IMF STAFF DISCUSSION NOTE

Economic Gains from Gender Inclusion: New Mechanisms, New Evidence

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EXECUTIVE SUMMARY

While progress has been made in increasing female labor force participation (FLFP) in the past 20 years, the pace has been uneven, and large gaps remain. FLFP was 54 percent for the median Organisation for Economic Co-operation and Development (OECD) country in 2014, 14 percentage points below male labor force participation (MLFP); for the median middle-income country, FLFP was only 49 percent, 26 percentage points below MLFP; and for the median low-income country, FLFP was 64 percent, 13 points below MLFP.

Narrowing participation gaps between women and men is likely to engender large economic gains, with two mechanisms pointing to larger gains than previously thought:

- **Gender diversity:** Women bring new skills to the workplace. This may reflect social norms and their impact on upbringing, social interactions, as well as differences in risk preference and response to incentives, for example. As such, there is an economic benefit from *diversity*—that is, from bringing women into the labor force—over and above the benefit resulting from simply having more workers. This hypothesis finds support in the data—both cross-country macro data and firm-level data. This paper finds that *male and female labor are complementary in production*. The results also imply that standard models, which do not differentiate between genders in their analysis, understate the favorable impact of gender inclusion on growth, and misattribute to technology a part of growth that is actually caused by women's participation. The results further suggest that narrowing gender gaps benefits both men and women, because of a boost to male wages from higher FLFP.

- **Sectoral reallocation:** As households get richer during the process of economic development, demand for services rises, and labor is reallocated to the growing sector. Because services are more gender equal in employment than other sectors, developing economies naturally become more inclusive. But barriers to FLFP (which include tax distortions, discrimination, and social/cultural factors) slow this process, reducing output and welfare. *This paper estimates that these barriers can depress FLFP by as much as a tax of up to 50 percent on female labor*, depending on the region. Barriers not only hold back gender parity, they have a direct cost: welfare gains from their removal would exceed 20 percent in India, Pakistan and other countries in the Middle East and North Africa, for example.

These mechanisms imply that reducing female underemployment should yield greater gains than an equivalent increase in male employment: gender *diversity* brings benefits all its own.

1. INTRODUCTION

1.   Although progress has been made in increasing FLFP in the past 20 years, it remains well below MLFP. The widespread increase in FLFP—attributable to changes in cultural attitudes (Fernandez, Fogli, and Olivetti 2004; Alesina, Giuliano, and Nunn 2013; McKinsey Global Institute 2015), to women- and childcare-friendly public policies (Connelly 1992; Gornick, Meyers, and Ross 1998), and to technological change (Autor and Dorn 2013; Autor 2015) favoring the growth of sectors in which employment is more gender equal—has been extensively documented. The reduced need for "brawn" in production has also boosted FLFP, including as reflected in growing services sectors in many countries.[1] But despite the progress, large gender gaps remain. In 2014 (the most recent year with comprehensive data) FLFP was 54 percent[2] for the median OECD country (14 points below MLFP), 49 percent for the median middle-income country (26 points below MLFP), and 64 percent for the median low-income country (13 points below MLFP).

2.   This paper takes a fresh look at *how* FLFP contributes to economic growth. It takes seriously the notion that, perhaps because of social norms affecting the way men and women are raised and later interact in the workplace, women bring different skills and ideas that are economically valuable (Lagarde 2014).[3] This simple idea has important implications for workhorse macro models, such as the production function linking outputs to inputs, because it implies that women and men are complementary in production. It also has far-reaching implications for policy analysis, including, for example, how economic policies and shocks differentially affect female and male employment and incomes (mainstream models at present largely ignore these effects). The paper also examines the role of women in the process of sectoral reallocation from traditional agriculture to services and the resulting effect on productivity and growth. Because FLFP is relatively high in services, sectoral reallocation along development paths serves to boost gender parity and productivity. Conversely, barriers that impede such reallocation of female participation have particularly large welfare and growth costs. Removing such obstacles is even more important than would be estimated by simple growth accounting exercises, reflecting the following two mechanisms: diversity and sectoral reallocation.

3.   To gauge the importance of gender diversity in macro data, economists rely on the concept of the elasticity of substitution (ES) between women and men (similar, say, to the ES between capital and labor). When the ES is very high (technically, when it is infinite—the usual assumption in macro models), there are no benefits from diversity and firms can substitute one worker

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[1] The role of "brain versus brawn" has been studied by Goldin (2006) and Galor and Weil (1996), among others. The nexus between sectoral changes and rising FLFP has been studied most recently for the United States by Ngai and Petrongolo (2017).

[2] The source is the World Bank's World Development Indicators, which has a wide coverage. FLFP is expressed in percent of the total population for women aged 15+ and is thus below the FLFP expressed in percent of the working age population (typically from ages 15 to 64).

[3] The importance of diversity, not just gender but also ethnic and cultural, for the economic performance of large companies across multiple industries has recently been documented by McKinsey Global Institute (2018).

(male or female) for another with no effect on the level of output, however initially scarce women are. When the ES is zero, a fixed proportion of women and men is always optimal, and any deviation from this proportion is pure waste. The economically relevant range turns out to be one of *partial* substitutability, or, equivalently, partial *complementarity*. Empirically, ES estimates are clustered below 1 in the macro data, between 1 and 2 in the sectoral data, and between 2 and 3 in the firm-level data. When female workers are initially in short supply relative to men, the effect of increasing female employment is larger than the effect of an equivalent increase in male workers as long as women's productivity is not substantially lower than male productivity. Previous models therefore underestimate the impact of gender diversity on growth, inappropriately attributing a part of growth to unknown factors (broadly interpreted as technological change) rather than to its real cause—past increases in women's participation. In the future, to the extent that social norms become more gender equal and gender differences vanish, these effects will be reduced or disappear entirely.

4.   **Gender-based barriers are particularly costly when they interfere with the process of sectoral reallocation.** Services tend to be more gender equal in employment (Weinberg 2000; Borghans, Weel, and Weinberg 2014). As countries develop, agriculture's share in employment declines, while services' share rises. Because of this, a substantial share of past increases in FLFP can be explained by the employment growth of the services sector. As time progresses, the development process will gradually incorporate more women into the labor force. A framework is developed in this paper that incorporates gender complementarities in production, and the fact that, as women enter the labor force, market production increases while home production declines. Reducing barriers to FLFP leads to a more efficient allocation of labor and to gains in both measured marketable output and welfare. There is substantial heterogeneity in the magnitude of these gains. While output and welfare effects are moderate in relatively gender-equal economies, potential gains are much larger in more unequal countries. Reducing gender-related barriers also leads to a rise in total LFP.

5.   **The rest of this paper proceeds as follows.** Section 2 documents stylized facts about the rise of FLFP across countries by using data at the country, sectoral, and firm levels. Section 3 assesses the role of diversity by allowing for complementarities between women and men in the production function. Both linear and nonlinear methods are employed to estimate the key elasticity of substitution parameter. Section 4 studies the role of structural transformation and sectoral reallocation in explaining cross-country differences and trends in gender equality. Section 5 concludes by discussing the main lessons from the analysis and their policy implications. This paper is part of the IMF's active agenda on gender, and complementary to other recent IMF papers on the benefits of gender equality (Elborgh-Woytek and others 2013; Gonzalez and others 2015; Khera 2016). It is also related to a broader literature on gender issues in macroeconomics (Diamond 1965; Wood 1995; Seguino 2017).

