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# ARTHA VIJÑĀNA

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## Articles

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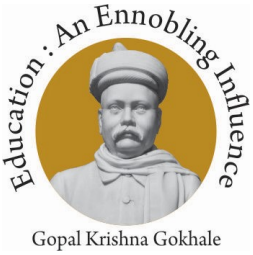


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### Articles

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# Efficiency of Elementary Education System in India: Exploration of Regional Asymmetries and Convergence Clubs

**Rachita Gulati, Anup Kumar Bhandari and Sunil Kumar**

*This paper examines the efficiency variations and identifies convergence clubs in the elementary education systems across Indian states and union territories. An innovative non-oriented sequential directional distance function-based metafrontier (NSDDFM) approach is applied to compute reliable efficiency estimates and decompose inefficiency in education delivery. The regional clubs on education development are identified using Phillips and Sul's (2007, 2009) club convergence approach. Empirical results reveal significant efficiency variations across states and years, and special category states & union territories (SCS&UTs) show higher efficiency in the elementary education delivery process relative to general category states (GCSs) during the sample period. The analysis of the regional gaps reveals that SCs & UTs employ best elementary education practices, and GCSs operate farther from the national best-practice frontier. The convergence test rejects the null hypothesis of parity in the elementary education delivery process and shows evidence of three convergent and one divergent club across states.*

**Keywords:** Elementary education; School dropouts; Sequential directional distance function; Club convergence; Metafrontier

## I Introduction

In India, policymakers have always put the growth of elementary education high on the national development planning agenda. The central and state governments started several action-oriented educational programmes like the District Primary Education Programme in 1994, the Sarva Shiksha Abhiyan (Education-For-All

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campaign) in 2000-2001, the Right of Children to Free and Compulsory Education Act in 2009, and the Samagra Siksha (Integrated Scheme for School Education) in 2018. These programmes are meant to give all children between the ages of 6 and 14 a good elementary education. All policy initiatives aim to stimulate universal education, girls' enrolment, and student retention, and meet the needs of the educationally underprivileged sections to reduce gaps between gender, regions and social categories (Government of India 2010). Consequent to these initiatives, the provision and use of elementary education services in India have improved phenomenally. The official statistics released by the Unified District Information System for Education Plus (UDISE+) show that the gross enrolment ratio went up from 82.5 per cent in 2003 to 96.9 per cent in 2016, and the number of schools rose to 1,449,078 in 2016 at all-India level. Besides, the school infrastructure has improved noticeably over the years (*see* Section II for more details).

Despite these developments and substantial efforts, there are noticeable variations in the overall elementary educational development outcomes across states and union territories (NUEPA 2017). The distribution of schools, infrastructure, computer and internet access, learning outcomes, the number of students per teacher, and quality of teaching have been found to vary greatly across states and regions (UDISE 2019, NAS 2020). But there isn't much empirical evidence on measuring spatial heterogeneity in efficiency levels of elementary education systems in India. Gourishankar and Lokachari (2012), Ghose (2017), and Purohit (2017) are a few past research endeavours in this direction. One of the key concerns with the above studies is that they only look at the quantitative outcomes and do not account for quality aspects and undesirable outcomes in modelling efficiency production specification. Except for Ghose (2017), existing studies ignore spatial heterogeneity and regional asymmetries while investigating differences in the efficiency of elementary education systems across states.

In light of this brief background, the objective of this paper is to come up with more accurate and reliable efficiency estimates as to how efficiently elementary school education systems in 28 Indian states and 8 Union Territories (UTs) are progressing. The efficiency analysis is conducted for the period from 2010-2011 to 2015-2016. This chosen study period investigates the efficacy of states and UTs in achieving the goal of universal primary education as determined under the "Education for All" (EFA) programme of the United Nations Development Programme (UNDP). The EFA goals align with the "Millennium Development Goals" and aim at helping countries, including India, to reach desired goals by 2015. We believe that policymakers will benefit from the empirical findings of the study in assessing the inefficiency gaps in elementary educational attainment by states and UTs during the analyzed period. The study will also be useful in identifying the states that did the best and also which ones lack in the attainment of universal primary education, so that they can plan for future development strategies effectively. Our efficiency assessment framework explicitly incorporates the "school dropouts" as an undesirable educational outcome. In addition, we also take into account heterogeneity in education systems across

general category states (GCSs) and Special Category States and Union Territories (SCS & UTs). The differences between GCSs and SCS & UTs exist because of differences in their demographic, fiscal, institutional, and economic settings/environments. The efficiency measurement framework used in this study, which we call the non-oriented sequential directional distance function-based metafrontier approach (NSDDFM), integrates the sequential data envelopment analysis (DEA)-based directional distance function (DDF) model with the metafrontier framework. The main benefits of the NSDDM model are that it allows the simultaneous expansion of desirable outputs and contraction of the undesirable, overcomes the problem of dimensionality, accounts for technical progress, and deals with unobserved spatial heterogeneity in the efficiency assessment.

The paper also uses the state-of-the-art convergence clustering procedure developed by Phillips and Sul (2007, 2009) to find the convergence clubs across states. The present study is perhaps the first attempt to look into the convergence clubs for elementary education delivery systems across states and UTs. In particular, we address one of the important research questions: do states form convergence clusters and converge to multiple steady-state equilibria on their level of elementary educational delivery? The approach is better than traditional $\sigma$- and $\beta$- convergence tests proposed by Barro, *et. al.* (1991) and Barro and Sala-i-Martin (1992) in economic growth literature. While the $\sigma$-convergence measures cross-sectional dispersion in the variable of interest, the $\beta$-convergence captures the catching-up effect. In both tests, the non-rejection of the null hypothesis connotes the absence of the convergence phenomenon. Phillips and Sul (2007) argued that failing to conclude convergence for the country as a whole does not indicate the absence of regional convergence clubs. Therefore, they advocated the use of the club convergence clustering approach. This approach is more innovative and has the following intrinsic advantages. First, this approach is based on a non-linear time-varying assumption that captures transitional dynamics and heterogeneity in the underlined phenomenon across observations. Second, this approach identifies the existence of club cluster(s) that converge into multiple steady-state equilibria. Third, this approach does not impose strong assumptions on the trend or stochastic stationarity properties on the estimated efficiency. Owing to the advantages mentioned above, we consider this approach the most convincing and compelling choice for testing convergence patterns and club formation on elementary education development across states and union territories.

The paper adds to the body of literature in many ways. First, this is the foremost empirical study focusing on both quality and quantity aspects of the school education system while measuring spatial efficiency differences. For a proper accounting of quality, we include the "dropout rate" as an undesirable output along with other desirable outputs in the output vector. Second, the study develops a novel non-oriented sequential directional distance function-based metafrontier approach (NSDDFM) that takes care of spatial heterogeneity and

handles dimensionality issues by sequentially increasing the number of observations, disentangles inefficiency, and captures the impact of undesirable factors. Third, we identify convergence clubs in school education systems in India, which is perhaps the foremost attempt. We are sure that the empirical results will help the education planners to identify the states or their groups that are moving ahead or falling behind in terms of efficiency in attaining school education outcomes.

The rest of the paper is organized as follows: the next section provides the geographical profile of states and union territories and the stylized facts on elementary education indicators. The subsequent section presents the methodological frameworks used and describes data and variables for efficiency measurement. The penultimate section discusses the empirical results, and the final section concludes the discussion.

## II Elementary Educational Indicators: Some Stylized Facts

As of 2016-2017, the geographical profile of India represents a total of 36 states and union territories with 18 General Category States (GCSs), 11 Special Category States (SCSs), and 7 Union Territories (UTs). There persist differences in the fiscal, institutional, and economic environments across GCSs and SCS&UTs. The GCSs depend on state finances, wherein the SCSs & UTs depend highly on the central government's finances to allocate funds for educational schemes. Also, SCSs & UTs share a few common characteristics like hilly territory, low population density and/or tribal population, borders with neighbouring countries, economic and infrastructural backwardness, etc., which raises a need for special considerations to be given to them while framing development policies. The official statistics reveal that all the states have made significant progress in achieving the accessibility targets for elementary education in the past decade. As evident from the DISE data, access to schools has increased from 81,807 in 2002-2003 to 1,467,680 in 2016-2017, and the gross enrolment ratio in primary and upper primary schools reached 95.12 per cent and 90.73 per cent, respectively (see Table 1).

Despite the fact that the significant progress made in access to elementary school education, the nation is still facing several daunting challenges in disseminating elementary education. First, gender disparities are enormous in terms of literacy rates across states and UTs. In GCSs, the overall literacy rate indicates variations from the lowest of 63.83 per cent in Bihar to the highest of 93.91 per cent in Kerala during 2016-2017. Further, eleven states fall below the national literacy rate of 74 per cent, with three states (Kerala, Lakshadweep, and Mizoram) being close to 100 per cent literacy. There is still a significant gap in male and female literacy rates of around 20 per cent across states and UTs. Second, access to schools has increased, but distribution is not uniform across the states. Further, of 36 states and UTs, 16 lie below the national average in terms of gross enrolment ratio in primary and 25 in upper primary education levels. The GC state,

like Uttar Pradesh, had the highest number of elementary schools, 254,204 in 2016-17. Still, the gross enrolment ratio (GER) in primary (87.16 per cent) and upper primary (72.74 per cent) is far below the national average. The bottom five states in terms of GER in primary education are Tripura (11.04), Lakshadweep (70.02), Jammu & Kashmir (77.09), Chandigarh (80.07), and Nagaland (81.67). However, the SC state, like Mizoram, has 3,077 elementary schools and a high GER of 115.68 per cent and 127.5 per cent at primary and upper primary levels, respectively.

The third concern is the double-digit school dropout rates at the elementary level, especially in the SCSs. Nagaland (20.09 per cent), followed by Arunachal Pradesh (19.97 per cent) and Meghalaya (17.66 per cent), recorded a higher dropout in the year 2016-2017. Among the GCSs, Jharkhand reported the highest dropout of 16.95 per cent, far above the national dropout rate of 6.96 per cent. Moreover, the dropout rate is high at a transition from primary to upper primary level, particularly in Grade V, and the retention rate is quite low in SCSs, especially for girl students. Fourth, as far as school infrastructure is concerned, UTs outperform GCSs and SCSs in India. The per centage of schools with safe drinking water, girls' toilets, and electricity have reached around 100 per cent for UTs, while the situation is still not perfect in GCSs and SCSs. These distinct educational characteristics across GCSs and SCS & UTs explain clear heterogeneity across Indian states.

Table 1: Key Elementary Educational Indicators in India (2016-17)

| Elementary educational indicators↓ | General category states (GCSs)# | Special category states (SCS&UTs)# | Union Territories# | All states |
|---|---|---|---|---|
| Number of elementary schools | 1,289,069 | 171,065 | 7,546 | 1,467,680 |
| GER (primary schools) | 95.92 | 94.09 | 85.51 | 95.12 |
| GER (upper primary schools) | 94.28 | 98.61 | 92.35 | 90.73 |
| Girls' enrolment | 0.93 | 0.95 | 0.93 | 0.94 |
| Dropout rate (%) | 5.31 | 10.98 | 0.96 | 6.96 |
| Retention rate(primary) | 87.93 | 69.46 | 98.20 | 84.28 |
| Retention rate(upper primary) | 78.19 | 61.26 | 93.14 | 75.92 |
| Female teachers (%) | 52.42 | 46.25 | 66.24 | 53.22 |
| Pupil-teacher ratio | 22.61 | 12.00 | 16.43 | 18.17 |
| Student-classroom ratio | 24.94 | 16.36 | 28.57 | 23.03 |
| Computer facilities (%) | 36.39 | 26.75 | 83.23 | 42.55 |
| Schools with girls' toilets (%) | 97.68 | 94.45 | 100 | 97.14 |
| Schools with drinking water (%) | 98.48 | 89.11 | 100 | 95.91 |
| Schools with electricity facility (%) | 74.23 | 47.54 | 98.20 | 70.74 |

Note: # indicates that average values are reported for GCSs, SCSs and UTs.

Source: Authors' compilation from DISE- Elementary State Report 2016-17.

The above discussion highlights that although in quantitative terms, the states have made significant strides in achieving the policy success related to improving access to elementary education, there are essential dimensions, including girls' enrolment, infrastructure, deployment of technology in teaching, learning achievements, dropouts, etc., where the Indian states really differ. Therefore, a state-level assessment is needed to understand the efficacy of the existing central and state governments' sponsored educational development programmes in explaining the educational efficiency across states.

