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The Human Capital Index 2020 Update

Background Paper

The Utilization-adjusted Human Capital Index (UHCI)

Steven Pennings

World Bank Group
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Development Research Group
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Abstract

The World Bank Human Capital Index (HCI) is based on the productivity gains of future workers from human capital accumulation. But in many developing countries, a sizeable fraction of people are not employed, or are in jobs in which they cannot fully use their skills and cognitive abilities to increase their productivity. The Utilization-adjusted Human Capital Indices (UHCIs) adjust the HCI for labor-market underutilization of human capital, based on fraction of the working age population that are employed, or are in the types of jobs where they might be better able to use their skills and abilities to increase their productivity ("better employment"). The UHCIs generalize the growth-based interpretation of the HCI: the inverse of a country's UHCI score represents long-run GDP per capita with complete human capital and complete utilization, relative to that under the status quo. The UHCIs are designed to complement the HCI, and not to replace it: they have different purposes, and the challenges of measuring utilization mean that the UHCIs should be interpreted with caution for policy analysis. Both utilization measures are available for more than 160 countries, and are roughly U-shaped in per capita income, suggesting human capital is particularly underutilized in middle-income countries. Human capital is also underutilized for women: while the HCI is roughly equal across boys and girls, female UHCIs are typically lower than those for males, driven by lower employment rates.

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The Utilization-adjusted Human Capital Index (UHCI)

Steven Pennings (spennings@worldbank.org)[1]

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[1] Any views expressed here are the author's and do not necessarily represent those of the World Bank, its Executive Directors, or the countries they represent. This work is a background paper for the 2020 HCI update. UHCI and utilization data can be downloaded from http://worldbank.org/humancapital I thank Aart Kraay, Roberta Gatti, Michael Weber, Kathleen Beegle, David Weil and a number of other reviewers for helpful comments. I am also indebted to Michael Weber for providing updated data from the JOIN database which splits employment by both status and economic activity.

1. Introduction and Overview

The World Bank's Human Capital Index (HCI) captures the size of the income gains when today's better-educated and healthier children become tomorrow's more productive workers. Specifically, a child born today can expect to be HCI×100% as productive *as a future worker* as she would be if she enjoyed complete education and full health. But this implicitly assumes that when today's child becomes a future worker, she will be able to find a job—which may not be the case in countries with low employment rates. Moreover, even if today's child is able to find employment in the future, she may not be in a job where she can fully use her skills and cognitive abilities to increase her productivity. In these cases, human capital can be considered *underutilized,* because it is not being used to increase productivity to the extent it could be. For example, unemployed future workers may be underutilizing their human capital, as are those out of the labor force. Likewise, engineers driving taxis are underutilizing their human capital because, even though they are employed, they do not hold jobs in which their education increases their productivity. Moreover, there is a stark gender gap in terms labor market outcomes: in many countries, women face inferior job and income opportunities compared to men, even with the same human capital. As such, simply considering the HCI by sex may give a distorted view in terms of realizing the potential of human capital investments.

This paper introduces two Utilization-Adjusted Human Capital Indices (UHCIs) that, as their name suggests, adjust the HCI for labor-market underutilization of human capital in a consistent way across a large number of countries. The UHCIs are designed to complement the main HCI, and *not* to replace it. In part this is because they have different purposes: the HCI is an index of supply of a factor of production (in the future), whereas the UHCIs are a hybrid between an index of factor supply (capturing investment in human capital), and a productivity index (capturing how efficiently that human capital is used in production). Second, there are numerous challenges in defining and measuring utilization in a consistent way across diverse country contexts. As such, the UHCIs should be seen as a first step towards a simple and consistent cross-country measure of human capital utilization and should be interpreted with caution for policy analysis.

Like the HCI, the UHCIs focus only on the private gains to worker productivity from human capital, which does not include broader gains from human capital to the production of children's human capital, women's empowerment, technological advancement, political economy and other areas. Moreover, incomplete utilization should not be interpreted as there being no gains from human capital investments, but rather that private labor market gains are just smaller than they could be.

Also like the HCI, the UHCI is derived to measure the effect of human capital on future GDP per capita. Specifically, Kraay (2018) writes that "Projected future per capita GDP will be approximately $1/HCI$ times higher in a 'complete education and full health' scenario than in a 'status quo' scenario." Both UHCI measures are derived in a similar way. However, for the UHCIs, utilization rates are now different in the status quo and full human capital scenarios. Specifically, both UHCIs are derived as future GDP per capita under the *status quo* relative to future GDP per capita with complete health, education, *and full utilization*.[2] This means that, in the long run, GDP per capita will be 1/*UHCI* higher in a world of full utilization, full health, and complete education than in the *status quo*.

While the two UHCIs take different approaches to measuring utilization, they have the following simple form, as the utilization rate multiplied by the HCI:

(1) $$UHCI(basic\ or\ full) = Utilization\ Rate\ (basic\ or\ full) \times \mathrm{HCI}$$

[2] In other words, a child born today can expect to be only UHCI×100% as productive as she would be, on average, if she enjoyed complete education and full health, and her future labor was fully utilized in better employment.

The first measure is the **basic UHCI,** which captures the income gains from employing all potential workers. The basic utilization measure is the employment-to-working-age-population ratio, drawn from the ILO and the World Bank's JOIN database. The basic UHCI has the advantage of simplicity, ease of construction and measurement. It is also available for a wider variety of countries and helps to fix concepts.

(2) Utilization (basic measure) = Employment/population (working age)

Second, I produce the **full UHCI** which, in addition to the gains from higher employment rates, also takes account of the income gains from moving workers to jobs where they can better use their human capital to increase productivity ("better employment"). The full utilization measure also has the desirable property that it is measured relative to potential: countries with high levels of human capital are penalized more heavily if people are not in the types of jobs where their human capital can be used to increase productivity. I define "better employment" as non-agricultural employees plus employers, which excludes the lowest productivity jobs in developing countries where human capital could have less effect on productivity: subsistence own-account/family agriculture, non-farm self-employment (which is often working in household microenterprises, as own-account workers or contributing family workers), and landless agricultural laborers.[3] This definition is not intended as a value judgment, but rather is based on the type of jobs that are relatively rare in low-income countries, but are common in high-income countries—suggesting they are associated with higher productivity (Merotto et al. 2018). The better employment rate (BER) is defined as the fraction of the working age population in better employment:

(3) Better employment rate (BER) = (Non-agricultural wage employees+ employers)/Population (working age)

The full UHCI is a weighted average of the HCI score for those in the better employment (who are as productive as their human capital allows), and the theoretical minimum HCI for the rest of the working age population. The theoretical minimum HCI≈ 0.2 represents the relative productivity of "raw labor", before it is boosted by human capital (see Box 1):

(4) UHCI (full measure) = BER $\times$ HCI+(1-BER) $\times$(minimum HCI)

The full utilization rate is given by Equation 5 and is the full UHCI divided by the HCI. This means that the utilization rate is a weighted average of 1 (complete utilization for those in better employment), and reduced utilization rates for the rest of the working age population. The utilization rate for the rest of the working age population (1-BER) is the productivity of raw labor (HCI min) relative to potential productivity of those workers (HCI). While the full UHCI is my preferred measure because it is more comprehensive and realistic, it has the disadvantages of greater complexity, slightly reduced country coverage and taking a stand on the definition of better employment.

(5) Utilization (full measure) = BER $\times$ 1+(1-BER) $\times$(minimum HCI)/HCI

Despite different methodologies, the basic and full measures produce broadly similar utilization rates and UHCI scores. They are both available for around 165 countries, and the average UHCI score is about 2/3 the size of the HCI (mechanically it will be lower). Utilization rates are roughly U-shaped in per capita income across countries, slightly declining with per capita income across low and middle income levels and the rising rapidly from middle to higher income levels. This feature of utilization rates implies that UHCIs are low in the poorest countries, where

[3] This definition of "better employment" came out of discussions with Michael Weber and Kathleen Beegle, and I thank them for both their constructive criticisms of the basic measure and helpful suggestions for refinements.

the HCI is also low on average, but remain low over a wider range of countries where rising HCI with income is offset by declining utilization.

Despite the similar average utilization rates for different income groups, the reason for those different utilization rates varies across methodologies at low-middle income levels, as do the scores for many individual countries. For the basic measure, higher employment rates among low income countries are driven, in part, by necessity to sustain livelihoods. But for the full measure, only a very small fraction of the working age population is in better employment, and so higher utilization rates are driven by low HCI scores that reduce the potential for under-utilization. At lower income levels, there is substantial variation in basic utilization (employment) rates, due in part to an inconsistent classification of employment of subsistence agriculture at the country level. This also leads to differences between the full and basic utilization rates for individual countries. However, almost all high income countries have both high rates of employment and high rates of better employment, leading both utilization scores to be bunched in a narrow range.

Both UHCIs reveal a starkly different result from the HCI in terms of gender gaps. While the HCI is roughly equal across boys and girls, with a slight advantage for girls on average, the female UHCIs are typically lower than those for males. This is driven by lower overall utilization rates for females, especially in the Middle East and North Africa (MENA) and South Asia (SA). Gender gaps are smaller for the full utilization measure than the basic measure. In general, the UHCI ranges from around ¼ in Sub-Sharan Africa (SSA) and SA, around 1/3 in Latin America (LAC) and MENA, 0.4 and East Asia and the Pacific (EAP) to almost ½ in Europe and Central Asia (ECA).

The rest of this paper is as follows. Section 2 outlines the conceptual framework behind the measurement of the UHCI (basic and full measures). Section 3 discusses the data used, and various measurement issues. Section 4 presents the main results for the aggregate UHCI and utilization rates (basic and full measures), and explores how they vary by income level and HCI score. Section 5 disaggregates the UHCI measures by gender and region. Section 6 concludes. The Appendix reports several extensions and robustness tests. Utilization rates, UHCIs and their components are available for download from http://www.worldbank.org/humancapital

Section 2. Conceptual Framework

As mentioned above, my goal is to produce an index that adjusts the HCI for human capital utilization, while maintaining the simplicity, broad cross-country coverage and productivity-based approach of the HCI. The UHCI meets these goals by introducing a new variable to scale the HCI, the utilization rate, as in Equation 1.

2.1 The basic UHCI

Labor market utilization in the basic UHCI is a ratio of current employment L relative to a measure of potential employment under "full utilization" $L^{\star}$ (Equation 6). In keeping with the spirit of the HCI, I define the target as the maximum theoretical employment ("complete employment"). The standard definition of the potential labor force is the working age population 15-64 years old, which I also adopt for $L^{\star}$.[4] Employment L is defined as the number of people 15-64 years old who are employed, to be consistent with the definition of the potential labor force. The definition of employment includes informal workers and most of the self-employed.[5] Note that for simplicity and

[4] For example, the working age population 15-64 is the denominator of the labor force participation rate. Naturally, no countries will have employment rates equal to 1, but this is consistent with approach in the HCI, where no country achieves full schooling or health either.

[5] Own-account agriculture workers (subsistence agriculture) are often excluded from the definition. By having the working age population in the denominator, I abstract from changes in dependence ratio, and changes in the retirement age.

due to data constraints, the definition of employment in the numerator does not adjust for the intensity of work (part time or full time), and the denominator does not adjust for people who are not available to work, or those who do not want a job.[6]

$$Utilization(basic) \equiv \frac{L}{L^{\star}} \tag{6}$$

Just like for the HCI, the basic UHCI is derived based on long-run income gains. Whereas the HCI measures the increase in long run per capita income a country could gain from moving to complete schooling and health alone, the UHCI measures the increase in long run per capita income from complete schooling, health *and complete utilization of the potential labor force.* Just like for the HCI, this involves comparing two different worlds: a status quo world where today's policies continue, and an alternative world with complete health, education, and utilization. An important, if technical, advantage of this setup that in the alternative world, everyone works and so one can rigorously apply the Mincer returns to human capital that underlie the HCI.[7]

To derive the basic UHCI, I start with a standard Cobb-Douglas production function as in Equation 7, identical to that in Kraay (2018) (but with slightly different notation). Here Y is GDP, h is the stock of human capital per worker, L is the number of workers, K is the stock of physical capital, A is Total Factor Productivity (TFP) and β is a parameter for the labor share of income. As in Kraay (2018), each of these Y, A, K, h and L are for the next generation (NG), because it takes at least a generation for the education and health policies affecting today's children (on which the HCI is based) to affect the productivity of the workforce that affects GDP (I omit the subscript $t = NG$ for brevity).[8] Note that *h* is not the HCI, but is worker productivity relative to that of raw labor (normalized to *h*=1).

In the status quo world, *h* represents human capital under current policies and *L* represents the number workers under constant/status-quo employment rates.[9]

$$Y = AK^{1-\beta}(hL)^{\beta} \tag{7}$$

In the alternative world, there is complete human capital per worker, denoted $h^{\star}$, and complete employment of potential workers, denoted $L^{\star}$. Long run GDP in this complete HC-complete employment world is denoted $Y^{\star}$:

$$Y^{\star} = AK^{1-\beta}(h^{\star}L^{\star})^{\beta} \tag{8}$$

In order to derive implications for per capita GDP, y (lower case), we need to divide both sides of Equation 7 and 8 by the population in the next generation N, which I assume follows the same trend under status quo and complete HC-utilization scenarios. We also need to assume, as in Kraay (2018), that the physical capital-to-output ratio is

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[6] These simplifications are partially offsetting and relaxing them is an interesting area for future research. The simplifications also apply to the full utilization measure.

[7] Mincer regression weights determine how changes in the years of schooling and health components map into the HCI. But Mincer returns are *only* estimated on a sample of wage workers, and so are not informative about the return to education or health for those currently not employed (or self-employed).

[8] Some of the gains from human capital or utilization are indirect (through physical capital accumulation), which only occurs in the long run. For more on the short-medium run dynamics of how human capital affects growth, see Collin and Weil (2018) and the Long Term Growth Model – Human Capital Extension (LTGM-HC) (www.worldbank.org/LTGM).

[9] As in Kraay (2018), only the health and education components of the HCI are used in discussions of economic growth. While the under-5 survival rate is naturally important in general, it has little direct effect on the human capital of workers in the long run, and so it does not appear in calculations here (or in Kraay 2018). Given the under-5 survival rates are usually very high, this exclusion has little quantitative impact, and so I use HCI and the version excluding the under-5 survival rate interchangeably.

constant in the long run $\bar{K}/\bar{Y}$ (one of the Kaldor's stylized facts). This keeps the marginal product of physical capital and the return to investment constant in the long run, and is how extra human capital spurs future investment in physical capital.[10] In per capita terms, Equations 6 and 7 become Equation 8 and 9, for status quo and complete HC-Utilization worlds respectively.

(8) $$y = A^{1/\beta}\,(\bar{K}/\bar{Y})^{(1-\beta)/\beta} h\, L/N$$

(9) $$y^{\star} = A^{1/\beta}\,(\bar{K}/\bar{Y})^{(1-\beta)/\beta} h^{\star}\, L^{\star}/N$$

The basic UHCI can be simply derived as the ratio $y/y^{\star}$, which is future GDP per capita under status-quo policies, as a fraction of future GDP per capita in the alternative complete-HC-complete-utilization world (Equation 10).[11] For the HCI, Kraay (2018) has the same expression, $y/y^{\star}$, but in his case labor L in the complete-HC world is constant across status quo and alternative worlds, and so cancels out, leaving only the HCI.[12]

(10) $$\begin{aligned}\frac{y}{y^{\star}} &= \frac{A^{1/\beta}(\bar{K}/\bar{Y})^{(1-\beta)/\beta} h\, L/N}{A^{1/\beta}(\bar{K}/\bar{Y})^{(1-\beta)/\beta} h^{\star}\, L^{\star}/N} \\ &= \frac{L}{L^{\star}} \times \frac{h}{h^{\star}} \\ &= Utilization\ (basic) \times HCI \\ &= UHCI\ (basic)\end{aligned}$$

One can use Equation 10 to interpret the basic UHCI. Long run GDP per capita in a complete-HC-complete utilization world will be 1/UHCI times larger than that under the status quo. For example, for countries at the mean UHCI of around 1/3, a world with complete human capital and full utilization will triple long-run per capita incomes. As the UHCI is lower than the HCI, the potential income gains are larger. For example, the mean HCI is around 0.5, suggesting a doubling rather than tripling of long run incomes from complete human capital alone. The difference – doubling rather than tripling – is due to the effect of increasing utilization.[13]

2.2 The full UHCI

One conceptual issue with the basic utilization measure (employment rate) is that it assumes that all jobs are the same in terms of their ability to utilize human capital. But in practice, a large share of employment in developing countries is in jobs where workers cannot fully use their human capital. For example, in the poorest countries, around half of all workers work are on family farms or as agricultural laborers, where productivity is low (Merotto et al. 2018). For the rest, around two-thirds of non-agricultural workers are self-employed or working unpaid in family businesses. These include many small-scale traders selling household goods or food, where the majority of time is spent waiting for customers.