Figure 1. Evolution of Female and Male Labor Force Participation

1. Labor Force Participation in OECD countries
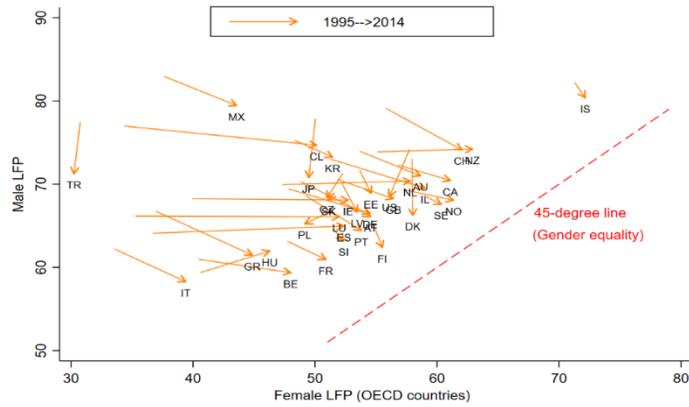
2. Labor Force Participation in Middle-income countries
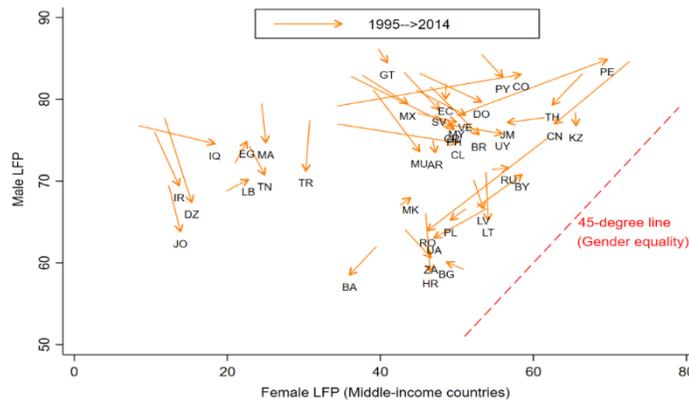
3. Labor Force Participation in Low-income countries
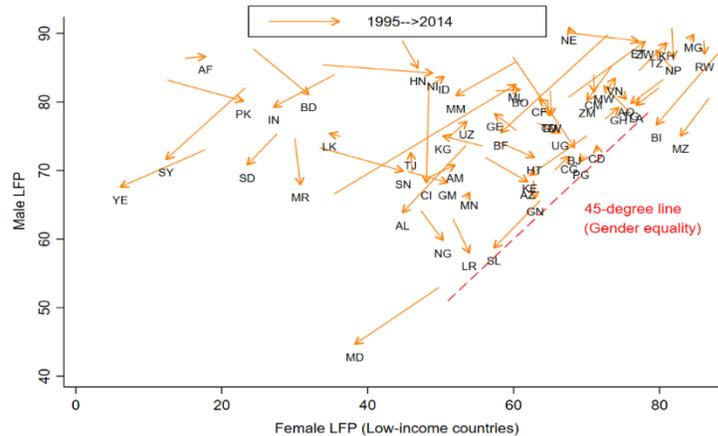
Source: World Bank, World Development Indicators.
Note: LFP stands for Labor Force Participation for those aged above 15; OECD stands for the Organization of Economic Co-operation and Development.

2. STYLIZED FACTS

6.   Although FLFP has increased in most countries, there remain large gaps between male and female participation around the world (World Development Report 2012). Figure 1 shows how FLFP and MLFP have become more equal (pointing toward the 45-degree line) over the past 20 years, with significant increases in FLFP in many countries, even as MLFP stagnated or declined. Still, FLFP remains lower than MLFP in all countries, and progress in reducing gender gaps has been slower in initially more gender-equal countries. No advanced economy or middle-income country has reduced the gender gap in LFP below 7 percentage points. For several low-income countries, gender gaps are seemingly smaller, but this could be misleading to the extent that women are employed in lower-quality jobs.

7.   Not all economic sectors show comparable levels of gender equality, with services being much more equal in both developing and developed economies. The male-to-female employment ratio is 1.7 on average in the services sector, 2.6 in manufacturing, and 4.6 in agriculture.[4] Figure 2 confirms that services are more gender equal than nonservices.[5] It also shows that countries that are gender equal in nonservices also tend to be more gender equal in the services sector. Finally, the figure shows that the variance in gender equality is larger in nonservices.

Figure 2. Female Employment as a Share of Total Employment, Services versus Other Sectors
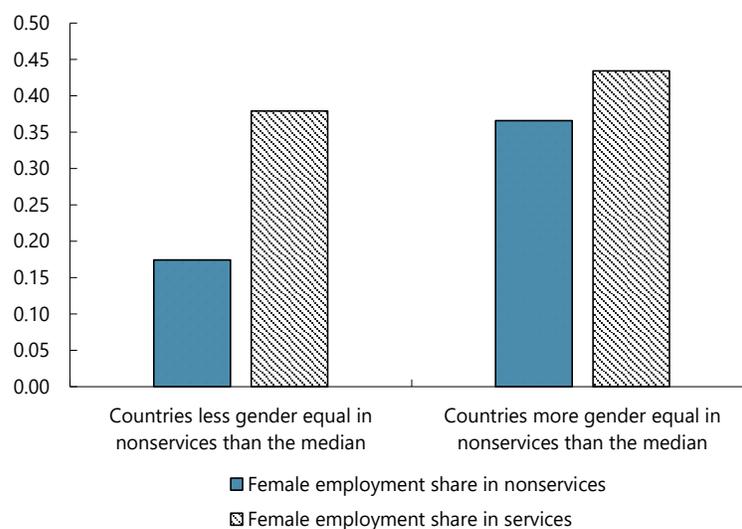
Source: Integrated Public Use Microdata Series International Data.
Note: Full sample.

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[4] The Integrated Public Use Microdata Series International census used here covers 77 countries.

[5] There are notable exceptions to this rule. For example, China enjoys markedly equal employment in all sectors, and India, on the other hand, has high aggregate employment ratios that are extraordinarily high in the services sector.

8.   The finding that services are more gender equal does not appear to be driven by specific types of services. Figure 3 shows that this pattern holds across a range of services: most types of services employ a higher proportion of women than do the agriculture or manufacturing sectors. The education, home, and health service sectors are the most equal in terms of employment.

9.   In general, countries with a greater share of employment in services tend to be more gender equal when regional factors are controlled for (Figure 4). When cultural, political, or economic regional factors are controlled for to identify the empirical effect of sectoral composition in a regression, the link between the gender gap in employment and the share of employment in services is stronger (Figure 4, panel 2). About three-quarters of the variance in the male-to-female employment ratio can be explained by regional variables and the share of employment in services.

10.   There is compelling evidence that countries experiencing faster growth in services also posted greater gains in gender equality. Figure 5, panel 1 shows the correlation between changes in male-to-female participation ratios and changes in the share of services in total employment. It shows that most countries have experienced both an increase in the importance of services and a reduction in gender disparities in participation. Notable exceptions are China, which was equal to begin with, and some commodity exporters. When looking at the evolution within a given country, there is a strong and significant negative correlation between increases in the share of services and the male-to-female employment ratio. This can be seen in Table 1, where changes in employment ratios are regressed on changes in the share of services in employment. As expected, the coefficients are negative and significant across all specifications. In contrast to the weak relationship observed in the cross-section, the co-movement of these variables over time is much more robust.

