Policy Research Working Paper 9942

A Gender Employment Gap Index (GEGI)

A Simple Measure of the Economic Gains from Closing Gender Employment Gaps, with an Application to the Pacific Islands

Steven Pennings

WORLD BANK GROUP
Development Economics
Development Research Group
February 2022

Policy Research Working Paper 9942

Abstract

Despite a policy consensus that closing gender employment gaps will boost economic growth, relatively little is known about the size of these gains in many developing countries. This paper develops a new Gender Employment Gap Index (GEGI), which is equal to the size of long-run GDP per capita gains from closing gender employment gaps. The GEGI is simple and transparent and can be easily constructed using closed-form expressions for almost all countries using macroeconomic employment rate data by gender. The basic variant of the GEGI is the gap between male and female employment as a share of total employment. The full GEGI is similar, but instead of using an aggregate employment gap, the full GEGI is the weighted average of a "better employment gap" and "other employment gap." The basic and full GEGIs are similar (correlation of 0.97), and both average 19 percent across countries. This means that GDP per capita in the long run would be almost 20 percent higher if female employment were exogenously increased to be the same as men's (other things being equal). The paper also provides an application for the Pacific Islands, for which a simple measure like the GEGI is particularly important given the lack of alternative estimates.

This paper is a product of the Development Research Group, Development Economics. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/prwp. The author may be contacted at spennings@worldbank.org.

A Gender Employment Gap Index (GEGI): A Simple Measure of the Economic Gains from Closing Gender Employment Gaps, with an Application to the Pacific Islands

Steven Pennings[1]
World Bank, DECMG

[1] Email: spennings@worldbank.org and steven.pennings@gmail.com
A spreadsheet with the Gender Employment Gap Index (GEGI) for each country (and background data used in its construction) are available for download [link] or at the author's website: https://sites.google.com/site/stevenpennings/
JEL: J16, 040, E24. Keywords: gender, employment, female labor force participation, economic growth.
The views expressed here are those of the author and are not necessarily those of the World Bank, its executive directors or the countries they represent. This paper was commissioned under the Pacific Gender Equality Program and guided by Helle Buchhave, Giorgia Demarchi and Dimitria Gavalyugova. I thank Kathleen Beegle, Helle Buchhave, Giorgia Demarchi, Federico Fiuratti, Anna Fruttero, Dimitria Gavalyugova, Aart Kraay and Sergio Schmukler for helpful comments on this paper; Dimitria Gavalyugova for help with employment data for the Pacific Islands; Young Kim for sharing her estimates of the effects of gender employment gaps on growth; Federico Fiuratti for research assistance and Kathleen Beegle and Michael Weber for discussions and data on better employment.

1. Introduction

This paper introduces a new *Gender Employment Gap Index (GEGI)*, which is a measure of gender employment gaps equal to the long-run GDP per capita gains from increasing women's employment rates, so they are equal to men's. This GEGI is designed to have low data requirements so it can be calculated for (almost) every country in the world, and to be simple and transparent so calculations can be replicated and updated using publicly available employment rates by gender. There are two closely related variants of the GEGI. The "basic" GEGI is the gap between male and female employment, as a share of total employment. The basic GEGI takes this form as it is the percentage increase in labor supply from closing gender employment gaps. The full GEGI is similar, but instead of aggregate employment gaps, it uses a weighted average of employment gaps in "better employment" and "other" types of employment (defined below).

Across all countries the basic and full GEGIs both average 19%, which indicates that long run GDP per capita would be almost 20% higher than otherwise if all gender employment gaps were to be closed. The size of these gaps varies substantially across countries, across regions and by per capita income. The GEGIs are roughly hump-shaped in per capita income, which stems from the U-shaped rates of female labor force participation with income (Goldin 1995), but relatively constant male rates of labor force participation. The lowest- and highest-income countries have smaller GEGIs, but a there is a great deal of dispersion for middle income countries.[2] Overall, the largest GEGIs are in the Middle East and North Africa (MENA) and South Asia (SA), with GEGIs of around 40%-50%. The lowest GEGIs are in Europe and Central Asia (ECA) with GEGIs of around 10%.

A key motivation for this paper is to calculate the economic effects of closing gender employment gaps in Pacific Island nations, as almost all of these countries are excluded from other studies. As documented in Section 7, the GEGIs average 22% across 11 Pacific Islands indicating that GDP per capita would be 22% higher in the long run if gender employment gaps were to be closed. However, this simple average masks substantial heterogeneity across islands, with GEGIs ranging from less than 10% to more than 35%, depending on the country considered.

The GEGIs use simple neoclassical growth theory to show that a specific measure of gender employment gaps in fact equals the GDP per capita gains from exogenously closing those same gender employment gaps. There are two mechanisms behind the relationship, relating to labor (direct) and capital (indirect). First, when more women work, they will directly produce more output. The basic GEGI is the percentage increase in employment from closing gender gaps. This channel involves an exogenous change in female employment, keeping other factors constant (like total factor productivity, human capital, etc.). Note that in a cross-section of countries when female labor changes *endogenously*, those other things will not be equal, which obscures causal relationship. Second, an increase in employment will induce an increase in physical capital accumulation (again, other things equal). This is because more female labor creates a relative shortage of capital equipment and structures which raises their marginal productivity and encourages the accumulation of more capital – though this only happens in the long term. Combined, these two mechanisms mean that an exogenous X% increase in total employment also increases long run GDP per capita by X%. A similar capital-adjustment mechanism is at the heart of economic interpretation of the World Bank Human Capital Index (Kraay 2018) and the Utilization-adjusted Human Capital Index (Pennings 2020).

While the GEGIs do not capture all of the mechanisms through which gender employment gaps affect growth, they are highly correlated with more comprehensive measures in other studies (>95% across regions). This suggests GEGIs capture some of the most quantitatively important channels. Other mechanisms the GEGIs do not capture include effects of female employment via fertility (Galor and Weil 1996), effects through faster growth due

[2] This is a consequence of the well-known U-shaped relationship of female labor force participation with income first documented by Goldin (1995). However, Klasen (2019) argues that the U-shaped pattern is mostly due to region fixed effects, and individual countries do not display this pattern along their development path.

to technology adoption by female workers (Devadas and Kim 2020), the effects of greater female entrepreneurship via TFP (Cuberes and Teignier 2016), higher hours per female worker (McKinsey Global Institute 2015; henceforth MGI), or greater allocational efficiency of female labor across sectors or firms (MGI 2015; Bertay et al 2020) — see Cuberes and Teignier (2014) for a literature review. In addition, the GEGIs only capture gender gaps in employment—as their name suggests—rather than broader measures of gender gaps in terms of pay (Woden and De La Briere 2018) or education (Dollar and Gatti 1999, Devadas and Kim 2020).

There are relatively few other papers that try to estimate the effects of closing gender employment gaps on GDP for a large number of developing countries. The closest studies are Cuberes and Teignier (2016), MGI (2015) and Devadas and Kim (2020), which are discussed in detail in Section 6.[3] As mentioned above, the GEGIs are highly correlated with these other studies (>95%). Relative to the effect on GDP in those studies, the GEGIs are similar on average, or a little smaller because the other studies include other mechanisms beyond those considered in the GEGI. However, when focusing on comparable mechanisms, the GEGIs are similar or slightly larger.

The contribution of the GEGI to this literature is to provide a simple and transparent measure of the growth impacts of gender gaps that is available for almost every country. Simplicity and transparency are needed because alternatives do not have closed-form solutions for the size of the effect on GDP, and are not easy to calculate. In contrast, the GEGIs can be calculated easily in a spreadsheet from employment rates using closed-form expressions. Data availability is important because the above measures exclude many developing countries. For example, the sample size of the basic GEGI is double that of MGI (2015) and Devadas and Kim (2020), and 40% larger than Cuberes and Teignier (2016). The GEGIs are not intended to be the most accurate or comprehensive measure of gender employment gaps in countries with very good data, but rather to provide approximate estimates of GDP impacts in *every* country, and the only estimates for many countries where the data used in other studies is missing.

The rest of this paper is organized as follows. Section 2 discusses the basic GEGI, Section 3 discusses the full GEGI, Section 4 explores differences between the basic and full GEGIs, Section 5 discusses the speed of adjustment of GDP toward the GEGI, Section 6 provides a quantitative comparison of the GEGIs with three other similar papers, Section 7 presents an application for Pacific Island countries and Section 8 concludes. Appendix Table 1 and an online spreadsheet [link] list the full and basic GEGIs for all countries, and the employment data from which they are constructed. Derivations are in Appendices 1-3. Appendix 4 provides adjusted GEGIs for eight countries with unbalanced male-female populations (Bahrain, Kuwait, Maldives, Nepal, Oman, Qatar, Saudi Arabia, and the UAE).

2. The basic Gender Employment Gap Index (GEGI)

2.1 Overview

The basic GEGI is defined as the gap between male employment L_M and female employment L_F, as a share of total employment $L = L_M + L_F$ as in Equation (1):

$$\text{(1)} \qquad Basic\ Gender\ Employment\ Gap\ Index\ (GEGI) \equiv \frac{L_M - L_F}{L} \times 100\%$$

Equation 1 takes this form because it represents the percentage increase in total employment from closing gender employment gaps; $L_M - L_F$ is the size of the increase in female employment from closing these gaps, and this is evaluated relative to total employment L.

[3] Goldman Sachs (2007) use a measure very similar to the basic GEGI to calculate GDP gains for 9 high income countries and the Euro area, though do not calculate it for a broader set of countries (and no developing countries). Unlike the GEGI, they claim that these gains are overstated due to "lower productivity, because it [higher employment] reduces the capital-to-labor ratio", whereas the GEGIs are long run measures that include the effects of induced capital accumulation.

The GEGI runs from 0% to 100%, with a bigger number indicating a larger gender employment gap.

- If there is no female employment at all ($L_F = 0, L_M = L$), then $GEGI = \frac{L_M - 0}{L_M + 0} \times 100\% = 100\%$ (the largest possible gender gap).
- If there is equal employment across females and males, $L_M = L_F$ then $GEGI = 0$ (no gender gap at all).

The GEGI can be calculated directly from employment data, measured as the number of people (e.g., L_M is the number of males employed, and L_F is the number of females employed and L is total number of people employed). But often labor market data are reported as the working-age employment-to-population ratio for each gender, which I denote with a lower case: $l_M = L_M/Pop_M$ and $l_F = L_F/Pop_F$. In that case, Equation 1 can be rearranged as Equation 2, which is equivalent, and is used in the empirical application later in this paper.[4]

(2) $$Basic\ Gender\ Employment\ Gap\ Index\ (GEGI) \equiv \frac{l_M - l_F}{l_M + L_F} \times 100\%$$

Note that the GEGI formula assumes an equal population of men and women, which holds in most countries. Appendix 4 considers an adjusted basic GEGI that should be used for eight countries with a higher male population share (Bahrain, Kuwait, Maldives, Nepal, Oman, Qatar, Saudi Arabia, United Arab Emirates).

2.2 Economic interpretation

The basic GEGI has a simple and appealing economic interpretation: *the increase in long-run GDP per capita from closing the gender gap in employment rates*. For example, if GEGI=19% (the cross-country average), it would imply that long-run GDP (or GDPPC) would be almost 20% higher if the employment gender gap was closed by increasing female employment. See Appendix 1 for a derivation.

The largest increase in GDP would occur in countries with the largest gender gaps. For example, in economy where no women were employed, GEGI=100%, so GDP would increase by 100% moving to equal employment rates (GDP doubles). In contrast, when the GEGI=0, gender parity has already been achieved so there are no untapped gains due to employment gaps.[5]

The GEGI has this interpretation because the size of the increase in long-run GDP is proportional to the change in the number of workers in the long-run in simple neoclassical growth models. This is because the capital-to-output ratio is constant in the long run (one of Kaldor's stylized facts).[6] This means that moving from no female employment to achieving gender parity in employment would double the number of workers, and so long-run GDP would also double. It is important to note that this calculation assumes an *exogenous* change in female employment, keeping everything else equal (productivity, human capital, etc.). In contrast, looking at a cross-country relationship in the data between female employment rates and GDP is uninformative about the causal relationship, because female labor supply varies *endogenously*. For example, an extended drought which lowers productivity and GDP could cause more women to work out of hardship, but this does not imply that higher female labor reduces GDP—that change in female labor supply is endogenous, not exogenous.[7] The GEGI calculation also assumes that human capital is the same across males and females—an accurate assumption based on the World Bank Human Capital Index (see Appendix Figure 3)—and that males and females are otherwise equally productive.

---

[4] To see that Equations 1 and 2 are equivalent, substitute $L = L_M + L_F$ in the denominator of Equation (1) and then substitute $L_M = l_M \times Pop_M$ and $L_F = l_F \times Pop_F$. Females and males have almost identical populations, $Pop_M = Pop_F$, and so population cancels in the numerator and denominator, yielding Equation (2).

[5] Note that in countries where male employment rates are low, parity of employment by gender is a less ambitious target.

[6] Appendix Figure 4 (reproduced from Jones 2016) shows that the US capital-to-output ratio has been broadly constant at about 3-3.5 since World War 2.

[7] Across countries, female employment is high in both low and high income countries (Pennings 2020), but this is a correlation, not causation.

The effect on GDP is in the long run (meaning a generation or so) because that is the amount of time required for physical capital to accumulate in response to higher employment rates (which will depend on financial market openness, domestic savings, etc.). More generally in standard Solow-Swan-style growth models, the effect of higher employment rates on economic growth has two parts:[8]

1. The *direct* boost to GDP from more workers. This occurs relatively quickly, but is somewhere between half and three-quarters of the total gains, depending on the economy (the labor share of income β).
2. The *indirect* boost to GDP, when higher female employment encourages capital accumulation. This occurs relatively slowly, and typically accounts for between a quarter to half of the total gains (1- β).

The "long-run" timeframe is needed to capture both direct and indirect effects. This is discussed more in Section 5.

In more concrete terms, this means that the basic GEGI can be interpreted to answer two counterfactuals:

- Backward-looking: suppose a previous government had implemented policies (a generation ago) to bring female employment rates up to men's, then GDPPC would be *GEGI%* higher today than it is currently.
- Forward-looking: suppose the government enacted policies today to bring female employment rates up to men's. Then GDPPC in the long-run (a generation or so from now) would be *GEGI%* higher than otherwise.[9]

2.3 Data – Basic GEGI

I calculate the GEGI using the employment-to-population ratio of 15-64-year-olds by gender, as in Equation 2. Employment data are available for around 185 countries. The data are taken from Pennings (2020), who in turn takes the survey data (not projections) from the ILO series "Employment-to-population by sex and age (%) – Annual", Age (Youth,Adults): 15-64, using the latest period available[10] or from the World Bank JOIN database, which focuses on low income and middle-income countries.[11] In most cases, the ILO data are the most recent. For three countries (Burundi, Sierra Leone and Togo) the basic GEGI as calculated by Equation 2 is slightly negative, and so in these cases I round up the basic GEGI to zero so it is between 0 and 100%.

As discussed in Pennings (2020), in a number of developing countries employment rates change dramatically over time. Most likely this is due to changes in the definition of employment and whether it includes or excludes own-use production workers (subsistence agriculture) — though this is rarely properly documented.[12] Definitional changes in employment are less of an issue for the GEGI than for other measures, as we are interested in the relative gap between male and female employment rather than its absolute magnitude.

