Panel Data Analysis of the Effects of Female Labor Force Participation on Profit Rates

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ABSTRACT

It is expected that increasing female labor force participation (FLFP) rate, due to the gender wage gap, reduces the unit labor costs, and therefore increases profit rates. Using a dataset of 130 countries for 1990-2019, this paper shows that while FLFP increases profit share in high-income countries, it reduces in middle-income countries. However, for both middle- and high-income countries, FLFP cannot prevent the overall tendency in profit rates to decline caused by a consistent decline in output-capital ratio.

Key words: *Female labor force participation, profit rate, profit share, output-capital ratio*

JEL Codes: B54, C01, E24

1. INTRODUCTION

Female labor force participation (FLFP) has increased in most countries since the late 1970s as the economic restructuring created more job opportunities for women. In parallel to this development, increased education and employment experience of women (i.e., human capital), the decline in unionization, more jobs for women, and a decrease in occupational segregation have all contributed to the improvement in the female/male wage ratio. The feminist literature discusses how gender differences in the labor market benefit capitalists in great detail. Because women are seen to be more productive than men in certain jobs, "less skilled" and lower-paid female workers result in reduced unit costs. This is due to the fact that women, with their "nimble fingers," are more agreeable and less prone to worker dissatisfaction, more suited to arduous work, and more dependable and trainable than men. In addition, because of the "divide and rule" approach to labor, women help in the repression of male workers' pay, reducing their bargaining leverage against employers. It is this background that this work focuses on the effect of FLFP on the profit share and the rate of profit. The mechanism is straightforward: increasing FLFP, due to the gender wage gap, reduces the unit labor costs, and therefore increases profit rates. It is important to provide some more comprehensive and new evidence on the important nexus of women's employment and

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profitability to see whether increasing women's employment is associated with increasing profitability for country groups with different economic development level.

A few studies have engaged with the effects women's employment on profitability. Both Zacharias and Mahoney (2009) and Tescari and Vaona (2014) found a positive impact of women's employment on wage share in the US from 1982-1997 and Italy from 1994-2008, respectively. Moreover, both Finnof and Jayadev (2006) for 23 OECD countries for 1975–2000 and Elveren et al. (2017) for 21 OECD countries for 1970–2008 showed that FLFP leads to increasing profit share and profit rate, respectively. Using a novel dataset that covers a very large set of countries (e.g., 130) over a recent time period of 1990-2019, this study provides more evidence on the effect of FLFP on three important variables, profit shares, profit rates, and output-capital ratio for various country groups.

2. DATA AND METHOD

Our main dependent variable is the rate of profit. To check robustness, we also use profit share and output-capital ratio, all obtained from Basu et al. (2022). While the profit rate is the ratio of profit income to capital stock, profit share is the ratio of profit income to total output, and finally, output-capital ratio is the ratio of total output to capital stock. Our key independent variable is FLFP rate (age 15-64, ILO estimation). Our alternative variables are women's employment rate and female-to-male employment ratio. We also use real GDP (PPP, 2017 constant) and the rate of unemployment, all obtained from the World Bank.

Standard panel models fail to capture the dynamic relationship among the variables. GMM is one widely used method for dynamic panel data analysis, particularly for the common cases of large N and small T data. However, this method captures only short-term dynamics. Therefore, Kiviet (1995) notes that the homogeneity assumptions on the slope coefficients of lagged dependent variables can create significant biases in GMM analyses. Therefore, GMM estimations are likely to lead to inconsistent and misleading long-run coefficients if the slope coefficients are not identical (Pesaran and Smith, 1995). We test for slope heterogeneity with the delta test suggested in Pesaran and Yamagata (2008) by using *xthst* command of Bersvenden and Ditzen (2021). This test allows us to test for slop heterogeneity in large panel data both in terms of number of years and country (see Table 1).

	Delta	p-value
	63.448	0.000
Adj.	70.937	0.000

Table 1 Slope Heterogeneity Test

We use autoregressive distributed lag models (ARDL) introduced by Pesaran et al. (1999). It is a heterogeneous dynamic panel model where the cross-section dimension augments the time-series information and T is sufficiently large that the fixed effect Nickel bias is not a problem. It derives consistent and efficient estimates of the parameters in a long-run relationship between both integrated and stationary variables in a panel data structure. Accordingly, ARDL (p, q), the dynamic heterogeneous panel regression equation with the error correction model can be written as follows:

$$\Delta(y_i)_t = \sum_{j=1}^{p-1} \gamma_j^i \, \Delta(y_i)_{t-j} + \sum_{j=0}^{q-1} \delta_j^i \, \Delta(X_i)_{t-j} + \varphi^i \left[(y_i)_{t-1} - \left\{\beta_0^i + \beta_1^i (X_i)_{t-1}\right\}\right] + \epsilon_{it} \qquad (1)$$