Figure 3. Female Employment as a Share of Total Employment, by Industry
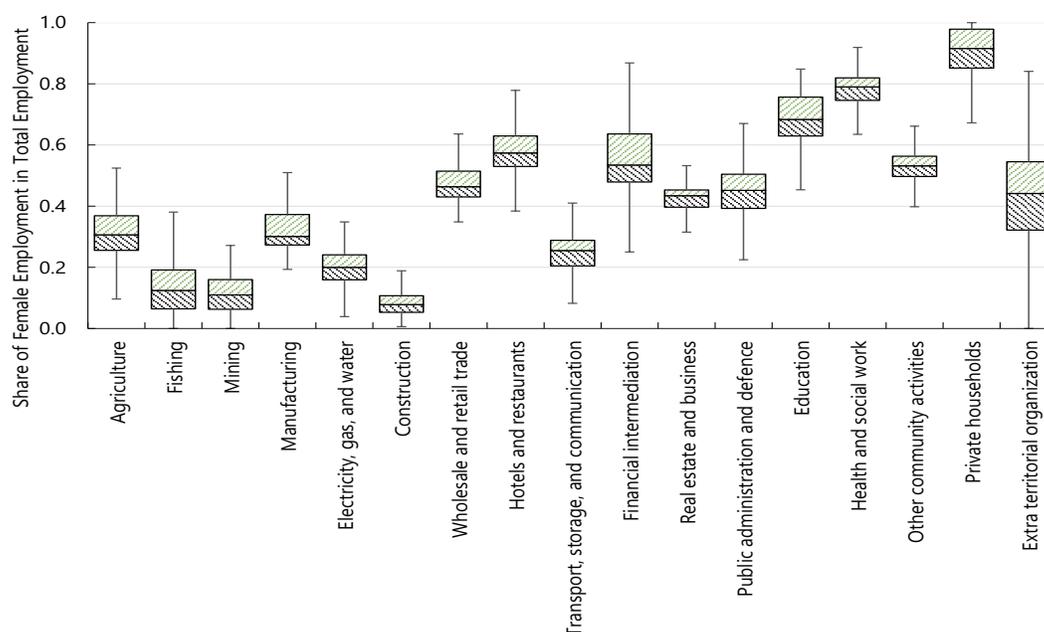
Source: Organization for Economic Co-operation and Development, Labor Force Survey.
Note: The black separation in the box indicates the median; the box is the 25th–75th range.

Figure 4. Male-to-Female Employment Ratios and Services Employment Shares

1.   With Controls

2.   With Regional Fixed Effects

Note: MLFP/FLFP is the Male Labor Force Participation Rate / Female Labor Force Participation Rate
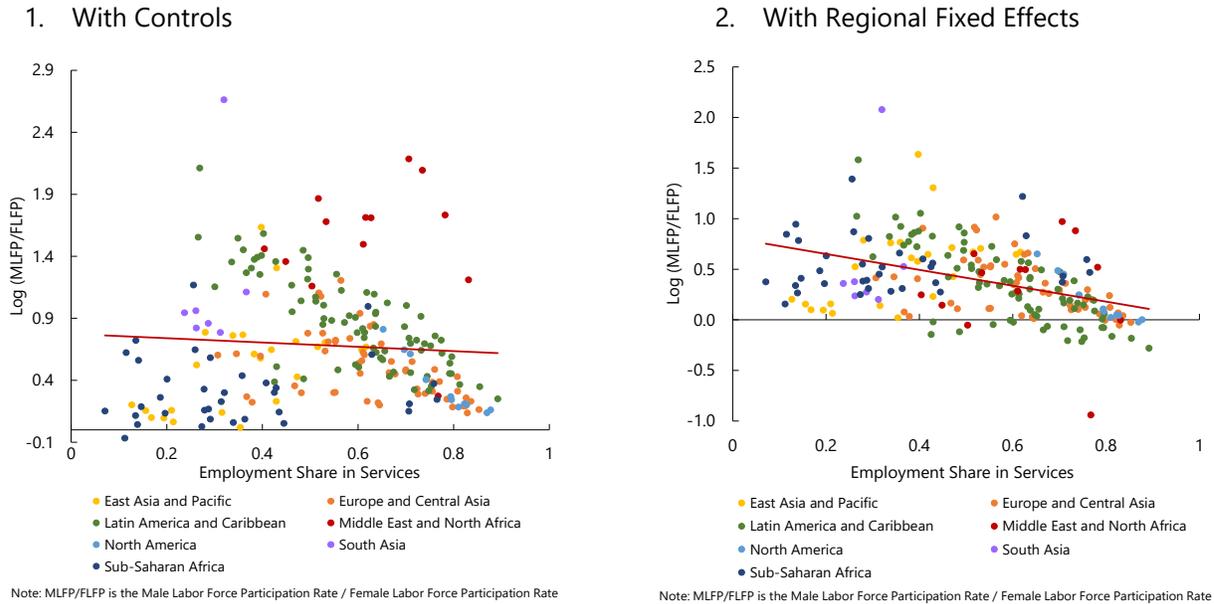
Source: Integrated Public Use Microdata Series International data.
Note: Full sample.

Figure 5. The Rise of Services and Decline in Male-to-Female Employment Ratios
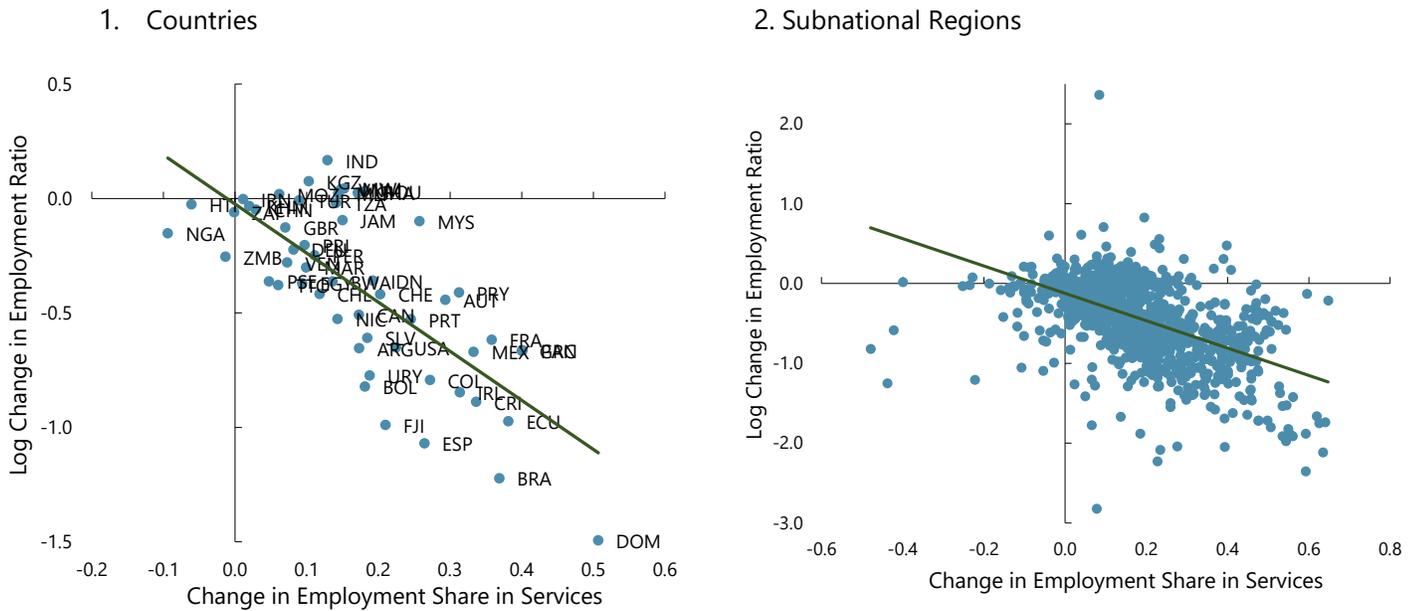
1.   Countries

2. Subnational Regions

Source: Integrated Public Use Microdata Series International Data.
Note: Change between first and last observation of each country.

Source: Integrated Public Use Microdata Series International Data.
Note: Change between first and last observation of each administrative region of a country.

