



An Econometric Analysis of a Complementarity between profit-wage and capital-labour: Skill-Biased Technological Change in Indian Services Sector

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ABSTRACT: This paper econometrically tests a complementary between the profit-wage and capital-labour ratios in the Indian services sector for the period of 1999-2017. The higher surplus-value is examined in terms of higher labour productivity, lower employment and lower wages. Two specific policy implications are advocated to revamp the Indian services sector for its sustainable future: (i) there is a need to increase public investment in the Indian services sector to expand employment opportunities and wages, to address the issues of deficiency of aggregate demand; (ii) there is also a need to reverse the complementary between profit-wage and capital-labour ratio to a complementary between wage-profit and labour-capital ratios, as that can lead to stable and sustainable demand and supply in Indian economy.

KEYWORDS: Service Sector, Skilled based Technology, Unemployment, Productivity, Labour

1. THE CONTEXT

Since early 1990s, in the neo-liberal regime, the governments including Indian government have been focusing on the promotion of foreign capital, technology, trade and use of high-skilled workers. The promotion of these foreign resources aims to achieve higher economic growth in the more open-economic scenario, to expand employment opportunities and increase output. Following the earlier government economic policies, the recent government in India, has used the neo-classical economic policies in the growth of Indian service sector. The recent two economic-surveys, 2015-16 and 2016-17 have followed the path of open macroeconomic policy of economic reforms. Exports of services has been a crucial part of India's growth and trade in recent years. WTO data shows that services exports of India grew from US \$ 16.8 billion in 2001 to US \$ 155.6 billion – which constitutes 7.5 per cent of the GDP in 2014 (GOI, 2016). The services sector is the main driver of economic growth and it contributes 62 per cent of its GDP growth in 2016-17 (GOI, 2017)

What are the experiences of Indian services sector during the four political regimes during the period

1999-2017? The four political regimes in the Indian parliament were/are followed: National Democratic Alliance (NDA-I) in the period 1999-2004 under prime-minister AB Vajpayee, the two regimes were ruled by United Progressive Alliances (UPA I and UPA II in 2004-2009 and 2009-2014) under prime minister ship of Dr. Manmohan Singh and the present regime after 15 years, for the period 2014-2019 is ruled by NDA II under PM Modi. This paper empirically examines the wages, employment, output, productivity and inequality. The main purpose of examining these variables is to analyse the open free-trade and macroeconomic policies, whether the Indian services sector is successful or failed or mixed effects. What are the lessons from these experiences for futuristic policy implications to address the real issues of employment and inequality for stable and sustainable development? The rest of the paper is divided into four sections. Section 2 provide details of theoretical framework: Skill-biased Technological Change as a complementarity between profit-wage ratio and capital-labour ratio. Section 3 presents data and econometric methodology. Section 4 presents econometric analysis: employment conditions, skill-based technological change, wages and profits, and

Productivities of Capital and Labour in Indian services sector and finally section 5 presents concluding remarks and policy implications

2. THEORETICAL FRAMEWORK

The present paper empirically tests Skill-biased Technological Change (SBTC) hypotheses (new international trade theory). The Heckscher-Ohlin and Samuelson theorem of international trade are defined as the traditional international trade theory or factor-endowment theory, which argues that capital-abundant countries would produce and export capital goods and capital-scarce countries would produce and export labour-intensive products. Both the trading-economies will expand their international trade and it will eventually increase their national income and hence lead to equalization of product-prices and factor-prices among trading-economies (Gupta & Mittal, 2020). However, Leontief (1953) found that the capital-abundant economy, US was exporting more the labour-intensive goods to its trading partner than the capital-intensive goods in 1947 and 1951, which was just opposite to the factor-endowment theory, which was known as 'Leontief-paradox'. The paradox was resolved by the higher productivity of the high-skilled labour, which expanded production and export of the labour-intensive products of the US in 1947 and 1951. Therefore the role of higher productivity of high-skilled workers increased the US production and export. However issue remained debatable in the recent time of globalisation that the equalisation of factor-prices and product-prices still hold or not? Because the new international trade theory or Skill-biased Technological Change (SBTC) explained that after ICT revolution, there is an increase in the use of high-technology and the high-tech machinery and it created more demand for high-skilled workers. The higher demand for high-skilled workers increases absolute wages of the high-skilled workers and even their relative wages to the wages of low-skilled workers which leads to an increase in inequality between the wages of high-skilled and low-skilled workers in the trading economy (Mittal, 2020b). This use of high-skilled workers has complemented with higher use of capital in total in comparison to the labour in total, to increase the level of profit and depresses the wage.