Where y is profit rate; X represents the explanatory variables, including FLFP, GDP, unemployment, and global profit. p and q refer to the lags of the dependent and independent variables, respectively.$\gamma$and δ are the short-run coefficients for profit and its determinants, respectively. β is the long-run coefficient. φ is the coefficient of the speed of adjustment to the long-run equilibrium ϵ, and is a time-varying disturbance term. i and t refer to country and time, respectively. The long-run regression coefficient in the square brackets in (1) is derived from equation (2) as follows:

$$(y_i)_t = \beta_0^i + \beta_1^i (X_i)_t + \mu_{i,t} \text{ where } \mu_{i,t} \sim I(0) \quad (2)$$

We use the mean group (MG) estimator created by Pesaran and Smith (1995), which allows for complete diversity in cross-country parameters, as well as Pesaran et al.'s (1999) dynamic fixed effects (DFE) estimator, which equalizes all slope coefficients across countries and the pooled mean group (PMG) estimator, which equalizes long-run slope coefficients across countries. As Pesaran et al. (1999) suggested, we do not add the lagged value of dependent variables to prevent biased results as the number of years is not large enough[1].

Cross-sectional dependence (CSD) in the errors is a common characteristic of panel data models. Since our dependent variables are profit rates, profit share, and output-capital ratio we suspect that there exists CSD. Because countries are not free from the influence of the global pattern in the capitalist production system. Therefore, in addition to major panel unit root tests, CADF and CIPS unit root tests, which allow for cross-sectional dependence showed that the variables were a mix of I (0) and I (1), and that no variable was I (2) (see Table 2). This allows us to use the ARDL approach.

Variables	Deterministic Terms	LLC	IPS	Breitung	CADF	CIPS
First Differences						
Profit	Intercept	-24.626***	-32.115***	-18.041***	-4.869***	-3.939***
Profit Share	Intercept	-25.472***	NA	-26.225***	-4.721***	-3.623***
Output-capital ratio	Intercept	-26.818***	-30.983***	-15.416***	-4.680***	-3.986***
FLFP	Intercept	-11.643***	-21.846***	-16.721***	-3.410***	-2.903***
GDP	Intercept	-20.783***	-24.035***	-8.041***	-2.999***	-2.448***
Unemployment	Intercept	-21.299***	-22.969***	-29.761***	-3.787***	-2.893***

Table 2 Panel unit root tests
Notes: The number of lags is determined according to SC. For CADF and CIPS, the number of lags is 1.
Significance is denoted by *** at 1% level.

[1] It is worth noting that 30 years is long enough to conduct this analysis as done even for shorter time periods in some model specifications in Pesaran et al. (1999).

Major tests (see Table 3) showed that there is CSD in our dependent variables. We control CSD by incorporating the cross-sectional mean of the dependent variables, and refer them as *global* (e.g., global profit etc.).

Profit	Pesaran's Test	Frees' Test	Friedman's Test
Test Statistic	15.890	26.991	132.660
Probability	0.0000	0.0861	0.3947
Profit Share			
Test Statistic	17.928	23.770	151.199
Probability	0.0000	0.0861	0.0884
Output-capital ratio			
Test Statistic	22.597	31.506	154.146
Probability	0.0000	0.0861	0.0649

Table 3 Cross Sectional Independence Tests

3. RESULTS

All model results meet the stationary condition that the coefficient of the error-correction term be negative and not less than -1 to stabilize adjustment in the error correction model. We emphasize the results of PMG (and DFE), rather than MG, as suggested by Hausman Test.

Table 4 presents the benchmark results[2]. First, FLFP has an overall negative impact on the profit rate. Second, as expected, increasing GDP[3] boosts profit rate by increasing capital accumulation. Unemployment leads to an increase in profit rate by pressing wages downward. Finally, it seems that an insignificant coefficient of global profit contradicts with what CSD tests suggest. Instead, it suggests that CSD is not strong in our data due to different global patterns with respect to country groups (Bailey et al. 2016). Also, that is why the time trend is inconsistent. These results suggest that there is a need for further analyses.

Table 5 indicates two issues. First, now significant coefficients of *Global profit* suggest that there is a global pattern in profit rates. Second, and more importantly, while increasing unemployment rate boosts profit rates in high-income countries, it is not the case in other groups, with only one model that is significant at the 10 percent level. This suggests that, in high-income countries, an increase in unemployment reduces wage bargaining power, therefore increasing the profit rate. However, regarding low-income countries, an increase in unemployment reduces effective demand, and this negative effect offsets the positive impact due to suppressed wages.