Table 1. Panel Regression of Male-to-Female Employment Ratios and Services Shares

Log (M_{it}/F_{it})	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Services Emp. Share	−2.245***	−1.143**	−1.622***	−0.995*	−1.990***	−1.180**	−2.066***	−1.493***
Education Gap			Yes	Yes	Yes	Yes	Yes	Yes
Log (Real GDPPC)					0.144	0.229*	0.222**	0.317**
Constant	2.380***	2.044***	1.931***	1.858***	1.011	0.277	1.994***	1.590
Other Controls							Yes	Yes
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effects		Yes		Yes		Yes		Yes
Observations	225	225	217	217	215	215	215	215
R-Squared	0.928	0.959	0.933	0.959	0.935	0.963	0.944	0.969

Source: Integrated Public Use Microdata Series International data.
Note: The regressions use robust, standard errors in parentheses: *** $p < 0.01$; **$p < 0.05$; *$p < 0.1$. Other Controls are the following variables: dummy variables for communist regime, dummy variables for religion, number of children, age, and age squared. EMP stands for Employment; GDPPC stands for GDP per capita.

3. GENDER DIVERSITY AND PRODUCTION

11.   To assess the importance of gender diversity, this paper differentiates between male labor and female labor in the production function. In typical macroeconomic analyses, the labor force is the sum of the headcounts of male and female workers.[6] Because replacing a man by a woman in this sum does not affect the labor force, there are no gains from gender diversity. The extension this paper proposes allows testing whether this assumption is valid, and understanding the implications. The focus is on developing the simplest model that disaggregates the labor force by gender; as such, this paper abstracts from other characteristics that could also matter, including age, skill level, ethnicity, migrant status, and so on.[7]

12.   The ES measures the change in a firm's use of female labor (relative to the use of male labor) when the marginal productivity of female labor (relative to the marginal productivity of male labor) increases. When the ES is zero, it is impossible to substitute male labor for female labor because producing a good requires fixed proportions of each gender. When the ES approaches infinity, male and female labor are indistinguishable and there are no gains from gender diversity. Intermediate values of the ES imply that the labor of men and women *complement* each other to produce the final output.

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[6] A few recent papers have looked at gender differences in macroeconomic models. Agénor (2017) shows the importance of accounting for women's time allocation when assessing the impact of public policy on growth, and Borella, De Nardi, and Yang (2017) show that models constructed to account for the gender composition of households better explain the macroeconomic data compared with the traditional representative agent models.

[7] There is literature that has looked at how these characteristics matter for wages (Grant and Hamermesh 1981) and for macroeconomic outcomes (Dustmann and Frattini 2014), and more recent literature that looks at the implications of the distribution of workers' characteristics for macroeconomic dynamics (Cuberes and Teignier 2016; Malta and Pinat 2018; Kolovich, Malta, and Mendes Tavares 2017).

13.   The lower the ES, the more complementary women and men are, and thus the higher the effect of increasing FLFP on growth. When women's and men's work complement each other in the production process, adding women to the labor force increases growth not only because there are more workers, but also because the initially scarce factor becomes more plentiful, which raises the average productivity of all workers (Box 1). Adding more women to the labor force should induce larger gains than an equal increase in male workers. If the complementarity effect is strong enough, it is also possible that men benefit from increased FLFP in terms of higher real incomes.

14.   Gender differences in work may reflect a number of factors. Women have been found to be more risk averse, reflecting greater fear of negative outcomes (Croson and Gneezy 2009), and to be more averse to competition (Harbaugh, Krause, and Liday 2002). Gender differences have also been linked to the nature of the job, to the stakes, and to time pressure (Shurchkov 2012; Azmat, Calsamiglia, and Iriberri 2016; for comprehensive surveys, see Azmat and Petrongolo 2014; Eswaran 2014). Hiring women can increase the productivity of women already employed in a firm, by reducing within-firm discrimination. In addition, studies have shown that the gender composition of a firm's board affects its performance. Dezsö and Ross (2012) find that for firms whose strategy is based on innovation, gender inclusiveness has positive effects on firm value. Christiansen and others (2016) find that the effect of female representativeness in corporate boards is larger for firms in the services sector, high-tech manufacturing, and knowledge-intensive services.

15.   This paper estimates the ES between women and men using production and employment data, under two different techniques:[8]

1. In a standard linear regression model, the link between the theoretical coefficients and the empirical estimates is used to identify the ES (see Box 1 for details).
2. Nonlinear least squares (NLLS) estimation yields a direct estimate of the ES from the production function.[9] A key advantage of this method is that it does not impose the assumption that firms pay workers their marginal productivity, an assumption that is inconsistent with the evidence that firms discriminate against women (Altonji and Blank 1999; Jarrell and Stanley 2004).

16.   The estimations are undertaken with three different data sets:

1. *A macroeconomic data set using World Bank data for FLFP and the Penn World Tables data for output and the capital stock:* Column 1 of Table 2 shows the results of the linear estimation technique. The coefficient for female employment is higher than that for male employment, a result robust to a different specification (column 2) or to using OECD and IMF data rather than World Bank data (column 3). As a

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[8] Existing estimates are based on wage data. Acemoglu, Autor, and Lyle (2004) used the exogenous increase in female labor supply in the United States triggered by male conscription during World WarII and found that the ratio of male wage to female wage increased with conscription, implying an ES of about 3. Pellizzari, Paccagnella, and De Giorgi (2014) similarly estimated an elasticity of 1.0–1.4 using Italian data. Using US wage data, Ghosh's (2018) estimates are about 1.7.

[9] See Arrow and others (1961); Duffy and Papageorgiou (2000); and Duffy, Papageorgiou, and Perez-Sebastian (2004).

(continued)

result, the ES is found to be below 1, although the estimation is not precise. The NLLS estimations (Table 3, columns 1–3) also suggest that the ES is low, between 0.2 and 0.6.

2. *The OECD Structural Analysis Database and the OECD Labor Force Survey database:* The Structural Analysis Database provides annual observations for value added, total employment, and capital stocks for 17 sectors in OECD countries, and is combined with the sector-level data from the OECD Labor Force Survey to disaggregate employment by gender.[10] Columns 4–6 of Table 3 show that, when the NLLS is estimated for the whole sample, the ES is found to be very high, but this estimation is not precise.[11] Hence, this paper presents in column 6 the NLLS estimates for a data set focusing on the services sectors.[12] The results appear to be more robust and the estimate of the ES is 1.8, with a confidence interval of [0.9–3.8]. Columns 4–5 of Table 2 show that, when using the linear method, the ES between men and women could even be below 1 in the agricultural, manufacturing, utilities, and trade and transport sectors, as well as in the hospitality, finance, and public administration services.[13]

3. *A firm-level data set from the Chinese Annual Surveys of Industrial Production:* The original data, which have been used in other studies of firm-level productivity (for example, Hsieh and Klenow 2009), provide information on the value added, employment, and capital stock needed for estimation.[14] NLLS estimation results are shown in Table 3. The estimate of the ES is consistent with that found in sectoral data, between 2 and 3 in most estimates.

17.   Overall, the results show strong complementarities between women and men in production. The range of estimates for the ES (Figure 6) implies that closing the gender gap in LFP could increase GDP by between 10 percent and 80 percent, depending on the initial value of FLFP. Complementarity effects yield gains in GDP larger than those estimated by existing growth-accounting exercises (for example, Goldman Sachs 2007; Booz & Company 2012), which are represented in Figure 7 by the black dotted lines, with the difference corresponding to gains in Total Factor Productivity stemming from gender diversity.

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[10] The consolidated data set yields 513 nonoverlapping five-year growth rates.

[11] Heterogeneity across sectors is likely to be behind this problem. It is known that the labor share varies across sectors, bottoming at 0.3–0.4 for the most capital-intensive sectors (mining, utilities) but exceeding 70 percent for several other sectors (hotels and restaurants, textiles) (Estrada and others 2014). The labor share has evolved over time, with the sharp fall in manufacturing's labor share post-2005 being of particular note (Karabarbounis and Neiman 2014). Unfortunately, the relatively small size of the data set did not allow splitting the sample by time period.