2.4 Results – Basic GEGI

The Basic Gender Employment Gap Index (GEGI) is shown in Figure 1, plotted against income per capita (log scale). On average the GEGI is close to 19%, indicating that long-run GDP per capita would be almost 20% higher if the gender employment gap was closed. The basic GEGIs are listed in Appendix Table 1 for all 185 countries.

---

[8] The GEGI does not include other potential benefits of higher female employment, like slower population growth.

[9] Note that because the World Bank Human Capital Index (HCI) used in the construction of the full GEGI is forward looking only, the full GEGI presented in Section 3 only has the second interpretation.

[10] Downloaded from https://www.ilo.org/shinyapps/bulkexplorer7/ on 13 Dec 2019. Tonga uses updated ILO data from 2018.

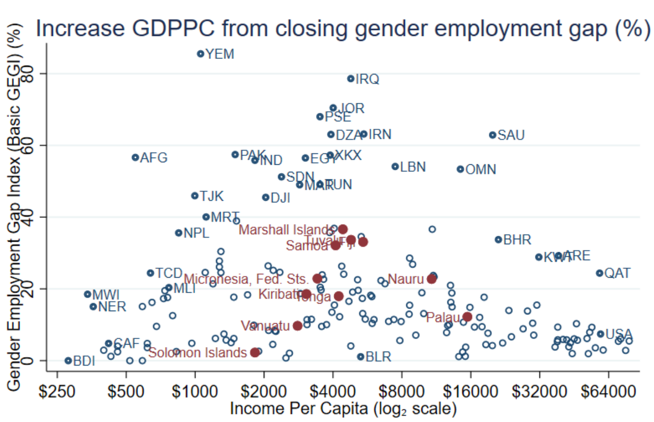
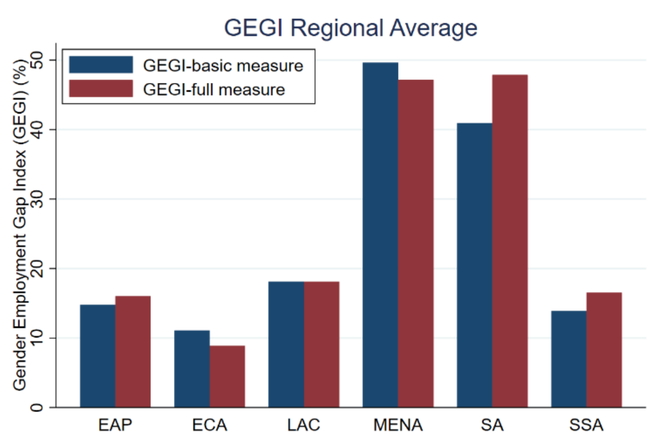
[11] The JOIN employment rate is sometimes sourced from "Employment to Population Ratio, aged 15-64, (Column V) of the public JOIN spreadsheet (downloaded 21 October 2019, link), and is sometimes calculated from more recent microdata that were acquired through private correspondence.

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

The GEGI is generally relatively small for both the highest income countries and the lowest income countries. For example, for the United States (USA), the GEGI is around 7.5% (a 7.5% GDPPC gain from closing the gender employment gap), but is similar (around 5%) in the Central African Republic (CAF). In low income countries, the relatively low GEGI is likely because women are too poor not to be employed, and because small-holder agricultural work may be more accessible to women. Middle income countries have the greatest variability in the GEGI. For example, at income per capita of around $5,000, the GEGI ranges from 1% in Belarus (BLR) to 79% in Iraq (IRQ)—in the latter case, GDPPC would be almost 80% higher if the gender employment gaps in Iraq were closed by increasing female employment.[13]

Looking across regional averages, the largest GEGIs are in the Middle East and North Africa (MENA) and South Asia (SA), with GEGIs of 50% and 41% respectively (Figure 2). In South Asia, GEGIs are close to 56% in Pakistan, India and Afghanistan. In MENA, the GEGI-basic is 85% in the Republic of Yemen, 70% in Jordan, and around 63% in Algeria and the Islamic Republic of Iran, indicating increases in GDPPC of 63%-85% in closing gender employment gaps in these economies.

For Saudi Arabia, the basic GEGI is also around 63%, though this is partially due large numbers of male migrant workers that mean that there are many more men than women in that country (recall the derivation of the GEGI assumes the male and female working age populations are equal). In Appendix 4, I produce an *adjusted basic GEGI*, which equalizes employment-to-population ratios by gender, rather than equalizing employment. For almost all countries the results are identical, but for Saudi Arabia, the Maldives and five Gulf countries (Bahrain, Kuwait, Oman, Qatar and the United Arab Emirates)—which also have unequal populations by gender—the basic GEGI is much smaller (for Nepal it is larger). In Saudi Arabia, for example, the adjusted basic GEGI is 44% (rather than 63%), and on average in this group the basic GEGI almost halves (a fall by 16ppts). For those interested gender employment gaps in these countries, using the *Adjusted Basic GEGI* in Appendix Table 2 is recommended.

Figure 1	Figure 2
	

Notes: GEGI is increase in long run GDP per capita from closing the employment gender gap. GEGI<0 rounded to 0 in Togo, Burundi and Sierra Leone. Income is GNIPC in 2017 dollars. Each dot represents a country with Pacific Islands in maroon.

Key: EAP=East Asia & Pacific, ECA=Europe and Central Asia, LAC=Latin America & Caribbean, MENA=Middle East & North Africa,SA= South Asia, SSA=Sub-Saharan Africa.

[13] In the basic GEGI framework, male and female employment are perfect substitutes and so GDP can also be increased by increasing male employment. Increasing male employment-to-population ratios to the 90th percentile (of Macao SAR) would increase long-run GDPPC by 14% on average, less than the 19% in the basic GEGI if achieving gender parity in employment-to-population ratios. Nonetheless, this calculation misses heterogeneity in *who* is brought into the labor market from higher employment, as captured in richer models like that of Cuberes and Teignier (2016). For example, increasing female labor force participation off a low base may bring extremely talented or productive women into the labor force, whereas trying to increase male participation rates off an already high base might require employing men who are not employed for a good reason – such as those in poor health. An extension capturing this heterogeneity in a simple way is an interesting area for future research.

3. The Full Gender Employment Gap Index

3.1 Overview

One of the concerns with the basic Gender Employment Gap Index (GEGI) is that that there is no adjustment for the types of work that women and men do.[14] For example, in many countries women may be employed in household-level micro-enterprises, but be locked out of wage employment which typically offers high income. This suggests a need to study gender gaps in the types of employment where women may be more productive, in addition to the aggregate gender gap.[15]

The Full Gender Employment Gap Index (full GEGI) seeks to address this concern by disaggregating total gender employment gaps into a "better employment" gender gap (BE_{Gap}) and an "other employment" gender gap (OE_{Gap}) – where "other employment" is defined as employment that is not "better employment". In the spirit of the basic GEGI, the better employment gap (BE_{Gap}) is defined as the gap between the male better employment (L_M^{BE}) and female better employment (L_F^{BE}), measured as a share of total better employment ($L^{BE} = L_M^{BE} + L_F^{BE}$) (Equation 3). The "other employment" gender gap is defined analogously for male other employment (L_M^{OE}) and female other employment (L_F^{OE}) (Equation 4).

(3) $$Better\ Employment\ Gender\ Gap\ (BE_{Gap}) = \frac{L_M^{BE} - L_F^{BE}}{L^{BE}} \times 100\%$$

(4) $$Other\ Employment\ Gender\ Gap\ (OE_{Gap}) = \frac{L_M^{OE} - L_F^{OE}}{L^{OE}} \times 100\%$$

The full GEGI is a defined as a weighted average of the "better employment" gender gap and the "other employment" gender gap, where the weights applied to better employment ω and other employment $(1-\omega)$ reflect their contributions to GDP (discussed further below). In countries with only better employment (which implies $\omega = 1$) or only other employment (which implies $\omega = 0$), the full GEGI collapses to the basic GEGI.

(5) $$Full\ GEGI = \omega BE_{Gap} + (1-\omega) OE_{Gap}$$

The interpretation of the full GEGI is analogous to the basic GEGI: the percentage increase in GDPPC in the long-run from closing all gender gaps in better employment and other employment so that female employment rates are equal to those of males. For example, if the full GEGI was 19% (the sample mean), then long-run GDP per capita would be almost 20% higher if the female rates of better employment and other employment were the same as males. See Appendix 2 for a derivation. Note that this increase in GDPPC is derived under a slightly different set of assumptions from those in the basic GEGI.[16] Just as for the basic GEGI, the full GEGI assumes equal male and female working-age populations, and the adjusted full GEGI (Appendix 4) should be used if that is not the case.

The concept of *better employment* is taken from Pennings (2020), and seeks to capture the employment categories where people might be better able use their human capital and skills to increase their productivity. 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 (see Pennings

---

[14] I thank Dimitria Gavalyugova for this critique and motivating work on the Full Gender Employment Gap Index (full GEGI).

[15] Note that this does not mean moving all female employment into these types of jobs, because in typical developing countries many men are not in these jobs either. Rather I study the closing of gender gaps such that female employment is equal to male employment in each type of job.

[16] The production function for basic GEGI assumes that "other employment" is just as productive as better employment. In contrast, the full GEGI assumes that better employment is more productive than other employment.

2020). Better employment is not about formality or informality—but rather about the organization of work in a team where employees are paid for their work (rather than working out of familial obligation).[17] This allows a minimum of specialization and organization, which helps to boost productivity and for people to use their skills.

Other employment is all types of employment other than better employment, and is calculated as the difference between total employment and better employment. The main categories usually in other employment are subsistence own-account/family agriculture, non-farm microenterprises, 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.[18]

The weights of better employment (ω) and other employment ($1-\omega$) depend on the relative contributions of better employment and other employment in generating GDP (Equation 6). This depends on both the number of workers in better employment and other employment, but also on their relative productivity. I assume that those in "other employment" are only as productive as raw labor, which has normalized productivity of 1. The human capital of these workers does not affect their productivity: a doctor working as an agricultural laborer will be just as productive as someone with no education doing the same job. In contrast, workers with better employment are as productive as their human capital allows; they are h times as productive as raw labor (where h is human capital per worker).[19] I assume that in each case males and females are equally productive, and have the same human capital $h_F = h_M = h$ (which is not a bad approximation based on the World Bank HCI, see Appendix Figure 3).

(6) $$\omega = \frac{hL^{BE}}{hL^{BE}+L^{OE}}$$

3.2 Calculating the full GEGI in the data: Employment ratios and the HCI

Often it is convenient to work with employment variables as shares of the working-age population—rather than in terms of the number of people. Here I rewrite the building blocks of the full GEGI—BE_{Gap}, OE_{Gap} and ω—in terms of ratios. These expressions are equivalent to those in Equations 3, 4 and 6 above, and are used to calculate the full GEGI empirically (see Appendix 3 for derivations). The first ratio is the Better Employment Rate (BER), which is defined better employment as a share of the working age population (Pennings 2020). The second ratio is the Other Employment Rate (OER) as other employment as a share of the working-age population. The other employment rate can be calculated as the employment-to-population ratio (l), less the better employment rate ($OER = l - BER$). This allows the Better Employment Gap to be expressed as (equivalent to Equation 3):

(7) $$BE_{Gap} = \frac{BER_M - BER_F}{BER_M + BER_F} \times 100\%$$

And the Other Employment Gap becomes (equivalent to Equation 4):

(8) $$OE_{Gap} = \frac{OER_M - OER_F}{OER_M + OER_F} \times 100\%$$

The calculation of the GDP weights ω requires data on human capital per worker h, which requires taking a stand on timing. Because we are usually interested in evaluating the effect of today's policy changes in the future (forward looking) we want a measure on human capital of the next generation: which is what the World Bank

[17] 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.

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

[19] For example, if $h = 3$ then the worker is three times as productive a raw labor.

Human Capital Index seeks to measure. However, the HCI is expressed relative to a theoretical maximum of complete education and health (which are assigned a score of one), rather than relative to the productivity of raw labor, as is needed here. Hence, we need to calculate $h = HCI/HCI_{Min}$ where $HCI_{Min} = 0.2$ is the theoretical minimum HCI (for someone with no education and poor health).[20] I also express the employment variables in ω in terms of BERs and OERs. So, the weight ω becomes (equivalent to Equation 6):

(9) $$\omega = \frac{h \times (BER_M + BER_F)}{h \times (BER_M + BER_F) + OER_M + OER_F} \quad \text{where } h = HCI/HCI_{Min}$$

3.3 Data – Full GEGI

The data to calculate the full GEGI are taken from the data file of Pennings (2020). In addition to data on the employment-to-working-age-population rate by gender (as in the basic GEGI), the full GEGI requires data on the HCI and the share of employment in better jobs (SEBJ)=better employment/total employment (by gender) – as in Equation 10.[21] The SEBJ is then multiplied by the employment rate to form the Better Employment Rate (Equation 11). The full GEGI can be calculated for 159 countries.

(10) $$Share\ of\ employent\ in\ better\ jobs\ (SEBJ) \equiv \frac{L_{BE}}{L} = \frac{Employees\ (non\text{–}agric.) + Employers}{Total\ Employment}$$

(11) $$Better\ Employment\ Rate\ (BER) \equiv \frac{L_{BE}}{Pop} = \frac{L_{BE}}{L} \times \frac{L}{Pop} = SEBJ \times l$$

The primary source of data on employers, non-agricultural employees and total employment for the numerator of the SEBJ is ILO series "Employment by sex, status in employment and economic activity (Thousands)", using the most recent year available.[22] 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.[23] 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 GEGI.[24]

The secondary source is the JOIN database microdata. At the time of data collection, 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.[25]

---

[20] For the backward-looking application, one could use the human capital measure from the Penn World Tables directly. This is expressed in productivity units relative to unskilled labor—like h—based on the years of schooling of the workforce today.

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

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

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

[24] In the initial sample based on data from Pennings (2020), Papua New Guinea, Kiribati and Tuvalu are missing data on Better Employment, and so were missing from the full GEGI. This was due to missing data on the number of employers, or missing data using the ICSE-93 classification. To ensure a more complete measure of employment gender gaps, I downloaded additional data on "Employment by sex, status in employment and economic activity (Thousands) -Annual" from https://www.ilo.org/shinyapps/bulkexplorer7/ (accessed 30 September 2021), using non-ICSE-93 categories and also assuming that the number of employers was zero (if it was missing). This allowed me to calculate the SEBJ for these three countries, and hence the Better Employment Gap and the full GEGI. SEBJ data for Tonga was also updated to 2018 (from ILO).

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

Finally, there are a small 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 (they are also missing JOIN data).[26] In these countries, I interpolate the agricultural share of employees in several different ways, which allows me to keep these countries/regions in the sample (see Pennings (2020) for details). Data on the HCI (combined for both genders), is taken from the 2020 Human Capital Update.[27] For five countries (Finland, Lithuania, Moldova, the Seychelles and Togo) the full GEGI as calculated by Equation 5 is slightly negative, and so in these cases I round up the full GEGI to zero so it is between 0 and 100%.

3.4 Results — Full GEGI

The Full Gender Employment Gap Index (GEGI) is shown in Figure 3, plotted against income per capita (log scale). Similar to the basic GEGI, the full GEGI is close to 19% on average, indicating that long-run GDP per capita would be almost 20% higher if gender employment gaps in each type of work were closed.

Like the basic GEGI, the full GEGI is relatively small for both the highest income countries and the lowest income countries. For example, the two highest income countries in the sample are Norway and Switzerland, which have full GEGI scores of around 6% and 1.5% respectively. On average, those are similar to Burundi—the lowest income country in our sample— which has a full GEGI score of 3.6%. Also like the basic GEGI, there is a huge range of full GEGI scores for middle-income countries, ranging from 3.6% in Bulgaria to 63% in the Islamic Republic of Iran.