However, in the case of Indian economy as a low-skilled labour abundant economy, it has been specializing in the production and export of high-technology service

products that is reflected in the highest level of exports of services at global level (Mittal, 2020; Yadav et. al., 2021). The exports from Indian service sector have been expanding at great pace at global level since 1990s of ICT revolution and globalisation policies. The share of services in India's external trade has increased from 12% in 1995 to 15% in 2013 (WB, 2015).¹ In the process of globalisation, the labour-abundant economy like India is looking for more capital and advanced technology with a view to increasing the pace of economic growth and development. The entrepreneurs and companies through foreign direct and portfolio investments (FDI and FPI) of advanced countries, like the US are looking for the locations for investment like Indian economy where they can minimize their private and social costs of the immigration of high-skilled labour in the US.² Therefore there would be an increase in the wages of high-skilled workers in the both trading economies and led to increase in the wage-inequality between high-skilled and low-skilled workers. The new international trade theory argues that international trade and capital (role of multi-national companies) would increase income-inequality between the nations (and within country as well) simply because the foreign trade and capital would be biased towards advanced high-technology and high-skilled workers rather than low-skilled workers (Krugman, 1987, 2012, 2014 and Stiglitz, 2002 and 2012, Lawrence and Slaughter, 1993)³. There is a complementarity between the use of high-skilled workers and capital to increase the profits and depress wages, which leads to higher income-inequality due to lower employment of workers and lower wages to the workers in general. Thus, the main objective of this paper is to empirically analyze the skilled-biased technological change in the Indian services sector

3. DATA AND ECONOMETRIC METHODOLOGY

To examine a complementarity between profit-wage and capital-labour ratio, the prowess data of Indian services sector is used from Centre for Monitoring Indian Economy (CMIE) for the period of 1999-2017. There are different variables are used for the seven sub-sectors of Indian services sector. The employment in the six-subsectors is compared with the seventh sub-sector-information technology (IT) sector as the base category, with the help of dummy variables. The sequence of dummy variables for the seven-subsectors is used as follows: Financial Services, communication, miscellaneous, hotel, trade; transport, and information

¹ In the case of China, however this share went down by 2 percentage-points from 8% in 1995 to 6% in 2013, whereas for the world as a whole, this share rose only by 1 percentage-point from 11% in 1995 to 12% in 2013. Comparatively, China being a low-skilled labour abundant economy has been focused on the production and export of low-skilled labor-intensive manufacturing products and has been the leader in the exports of manufacturing products at global level.

² Girma and Gorg (2007) elaborated that FDI have positive impacts on the absolute wages but have negative impacts on relative wages, which perpetuates wage-inequality in the trading-economy.

³ However, there is another view of the non-linearity impacts of FDI on wage-inequality, which asserts that at the first stage FDI increases wage inequality but later it decreases the inequality in the receiving countries by using a large panel of 100 developed and developing countries for the period, 1980-2002 (Fagini and Gorg, 2011).

technology. The names of other variables are used for the panel regressions with random and fixed effects are as follows: capital (K), labour (L), production (Q), exports (X), imports (M), wages (W), profit (Profit), profit-wage gap (profit-wagegap), and capital-labour ratio (KLratio); exports to output ratio (XQratio) and imports output ratio (MQratio). All these variables are logged to examine the percentage changes, which makes simplicity to interpret.

4. ECONOMETRIC ANALYSIS

4.1 Employment conditions

To examine the conditions of employment, the panel regression with random effect is estimated, as Breusch and Pagan Lagrangian multiplier test for random effects is conducted. The employment elasticity of output in the services sector is lower at 0.16, which is significant at 10% level. The effect of profit on employment is negatively related, which is signified by the value of lnprofit variable at (-) 0.02, this implies that 10% increase in profit will decline lead to a decline in employment by 0.2%. The coefficients of logged exports (lnX) and logged capital (lnK) are 0.02 and 0.08 respectively. The effect of wages on employment (lnW) is positive and shows highest impact with the value of its coefficient at 0.43. There is no significant difference between the percentage changes in employment levels of the IT sector and both the financial services and communication sectors, as they are not significant at 10% level. However, miscellaneous firms have lower percentage in employment than that of the IT sector by 26%. Hotel services have higher percentage of employment than that of the IT sector by 42%. Trade and transport have lower percentage of employment in comparison to that of IT sector; by 63% and 77%, respectively.