[12] This paper excludes the electricity and wholesale trade sectors, as they are quite different from the other services sectors in terms of gender equality.

[13] Estimating the linear model sector by sector is not possible because such an estimation would rely on too small a sample (about 50 observations per sector). Thus, the sectors are grouped using information from Figure 3 such that the ratio *F/M* is roughly constant in the panel, since this ratio must be fixed to estimate ES using the linear method proposed in Box 1. The model does not converge to a positive ES for the other sectors.

[14] However, the gender composition of the labor force of each firm is available for only the year 2004, which restricts the type of model that can be estimated.

Table 2. Linear Estimation Results

Variables (all in PC change)	(1) Macro Level Fixed Effects, WB data	(2) Macro Level Fixed Effects, Constant Returns to Scale, WB data	(3) Macro Level Fixed Effects, OECD and PWT data	(4) Sectoral Level Agriculture, Manufacturing, Electricity, Gas and Water, Wholesale and Retail Trade, Transport, Storage, and Communication	(5) Sectoral Level Hotels and Restaurants, Financial Intermediation, Administration, and Defense
Female Labor Supply, WB	0.649***	0.691***			
	[2.795]	[3.022]			
Male Labor Supply, WB	0.531	0.225			
	[1.403]	[0.987]			
Capital Stock, PWT	0.0712	0.0838*			
	[1.486]	[1.812]			
Capital Stock, IMF, PPP			0.308**		
			[2.544]		
Female Employment, OECD			0.328**	0.0572*	0.088
			[2.044]	[1.700]	[1.590]
Male Employment, OECD			0.313	0.0471	0.141***
			[1.278]	[0.884]	[3.323]
Capital Stock, OECD				0.243***	0.308***
				[4.284]	[4.090]
Constant	0.0863***	0.233***	0.0708***	0.0126***	-0.00449
	[6.713]	[5.793]	[4.827]	[3.109]	[-1.009]
No. of Observations	140	140	172	241	144
R-Squared	0.331		0.218	0.161	0.401
Avg. female to male empl.	0.77	0.77	0.77	0.504	1.259
Elasticity of substitution (ES)	**0.57**	**0.19**	**0.85**	**0.78**	**0.33**

Sources: Organisation for Economic Co-operation and Development; PWT datasets; and World Bank.
Note: The regressions control for sectoral fixed effects and use robust standard errors in parentheses: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

18.   **Our estimates also imply that men stand to gain from higher FLFP.** There are two opposing effects of increasing FLFP on male wages. The first one is to increase male wages because gender complementarity increases productivity. The second effect is to lower male wages because the capital/labor ratio is reduced when total labor supply increases. When the ES is below an estimated threshold of 2.5,[15] as is the case in most of this paper's estimates, the first effect dominates and FLFP will tend to increase the real wages of men.[16]

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[15] The theoretical condition is that the ES should be below $1/(1 - \alpha)$, where α is the share of labor income in total income, and thus $1 - \alpha$ is the share of capital income. The share of capital income has increased in recent decades to about 0.4–0.5. Thus, an ES below 2–2.5 implies that men's wages should increase when FLFP increases.

[16] In addition, increases in FLFP should increase male wages relative to female wages because women become less scarce. However, in practice, increases in FLFP will come about from lower barriers to FLFP, which will affect positively both female wages and FLFP.

Table 3. Nonlinear Least Squares Estimation Results

	(1) Macro Level WB data	(2) Macro Level OECD data (post-1995)	(3) Macro Level OECD data (whole sample)	(4) Macro Level All sectors	(5) Sectoral Level All sectors, excl. Agr., Fishing, Mining, Manuf.	(6) Sectoral Level All sectors, excl. Agr., Fishing, Mining, Manuf., Elect., and Wholesale	(7) Firm Level data excluding 1st and 99th pctile.	(8) Firm Level Firms Larger than Median (in number of employees)	(9) Firm Level Firms Smaller than Median (in number of employees)
Labor Share (α)	0.83	0.84	0.79	0.38	0.46	0.46	0.74***	0.72***	0.79***
	(0.05)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)
TFP Growth (or log-lev. for firm-level est., β)	0.10	0.11	0.11	0.02	0.00	0.01	2.68***	2.58***	2.87***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.17)	(0.13)	(0.32)
Women CES weight coef. (δ)	0.40	0.07	0.11	0.30	0.68	0.45	0.49***	0.53***	0.58***
	(0.79)	(0.22)	(0.25)	(0.24)	(0.38)	(0.36)	(0.05)	(0.09)	(0.09)
ES (elasticity of substitution, σ)	**0.59**	**0.26**	**0.27**	**10.00**	**1.16**	**3.33**	**1.92**	**5.26**	**1.75**
(Median bootstrapping estimate)	*0.51*	*0.26*	*0.29*	*3.20*	*4.33*	*1.83*	*1.84*	*2.58*	*1.72*
(one standard deviation confidence interval)	*[0.22–1.64]*	*[0.06–0.54]*	*[0.20–0.51]*	*[0.7–9.3]*	*[2.5–12.0]*	*[0.9–3.8]*	*[1.25–2.89]*	*[1.52–6.22]*	*[1.28–2.57]*
No. of Observations	140	135	178	513	395	324	2406	1200	1206

Source: 2004 Chinese Annual Surveys of Industrial Production; Organisation for Economic Co-operation and Development; PWT data sets; and World Bank.
Note: The regressions use robust standard errors in parentheses: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Figure 6. Range of Estimates for the Elasticity of Substitution
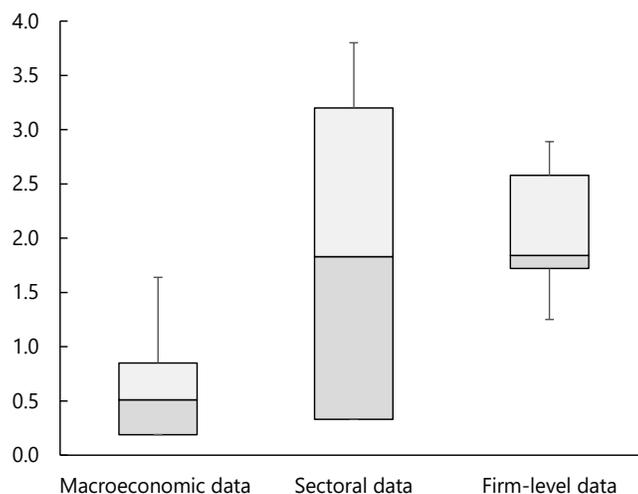
Source: IMF staff estimates.
Note: Midpoint is the baseline estimate.
The box captures the range of estimates across models.
Whiskers represent uncertainty related to the baseline estimate.