## III Relevant Literature Review

In their extensive survey articles, from Worthington (2001), Johnes (2015), to De Witte and Lopez-Torres (2015), and Agasisti and Munda (2017), they have clearly pointed out that voluminous studies have examined educational efficiency using frontier approaches. The research efforts date back to the early eighties, with the vast majority of the studies in the efficiency literature focused on the education sector of developed countries with particular emphasis on the US, UK, and European Union (see Table 2 for more details on the international and national literature). The studies that focused on assessing the efficiency of education development in schools or regions include Bessent and Bessent (1980) and Bessent, *et. al.* (1982), Ray (1991), Fukuyama and Weber (2002), Primont and Domazlicky (2006), Conroy and Arguea (2008), Knoeppel and Sala, (2018) for USA; Portela and Thannassoulis (2001) for UK; Muniz (2002), Cherchye, *et. al.* (2010), Haelermans and De Witte (2012), Agasisti (2013) and Lopez-Torres *et al.* (2017) for EU nations; Yahia, *et. al.* (2018) for Tunisia; Haug and Blackburn (2017), Lee, *et. al.* (2019) for Australian schools; among others. In the literature on education efficiency, we observe two key concerns: (i) the choice of educational input and output factors in the efficiency production framework and (ii) an appropriate frontier methodology for efficiency measurement. Most commonly, proxies related to access to schools (number of elementary schools per lakh population), teachers' characteristics (education qualification, experience, etc.), staff support, school infrastructure and services (facilities, class sizes, etc.), and per-student expenditure are taken as input factors/variables, and the student achievements and enrolment rate as outputs variables in education efficiency measurement. Few recent studies have also proposed extensions by incorporating undesirable outputs jointly with desirable outputs (Yahia, *et. al.* 2018). For efficiency measurement, most popularly, the researchers have gauged the efficiency of schools or regions in education delivery by employing parametric (i.e., stochastic frontier analysis) and non-parametric (such as DEA, FDH, and order-*m* frontier) methods. Nevertheless, such efforts to measure the efficiency in education are very limited for emerging nations like India.

In the Indian context, only a few studies have evaluated the efficiency of the school education systems (*see* Table 2). Among those, Sankar (2007) estimated the efficiency of 19 Indian states in elementary education delivery using the data

for 2004-2005. Gourishankar and Lokachari (2012) developed the educational development efficiency model to benchmark 35 Indian states and UTs. The study claimed that Andhra Pradesh, Karnataka, Kerala and Tamil Nadu are efficient towards national educational development. The eastern states like Assam, Bihar, Jharkhand and Meghalaya are low-performing states, whereas the northern and western states are moderate performers. Dutta (2012) analyzed the technical efficiency variations in the elementary education systems (both primary and upper primary) across 29 states and union territories in 2007-2008 using DEA. The study revealed that Delhi, Goa, Himachal Pradesh, Kerala, Meghalaya, Nagaland, and Tamil Nadu are globally efficient states. While Gujarat, Karnataka and Mizoram are locally efficient states in terms of educational input-output. States like Bihar, Odisha, Uttar Pradesh, and Rajasthan are low-performing states. The study suggests that a state with a high educational outcome level should emphasize efficiency more than increasing investment. The state with low educational outcomes should look for more allocations for the education sector until it reaches the desirable outcomes. Ghose and Bhanja (2014) evaluated efficiency in the delivery of elementary education (primary and upper primary levels) for the 20 districts of West Bengal over the period from 2005-2006 to 2011-2012. The study finds that none of the districts of West Bengal is perfectly efficient in disseminating education at the primary and upper primary levels. Purohit (2018) assessed the efficiency of major urban Indian states in delivering elementary education in the years 2012-2013. The study revealed that many states could enhance the efficiency in input usage or maximize the output, i.e., enrolments. Better access to water and electricity can help to enhance enrolment and achieve higher literacy.

From the in-depth review of the literature, we draw the following observations. First, the existing literature mainly focused on assessing the efficiency of school education mainly for developed nations. This is perhaps due to limited data available for evaluating the performance of the education systems of developing and emerging nations. Also, most developing countries do not even participate in international education surveys like PISA. Second, although the studies have assessed inter-state and/or inter-district variations and reported efficiency variations in the delivery of the elementary education process, none of the studies has captured the technical progress and spatial heterogeneity in education development across states or regions. Third, due to the lack of comprehensive data at the school level and other complexities in choosing the input-output indicators and their potential impact, this area has remained under-researched and infeasible in India. This study thus analyzes state-wide variations in efficiency levels of school education by developing a production model that jointly deals with both desirable and undesirable inputs and outputs. There is hardly any study explaining the efficiency differences in the delivery of elementary education by accounting for school dropouts and heterogeneity across states.

Table 2: Studies on School Education Efficiency

| Author (Year) | Sample Coverage | Efficiency/Productivity measure | Frontier Approach | Inputs | Outputs |
|---|---|---|---|---|---|
| Bessent and Bessent (1980) | 55 Elementary schools in the USA 1976 | Technical efficiency | DEA | Achievement of pupils in mathematics and reading in the earlier year, Per centage of Anglo-Americans, Per centage not from low-income households, Attendance rate, Mobility index, Professional staff per pupil, Instructional expenditure per pupil, Job satisfaction of teachers, Social interaction amongst teachers, Motivation of teachers and principal, friendliness of principal, Index of teaching methods | Median per centile test scores in reading and mathematics |
| Ray (1991) | 122 districts of high schools in the USA; 1980-81 | Technical efficiency | DEA | Classroom teachers per Pupil, Support staff per pupil, Administrative staff per pupil | District average score in mathematics, language arts, writing, and reading of 9$^{th}$ grade students |
| Chakraborty, *et. al.* (2001) | 40 school districts in the USA; 1992-1993 | Technical efficiency | DEA, SFA | Student-teacher ratio, Percentage of teachers with an advanced degree, Percentage of teachers with more than 15 years of experience, Children with subsidized lunch, Percentage of district population having completed high school, Net assessed value per student | Test scores in the 11$^{th}$ grade in reading, writing and mathematics skill |
| Mizala, *et. al.* (2002) | 2000 schools in Chile, 1996 | Technical efficiency | DEA, SFA | Vulnerability index, Type of school, Geographical index, School size, Pupil-teacher ratio, Whether or not pre-school education is provided, Average teacher experience | The average score in Spanish and mathematics |
| Cherchye, *et. al.* (2010) | 3413 pupils in the Netherlands; 2003-04 | Educational efficiency | DEA, Robust Order-m | Number of instruction units assigned to pupil, Equal educational opportunity | Standardized scores in mathematics and the Dutch language |
| Gourishankar and Sai Lokachari (2012) | 28 States & 7 UTs; 2006-07 | Technical efficiency, Scale efficiency | DEA | Primary school and upper primary schools per 1000 population, Percentage of schools having infrastructure, Student-teacher ratio, Per centage of female teachers, pupil-teacher ratio, Per centage of the teacher with graduation and above, Per centage of professionally trained teachers, Per centage of the school received school development grant, Per centage of schools which received teaching learning material grant | Gross enrolment ratio, Per centage of students who have passed with marks over 60 per cent |

Contd…

Table 2: Studies on School Education Efficiency

| Author (Year) | Sample Coverage | Efficiency/Productivity measure | Frontier Approach | Inputs | Outputs |
|---|---|---|---|---|---|
| Dutta (2012) | 29 States (elementary level); 2007-08 | Technical efficiency | DEA | Primary and upper primary schools, Per centage of habitation access to a primary school within 1 km distance and upper primary school within 3-5 km, Per centage of trained teachers, Per centage of full-time teachers | Enrolment rate and completion rate in primary schools and upper primary schools |
| Ghose (2017) | 28 States & 7 UTs (elementary level); 2005-2011 | Technical efficiency | DEA-meta frontier | No. of schools per lakh population, Teacher-pupil ratio, Classroom-student ratio, Per centage of teachers with qualification graduation and above | Net enrolment ratio, Per centage of students who passed with 60 per cent in the examination |
| Lopez-Torres, *et. al.* (2017) | 1127 public primary schools in Spain, 2009-10 | Conditional Efficiency | Robust conditional order-m | Total number of teachers working at the school, School operational expenses, Socioeconomic level of the families | Number of students who pass the basic skill tests, Aggregate average marks in languages and Mathematics in the 6$^{th}$ grade |
| Yahia, *et. al.* (2018) | 105 secondary schools, Tunisia | Technical efficiency | DEA-DDF | Science, Language, and Mathematics learning time (in minutes) per week, Index of quality of physical infrastructure, Index of quality of school resources | PISA test scores on mathematics, reading and science literacy, Students leaving the school without certificates |
| Purohit (2018) | 19 major urban Indian states (elementary level); 2012-13 | Technical efficiency | DEA | The average number of instruction days, Schools established in 2002, Single-classroom schools, Student-classroom ratio, | Enrolments in urban primary and upper primary |
| Lee, *et. al.* (2019) | 430 state primary schools in Australia, 2009-13 | Technical efficiency | DEA-double bootstrap | The ratio of FTE teaching staff per FTE student, cumulative capital expenditure per FTE student | NAPLAN average scores in reading, writing, spelling, grammar and punctuation, and numeracy |
| Aparicio, *et. al.* (2020) | 6 Latin American Countries, 2006, 2012, 2018 | Technical efficiency | DEA-based Malmquist productivity index | Teacher/ student ratio, School resources index, Students' family background, schooling of parental education | Average score in reading, math, and science in PISA |

Source: Authors' elaboration.

## IV Methodology and Data

### *Sequential Directional Distance Function Based Metafrontier Approach*

This study develops a non-oriented sequential directional distance function-based metafrontier (*NSDDFM*) approach to estimate reliable efficiency estimates. The *NSDDFM* approach combines the ideas of the sequential production possibility set

of Tulkens and Vanden Eeckaut (1995), the direction distance function (*DDF*) of Chung, *et. al.* (1997), and the metafrontier of O'Donnell, *et. al.* (2008). Hayami and Ruttan (1970) were the first ones to pioneer metafrontier analysis. The key advantages of using this approach are that it (i) allows the simultaneous expansion of desirable outputs and contraction of undesirable outputs; (ii) takes all the past and the current year's observations or technologies in the construction of the efficiency frontier and allows the outward shifts in the efficiency frontier over time; (iii) overcomes the problem of dimensionality (if $n<k$) by successively increasing the number of observations in the following years; and (iv) accounts for unobserved heterogeneity among states and UTs. Hence, the observations for the current year and all the preceding years ($t$-1, $t$-2,..., $t$-T) are thus used in constructing the sequential efficiency frontier at time $t$. The mix of these three ideas enables us to compute technology gap ratios (*TGR*s) and break down the overall inefficiency (*OTIE*) into relative inefficiency (*RIE*) and technology gap inefficiency (*TGIE*). This approach involves the computation of the efficiency of an elementary education system, in a state relative to its own group frontier and metafrontier (a global frontier enveloping all the group frontiers)

At first, we compute the spatial efficiency with reference to the group frontier by assuming $k$=2 groups corresponding to GCSs and SCS & UTs. Let us consider a production process which includes '$s$' desirable output(s), i.e., $y=(y_1,y_2,....,y_s)\in\Re_s^+$ and '$l$' undesirable output(s), i.e., $b=(b_1,b_2,....b_l)\in\Re_l^+$ are jointly produced using a given level of $m$ input(s), i.e., $x=(x_1,x_2,....x_m)\in\Re_m^+$. The technology set is thus defined as $\Psi=\left\{(x,y,b)\in\Re_+^{m,s,l}\,\middle|\,(x,y,b)\text{ is feasible}\right\}$ where $\Psi$ describes the technologically feasible relationships of inputs ($x$) with the desirable ($y$) and undesirable outputs ($b$). It is noteworthy here that for the efficiency estimation, we assume undesirable output to be weakly disposable in the sequential DDF model, i.e., if $(y,\ b)\in P(x)$ and $0\le\theta\le 1,$ then $(\theta y,\ \theta b)\in P(x)$ (Chung, *et. al.* 1997; Fare and Grosskopf, 2006)[1]. The non-oriented directional distance function model for state '$o$' in $k^{\text{th}}$ group, with reference to own group technology under the assumptions of constant returns to scale and weak disposability of undesirable output, is given in the model (1) as follows:

$$\vec{D}_o^k(x,y,b;-d_x,d_y,-d_b)=\max_{\beta,\lambda}\beta$$

*s.t.*

$$\begin{aligned}
&\sum_{j=1}^{N_k}\lambda_j^k x_{ij}^k \le (1-\beta)x_{io}^k, && i=1,...,m\\
&\sum_{j=1}^{N_k}\lambda_j^k y_{rj}^k \ge (1+\beta)y_{ro}^k, && r=1,...,s\\
&\sum_{j=1}^{N_k}\lambda_j^k b_{lj}^k = (1-\beta)b_{lo}^k, && l=1,...,q\\
&\lambda_j^k \ge 0 && j=1,...,n
\end{aligned} \qquad \ldots(1)$$

In model (1), the vector $d=\left(-d_x,d_y,-d_b\right)$ is taken as $\left(-x_o,y_o,-b_o\right)$ and $\lambda_j^k$ is an intensity vector assigned to each state corresponding to the $k^{\text{th}}$ group. Further, $(1-\beta)b_{lo}^k$ and $(1-\beta)x_{io}^k$ are the maximum proportionate reduction of undesirable outputs and desirable inputs, respectively, and $(1+\beta)y_{ro}^k$ is the maximum proportionate expansion of desirable outputs. We define the efficiency score for the state '*o*' in $k^{\text{th}}$ group as: $\hat{E}_o^k=(1-\beta_o^{k*})/(1+\beta_o^{k*})$, where $\beta_o^{k*}$ is the optimal value of $\beta_o$ for state *o* in $k^{\text{th}}$ group. The efficiency score $\hat{E}_o^k$ lies between (0,1], and a higher value of $\hat{E}_o^k$ implies the better performance of the state under evaluation.