Figure 3

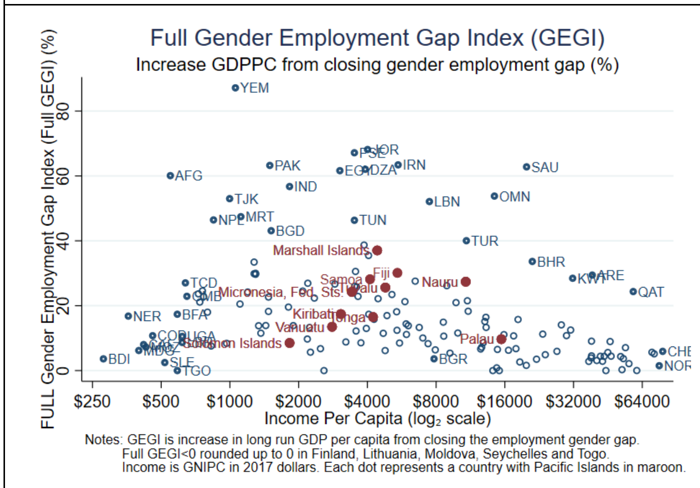
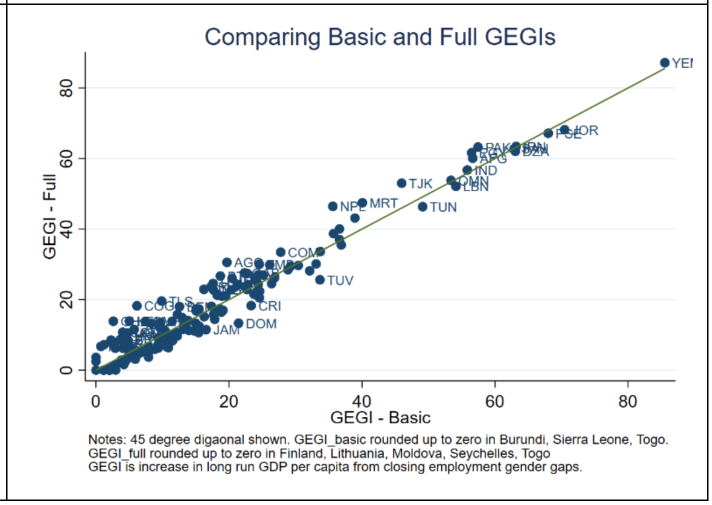


Figure 4



4. Comparison of Full and Basic GEGIs

Despite the more advanced treatment of employment gaps, the basic and full GEGIs are very similar, with a cross-country correlation of 97%. Figure 4 shows that when one is plotted against the other, they lie close to the 45 degree line. Only in around 20% of the sample are the two measures more than 5ppts apart, and only in four countries (Angola, Rep. Congo, Ghana, and Nepal) are the gaps more than 10ppts, with GEGI(full) typically being only just more than 10ppts above GEGI(basic) in this group.[28]

---

[26] 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.

[27] https://www.worldbank.org/en/publication/human-capital and https://development-data-hub-s3-public.s3.amazonaws.com/ddhfiles/144347/hci_data_september_2020.xlsx (vintage at release in September 2020).

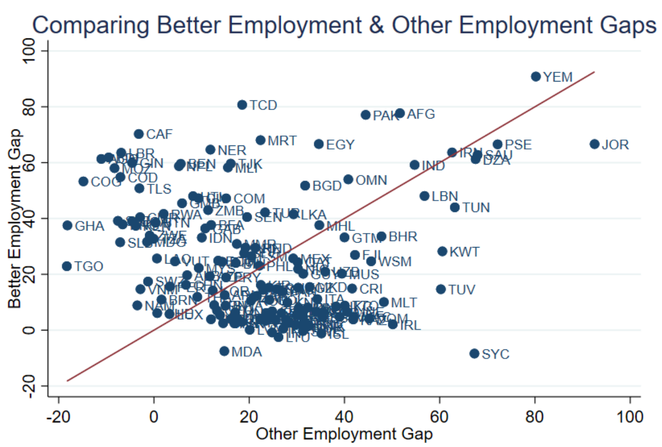
[28] In a regression of GEGI(full)=β_0+β_1 GEGI(basic), we fail to reject that $\hat{\beta}_0 = 0$ and $\hat{\beta}_1 = 1$.

Unsurprisingly, the basic and full GEGIs are also very similar in different regions (Figure 2). The largest gender gaps by both measures are in MENA and South Asia. The only meaningful differences between the full and basic GEGIs are in South Asia and Sub-Saharan Africa, where the full GEGI is about 4-5ppts above the basic GEGI (using a common sample). In those regions, women may be particularly lacking in access to better jobs.

4.1 Why are the basic and full GEGIs so similar?

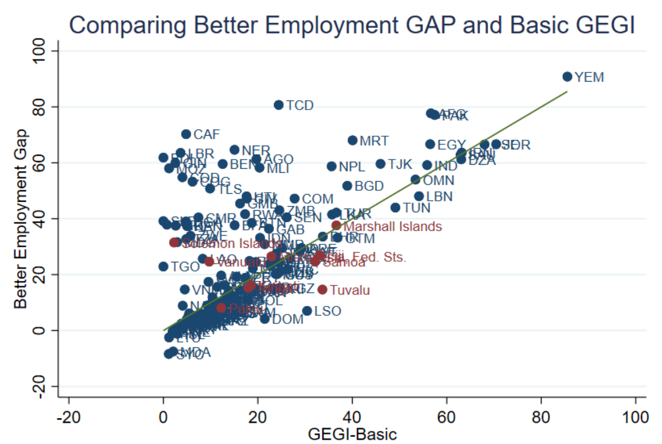
A natural hypothesis is that the gender gaps in better and other employment are highly correlated. Indeed, under the condition that $OE_{Gap} = BE_{Gap}$, the full and basic GEGIs are identical. But this is not the case. In fact, Better and Other Employment gender gaps are almost uncorrelated (correlation=-1%), as can be seen in Figure 5. Moreover, a number of countries that have very low basic GEGIs have quite high Better Employment Gaps. For example, the Central African Republic (CAF) has a basic GEGI of only 5%, whereas a Better Employment Gap of 70% (Figure 6).

Figure 5



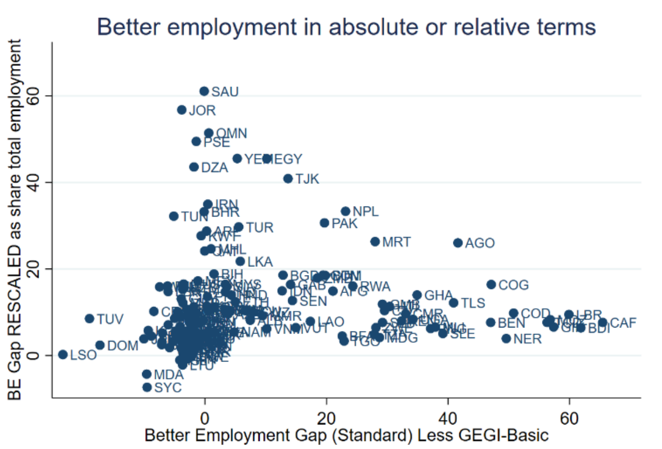
Notes: 45 degree line shown. Excludes Nauru (-100% OE gap) and countries missing GEGI-Full.

Figure 6



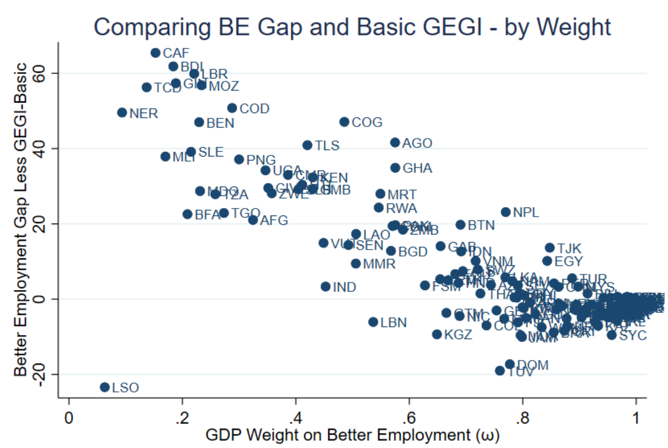
Notes: 45 degree digaonal shown. Excludes Nauru and countries with missing GEGI-Full.

Figure 7



Notes: Excludes Nauru and countries with missing GEGI-Full.

Figure 8



Notes: Excludes Nauru and countries with missing GEGI-Full.

One reason for large better employment gaps in countries with small basic GEGIs is the small denominator (total better employment) in the BE_{Gap}, formula (Equation 3 or 7), rather than a large better employment gender gap in absolute terms. For example, in the case of Central African Republic, only 10% of employment is in better jobs. Hence a 70% better employment gap (Equations 3 or 7) is a 7% *absolute* gap in better employment (as a share of total employment). This can be seen in Figure 7, where I plot the gap in better employment $L_M^{BE} - L_F^{BE}$ as a share of total employment L (not better employment L^{BE}) on the Y axis against the difference between the standard

BE_{Gap}, $((L_M^{BE} - L_F^{BE})/L^{BE})$ and the basic GEGI on the X axis. One can see that most countries away from the origin fit in one of two groups. First, the only countries with a large better employment gap in *absolute* terms, like Jordan, also have the BE_{Gap} similar to the basic GEGI (and hence will have a similar basic and full GEGIs). The second group of countries is where the BE_{Gap} is much larger than the basic GEGI—including Central African Republic discussed previously (on the bottom right of Figure 7). In these countries the better employment gap is relatively unimportant in absolute terms, because so few people in those countries work in better jobs. Expressed differently, Appendix Figure 1 shows that countries with a large difference between the BE_{Gap} and the basic GEGI have less than half of employment in better jobs.

Returning to the definition of the full GEGI (Equation 5) one can see that the where BE_{Gap} is much larger than the basic GEGI, better employment is not very important as a share of GDP (low ω).[29] Hence, any increase in female employment in the better-employment sector can only generate a modest improvement in GDP. One can see this in Figure 8, where the difference between Better Employment Gap and the basic GEGI is negatively related to the weight of better employment in GDP (ω).[30] In the case of Central African Republic (CAF), for example, the impact of closing the large Better Employment gap is shrunk down because better employment only contributes 15% of GDP. This low GDP weight of better employment is a function of the share of employment in better jobs discussed above, as well as a low productivity premium of better jobs due to a low level of human capital. Specifically, Appendix Figure 2 shows that in most of the countries where BE_{Gap} is much larger than the basic GEGI, the productivity boost from human capital is around twice that unskilled labor ($h = HCI/HCI_{min} \approx 2$), vs 4 times as productive in countries where the BE_{Gap} and basic GEGI are similar.[31]

5. The Speed of Adjustment in GDP

The GEGIs capture the size of the increase in GDPPC from closing gender employment gaps in the long run. But how long is the long run? And what fraction of the gains can be achieved in the short-to-medium term? The answer to these questions is complicated as it depends on modeling assumptions, parameters that vary country-by-country (and require data that are missing for the Pacific Islands), and the speed of the policy adjustment itself that generates the increase in female employment.

But to try to provide rough calculation, I calibrated the Long Term Growth Model (LTGM, Loayza and Pennings 2018) to the Philippines (based on Qian et al (2018), Ch 5), [32] and then simulated the effect on GDPPC of an immediate increase in female employment in 2020 that closed the gender gap.[33] This is similar to the exercise in the basic GEGI. The LTGM is an appropriate tool to answer this question as the production function in the LTGM is the same as that in the basic GEGI. In this calibration, the initial female employment rate is 46% and the initial male

[29] According to the assumptions made.
[30] Note that this weight depends on the number of workers of both genders in better employment, not the gender gap in better employment.
[31] This assumes the human capital is evenly spread across the population. In reality, there is likely to be some positive sorting, such that people with higher human capital are more likely to be in better employment.
[32] Most importantly, I assume that the labor share β=0.5. The depreciation rate is 3.6%, capital-to-output ratio is 2.2, human capital growth rate is 0.5%, TFP growth rate is 1.5% and investment rate trends up from 26% of GDP initially to 30.1% by 2040. Population demographics are taken from the UN. Baseline GDP growth is initially about 5.5%, but slows to 4.5% by 2050. The male LFP rate is assumed constant at 72%.
[33] The Philippines was chosen because of the other gender work in that country and an existing LTGM calibration. However, its LTGM calibration is fairly similar to that in other developing countries, and so this exercise is likely informative for other countries. For example, the assume labor share of 0.5, is similar to the cross- country average in Penn World Tables 10.

employment rate is 73%.[34] The basic GEGI suggests the long-run gains from closing the gender gap (increasing female employment to 73%) is 100%*(73%-46%)/(46%+73%)=22.7%, which is indicated in the Figure 9 by the horizonal blue line.

In the default calibration for the Philippines (shown in black in Figure 9), the increase in female employment increases GDPPC immediately by almost 11%, or half of the GEGI. This is the direct effect of higher employment on GDP. The size of the direct effect is governed by the labor share of GDP, β, which is 0.5 in the default calibration for the Philippines. In reality, the direct increase in GDP would be a slower—female employment rates could not be increased so rapidly—but this exercise is meant to separate the direct and indirect effect of higher employment. After the initial adjustment, the indirect effect through induced capital accumulation is much slower. By the end of the simulation period in 2050, GDPPC is about 20ppts higher, or almost 90% of the increase in the GEGI. In other words, it takes around 30 years after the period of the policy change to achieve 90% of the GDP gains in the GEGI.