Table 5 presents the results of the effect of FLFP[4] on profit share, output-capital ratio, and profit rates for the OECD countries, for which data of all variables is available. The coefficients of global dependent variables (i.e., global^) and time trend suggest that while overall profit share has increased, output-capital ratio and profit rate have declined. The negative coefficient of GDP means that profit shares are counter-cyclical (see footnote 3), suggesting that workers are likely to increase their share during a boom. Finally, Table 7 shows that while increasing FLFP reduces profit share in middle-income countries, the effect is positive in high-income countries[5]. That is,

[2] Since we focus on the long-term relations, we do not provide short-term coefficients.
[3] The GDP coefficient should be interpreted in terms of its deviation from trend because the models include a time trend, but the results are same without trend.
[4] The results are the same when women's employment or women-to-male labor force participation rate are used.
[5] Missing values in low-income countries prevent us from conducting the same analysis.

income earned by women helps to increase wage share (i.e., decline in profit share) in the former group.

Long Run Coefficients	PMG	MG	DFE
FLFP	-0.485*** [0.072]	0.246 [2.314]	-0.185 [0.156]
GDP	0.187*** [0.033]	0.582* [0.354]	0.246*** [0.066]
unemployment	0.171*** [0.013]	0.071 [0.089]	0.164*** [0.036]
Global profit	0.326 [0.105]	0.082 [0.232]	0.353 [0.327]
Time trend	0.006*** [0.001]	-0.021 [0.016]	-0.006* [0.003]
Error Correction Coefficient	-0.171*** [0.015]	-0.608*** [0.025]	-0.167*** [0.008]
No. Countries	130	130	130
No. Observations	3770	3770	3770

Table 4 The Long-run Effects of FLFP on Profit Rates

Note: Standard errors in brackets. Significance denoted by *** at 1%, ** at 5%, and * at 10% level.

	Low-Income			Middle-Income			High-Income		
	PMG	MG	DFE	PMG	MG	DFE	PMG	MG	DFE
FLFP	0.643*** [0.047]	0.991 [6.816]	0.015 [0.325]	-0.797*** [0.092]	-0.779 [1.031]	-1.455*** [0.316]	-0.824*** [0.120]	0.401 [0.338]	-0.319 [0.225]
GDP	0.644*** [0.054]	0.006 [0.438]	0.146 [0.122]	0.206*** [0.056]	1.667 [1.037]	0.365*** [0.121]	0.303*** [0.053]	0.221 [0.186]	0.559*** [0.111]
unemp	0.034* [0.019]	-0.050 [0.226]	0.003 [0.071]	0.017 [0.023]	0.185 [0.141]	0.081 [0.071]	0.223*** [0.021]	0.088* [0.051]	0.295*** [0.048]
Global profit	-0.208 [0.130]	0.379 [0.441]	1.242** [0.624]	0.283** [0.130]	-0.520 [0.507]	-1.042 [0.655]	0.222 [0.144]	0.305 [0.252]	-0.510 [0.393]
Time trend	-0.019*** [0.003]	-0.002 [0.021]	-0.011 [0.006]	-0.004** [0.002]	-0.063 [0.047]	0.004 [0.006]	0.009 [0.002	-0.004 [0.006]	-0.009*** [0.003]
Error Correction Coefficient	-0.237*** [0.040]	-0.667*** [0.045]	-0.201*** [0.016]	-0.191*** [0.034]	-0.578*** [0.046]	-0.127*** [0.012]	-0.150*** [0.021]	-0.578*** [0.039]	-0.172*** [0.015]
No. Countries	44	44	44	39	39	39	47	47	47
No. Obs.	1276	1276	1276	1131	1131	1131	1363	1363	1363

Table 5 The Long-run Effects of FLFP on Profit Rates with respect to Income Groups

Note: Standard errors in brackets. Significance denoted by *** at 1%, ** at 5%, and * at 10% level.