The sequential production possibility set in period $\tau$ is defined as $P_s^\tau\left(x^\tau,y^\tau,b^\tau\right)=P^1\left(x^1,y^1,b^1\right)\cup P^2\left(x^2,y^2,b^2\right)\cup\ldots\cup P^\tau\left(x^\tau,y^\tau,b^\tau\right)$. The DEA-based *NSDDF* for computing the efficiency score of state '*o*' in $k^{\text{th}}$ group under the sequential reference technology with the assumption of constant returns-to-scale ( $\hat{E}_o^{\tau\_group\ k}$ ) can be outlined as follows in the model (2):

$$\vec{D}_o^{\tau\_group\ k}(x^\tau, y^\tau, b^\tau; -d_x, d_y, -d_b) = \max_{\beta,\lambda} \beta_o$$

*s.t.*

$$\begin{aligned}
&\sum_{t=1}^{\tau}\sum_{j=1}^{N_k} \lambda_j^{tk} x_{ij}^{tk} \le (1-\beta_o^\tau) x_{io}^{\tau k}, \qquad i = 1,...,m \\
&\sum_{t=1}^{\tau}\sum_{j=1}^{N_k} \lambda_j^{tk} y_{rj}^{tk} \ge (1+\beta_o^\tau) y_{ro}^{\tau k}, \qquad r = 1,...,s \\
&\sum_{t=1}^{\tau}\sum_{j=1}^{N_k} \lambda_j^{tk} b_{lj}^{tk} = (1-\beta_o^\tau) b_{lo}^{\tau k}, \qquad l = 1,...,q \\
&\lambda_j^{tk} \ge 0 \qquad\qquad\qquad\qquad j = 1,...,n
\end{aligned} \qquad \ldots(2)$$

The efficiency scores with reference to metafrontier ( $\hat{E}_o^{\tau\_meta}$ ) is computed using model (3):

$$\vec{D}_o^{\tau\_meta}(x^\tau, y^\tau, b^\tau; -d_x, d_y, -d_b) = \max_{\beta,\lambda} \beta_o$$

*s.t.*

$$\begin{aligned}
&\sum_{t=1}^{\tau}\sum_{j=1}^{N_k}\sum_{k=1}^{K} \lambda_j^{tk} x_{ij}^{tk} \le (1-\beta_o^\tau) x_{io}^{\tau k} \qquad i = 1,...,m \\
\text{s} &\sum_{t=1}^{\tau}\sum_{j=1}^{N_k}\sum_{k=1}^{K} \lambda_j^{tk} y_{rj}^{tk} \ge (1+\beta_o^\tau) y_{ro}^{\tau k} \qquad r = 1,...,s \\
&\sum_{t=1}^{\tau}\sum_{j=1}^{N_k}\sum_{k=1}^{K} \lambda_j^{tk} b_{lj}^{tk} = (1-\beta_o^\tau) b_{lo}^{\tau k} \qquad l = 1,...,q \\
&\lambda_j^{tk} \ge 0 \qquad\qquad\qquad\qquad j = 1,...,n
\end{aligned} \qquad \ldots(3)$$

The Technology Gap Ratio (*TGR*) for state '*o*' in group *k* under sequential production technology is then defined as:

$$TGR_o^k = \frac{\hat{E}_o^{\tau\_\text{meta}}}{\hat{E}_o^{\tau\_group\ k}}$$

Since we have two groups of states, we define $TGR_o^{GCSs} = \hat{E}_o^{\tau\_\text{meta}} \Big/ \hat{E}_o^{\tau\_GCSs}$ and $TGR_o^{SCS\&UTs} = \hat{E}_o^{\tau\_\text{meta}} \Big/ \hat{E}_o^{\tau\_SCS\&UTs}$ . Note that *TGR* lies between (0,1] and measures the closeness of group frontier (state and UTs) to metafrontier (national

frontier). In addition, we decomposed the *OIE* (i.e., $OIE_o$ = 1- $\hat{E}_o^{\tau\_\text{meta}}$) and formulated all the inefficiency measures as: relative inefficiency for GCSs ($RIE^{\text{GCSs}}$) = 1- $\hat{E}_o^{\tau\_GCS}$, relative inefficiency for SCS&UTs ($RIE^{\text{SCS\&UTs}}$) = 1- $\hat{E}_o^{\tau\_SCS\&UTs}$, technology gap inefficiency for GCs ($TGIE^{\text{GCSs}}$) = $\hat{E}_o^{\tau\_GCSs}$ - $\hat{E}_o^{\tau\_\text{meta}}$, and technology gap inefficiency for SCS&UTs ($TGIE^{\text{SCS\&UTs}}$) = $\hat{E}_o^{\tau\_SCS\&UTs}$ - $\hat{E}_o^{\tau\_\text{meta}}$. Note here that under the sequential approach, we consider the data of 2010-2011 (first year) for obtaining the scores for 2010-2011; the combined data for 2010-2011 and 2011-2012 for getting the scores of 2011-2012. Similarly, 2012-2013 scores are based on the pooled data sheet of 2010-2011, 2011-2012 and 2012-2013. Therefore, the scores for a terminal year are based on the pooled data sheet of all the years.

### *Phillips and Sul's Club Clustering Procedure*

In the present study, we employ the club convergence clustering algorithm developed by Phillips and Sul (2007, 2009) to identify the convergence clubs on the elementary education development efficiency. As noted above, this approach holds superiority over traditional $\sigma$- and $\beta$- convergence tests, proposed by Barro, *et. al.* (1991) and Barro and Sala-i-Martin (1992) in economic growth literature. The $\sigma$-convergence measures cross-sectional dispersion in the variable of interest, and the $\beta$-convergence captures the catching-up effect. In both tests, the non-rejection of the null hypothesis connotes the absence of the convergence phenomenon. Phillips and Sul (2007) argued that failing to conclude convergence on elementary education development does not indicate the absence of convergence clubs. Therefore, they advocated the use of the club convergence clustering approach. This approach is more innovative and has the following intrinsic advantages. First, this approach is based on a non-linear time-varying assumption that allows capturing transitional dynamics and heterogeneity in the underlined phenomenon across observations. Second, this approach identifies the existence of club cluster(s) that converge into multiple steady-state equilibria. Third, this approach does not impose strong assumptions on the trend or stochastic stationarity properties of the estimated composite indices. Owing to the above-mentioned advantages, we consider this approach as the most convincing and compelling choice for testing convergence patterns and club formation on education efficiency across states and UTs.

### *The log(t) Regression Test*

In the first stage of this approach, we test the null hypothesis of convergence in $X_{jt}$ (in this article, it is $\hat{E}^{\tau\_\text{meta}}$) using the log *t* regression, estimated using (4):

$$\log\left(\frac{H_1}{H_t}\right) - 2log\{\log(t)\} = \alpha_1 + \alpha_2 \log(t) + u_{t,}$$

For t =[rT], [rT]+1, …., T with r >0 …(4)

where $\hat{\alpha}_2$ measures the speed and magnitude of convergence, *r* as a fraction of the sample that is discarded, which we set as 0.3 since the sample size is less than 50. $H_t = \sum_{i=1}^{n}\left(h_{jt}-1\right)^2 \Big/ n$ and $H_1/H_t$ is the cross-sectional variance ratio. Note that $h_{it}$ is relative transition coefficient computed as: $h_{jt} = X_{jt} \Big/ \left(\sum_{j=1}^{n} X_{jt} / n\right)$. If $t_{\hat{\alpha}_2} < -1.65$ (critical value), the null hypothesis of convergence is rejected at the five per cent significance level.

### *Clustering and Merging Algorithms*

In the second stage, we identify the convergence clubs using the clustering and merging algorithms. We implement the club clustering algorithm proposed by Phillips and Sul (2007) and the club merging algorithm developed by Schnurbus, *et. al.* (2017) to detect the clubs that converge to multiple steady-state equilibria. The procedure consists of repeated log *t*-tests that start with forming a core club, and new members are subsequently added or dropped to identify any convergent or divergent clubs. Interested readers can refer to Du (2017) for the detailed algorithm for this approach. However, the procedure is explained briefly below. The identification of clubs and final club merging is made using the five-step procedure, which is outlined below:

*Step 1:* (*Ordering the panel*) We sort the states and UTs in the panel in the decreasing order of their $X_{jt}$ (in this article, it is $\hat{E}^{\tau\_\text{meta}}$) in the last period under observation.

*Step 2:* (*Core Group Formation*) We form the core group by selecting the first *k*' states highest in terms of $\hat{E}^{\tau\_\text{meta}}$ identified from the ordered panel defined in Step 1. Then we perform the convergence test and estimate statistics $t_{\hat{\alpha}_2}(k)$ for each group of size *k'*. The core group of size $k'^{*}$ that converges is then chosen by

maximizing $t_{\hat{\alpha}_2}(k)$ under the condition that $\min\{t_{\hat{\alpha}_2}(k')\} > -1.65$ , then, select the states and UTs in the club. If no group of size *k*' satisfies this condition, then exit the clustering algorithm and conclude that there are no convergence clubs in the panel.

*Step 3:* (*Sieving for Club membership*) In this step, we add a state and UT one by one from the remaining $N-k^{**}$ states and UTs to the core group and again perform a log *t*-test. Then the state and UT are selected in the club that converges if the $t_{\hat{\alpha}_2}$ is greater than a chosen critical value of -1.65. This procedure is repeated for the remaining states until the maximum value of $t_{\hat{\alpha}_2}$ is not greater than -1.65, and at that point, the procedure is stopped to form the initial convergence club.

*Step 4:* (*Recursion*) Repeat Steps 1-3 for the remaining states and UTs if there are any states, identify other convergence clubs until all the remaining states and UTs fail to converge.

*Step 5:* (*Club merging*) To avoid having too many clubs, finally, we adopt the club merging algorithm developed by Schnurbus *et al.* (2017) to integrate clubs formed in Steps 2-4 to have the smallest number of convergence clubs. The club merging iterative procedure is implemented as follows. First, we run the log *t*-regression test for the initial convergence clubs 1 and 2. If the convergence hypothesis relating to the log *t*-test is validated jointly, then merge clubs 1 and 2 to form a new club 1. Second, we re-run the log *t*-test for the new club 1 and the initial club 3 jointly. If not, then we perform the test for initial clubs 2 and 3, clubs 2 and 4, so on. This procedure is repeated until a new club classification is obtained, and no further clubs can be merged.

## *Data and Selection of Variables*

The required data to calculate efficiency scores are obtained from "Elementary State Report Cards", a DISE database maintained by the National University of Educational Planning and Administration (NUEPA). This study is limited to the period from 2011 to 2016. This chosen study period investigates the efficacy of states and UTs in achieving the goal of universal primary education under the EFA programme of the UNDP. Note that the dataset for the period 2011-2014 pertains to a total of 35 regional entities, which are bifurcated into 17 GCSs and 18 SCS & UTs. The analysis for the years 2015 and 2016 is based on 36 regional entities, including 18 GCSs and 18 SCS & UTs. SCS & UTs face no hard budget constraints, and central transfer to these regional entities is high. The literature on education efficiency features a wide diversity of choices for both inputs and outputs. This study includes four inputs, two desirable outputs, and one

undesirable output for efficiency measurement. The output vector consists of i) the gross enrolment ratio, ii) the per centage of girls in total enrolment, and iii) the dropout rate. The variable dropout rate is taken as undesirable in the education delivery process. The input vector includes four variables: (i) the number of schools per lakh population, (ii) the teacher-pupil ratio in the school, (iii) the classroom-student ratio in the school, and (iv) per centage of teachers with qualification graduation and above. The last input variable captures the quality of teacher input.

