in educational opportunities and outcomes, gaps that become increasingly manifest after junior high school and which have implications for economic growth, inequality, and social stability. China also has a lot of work to do to improve its vocational and higher education

[19] In addition to Loyalka et al. (2021), see also Loyalka, P., Liu, O. L., Li, G., Chirikov, I., Kardanova, E., Gu, L., ... & Tognatta, N. (2019). Computer science skills across China, India, Russia, and the United States. *Proceedings of the National Academy of Sciences*, *116*(14), 6732-6736.
[20] http://en.moe.gov.cn/documents/reports/202210/t20221022_671529.html
[21] http://en.moe.gov.cn/documents/reports/202210/t20221022_671529.html

systems. Given its strategic importance for national development, it seems highly likely that China will put considerable attention towards improving its higher education system in the years ahead.