4.2 Skill-biased technological change

To test the skill-biased technological change, logged profit-wage variable (lnprofitwagegap) is regressed on the independent variable logged capital-labour (lnKLratio) ratio and other control variables are the sub-sectors dummies and logged exports-output ratio (lnXQratio) and logged imports-output ratio (lnMQratio). There is a complementary between profit-wage and capital-labour ratio as the coefficient of lnKLratio is 0.13, significant at level of 1%. This means that 10% increase in capital labour ratio that has positively increased the profit-wage gap by 1.2%, testing skill-biased technological change, which is also true in the case of import of firms as further explained that there is positive causal relationship of import to the profit-wage gap. There is no significant difference between the profit-wage gaps of IT sector and the other five sub-sectors except financial services sector as the coefficients of the five sectors are not significant at 10% level. However, the coefficient of dummy 1 of financial services is 0.15, which is significant at 1%. This implies that financial services sector has higher profit-wage gap in comparison to the IT sector, by 15%. The values of

coefficients of lnXQratio and lnMQratio are - 0.04 and 0.04 respectively significant at 5% level, implying that increase in exports by 10% leads to 0.4% decline in profit wage-gap and 10% increase in imports leads to rise in profit wage gap by 0.4%. This may imply that India imports more capital goods and exports more labour intensive goods.

To examine the separate or partial effects marginal effects on wages and profits, the two random-effect panel regressions ran on these two dependent variables. To know the effects of capital and labour on profits, the coefficient of lnK is significant and positive at 0.21 and the coefficient of lnL is significant negative at (-) 0.07. These values signified that an increase in labour inputs by 10%, then it will reduce the profit by 0.7%, as it has cost for the firms. However an increase in capital-inputs by 10% would result in an increase in profit by 2.1%, capital stock leads to higher profit as it is expected. At the significance level of 1%, the coefficients of the lnQ, lnW, lnM are 0.28, 0.46 and 0.11 respectively and coefficient of lnX is not significant at 10% level. The percentage increase in output, wages and imports have positive effects on profits. A 10% increase in wages leads to 4.6% increase in profits, which shows inelastic impact of wages on profits, showing cost of labour for firms in terms of higher wages. Two sector dummy variables are significant, these dummies are 1 (at 1% level) and 5 (at 5% level), their values are 1.38 and (-) 0.32 respectively.

Table 1: Estimates of Panel Regressions with fixed and random effects

Dependent Variable: lnprofit wage gap		
Variable	fixed	random
lnK .	.14524292**	.2049265***
lnL	-09863751*	-.0682069*
lnQ	.41130272***	.28093207***
lnW	.3203636***	.45533586***
lnM	.05600262**	.10651894***
lnX .	04114234*	.02470238
sectordummy		
1	1.3841067***	
2	.0152758	
3	.2088532	
4	.08407848	
5	-.31610316*	
6	-.03691574	
cons	-.32576187 -1.0228939***	
N = 2629		
legend: * p<0.001		

4.3 Wages and Profits

Panel regressions of Fixed-effects and random effects, are examined for the factors of wages. Increase in employment have highest positive effects on the wages

and even increase in production also leads to higher wages, in comparison to the effects of profit, capital, exports and imports. If we compare the effects of capital on wages and profits then, there are higher positive effects on profits as the coefficients of lnK in profits and wages panel random effect regressions are 0.21 and 0.16 respectively. However the coefficients of lnL in profits and wages panel random effect regressions are (-) 0.07 and 0.38 respectively. These effects imply that there are significantly higher positive effect on profits from capital accumulation in the Indian services sector, as compared to the contribution in wages.