## V Empirical Results

### *Efficiency Levels across States*

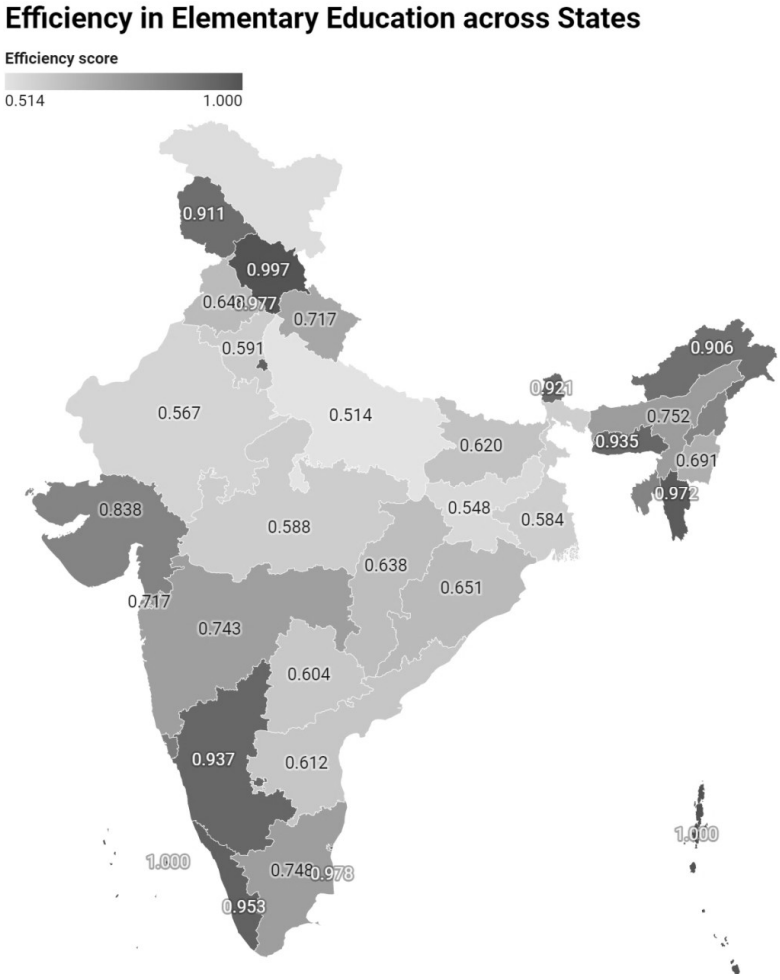
The yearly efficiency scores computed relative to the sequential metafrontier are presented in Table 3, and mean estimates can be visualized in Figure 1. We note significant variations across states and years in efficiency levels in the provision of elementary education in India. An average efficiency level across all states and years is 0.785, implying that a typical regional entity, on average, could have the potential to simultaneously reduce undesirable (school dropouts) and input factors and expand the desirable output factors by about 21.5 per cent. This potential adjustment in input and output factors varies across states, UTs and years. The findings uncover that no GCSs demonstrate 100 per cent efficiency in elementary education delivery during the sample period. Kerala (0.953), Karnataka (0.937), and Goa (0.864) are the three best-performing GCSs. Further, Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh, show the lowest efficiency in the elementary education delivery system. Moreover, the top three SCS&UTs include Himachal Pradesh (a hilly state) (0.997), Lakshadweep (1), and Andaman & Nicobar Islands (1).

Table 3: Yearly Estimates of Efficiency Scores for Indian States Corresponding to Sequential DDF Meta-Frontier (2010-11-2015-16)

| States | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014/15 | 2015-16 | Average |
|---|---|---|---|---|---|---|---|
| *Panel A: Efficiency scores for GCSs* | | | | | | | |
| Andhra Pradesh | 0.647 | 0.604 | 0.633 | 0.622 | 0.602 | 0.565 | 0.612 |
| Bihar | 0.698 | 0.707 | 0.507 | 0.469 | 0.624 | 0.714 | 0.620 |
| Chhattisgarh | 0.679 | 0.627 | 0.629 | 0.631 | 0.669 | 0.591 | 0.638 |
| Goa | 0.85 | 0.705 | 0.689 | 1 | 0.975 | 0.963 | 0.864 |
| Gujarat | 1 | 1 | 1 | 0.688 | 0.696 | 0.646 | 0.838 |
| Haryana | 0.571 | 0.575 | 0.73 | 0.58 | 0.603 | 0.486 | 0.591 |
| Jharkhand | 0.559 | 0.515 | 0.535 | 0.564 | 0.561 | 0.552 | 0.548 |
| Karnataka | 1 | 0.837 | 1 | 0.885 | 1 | 0.901 | 0.937 |
| Kerala | 0.742 | 0.974 | 1 | 1 | 1 | 1 | 0.953 |
| Madhya Pradesh | 0.624 | 0.585 | 0.576 | 0.581 | 0.583 | 0.579 | 0.588 |
| Maharashtra | 0.903 | 0.759 | 0.709 | 0.67 | 0.768 | 0.651 | 0.743 |
| Odisha | 0.705 | 0.627 | 0.633 | 0.65 | 0.668 | 0.623 | 0.651 |
| Punjab | 0.75 | 0.686 | 0.669 | 0.621 | 0.629 | 0.535 | 0.648 |
| Rajasthan | 0.565 | 0.569 | 0.58 | 0.583 | 0.565 | 0.54 | 0.567 |
| Tamil Nadu | 0.781 | 0.81 | 0.624 | 0.628 | 0.647 | 1 | 0.748 |
| Telangana | * | * | * | * | 0.622 | 0.586 | 0.604 |
| Uttar Pradesh | 0.535 | 0.495 | 0.524 | 0.526 | 0.528 | 0.475 | 0.514 |
| West Bengal | 0.677 | 0.561 | 0.51 | 0.558 | 0.604 | 0.593 | 0.584 |
| *Panel B: Efficiency scores for SCS&UTs* | | | | | | | |
| A & N Islands | 1 | 1 | 1 | 1 | 1 | 1 | 1.000 |
| Arunachal Pradesh | 1 | 1 | 1 | 0.864 | 0.786 | 0.786 | 0.906 |
| Assam | 0.754 | 0.881 | 0.704 | 0.705 | 0.717 | 0.748 | 0.752 |
| Chandigarh | 1 | 1 | 1 | 0.863 | 1 | 1 | 0.977 |
| D & N Haveli | 1 | 1 | 0.616 | 0.516 | 0.583 | 0.584 | 0.717 |
| Daman & Diu | 0.808 | 0.562 | 0.535 | 1 | 0.6 | 0.617 | 0.687 |
| Delhi | 0.834 | 1 | 0.951 | 0.941 | 1 | 1 | 0.954 |
| Himachal Pradesh | 1 | 0.993 | 1 | 1 | 1 | 0.99 | 0.997 |
| Jammu & Kashmir | 0.974 | 0.944 | 0.943 | 0.919 | 0.844 | 0.844 | 0.911 |
| Lakshadweep | 1 | 1 | 1 | 1 | 1 | 1 | 1.000 |
| Manipur | 0.697 | 0.675 | 0.714 | 0.668 | 0.739 | 0.654 | 0.691 |
| Meghalaya | 1 | 1 | 0.929 | 0.917 | 0.891 | 0.87 | 0.935 |
| Mizoram | 1 | 0.984 | 0.969 | 1 | 0.986 | 0.89 | 0.972 |
| Nagaland | 0.908 | 0.82 | 0.765 | 0.812 | 0.93 | 0.764 | 0.833 |
| Puducherry | 1 | 1 | 1 | 1 | 0.933 | 0.933 | 0.978 |
| Sikkim | 1 | 1 | 0.524 | 1 | 1 | 1 | 0.921 |
| Tripura | 0.928 | 0.751 | 0.873 | 0.747 | 0.82 | 0.911 | 0.838 |
| Uttarakhand | 0.73 | 0.721 | 0.73 | 0.773 | 0.7 | 0.648 | 0.717 |
| All GCSs | 0.727 | 0.690 | 0.682 | 0.665 | 0.686 | 0.667 | 0.686 |
| All SCS&UTs | 0.924 | 0.907 | 0.847 | 0.874 | 0.863 | 0.847 | 0.877 |
| All India | 0.832 | 0.805 | 0.770 | 0.775 | 0.774 | 0.757 | 0.785 |

Source: Authors' calculations.

Figure 1: Mean Efficiency in Elementary Education across States and UTs (2011-2016)




### *Efficiency Comparisons across GCSs and SCS&UTs*

The comparative analysis of the efficiency reveals that, except for a few eastern states, SCS&UTs appear to have performed more efficiently than GCSs. This is clearly reflected from the distribution of efficiency scores for GCSs, which is the bi-model and to the left of SCS&UTs (*see* Figure 2). We observe a few states in the GCSs category whose efficiency levels are similar to that of SCS & UTs. The above results are statistically validated using the Simar-Zelenyuk-adapted Li test, reported in Table 4. We track down that the observed differences in the efficiency of GCSs and SCS&UTs are significant in most of the sample years and the entire study period since the null hypotheses of equality of distributions are rejected.

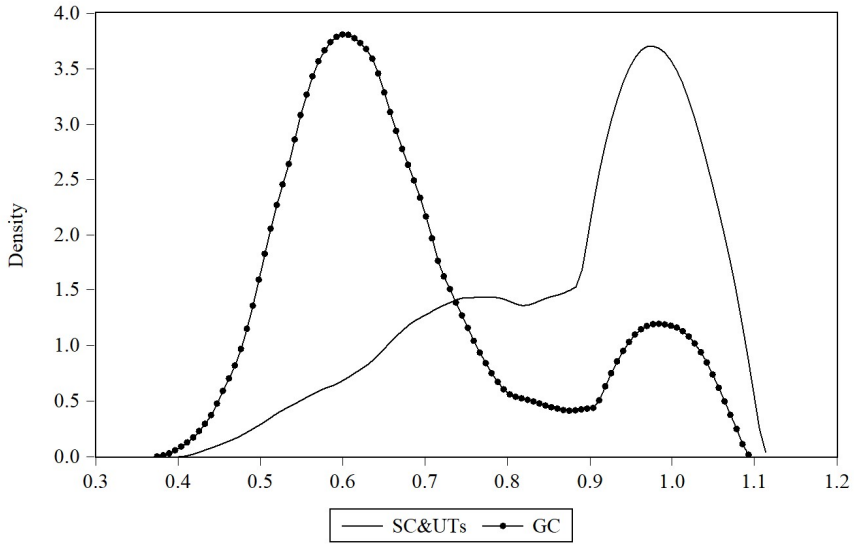
Table 4: Results of the Simar-Zelenyuk-adapted-Li test

| Year | Null hypothesis ($H_0$) | Test Statistic | Bootstrapped p-value | Decision |
|---|---|---|---|---|
| 2010-11 | pdf(efficiency of GCSs)=pdf(efficiency of SCS&UTs) | 6.40*** | 0.00501 | Reject $H_0$ |
| 2011-12 | pdf(efficiency of GCSs)=pdf(efficiency of SCS&UTs) | 5,744*** | 0.00000 | Reject $H_0$ |
| 2012-13 | pdf(efficiency of GCSs)=pdf(efficiency of SCS&UTs) | -0.435 | 0.18546 | Do not reject $H_0$ |
| 2013-14 | pdf(efficiency of GCSs)=pdf(efficiency of SCS&UTs) | 5.729*** | 0.00000 | Reject $H_0$ |
| 2014-15 | pdf(efficiency of GCSs)=pdf(efficiency of SCS&UTs) | 3.919*** | 0.00251 | Reject $H_0$ |
| 2015-16 | pdf(efficiency of GCSs)=pdf(efficiency of SCS&UTs) | 3.185*** | 0.00250 | Reject $H_0$ |
| 2010-11 to 2015-16 | pdf(efficiency of GCSs)=pdf(efficiency of SCS&UTs) | 24.86*** | 0.0000 | Reject $H_0$ |

Notes: i) pdf stands for probability density function, and ii) *** indicates statistically significant at 1 per cent level.

Source: Authors' calculations.

Figure 2: Technical Efficiency of GCSs and SCS&UTs for the Period 2011-2016




### *Technology Gap Ratios, Inefficiency, and Regional Heterogeneity*

The yearly mean estimates relative to group (regional) frontier and TGRs are reported in Table 5[2]. For all the states, efficiency scores relative to their own frontier are greater than those relative to the metafrontier. Thus, observed TGRs lie between 0 and 1, with an average $TGR^{SCS\&UTs}$ is 0.980 and an average $TGR^{GCSs}$ is 0.734. This indicates that SCS & UTs are innovators in education delivery because they operate more closely to metafrontier in most of the years, and *RIE* mainly drives their *OTIE*. Out of the observed 12.3 per cent of $OTIE^{SCS\&UTs}$, about 10.4 is due to $RIE^{SCS\&UTs}$, and a diminutive portion is due to not operating on the

national best-practice frontier. In the case of GCSs, a large portion (about 25.1 per cent) of $OTIE^{GCSs}$ is due to $TGIE^{GCSs}$.

Table 5: Mean Efficiency Scores Relative to the Group and Metafrontier, Technology Gap Ratios and Inefficiency Estimates

| Year→ Group↓ | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014/15 | 2015-16 | 2011-2016 |
|---|---|---|---|---|---|---|---|
| *Panel A: GCSs* | | | | | | | |
| $E^{\tau\_meta}$ | 0.727 | 0.690 | 0.682 | 0.665 | 0.686 | 0.667 | *0.686* |
| $E^{\tau\_GCSs}$ | 0.962 | 0.954 | 0.930 | 0.909 | 0.917 | 0.922 | *0.932* |
| $TGR^{GCSs}$ | 0.751 | 0.718 | 0.727 | 0.726 | 0.753 | 0.727 | *0.734* |
| $OTIE^{GCSs}$(%) | 27.7 | 31.6 | 32.1 | 33.8 | 31.4 | 33.3 | *31.6* |
| $RIE^{GCSs}$(%) | 3.6 | 4.3 | 6.6 | 8.6 | 8.3 | 7.8 | *6.5* |
| $TGIE^{GCSs}$(%) | 24.1 | 27.3 | 25.5 | 25.2 | 23.1 | 25.6 | *25.1* |
| *Panel B: SCS&UTs* | | | | | | | |
| $E^{\tau\_meta}$ | 0.924 | 0.907 | 0.847 | 0.874 | 0.863 | 0.847 | *0.877* |
| $E^{\tau\_SCS\&UTs}$ | 0.974 | 0.908 | 0.878 | 0.878 | 0.865 | 0.871 | *0.896* |
| $TGR^{SCS\&UTs}$ | 0.948 | 0.999 | 0.969 | 0.995 | 0.997 | 0.972 | *0.980* |
| $OTIE^{SCS\&UTs}$(%) | 7.6 | 9.3 | 15.3 | 12.6 | 13.7 | 15.3 | *12.3* |
| $RIE^{SCS\&UTs}$(%) | 2.6 | 9.2 | 12.2 | 12.3 | 13.5 | 12.9 | *10.4* |
| $TGIE^{SCS\&UTs}$(%) | 5.0 | 0.1 | 3.1 | 0.4 | 0.2 | 2.5 | *1.9* |

Source: Author's calculations.