Figure 9

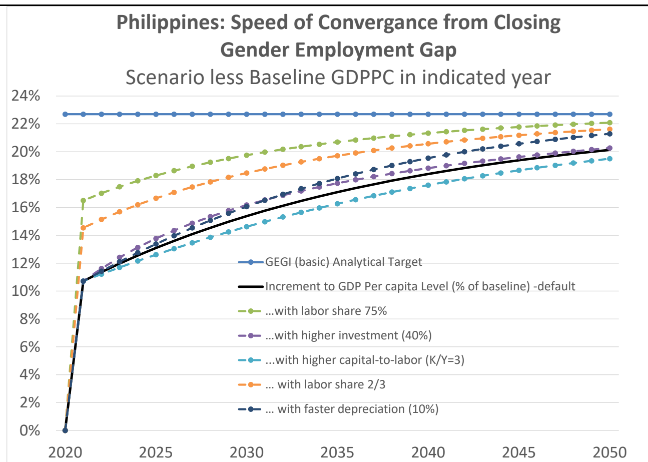


Figure 10

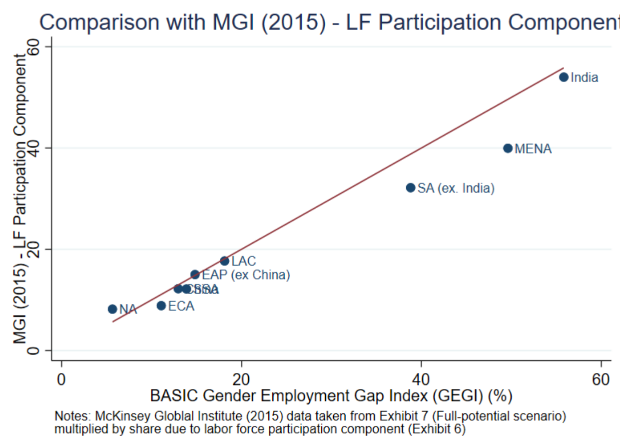


Figure 11

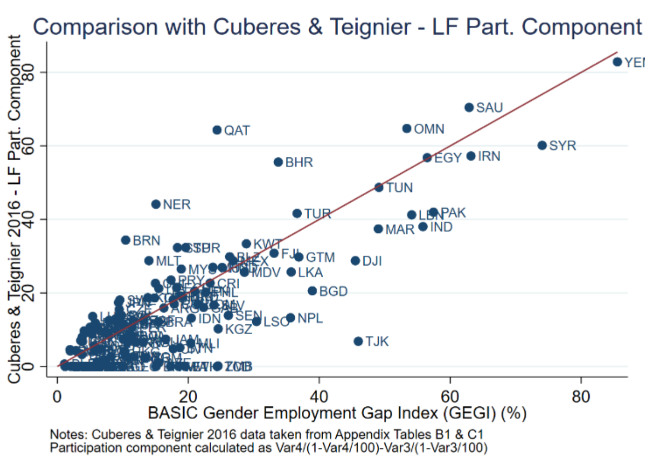
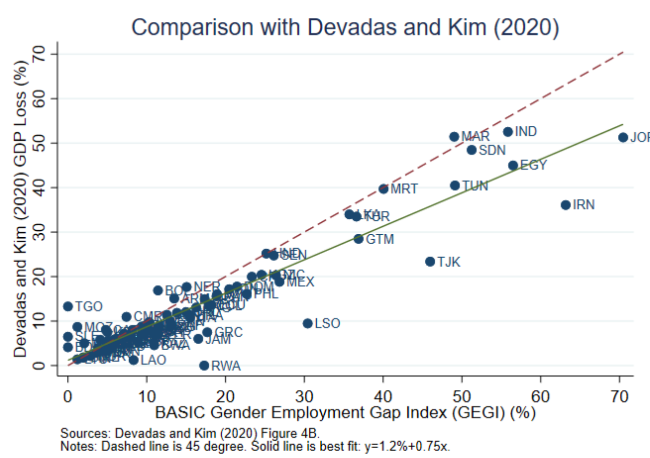


Figure 12



The speed of adjustment depends on other model parameters, but is most sensitive to the labor share of GDP, β. Across countries (according to PWT 10) the labor share averages slightly above 50%, but for many countries

[34] In the LTGM these appear as labor force participation rates, but as there is no unemployment in the LTGM, they are also employment-to-working-age population ratios.

(especially OCED countries), it is substantially higher.[35] For example, for a labor share of 2/3 (orange dashed line in Figure 8), it takes about 15 years to reach the 20ppt threshold (≈90% of the gains), and with a labor share of ¾ it only takes about 10 years (green line) to achieve 20 ppts (≈90% of the gains). The labor share mostly affects the size of direct effect.

Other parameters affect the speed of the indirect effect, though are less important quantitatively. Higher investment (purple line) and faster depreciation (dark blue) both marginally increase the speed of adjustment. A higher capital-to-output ratio slows the adjustment speed slightly.

Summary. In sum, a good rule of thumb is that about ½ to 2/3 of the gains to GDP happen roughly contemporaneously with the increase in female employment itself (the "direct effect" through higher labor), especially if the policy change is phased in over time. Remaining "indirect effect" (though induced capital accumulation) happens much more slowly, such that it takes 15-30 years after the change in employment for 90% of the total gains to be in place. Achieving the last few percentage points of the gains takes much longer.

6. Detailed comparison with the literature

The three closest studies are McKinsey Global Institute (2015; henceforth MGI), Cuberes and Teignier (2016 henceforth CT), and Devadas and Kim (2020, henceforth DK). All of these studies try to estimate the gains to GDP of closing gender employment gaps in a broad cross-section of countries (including many developing countries). However, all three other papers also consider other mechanisms in addition to employment rates, and consequently have a broader perspective on the costs of gender gaps. However, these other mechanisms come at the expense of simplicity, transparency, a closed-form expression for the size of the impact on GDP and a substantially lower country coverage than the GEGI – especially for developing countries.

Despite this, the size of the gains are broadly similar, as is their cross-region correlation (I focus on regions rather than countries here given MGI do not report country-level estimates). Across regions, the correlation of the basic GEGI with broader measures in the three other papers are 95.8% for MGI, 95.9% for CT and 96.4% for DK. The average of the basic GEGI across regions (not countries) is 22%, which is slightly larger than DK (19%), but a little less than MGI (33%) and CT (26%). This is because of some of the other mechanisms in MGI and CT: stripping the other mechanisms out, the cross-region averages fall to 20% and 18% in MGI and CT respectively, which are slightly lower than the cross-region average in the basic GEGI. I now discuss each of these papers in turn.

McKinsey Global Institute (2015) provide one of the most high-profile estimates of the effect of closing gender gaps on GDP. Although these are reported for the year 2025, they are actually closer to "long run" measures reported here.[36] MGI includes three types of gender gaps: (i) employment rates (like in the basic GEGI); (ii) hours worked per employed person, and (iii) sectoral mix of employment by gender.

While this has the potential to provide more accurate estimates for countries with good data, it is also costly in terms of reduced country coverage and interpolated data for many developing countries. MGI states that it produces estimates for 95 countries, which is around half of the 185 countries for the basic GEGI, and 60% of the

[35] There is a slight negative relationship between the basic GEGI and labor share, driven in part by oil rich countries in the Middle East that have both high GEGIs and low labor shares (due to oil). This slight negative relationship means that countries with higher basic GEGIs may be slightly slower to feel the benefits of higher female employment on GDP.

[36] MGI project GDP forward to 2025 (from 2014) under a business-as-usual scenario, and then compares this to the GDP in 2025 with the 3 employment gaps above closed (participation hours and sectoral mix). While this is reported as GDP by 2025, in fact is closer to "long run GDP" as in this paper. First, closing such large gaps in many countries are implausible in such a short time and would cause substantial disruption to labor markets. Moreover, by assuming that sub-sectoral labor productivity is constant, they are effectively fixing the capital-to-labor ratio, which implies a substantial increase in required capital when female employment increases.

159 countries for the full GEGI. But this does not include the interpolation used to produce measures of hours worked and the sectoral mix (the parts not included in the basic GEGI). Only about half of countries in their sample (53/95) have data on hours worked, and so they interpolate these data for all the other 42 countries. They only use data on sub-sectorial labor productivity and employment by gender for around a quarter of countries in their sample (25/95), and so they interpolate this for other countries. As such, there are only 14 developing countries in their sample with complete data for all three types of gaps.[37]

The basic GEGI is the most comparable with the GDP gains from closing labor force participation gaps in MGI (2015). While MGI does not report gaps for all countries, for the regions and selected large countries reported in their exhibits 6 and 7, the effects of closing gender gaps in participation rates on GDP line up quite closely with estimates from the basic GEGI (Figure 10) — and for MENA and SA (ex. India), the basic GEGI is slightly larger. When including the gains from closing gaps in hours and sectoral allocation, the GDP gains are unsurprisingly slightly larger in MGI on average (see Appendix Figure 5). These other two mechanisms are less important for the regions/countries with the largest gaps (such as India and MENA), but more important for the regions with lower participation-based gaps. However, as the hours and sectoral gaps are interpolated for many developing countries, those estimates may be less reliable – especially at the individual country level.

Cuberes and Teignier (2016) estimate the effects of gender gaps in both entrepreneurship and labor force participation on GDP, using a Lucas span-of-control type model of occupational choice.[38] Their estimates are available for 139 countries (33 OCED, 106 non-OECD), which is about 75% of the basic GEGI and 87% of the full GEGI (there is no interpolated data). CT define GDP losses relative to a higher benchmark without gender gaps—rather than as a fraction of the lower status quo for the GEGI (and MGI 2015)—so for comparability, CT's gender gaps need to be scaled up by $1/(1 - CT\%)$. I compare the basic GEGI at the country level with CT estimates of losses due to participation only (CT-Participation), which I calculate as their total losses (Variable 4 in Appendix Tables B1 and C1) less losses only due to gender gaps in entrepreneurship losses (Variable 3 in Appendix Tables B1 and C1).

Figure 11 shows that the estimates of GDP losses from the basic GEGI are highly correlated with those from CT and for some countries they are almost identical (such as the Republic of Yemen, the Arab Republic of Egypt, Fiji and Tunisia). In general, the CT-Participation measure is about 10%-20% smaller than the basic GEGI.[39] Most of the differences are likely due to definitional difference between employment (for the GEGI) and participation (for CT2016), as well as different vintages of labor-market data. CT's full measure—including entrepreneurship gaps in addition to participation gaps—is about 10ppts larger than the basic GEGI for low-GEGI countries, but almost identical for high-GEGI countries (Appendix Figure 6).[40]

Devadas and Kim (2020) use the World Bank Long Term Growth Model (as in Section 5) to calculate the effects on growth of closing gender gaps in labor force participation.[41] In addition to the standard neoclassical

[37] The Appendix to MGI describes this group as the G20 plus Bangladesh, Morocco, Malaysia, the Netherlands, and Sweden. Of these, none are low income, four are lower-middle income (Bangladesh, India and Indonesia, Morocco) and ten are upper-middle income (Malaysia, Argentina, China, Mexico, the Russian Federation, Mexico, Argentina, South Africa, Turkey, Brazil).

[38] In this type of model, the more talented the manager is, the more productive are the labor and capital in his or her firm (and more talented managers run larger firms). Gender gaps in entrepreneurship result in GDP losses because many talented female managers are not able to become managers, resulting in losses in total factor productivity.

[39] In part this due to 20 countries with no gender participation gaps in their sample ($\lambda = 1$ in their notation), though it could also be due to a decreasing returns to scale production function.

[40] As the full GEGI is fairly similar to the basic GEGI, so is the relationship with the MGI and CT2016 as discussed above. Appendix Figure 7 compares the MGI measures with the full GEGI, with the most important difference being that the full GEGI is more similar to the MGI (LFP+hours+Sectors measure) for MENA and South Asia (ex-India). The full GEGI is plotted against the measures from Cuberes and Teignier (2016) in Appendix Figure 8, and has a slightly worse fit relative to the enterprise + participation measure.

[41] DK2020 also consider the effects of closing gender gaps in human capital, but those are mostly small.

channels considered here (which are also part of the LTGM), they also estimate a reduced-form regression between the TFP determinant index of Kim and Loayza (2019) and gender gaps in participation and schooling, and then allow a reduction of those gaps to affect GDP growth via TFP. They produce estimates for 91 countries, about half the number for the basic GEGI, and 60% that for the full GEGI. They estimate losses as the proportional change in GDP per capita without and with gender gaps.

Figure 12 shows that basic GEGI is similar but slightly larger than the adjusted DK measure (the adjusted DK measure is about ¾ of that of the basic GEGI). One might expect larger gender gaps in DK given they also consider an effect through TFP, but it turns out the effect through TFP is large only for some countries (but not on average). Moreover, the adjustment process in GDP in the LTGM is not fully finished by 2050—especially in countries with a lower labor share—which might explain the smaller effect. As with CT2016, some country-level deviations are likely due to differences between employment (for the GEGI) and participation (for DK), and different vintages of labor-market data used.

7. The GEGIs in the Pacific Islands

A simple measure of gender employment gaps like the GEGI is particularly advantageous for the Pacific Islands as these countries often have missing data that exclude them from other studies.[42] For example, of the other cross-country estimates discussed in Section 6, MGI (2015) and Devadas and Kim (2020) do not produce any estimates for the Pacific Islands and Cuberes and Teignier (2016) only produce estimates for Fiji.[43] Those estimates turn out to be similar: CT estimated GDP gains (adjusted) for Fiji from closing labor participation gaps are 31%, which are almost identical to the basic GEGI of 30%. The full CT gains (including the effects of entrepreneurship) are 38%, compared with 33% in the full GEGI.

Figure 13

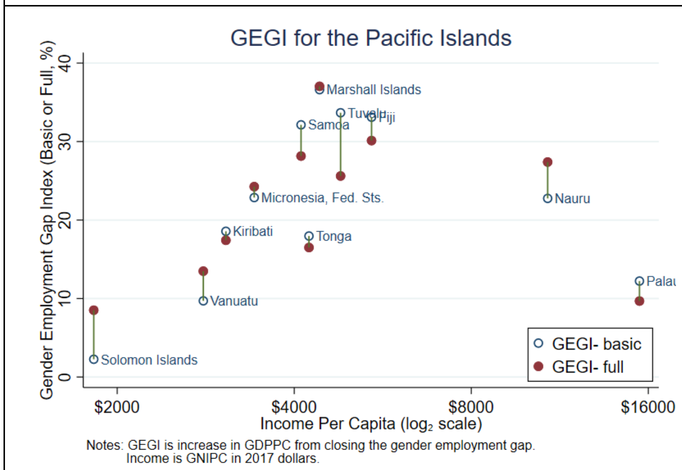


Figure 14

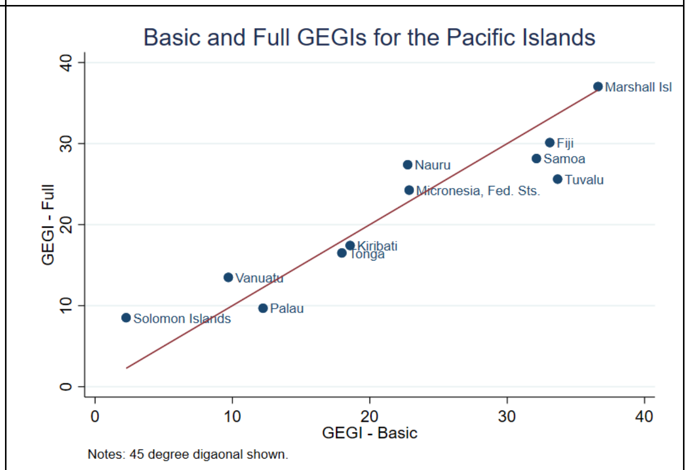


Figure 13 plots the GEGI (basic and full) against per capita income for 11 Pacific Island countries (individual scores are listed in Table 1). On average for the Pacific Islands, long-run GDP per capita would be around 22% higher if gender employment gaps were to close (by both full and basic measures) —slightly above the all-country average

[42] The GEGI analysis presented here covers the 11 Pacific Islands (Fiji, Samoa, Kiribati, Marshall Islands, Micronesia Federated States, Nauru, Palau, Solomon Islands, Tonga, Tuvalu, Vanuatu).

[43] MGI does not list which countries are in their sample, but Pacific Islands as a group are not mentioned the report, and neither are the largest Pacific Islands like Fiji. Penn World Tables 10, a standard macroeconomic data set used for calibrating growth simulations, only has data for Fiji—the other 10 countries in the Pacific Islands are missing.

of 19%. As for the whole sample, one can see the GEGIs have a rough hump shape in per capita income, but one that varies widely across countries from around 2% to 37%. Also, and as with the full sample, basic and full GEGIs are closely related for the Pacific Islands (Figure 14), with a correlation of 0.93, though can differ for individual countries.

The lowest GEGI score is for the basic measure the Solomon Islands (2.3%). However, the small aggregate gender employment gap masks much larger gaps in better employment, of around 31.5%. While better employment only has a modest weight in the Solomon Islands (of ω=0.4), accounting for gaps in better employment increases the full GEGI to 8.5%. Nauru (+5ppts) and Vanuatu (+4ppts) also experience large increases moving from the basic to the full measure.