Figure 7. GDP Gains from Closing the Gender Gap in Labor Force Participation
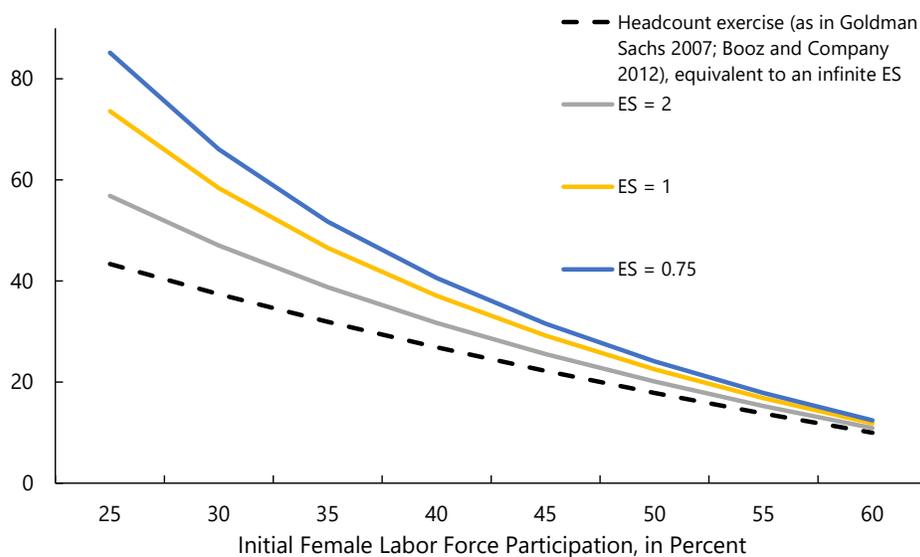
Source: IMF staff estimates.
Note: The calculations assume that there are constant returns to scale to labor, that male labor force participation is at 75 percent, and that women's working hours are 17 percent lower than men's. These assumptions imply that the women's share parameter δ is such that $\delta^{1/\rho} = 0.83$. Although it fits within the range of estimates for δ provided by the nonlinear least squares, there is significant uncertainty about this estimate, possibly because of cross-country heterogeneity. However, the estimates for the elasticity of substitution (ES) are reasonably robust to fixing δ to a specific value.

4. DEVELOPMENT AND GENDER INCLUSION

19.   Services are a relatively gender-equal sector, and therefore the costs of barriers to FLFP will escalate whenever such barriers interfere with the process of sectoral reallocation toward services that is inherent in economic development. To understand the underlying mechanisms and implications, this paper develops a multisector growth model of marketable and home production, with men and women being complementary in production (with an ES set to 2, a parameter in the range of the estimates obtained in the previous section).

20.   The model is built to assess the role of barriers to FLFP and the potential welfare gains from removing them (see Boxes 2 and 3):
- The model disaggregates between the production of home goods and marketable goods in order to differentiate gains in GDP (a measure that captures only the value of marketable goods) from gains in welfare.
- The model is used to understand the effect of income growth on the services sector and the demand for female labor.
- The model allows for the number of women employed in different sectors to be driven by both the presence of *barriers*—capturing discrimination, cultural differences, social norms, and so on, which can affect either labor demand and/or supply—and the presence of potential differences in productivity across sectors.

21.   The model illustrates how income growth can bring women into the labor force as the demand for services increases. In the model, as in reality, economic growth is associated with a sectoral shift toward services (Figure 8, panel 1).[17] Figure 8, panel 2 shows the implications of such a shift for the gap in participation rates between women and men under two different scenarios: no barriers to FLFP (green line), where the male-to female employment ratio is low; and high barriers to FLFP, which leads to high male-to-female ratios. In both scenarios, the rise of the services sector induced by higher incomes leads to a decline in male-to-female ratios, but this decline is more pronounced in countries with high initial barriers to FLFP.[18] This result from the model matches the smaller declines in the gender gap seen in (initially more) gender-equal countries. Overall, the model shows that structural transformation should help reduce the gender gap in LFP but that FLFP barriers slow down this process, leading to misallocation of labor and potentially large welfare losses.

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[17] This is the result of the assumption of nonhomothetic preferences used widely in the literature on structural transformation: as income increases the demand for services increases more than proportionally to income.

[18] In the model, female labor supply is more wage elastic when initial FLFP is low because the marginal utility of consumption of marketable goods is higher at lower levels of income and FLFP.

## Figure 8. A Model of Development, Structural Change, and Gender Inclusion

1. Improvements in Labor Productivity Increase Income and the Demand for Services

2. As Services Grow, Female Employment Increases and the Gender Gap Is Reduced
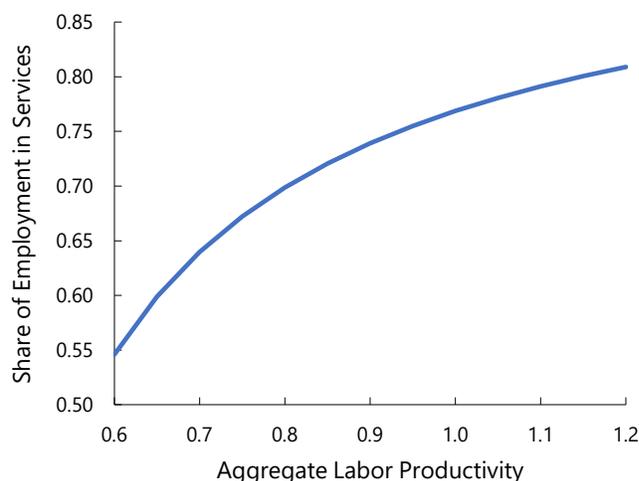
Source: IMF staff estimates.
Note: As total labor productivity increases (*Aj*, as per the notation in Box 2), income and thus the demand for services and the share of services in total employment increase.
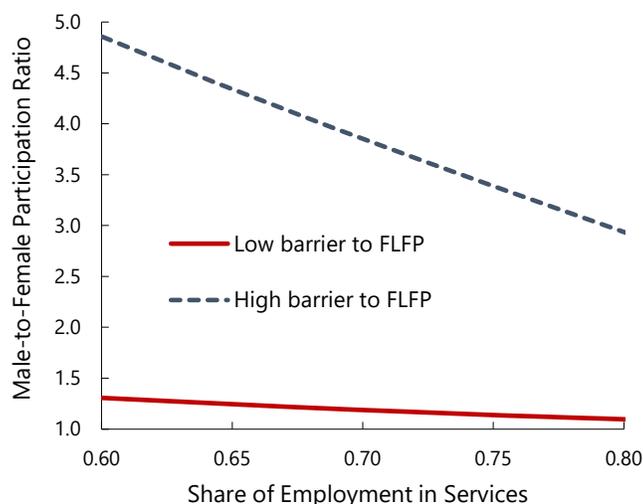
Source: IMF staff estimates.
Note: As the share of services employment in total employment increases, gender gaps in participation are reduced. The reduction in gender inequality is higher when the initial barrier was higher.
FLFP is female labor force participation

22. **The model, applied at the country level, suggests that only large barriers to FLFP can explain observed cross-country differences in FLFP.** To assess the role of barriers to FLFP and estimate the potential gains from removing them, the following exercise is conducted:

- The model is calibrated to a baseline economy (the most gender-equal developed economy in the sample[19]) under the assumption that the gender gap in in this economy is not due to any *barrier*, but reflects instead female comparative technological advantage in services. This extreme assumption is made only to be conservative in the calibration of the barriers, with the implication that the model will tend to understate the true effect of barriers to FLFP.

- For each country, the barrier to FLFP is inferred by comparing differences in employment gaps between marketable and home goods sectors in each country to those in the baseline economy. The higher the difference in male-to-female participation rates between the country analyzed and the baseline country, the higher the barrier to FLFP identified by the model (Boxes 2–3).[20]

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[19] The developed economy with the most equal labor force participation ratios in the sample is Iceland. Thus, this is used as the baseline economy for calibration. FLFP barriers and potential gains from reducing them are only moderately lower if the United States is used as a baseline instead.

[20] The crucial assumption is that complementarities between men and women as well as their comparative advantages (in terms of productivity) are the same across countries. In other words, it is assumed that differences in technology access across countries do not have large effects on the comparative advantages of men relative to

- The model is recalibrated for all economies in the world, each with their own set of barriers to FLFP, to assess the gains to FLFP, marketable output (that is, GDP), and welfare, from removing such barriers.

23.   The barriers to women entering the labor force are estimated to be equivalent to a 4 percent tax on female labor in the average country in Europe and Central Asia, and rising to the equivalent of a 53 percent tax rate on female labor in the average country in the Middle East and North Africa (Table 4, column 1). Although the barriers are expressed in terms of tax rate equivalents, the reasons why FLFP is low are varied, ranging from legal and cultural discrimination and higher costs from joining the labor market, to other gender-biased norms affecting labor supply. Moreover, since barriers are inferred under the assumption that there are no barriers to FLFP in the baseline country, the true barriers (and the associated welfare and output costs) are higher than what is estimated.