While there is some scope for human capital to increase productivity in these jobs, it is more limited. Filmer and Fox (2014) compare the income of household-enterprise owners of different education levels in four African

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[10] The marginal product of [physical] capital is $MPK = (1-\beta)Y/K$, and the return to physical investment is $MPK - \delta$ (where δ is the constant depreciation rate). As such, a constant $\bar{K}/\bar{Y}$, implies a constant return on investment. Higher human capital increases Y, which increases in the MPK in the short run. Higher investment is then required to reduce the MPK back to its equilibrium level, further boosting the growth from human capital accumulation.

[11] In Equation 10, population N, the capital-to-output ratio $(\bar{K}/\bar{Y})$ and TFP A are identical in both worlds and so cancel out.

[12] Equation 10 means that the long-run income gains from investing in human capital do not depend on the utilization rate. That is, in the framework of the basic UHCI, an increase in human capital alone has the *exact* same effect on long run economic growth as in the HCI, but just that countries can do better by also increasing utilization (it is not one or the other).

[13] This also captures some extra output from a higher supply of raw labor, which I adjust for in the full UHCI measure.

countries. On average, the increase in income due to education, while positive, is much less than would be predicted given the number of years of schooling.[14] Most developing countries suffer from high rates of mismatch between the level of education required for a job, and the education of the people actually doing it: the well-known anecdote of unemployed engineers driving taxis.[15] In the literature, this is often referred to as "over-education", though a better description is "underutilization" as it is the lack of jobs and not the level of education that is cause of the mismatch. In some regions, especially the Middle East and North Africa, underutilization is associated with self-employment, for example while queuing for a formal sector job.[16]

To address this, the full UHCI introduces a concept of *better employment,* which is designed to capture the employment categories where people can better use their human capital (subject to available data). More specifically, *better employment* is defined as non-agricultural employees, plus employers. This definition is not intended as a value judgment, but rather is based on the type of jobs that are relatively rare in low-income countries, but are common in high-income countries—suggesting they are associated with higher productivity. The share of employment in better jobs increases from about 20 percent in low-income countries to 80 percent in high-income countries (Merotto et al. 2018, Figure 0.8). The main categories excluded from the definition are subsistence own-account/family agriculture, small-scale traders, and landless agricultural laborers, as these employment types are only common in low-income countries—suggesting they are more likely to have lower productivity.[17] By using a narrower definition, better employment also reduces variation in employment rates across low-income countries (variation in basic utilization is are often caused by variation in the employment definition used).

The definition of better employment is based on the way that the work is organized, rather whether the job is formal or informal. For example, non-agricultural employees could be formal or informal.[18] Better employment involves work organized in a team consisting of at least an employer and employee, where employees are paid for their work (rather than out of familial obligation). This allows a minimum degree of specialization and organization, which helps to boost productivity and for people to use their skills.[19]

A second conceptual issue with the basic measure is that utilization should be *relative to potential*, which will depend on how much human capital there is to underutilize. That is, a doctor working as an agricultural laborer results in severely underutilized human capital, whereas the human capital of a worker with no education doing the same job is closer to being fully utilized. This means the utilization scores of countries with higher levels of human capital should be more heavily penalized by a lack of better employment.

The final, and more technical, conceptual issue that some of the income gains in Equation 10 are from utilizing people's time, rather than utilizing their human capital: even in a country with no human capital in both status quo and alternative worlds (h=1, raw labor), an increase in basic utilization will still increase output.

[14] On average, those with a complete secondary education were only earning 60 percent more than those with no education, which is the equivalent of fewer than 6 years with an 8 percent return to education. Omitted variables such as parental income and ability mean that the 6 years is likely an overstatement.

[15] See Battu and Bender (2020) for a survey. Another cause of the mismatch can be poor education quality, where those with a qualification are not able to perform the functions required. In this case, the cause of the engineer driving a taxi is because of he or she is not able perform the tasks of an engineer due to poor quality education.

Handel et al (2016) find that in 12 low- and middle-income countries, the overeducation/underutilization rate is 36 percent. Overeducation/underutilization rates vary across countries and can depend on how it is measured.

[16] See Handel et al (2016) and Gatti et al (2013).

[17] The categories here are based on "International Classification by Status in Employment, 1993 (ICSE-93)", and also exclude workers not classifiable by status.

[18] The definition of formal employment varies across countries, but generally refers to the coverage of the worker with respect to benefits like unemployment insurance, pensions, and sick or annual leave.

[19] Better employment is different from "decent work" (ILO) and "Good jobs for development" (WDR 2013).

Putting these concerns together first suggests that the full UHCI should depend on the better employment rate (BER) (better employment as a share of the working-age population), rather than raw employment rates. However, the utilization rate is not simply the BER, because this fails to adjust for how much human capital there is to underutilize. Instead, utilization rates for those without better employment should depend *inversely* on the HCI (relative to a natural minimum). Finally, there should be some adjustment for utilization of people's time. The full utilization measure and full UHCI capture all of these concerns.

<u>Deriving the full UHCI as the long run income gains from complete HC and complete utilization</u>

The full UHCI is derived in the same way as the basic UHCI, as the ratio $y/y^{\star}$: future GDP per capita y under status-quo policies, as a fraction of future GDP per capita $y^{\star}$ in an alternative complete-HC-complete-utilization world. Per capita GDP for the full UHCI in the complete HC-complete utilization world is the same as in basic UHCI.[20] The differences between the full and basic UHCI depend on how the labor contribution of status-quo GDP per capita is formed, which I explain now.

Let L_{BE} be the number of workers in better employment. I assume these workers are as productive as their human capital allows—in other words, their human capital is fully utilized (utilization rate of 1). The per worker boost to productivity is just their human capital h, and so the effective contribution of all workers in better employment to GDP is hL_{BE}.

L is the total number of people employed (in better employment and other types of employment). I assume that those employed, but without better employment $(L - L_{BE})$, are only as productive as raw labor (h_{min} =1). So, their contribution GDP will be $h_{min}(L - L_{BE})$. As their have more human capital than that ($h > 1$), it is being underutilized. The degree of underutilization is their productivity relative to potential under current policies $1/h$.

Finally, $L^{\star}$ is the potential labor force (equal to the working age population, as before). Moving to a world of complete utilization involves an expansion of employment of $L^{\star} - L$. To prevent misclassifying the income gains from increase in utilization of time (raw labor) as utilization of human capital, I add the raw labor contribution $h_{min}(L^{\star} - L)$ to status quo GDP.

The Better Employment Rate (BER), as mentioned above, is the fraction of all people of working age who have jobs where they can make better use their human capital. This can be constructed as the employment-to-working age population ratio (basic utilization), multiplied by the share of the share of employment in better jobs (SEBJ): [21]

(11) $$Better\ Employment\ Rate\ (BER) \equiv \frac{L_{BE}}{L^{\star}}$$

$$= \frac{L_{BE}}{L} \times \frac{L}{L^{\star}} = SEBJ \times Utilization(basic)$$

(12) $$Share\ of\ employent\ in\ better\ jobs\ (SEBJ) \equiv \frac{L_{BE}}{L}$$

For the derivation, we will also have to use the definition of the HCI: human capital h relative to its theoretical maximum $h^{\star}$ (HCI= $h/h^{\star}$). The minimum HCI is defined in the same way, but with $h_{min} = 1$ rather than h: $HCI_{min} = 1/h^{\star} \approx 0.2$ (see Box 1).

[20] Except full employment is in better jobs.

[21] A minor complication is that data on employees and employers are often for all age groups, whereas the employment-to-population ratio is based on the working age population. This is why the BER is based on the product of these two ratios.

As mentioned above, the labor contribution to future GDP per capita in the status-quo world is different from that in the basic UHCI. Specifically, hL in Equation 8 is replaced by three terms:

- The contribution to GDP of workers in better employment is hL_{BE} (blue). This is similar to that in the basic UHCI, but only covers workers in better employment L_{BE}, rather than all workers L.
- The contribution to GDP of the raw labor of those employed, but outside better employment is $h_{min}(L - L_{BE})$ (green). Recall that these workers have human capital $h > h_{min}$, but cannot use it to increase productivity in their jobs.
- An additional term to adjust for income gains from greater utilization of people's time (raw labor) in full employment, $h_{min}(L^{\star} - L)$ (purple). This boosts GDP in the status quo world, to make sure that GDP per capita in the status quo and alternative worlds are measured on a consistent basis.

As such, future GDPPC in the status quo world becomes Equation 13 (recall A is TFP, $\bar{K}/\bar{Y}$ is the capital-to-output ratio and N is population – all of which are the same in the status-quo and complete HC-complete utilization world).

(13) $$y = A^{1/\beta}\,(\bar{K}/\bar{Y})^{(1-\beta)/\beta}(hL_{BE} + h_{min}(L - L_{BE}) + h_{min}(L^{\star} - L))/N$$

The full UHCI can be simply derived as the ratio $y/y^{\star}$ (recall $y^{\star}$ is future GDPPC in the in the complete HC-complete utilization world):

(14) $$\begin{aligned}\frac{y}{y^{\star}} &= \frac{A^{1/\beta}(\bar{K}/\bar{Y})^{(1-\beta)/\beta}(hL_{BE}+h_{min}(L-L_{BE})+h_{min}(L^{\star}-L))/N}{A^{1/\beta}(\bar{K}/\bar{Y})^{(1-\beta)/\beta}h^{\star}\,L^{\star}/N} \\ &= \frac{hL_{BE}+h_{min}(L-L_{BE})+h_{min}(L^{\star}-L)}{h^{\star}L^{\star}} \\ &= \frac{L_{BE}}{L^{\star}} \times \frac{h}{h^{\star}} + \frac{(L^{\star}-L_{BE})}{L^{\star}} \times \frac{h_{min}}{h^{\star}} \\ &= BER \times HCI + (1 - BER) \times HCI_{min} \\ &= UHCI(full)\end{aligned}$$

The full UHCI in Equation 14 is a weighted average of the HCI score for those in the better employment (who are as productive as their human capital allows), and the theoretical minimum HCI for the rest of the working age population, who are as productive as raw labor. As with the basic UHCI, Equation 14 implies that long run GDP per capita in a complete HC-complete utilization world is 1/UHCI times that in a status quo world.

The full is utilization rate is defined by dividing the UHCI by the HCI (Equation 15). This means that the full utilization rate is a weighted average of 1 (complete utilization for those in better employment), and a reduced utilization rates for the rest of the working age population (1-BER). The utilization rate for the rest of the working age population is the productivity of raw labor (HCI_{min}) relative to potential productivity of those workers (HCI).

(15) $$Utilization(full) \equiv \frac{UHCI(full)}{HCI} = BER + (1 - BER) \times \frac{HCI_{min}}{HCI}$$

Box 1: $HCImin$ and the productivity of raw labor

In a standard production function h is human capital-driven worker productivity relative to the *lowest* possible score $h_{min} = 1$ for raw labor. For example, a worker whose years of schooling make them twice as productive as a raw labor, would have a score of $h = 2$. In contrast, the HCI is an index of human capital-driven worker productivity measured relative to a highest possible score (complete HC). Denoting the maximum HC score as $h^{\star}$, the $HCI = h/h^{\star}$. Consequently in Equation 14, the $HCI_{min} = h_{min}/h^{\star} = 1/h^{\star}$ is the productivity of raw labor relative to its theoretical maximum. For the full UHCI, I assume workers without better employment are only as productive as raw labor.

The minimum HCI score can be calculated by substituting the minimum possible scores for education and health into the standard HCI Equations 9-12 in Kraay (2018): zero expected quality-adjusted year of schooling (QAYS=0), complete stunting (not stunted (NS) rate of 0), and zero chance of adults surviving to age 60 (ASR=0). The probability of survival to age 5, which is part of the HCI but not in a growth accounting framework, is assumed to be 1 as this does not affect the growth calculations.

(16)
$$\begin{aligned} HCI_{min} &\equiv Survival \times School_{min} \times Health_{min} \\ &= 1 \times e^{0.08\times(QAYS_{min}-14)} \times e^{(0.65\times(NS_{min}-1)+0.35\times(ASR_{min}-1))/2} \\ &= 1 \times e^{0.08\times(0-14)} \times e^{(0.65\times(0-1)+0.35\times(0-1))/2} \\ &\approx 0.2 \end{aligned}$$

In Appendix 4, I calculate an alternative HCI_{min}^{Alt} assuming that raw labor (for those without better jobs) makes use of health human capital, but not education human capital. The results are broadly similar.

Example full UHCI scores

The full utilization rate and full UHCI change with both the better employment rate (BER) and the HCI score of a country.

Figure 1: Theoretical Full Utilization — by BER and HCI

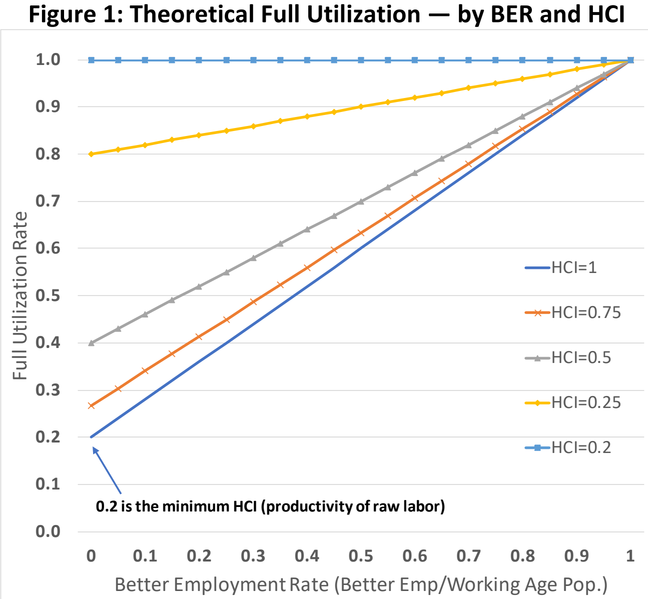
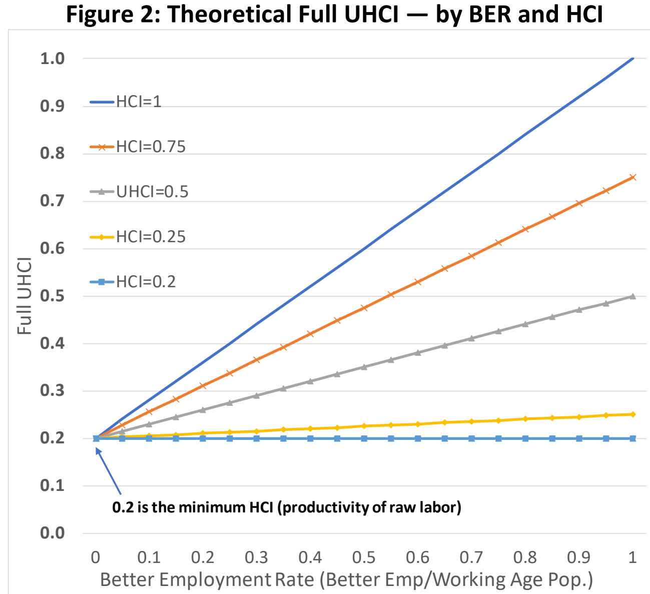


Figure 2: Theoretical Full UHCI — by BER and HCI



The lowest full utilization rates will be in countries with *both* a small fraction of potential workers in better employment AND a high HCI, as this combination wastes the most human capital (blue solid line in Figure 1). This corresponds to the "engineers driving taxis" anecdote mentioned above. The utilization rate will be *highest* (close to 1 with $UHCI \approx HCI$), in two polar opposite cases. First is where better employment rates are very high ($BER \approx 1$, right of Figure 1). This yields a high utilization rate regardless of the value of the HCI, but in practice only happens in high income countries. The second is in countries with little human capital to underutilize $\frac{HCI_{min}}{HCI} \approx 1$ (blue line with squares in Figure 1), regardless of the value of BER. In these second group of countries, the income gain from being in better employment is negligible because productivity is constrained by human capital, not by an absence of better jobs ("taxi drivers driving taxis").