### *Convergence Clubs*

The convergence clubs of sample states are presented in Table 6. We note that the log($t$) test rejects the null hypothesis of full convergence and supports the formation of three convergent clubs and one divergent club. The majority of the SCS&UTs belong to Club 1 and Club 2, while the GCSs mainly falls to Club 3. The observed difference in $\overline{E}^{\tau\_meta}$ across Club 1 and Club 3 is huge (0.961 *vis-à-vis* 0.653), with the states clustered in Club 3 experiencing the lowest efficiency level. Strikingly, D&N Haveli, Delhi, and Kerela fall into the non-convergent club. Club 3 shows a moderate convergence rate, as observed from the higher estimate of $\hat{\alpha}_2$. Since the estimated value $\hat{\alpha}_2$ is less than 2 in our case, we report the evidence of relative convergence in efficiency levels in India.

Table 6: Convergence Clubs on Elementary Education Delivery

| Clubs | $\hat{\alpha}_2$ (*t*-statistic) | Decision of log(*t*) test |
|---|---|---|
| *log(t) test for club convergence* | | |
| Test statistics | -1.3732 (-141.883) | Reject $H_0$ |
| *Spatial convergence clubs* | | $\overline{E}$Meta |
| **Club 1**: A & N Islands, Chandigarh, Goa, Himachal Pradesh, Karnataka, Lakshadweep, Mizoram, Puducherry, Sikkim | -0.011 (-0.040) | 0.961 (9) |
| **Club 2**: Assam, Jammu & Kashmir, Manipur, Meghalaya, Nagaland, Tamil Nadu, Tripura | -0.150 (-1.440) | 0.815 (7) |
| **Club 3**: Andhra Pradesh, Arunachal Pradesh, Bihar, Chhattisgarh, Daman & Diu, Gujarat, Haryana, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand, West Bengal | 0.249 (1.917) | 0.653 (16) |
| **Non-convergent group**: D & N Haveli, Delhi, Kerala | -3.689 (-18.839) | 0.875 (3) |

Source: Author's calculations.

## VII Conclusions and Policy Implications

This paper explores the efficiency differences in the elementary education delivery systems across 28 Indian states and 8 union territories. The DEA-based non-oriented sequential directional distance function-based metafrontier approach is employed for efficiency estimation. This approach precludes the possibility of technical regress and provides more reliable estimates of efficiency and technology gaps in the presence of undesirable factors (school dropouts in our case). In addition, the convergence clubs are detected using Phillips and Sul's (2007, 2009) club clustering procedure. The paper delivers some important findings. First, there exist significant differences in efficiency levels across states in the elementary education delivery systems. Kerala, Karnataka, and Goa are the three best-performing general category states. The persistently lower efficiency of Uttar Pradesh, Madhya Pradesh, Jharkhand and West Bengal is a grave concern for educational planners. Second, SCS&UTs perform significantly better in elementary education delivery relative to GCSs. Third, while UTs adopt best-practice elementary education production technology, few northeastern (like Manipur and Assam) and general category states operate farther from the national best-practice frontier. This finding provides strong evidence of heterogeneity across states' educational outcomes. Finally, the club clustering procedure reveals the absence of full convergence in education delivery systems across regional entities. However, it supports the formation of three convergent clubs and one divergent club.

The study draws significant policy implications. First, the empirical results suggest that states have a larger room for improvement in elementary education delivery. This is in line with the EFA Global Monitoring Report (2015), which states that only one-third of the nations have reached the status of a universal

education level. India, like many other nations, has not been able to achieve the goal of education for all elementary levels by 2015. Second, even though the policymakers put forth tireless efforts to standardize school education nationwide, we see only a remarkable improvement in educational outcomes in a few states and UTs. Therefore, the study suggests that the "one-size-fits-all" approach to educational development might not seem appropriate for all states. The optimal system requires a "focused" approach to implementing education policy programmes at the state level. Third, the dropout rate is still high, and many states have double-digit rates. Therefore, the state strategy should focus on improving the quality of school education. Future research efforts can be stretched out to determine the influential factors determining the spatial efficiency differences in elementary education delivery systems. The work can also be expanded to evaluate the efficiency and effectiveness of education development at all education levels, including the secondary level, and examine the effects of Covid-19 on education delivery.

## Endnotes

1. Under certain circumstances, the undesirable outputs cannot be strongly disposable, i.e., the DMU has to undertake cost in terms of desirable output to contract the level of undesirable output.
2. For the sake of brevity, we have only reported the mean estimates here. However, the state wise estimates are presented in Tables A1-A5 in Appendix A.

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## Appendix A

Table A1: Yearly Efficiency Scores for Indian States Corresponding to Group-Specific Sequential DDF Frontiers (2010-11 to 2015-16)

| States | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | Average |
|---|---|---|---|---|---|---|---|
| *Panel A: Efficiency scores for GCSs* | | | | | | | |
| Andhra Pradesh | 1 | 1 | 1 | 1 | 0.953 | 0.989 | 0.990 |
| Bihar | 0.747 | 0.731 | 1 | 0.622 | 0.647 | 0.714 | 0.744 |
| Chhattisgarh | 1 | 1 | 0.948 | 0.994 | 0.944 | 0.958 | 0.974 |
| Goa | 1 | 1 | 1 | 1 | 1 | 1 | 1.000 |
| Gujarat | 1 | 1 | 1 | 0.857 | 0.866 | 0.823 | 0.924 |
| Haryana | 0.934 | 0.843 | 0.846 | 0.838 | 0.867 | 1 | 0.888 |
| Jharkhand | 1 | 1 | 0.845 | 0.903 | 0.913 | 0.941 | 0.934 |
| Karnataka | 1 | 1 | 1 | 1 | 1 | 0.957 | 0.993 |
| Kerala | 1 | 1 | 1 | 1 | 1 | 1 | 1.000 |
| Madhya Pradesh | 1 | 1 | 0.969 | 0.994 | 1 | 0.983 | 0.991 |
| Maharashtra | 1 | 0.929 | 0.84 | 0.785 | 0.823 | 0.8 | 0.863 |
| Odisha | 1 | 1 | 0.908 | 0.918 | 0.923 | 0.957 | 0.951 |
| Punjab | 1 | 1 | 1 | 1 | 1 | 1 | 1.000 |
| Rajasthan | 1 | 0.97 | 0.919 | 1 | 1 | 0.959 | 0.975 |
| Tamil Nadu | 1 | 1 | 0.986 | 1 | 0.987 | 1 | 0.996 |
| Telangana | na | na | na | na | 1 | 0.97 | 0.985 |
| Uttar Pradesh | 0.756 | 0.799 | 0.7 | 0.717 | 0.694 | 0.7 | 0.728 |
| West Bengal | 0.948 | 0.998 | 0.919 | 0.91 | 0.884 | 0.849 | 0.918 |
| *Panel B: Efficiency scores for SCS&UTs* | | | | | | | |
| A & N Islands | 1 | 1 | 1 | 1 | 1 | 1 | 1.000 |
| Arunachal Pradesh | 1 | 1 | 1 | 0.864 | 0.786 | 0.786 | 0.906 |
| Assam | 0.968 | 0.898 | 0.729 | 0.727 | 0.748 | 0.748 | 0.803 |
| Chandigarh | 1 | 1 | 1 | 0.863 | 1 | 1 | 0.977 |
| D & N Haveli | 1 | 1 | 0.617 | 0.516 | 0.583 | 0.584 | 0.717 |
| Daman & Diu | 1 | 0.562 | 0.535 | 1 | 0.6 | 0.617 | 0.719 |
| Delhi | 1 | 1 | 1 | 0.967 | 1 | 1 | 0.995 |
| Himachal Pradesh | 1 | 0.993 | 1 | 1 | 1 | 1 | 0.999 |
| Jammu & Kashmir | 1 | 0.944 | 0.943 | 0.919 | 0.844 | 0.844 | 0.916 |
| Lakshadweep | 1 | 1 | 1 | 1 | 1 | 1 | 1.000 |
| Manipur | 0.859 | 0.675 | 0.714 | 0.668 | 0.739 | 0.739 | 0.732 |
| Meghalaya | 1 | 1 | 0.93 | 0.931 | 0.904 | 0.904 | 0.945 |
| Mizoram | 1 | 0.984 | 0.969 | 1 | 0.986 | 0.986 | 0.988 |
| Nagaland | 1 | 0.82 | 0.765 | 0.812 | 0.93 | 0.93 | 0.876 |
| Puducherry | 1 | 1 | 1 | 1 | 0.933 | 0.933 | 0.978 |
| Sikkim | 1 | 1 | 1 | 1 | 1 | 1 | 1.000 |
| Tripura | 0.978 | 0.751 | 0.873 | 0.747 | 0.82 | 0.911 | 0.847 |
| Uttarakhand | 0.73 | 0.721 | 0.73 | 0.781 | 0.7 | 0.7 | 0.727 |
| All GCSs | 0.962 | 0.954 | 0.930 | 0.909 | 0.917 | 0.922 | 0.932 |
| All SCS&UTs | 0.974 | 0.908 | 0.878 | 0.878 | 0.865 | 0.871 | 0.896 |

Source: Authors' calculations.

Table A2: Yearly Estimates of Technological Gap Ratios (TGRs) for Indian States (2010-11 to 2015-16)

| States | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | Average |
|---|---|---|---|---|---|---|---|
| *Panel A: TGRs for GCSs* | | | | | | | |
| Andhra Pradesh | 0.647 | 0.604 | 0.633 | 0.622 | 0.632 | 0.571 | 0.618 |
| Bihar | 0.934 | 0.967 | 0.507 | 0.754 | 0.964 | 1.000 | 0.855 |
| Chhattisgarh | 0.679 | 0.627 | 0.664 | 0.635 | 0.709 | 0.617 | 0.655 |
| Goa | 0.850 | 0.705 | 0.689 | 1.000 | 0.975 | 0.963 | 0.864 |
| Gujarat | 1.000 | 1.000 | 1.000 | 0.803 | 0.804 | 0.785 | 0.899 |
| Haryana | 0.611 | 0.682 | 0.863 | 0.692 | 0.696 | 0.486 | 0.672 |
| Jharkhand | 0.559 | 0.515 | 0.633 | 0.625 | 0.614 | 0.587 | 0.589 |
| Karnataka | 1.000 | 0.837 | 1.000 | 0.885 | 1.000 | 0.941 | 0.944 |
| Kerala | 0.742 | 0.974 | 1.000 | 1.000 | 1.000 | 1.000 | 0.953 |
| Madhya Pradesh | 0.624 | 0.585 | 0.594 | 0.585 | 0.583 | 0.589 | 0.593 |
| Maharashtra | 0.903 | 0.817 | 0.844 | 0.854 | 0.933 | 0.814 | 0.861 |
| Odisha | 0.705 | 0.627 | 0.697 | 0.708 | 0.724 | 0.651 | 0.685 |
| Punjab | 0.750 | 0.686 | 0.669 | 0.621 | 0.629 | 0.535 | 0.648 |
| Rajasthan | 0.565 | 0.587 | 0.631 | 0.583 | 0.565 | 0.563 | 0.582 |
| Tamil Nadu | 0.781 | 0.810 | 0.633 | 0.628 | 0.656 | 1.000 | 0.751 |
| Telangana | na | na | na | na | 0.622 | 0.604 | 0.613 |
| Uttar Pradesh | 0.708 | 0.620 | 0.749 | 0.734 | 0.761 | 0.679 | 0.708 |
| West Bengal | 0.714 | 0.562 | 0.555 | 0.613 | 0.683 | 0.698 | 0.638 |
| *Panel B: TGRs for SCS&UTs* | | | | | | | |
| A & N Islands | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Arunachal Pradesh | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Assam | 0.779 | 0.981 | 0.966 | 0.970 | 0.959 | 1.000 | 0.942 |
| Chandigarh | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| D & N Haveli | 1.000 | 1.000 | 0.998 | 1.000 | 1.000 | 1.000 | 1.000 |
| Daman & Diu | 0.808 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.968 |
| Delhi | 0.834 | 1.000 | 0.951 | 0.973 | 1.000 | 1.000 | 0.960 |
| Himachal Pradesh | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.990 | 0.998 |
| Jammu & Kashmir | 0.974 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.996 |
| Lakshadweep | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Manipur | 0.811 | 1.000 | 1.000 | 1.000 | 1.000 | 0.885 | 0.949 |
| Meghalaya | 1.000 | 1.000 | 0.999 | 0.985 | 0.986 | 0.962 | 0.989 |
| Mizoram | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.903 | 0.984 |
| Nagaland | 0.908 | 1.000 | 1.000 | 1.000 | 1.000 | 0.822 | 0.955 |
| Puducherry | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Sikkim | 1.000 | 1.000 | 0.524 | 1.000 | 1.000 | 1.000 | 0.921 |
| Tripura | 0.949 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.991 |
| Uttarakhand | 1.000 | 1.000 | 1.000 | 0.990 | 1.000 | 0.926 | 0.986 |
| All GCSs | 0.751 | 0.718 | 0.727 | 0.726 | 0.753 | 0.727 | 0.734 |
| All SCS&UTs | 0.948 | 0.999 | 0.969 | 0.995 | 0.997 | 0.972 | 0.980 |

Source: Authors' calculations.