24.   Significant gains in employment equality, income, and welfare are achievable by removing existing barriers to FLFP. Once the model is calibrated, counterfactual simulations are computed for each country, setting FLFP barriers to zero. The welfare and economic gains from eliminating FLFP barriers are summarized by region in Table 4. Gains in welfare are significant and exceed 20 percent in MENA and in South Asia.

25.   Regional variation in welfare gains is explained by differences in the estimated barriers to FLFP and differences in initial income levels. The regional rankings in terms of output gains and welfare gains can be different because welfare gains from increased production (and thus consumption) are higher in poorer countries. South Asia, Pakistan, and India would reap large gains in welfare (output) from removing barriers to FLFP, reaching 59 percent (16 percent) and 35 percent (12 percent), respectively. The welfare (output) gains from removing barriers to FLFP would reach 21 percent (15 percent) in the Middle East and North Africa region. Overall, the model shows that gender gaps in many countries are nearly impossible to justify in terms of technological differences, and thus FLFP barriers are likely to be large.

26.   Output and welfare gains could be much larger if all barriers to female participation could be removed. The model attributes part of the gap in participation to productivity differences between genders, for which the model has no direct evidence. The model also does not account for the quality of jobs. For instance, FLFP can be high (as it is in sub-Saharan Africa) but, to the degree that women work in low-quality, vulnerable jobs with lower pay, welfare implications of existing barriers are different. When all gender differences are eliminated, and labor force participation and hourly productivity are equalized between men and women, gains exceed 50 percent in MENA and increase to about 10 to 15 percent in Europe and Central Asia, sub-Saharan Africa, and East Asia-Pacific (Table 4, column 4). The gains increase further with somewhat lower values of the ES (column 5).

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women in each sector. This calibration is informative of gender distortions in the economy as long as technologies do not systematically benefit men's labor productivity relative to women's labor productivity.

Table 4. Welfare and GDP Gains from Eliminating Barriers to Female Labor Force Participation

Region	(1) FLFP Barrier, in Tax Equivalent, in percent	(2) Welfare Gain from Removing Barrier, in percent	(3) Marketable Output Gain from Removing Barrier, in percent	(4) Marketable Output Gain from Closing Gender Gap in FLFP, ES = 2, in percent	(5) Marketable Output Gain from Closing Gender Gap in LFP, ES = 1.5
Middle East and North Africa	53	22.2	16.4	58.2	63.6
South Asia	32	23.6	7.0	29.0	30.7
Latin America and Caribbean	25	2.9	4.0	22.1	23.1
Sub-Saharan Africa	15	2.2	0.2	7.3	7.5
East Asia and Pacific	11	3.2	0.9	12.7	13.1
Europe and Central Asia	7	0.9	0.0	14.0	14.4

Source: IMF staff estimates.
Note: The results in columns 1–3 are obtained using the model presented in Boxes 2 and 3. For clarity of exposition, the table reports a unique barrier, expressed in tax rate equivalent (tax rate = $100 * (1 − 1/(1 + \tau))$) as the unweighted average of the barriers in services and nonservices. Welfare and output gains are measured in terms of home good consumption units. Low gains can occur in countries that have a high barrier in the services sectors but low barriers in manufacturing. Reducing both barriers to zero shifts resources toward services, which tend to have lower market value. Because the barrier presented in this table is the average barrier for a two-sector model, it hides these more complex sectoral reallocations computed in the three-sector model. The results in columns 4 and 5 are obtained using the aggregate model presented in Section 2 (model with no capital; that is, $\alpha = 1$), with the average productivity of women equal to men's productivity, but with working hours set to 83 percent of men's working hours. FLFP stands for Female Labor Force Participation; ES stands for elasticity of substitution; LFP stands for Labor Force Participation.

5. TAKEAWAYS

27.   A key result of the work developed in this paper is that, because women bring new skills to the workplace, gender *diversity* is likely to be beneficial to productivity growth. There is thus a connection between the extent of productivity growth observed in a country and that country's progress in boosting FLFP. For example, while Ireland's FLFP has grown by about 20 percentage points since 1990, contributing to its strong productivity gains, total factor productivity (TFP) growth was negative in Morocco, a country where FLFP stagnated at 25 percent. This paper's estimates of the complementarity between women and men in production suggest that, had Morocco increased FLFP as much as Ireland did over the past few decades, total factor productivity (TFP) growth might have been boosted by some 0.4 percentage points per year, and GDP would also be a third larger. In countries where FLFP has grown fast, such as Brazil or the Dominican Republic since the early 1990s, female employment was supported by an expanding services sector, which grew from generating about half the jobs in the economy to supporting two-thirds of economywide employment. By contrast, to take the example of Egypt, FLFP has been stagnant over this period, with only 16 percent of working-age women participating in the labor market, and a services sector that barely supports half of the economy's employment. This paper's model

suggests that the barriers to female labor force participation in Egypt are equivalent to an additional tax rate of about 50 percent on women's labor income. Removing such barriers would improve welfare by 25 percent, and fully equalizing male and female labor force participation could increase GDP by some 60 percent. Gains of a similar magnitude would be achievable in other highly unequal countries such as Pakistan and India. Barriers to female participation encompass discrimination, differential investments in human capital, and deficient parental leave policies, to name a few. In 18 countries in this paper's sample, for example, husbands can legally prevent their wives from working. In 104 countries, laws remain on the books that bar women from specific jobs, while 59 countries have no laws of any kind against sexual harassment at work (World Bank 2018).

28.   The key message of this paper therefore is that obstacles to women entering the labor force are even more costly than initially thought, and benefits from closing gender gaps are likely to be larger than initially thought. A range of (macro- and microeconomic) data suggest that women and men complement each other in the production process. The implication is that there is a value to diversity: adding more women to the labor force should induce larger gains than an equal increase in male workers. These higher gains are preserved even when considering that home production would decline when women work in the market economy. This paper's results also imply that standard models, which ignore gender composition, understate the favorable impact of gender inclusion on growth and misattribute to technology a part of growth that is caused by women's participation.

29.   Our findings also suggest that greater gender diversity is likely to boost male incomes. This makes discrimination against women in labor markets not only economically inefficient but also directly costly to men.

30.   The persistence of sizable gender gaps reflects pervasive barriers (akin to taxes on female labor), albeit ones that vary across regions and countries. This paper finds these barriers to be equivalent to tax rates on female labor of up to 50 percent, with the MENA and South Asia regions estimated to have the largest barriers.

31.   The rise of the services sector in developing economies should contribute to smaller gender gaps over time: impediments to structural transformation should be resisted/removed. The growth of services should improve gender parity, and lead to favorable growth outcomes. Removal of barriers to female employment will facilitate structural transformation and pave the way for output and welfare increases (even taking into account the reduction in home production as women enter the labor force). Gains will be larger where preexisting barriers are larger. While there is no silver bullet, there are several policy recommendations in the literature. These include enacting laws to ensure that women have equal rights to own property and access credit; reforming taxes (for example, by replacing family taxation with individual taxation and providing tax credits to incentivize labor force participation among low-income earners; see Elborgh-Woytek and others 2013); tackling gender inequality in education and health care, including publicly financed maternity and paternity leave and expanded childcare and elder care availability; and improving access to transportation, electricity, and water infrastructure (Gonzales and others 2015).