There are also countries where the full GEGI is smaller than the basic GEGI because gender gaps in better employment are smaller than for employment as whole. This second group includes Tuvalu (-8ppts), Samoa (-4ppts), Fiji (-3ppts) and Palau (-2.5ppts).

At other end of the spectrum, the largest GEGIs are in the Marshall Islands (37%) (similar in the basic and full measures). Fiji, Tuvalu, Samoa, Nauru and Micronesia also all have large GEGIs in the order of 20%-35%.

Table 1: Gender Employment Gaps for the Pacific Islands (Basic and Full GEGI)

	Empl.-to-Pop. Ratio (15-64)		**GEGI basic (%)**	**Better Empl. Rate (15-64)**		**Better Emp. Gap (%)**	**Other Empl. Rate (15-64)**		**Other Emp. Gap (%)**	**HCI**	**h**	**ω**	**GEGI full (%)**
	Male	Female		Male	Female		Male	Female					
Fiji	0.77	0.39	33.1%	0.44	0.25	26.9%	0.33	0.13	42.2%	0.51	2.6	0.79	30.1%
Samoa	0.52	0.27	32.1%	0.32	0.19	24.7%	0.20	0.08	45.6%	0.55	2.8	0.83	28.2%
Kiribati	0.48	0.33	18.6%	*0.29*	*0.21*	16.2%	0.19	0.12	22.4%	0.49	2.5	0.80	17.4%
Marshall Islands	0.49	0.23	36.6%	0.32	0.15	37.6%	0.17	0.08	34.7%	0.42	2.1	0.80	37.0%
Micronesia, Fed. Sts.	0.66	0.42	22.9%	0.27	0.16	26.5%	0.39	0.26	20.5%	0.51	2.6	0.63	24.3%
Nauru	0.74	0.47	22.8%	0.74	0.39	30.5%	0.00	0.07	-100.0%	0.51	2.6	0.98	27.4%
Palau	0.77	0.60	12.2%	0.61	0.52	8.1%	0.15	0.08	32.3%	0.59	3.0	0.94	9.7%
Solomon Islands	0.88	0.84	2.3%	0.27	0.14	31.5%	0.61	0.70	-7.1%	0.42	2.1	0.40	8.5%
Tonga	*0.57*	*0.40*	18.0%	*0.39*	*0.28*	15.2%	0.18	0.11	24.2%	0.53	2.7	0.86	16.5%
Tuvalu	0.69	0.34	33.7%	*0.35*	*0.26*	14.7%	0.35	0.09	60.2%	0.45	2.3	0.76	25.6%
Vanuatu	0.70	0.57	9.7%	0.21	0.13	24.6%	0.49	0.45	4.4%	0.45	2.3	0.45	13.5%

Source: Pennings (2020) and Equations 2, 5 and 7-9. Figures in italics use updated data. HCI_min= 0.20

8. Conclusions

This paper produces a new measure of the effect of closing gender employment gaps on long-run GDP: the Gender Employment Gap Index (GEGI). Both the basic and full variants of the GEGI are *equal* to the percentage increase in long-run GDP from increasing female employment to close gender employments gaps, making them particularly easy to interpret. They are also transparent, and can be easily calculated via a simple closed-form expression for almost every country in the world (185 countries for the basic GEGI, 159 for the full GEGI). This is much larger than for estimates in other papers, allowing the production of estimates for many developing countries for which no other estimates exist (including most Pacific Islands). The GEGIs are highly correlated with other measures, which are quantitatively similar when defined using the same mechanims. On average across countries, the GEGIs indicate long-run GDP per capita would be around 19% higher if gender gaps could be closed by increasing female employment to that of men, though for individual countries with the largest gaps, GDP could be up to 85% larger. Long-run GDP per capita would be about 22% larger on average across 11 Pacfic Islands from closing gender employment gaps.

The basic GEGI is defined as the difference between male and female employment, as a share of total employment. This is equal to the precentage increase in employment from increasing female employment until it is equal to that of men. Intrepreted through the lens of a standard neoclassical growth model, that number is also equal to the gain in long run GDP (or long run GDP per capita) from an exogenous increase in female employment to erase gender employment gaps, keeping other things equal. The full GEGI has a similar interpretation and is of a similar size in most countries, but is defined in terms of closing gaps in better employment and other employment.

In closing, it is important to mention three caveats.[44] First, the GEGIs represent the GDP gains from closing a specific definition of gender employment gaps, via a particular thought experiment and through specific mechanisms. While this combination seems to be quantitatively important—and is highly correlated with alternatives—it does not take account of other types of gender gaps such as wage gaps or education gaps, or other types of mechanisms. The literature survey in the introduction cites a number of other channels—including TFP (innovation, entrepreurship), human capital and fertility. Second, the full GEGI assumes that the weights on better and other employment persist in the long run. This may understate gains from closing gender employment gaps if the total number of workers (male and female) in better employment changes along the development path. Finally, the definititons of employment and GDP are the standard ones based on market transactions. This does not include important types of work women do in the home (caring for children and the elderly, and other housework). Broader measures that include these types of activities as employment and value them as part of GDP would result in smaller gender employment gaps, and hence a smaller boost to GDP (as they are already included).

Supplementary Material:

A spreadsheet with the (GEGI) for each country (and background data used in its construction) are available for download [link]and at the author's website: https://sites.google.com/site/stevenpennings/

References

Bertay, A, L. Dordevic, and C. Sever (2020) "Gender Inequality and Economic Growth: Evidence from Industry-Level Data" IMF working paper WP/20/119

Cuberes D. and M. Teignier (2014) "Gender Inequality and Economic Growth: A Critical Review," *Journal of International Development,* 26, 260–276

Cuberes D. and M. Teignier (2016) "Aggregate Effects of Gender Gaps in the Labor Market: A Quantitative Estimate", *Journal of Human Capital* 10(1).

Galor, O., and D. Weil (1996). "The Gender Gap, Fertility, and Growth." *American Economic Review*, 86(3), 374-387.

Goldin C. (1995) "The U-Shaped Female Labor Force Function in Economic Development and Economic History." In: Schultz TP (ed), *Investment in Women's Human Capital and Economic Development*. U. Chicago Press: 61-90.

Goldman Sachs (2007) "Gender Inequality, Growth and Global Ageing", Global Economics Paper No: 154

Jones C. (2016) "The Facts of Economic Growth", Chapter 1 in J.Taylor and H. Uhlig *Handbook of Macroeconomics, Volume 2A*, Elsevier

Kim Y. and N. Loayza (2019) "Productivity Growth: Patterns and Determinants Across the World" World Bank Policy Research WP 8852 [link]

Klasen S. (2019) **"**What Explains Uneven Female Labor Force Participation Levels and Trends in Developing Countries?" *World Bank Research Observer*, 34(2).

[44] I thank Kathleen Beegle, Dimitria Gavalyugova, Aart Kraay, and Sergio Schmukler for suggesting these caveats.

Kraay A. (2018) “Methodology for a World Bank Human Capital Index” World Bank Policy Research WP 8593. [link]

Loayza N. and S. Pennings (2018) *The Long Term Growth Model. http://www.worldbank.org/LTGM*

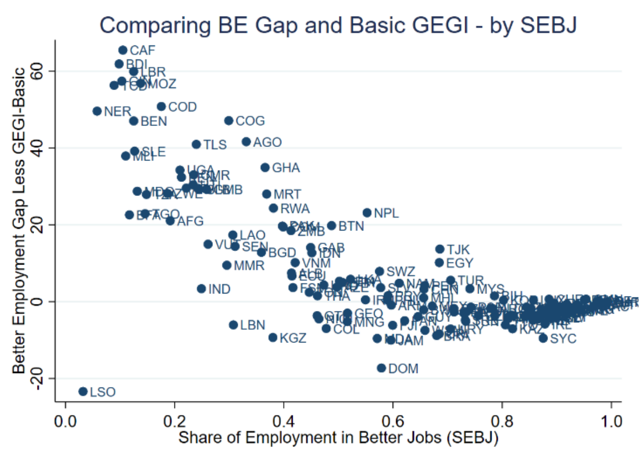
McKinsey Global Institute (2015) “The Power of Parity: How Advancing Women’s Equality can add $12tr to global growth”, McKinsey & Company (Sept 2015) [link]

Pennings, S. (2020) “The Utilization-adjusted Human Capital Index (UHCI)” WB Policy Research WP 9375 [link]

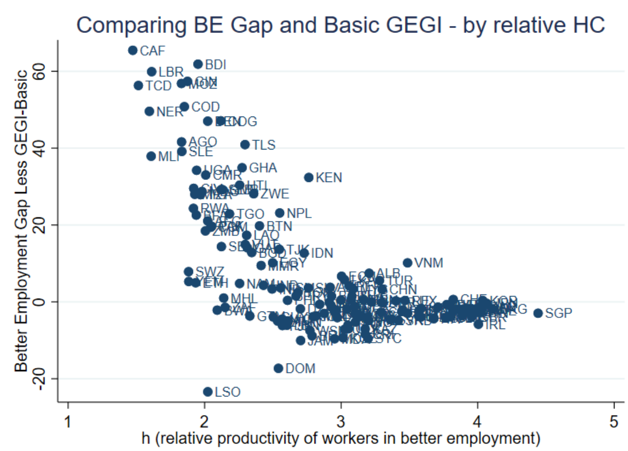
Qian, R.; Warwick, M. Diop, N.; Hansl, B.; Cruz, K.; Bruckner, M.; Chua, K.; Enriquez, K.; Galang, R.; Garcia, A.; Miralles, G.; Lootty, M; Pennings, S.; Guzman, J.; Kim, Y.; Devadas, S.; and H. Nguyen. (2018) “Growth and Productivity in the Philippines: Winning the Future” *(English).* Washington, D.C.: World Bank [link]

Wodon, Q., and B. de la Brière. 2018, Unrealized Potential: The High Cost of Gender Inequality in Earnings. The Cost of Gender Inequality Notes Series. Washington, DC: The World Bank.

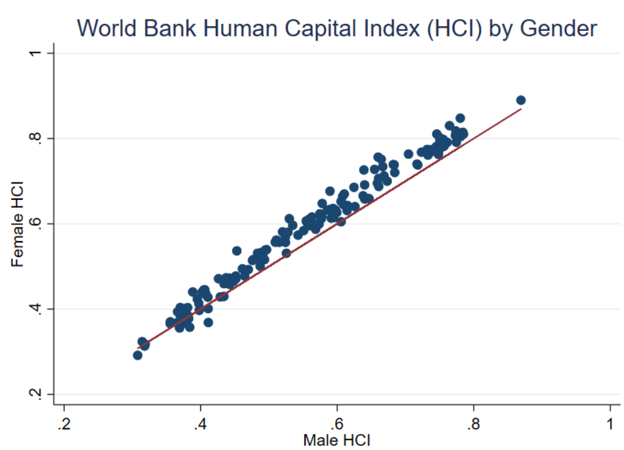
Appendix Figure 1



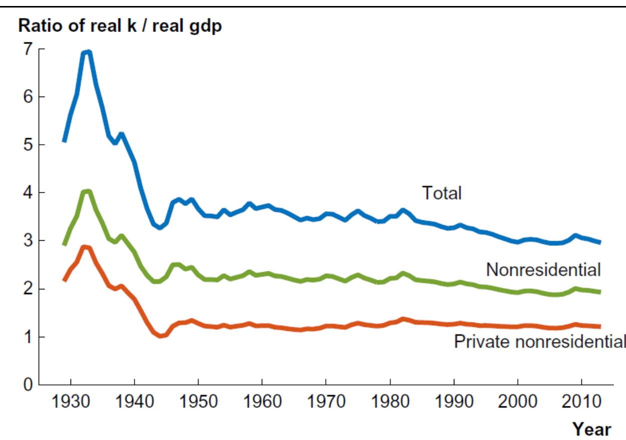
Appendix Figure 2



Appendix Figure 3

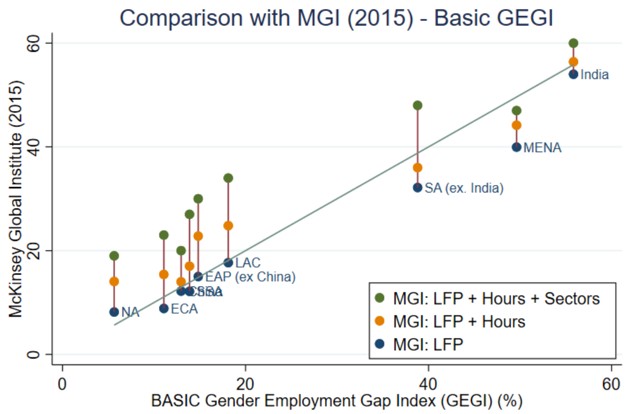


Appendix Table 4



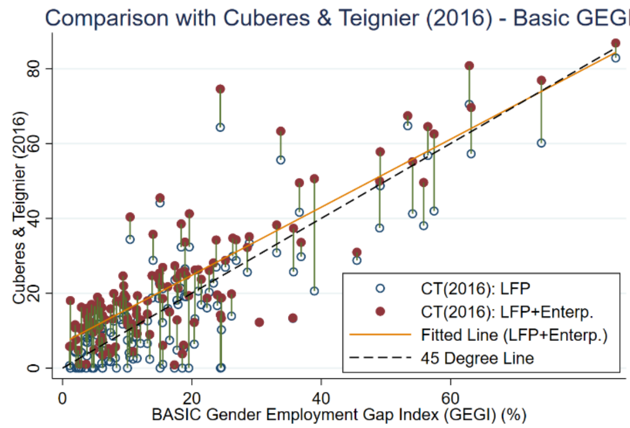
Source: Jones (2016), Figure 3. Notes: Data for the US from the BEA.