Figure 2 shows that when the better employment rates are very low, the full UHCI converges to 0.2 ($= HCI_{min}$), regardless of the value of the HCI. This is because even if people are potentially more productive due to a high human capital, they are not able to utilize that human capital. The UHCI increases as better employment expands, as people can increasing use their human capital to increase productivity, with a faster rate of increase for those countries with a high HCI.

Section 3. Data and Measurement

The 2020 HCI data are available for a large number of countries (174), and one of the goals of the UHCI is to maintain the wide cross-country coverage of the HCI.[22] To calculate the UHCIs also requires a range of employment data, which are taken from the International Labour Organization (ILO) and the World Bank's Jobs Indicator Database (JOIN), generally using the most recent year if multiple data sources are available.[23] Both the ILO and JOIN also provide splits by gender.

3.1 Data — Basic UHCI

For the basic UHCI, the main extra data series required is the employment-to-population ratio of 15-64-year-olds. Employment data are available for 185 countries (182 after conditioning on the availability GNI per capita).[24] Combining the employment rate data and HCI data, I can calculate the basic UHCI for 169 countries/regions.

The main source of employment-to-population data is the ILO series "Employment-to-population by sex and age (%) – Annual", Age (Youth,Adults): 15-64, using the latest period available.[25] The ILO employment-to-population data are the most recent for 150 countries. Some of these countries do not have HCI data, so ILO employment-to-population data are used for 83% of the basic UHCI sample (140 countries). The median year of the survey used is 2018 (and mostly range from 2010-2019).[26] The ILO data are mostly sourced from the ILO "microdata repository".[27] It should be noted that the ILO data usually applies to the whole population, but occasionally the underlying surveys focus on certain geographies (like the urban population), exclude borderline ages (like 15 year olds), or exclude certain subgroups (like those employed in the armed forces).[28] Note that employment rates in other publications (and in policy discussions) are sometimes quoted for the 15+ age group rather than the 15-64 age group (possibly using from other underlying surveys), and so can differ from the ones used in this paper.

[22] HCI data can be downloaded from the World Development Indicators website: http://wdi.worldbank.org

[23] In practice, the algorithm is slightly more complicated because I make sure that both basic and full utilization rates come from the same data set and give preference to actual data over interpolated data. The data requirements of the basic utilization rate are a subset of those of the full utilization rate. First, if only one data set has the full data available, I choose that one. Second, I choose JOIN data if the ILO data are interpolated. Third, I choose the most recent data set if both are available, with a preference for ILO data if both data sets are from the same year.

[24] The three large countries/regions without GNIPC data are Somalia, the Syrian Arab Republic, and Taiwan, China. They also do not have HCI data, and so I cannot calculate either UHCI or the full utilization rate.

[25] Downloaded from https://www.ilo.org/shinyapps/bulkexplorer7/ on 13 December 2019. In cases where there are multiple sources for a country for the latest period (e.g. Thailand, Costa Rica and Armenia), I use the labor force survey (LFS).

[26] The reported "year" of the ILO data reflects the average of the years of different data sources used in the construction of the full utilization measure. Generally, this is the average of the year of the employment rate data (basic utilization) and the data used to construct the SEBJ. In countries with interpolated ILO data, the year of the SEBJ data is itself an average of the year of the agricultural employment data and the all-sector employee/employer data. This averaging process explains why the reported year is not always an integer. For countries missing the full utilization rate, the year is only that of the employment-to-population data. The only ILO data from before 2010 are for St. Kitts and Nevis, which come from the 1990s.

[27] That is, they are calculated by ILO staff based on microdata from labor force surveys or living standards surveys – though there are some from other sources. They are similar to the ILO's "National Estimates" reported in the World Development Indicators. The ILO also produces "Modelled Estimates" that are highly interpolated and are not used in this paper.

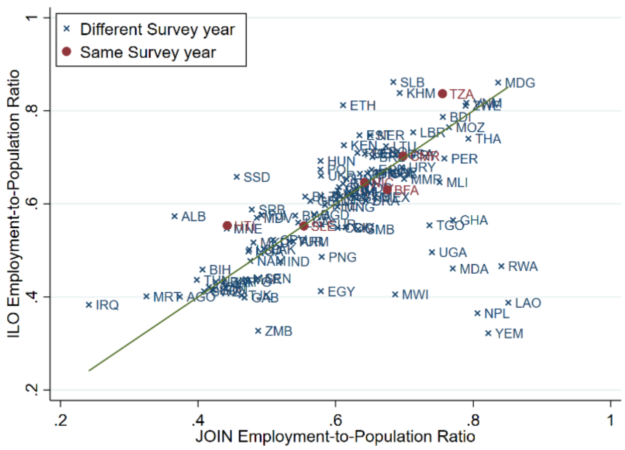
[28] For example, the Labor Force Survey underlying the Peruvian data covers the "main city of metropolitan area."

The second source of employment-to-population rate data is the JOIN database, which focuses on low income and middle-income countries.[29] After merging with HCI data, the JOIN data are the most recent for 29 countries, around 20% of the sample. The data range from 1996 to 2017, with a median year of 2013.

Data quality for employment-to-population ratios

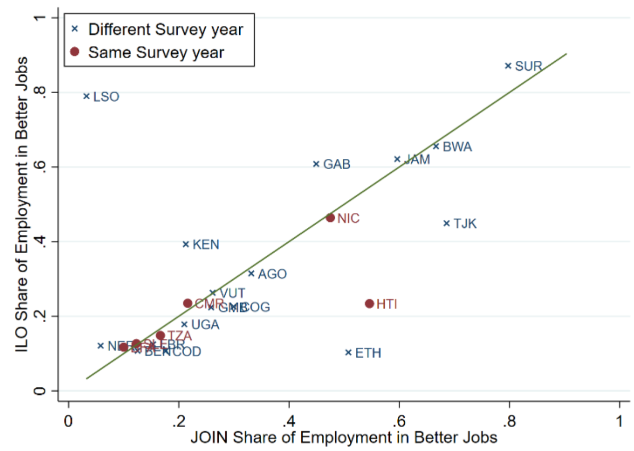
For a number of countries, I have employment rate data available from both ILO and JOIN, which allows me to cross-check employment rates across data sources (Figure 3).[30] The correlation is only around 0.5, which is low for two data sets ostensibly measuring the same thing. There are a number of countries with very high employment rates in JOIN that have low employment rates using ILO (and a few that are high in ILO and low in JOIN). For example, the Republic of Yemen has one of the highest employment rates using the JOIN data (0.82, from 2005), but one of the lowest employment rates using the ILO data (0.32, 2014).[31] Likewise, employment rates in the Rwanda are 0.84 according to the public JOIN database (from 2013), whereas they are only 0.47 (from 2018) using ILO data.

Figure 3: Employment-to-Population Ratios; JOIN vs ILO



Notes: Data for 106 common countries. *Sources*: ILO/JOIN.

Figure 4: Share of Employment in Better Jobs: JOIN vs ILO



Notes: Data for 23 common countries. *Sources:* ILO/JOIN.

One potential explanation is the timing of the underlying survey; in the Republic of Yemen example, the data in JOIN and the ILO are almost a decade apart, and the Rwanda data are 5 years apart. When I restrict the sample to surveys conducted in the same year (red circles in Figure 3), the ILO and JOIN employment measures are closely related and have a correlation of 0.9. However, employment-to-population ratios are generally thought to be highly persistent variables and should not change so drastically over time—such as a 50ppts change over a decade in the Republic of Yemen and a 35ppts change in Rwanda over 5 years.

The extreme changes over time likely reflect, in part, changes in the definition of employment. In Rwanda's case, the reason is that the 2018 ILO estimate "excludes own-use production workers" (subsistence agriculture) in their definition of employment, whereas the earlier measure does not.[32] Indeed ILO employment rates from 2014 are

[29] The JOIN employment rate is sometimes sourced from "Employment to Population Ratio, aged 15-64, (Column V) of the public JOIN spreadsheet (downloaded 21 October 2019, link), and is sometimes calculated from more recent microdata that were acquired through private correspondence.

[30] If I cross-check ILO data with alternative data collected from the OECD for the same countries, I find that they line up almost exactly (not shown). This is not surprising given the high quality of data from high-income countries.

[31] Using a previous survey in the JOIN data (from 1998), the Republic of Yemen's employment rate was 0.47. The data are not affected by the Yemeni civil war, which only started in 2015.

[32] These changes stem from definitional changes following the 19th International Conference of Labor Statistics (2013), though the implementation of those definitional changes across countries is slow and not uniform.

very similar to those from JOIN in 2013. However, for other countries experiencing changes in employment rates, the methodological changes are not well documented. These measurement issues also motivate using a more specific definition of employment in the full UHCI (discussed in the next section).

3.2 Data — Full UHCI

In addition to the HCI and employment-to-working-age-population (basic utilization) rate, the full UHCI requires data on the share of employment in better jobs (SEBJ) as in Equation 12.[33] The SEBJ is then multiplied by the basic utilization (employment) rate to form the Better Employment Rate (BER, as in Equation 11). For those countries with HCI data, the BER is available for 161 countries (and 12 other countries with missing HCI data).

The primary source of data on employers, non-agricultural employees and total employment is ILO series "Employment by sex, status in employment and economic activity (Thousands)", using the most recent year available.[34] The "Status in Employment" used is defined by the International Classification by Status in Employment, 1993 (ICSE-93), which breaks total employment into Employees, Employers, Own-account workers, Members of producers' cooperatives, Contributing family workers, and Workers not classifiable by status, where I use data on the first two categories as parts of better employment.[35] In terms of "economic activity", I use the broad sectors "Total" (for employers and total employment) and "non-agriculture" (for employees). The SEBJ calculated using ILO data is multiplied by the employment-to-population ratio from the ILO used in the basic UHCI.[36] For countries with HCI data, these ILO data are available for 115 countries or 71% of the sample.

The secondary source is the JOIN database microdata. At the time of writing, the public JOIN data set provides data by Status in Employment or Economic Activity, but not both. As such splitting by both (with the latest surveys) needs to be constructed manually from the underlying microdata.[37] These data are used for 28 developing countries.

Finally, there a number of countries/regions that have ILO data on the total number of employees and employers, but are missing data on the non-agricultural share of employees.[38] In these countries I interpolate the agricultural share of employees, $AGE = \frac{agricultural\ employees}{total\ employes}$. Hong Kong SAR, China, and Macao SAR, China, are city states, so we know almost all employees work outside agriculture, so the total number of employees will be virtually identical to the number of non-agricultural employees. For other countries, I utilize ILO data on $\widehat{AGE} = \frac{total\ agricultural\ employment}{total\ employment}$ (employment not employees) which has wider coverage.[39] Using a sample of countries with both variables, I estimate a regression of $AGE = \theta\widehat{AGE}$, and find that $\theta \approx 1/2$ for high income countries and $\theta \approx 1/4$ for other countries.[40] These estimates of θ are not surprising as self-employment and family work are especially common in agriculture. Given these estimates, I then interpolate the SEBJ as:

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[33] Recall the SEBJ is defined as the number of employers plus non-agricultural employees, as fraction of total employment.

[34] Downloaded from https://ilostat.ilo.org/data/browse-by-subject/ on 20 February 2020 (with ICSE-93 option).

[35] Note that I must use ICSE-93 rather than "Aggregate status in employment", as the latter is missing data on employers.

[36] The reason for this is that the SEBJ data are based on total employment, whereas the employment-to-population ratios are based on the 15-64 age group.

[37] I thank Michael Weber for providing these data (accessed on 25th February 2020). In cases where multiple JOIN surveys are available for the same year, I use the one with the largest total employment.

[38] The ILO series used here is "Employment distribution by status in employment (by sex) (%) – Annual", downloaded from https://www.ilo.org/shinyapps/bulkexplorer7/ on 22nd January 2020.

[39] ILO data set "Share of agriculture in total employment (%)- Annual" (latest period), accessed 22nd January 2020 from https://www.ilo.org/shinyapps/bulkexplorer7/

[40] More specifically, I trim the top 5% of $\widehat{AGE}$ outliers in each case, and estimate using OLS without a constant. The estimates of 0.53 and 0.30 are rounded to ½ and ¼ respectively.

$$SEBJ \approx \frac{total\ employees}{total\ employment} \times \left(1 - \theta \times \frac{total\ agricultural\ employment}{total\ employment}\right) + \frac{total\ employers}{total\ employment} \tag{17}$$

I interpolate data in this fashion for 18 countries (13 high income, 4 upper middle income, 1 lower middle income). In most countries—especially high income countries—the share of employment in agriculture is below 5%, so the BER rate will be fairly insensitive to the accuracy of this approximation. I verify this in Appendix Figure 1, by applying the interpolation method in Equation 17 to a set of countries for which I already have ILO data on the actual number of non-agricultural employees from the ILO. With a few exceptions, the interpolation is extremely accurate.

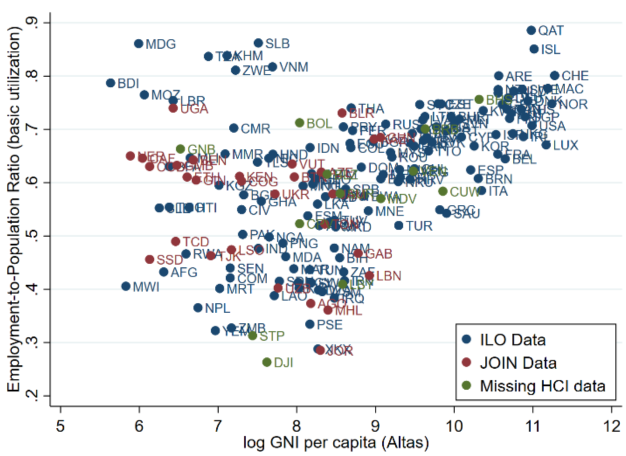
Nonetheless, other measurement issues remain. Figure 4 plots the share of employment in better jobs (SEBJ) for a common subsample of countries which have both ILO and JOIN data. For most countries (except Haiti), the SEBJ is very similar if the surveys are in the same year. But if the years differ, SEBJ from JOIN and the ILO can be substantially different, and only have a correlation of 55%. A further investigation on the measurement of the SEBJ is an interesting area for future research.