Box 1. Estimating the Elasticity of Substitution

Production function. Output, Y, is produced with a Cobb-Douglas technology in the factors of production—the labor composite input, L (see definition below), and the capital stock, K:

$$Y = AK^{1-\alpha}L^{\alpha}, \qquad (1)$$

where A is the level of technology, α is the share of labor in total income, and L is a constant elasticity of substitution composite of female (F) and male (M) labor:

$$L = \left(\delta F^{\rho} + M^{\rho}\right)^{1/\rho}. \qquad (2)$$

The elasticity of substitution between male and female workers is $\sigma = 1/(1-\rho)$, and δ is the share parameter. Noting with lowercases the logarithm of the uppercases variables, growth is obtained by taking the logarithm of equation (1) and taking the difference between t and $t-1$, using the operator Δ:

$$\Delta y = \Delta a + \alpha \Delta l + (1-\alpha)\Delta k. $$

Similarly, a log-linearization of equation (2) yields $\Delta l = \mu \Delta f + (1-\mu)\Delta m$, where $\mu = F(\partial L/\partial F)/L = \delta F^{\rho}/L^{\rho}$ is the share of women's labor income in total labor income. A Taylor approximation of μ related to an elasticity of substitution of 1 (that is, for values of ρ close to 0) yields $\mu \approx \delta/(1+\delta)\left[1 - \rho\, \delta \ln(M/F)\right]$. Given μ, growth can be rewritten as

$$\Delta y = \Delta n + (1-\alpha)\Delta k + \alpha(\Delta f - \Delta m)(\mu - F/N) + \Delta a, \qquad (3)$$

where $N = F + M$ and $\Delta n = F/N\Delta f + M/N\Delta m$ are respectively the level and the growth rate in the headcount of the total workforce. The third term in equation (3) shows that when women's employment increases faster than men's ($\Delta f - \Delta m > 0$), total factor productivity, as estimated using growth in the capital stock Δk and growth in total employment Δn, is growing faster than technological progress (Δa) if, and only if, $\mu - F/N > 0$. This condition always holds for $\delta = 1$ and for $r \to 0$ from above, and numerical calculations show that for $d = \delta^{1/\rho} = 0.83$ (the ratio of female work hours to male work hours, calculated using the OECD Labour Market Position of Families 2.1 working hours statistics), it holds for $\sigma < 2$.

Estimating the elasticity of substitution (σ). It is possible to estimate σ using nonlinear least squares on the logarithm of equation (1), where L has been replaced using equation (2). One can also estimate σ by ordinary least squares (OLS), by linking the theoretical expression for growth,

$$\Delta y = \alpha(\mu \Delta f + (1-\mu)\Delta m) + (1-\alpha)\Delta k + \Delta a, \qquad (4)$$

to its empirical counterpart,

$$\Delta y_{i,t} = \beta_f \Delta f_{i,t} + \beta_m \Delta m_{i,t} + \beta_k \Delta k_{i,t} + \Gamma Z_{i,} + \epsilon_{i,t}, \qquad (5)$$

where $Z_{i,t}$ is a matrix of control variables, and Γ is the vector of coefficients for these variables. Identifying μ and thus σ by comparing equations (4) and (5) is possible thanks to the estimated coefficients β_f and β_m:

$$\beta_f/\beta_m = \mu/(1-\mu) \Rightarrow 1 - 1/\sigma = \rho = \ln[\beta_f/\beta_m]/\ln[dF/M].$$

Box 2. A Model of Structural Change and Female Labor Force Participation

The model has four parts: (1) a home production sector, where gender differences in labor force participation are allowed; (2) structural change driven by higher demand for services when income grows; (3) gender differences in productivity; and (4) barriers faced by women that differ by sector.

- **Preferences:** There is a representative household with nonhomothetic preferences given by

$$u(c_s, c_b) = \alpha \, log(c_b - \bar{b}) + (1 - \alpha)log(c_s),$$

where, c_s is marketable services and c_b is a composite of all other nonservice goods. The nonservice good, c_b, is itself a composite of home (c_h) and marketable nonservice production (c_n):

$$c_b = \left[\lambda c_n^{\frac{\eta-1}{\eta}} + (1 - \lambda)c_h^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}.$$

The household is composed of a man and woman each endowed with one unit of labor, divisible across sectors. Population is constant and thus the model is not fit to discuss fertility or migration.

- **Technology:** There are three goods in the economy: home goods, nonservice marketable goods, and marketable services. Home goods are produced and consumed directly by the household, while services and nonservice marketable goods are produced by representative firms employing male and female labor in each sector. The production function for each sector, j, is given by

$$Y_j = A_j \left[\psi_j L_{mj}^{\frac{\sigma-1}{\sigma}} + \left(1 - \psi_j\right)L_{fj}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}},$$

where L_{mj} and L_{fj} are the units of male and female labor employed in the production of goods from sector j, and A_j is the aggregate productivity of the labor constant elasticity of substitution composite. Importantly, ψ_j is a sector-specific parameter that governs the technological comparative advantage of men relative to women in the sector. The higher the ψ_j, the higher the marginal productivity of men compared with women in sector j. The specification abstracts from dynamic gains in production, although these could matter especially in the nonservices sector and in the home sector, where care of children at home may have positive long-term externalities.

- **Barriers to female labor force participation:** In the spirit of Becker (1957), barriers to female labor force participation are modeled as a wedge between the value of the marginal product of female work (*MVP*) and the wage offered by employers:

$$\left(1 + \tau_j\right)w_f = MVP_{fj} \, ,$$

where $j \in \{n, s\}$ is one of the two marketable sectors. This wedge parameter can be due to a range of factors affecting labor demand or labor supply, including discrimination by the employers, a distaste from letting women work outside of home, or a tax on female employment of $1 + \tau_j$.

Box 3. Calibration of the Model

The baseline model is solved and calibrated first to a baseline country (Iceland) before being applied to the rest of the world.

- **Calibrating the model**: More specifically, parameters are chosen to match the data of the most equal developed economy in the sample (Iceland) under the extreme assumption that, in this economy, the female labor force participation barriers are null ($\tau_j = 0$ for all j). This assumption biases downward the eventual gains from removing female labor force participation barriers in other countries. Preference parameters are calibrated in line with the literature on structural transformation and gender gaps. The benchmark values of η and σ are taken from Ngai and Petrongolo (2017) in their US study, and are pinned down by employment responses to past wage gap movements and estimates from the literature addressing the elasticity of substitution between home and market consumption. The weight parameter, α, is chosen to match a long-term service consumption share of 90 percent. Other parameters are jointly determined in equilibrium (although each parameter tends to depend more strongly on one particular moment of the data). The subsistence parameter, $\bar{b}$, and the parameter determining the importance of home consumption, λ, are calibrated to match the share of service employment and total labor force participation in the baseline economy participation ratios. From the production side, productivity parameters are all set equal to one in the baseline. Since all male comparative advantage parameters, ψ_j, are not separably identifiable from the data, ψ_h is ad hoc set to 0.5 in the baseline. The assumption implies that men and women are assumed to be, potentially, equally productive at home from a technological standpoint. Other technology parameters, ψ_n and ψ_s, match the male-to-female ratio employed in services relative to home.

- **Barriers to female labor force participation in other countries are calibrated to match participation ratios in the data**: Once parameters for the baseline economy are determined, distortions for all other countries in the world are calculated from the equilibrium condition of the model:

$$\tau_j^c = \left(\frac{L_{mj}^c/L_{fj}^c}{L_{mh}^c/L_{fh}^c}\right)^{1/\sigma} \left(\frac{L_{mj}^{US}/L_{fj}^{US}}{L_{mh}^{US}/L_{fh}^{US}}\right)^{-1/\sigma} - 1,$$

where $j \in \{n, s\}$ is the sector in country c. Once barriers are calibrated for all countries in the economy, counterfactual exercises in which the barriers are set to zero are computed for all economies in the world. The output and welfare impact from those exercises are shown in Table 4.

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