Table 2: Estimates of Panel Regressions with fixed and random effects

Dependent Variable: lnW		
Variable	random	fixed
lnProfit	.10496252***	.07020856***
lnK	.16063437***	.24230072***
lnL	.38134746***	.29508259***
lnQ	.2964743***	.38256814***
lnM	.05436087***	.07127212***
lnX	.06064694***	.05869372***
sectordummy		
1	.07699635	
2	-.65865**	
3	-.16127554	
4	-.50712911**	
5	-1.000621***	
6	-.45090731**	
cons -.71549015*** -1.3887672***		
N = 2629		
legend: * p<0.001		

The labour inputs have negatively affected the profit rates and positively affected the wages as it provides employment. But Indian services sector is capital intensive which is reflected in the Economic Survey 2016-17 that it contributes 53% in Indian GDP and only 29% is provided employment in Total Indian employment. This implies that there is a gap of 24% gap between the shares of Services sector contributions in Indian GDP and employment. Even The Economic Survey also includes other services sectors which are public funded and welfare oriented like, public education, health and community services sectors, which take care more employment opportunities in comparison to the private sector and multinational companies (MNCs) in this prowess data of seven sub-sectors of the Indian services.

Table 3: Estimates of Panel Regressions with fixed and random effects

Dependent Variable: lnProfit		
Variable	fixed	random

lnK	.14524292**	.2049265***
lnL	-.09863751*	-.0682069*
lnQ	.41130272***	.28093207***
lnW	.3203636***	.45533586***
lnM	.05600262**	.10651894***
lnX	.04114234*	.02470238
sectordummy		
1	1.3841067***	
2	.0152758	
3	.2088532	
4	.08407848	
5	-.31610316*	
6	-.03691574	
_cons -.32576187 -1.0228939***		
N = 2629		
legend: * p<0.001		

4.4 Productivities of Capital and Labour in Indian services sector

To examine empirically the trajectories of the higher productivities in Indian services sector, logged output is ran on logged labour, logged capital, logged exports and logged imports. The two panel regressions of fixed and random effects are estimated. The random effect panel regression is used to estimate the marginal effects of sector dummies.

The contribution of labour is highest in the total services production, as the coefficients of lnL, lnK, lnX and lnM are 0.38, 0.27, 0.13 and 0.18 respectively. The highest contribution of labour may resulted from the high-skilled workers in these sectors during the times of ICT revolution in India. However, the return or payment for the higher labour productivities is not optimally paid. Because there is a complementary between profit-wage gap capital-labour ratio. This implies that there is higher use of capital in comparison to the provision of employment in the Indian sector.

Table 4: Estimates of fixed and random effects in panel regressions

Dependent Variable: lnQ		
Independent Variable	fixed	random
lnL	.38145334***	.4011982***
lnK	.2733133***	.22174896***
lnX	.12894182***	.13646798***
lnM	.18194365***	.19832122***
Sector dummy		
1	-1.0331892***	
2	1.2465877***	
3	.67357366***	
4	.10954201	

 5 1.500323***

 6 1.2967103***

 _cons 1.8417601*** 1.3116247***

 N = 3251

 legend: * p<0.05; ** p<0.01; *** p<0.001

In the Indian services sector, the percentage changes in production are higher in most of the sectors in comparison to the IT sector, except financial services, as the dummies have positive values. The financial services have lower output growth rate in comparison to the IT sector and there is no significant difference between the percentages changes in IT and hotel sector.

5. CONCLUDING REMARKS AND POLICY IMPLICATIONS

In the process of globalisation era, the foreign and private capital, use of high-skilled workers and modern advanced-technology are expanding, which is same trend in the Indian services sector. The private capital accumulation has extracted higher profits in terms of surplus-value, through higher labour productivity, lower employment and lower wages. The extraction of higher surplus is created a gap between profits and wages in the Indian services sector. There are two challenges emerged in the Indian services sector: (i) Due to lower wages and employment, it has led to deficiency of aggregate demand in the Indian economy; (ii) Because of higher labour productivity and ICT revolution in Indian services sector, there is over-production in Indian services sector, which is further aggravated due to lower external demand in the US and other development countries during post-global financial crisis period. The US is adopting more protectionist approach to deal their domestic economic problems including higher unemployment. There is need to revamp the Indian services sector for its sustainable future: Two specific policies can be adopted: (i) increase public investment in the Indian services sector to increase the employment and wages, which ultimately increase the aggregate demand to meet the aggregate output or supply, (ii) reverse the complementary between profit-wage and capital labour ratio into other way around as a complementary between wage-profit and labour-capital ratios, as that can lead to stable and sustainable demand and supply in Indian economy.

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