Section 4. Aggregate Results

4.1 Utilization Rates

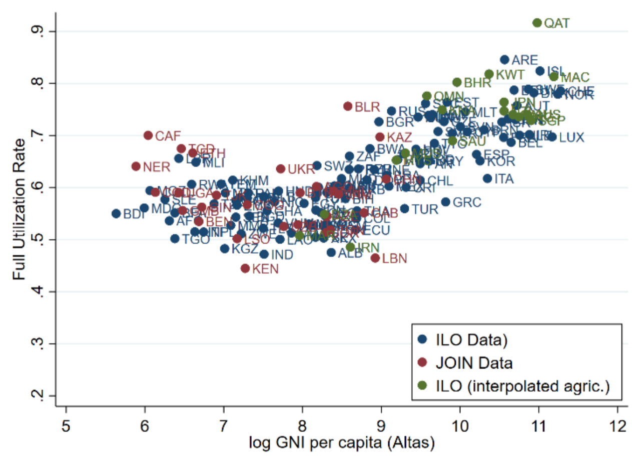
For both basic and full measures, the utilization rate is U-shaped in per capita income (Figures 5 and 6 respectively, plotted on the same scale with color coding by data set). The highest income countries also have the highest average rates of utilization, generally in a narrow range around 0.75. To some extent, this is unsurprising because it is difficult to have high per-capita incomes without high employment rates. It is also the case that in high income countries, almost all of employment is focused in better jobs (Figure 7).

Figure 5: Basic Utilization Rate (Emp/Pop) and GNIPC



Notes: Data for 182 Countries. Working age population is 15-64.
Sources: GNI per capita; WDI. Emp/Pop; ILO/JOIN.

Figure 6: Full Utilization Rate and GNIPC



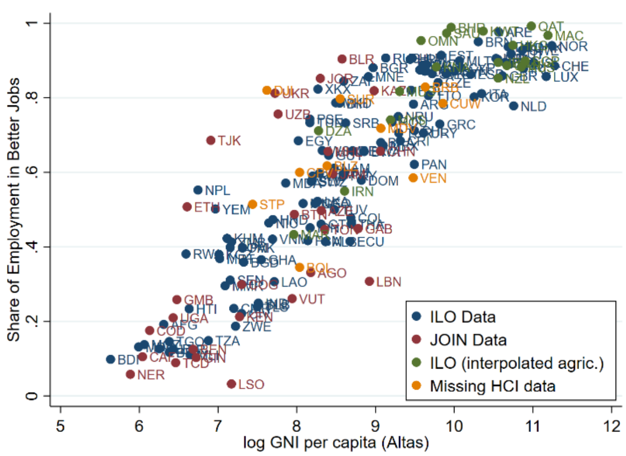
Notes: Data for 161 Countries.
Sources: GNI per capita; WDI. Full Utilization; ILO/JOIN/WDI.

The second highest utilization rates are among low income countries—for both utilization measures—but for different reasons. In the basic measure, low income countries have high employment rates because people are sufficiently poor that they must work to survive. As such, high utilization rates reflect poverty rather than well-functioning and inclusive labor markets that use human capital efficiently. However, there is also substantial dispersion in the basic utilization measure among poorer countries due different definitions of employment, and whether own-use production workers (mostly subsistence agriculture) are excluded. Following the 2013 change in the ILO's definition of employment, they should be, but this has been applied in some countries but not others.

For the full utilization measure, better employment rates are close to zero for low income countries (Figure 8), which means that the utilization rate is driven by how much human capital there is to underutilize (the final term in Equation 14, HCImin/HCI, as $1 - \mathrm{BER} \approx 1$). For the poorest countries, the HCI≈ 0.33, and hence Util≈HCImin/HCI≈ $0.2/0.33 = 0.6$. In other words, the relatively high utilization rates in low income countries do not reflect efficient and inclusive labor markets either, but rather reflect low capacity ("taxi drivers driving taxis").

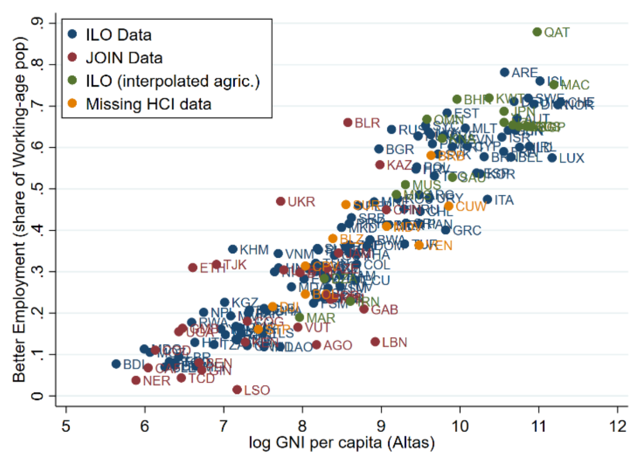
The countries with the lowest levels of utilization are middle income countries (those at the bottom of the U in Figures 5-6). Again, this reflects different mechanisms across measures. In the basic measure, people in middle income countries have enough income such that they do not have to work to survive, and so employment is more of a choice (albeit a constrained one). In combination with cultural norms, this allows for women not to work outside the home, though this varies across countries and regions. Many men in middle income countries prefer to hold off on employment in the hope of getting a better job, especially in MENA (Gatti et al 2013). In the full utilization measure, many middle income countries still have low better employment rates (BER) of around 1/3 (Figure 8), driven by a combination of low employment-to-population ratios (as in the basic measure), and also that only half of those employed are in better jobs (Figure 7). This small increase in the BER (relative to low income countries), is more than offset by higher rates of human capital to waste (HCImin/HCI), which increases the potential for underutilization. Hence, a lack of better employment is a more serious problem in middle income countries, and has a larger effect on utilization ("engineers driving taxis").

Figure 7: Share of Employment in Better Jobs and GNIPC



Notes: Data for 171 Countries.
Sources: GNI per capita; WDI. SEBJ; ILO/JOIN.

Figure 8: Better Employment Rates (BER) and GNIPC



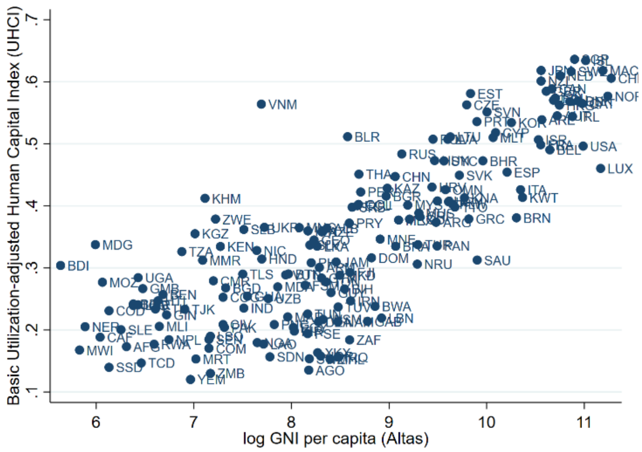
Notes: Data for 171 Countries.
Sources: GNI per capita: WDI. BER: ILO/JOIN.

4.2 UHCIs

The basic and full UHCIs are shown Figures 9 and 10 (respectively), plotted against per capita income (on the same scale). Both measures are broadly flat at around ¼ over low and lower-middle income ranges (with income <$4000 per capita, or log(income)<8.3), as higher HCI scores are mostly offset by lower utilization rates. Only when countries hit upper middle income status do the UHCIs start rising substantially in per capita income, as both HCIs and utilization rates increase. Both UHCIs increase from about 1/3 for upper middle income countries to 0.5 for high income countries as a whole and to 0.6 for the richest countries in the sample.

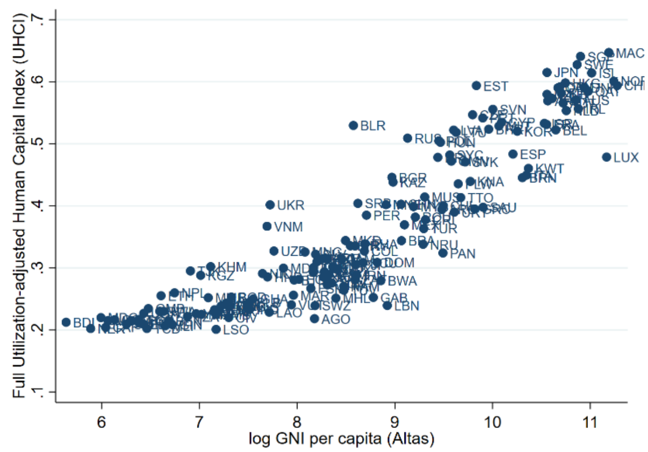
The main difference between the UHCI series is that there is a greater degree of compression of full UHCI scores around 0.2 for low income countries, whereas there is more dispersion for the basic UHCI. For the basic UHCI, the dispersion is driven by wide variation in employment rates—in part due to inconsistent definitions of employment—as well as variation in the HCI. In contrast, better employment rates that are close to zero for low income countries mean the productivity of most of the workforce is similar to that of raw labor, which corresponds mechanically to a minimum HCI score of 0.2.

Figure 9: Basic UHCI and GNIPC



Notes: Data for 169 Countries.
Sources: GNI per capita and HCI: WDI. Empl. rate: JOIN/ILO.

Figure 10: Full UHCI and GNIPC

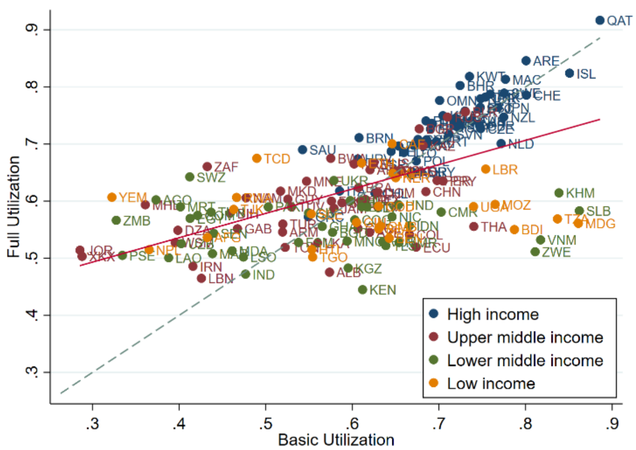


Notes: Data for 161 Countries.
Sources: GNI per capita and HCI: WDI. Empl. rate: JOIN/ILO.

4.3 Comparing utilization and HCI measures at the individual country level

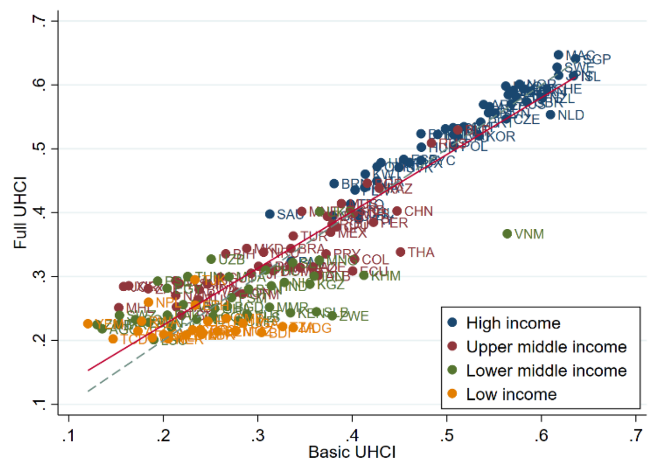
While the full and basic utilization measures have the same U-shaped relationship with per capita income, they often differ substantially for individual countries (Figure 11, correlation of only 0.6).[41] The strongest correlation is for a group of high income countries, because in order to generate high per capita incomes, employment rates need to be high and those people working need to use their human capital to be productive. But for lower income countries, the drivers of high utilization vary across measures (discussed above), and the similarity of average scores is coincidental.

Figure 11: Basic Utilization vs Full Utilization



Notes: Data for 161 countries. Dashed line is 45 degree diagonal.
Fitted line: y=0.37+0.43x *Sources*: WDI/JOIN/ILO.

Figure 12: Basic UHCI vs Full UHCI



Notes: Data for 161 countries. Dashed line is 45 degree diagonal.
Fitted line: y=0.05+0.89x *Sources*: WDI/JOIN/ILO.

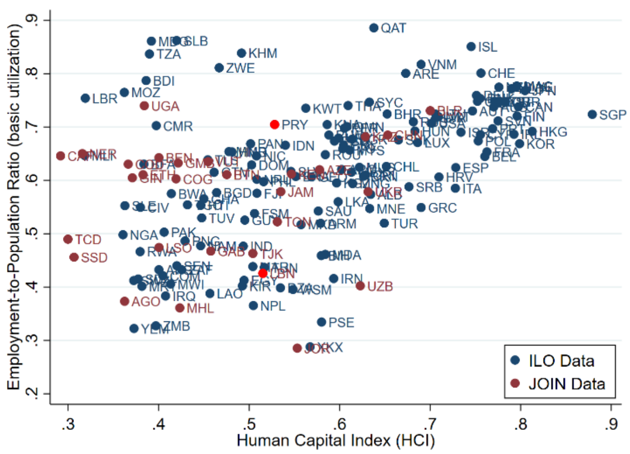
[41] This is driven by a number of countries on the left side of Figure 11 in MENA and elsewhere where a high fraction of total employment is classified as better employment (such as wage employment), and a number of countries, often in EAP, with lower rates of wage employment on the right side of Figure 11. Some of these EAP countries are also penalized in the full measure by having HCI that increases the potential to waste human capital. Full and basic utilization rates are also more similar.

For the UHCI, the scores of individual countries are more similar in the full and basic measures (Figure 12, correlation 0.93). In part this is because full and basic UHCI have the HCI as a common component. It is also because the disagreements about utilization across data sets occur mostly for countries with low HCI scores, which shrinks any differences.[42]

4.4 The economic gains from increasing the UHCI vs HCI

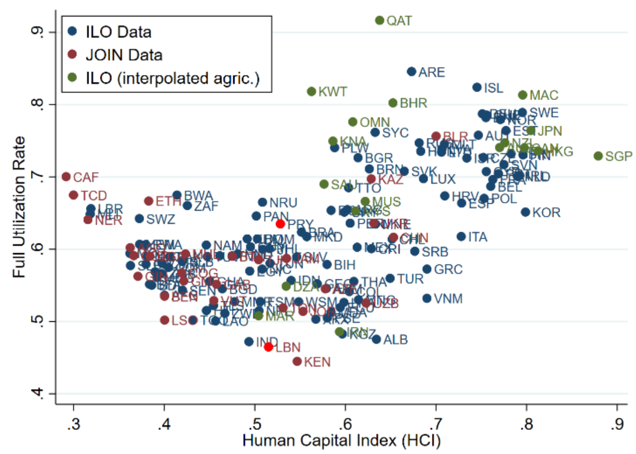
The two components of the UHCI – utilization and the HCI – are shown in Figures 13 and 14 (for the basic and full measures respectively). First, one can see that these two components are only weakly correlated (correlation coefficient of around 0.45), which explains why the UHCI and HCI scores differ somewhat. On average, both basic and full utilization rates are around 0.6, which suggests that the HCI will be shrunk down to about 60% of its original rate in the UHCI (Figure 15 and 16). Whereas the HCI runs from around 0.3 to 0.9, the UHCIs are lower, ranging from 0.12-0.2 to 0.65.

Figure 13: Basic Utilization Rate (Emp/Pop) and HCI



Notes: Data for 169 Countries. *Sources*: WDI/ILO/JOIN.

Figure 14: Full Utilization Rate and HCI



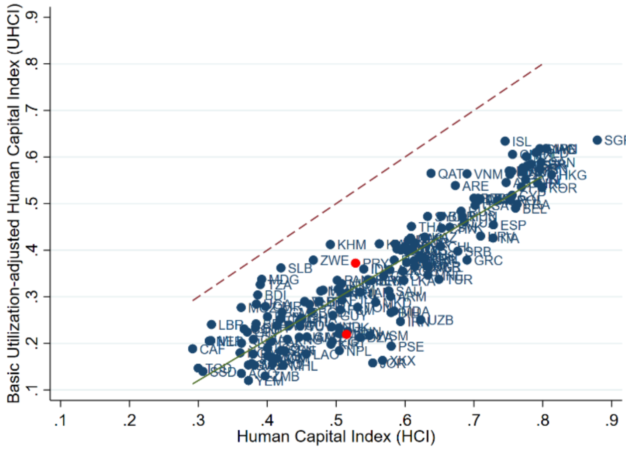
Notes: Data for 161 Countries. *Sources*: ILO/JOIN/WDI.