Appendix Figure 5



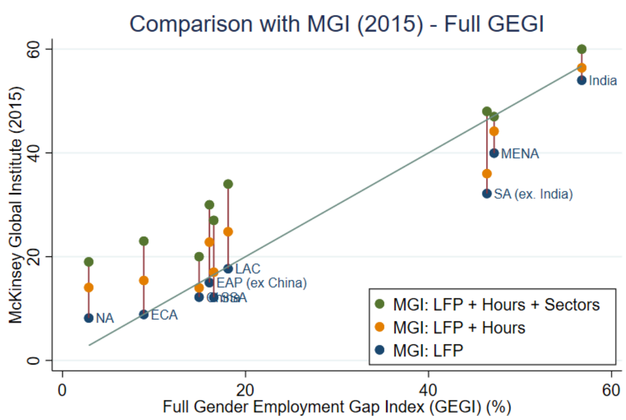
Notes: McKinsey Globlal Institute (2015) data taken from Exhibit 7 (Full-potential scenario) multiplied by share due to labor force participation and/or hours components (Exhibit 6)

Appendix Figure 6



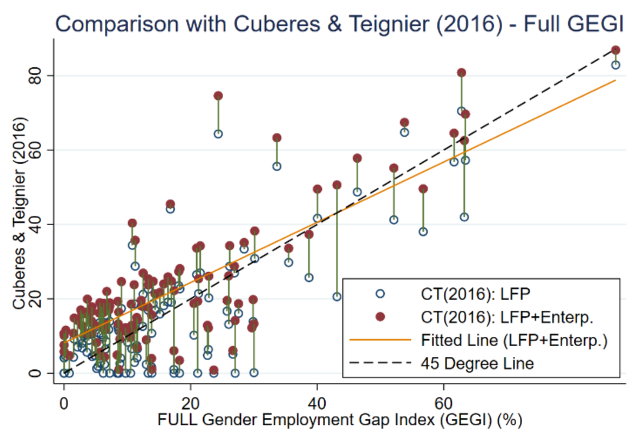
Notes: Adjusted Cuberes & Teignier (2016) data from Appendix Tables B1 and C1

Appendix Figure 7



Notes: McKinsey Globlal Institute (2015) data taken from Exhibit 7 (Full-potential scenario) multiplied by share due to labor force participation and/or hours components (Exhibit 6)

Appendix Figure 8



Notes: Adjusted Cuberes & Teignier (2016) data from Appendix Tables B1 and C1

Appendix Table 1: Gender Employment Gaps (Basic and Full GEGI)

	Empl.-to-Pop. Ratio (15-64)		GEGI basic (%)	Better Empl. Rate (15-64)		Better Emp. Gap (%)	Other Empl. Rate (15-64)		Other Emp. Gap (%)	HCI	h	ω	GEGI full (%)
	Male	Female		Male	Female		Male	Female					
Afghanistan	0.68	0.19	56.6%	0.15	0.02	77.7%	0.53	0.17	51.6%	0.40	2.0	0.32	60.1%
Albania	0.64	0.50	12.2%	0.28	0.19	19.7%	0.36	0.31	7.0%	0.63	3.2	0.69	15.8%
Algeria	0.65	0.15	63.1%	0.45	0.11	61.2%	0.19	0.04	67.5%	0.53	2.7	0.87	62.1%
Angola	0.48	0.32	19.7%	0.28	0.07	61.3%	0.21	0.26	-11.1%	0.36	1.8	0.57	30.6%
Argentina	0.73	0.52	16.3%	0.56	0.42	14.4%	0.17	0.10	22.9%	0.60	3.0	0.92	15.1%
Armenia	0.60	0.45	13.5%	0.35	0.27	12.6%	0.24	0.18	14.9%	0.58	2.9	0.81	13.0%
Australia	0.78	0.69	6.2%	0.67	0.63	3.6%	0.11	0.06	25.6%	0.77	3.9	0.97	4.3%
Austria	0.77	0.69	6.1%	0.71	0.63	5.4%	0.07	0.05	13.9%	0.75	3.8	0.98	5.6%
Azerbaijan	0.72	0.53	15.5%	0.37	0.25	19.3%	0.35	0.28	11.7%	0.58	2.9	0.74	17.4%
Bahamas, The	0.81	0.71	7.1%										
Bahrain*	0.88	0.44	33.7%	0.87	0.43	33.6%	0.01	0.00	47.8%	0.65	3.3	1.00	33.6%
Bangladesh	0.81	0.36	38.9%	0.32	0.10	51.8%	0.49	0.25	31.7%	0.46	2.3	0.57	43.1%
Barbados	0.73	0.68	3.8%										
Belarus	0.75	0.73	1.1%										
Belgium	0.68	0.61	5.8%	0.60	0.55	3.9%	0.08	0.05	22.3%	0.76	3.8	0.97	4.4%
Belize	0.78	0.46	26.3%										
Benin	0.73	0.57	12.6%	0.13	0.03	59.6%	0.60	0.53	5.6%	0.40	2.0	0.23	18.0%
Bhutan	0.73	0.50	18.7%	0.41	0.18	38.5%	0.32	0.32	0.4%	0.48	2.4	0.69	26.7%
Bolivia	0.80	0.63	11.4%										
Bosnia and Herzegovina	0.56	0.35	22.6%	0.45	0.27	24.0%	0.12	0.08	17.2%	0.58	2.9	0.91	23.5%
Botswana	0.64	0.52	10.9%	0.41	0.35	8.8%	0.23	0.17	15.0%	0.41	2.1	0.80	10.0%
Brazil	0.71	0.52	15.4%	0.44	0.39	6.6%	0.26	0.13	34.0%	0.55	2.8	0.85	10.6%
Brunei Darussalam	0.67	0.54	10.4%	0.64	0.51	11.0%	0.03	0.03	1.6%	0.63	3.2	0.98	10.8%
Bulgaria	0.71	0.64	5.6%	0.61	0.58	2.6%	0.10	0.06	28.4%	0.61	3.1	0.96	3.6%
Burkina Faso	0.74	0.54	15.1%	0.11	0.05	37.7%	0.63	0.50	12.0%	0.38	1.9	0.21	17.4%
Burundi	0.77	0.80	**0.0%**	0.13	0.03	61.9%	0.64	0.77	-9.5%	0.39	2.0	0.18	3.6%
Cabo Verde	0.57	0.47	10.0%										
Cambodia	0.89	0.79	6.2%										
Cameroon	0.76	0.65	7.4%	0.24	0.10	40.4%	0.52	0.55	-2.9%	0.40	2.0	0.39	13.8%
Canada	0.77	0.71	3.9%	0.67	0.64	2.5%	0.10	0.07	14.5%	0.80	4.0	0.97	2.9%
Central African Republic	0.68	0.62	4.8%	0.12	0.02	70.3%	0.56	0.60	-3.2%	0.29	1.5	0.15	8.0%
Chad	0.62	0.38	24.4%	0.09	0.01	80.7%	0.54	0.37	18.5%	0.30	1.5	0.14	27.0%
Chile	0.72	0.53	15.0%	0.50	0.39	12.3%	0.22	0.14	21.6%	0.65	3.3	0.89	13.3%
China	0.77	0.60	13.0%	0.52	0.38	16.2%	0.25	0.22	6.7%	0.65	3.3	0.86	14.9%
Colombia	0.79	0.55	17.9%	0.35	0.28	10.9%	0.43	0.26	24.2%	0.60	3.1	0.74	14.4%
Comoros	0.55	0.31	27.8%	0.25	0.09	47.2%	0.30	0.22	15.2%	0.40	2.0	0.57	33.4%
Congo, Dem. Rep.	0.66	0.61	4.0%	0.18	0.05	54.8%	0.48	0.55	-7.0%	0.37	1.9	0.29	10.7%
Congo, Rep.	0.64	0.57	6.2%	0.29	0.09	53.3%	0.36	0.48	-14.8%	0.42	2.1	0.49	18.2%
Costa Rica	0.75	0.47	23.3%	0.48	0.35	14.9%	0.27	0.11	41.6%	0.63	3.2	0.87	18.3%
Cote d'Ivoire	0.65	0.45	17.7%	0.18	0.06	47.2%	0.47	0.39	9.4%	0.38	1.9	0.35	22.7%
Croatia	0.65	0.56	7.8%	0.58	0.51	6.1%	0.07	0.04	23.6%	0.71	3.6	0.97	6.7%
Curacao	0.63	0.54	7.6%										
Cyprus	0.73	0.64	6.6%	0.63	0.58	4.2%	0.10	0.06	24.3%	0.76	3.8	0.96	4.9%
Czech Republic	0.82	0.68	9.5%	0.66	0.59	5.6%	0.15	0.08	30.0%	0.75	3.8	0.95	6.8%
Denmark	0.78	0.73	3.6%	0.72	0.69	1.6%	0.06	0.03	32.6%	0.76	3.8	0.98	2.1%
Djibouti	0.39	0.15	45.5%										
Dominican Republic	0.77	0.50	21.4%	0.38	0.35	4.2%	0.39	0.15	45.2%	0.50	2.5	0.78	13.3%
Ecuador	0.80	0.55	18.2%	0.35	0.21	24.9%	0.45	0.34	13.5%	0.59	3.0	0.68	21.3%
Egypt, Arab Rep.	0.64	0.18	56.5%	0.46	0.09	66.7%	0.17	0.08	34.6%	0.49	2.5	0.84	61.6%
El Salvador	0.78	0.48	23.9%	0.46	0.26	27.5%	0.32	0.21	19.0%	0.55	2.8	0.79	25.7%
Estonia	0.78	0.71	4.5%	0.70	0.67	2.0%	0.08	0.04	31.2%	0.78	3.9	0.98	2.6%
Eswatini	0.45	0.38	9.5%	0.28	0.20	17.4%	0.17	0.18	-1.3%	0.37	1.9	0.72	12.2%
Ethiopia	0.74	0.50	19.5%	0.39	0.24	24.5%	0.35	0.26	14.3%	0.38	1.9	0.67	21.1%
Fiji	0.77	0.39	33.1%	0.44	0.25	26.9%	0.33	0.13	42.2%	0.51	2.6	0.79	30.1%
Finland	0.73	0.71	2.0%	0.64	0.65	-0.8%	0.10	0.06	24.8%	0.80	4.0	0.97	**0.0%**
France	0.69	0.62	5.3%	0.61	0.57	3.4%	0.08	0.05	23.4%	0.76	3.9	0.97	3.9%
Gabon	0.58	0.37	22.3%	0.29	0.14	36.4%	0.29	0.23	10.8%	0.46	2.3	0.66	27.6%
Gambia, The	0.75	0.54	16.2%	0.24	0.09	45.4%	0.50	0.45	5.9%	0.42	2.1	0.43	22.9%
Georgia	0.67	0.55	10.0%	0.34	0.29	7.0%	0.33	0.26	13.2%	0.57	2.9	0.75	8.6%
Germany	0.80	0.72	5.0%	0.74	0.68	4.2%	0.06	0.04	17.6%	0.75	3.8	0.98	4.4%
Ghana	0.58	0.55	2.6%	0.29	0.13	37.5%	0.29	0.42	-18.2%	0.45	2.3	0.58	13.9%
Greece	0.65	0.45	17.7%	0.46	0.34	14.7%	0.19	0.11	25.8%	0.69	3.5	0.90	15.8%

Appendix Table 1 (continued) : Gender Employment Gaps (Basic and Full GEGI)

	Empl.-to-Pop.		GEGI	Better Empl.		Better Emp.	Other Empl.		Other Emp.	HCI	h	ω	GEGI full
	Male	Female	basic	Male	Female	Gap (%)	Male	Female	Gap (%)				(%)
Guatemala	0.86	0.40	36.9%	0.39	0.19	33.2%	0.48	0.20	40.0%	0.46	2.3	0.67	35.5%
Guinea	0.62	0.59	2.5%	0.11	0.03	59.9%	0.52	0.56	-4.6%	0.37	1.9	0.19	7.6%
Guinea-Bissau	0.73	0.60	9.6%										
Guyana	0.65	0.40	24.1%	0.41	0.27	20.2%	0.24	0.13	31.3%	0.50	2.5	0.82	22.2%
Haiti	0.66	0.46	17.6%	0.20	0.07	48.0%	0.46	0.39	8.2%	0.45	2.3	0.41	24.6%
Honduras	0.83	0.50	25.2%	0.41	0.22	29.5%	0.42	0.27	21.3%	0.48	2.4	0.69	26.9%
Hong Kong SAR, China	0.77	0.63	10.3%	0.71	0.60	8.5%	0.06	0.03	38.2%	0.81	4.1	0.98	9.0%
Hungary	0.76	0.62	10.1%	0.68	0.58	8.0%	0.08	0.05	30.4%	0.68	3.5	0.97	8.6%
Iceland	0.88	0.82	3.0%	0.74	0.76	-1.2%	0.13	0.06	35.2%	0.75	3.8	0.97	0.0%
India	0.74	0.21	55.8%	0.19	0.05	59.2%	0.55	0.16	54.7%	0.49	2.5	0.45	56.7%
Indonesia	0.80	0.53	20.5%	0.40	0.20	33.2%	0.40	0.33	10.0%	0.54	2.7	0.69	26.0%
Iran, Islamic Rep.	0.68	0.15	63.2%	0.37	0.08	63.6%	0.30	0.07	62.6%	0.59	3.0	0.79	63.4%
Iraq	0.68	0.08	78.6%										
Ireland	0.74	0.63	7.9%	0.62	0.59	2.1%	0.13	0.04	50.2%	0.79	4.0	0.97	3.7%
Israel	0.72	0.66	3.8%	0.64	0.61	2.4%	0.08	0.05	16.9%	0.73	3.7	0.97	2.8%
Italy	0.68	0.49	15.5%	0.53	0.42	11.1%	0.15	0.07	34.3%	0.73	3.7	0.94	12.5%
Jamaica	0.68	0.49	16.5%	0.37	0.32	6.5%	0.31	0.16	31.3%	0.53	2.7	0.80	11.5%
Japan	0.84	0.70	9.3%	0.75	0.63	9.0%	0.09	0.07	12.6%	0.80	4.1	0.97	9.1%
Jordan	0.48	0.08	70.5%	0.40	0.08	66.6%	0.08	0.00	92.5%	0.55	2.8	0.94	68.2%
Kazakhstan	0.76	0.61	10.9%	0.58	0.54	3.8%	0.18	0.07	41.9%	0.63	3.2	0.93	6.4%
Kenya	0.64	0.58	5.0%	0.18	0.08	37.4%	0.46	0.50	-3.8%	0.55	2.8	0.43	13.9%
Kiribati	0.48	0.33	18.6%	0.29	0.21	16.2%	0.19	0.12	22.4%	0.49	2.5	0.80	17.4%
Korea, Rep.	0.76	0.58	13.8%	0.61	0.46	14.2%	0.15	0.12	12.3%	0.80	4.0	0.94	14.1%
Kosovo	0.45	0.12	57.3%										
Kuwait*	0.88	0.49	28.9%	0.86	0.48	28.2%	0.02	0.01	60.6%	0.56	2.8	0.99	28.5%
Kyrgyz Republic	0.74	0.45	24.6%	0.26	0.19	15.2%	0.48	0.26	30.3%	0.60	3.0	0.65	20.5%
Lao PDR	0.42	0.36	8.3%	0.15	0.09	25.7%	0.27	0.27	0.6%	0.46	2.3	0.51	13.3%
Latvia	0.74	0.70	2.4%	0.64	0.64	0.1%	0.10	0.07	20.1%	0.71	3.6	0.97	0.8%
Lebanon	0.65	0.19	54.1%	0.19	0.07	48.1%	0.46	0.13	56.8%	0.52	2.6	0.54	52.1%
Lesotho	0.62	0.33	30.4%	0.02	0.01	7.0%	0.61	0.32	31.2%	0.40	2.0	0.06	29.7%
Liberia	0.77	0.72	3.6%	0.18	0.04	63.5%	0.59	0.68	-6.9%	0.32	1.6	0.22	8.7%
Libya	0.55	0.27	34.6%										
Lithuania	0.73	0.72	1.2%	0.62	0.65	-2.5%	0.12	0.07	26.1%	0.71	3.6	0.96	**0.0%**
Luxembourg	0.71	0.63	5.4%	0.61	0.54	5.8%	0.10	0.09	3.3%	0.69	3.5	0.95	5.6%
Macao SAR, China	0.83	0.73	6.1%	0.79	0.72	4.8%	0.04	0.01	42.0%	0.80	4.0	0.99	5.2%
Madagascar	0.89	0.84	2.9%	0.15	0.08	31.6%	0.74	0.76	-1.5%	0.39	2.0	0.23	6.2%
Malawi	0.49	0.33	18.5%										
Malaysia	0.77	0.53	18.9%	0.59	0.37	22.3%	0.19	0.15	9.4%	0.61	3.1	0.90	21.0%
Maldives*	0.75	0.42	28.6%										
Mali	0.79	0.52	20.4%	0.12	0.03	58.3%	0.67	0.49	15.5%	0.32	1.6	0.17	22.8%
Malta	0.82	0.62	14.0%	0.71	0.58	10.1%	0.11	0.04	48.3%	0.71	3.6	0.97	11.2%
Marshall Islands	0.49	0.23	36.6%	0.32	0.15	37.6%	0.17	0.08	34.7%	0.42	2.1	0.80	37.0%
Mauritania	0.59	0.25	40.1%	0.27	0.05	68.1%	0.32	0.20	22.4%	0.38	1.9	0.55	47.5%
Mauritius	0.77	0.48	23.8%	0.61	0.41	20.2%	0.16	0.07	39.5%	0.62	3.1	0.93	21.5%
Mexico	0.79	0.46	26.9%	0.53	0.31	25.7%	0.26	0.14	29.2%	0.61	3.1	0.86	26.2%
Micronesia, Fed. Sts.	0.66	0.42	22.9%	0.27	0.16	26.5%	0.39	0.26	20.5%	0.51	2.6	0.63	24.3%
Moldova	0.47	0.45	2.1%	0.24	0.28	-7.5%	0.23	0.17	14.8%	0.58	3.0	0.80	**0.0%**
Mongolia	0.67	0.53	11.5%	0.33	0.29	6.3%	0.34	0.24	17.1%	0.61	3.1	0.77	8.8%
Montenegro	0.61	0.48	11.5%	0.50	0.44	6.6%	0.11	0.05	40.5%	0.63	3.2	0.95	8.3%
Morocco	0.66	0.23	49.0%										
Mozambique	0.77	0.76	1.2%	0.17	0.05	58.0%	0.60	0.71	-8.3%	0.36	1.8	0.23	7.2%
Myanmar	0.81	0.52	21.4%	0.26	0.14	30.9%	0.55	0.39	17.4%	0.48	2.4	0.51	24.2%
Namibia	0.50	0.46	4.1%	0.32	0.27	8.9%	0.18	0.19	-3.5%	0.45	2.3	0.78	6.2%
Nauru	0.74	0.47	22.8%	0.74	0.39	30.5%	0.00	0.07	-100.0%	0.51	2.6	0.98	27.4%
Nepal*	0.52	0.25	35.6%	0.34	0.09	58.8%	0.17	0.16	5.2%	0.50	2.5	0.77	46.4%
Netherlands	0.82	0.73	5.7%	0.62	0.58	3.9%	0.19	0.15	12.0%	0.79	4.0	0.93	4.4%
New Zealand	0.82	0.73	5.8%	0.69	0.63	4.0%	0.13	0.10	16.1%	0.78	3.9	0.96	4.5%
Nicaragua	0.83	0.48	26.4%	0.37	0.24	21.9%	0.46	0.24	30.3%	0.51	2.6	0.69	24.5%
Niger	0.89	0.65	15.1%	0.08	0.02	64.6%	0.81	0.64	11.9%	0.32	1.6	0.09	16.8%
Nigeria	0.54	0.46	8.4%										
North Macedonia	0.61	0.42	19.1%	0.47	0.34	15.5%	0.14	0.07	32.7%	0.56	2.8	0.91	17.0%
Norway	0.77	0.73	2.8%	0.71	0.70	1.0%	0.06	0.03	31.9%	0.77	3.9	0.98	1.5%