Table A3: Yearly Estimates of Overall Inefficiency (OTIE) for Indian States (2010-11 to 2015-16)

| States | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | Average |
|---|---|---|---|---|---|---|---|
| *Panel A: OTIE estimates for GCSs* | | | | | | | |
| Andhra Pradesh | 35.3 | 39.6 | 36.7 | 37.8 | 39.8 | 43.5 | 38.8 |
| Bihar | 30.2 | 29.3 | 49.3 | 53.1 | 37.6 | 28.6 | 38.0 |
| Chhattisgarh | 32.1 | 37.3 | 37.1 | 36.9 | 33.1 | 40.9 | 36.2 |
| Goa | 15 | 29.5 | 31.1 | 0 | 2.5 | 3.7 | 13.6 |
| Gujarat | 0 | 0 | 0 | 31.2 | 30.4 | 35.4 | 16.2 |
| Haryana | 42.9 | 42.5 | 27 | 42 | 39.7 | 51.4 | 40.9 |
| Jharkhand | 44.1 | 48.5 | 46.5 | 43.6 | 43.9 | 44.8 | 45.2 |
| Karnataka | 0 | 16.3 | 0 | 11.5 | 0 | 9.9 | 6.3 |
| Kerala | 25.8 | 2.6 | 0 | 0 | 0 | 0 | 4.7 |
| Madhya Pradesh | 37.6 | 41.5 | 42.4 | 41.9 | 41.7 | 42.1 | 41.2 |
| Maharashtra | 9.7 | 24.1 | 29.1 | 33 | 23.2 | 34.9 | 25.7 |
| Odisha | 29.5 | 37.3 | 36.7 | 35 | 33.2 | 37.7 | 34.9 |
| Punjab | 25 | 31.4 | 33.1 | 37.9 | 37.1 | 46.5 | 35.2 |
| Rajasthan | 43.5 | 43.1 | 42 | 41.7 | 43.5 | 46 | 43.3 |
| Tamil Nadu | 21.9 | 19 | 37.6 | 37.2 | 35.3 | 0 | 25.2 |
| Telangana | na | na | na | na | 37.8 | 41.4 | 39.6 |
| Uttar Pradesh | 46.5 | 50.5 | 47.6 | 47.4 | 47.2 | 52.5 | 48.6 |
| West Bengal | 32.3 | 43.9 | 49 | 44.2 | 39.6 | 40.7 | 41.6 |
| *Panel B: OTIE estimates for SCS&UTs* | | | | | | | |
| A & N Islands | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Arunachal Pradesh | 0 | 0 | 0 | 13.6 | 21.4 | 21.4 | 9.4 |
| Assam | 24.6 | 11.9 | 29.6 | 29.5 | 28.3 | 25.2 | 24.9 |
| Chandigarh | 0 | 0 | 0 | 13.7 | 0 | 0 | 2.3 |
| D & N Haveli | 0 | 0 | 38.4 | 48.4 | 41.7 | 41.6 | 28.4 |
| Daman & Diu | 19.2 | 43.8 | 46.5 | 0 | 40 | 38.3 | 31.3 |
| Delhi | 16.6 | 0 | 4.9 | 5.9 | 0 | 0 | 4.6 |
| Himachal Pradesh | 0 | 0.7 | 0 | 0 | 0 | 1 | 0.3 |
| Jammu & Kashmir | 2.6 | 5.6 | 5.7 | 8.1 | 15.6 | 15.6 | 8.9 |
| Lakshadweep | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Manipur | 30.3 | 32.5 | 28.6 | 33.2 | 26.1 | 34.6 | 30.9 |
| Meghalaya | 0 | 0 | 7.1 | 8.3 | 10.9 | 13 | 6.6 |
| Mizoram | 0 | 1.6 | 3.1 | 0 | 1.4 | 11 | 2.9 |
| Nagaland | 9.2 | 18 | 23.5 | 18.8 | 7 | 23.6 | 16.7 |
| Puducherry | 0 | 0 | 0 | 0 | 6.7 | 6.7 | 2.2 |
| Sikkim | 0 | 0 | 47.6 | 0 | 0 | 0 | 7.9 |
| Tripura | 7.2 | 24.9 | 12.7 | 25.3 | 18 | 8.9 | 16.2 |
| Uttarakhand | 27 | 27.9 | 27 | 22.7 | 30 | 35.2 | 28.3 |
| All GCSs | 27.7 | 31.6 | 32.1 | 33.8 | 31.4 | 33.3 | 31.6 |
| All SCS&UTs | 7.6 | 9.3 | 15.3 | 12.6 | 13.7 | 15.3 | 12.3 |

Source: Authors' calculations.

Table A4: Yearly estimates of Relative inefficiency(RIE) for Indian states (2010-11 to 2015-16)

| States | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | Average |
|---|---|---|---|---|---|---|---|
| *Panel A: RIE Estimates for GCSs* | | | | | | | |
| Andhra Pradesh | 0 | 0 | 0 | 0 | 4.7 | 1.1 | 1.0 |
| Bihar | 25.3 | 26.9 | 0 | 37.8 | 35.3 | 28.6 | 25.7 |
| Chhattisgarh | 0 | 0 | 5.2 | 0.6 | 5.6 | 4.2 | 2.6 |
| Goa | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Gujarat | 0 | 0 | 0 | 14.3 | 13.4 | 17.7 | 7.6 |
| Haryana | 6.6 | 15.7 | 15.4 | 16.2 | 13.3 | 0 | 11.2 |
| Jharkhand | 0 | 0 | 15.5 | 9.7 | 8.7 | 5.9 | 6.6 |
| Karnataka | 0 | 0 | 0 | 0 | 0 | 4.3 | 0.7 |
| Kerala | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Madhya Pradesh | 0 | 0 | 3.1 | 0.6 | 0 | 1.7 | 0.9 |
| Maharashtra | 0 | 7.1 | 16 | 21.5 | 17.7 | 20 | 13.7 |
| Odisha | 0 | 0 | 9.2 | 8.2 | 7.7 | 4.3 | 4.9 |
| Punjab | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Rajasthan | 0 | 3 | 8.1 | 0 | 0 | 4.1 | 2.5 |
| Tamil Nadu | 0 | 0 | 1.4 | 0 | 1.3 | 0 | 0.5 |
| Telangana | na | na | na | na | 0 | 3 | 1.5 |
| Uttar Pradesh | 24.4 | 20.1 | 30 | 28.3 | 30.6 | 30 | 27.2 |
| West Bengal | 5.2 | 0.2 | 8.1 | 9 | 11.6 | 15.1 | 8.2 |
| *Panel B: RIE Estimates for SCS&UTs* | | | | | | | |
| A & N Islands | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Arunachal Pradesh | 0.0 | 0.0 | 0.0 | 13.6 | 21.4 | 21.4 | 9.4 |
| Assam | 3.2 | 10.2 | 27.1 | 27.3 | 25.2 | 25.2 | 19.7 |
| Chandigarh | 0.0 | 0.0 | 0.0 | 13.7 | 0.0 | 0.0 | 2.3 |
| D & N Haveli | 0.0 | 0.0 | 38.3 | 48.4 | 41.7 | 41.6 | 28.3 |
| Daman & Diu | 0.0 | 43.8 | 46.5 | 0.0 | 40.0 | 38.3 | 28.1 |
| Delhi | 0.0 | 0.0 | 0.0 | 3.3 | 0.0 | 0.0 | 0.6 |
| Himachal Pradesh | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Jammu & Kashmir | 0.0 | 5.6 | 5.7 | 8.1 | 15.6 | 15.6 | 8.4 |
| Lakshadweep | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Manipur | 14.1 | 32.5 | 28.6 | 33.2 | 26.1 | 26.1 | 26.8 |
| Meghalaya | 0.0 | 0.0 | 7.0 | 6.9 | 9.6 | 9.6 | 5.5 |
| Mizoram | 0.0 | 1.6 | 3.1 | 0.0 | 1.4 | 1.4 | 1.3 |
| Nagaland | 0.0 | 18.0 | 23.5 | 18.8 | 7.0 | 7.0 | 12.4 |
| Puducherry | 0.0 | 0.0 | 0.0 | 0.0 | 6.7 | 6.7 | 2.2 |
| Sikkim | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tripura | 2.2 | 24.9 | 12.7 | 25.3 | 18.0 | 8.9 | 15.3 |
| Uttarakhand | 27.0 | 27.9 | 27.0 | 21.9 | 30.0 | 30.0 | 27.3 |
| All GCSs | 3.6 | 4.3 | 6.6 | 8.6 | 8.3 | 7.8 | 6.5 |
| All SCS&UTs | 2.6 | 9.2 | 12.2 | 12.3 | 13.5 | 12.9 | 10.4 |

Source: Authors' calculations.

Table A5: Yearly Estimates of Technological Gap Inefficiency (TGIE) for Indian States (2010-11 to 2015-16)

| States | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | Average |
|---|---|---|---|---|---|---|---|
| *Panel A: TGIE estimates for GCSs* | | | | | | | |
| Andhra Pradesh | 35.3 | 39.6 | 36.7 | 37.8 | 35.1 | 42.4 | 37.8 |
| Bihar | 4.9 | 2.4 | 49.3 | 15.3 | 2.3 | 0 | 12.4 |
| Chhattisgarh | 32.1 | 37.3 | 31.9 | 36.3 | 27.5 | 36.7 | 33.6 |
| Goa | 15 | 29.5 | 31.1 | 0 | 2.5 | 3.7 | 13.6 |
| Gujarat | 0 | 0 | 0 | 16.9 | 17 | 17.7 | 8.6 |
| Haryana | 36.3 | 26.8 | 11.6 | 25.8 | 26.4 | 51.4 | 29.7 |
| Jharkhand | 44.1 | 48.5 | 31 | 33.9 | 35.2 | 38.9 | 38.6 |
| Karnataka | 0 | 16.3 | 0 | 11.5 | 0 | 5.6 | 5.6 |
| Kerala | 25.8 | 2.6 | 0 | 0 | 0 | 0 | 4.7 |
| Madhya Pradesh | 37.6 | 41.5 | 39.3 | 41.3 | 41.7 | 40.4 | 40.3 |
| Maharashtra | 9.7 | 17 | 13.1 | 11.5 | 5.5 | 14.9 | 12.0 |
| Odisha | 29.5 | 37.3 | 27.5 | 26.8 | 25.5 | 33.4 | 30.0 |
| Punjab | 25 | 31.4 | 33.1 | 37.9 | 37.1 | 46.5 | 35.2 |
| Rajasthan | 43.5 | 40.1 | 33.9 | 41.7 | 43.5 | 41.9 | 40.8 |
| Tamil Nadu | 21.9 | 19 | 36.2 | 37.2 | 34 | 0 | 24.7 |
| Telangana | na | na | na | na | 37.8 | 38.4 | 38.1 |
| Uttar Pradesh | 22.1 | 30.4 | 17.6 | 19.1 | 16.6 | 22.5 | 21.4 |
| West Bengal | 27.1 | 43.7 | 40.9 | 35.2 | 28 | 25.6 | 33.4 |
| *Panel B:TGIE estimates for SCS&UTs* | | | | | | | |
| A & N Islands | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Arunachal Pradesh | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Assam | 21.4 | 1.7 | 2.5 | 2.2 | 3.1 | 0 | 5.2 |
| Chandigarh | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| D & N Haveli | 0 | 0 | 0.1 | 0 | 0 | 0 | 0.0 |
| Daman & Diu | 19.2 | 0 | 0 | 0 | 0 | 0 | 3.2 |
| Delhi | 16.6 | 0 | 4.9 | 2.6 | 0 | 0 | 4.0 |
| Himachal Pradesh | 0 | 0 | 0 | 0 | 0 | 1 | 0.2 |
| Jammu & Kashmir | 2.6 | 0 | 0 | 0 | 0 | 0 | 0.4 |
| Lakshadweep | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Manipur | 16.2 | 0 | 0 | 0 | 0 | 8.5 | 4.1 |
| Meghalaya | 0 | 0 | 0.1 | 1.4 | 1.3 | 3.4 | 1.0 |
| Mizoram | 0 | 0 | 0 | 0 | 0 | 9.6 | 1.6 |
| Nagaland | 9.2 | 0 | 0 | 0 | 0 | 16.6 | 4.3 |
| Puducherry | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Sikkim | 0 | 0 | 47.6 | 0 | 0 | 0 | 7.9 |
| Tripura | 5 | 0 | 0 | 0 | 0 | 0 | 0.8 |
| Uttarakhand | 0 | 0 | 0 | 0.8 | 0 | 5.2 | 1.0 |
| All GCSs | 24.1 | 27.3 | 25.5 | 25.2 | 23.1 | 25.6 | 25.1 |
| All SCS&UTs | 5.0 | 0.1 | 3.1 | 0.4 | 0.2 | 2.5 | 1.9 |

Source: Authors' calculations.