To understand the relationship between the UHCI and HCI, consider the example of two countries (Lebanon (LBN) and Paraguay (PRY)) that have similar scores for the HCI of about 0.5, but very different basic utilization rates. The HCI suggests that moving from the status quo to full health and education will approximately double per capita incomes in the long run in both countries. But the basic utilization rate is about 0.43 in Lebanon and about 0.7 in Paraguay, suggesting much of the measured human capital is not fully utilized. This leads to a higher basic UHCI in Paraguay (0.37) than Lebanon (0.22). Consequently, the long run income gains from moving to full human capital *and complete economic utilization of human capital* are much larger in Lebanon (4.5× status quo income) than Paraguay (slightly less than 3× status quo income).

Using the full UHCI measures, there is still a utilization gap between the countries, but one that is a smaller (Figure 14, full utilization rate of 0.46 in Lebanon vs 0.64 in Paraguay). This means that differences in the full UHCI are also smaller (Figure 16, full UHCI of 0.24 and 0.33 respectively). It also means the long run income gains from moving to complete utilization and human capital are also smaller than in the basic UHCI (1/0.24=4.2 times in Lebanon vs 1/0.33=3.0 in Paraguay).

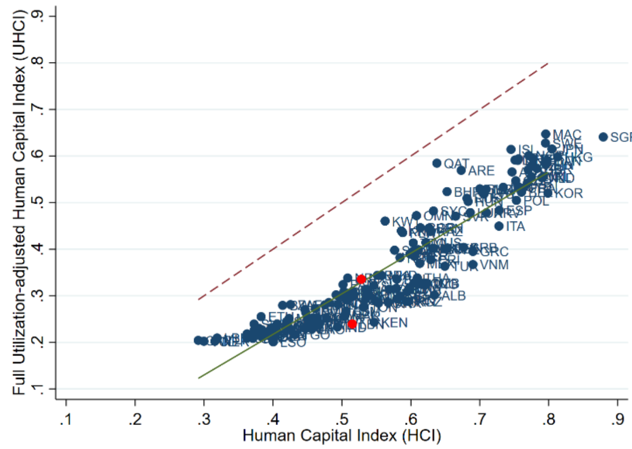
[42] The one exception is Vietnam, which has high employment rates, but a low fraction of that is in better jobs. These differences remain prominent in the UHCI because of Vietnam's high HCI score.

Figure 15: Basic UHCI vs HCI



Notes: Data for 169 Countries. Dashed line is 45 degree diagonal. Solid fitted line: y=-0.14+0.88x *Sources*: HCI: WDI. Empl. rate: JOIN/ILO.

Figure 16: Full UHCI vs HCI



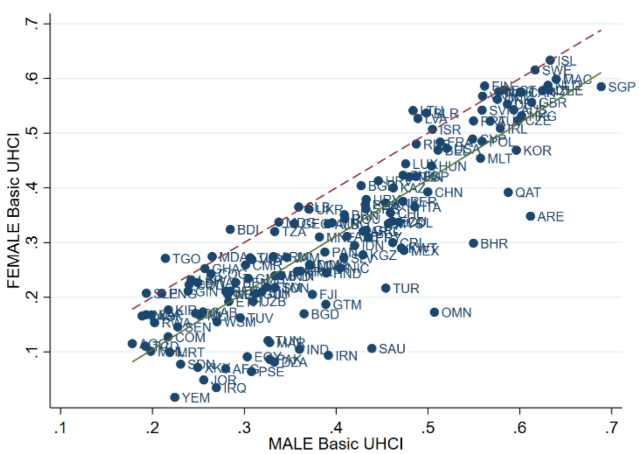
Notes: Data for 161 Countries. Dashed line is 45 degree diagonal. Solid fitted line: y=-0.13+0.88x *Sources*: WDI/JOIN/ILO.

Section 5. Disaggregation by Gender and Region

5.1 Disaggregation by gender

While the HCI is roughly equal across boys and girls, with a slight advantage for girls on average (see Appendix Figure 2), the UHCI shows that female UHCIs are typically lower than those for males, due to lower utilization rates. The basic UHCI is lower for females (y-axis) than for males (x-axis) for all but a handful of countries (Figure 17); that is, the points lie below the dashed 45-degree line. Typically, the basic UHCI is about 0.1 lower for females than males, and that relationship does not change much as the UHCI increases. This means the UHCI for females is about half that of male for the lowest UHCI countries, but about 15% lower for highest UHCI countries. The full UHCI is lower for females than males but now the [constant] gap is smaller: female full UHCI scores are about 0.035 less than those of males (Figure 18).[43]

Figure 17: Basic UHCI by Gender



Notes: Data for 148 Countries. Dashed line is 45 degree diagonal. Solid fitted line: y=-0.1+1.04x. *Sources*: WDI/JOIN/ILO.

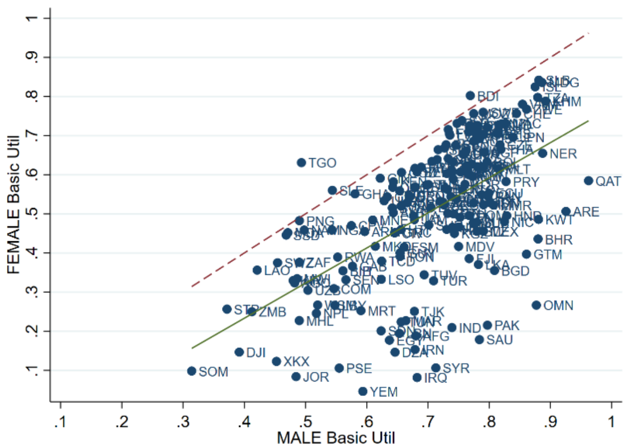
Figure 18: Full UHCI by Gender

Notes: Data for 138 Countries. Dashed line is 45 degree diagonal. Solid fitted line: y=-0.032+1.01x. *Sources*: WDI/JOIN/ILO.

[43] The full UHCI also has a bunching of countries close to the minimum UHCI score of 0.2 for both male and female, as well as more countries with the female UHCI scores above those of males.

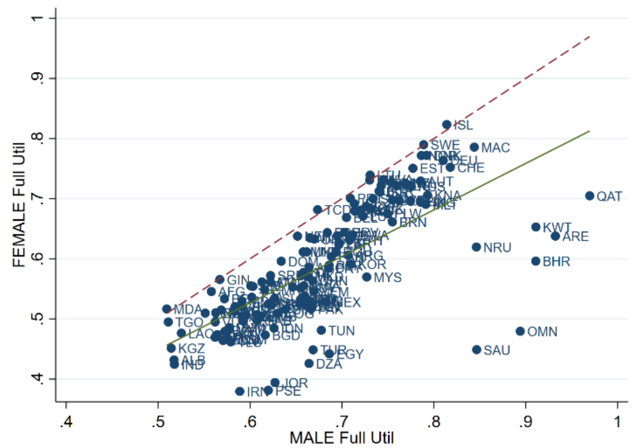
The lower UHCI scores for females relative to males are generated by lower utilization rates (Figures 19 and 20). Figure 19 shows that basic female employment rates are about 0.2 lower than male rates, with an almost-constant gap. For full utilization, the gap is about 0.05-0.1 (Figure 20), but with a number MENA oil and gas producers with full utilization rates of around 0.9 for men but 0.45-0.7 for women (e.g. Saudi Arabia, Oman, Bahrain, United Arab Emirates Kuwait and Qatar). The male utilization rates are likely so high due in part to the large number of male migrant workers who are classified as non-agricultural employees.[44]

Figure 19: Basic Utilization Measure by Gender



Notes: Data for 185 countries. Dashed line is 45 degree diagonal. Fitted solid line: y=-0.13+0.89x. *Sources*: WDI/JOIN/ILO.

Figure 20: Full Utilization Measure by Gender

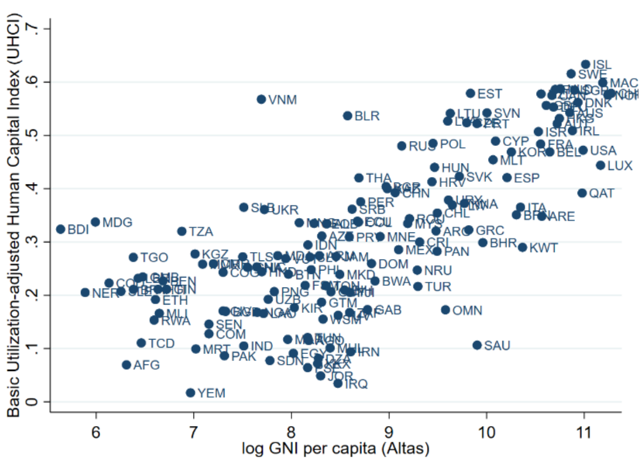


Notes: Data for 138 countries. Dashed line is 45 degree diagonal. Fitted solid line: y=0.06+0.77x. *Sources*: WDI/JOIN/ILO.

Gender and per capita income

Figures 21 (A/B) plot the basic UHCI by gender for countries of different income levels. OECD countries have a cluster of UHCI scores of around 0.6 for both genders. The UHCIs for both genders are increasing in income, especially after about $4,000 (log GNIPC=8.3), but female UHCIs are generally lower and are more dispersed at all income levels. Figures 22 (A/B) show the same basic pattern for the full UHCI, but with less dispersion and a smaller gender gap.

Figure 21A: Female – Basic UHCI and GNIPC



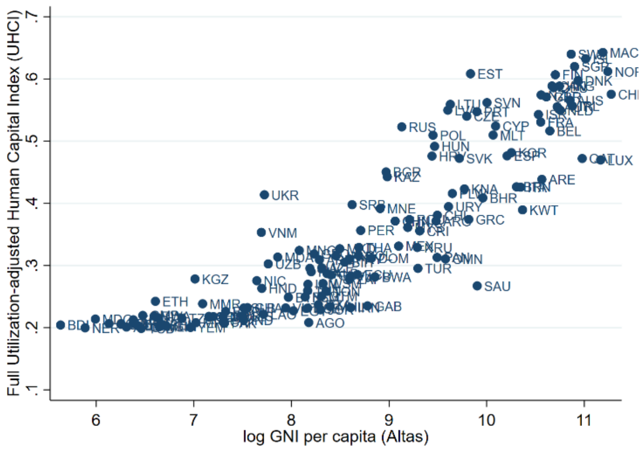
Notes: Data for 148 countries. *Sources*: WDI/JOIN/ILO.

Figure 21B: Male – Basic UHCI and GNIPC

Notes: Data for 148 countries. *Sources*: WDI/JOIN/ILO.

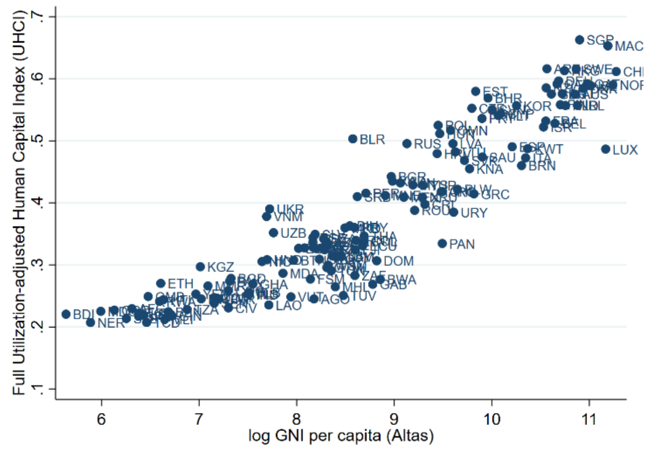
[44] Outside this group, the Islamic Republic of Iran, Jordan and Algeria and others have very low full utilization rates of around 0.4 for women, but also moderately low employment rates for men (of about 0.65).

Figure 22A: Female – Full UHCI and GNIPC



Notes: Data for 138 countries. *Sources*: WDI/JOIN/ILO.

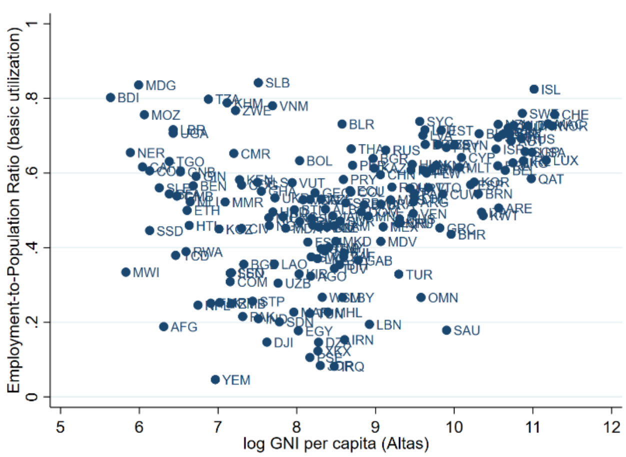
Figure 22B: Male – Full UHCI and GNIPC



Notes: Data for 141 countries. *Sources*: WDI/JOIN/ILO.

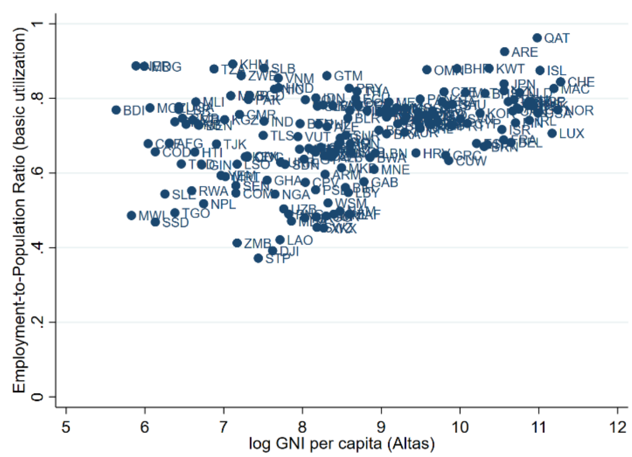
The patterns above are largely driven by employment rates at different income levels, as shown in Figures 23A and 23B (for basic utilization). Figure 23A shows that female employment rates exhibit a U-shaped relationship with per capita income (as documented in Goldin 1995)—high in the some of the lowest income countries (around 0.8), falling substantially to upper middle income countries (around 0.45), and then increasing again as incomes increase (0.7 for most of the OECD countries). In part, this could be because at the lowest per capita incomes, households are so poor that all household members must work outside the home to survive, whereas in middle income countries have less binding income constraints. However, Klasen (2019) argues that the U-shaped pattern of female employment rates is mostly due to region fixed effects, and individual countries do not display this pattern along their development path. In most high income countries, there are high female employment rates with much less dispersion. Male employment rates (Figure 23B) look completely different: they are relatively flat across the income spectrum, with a less pronounced U-shape, and are much more compressed—especially at upper-middle and high income levels.

Figure 23A: Female Basic Utilization (Emp/Pop) and GNIPC



Notes: Data for 182 Countries. Working age population is 15-64.
Sources: GNI per capita; WDI. Emp/Pop; ILO/JOIN.

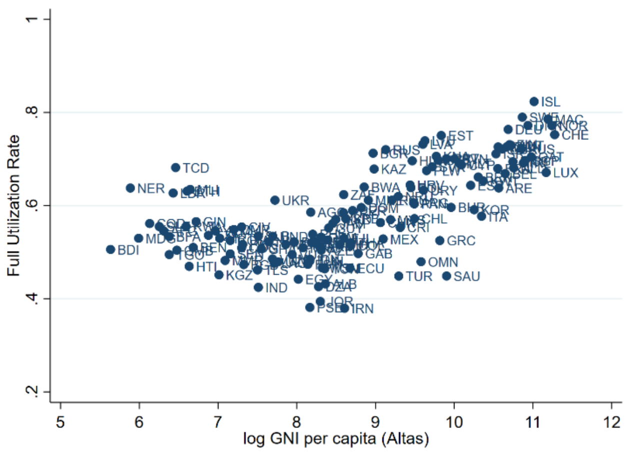
Figure 23B: Male Basic Utilization (Emp/Pop) and GNIPC



Notes: Data for 182 Countries. Working age population is 15-64.
Sources: GNI per capita; WDI. Emp/Pop; ILO/JOIN.