Appendix Table 1 (continued) : Gender Employment Gaps (Basic and Full GEGI)

	Empl.-to-Pop.		GEGI	Better Empl.		Better Emp.	Other Empl.		Other Emp.	HCI	h	ω	GEGI full
	Male	Female	basic	Male	Female	Gap (%)	Male	Female	Gap (%)				(%)
Oman*	0.88	0.27	53.4%	0.84	0.25	54.0%	0.04	0.02	40.8%	0.61	3.1	0.98	53.8%
Pakistan	0.80	0.22	57.4%	0.36	0.05	77.1%	0.44	0.17	44.5%	0.41	2.1	0.58	63.2%
Palau	0.77	0.60	12.2%	0.61	0.52	8.1%	0.15	0.08	32.3%	0.59	3.0	0.94	9.7%
Panama	0.80	0.54	18.9%	0.47	0.36	13.9%	0.32	0.19	27.0%	0.50	2.5	0.81	16.4%
Papua New Guinea	0.49	0.48	0.7%	0.11	0.05	37.9%	0.38	0.43	-6.6%	0.43	2.2	0.30	6.7%
Paraguay	0.83	0.58	17.4%	0.50	0.34	18.9%	0.33	0.24	15.1%	0.53	2.7	0.79	18.1%
Peru	0.78	0.62	11.4%	0.53	0.39	15.6%	0.25	0.23	3.3%	0.61	3.1	0.86	13.8%
Philippines	0.73	0.46	22.7%	0.43	0.27	23.1%	0.30	0.19	22.1%	0.52	2.6	0.79	22.9%
Poland	0.74	0.61	9.8%	0.59	0.52	6.1%	0.15	0.09	26.8%	0.75	3.8	0.95	7.2%
Portugal	0.73	0.67	4.2%	0.61	0.60	0.6%	0.12	0.07	27.2%	0.77	3.9	0.96	1.6%
Qatar*	0.96	0.58	24.4%	0.95	0.58	24.3%	0.01	0.00	30.2%	0.64	3.2	1.00	24.4%
Romania	0.73	0.56	13.1%	0.53	0.43	10.5%	0.21	0.14	20.3%	0.58	3.0	0.89	11.6%
Russian Federation	0.76	0.66	7.1%	0.67	0.62	4.6%	0.09	0.05	31.3%	0.68	3.4	0.97	5.4%
Rwanda	0.55	0.39	17.3%	0.26	0.11	41.6%	0.30	0.28	2.0%	0.38	1.9	0.55	23.7%
Samoa	0.52	0.27	32.1%	0.32	0.19	24.7%	0.20	0.08	45.6%	0.55	2.8	0.83	28.2%
Sao Tome and Principe	0.37	0.26	18.3%										
Saudi Arabia*	0.78	0.18	62.9%	0.76	0.17	62.8%	0.02	0.00	68.0%	0.58	2.9	0.99	62.8%
Senegal	0.57	0.33	26.1%	0.20	0.08	40.5%	0.37	0.25	19.5%	0.42	2.1	0.49	29.9%
Serbia	0.66	0.52	11.6%	0.46	0.40	6.8%	0.20	0.12	24.8%	0.68	3.4	0.90	8.5%
Seychelles	0.76	0.74	1.1%	0.60	0.71	-8.4%	0.16	0.03	67.3%	0.63	3.2	0.96	**0.0%**
Sierra Leone	0.54	0.56	**0.0%**	0.10	0.04	39.2%	0.44	0.52	-7.6%	0.36	1.8	0.22	2.5%
Singapore	0.79	0.66	9.3%	0.69	0.61	6.3%	0.10	0.05	35.5%	0.88	4.4	0.98	7.1%
Slovak Republic	0.74	0.61	9.4%	0.61	0.56	4.7%	0.13	0.06	39.0%	0.66	3.4	0.96	6.3%
Slovenia	0.75	0.68	4.9%	0.64	0.60	2.9%	0.11	0.07	18.5%	0.77	3.9	0.96	3.5%
Solomon Islands	0.88	0.84	2.3%	0.27	0.14	31.5%	0.61	0.70	-7.1%	0.42	2.1	0.40	8.5%
Somalia	0.31	0.10	52.3%										
South Africa	0.49	0.38	13.1%	0.41	0.32	11.7%	0.08	0.05	20.9%	0.43	2.1	0.92	12.4%
South Sudan	0.47	0.45	2.5%										
Spain	0.68	0.57	8.9%	0.56	0.51	4.7%	0.12	0.06	35.5%	0.73	3.7	0.96	5.9%
Sri Lanka	0.78	0.37	35.7%	0.43	0.18	41.5%	0.35	0.19	29.3%	0.60	3.0	0.77	38.7%
St. Kitts and Nevis	0.79	0.62	12.1%	0.68	0.56	9.9%	0.11	0.06	28.0%	0.59	3.0	0.96	10.7%
Sudan	0.62	0.20	51.2%										
Suriname	0.70	0.47	19.6%										
Sweden	0.79	0.76	1.9%	0.72	0.72	-0.3%	0.07	0.04	31.3%	0.80	4.0	0.98	0.3%
Switzerland	0.84	0.76	5.5%	0.75	0.67	6.1%	0.09	0.09	0.7%	0.76	3.8	0.97	5.9%
Syrian Arab Republic	0.71	0.11	74.0%										
Taiwan, China	0.74	0.59	11.4%										
Tajikistan	0.68	0.25	46.0%	0.51	0.13	59.6%	0.17	0.12	16.1%	0.50	2.5	0.85	53.0%
Tanzania	0.88	0.80	4.8%	0.17	0.08	32.7%	0.71	0.71	-0.1%	0.39	2.0	0.26	8.4%
Thailand	0.82	0.66	10.4%	0.38	0.30	11.9%	0.44	0.36	9.1%	0.61	3.1	0.73	11.1%
Timor-Leste	0.70	0.57	9.9%	0.23	0.08	50.8%	0.47	0.50	-3.1%	0.45	2.3	0.42	19.6%
Togo	0.49	0.63	**0.0%**	0.10	0.06	22.9%	0.39	0.57	-18.3%	0.43	2.2	0.27	**0.0%**
Tonga	0.57	0.40	18.0%	0.39	0.28	15.2%	0.18	0.11	24.2%	0.53	2.7	0.86	16.5%
Trinidad and Tobago	0.76	0.56	14.9%	0.58	0.48	8.8%	0.18	0.08	40.1%	0.60	3.0	0.93	11.1%
Tunisia	0.66	0.22	49.1%	0.46	0.18	44.0%	0.19	0.04	63.2%	0.52	2.6	0.88	46.3%
Turkey	0.71	0.33	36.6%	0.52	0.21	42.2%	0.19	0.12	23.3%	0.65	3.3	0.89	40.0%
Tuvalu	0.69	0.34	33.7%	0.35	0.26	14.7%	0.35	0.09	60.2%	0.45	2.3	0.76	25.6%
Uganda	0.78	0.71	4.8%	0.22	0.10	39.0%	0.56	0.61	-4.6%	0.38	1.9	0.35	10.5%
Ukraine	0.63	0.53	8.2%	0.49	0.45	4.3%	0.14	0.08	25.0%	0.63	3.2	0.93	5.7%
United Arab Emirates*	0.93	0.51	29.3%	0.90	0.49	29.5%	0.02	0.01	19.2%	0.67	3.4	0.99	29.4%
United Kingdom	0.79	0.70	5.9%	0.65	0.63	2.0%	0.14	0.07	29.7%	0.78	4.0	0.96	3.1%
United States	0.76	0.66	7.4%										
Uruguay	0.75	0.61	10.7%	0.50	0.46	3.6%	0.26	0.15	27.7%	0.60	3.0	0.88	6.5%
Uzbekistan	0.50	0.30	24.6%	0.37	0.24	21.0%	0.13	0.06	36.0%	0.62	3.1	0.91	22.4%
Vanuatu	0.70	0.57	9.7%	0.21	0.13	24.6%	0.49	0.45	4.4%	0.45	2.3	0.45	13.5%
Venezuela, RB	0.75	0.49	21.0%										
Vietnam	0.85	0.78	4.5%	0.39	0.29	14.7%	0.46	0.49	-2.8%	0.69	3.5	0.72	9.7%
West Bank and Gaza	0.55	0.11	68.0%	0.41	0.08	66.6%	0.15	0.02	72.2%	0.58	2.9	0.89	67.2%
Yemen, Rep.	0.59	0.05	85.5%	0.31	0.01	90.8%	0.29	0.03	80.2%	0.37	1.9	0.65	87.2%
Zambia	0.41	0.25	24.5%	0.20	0.08	43.0%	0.22	0.17	11.4%	0.40	2.0	0.59	30.0%
Zimbabwe	0.86	0.77	5.7%	0.21	0.10	33.9%	0.65	0.66	-0.9%	0.47	2.4	0.36	11.5%

Source: Pennings (2020) and Equations 2, 5 and 7-9. Bold indicates rounded up to zero. HCI_min= 0.20

* For these 8 countries with unbalanced male-female populations, the adjusted basic & full GEGIs are prreferred (see Appendix 4 and Appendix Table 2) .

Appendix 1: Derivation of the connection between the basic GEGI and GDP per capita

To derive the basic $GEGI$, I start with a standard Cobb-Douglas production function as in Equation A1, as in Kraay (2018) and Pennings (2020). 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. For now, we will take the forward-looking interpretation above and assume that each of these Y, A, K, h and L are in the future (for the next generation) (but using the backward-looking interpretation is analogous).

In a status quo world, $L = L_M + L_F$ represents the number workers (male plus female) under constant employment rates, and so GDP is given by:

(A1) $$Y = AK^{1-\beta}(hL)^{\beta}$$

In an alternative world, there is a policy intervention to close the gender gap so that female employment equals male employment $L_F^{\star} = L_M$. Then total employment is $L^{\star} = L_M + L_F^{\star} = 2 \times L_M$ and long-run GDP, denoted $Y^{\star}$ is:

(A2) $$Y^{\star} = AK^{1-\beta}(hL^{\star})^{\beta}$$

Following Kraay (2018) and Pennings (2020), I assume that the physical capital-to-output ratio $\bar{K}/\bar{Y}$ is constant in the long run (one of the Kaldor's stylized facts). This keeps the marginal product of capital (MPK) and the return to investment constant in the long run, and is the "indirect channel" through which higher employment spurs future investment in physical capital.[45] To do this, take Equation A1 and A2 to the power of $1/\beta$ and rearrange.

We also need to express output in terms of GDP per capita, y (lower case). To do this, take each rearranged equation and divide by the population in the next generation N, which I assume follows the same trend under status quo and high female employment scenarios. This yields Equations A3 and A4.

(A3) $$y = A^{1/\beta}\,(\bar{K}/\bar{Y})^{(1-\beta)/\beta} h\, L/N$$

(A4) $$y^{\star} = A^{1/\beta}\,(\bar{K}/\bar{Y})^{(1-\beta)/\beta} h\, L^{\star}/N$$

The GEGI then can be simply derived as the ratio $(y^{\star} - y)/y$, which is increase future GDP per capita with zero gender gap relative to future GDP per capita in the status-quo world.[46]

(A5) $$\begin{aligned} \frac{y^{\star}-y}{y} \times 100\% &= \left[\frac{A^{1/\beta}(\bar{K}/\bar{Y})^{(1-\beta)/\beta} h\, L^{\star}/N}{A^{1/\beta}(\bar{K}/\bar{Y})^{(1-\beta)/\beta} h\, L/N} - 1\right] \times 100\% \\ &= \left[\frac{L^{\star}}{L} - 1\right] \times 100\% \\ &= \left[\frac{2 \times L_M}{L} - 1\right] \times 100\% \\ &= \frac{2 \times L_M - (L_F + L_M)}{L} \times 100\% \\ &= \frac{L_M - L_F}{L} \times 100\% \\ &= basic\ GEGI \end{aligned}$$

[45] 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 employment increases Y, which increases in the MPK in the short run. Higher investment then reduce the MPK back to its equilibrium level, further boosting growth from higher female employment.

[46] In Equation A5, population N, the capital-to-output ratio ($\bar{K}/\bar{Y}$) and TFP A are identical in both worlds and so cancel out.