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# Determinants of Labour Productivity in the Organised Textile Sector of India: Dynamic Heterogeneous Panel Evidence

**Rajesh V. Shetgaokar**

*The paper aims to identify the key determinants of labour productivity in the organised textile sector of India using the Panel Autoregressive Distributed Lag model. Panel data from the Annual Survey of Industries for 17 states for the period 1991–1992 to 2018–2019 was used for the study. Based on the results of the Hausman Test, the pool-mean-group model was consistently more efficient and reliable than mean-group or dynamic-fixed-effect models. Labour productivity is affected by skill intensity, wages, capital intensity, capacity utilisation, and welfare expenditure in both the short and long run. Skill intensity and capital intensity have smaller effects on labour productivity in the short run, but play a larger role in the long run. On the other hand, the importance of wages decreases in the long run compared to the short run in determining labour productivity. Further, the coefficient of error correction term is negative and significant, indicating that all the variables in the model were cointegrated in the long run. Any deviation from the equilibrium between labour productivity and its determinants, in the long run, will be adjusted by 28 per cent and states will be able to regain equilibrium after five years. The error correction term for each state shows that all the states will converge to equilibrium position at a different speed, but Tamil Nadu has the fastest speed of convergence while Uttar Pradesh shows slow adjustment towards equilibrium.*

**Keywords:** Labour productivity, ARDL Approach, Error correction term, Skill, Capital intensity, Real wages

## I Introduction

Labour productivity is considered as a decisive driver of economic performance and influences the welfare of people in the economy (Rath 2006). The increase in labour productivity enables the country to boost its competitive position and keep the nation at the leading edge in global performance (ODEC, 2011). Further, labour productivity is recognised as an indicator that demonstrates the efficiency of the workforce. The growth in labour productivity leads to an increase in wages due to increased output per worker. Due to predetermined biases in determining the capital stock, it is also a better measure for examining trends in long-term

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economic growth. Higher labour productivity also contributes to the expansion of exports as it lowers the per-unit cost and helps firms export goods and services at competitive prices in the international market. It also greatly helps in attracting investment into the various economic sectors by regulating profitability. According to the empirical literature, increases in labour productivity determine the extent of an increase in per capita income over the long term. Labour productivity is regarded as a crucial productivity measure. By lowering production costs, worker productivity is correlated with an increase in investment and innovation activities and, consequently, output growth. It is crucial to remember that increase in labour productivity will support economic growth (Shirov, Gusev, Yantovskii, Potapenko 2012, Auzina-Emsina, 2014).

From observing these beneficial effects on labour productivity, we can conclude that it is crucial to understand the issue of labour productivity, which has received scant attention in India. It is rightly pointed out by several researchers that labour productivity issues are ordinarily underestimated in India (Balakrishnan 2004, Sharma and Mishra 2009, Kathuria,2010). It is disconcerting that labour productivity has received very little attention, particularly when India's labour productivity is perceived to be very low. India’s average labour productivity growth from 2010 to 2019 was 6.5 per cent, much lower than that of the emerging market (RBI 2018). Increasing labour productivity in all sectors of the economy is a compelling requirement if we want to put the economy on a prosperous path.

In this context, we made an effort to identify the determinants of labour productivity in India's organised textile industry, since India has a diverse range of industries, ranging from large capital-intensive industries to various labour-intensive industries spread throughout the country. Thus, Indian industries have a formidable degree of intra-industry diversity. Therefore, our focus is on sector-specific estimates as compared to previous studies, where the majority of the studies focused on an aggregate level. The textile industry, which is eminently labour-intensive, exquisitely suits our framework for evaluating the performance of labour productivity.

We would like to address a few concerns in this paper. First, is there a long-term cointegration between the variables such as wages, skill, capital intensity, capacity utilisation, and welfare expenditure with labour productivity? Second, what are the short-term and long-term effects of the independent variables on labour productivity? Third, which Indian states follow the speed of the adjustment mechanism to converge to equilibrium if the dependent and independent variables diverge? Based on the aforementioned research question, we define the three primary objectives of this paper. The first objective is to investigate how labour productivity and its determinants (wages, skill, capital intensity, capacity utilization, and welfare expenditure) cointegrated over time in the Indian textile sector. The second objective is to determine the long-term and short-term effects of the key parameters on labour productivity. Finally, we aim to demonstrate the

speed of adjustment between labour productivity and its determinants between different states.

The literature is limited on the issue of labour productivity and its determinants in India. A few prominent studies by Kumar (2002), Sahoo (1995), Naidu and Ravindrakumar (1992), and Rath (2006) dealt with the labour productivity topic. However, our study differs from that of the previous researchers in several respects. Previously, all studies were centered on the macro level, taking the manufacturing sector as a whole. Our study is industry-specific, with an emphasis on labour-intensive industries like textiles. Second, in our study, we have updated a large database for the period 1980–1981 to 2019–2020 for 17 major textile-producing Indian states. Finally, the methodology used in our study is different since we used the Panel Autoregressive Distributed Lag Model (PARDL) to estimate the results. A thorough investigation of this topic will help in identifying the key variables that influence labour productivity, especially in a labour-intensive sector like the textile industry.

The arrangement of the remaining papers is as follows: Section II provided a profile of the textile industry. Section III details empirical evidence of labour productivity and its determinants based on a thorough review of the prior literature. A description of the data has been provided in Section IV, while a description of the methodology has been provided in Section V. Section VI of the paper deals with model specifications. Section VII provides the details of measurement of key variables while Section VIII discusses the preliminary test output, Panel Autoregressive Distributed Lag Model result and interpretations. The inferences drawn from the results are provided in Section IX. We conclude our paper with Section X with some concluding remarks.

## II Profile of the Textile Industry

The textile industry is, notably, the single largest industry in the economy and forms the backbone of the socioeconomic structure of India (Tondan 2013). Also, this industry is regarded as a typical ‘starter' industry for nations that have initiated export-oriented industrialization (Gereffi 2001). Besides these, its contribution to industrial production and the gross domestic product is highly noteworthy. It contributes around 14 per cent to industrial production and 4 per cent to gross domestic product, respectively (Ministry of Textile, Government of India, 2019). In terms of employment, it is the second-largest employer after agriculture, providing a livelihood for 45 million people directly (Ministry of Textile, Government of India, 2019). Additionally, it provides indirect employment to around 60 million people, mainly preoccupied with agriculture-based raw materials and trade-related handling (ibid.). Around 15 per cent of foreign exchange earned in India is earned by this sector (Verma 2002). Moreover, due to its low capital requirement, it is the preferred industry to achieve the objectives of decentralisation and rural development.

The textile industry, which is recognised for its labour-intensive nature, certainly encapsulates our framework for assessing the performance of labour productivity. Although many other industries, like processing, tobacco, apparel, leather, wood, and furniture, rely heavily on labour, the textile sector is unique in a number of ways. First, on one hand, the textile industry includes large-scale, capital-intensive segments like spinning, weaving, and finishing textiles, while on the other, we can find small factories like power looms, handlooms, and cotton ginning that run on either electricity or manual labour. Second, even though synthetic fibres have begun to replace cotton in recent years, cotton still dominates the Indian textile sector. Thirdly, this industry is much more decentralised, with rural, smaller firms predominating and making a large contribution to employment. It primarily employs women, as well as significant numbers of unskilled and semi-skilled workers. Fourthly, the textile industry is highly integrated with agriculture and has relatively forward and backward linkages.

## III Review of Literature

Over the years, empirical literature and economic theory have explained labour productivity as a critical variable for improving economic growth and living standards (Aggarwal 2004). In conjunction with these, efforts were made by researchers at international and national levels to identify the determinants of labour productivity. For instance, Fortune (1987), while investigating the determinants of labour productivity in the manufacturing sector of the USA, found a positive and noteworthy relationship between the growth rate of GNP and labour productivity. Abbas (2003), while investigating the determinants of labour productivity in the manufacturing sector of Australia from 1970 to 2001, identified that labour productivity is exceptionally influenced by information technology, real net capital stock, wage rate, human capital, trade openness, union membership, and international competitiveness in the short run, while in the long run, human capital and labour reform were insignificant in determining labour productivity. Dearden, Reed, Van, (2006) found on-the-job training to be a noteworthy determinant of labour productivity. Their study noticed that for every 1 per cent gain in training, labour productivity has expanded by 0.6 per cent in the British manufacturing sector. In a related line, Sala and Silva (2011) found the significance of vocational training on labour productivity in multi-country, multi-sectorial data for 38 countries in Europe between 1998–1999 and 2005–2006. According to the study, for every additional hour of labour invested in training, labour productivity increases by about 55 per cent. Weckers (2006) found that investment in human capital was a significant factor in determining labour productivity. Aggrey, Eliab, Joseph (2010) found that labour productivity in the economy is predominantly dependent on educated workers with knowledge of technological advancement. The study found that when the employees are educated and trained, they execute more accurately in terms of operations, techniques, and innovation, contributing to higher output. Eminent studies by

Rijkar (2010) and Tamasauskien and Stankaityte (2013) contend that urban firms have higher labour productivity compared to rural enterprises. Also, Ramirez (2006) shows that the FDI inflow presents greater managerial know-how and technology transfer, influencing labour productivity largely with a lag term effect in the economy. Bigsten and Juselius (2010) identified that the size of the firms affects the labour productivity significantly in the Kenya manufacturing sector. However, the study noted an insignificant relationship between labour productivity and foreign ownership or the age of the firm.

In the Indian context, studies on labour productivity are sparse. There are a handful of studies that deal with the concern of labour productivity. Deshmukh and Kumar (2009) reveal that real wages and labour productivity enjoy a relatively higher association. According to the study, an increase in wages would increase the opportunity cost of losing a job and motivate workers to put forth extra effort to avert redundancy. Kumar (2002) applied multiple-regression analysis and found that man-days lost and growth in capital intensity was the significant variables in determining labour productivity. Sahoo (1995) audited the factors determining regional productivity and discovered that the size of the firms, skilled manpower, and wage rate were positively related to labour productivity. Aggarwal (2014) used Shapley Decomposition Techniques to examine the labour productivity in the manufacturing sector of India for the years 1973–1974 to 2012–2013. He discovered an almost 13 per cent decline in labour productivity in India.

The empirical literature discussed is largely at the aggregate level. The survey of empirical studies show that no researchers made an attempt to identify the determinants of labour productivity in the organised textile sector of India. Papola (1968) showed a positive influence of the cost of living on wage movements for men and women working in India's textile industry. Mehta (1997) analyses the post-MFA implications for the Indian textile industry. The study found that the removal of MFA has led to an increase in demand for Indian textiles abroad. Further, Roy (1998) discovered that, following the 1992 round of trade and regulatory policy reforms, the Indian textile industry, particularly the cotton textile sector, has seen a significant transformation. The paper concludes that the shift in the textile industry can be seen as an example of delayed integration due to numerous organisational and technological flaws, particularly in the capital goods sector. Tewari (2000) noted that decades of policy decisions had a significant impact on the structure of the Indian textile and apparel sector. The industry has remained small in scale with a few significant corporations, mainly due to the government's licencing and reservation policies. Verma (2002) made an attempt to evaluate the export competitiveness of the Indian textile industry and garment exports and concluded that little progress had been made in exploiting the actual potential of textile products. Narayanan (2003) discovered that the Indian textile sector has gone through a recession in terms of both output and employment, with a negative growth rate for employment. This shows that employment has been more negatively impacted by the recession than output and capital in the textile industry. Hashim’s study (2004) found an inverse relationship between the unit

cost of production and productivity. The study identified the disbursement of credit, cheaper raw materials, and better availability of electricity at reasonable rates as key factors. Moorthy (2005) studied industrial relations in the textile industry in Tamil Nadu and found that both, the number of disputes and the number of workers involved in the disputes, had come down gradually in the post-reform period. Singh (2007) noted that the rise in the young population has contributed to the Indian textile industry's impressive growth. The industry needs to modernise and receive more investment in this area. A study found obsolete equipment and machinery, as well as onerous labour restrictions, seriously jeopardize the future development of the industry. According to Kumar (2018), government regulations and foreign investors do not support the fragmented and labour-intensive Indian textile industry. Companies must improve the quality of their products and production methods while benchmarking their goods against the finest in the world.