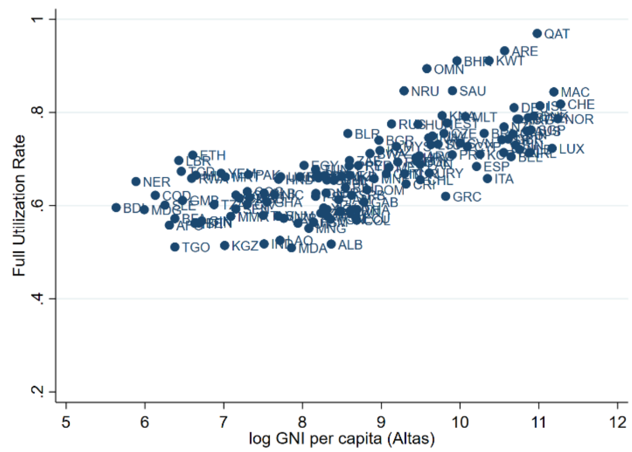
The full utilization rate for females also displays a U-shape in per capita income (Figure 24A), but one that is less pronounced (and with less dispersion). The male full utilization rate is mostly flat at around 0.6 for low and lower-middle income countries and increasing with income for upper-middle and high income countries (Figure 24B).

Figure 24A: Female Full Utilization Rate and GNIPC



Notes: Data for 138 Countries. *Sources*: ILO/JOIN/WDI.

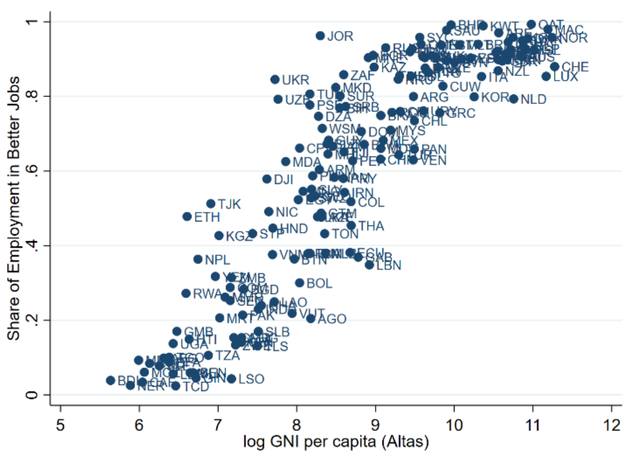
Figure 24B: Male Full Utilization Rate and GNIPC



Notes: Data for 141 Countries. *Sources*: ILO/JOIN/WDI.

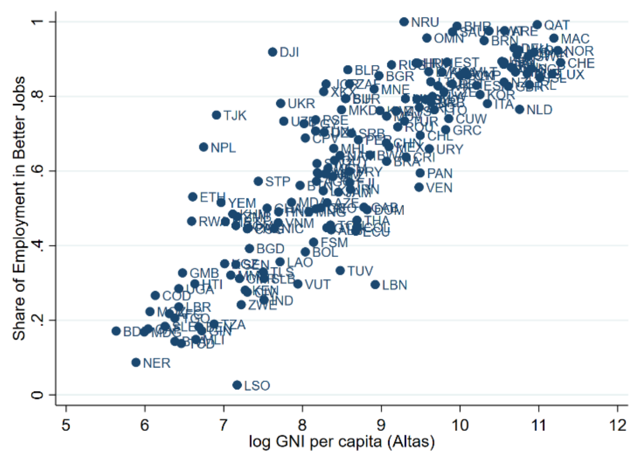
Figures 25 A/B and Figures 26 A/B dig deeper into the determinants of the full utilization measure. The share of employment in better jobs (SEBJs) increases substantially with income for both men and women, but it does so over a shorter income interval for females (Figure 25A) than for males (Figure 25B). This suggests that as women become employed, they shift rapidly to better types of jobs. As overall employment rates are lower for women than for men, this results in better employment rates (BER) for females that are close to zero for low and lower-middle income countries (Figure 26A), but then increasing rapidly after that. In contrast male better employment rates start slightly higher and increase more linearly with log income (Figure 26B).[45]

Figure 25A: Female – Share of Employment in Better Jobs (SEPJ) and GNIPC



Notes: Data for 166 countries. *Sources*: GNI per capita; WDI. SEBJ; ILO/JOIN.

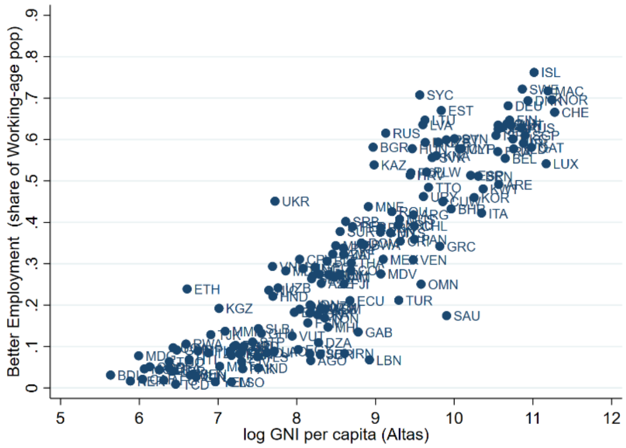
Figure 25B: Male – Share of Employment in Better Jobs (SEPJ) and GNIPC



Notes: Data for 170 countries. *Sources*: GNI per capita; WDI. SEBJ; ILO/JOIN.

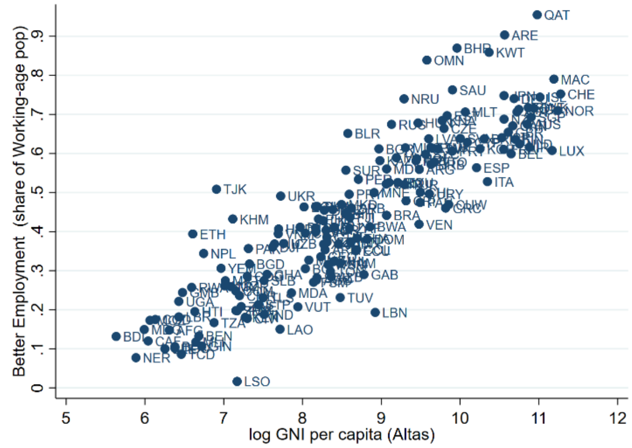
[45] Appendix Figures 3 (A/B) display the relationship between the HCI and basic utilization rates by gender. As with the relationship with income, female employment-to-population rates are U-shaped in the HCI, whereas male employment-to-population rates are almost uncorrelated with the HCI. The full utilization rate (Appendix Figure 4 A/B) displays a similar pattern, but with a more striking of a U-shape with the HCI for both genders (with less dispersion), and with a number of MENA countries being notable outliers.

Figure 26A: Female – Better Employment Rates (BER) and GNIPC



Notes: Data for 166 countries. *Sources*: GNI per capita; WDI. BER; ILO/JOIN.

Figure 26B: Male – Better Employment Rates (BER) and GNIPC

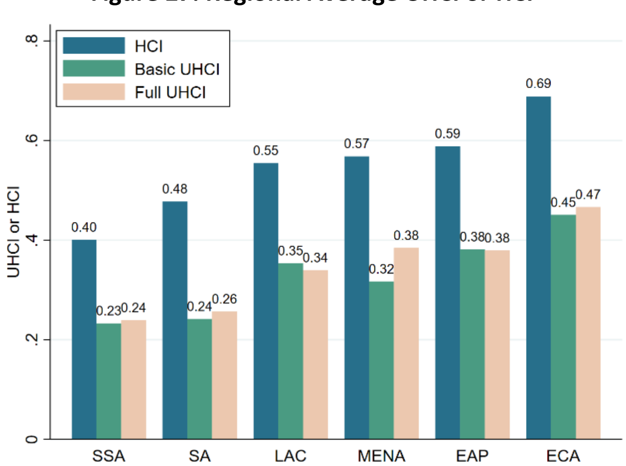


Notes: Data for 170 countries. *Sources*: GNI per capita; WDI. BER; ILO/JOIN.

5.2 Disaggregation by region

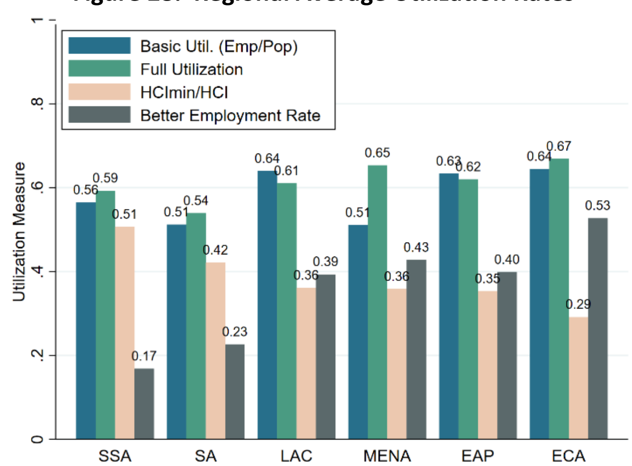
Figure 27 decomposes the UHCI measures (and the HCI) by region. One of the striking observations is that the basic and full UHCI measures are very similar to each other in almost all regions (usually within 0.02, except for MENA, where the gap is 0.06). Both UHCI measures are the lowest in SSA and SA at around 0.24, increasing to 0.35 for LAC and MENA and 0.38 for EAP and 0.47 for ECA.[46] This is roughly the same regional order as for the HCI.

Figure 27: Regional Average UHCI or HCI



Sources: WDI/ILO/JOIN.

Figure 28: Regional Average Utilization Rates



Sources: WDI/ILO/JOIN.

Figure 28 displays the two utilization measures, as well as the relative HCI and the BER, which are the two drivers of the full utilization measure (also ordered in the same way). The full utilization measure varies by less than 0.15 across regions (from 0.54 in South Asia (SA) to 0.67 in ECA). This reflects the offsetting factors of a rising better employment rate with development (grey bars), as well as a greater potential for underutilization (due to higher HCI, beige bars). Using the basic utilization measure, the lowest employment-to-population ratios are in SA and MENA, though when using the full measure MENA pulls ahead due to a greater fraction of employees of better jobs.

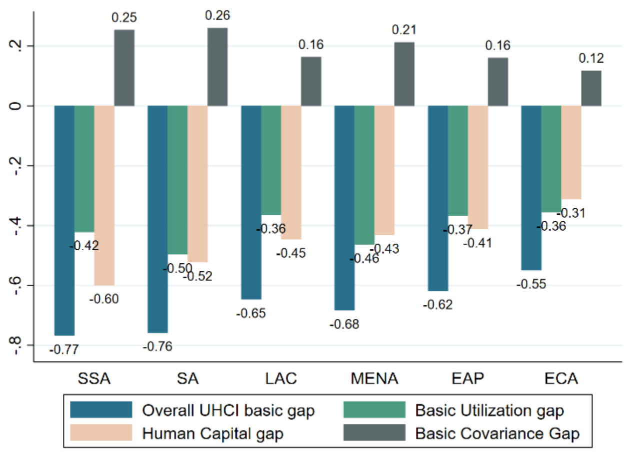
[46] The North America region is not shown in all regional plots as it consists of only two countries (the United States and Canada).

Gap analysis

To understand the drivers of the UHCI rates (in either the basic or full UHCI), one can decompose the "gap" between the UHCI and one (the theoretical maximum) into three gaps, as in Equation 18:

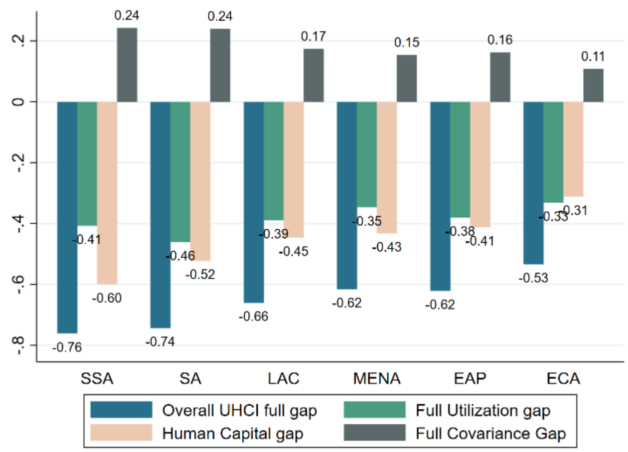
$$UHCI - 1 = (Util - 1) + (HCI - 1) + (Util - 1)(HCI - 1) \quad (18)$$

Figure 29: Contributions to regional *Basic* UHCI Gap



Note: The Utilization gap, Human Capital Gap and Covariance Gap add up to the UHCI Gap. *Sources*: WDI/ILO/JOIN.

Figure 30: Contributions to regional *Full* UHCI Gap



Note: The Utilization gap, Human Capital Gap and Covariance Gap add up to the UHCI Gap. *Sources*: WDI/ILO/JOIN

The first component $(Util - 1)$ is the *labor utilization gap*, which measures the difference between current utilization rates and their theoretical maximum. The second component is the *human capital gap*, which measures the shortfall in the human capital index relative to complete schooling and health. And finally, the third component is the "gap covariance", which is the opposite sign (positive) and recognizes that the sum of the other two gaps overstates the UHCI gap.[47]

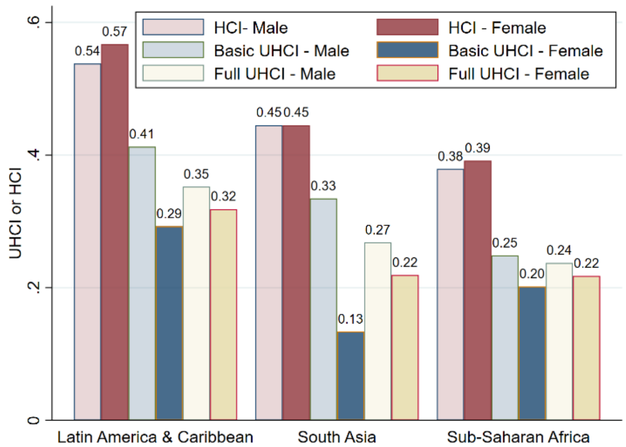
Applying the gap analysis, one can see in almost all regions and across both measures, the human capital gap is the most important factor in determining the UHCI gap (Figure 29 and Figure 30). The exception is MENA (basic measure) due to very low employment rates. For EAP (full measure) and SA (basic measure) the gaps are very similar.

5.3 Disaggregation by region and gender

Figures 31 A/B break down average HCI and UHCIs scores by both gender and region. In almost all regions, the female HCI is slightly higher than male HCI (equal for South Asia, red bars). However, the opposite is true for both UHCIs: in almost all regions the female UHCI is lower (the only exception is ECA for the full UHCI), because female utilization rates are lower than those for men.

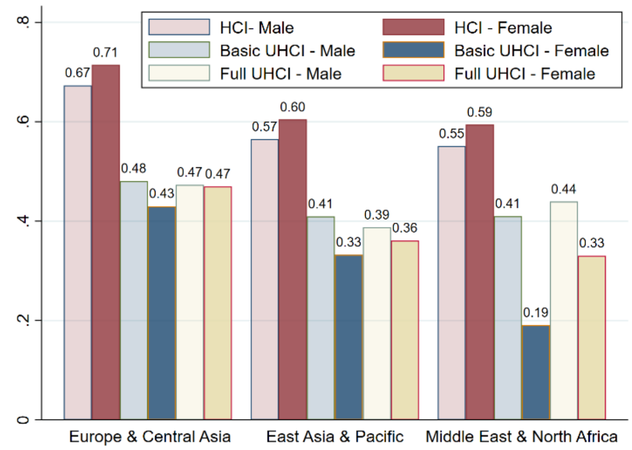
[47] More specifically, shortfalls in utilization contribute less to the UHCI gap in countries with low HCI (and vice versa).