	Profit Share			Output-Capital Ratio			Profit Rate		
	PMG	MG	DFE	PMG	MG	DFE	PMG	MG	DFE
FLFP	-0.073 [0.069]	-0.631 [0.402]	-0.067 [0.111]	-0.041 [0.045]	-0.145 [0.257]	-0.483*** [0.146]	-1.035*** [0.133]	0.191 [0.336]	-0.568*** [0.185]
GDP	-0.283*** [0.035]	-0.152 [0.187]	-0.006 [0.056]	-0.112*** [0.036]	0.312 [0.215]	0.362*** [0.069]	0.662*** [0.059]	0.280 [0.216]	0.401*** [0.089]
unemp	0.117*** [0.012]	0.026 [0.048]	0.113*** [0.023]	0.089*** [0.013]	0.011 [0.027]	0.180*** [0.031	0.280*** [0.027]	0.115** [0.052]	0.289*** [0.043]
Global^	1.056*** [0.165]	1.751** [0.810]	0.482 [0.411]	-0.763*** [0.141]	-0.173 [0.168]	-1.291*** [0.415]	-0.354** [0.171]	-0.089 [0.191]	-0.594* [0.307]
Time trend	0.008*** [0.001]	0.011* [0.006]	0.003 [0.002]	-0.003*** [0.001]	-0.008* [0.004]	-0.011*** [0.002]	-0.002 [0.002]	-0.005 [0.006]	-0.005** [0.003]
Error Correction Coefficient	-0.179*** [0.027]	-0.545*** [0.039]	-0.155*** [0.016]	-0.166*** [0.017]	-0.455*** [0.039]	-0.177*** [0.014]	-0.143*** [0.021]	-0.527*** [0.038]	-0.179*** [0.015]
No. Countries	38	38	38	38	38	38	38	38	38
No. Obs.	1102	1102	1102	1102	1102	1102	1102	1102	1102

Table 6 The Long-run Effects of FLFP on Profit Share, Output-Capital Ratio, and Profit Rates in OECD Countries

Note: Standard errors in brackets. Significance denoted by *** at 1%, ** at 5%, and * at 10% level. Global^ refers to global profit, global profit share, and global output-capital ratio.

	Middle-Income			High-Income		
	PMG	MG	DFE	PMG	MG	DFE
FLFP	-0.415*** [0.051]	-4.815 [4.291]	-0.288* [0.169]	0.244*** [0.059]	-0.510 [0.347]	-0.006 [0.103]
GDP	-0.086*** [0.021]	0.176 [0.173]	0.038 [0.065]	-0.091*** [0.033]	-0.255* [0.151]	-0.046 [0.056]
unemployment	0.043*** [0.013]	1.549 [1.500]	0.081** [0.038]	0.127*** [0.010]	0.009 [0.037]	0.117*** [0.024]
Global^	1.329*** [0.207]	-6.366 [5.835]	0.419 [0.785]	1.013*** [0.147]	1.704** [0.717]	0.651 [0.424]
Time trend	0.004*** [0.001]	0.071 [0.072]	0.001 [0.003]	0.004*** [0.148]	0.011** [0.005]	0.003 [0.002]
Error Correction Coefficient	-0.189*** [0.028]	-0.646*** [0.059]	-0.123*** [0.012]	-0.178*** [0.025]	-0.593*** [0.043]	-0.133*** [0.014]
No. Countries	39	39	39	47	47	47
No. Obs.	1132	1132	1132	1363	1363	1363

Table 7 The Long-run Effects of FLFP on Profit Share

Note: Standard errors in brackets. Significance denoted by *** at 1%, ** at 5%, and * at 10% level. Global^ refers to global profit, global profit share, and global output-capital ratio.

Overall, our results suggest that 'positive' impact of FLFP was not large enough to counteract the tendency of profit rates to decline, particularly considering a consistent decline in gender wage gap across the countries. The negative trend in profit rate was mainly due to a decline in output-capital ratio, and an increase in profit share only slowed down an otherwise larger decline (Basu et al. 2022). Compared to the previous studies discussed above, our findings suggest that the 'boosting' effect of FLFP is not as strong as it was in the previous decades. Firms constantly seek for advanced technologies to increase labor productivity, but it also increases *the technical composition of capital*. However, such an increase apparently leads to a decline in output-capital ratio, which in turn becomes the primary cause of decline in the profit rate. In other words, capital accumulation leads to automation, reducing the rate of profit (not total profit or profit share). This paradoxical situation has long been discussed in political economy literature. Automation increases FLFP and, perhaps, can reduce the gender wage gap in some specific cases (Cortes et al. 2020: 919). That is, automation can also reduce the positive effect of FLFP on profit rates by increasing profit share, as a part of this paradoxical pattern in capitalist economies.

4. CONCLUSION

Focusing on 130 countries for 1990-2019 with a panel ARDL model, this paper showed that while FLFP increases profit share in high-income countries, it reduces in middle-income countries. However, for both middle- and high-income countries, FLFP cannot prevent the overall tendency in profit rates to decline caused by a consistent decline in output-capital ratio. Our results add some more evidence to those of Finnof and Jayadev (2006) and Elveren et al. (2017). First, while we confirm that there exists a positive relationship between increasing FLFP and profit share in the case of high-income countries, we show that this is not the case for other countries. Second, we showed that a positive relationship between FLFP and profit rates, which was the case for 1970-2008 (Elveren et al. 2017), is no more valid in the last three decades.

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