Appendix 2: Derivation of Full GEGI (in terms of gender gaps of number of better and other employment)

Assume that (i) people in "better employment" L^{BE} are as productive as their human capital allows, i.e with productivity h and (ii) people not in better employment – other employment (OE), L^{OE}—are only as productive as raw labor which I normalize to 1. Total employment is L=$L^{OE} + L^{BE}$. Then current GDP per capita is given by:

$$y = A^{\frac{1}{\beta}} (\bar{K}/\bar{Y})^{\frac{1-\beta}{\beta}} [hL^{BE} + h_{min}L^{OE}]/N$$

Next, we disaggregate both types of labor by gender (denoted M and F), but assuming that the human capital of males and females is the same, and so the productivity of males and females is the same. Then GDPPC becomes:

$$y = A^{\frac{1}{\beta}} (\bar{K}/\bar{Y})^{\frac{1-\beta}{\beta}} [h(L_M^{BE} + L_F^{BE}) + (L_M^{OE} + L_F^{OE})]/N$$

Let $y^{\star}$ denote GDPPC in a world without gender gaps in either "better employment" or "other employment". As the male and female populations are almost identical, in a world without gender gaps $L_F^{BE} = L_M^{BE}$ and $L_F^{OE} = L_M^{OE}$, so $L_M^{BE} + L_F^{BE} = 2L_M^{BE}$ and $L_F^{OE} + L_M^{OE} = 2L_M^{OE}$. Then GDPPC becomes:

$$y^{\star} = A^{\frac{1}{\beta}} (\bar{K}/\bar{Y})^{\frac{1-\beta}{\beta}} 2[hL_M^{BE} + L_M^{OE}]/N$$

The percentage increase in GDPPC from closing gender gaps in both better and other employment is equal to:

$$\left[\frac{y^{\star}}{y} - 1\right] \times 100\% = \left[\frac{A^{\frac{1}{\beta}} (\bar{K}/\bar{Y})^{\frac{1-\beta}{\beta}} 2[hL_M^{BE} + L_M^{OE})]/N}{A^{\frac{1}{\beta}} (\bar{K}/\bar{Y})^{\frac{1-\beta}{\beta}} [h(L_M^{BE} + L_F^{BE}) + (L_M^{OE} + L_F^{OE})]/N} - 1\right] \times 100\%$$

$$=\left[\frac{2[h(L_M^{BE})+(L_M^{OE})]}{[h(L_M^{BE}+L_F^{BE})+(L_M^{OE}+L_F^{OE})]} - 1\right] \times 100\%$$

$$=\left[\frac{2[h(L_M^{BE})+(L_M^{OE})]-[h(L_M^{BE}+L_F^{BE})+(L_M^{OE}+L_F^{OE})]}{[h(L_M^{BE}+L_F^{BE})+(L_M^{OE}+L_F^{OE})]}\right] \times 100\%$$

$$=\left[\frac{[hL_M^{BE}+L_M^{OE}]-[hL_F^{BE}+L_F^{OE}]}{hL^{BE}+L^{OE}}\right] \times 100\%$$

$$=\left[\frac{h[L_M^{BE}-L_F^{BE}]}{hL^{BE}+L^{OE}} + \frac{L_M^{OE}-L_F^{OE}}{hL^{BE}+L^{OE}}\right] \times 100\%$$

$$=\left[\frac{L_M^{BE}-L_F^{BE}}{L^{BE}}\frac{hL^{BE}}{hL^{BE}+L^{OE}} + \frac{L_M^{OE}-L_F^{OE}}{L^{OE}}\frac{L^{OE}}{hL^{BE}+L^{OE}}\right] \times 100\%$$

$$=\left[\frac{L_M^{BE}-L_F^{BE}}{L^{BE}}\omega + \frac{L_M^{OE}-L_F^{OE}}{L^{OE}}(1-\omega)\right] \times 100\% \qquad \text{where } \omega = \frac{hL^{BE}}{hL^{BE}+L^{OE}}.$$

=full GEGI

This last expression shows that the full GEGI is the weighted average of gender gaps in better employment $\frac{L_M^{BE}-L_F^{BE}}{L^{BE}}$ and the gender gap in other employment $\frac{L_M^{OE}-L_F^{OE}}{L^{OE}}$, where the weights ω and (1- ω) applied to each are their relative contributions to GDPPC. Note here that L^{BE} and L^{OE} are measured in the number of people.

Alos note that when either everyone is in "better employment" ($\omega = 1$) or everyone is in "other employment" ($\omega = 0$), the full GEGI collapses to the basic GEGI.

Appendix 3: Calculating the Full GEGI in the data in term of ratios (BER, emp/pop)

As before, it is often easier to define the GEGI in terms of ratios rather than numbers of people. Pennings (2020) uses the better employment rate (BER)= better employment/working age population=L^{BE}/Pop.[47] As for the basic GEGI, we can use the employment to working age population ratio (lower case) $l = L/Pop$. Also define the other employment rate (OER)= other employment/working age population=$L^{OE}/Pop =$. This can be rewritten as $OER = \frac{L-L^{BE}}{Pop} = l - BER$. Rewrite $L_j^{BE} = BER_j \times Pop_j$, $L_j^{OE} = OER_j \times Pop_j$, and $L_j = l_j \times Pop_j$, for $j = M, F$ and note that the male and female working age populations are approximately equal: $Pop_M = Pop_F$. Then the Better Employment gender gap becomes the gender gap in better employment rates, relative to their sum:

$$BE_{Gap} = \frac{L_M^{BE} - L_F^{BE}}{L^{BE}} \times 100\% = \frac{L_M^{BE} - L_F^{BE}}{L_M^{BE} + L_F^{BE}} \times 100\%$$
$$= \frac{BER_M \times Pop_M - BER_F \times Pop_F}{BER_M \times Pop_M + BER_F \times Pop_F} \times 100\%$$
$$= \frac{BER_M - BER_F}{BER_M + BER_F} \times 100\%$$

Similarly, the Other Employment gender gap becomes the gender gap in other employment rates, relative to their sum:

$$OE_{Gap} = \frac{L_M^{OE} - L_F^{OE}}{L^{OE}} \times 100\% = \frac{(L_M - L_M^{BE}) - (L_F - L_F^{BE})}{(L_M - L_M^{BE}) + (L_F - L_F^{BE})} \times 100\%$$
$$= \frac{OER_M \times Pop_M - OER_F \times Pop_F}{OER_M \times Pop_M + OER_F \times Pop_F} \times 100\%$$
$$= \frac{OER_M - OER_F}{OER_M + OER_F} \times 100\%$$

The GDP weight of better employment can be expressed in terms of BER (dividing top/bottom by Pop_j):[48]

$$\omega = \frac{h(L_M^{BE} + L_F^{BE})}{h(L_M^{BE} + L_F^{BE}) + (L_M^{OE} + L_F^{OE})}$$
$$= \frac{h\left[\frac{L_M^{BE}}{Pop_M} + \frac{L_F^{BE}}{Pop_F}\right]}{h\left[\frac{L_M^{BE}}{Pop_M} + \frac{L_F^{BE}}{Pop_F}\right] + \left[\frac{L_M - L_M^{BE}}{Pop_M} + \frac{L_F - L_F^{BE}}{Pop_F}\right]}$$
$$= \frac{h(BER_M + BER_F)}{h(BER_M + BER_F) + OER_M + OER_F}$$

Note that h is the relative productivity of skilled to raw labor (which has productivity 1). For example, if $h = 3$, then skilled labor (people in better employment) are three times as productive as raw labor. For the current generation, the Penn World Tables human capital measure is exactly this ratio. For the next generation, can be calculated from the World Bank Human Capital Index. However, this requires some adjustment, because the HCI is productivity relative to a theoretical maximum ("complete human capital") not relative to raw labor. The lowest HCI score, of someone with no education and in poor health is $HCI_{min} \approx 0.1979$. Hence the productivity of better employment relative to raw labor is $h = HCI/HCI_{min}$. Hence, the full GEGI can be written as:

$$\text{Full GEGI} = \left[\omega BE_{Gap} + (1-\omega) OE_{Gap}\right] \times 100\%$$
$$\text{where } \omega = \frac{(HCI/HCI_{min})(BER_M + BER_F)}{(HCI/HCI_{min})(BER_M + BER_F) + OER_M + OER_F}$$

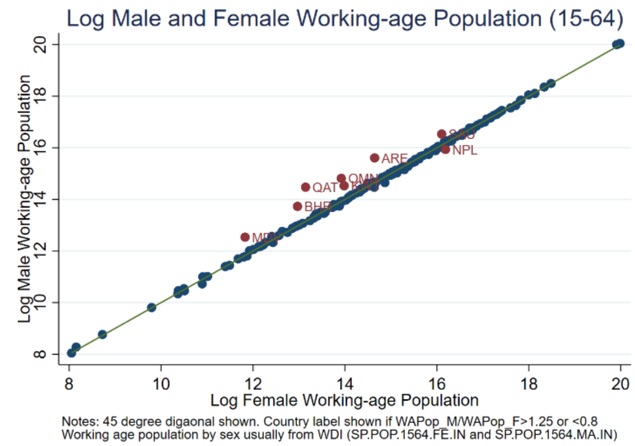
[47] He also uses share of employment in better jobs (SEBJ)=better employment/total employment =L^{BE}/L .

[48] In terms of aggregates, this share can also be written as $\omega = \frac{(h/h_{min})SEBJ}{(h/h_{min})SEBJ + (1-SEBJ)}$

Appendix 4: Adjusting the GEGIs with unequal male and female populations

The derivation of the basic and full GEGIs assumes that the male and female working-age populations are equal. This is a good approximation most countries (Appendix Figure 9). However, there are eight countries —mostly in the Middle East with large populations of male migrant workers — where the difference between male and female working age populations is large enough to be quantitatively important. These countries have a gender working-age population ratio $\rho \equiv \frac{Pop_M}{Pop_F} \geq 1.25$ or $\rho \leq 0.8$ (see Appendix Table 2, i.e., there are at least 1.25 working-age men (women) for each working-age woman (man)). Adjusting for this difference yield adjusted basic and full GEGIs (Appendix Table 2), which should be used instead of the ones reported in the main text.

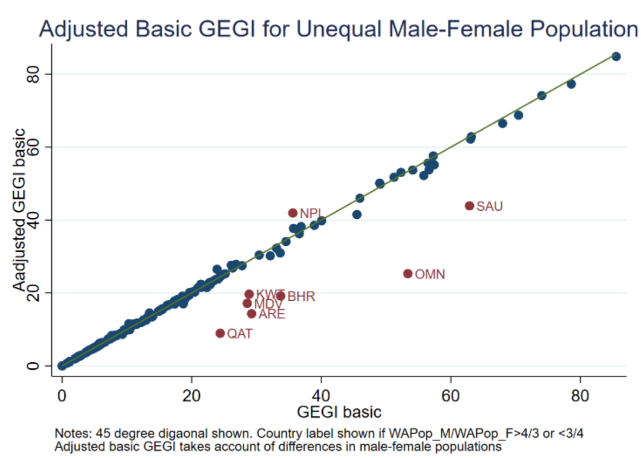
Appendix Figure 9



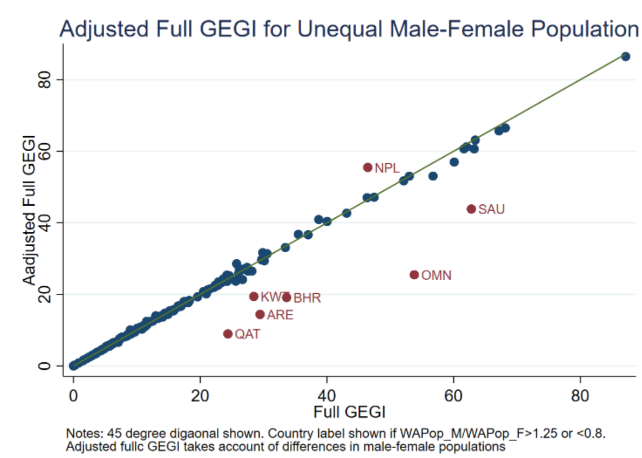
For the basic GEGI, adjusting for population of each gender means that that "target" rate of employment for women $L_F^\star$ is the male employment rate adjusted for the gender population ratio $L_F^\star = L_M / \frac{Pop_M}{Pop_F} = L_M/\rho$. Substituting this into the basic GEGI formula (Equation A5, second line) yields and expression for the *Adjusted Basic GEGI* (Equation A6). While this adjustment does not have much effect for most countries (Appendix Figure 10), it greatly reduces the basic GEGI for the seven countries with $\rho \geq 1.25$, on average by 16ppts (or 45%), and increases it by 6.3ppts (or 18%) for Nepal (Appendix Table 2), and is the preferred measure for these countries.

$$\begin{aligned} Adjusted\ Basic\ GEGI &= \frac{L_M/\rho - L_F}{L_M + L_F} \times 100\% \\ &= \frac{Pop_M \times l_M/\rho - Pop_F \times l_F}{Pop_M \times l_M + Pop_F \times l_F} \times 100\% \\ &= \frac{l_M - l_F}{\rho l_M + l_F} \times 100\% \end{aligned} \tag{A6}$$

Appendix Figure 10



Appendix Figure 11



For the full GEGI, a similar adjustment is required (expressed in terms of ratios); I equalize better employment rates and other employment rates across genders, but the denominator needs to be reweighted.

$$BE_{Gap}^{Adj} = \frac{L_M^{BE}/\rho - L_F^{BE}}{L^{BE}} \times 100\% = \frac{BER_M - BER_F}{BER_M\rho + BER_F} \times 100\%$$

$$OE_{Gap}^{Adj} = \frac{L_M^{OE}/\rho - L_F^{OE}}{L^{OE}} \times 100\% = \frac{OER_M - OER_F}{OER_M\rho + OER_F} \times 100\%$$

The weight on better employment, ω_A, also has to be adjusted when expressed in terms of ratios:

$$\omega_{Adj} = \frac{h(L_M^{BE} + L_F^{BE})}{h(L_M^{BE} + L_F^{BE}) + (L_M^{OE} + L_F^{OE})} = \frac{h(BER_M\rho + BER_F)}{h(BER_M\rho + BER_F) + (OER_M\rho + OER_F)}$$

Then the formula for the adjusted full GEGI takes the same form, but using the adjusted components:

(A6) Adjusted Full GEGI= $\left[\omega_A BE_{Gap}^{Adj} + (1-\omega_A) OE_{Gap}^{Adj}\right] \times 100\%$

While this adjustment does not have much effect for most countries (Appendix Figure 11), it greatly reduces the full GEGI for the seven countries with $\rho \geq 1.25$, on average by 17ppts (or 44%), and increases it by 9ppts (or 19%) for Nepal, and is the preferred measure for these countries (see Appendix Table 2).

Appendix Table 2: Adjusting the Basic GEGI and Full GEGI for Unequal Male-Female Working Age Populations

Country Name	**Gender Pop. Ratio ***	**Basic GEGI**			**Full GEGI**		
	ρ=Pop(M)/Pop(F)	Original	Adjusted	Diff (ppts)	Original	Adjusted	Diff (ppts)
Bahrain	2.14	34%	19%	-14.6	34%	19%	-14.5
Kuwait	1.73	29%	20%	-9.2	28%	19%	-9.0
Maldives	2.03	29%	17%	-11			
Nepal	0.78	36%	42%	6.3	46%	55%	9.0
Oman	2.45	53%	25%	-28.1	54%	25%	-28.3
Qatar	3.77	24%	9%	-15.4	24%	9%	-15.4
Saudi Arabia	1.53	63%	44%	-19.0	63%	44%	-19.0
United Arab Emirates	2.62	29%	14%	-19.0	29%	14%	-15.1

* Working age population (15-64 years). Data from WDI series SP.POP.1564.FE.IN and SP.POP.1564.MA.IN for 2020.