Figure 31A: UHCI Gender Gaps by Region



Sources: WDI/ILO/JOIN. *Notes:* Regional Averages

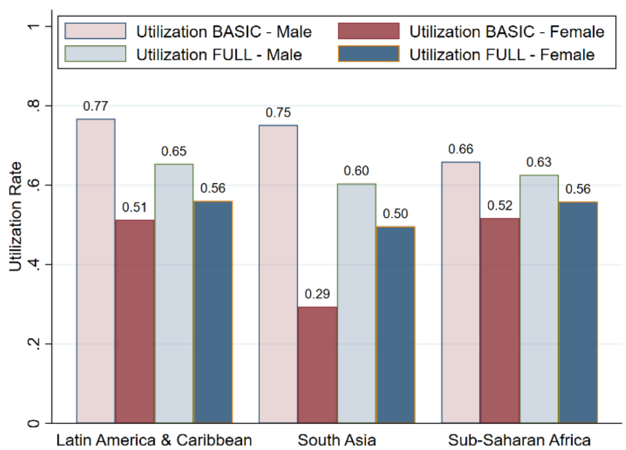
Figure 31B: UHCI Gender Gaps by Region



Sources: WDI/ILO/JOIN. *Notes:* Regional Averages

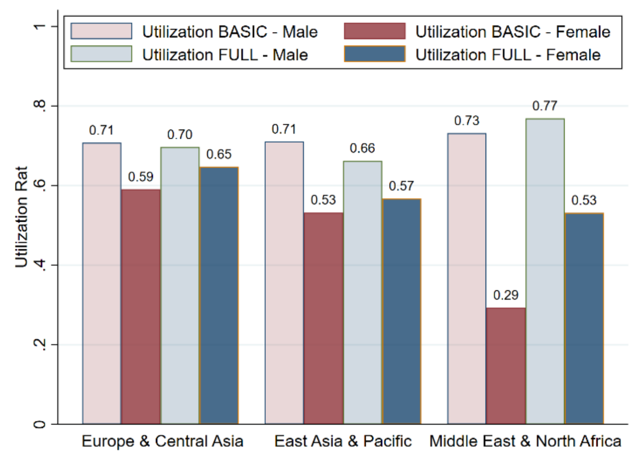
For the basic utilization rate (employment-to-population ratio), the gender gap is around 20 percentage points on average across all countries (Figures 32 A/B). The largest regional gender gaps for the basic UHCI and basic utilization rate are for the Middle East and North Africa (MENA), and South Asia (SA). In these two regions, basic utilization for females are very low: employment rates for women are more than 40 percentage points below those for men. This reflects a variety of factors, including social norms.[48]

Figure 32A: Utilization Gender Gaps by Region



Sources: WDI/ILO/JOIN. *Notes:* Regional Averages

Figure 32B: Utilization Gender Gaps by Region



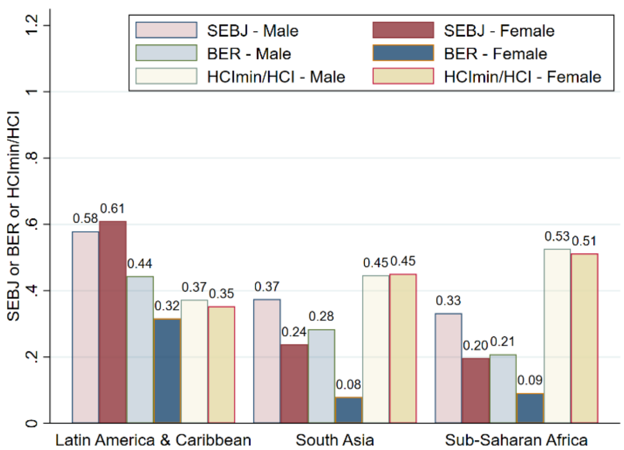
Sources: WDI/ILO/JOIN. *Notes:* Regional Averages

However, the gender gaps for the full utilization measure are much smaller, both on average across all countries (around a 10 percentage point gap), and also in SA and MENA specifically (10 and 24 percentage point gaps, respectively). There are several reasons for the smaller gap, which are explored further in Appendix 5 and Figures 33A/B. First, in countries with low HCI scores, there is not as much human capital to underutilize, and so gender

[48] More specifically, female labor force participation (FLFP) rates in MENA are low for women without tertiary education, whereas FLFP rates are much higher for those with tertiary education (Gatti et al 2013). This may reflect high reservation wages, and because tertiary education is required for public-sector jobs that are perceived to be safer for women.

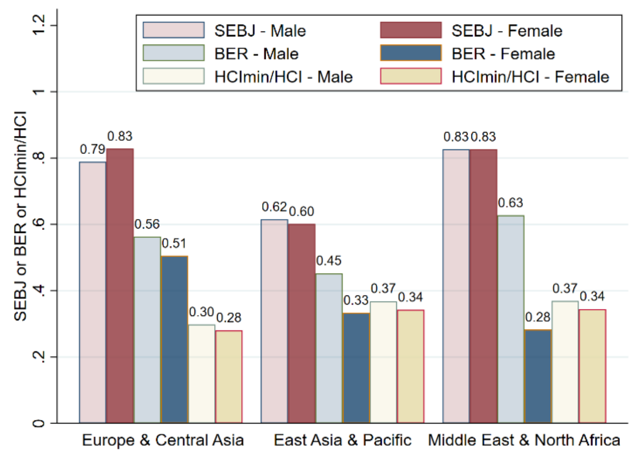
gaps in employment partly reflect underutilized time rather than underutilized human capital. This is captured by the term HCI_{min}/HCI, which is the most important in South Asia and Sub-Saharan Africa, and in most countries is roughly equal across genders. Second, in countries where the Share of Employment in Better Jobs (SEBJ) is low, large gaps in employment across genders result only in small differences in Better Employment Rates (BER). For example, in South Asia, the SEBJ in total is around 1/3, so—other things equal—a raw employment gender gap of around 45 percentage points would become a better employment gender gap of only 15 percentage points. Working in the opposite direction, gender gaps in the SEBJ will increase gender gaps in better employment rates—in the South Asian example, the gap in better employment rates is 20 percentage points, not 15 percentage points. However, gender gaps in SEBJ are not quantitatively large enough to reverse the shrinkage of employment gender gaps caused by how much human capital there is to underutilize and low levels of SEBJ. In fact, the gender gaps in the SEBJ are perhaps smaller than one might expect: as women become employed, they shift rapidly to better types of jobs. This is especially true in MENA, where there is no gender gap in the SEBJ.

Figure 33A: Understanding Full Utilization Gaps



Notes: SEBJ is the Share of Employment in "Better Jobs"
BER is the Better Employment Rate (Better Employment/Pop)
HCImin/HCI Util is the assumed Human Capital Utilization Rate of those without better employment.
Sources: WDI/ILO/JOIN.

Figure 33B: Understanding Full Utilization Gaps



Notes: SEBJ is the Share of Employment in "Better Jobs"
BER is the Better Employment Rate (Better Employment/Pop)
HCImin/HCI Util is the assumed Human Capital Utilization Rate of those without better employment.
Sources: WDI/ILO/JOIN.

Section 6. Conclusions, Caveats and Areas for Future Work

This paper seeks to adjust the World Bank's Human Capital Index (HCI) to take account of inefficiencies in real-world labor markets that may stop people from fully utilizing their human capital. Consistent with the approach in the HCI, the two new Utilization-adjusted Human Capital Indices are simple, are available for almost all countries, and are based on the size of the increase in long run income as a country moves to complete human capital and complete utilization. While the UHCI shifts down the HCI by about 1/3 on average, the reductions are larger for middle income countries and for women, suggesting a possible need for higher utilization of human capital for these two groups.

There are several caveats to the index, the most important being data quality. As shown in the discussion on data (Section 3), there is substantial variation in the employment rate and the share of employment in better jobs across data sets and over time within the same country. This means that scores for individual countries—which are the most sensitive to measurement issues—should be interpreted with caution for policy analysis.

The second main caveat is on the measurement of better employment. This terminology is designed to capture the extent to which different categories of workers are able to utilize their human capital to increase their own productivity, and should not be interpreted as a value judgment. In order to keep the index simple and country coverage broad, I have made simplifying assumptions about what constitutes better employment, with a focus on the most important broad types of employment. Naturally, there are many examples of jobs where people can utilize higher levels of human capital but fall outside this definition: formal self-employed workers (many doctors, consultants, tradespeople) and farmers in developed countries are good examples. In reality, the extent to which people can use human capital to boost productivity is a continuum across different job types, rather than the stark in-or-out categorization adopted here for simplicity.

This suggests that a fruitful area for future research might be a more empirical and nuanced definition of better employment, with different utilization rates across employment categories and sectors. For example, it could be that education is better utilized in informal trading (ability to do basic accounts) and subsistence agriculture (reading instructions for the application of fertilizer and pesticide) than in manual agricultural wage labor. These differences could be based on the development literature, or on observed earnings (conditional on human capital) across different employment types.

One other promising area for future work is to allow for a greater disaggregation of human capital and utilization rates. The analysis in this paper implicitly assumes that a representative agent has average human capital and average utilization rates. However, it could be that better educated/healthier subgroups of the population are more likely to work or are more likely to work in better jobs. This positive correlation between HCI and utilization measures would result in a higher UHCI. Conversely, a negative correlation ("unemployed engineers"), would reduce the UHCI. Appendix 3 shows that if the disaggregation is by gender—the only level for which aggregate data exist—the total UHCI is very similar, but this might not be the case for disaggregation at other levels.

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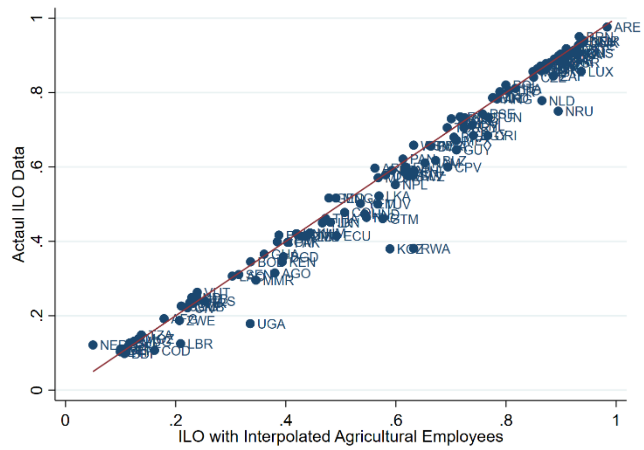
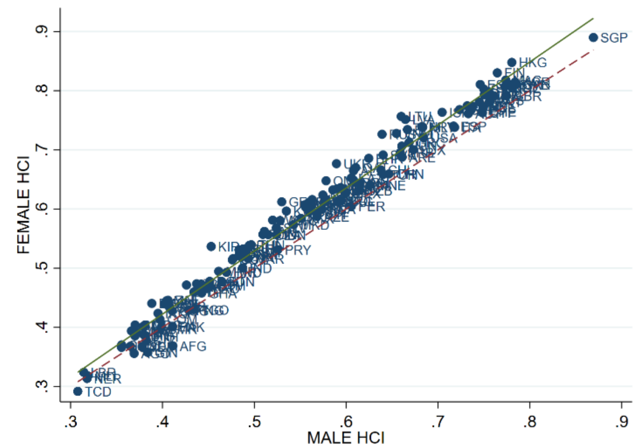
Appendix 1: Additional Figures

Appendix Figure 1: Share of Employment in Better Jobs - Interpolation Test



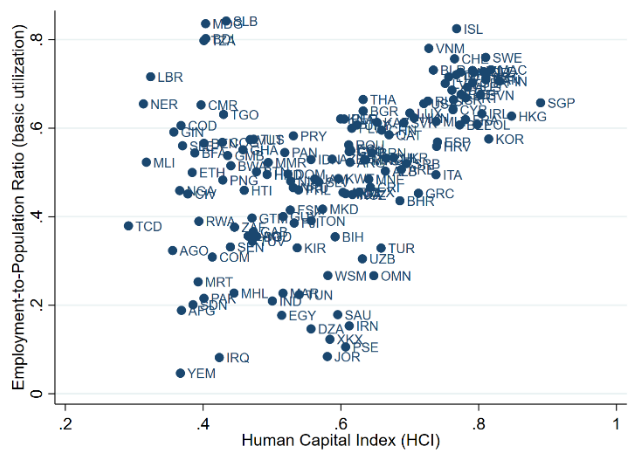
Notes: Applying the interpolation method to countries with actual ILO Data. *Source:* ILO

Appendix Figure 2: HCI by Gender



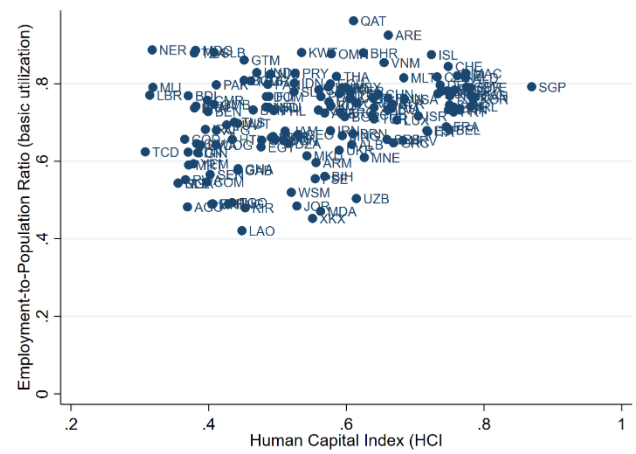
Notes: Data for 148 countries. Dashed line is 45 degree diagonal. Fitted solid line: y=-0.004+1.07x *Sources*: WDI

Appendix Figure 3A: Female Basic Utilization and HCI



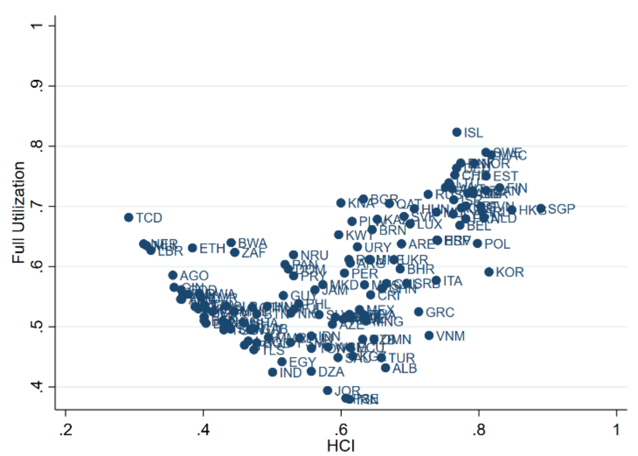
Notes: Data for 148 countries. *Sources*: WDI/ILO/JOIN.

Appendix Figure 3B: Male Basic Utilization and HCI



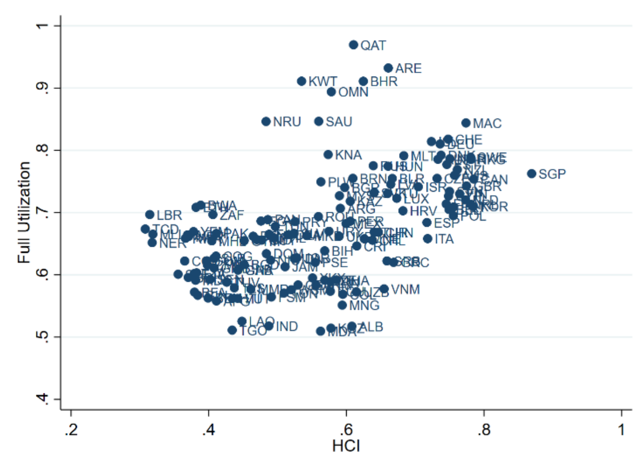
Notes: Data for 148 countries. *Sources*: WDI/ILO/JOIN.

Appendix Figure 4A: Female Full Utilization and HCI



Notes: Data for 138 Countries. *Sources*: WDI/ILO/JOIN.

Appendix Figure 4B: Male Full Utilization and HCI



Notes: Data for 141 Countries. *Sources*: WDI/ILO/JOIN.

Appendix 2: Disaggregation of Employment Rates into Not-unemployed and Labor Force Participation

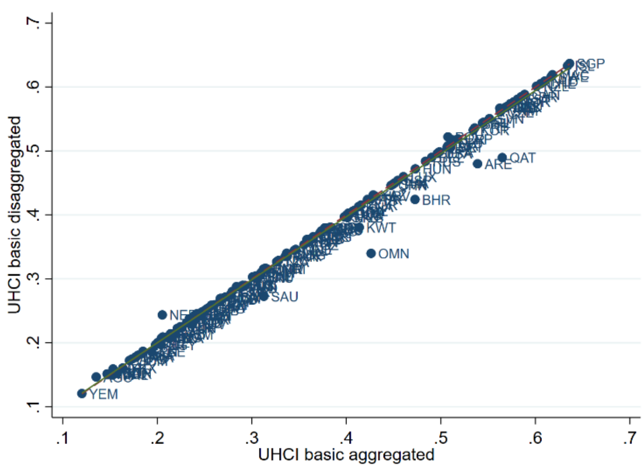
In high income countries, policy discussions of labor market underutilization often focus on the unemployment rate, and (to a lesser extent) the labor force participation rate, rather than the employment rate. My focus on the employment rate is because in most developing countries, there are few formal mechanisms for searching for work, which blurs the distinction between being unemployed and not participating in the labor force. The employment rate (basic utilization) is closely related to both of these measures, as the product between the not-unemployed rate (1- $UnempRate$), and the labor force participation rate ($LFParticipationRate$) as in Equation 18 (with all categories for people of working age, 15-64):[49]

(18)
$$Util\ (basic) = \frac{Employed}{Population} = \frac{Employed}{LaborForce} \times \frac{LaborForce}{Population}$$
$$= \frac{LaborForce - Unemployed}{LaborForce} \times LFParticaptionRate$$
$$= (1 - UnempRate) \times LFParticipationRate$$

Appendix 3: The Aggregate UHCI Formed by Combining by Gender-disaggregated UHCIs

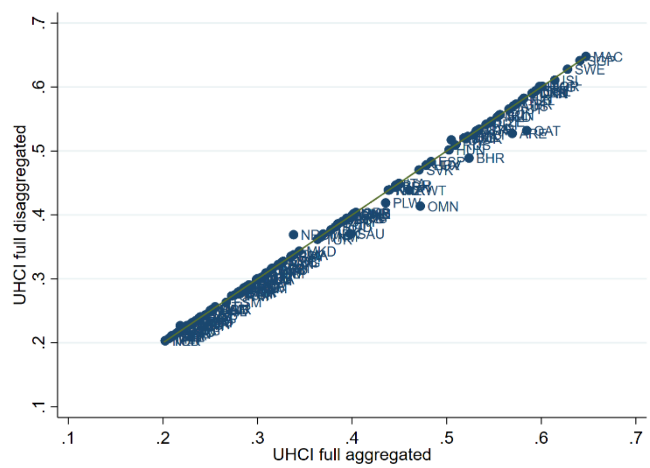
The UHCI is calculated in the main text assuming a representative agent with average human capital and average utilization rates. However, it could be that better educated/healthier subgroups of the population are more (or less) likely to work, or are more (or less) likely to work in better types of jobs, which would affect the aggregate index. Unfortunately, most subgroup analyses are limited by available data, but I can produce UHCIs calculated in this disaggregate way from male and female UHCIs (see Appendix Figures 5 and 6 respectively).[50] Apart from a handful of countries, the UHCI formed from averaging male and female UHCIs are very similar to the aggregate reported in the main text. In the other countries, the difference may be due to lopsided gender ratios. For example, in Oman—one of the countries where the average disaggregate UHCI is lower than the aggregate—2/3 of the working age population is male (perhaps due to migrant workers), suggesting a weighted average, rather than a simple average, is needed.

Appendix Figure 5: Basic UHCI Aggregate vs Disaggregate



Notes: Data for 148 countries. Dashed line is 45 degree line diagonal. Fitted solid line: y=0.003+0.99x. " Disaggregated UHCI is average of male and female UHCI. *Sources*: WDI./JOIN/ILO.

Appendix Figure 6: Full UHCI Aggregate vs Disaggregate



Notes: Data for 138 countries. Dashed line is 45 degree line diagonal. Fitted solid line: y=0.003+0.99x. " Disaggregated UHCI is average of male and female UHCI. *Sources*: WDI./JOIN/ILO.

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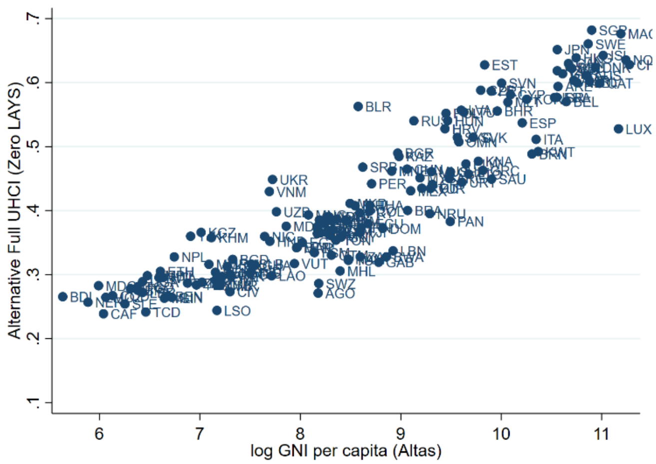
[49] The labor force participation rate ($LFParticationRate$) is usually defined as the fraction of those aged 15-64 years who are either officially employed or officially unemployed. The unemployed are those who are not employed but are actively seeking work and available to start work. The unemployment rate ($UnempRate$) is the fraction of the labor force that is unemployed.

[50] I take the simple average of male and female UHCIs as male and female populations are similar in most countries.

Appendix 4: Alternative Full UHCI with Zero Learning-Adjusted Years of Schooling

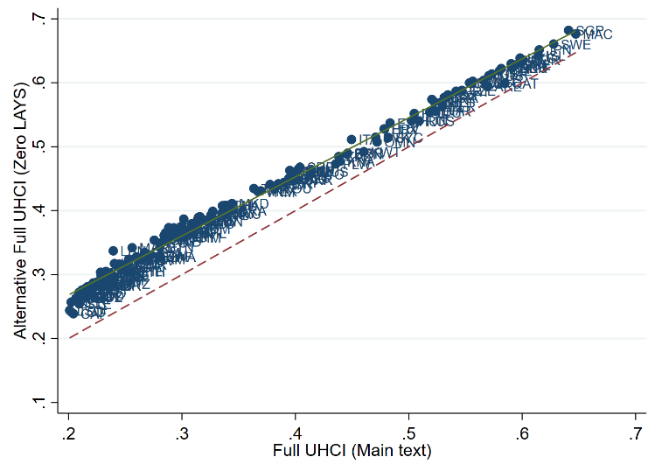
In the full UHCI in the main text, I assumed that the productivity of raw labor—which applies to people not in better employment—was the minimum HCI with zero years of schooling and zero health (zero adult survival rate and zero not-stunted rate), $HCI_{min} \approx 0.2$.[51] However, a reasonable criticism is that raw labor is actually quite sensitive to health: people who are stunted cannot lift as much as those of normal size, and manual labor is difficult to do if one is sick. To capture this, here I assume instead that jobs outside better employment reduce the productivity gains from education only, and not from health. That is, I recalculate the $HCI_{min}^{Alt} = (p/p^{\star}) \times e^{0.08\times(0-14)} \times e^{(0.65\times(ASR-1)+0.35\times(NotStunted-1))/2}$ as the productivity applied to raw labor, assuming the learning adjusted years of schooling are zero ("Zero LAYS"), but using the country's actual ASRs and not-stunted rates. This HCI_{min}^{Alt} now varies across countries depending on their health HCI score, with a mean of 0.29 (range 0.24-0.32).[52]

Appendix Figure 7: Alt. Full UHCI (Zero LAYS) and GNIPC



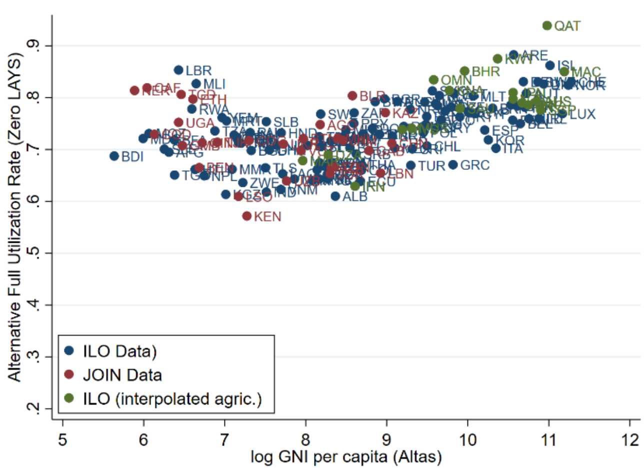
Notes: Data for 161 Countries. *Sources*: WDI/ JOIN/ILO.

Appendix Figure 8: Alt. Full UHCI (Zero LAYS) vs Full UHCI



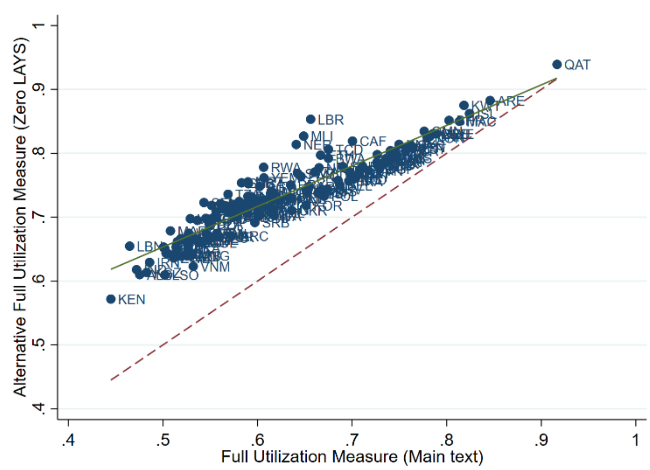
Notes: Data for 161 Countries. Dashed line is 45 degree diagonal. Fitted line: y=0.08+0.92x *Sources*: WDI/ JOIN/ILO.

Appendix Figure 9: Alt. Full Utilization Rate (Zero LAYS) and GNIP



Notes: Data for 161 Countries. *Sources*: WDI/ JOIN/ILO.

Appendix Figure 10: Full Utilization Measures – Alternative vs Main Text



Notes: Data for 161 Countries. Dashed line is 45 degree diagonal. Fitted line: y=0.34+0.63x *Sources*: WDI/ JOIN/ILO.

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[51] This was designed to capture the role of health indicators in boosting the productivity in cognitive tasks (concentration, for example), that are less important for raw labor.

[52] In the main text, I assume the minimum HCI has under-5 survival rates of $p/p^{\star}=1$ (which allows HCI_{min} to be constant across countries). Here I adopt the probability of survival to age 5 for each country in the HCI. If I instead calculated the HCI_{min}^{Alt} with $p/p^{\star}=1$, the results are very similar: the mean HCI_{min}^{Alt} increases slightly to 0.30, with range 0.26-0.32.

The definitional change increases the UHCI score by about 0.06 for those countries with the lowest UHCI, from 0.2 to 0.26 (Appendix Figures 7-8). Low income countries are the most affected, because they have a BER of close to zero; in contrast, in high income countries with BER close to 1, the minimum HCI score receives a very small weight in forming the UHCI. As expected, this also increases the full utilization rates substantially of countries with a low BER (Appendix Figures 9-10). For example, countries like Liberia (LBR), Mali (MLI) and Niger (NER) increase their full utilization rates by around 0.15 (from 0.65 to over 0.8). This gives the full utilization rate a more noticeable U-shape in per capita income.

Appendix 5: Understanding Differences in Gender Gaps Across Utilization Measures

The gender gap (male-female) for full utilization measure (10 percentage points) is about half the size the same gap for the basic utilization measure (20 percentage points). Full utilization gender gaps are 10 and 24 percentage points in SA and MENA, versus a gap of more than 40 percentage points for basic utilization. The smaller gap for the full utilization measure is due to two factors:

(i) The full utilization measure adjusts for how much human capital there is to underutilize: in countries with low HCI, gender gaps in employment mostly reflect gaps in utilization of time, rather than of human capital.

(ii) Raw employment gaps are shrunk by a low share of employment in better jobs (SEBJ). For example, consider a country where no women work, all men work, but only 10% of men work in "better jobs". Then the gender gap of 1 in terms of employment becomes a gender gap of 0.1 in terms of better employment.

To see this more rigorously, the gender gaps in terms of full and basic utilization are as in Equation 19, under the assumption that that male and female HCI scores are approximately equal (which is true in most countries):

(19)
$$\begin{aligned} Gap_{UtilFull} &= UtilFull_M - UtilFull_F \\ &= (BER_M - (1 - BER_M) \times \left(\frac{HCI_{min}}{HCI}\right)) - (BER_F - (1 - BER_F) \times \left(\frac{HCI_{min}}{HCI}\right)) \\ &= (\frac{HCI - HCI_{min}}{HCI}) \times (BER_M - BER_F) \\ &= (\frac{HCI - HCI_{min}}{HCI}) \times (UtilBasic_M \times SEBJ_M - UtilBasic_F \times SEBJ_F) \end{aligned}$$

To isolate the effect of the amount of human capital there is to underutilize (the first factor above), assume that everyone that worked was in better jobs ($SEBJ_F = SEBJ_M = 1$), so that Equation (19) becomes:

(20)
$$Gap_{UtilFull} = (\frac{HCI - HCI_{min}}{HCI}) \times Gap_{UtilBasic}$$

Equation (20) says that the full utilization gap is equal to the basic utilization gap shrunk down by $(HCI - HCI_{min})/HCI$, which reflects how much human capital there is to underutilize. For example, in a country with no human capital ($HCI = HCI_{min}$), then all raw employment gaps reflect underutilized time rather than underutilized human capital, and so $Gap_{UtilFull} = 0$. The higher the HCI, the larger $(HCI - HCI_{min})/HCI$, and so the more human capital is wasted by employment gaps. Empirically, $(HCI - HCI_{min})/HCI$ ranges from 0.33 to 0.75 with a mean of around 0.6, so in a world where all jobs are better jobs underutilized time.

To see the role of the share of employment in better jobs, take Equation (19) and now assume no gender gaps in the $SEBJ$ ($SEBJ_F \approx SEBJ_M = SEBJ$) (true in many regions, including MENA), then:

(21)
$$Gap_{UtilFull} = (\frac{HCI - HCI_{min}}{HCI}) \times SEBJ \times Gap_{UtilBasic}$$

Equation 21 shows that in countries with a low share of employment in better jobs, gender gaps in employment become quantitatively smaller gaps in the better employment. The SEBJ ranges from almost 0 to 1, with a mean about 0.6, which shrinks employment gender gaps by a further 40%. Combining the effect of (i) how much human capital there is to underutilize and (ii) a lack of better jobs, would mean the full utilization measure more than halves gender gaps in employment.