Saluja (2008) analysed the international competitiveness of the Indian textile industry. The study found that countries need to make high investments in R&D to launch new products and reduce transaction costs per unit. Abraham and Sasikumar (2010) analyse the methods used by the firms to enhance their international competitiveness in exporting. It was found that increasing the share of low-cost labour was an important route through which the export performance of Indian firms in textile and clothing was enhanced. Murugeshwari (2011) studied the impact of policy shifts on total factor productivity in the Indian textile industry and revealed that competition had reduced the productivity performance and the technological progress of this industry. Gupta (2011) examined the wages, unions, and labour productivity in the Indian cotton mills. A study has shown that unionisation increased wages and compelled managers to raise productivity in Indian cotton mills. Chaudhary (2011) analysed the changing structure of the Indian textile industry after the MFA phaseout. The study divided the time into pre-MFA (2001–2004) and post-MFA (2005–2009). It found that the phase-out of MFA had a positive impact on the Indian textile and clothing sector. According to Abraham and Sasikumar (2011), increasing the proportion of low-cost labour was a key strategy for improving export performance, whereas capital- and technology-based factors had no discernible impact. Export performance with high import intensity indicates that Indian textiles and clothing are becoming more and more integrated into the global value chain. Vanitha and Mohanasundari (2012) made an attempt to analyse the trends and determinants of labour productivity in the cotton textile industry in India and Tamil Nadu. The study found that managerial skill emerged as the major determinant of workers' productivity. According to Bhandari and Ray (2012), maintaining and improving production efficiency is a requirement for Indian enterprises to compete in the newly liberalized global market in the face of a full integration of the textiles sector into the WTO. Sudana and Raju (2013) analysed the profitability of the cotton textile industry and the manmade textile industry for the period 1999–2000 to 2010–2011. It was found that the gross profit to sales ratio in both manmade and cotton textiles during the

study period were very poor. According to Gambhir and Sharma (2015), scale efficiency and changes in technology appear to be the main factors driving productivity in the textile industry. The findings imply that in India's textile industry, fairly large enterprises are doing more productively. Carswell (2016) discovered that while most women choose careers that take into account a variety of social and reproductive restrictions, those who choose not to work are subjected to new manifestations of patriarchy in the Tiruppur textile sector in India. According to Goyal, Kaur, Aggarwal (2017), managerial inefficiency accounts for 16.44 per cent of total technical inefficiency in the textile industry of India. As a result, policymakers must take decisive action to compete with foreign firms. Dhiman and Sharma (2017) research indicates that there has been a severe fall in the growth rates of labour productivity and capital productivity in the textile industry, which appears to be a significant cause for concern; consequently, the textile industry needs to be more productive and capital-intensive.

The trade performance and competitiveness of the Indian textile industry and its rivals, China and Vietnam, were studied by Gautam and Lal (2020) from 1988 to 2016. The findings revealed that India had a comparative advantage from 7 to 8 products, whereas Vietnam had a significant improvement from 2 to 7. Kaur (2021) studied the business-related issues faced by textile entrepreneurs in Punjab due to COVID-19. It was found that entrepreneurs were digitally equipped to accept digital know-how instantly and grabbed opportunities by manufacturing N95 masks and PPE. Ahlawat and Renu (2018) found huge gender disparities in employment. It found that an increase in the real wage rate causes an enhancement in employment in textile manufacturing and that labour productivity is a significant determinant of the wage rate of textile employees. The findings of the study by Dhiman and Verma (2019) demonstrate the absence of feedback effects between the variables and the identification of just a single path of causality. No long- or short-term causation connecting an independent variable to a dependent variable is shown by the Vector Error Correction Model (VECM). The study recommends that manufacturers of textiles implement the productivity-based wage approach. Dhiman, Kumar, Rana (2020) reveal that, given the volatility tendency, export competitiveness is a problem that must be solved in order to survive in the global market. The results of the Granger causality test show that there is a one-way causal relationship between export competitiveness and the exchange rate. The study discovered, however, that there is no connection between the real exchange rate and export competitiveness. According to Arnold (2022), the unorganised feminization of the workforce in the textile and apparel sectors in Tiruppur and Coimbatore has given rise to formal, ruralized labour. For the garment and textile workers in the area, the recruitment of long-distance male migrants by labour brokers has created a nationwide labour market.

## IV Data Description

The data on all the relevant variables is drawn from the Annual Survey of Industries (ASI) for the period 1980-1981 to 2019-2020 for fifteen major states. NIC codes change constantly over time; hence, different years' data have been compiled to arrive at a consistent series before being used in empirical work. We have adjusted pre-2004 and post-2004 data to reflect the appropriate adoption of industries. Figures for all industries have been combined because some industries within the states do not have data for specific years. Additionally, ASI data is published at current prices. The single deflation method is applied to deflate the data in order to compare the values of the various variables. Arithmetically priced index series have evolved using the splicing technique. Data on gross value added has been deflated using a wholesale price index for the base year 1993–1994 (100), which was acquired from the Economic Advisors, Minister of Commerce and Industry, Government of India. Various volumes of the RBI Bulletin and the Bulletin of Food Statistics contain city-specific information on the consumer price index of industrial workers. The Consumer Price Index (CPI) for industrial workers does not exist at the state level. In order to create a single general price index number, the average of all the cities in a given state's accessible CPI for industrial employees was taken. The representative state has been simulated using this index. We translated the nominal emolument to the real emolument using the state-specific CPI for industrial workers (1993-1994 =100). Additionally, nominal data on fixed investment was deflated using the wholesale price index for machinery and tools from the Reserve Bank of India (base year 1993–1994 = 100).

## V Econometric Methodology

The empirical literature review reveals that, the majority of the studies used pooled OLS, fixed and random effects, and the generalised moment's method methodology of panel data. Due to the numerous constraints of static panel data models, which yield inconsistent, deceptive, and inefficient results, we use a novel technique called the Panel Autoregressive Distributed Lag Model in this study to investigate the link between labour productivity and its determinants. Asterios (2007) makes the case, based on anecdotal data, that pooling OLS will not result in reliable and efficient coefficients but will rather produce spurious coefficients. The challenges of non-stationary heterogeneous panel data analysis, when intercepts and slope coefficients fluctuate between groups, are also highlighted by Frank and Blackburne (2007). According to Pesaran, Shin, Smith (1999), the homogeneity assumption cannot be applied to slope coefficients, when the number of cross-sections exceeds the number of periods. Bildirici (2014) has discovered that if there is a large period (T) and a short cross-section, GMM estimations will produce false outcomes. Therefore, the over-identification restriction of the Sargan test will be caused by the assertion that, there will be an increase in instruments.

As a result, the endogenous instrument hypothesis would be erroneously rejected. The homogeneity of coefficients on the lagged dependent variable is a typical assumption in conventional panel data modeling (Holly and Raissi 2009), which can lead to a significant distortion when the parameters are diverse across units. This demonstrates that a key problem in empirical economics is that the static panel methodologies fail to account for the dynamic nature of the industry data.

We used the Panel Autoregressive Distributed Lag Model to take into account the above-mentioned constraints and provide a competent, equitable, and accurate coefficient. The ARDL approach differs from others panel data model like fixed effects and random effects in that it can find both long- and short-run correlations between variables. Studies that analyse the relationships between independent and dependent variables have frequently employed it (*see* Fatai, Oxley, Scrimgeour 2004, Narayan and Smyth 2005, Jalil and Mahmud 2009, Ozturk 2010, Payne 2010, Katircioglu 2009, Wang 2009), and so forth. The ARDL accurately determines the factors that influence integration. Furthermore, this methodology is particularly well suited to huge T panels, or panels with several time series observations in each group. Pesaran, *et. al.* (1999) consider the case in which a panel ARDL specification is estimated under the presumption that the long-run parameters have comparable characteristics across groups while the short-run dynamic parameters are heterogeneous. The functional form of the ARDL (p, q) process has intuitive appeal because it allows for partial adjustment towards an economically significant long-run equilibrium relationship between yt and xt, whereas there are frequently good reasons to believe that long-run equilibrium relationships should be approximately common across groups, but, generally, the same cannot be said for dynamic parameters. For states where the time series (T) is larger than the cross-section (N), or T > N, we have also merged time series and cross-section data. The variables are cointegrated using the numerous advantages of the ordinary least square (OLS) method, and the integration order of the variables is fairly adaptable (Duasa 2007). According to Frimpong and Oteng (2006), it functions well with independent variables like I(0), I(1), or those that are cointegrated with one another. Additionally, the ARDL model could generate reliable estimates of the long-run parameters even in the presence of weak endogeneity since it naturally takes into consideration the serial correlation structure that exists among the first differences series. Further, the Panel Autoregressive Distributed Lag Model is suitable for our investigation because of the non-stationary character of the data that we are using. By utilising the consistency properties of the cointegrating frameworks, we may be able to use the Panel Autoregressive Distributed Lag model to address inescapable predispositions brought on by endogeneity and missing components. The static assumption that coefficients are homogeneous is therefore meaningless in practice because states differ in terms of economic development, human resources, geography, innovation, and other aspects. Furthermore, Pesaran, *et. al.* (1999) discovered that these estimators produce long-term coefficients with greater accuracy regardless of whether our variables are integrated in I(0) or I(1), a

different order. With the use of these tests, multicollinearity is lessened, results are more accurate, predilection is reduced, and coefficients are accurately estimated (ibid.). Additionally, the estimates' slope, intersection, and error standard deviation provide details about the entire group. The noise produced by individual time-series estimations is additionally mitigated by a panel autoregressive distributed lag model estimate (Pesaran, *et. al.* 1999). As a result; the inferences made are more credible. Additionally, considering that it naturally takes into account the serial correlation structure that exists among the first differences of yt and xt, the ARDL model could produce accurate estimates of the long-run parameters even in the face of weak endogeneity.

The Panel Autoregressive Distributed Lag Model approach overcomes the limitations of Johansen (1995) and Philipps and Hansen (1990), which require the variables to have the same order of integrations to establish the long-term relationship. In addition, Pesaran, *et. al.* (1999) claim that the Panel Autoregressive Distributed Lag Model approaches will provide a consistent result even when the variables are grouped differently or mixed. Also, the Panel Autoregressive Distributed Lag Model produces consistent estimates even when endogeneity is present due to the inclusion of lags for dependent and i Panel analysis on the unrestricted specification for the Panel Autoregressive Distributed Lag Model for time periods t = 1, 2,..., T and groups i = 1, 2,..., N; and the dependent variable y is:

$$y_{it} = \sum_{j=1}^{p} \vartheta_{ij}\, y_{i,t-j} + \sum_{j=o}^{q} \gamma'_{ij}\, x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad \ldots(1)$$

Where s is a scalar dependent variable, the k x 1 vector of explanatory variables for group i denotes the fixed effects, are the scalar coefficients of the lagged dependent variables, which are k × 1 coefficient vectors.

The re-parameterized form of Equation (1) can be formulated as follows:

$$\Delta y_{it} = \varphi_i y_{i,t-1} + \beta'_i x_{i,t-1} \sum_{j=1}^{p-1} \vartheta_{ij}\, \Delta y_{i,t-j} + \sum_{j=o}^{q-1} \gamma'_{ij}\, \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad \ldots(2)$$

It is assumed that the disturbance terms are independently distributed across the population with zero means and variances. It is assumed further that, there exists a long-term relationship between coefficient vectors and that is defined by:

$$y_{it} = \theta' x_{it} + n_{it} i = 1,2 \ldots\ldots N; \qquad t = 1,2 \ldots\ldots\ldots T$$

Where,$\theta' = -\beta'_i/\theta_i$ is the k × 1 vector of the long-run coefficients and $n_{it}$'s stationary with possibly non-zero means (including the fixed effects). Hence, Equation (2) can be written as:

$$\Delta y_{it} = \varphi n_{i,t-1}{}_i n_{i,t-1} + \sum_{j=1}^{p-1} \delta_{ij}\, \Delta y_{i,t-j} + \sum_{j=o}^{q-1} \gamma'_{ij}\, \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad \ldots(3)$$

Where $\varphi$ is the error correction term given by Equation (3), and thus where the error correction term coefficient is measuring the speed of adjustment towards the long-run equilibrium. This parameter is expected to be significantly negative, implying that variables return to long-run equilibrium. The PMG method of estimation allows short-run coefficients, intercepts, and error variances to vary across countries but constrains the long-run coefficients to be equal. Consequently, Pesaran, *et. al.* (1999) assumed that disturbances were normally distributed in order to estimate the short-run coefficients and the common long-run coefficients.

## VI Measurement of Key Variables

In this study, five significant variables were identified as the determinants of labour productivity based on theoretical and empirical support.
*Labour productivity:* Labour productivity is calculated by dividing the real gross value added of a firm by the number of employees. Labour productivity is the dependent variable in the model.

*Real wage:* Inflation-adjusted gross wage for industrial workers, 1993–1994 = 100. The wage rate is measured as the real wage per worker. We assume that the wage rate tends to positively affect productivity.

*Capital intensity:* Capital intensity is measured as the ratio of fixed capital to employees in a firm. We assume that capital intensity has a positive relationship with labour productivity.

*Capacity utilisation:* The ratio of gross output to productive capital is measured as capital utilisation and interpreted as an indicator of technology adoption. We assume that better capacity utilisation will have a significant and positive effect on labour productivity.

*Skill intensity:* It is defined as the proportion of skilled workers in total employment. Supervisory and managerial employment is considered a proxy for human capital. It is therefore anticipated that it will have a positive impact on labour productivity.

*Welfare Expenditures:* Welfare expenditures included additional perks for the employees over and above their wages. Welfare expenditure tends to have a positive effect on labour productivity.

## VIII Econometrics Model

Using the Panel Autoregressive Distributed Lag Modelparadigm, we have investigated how the aforementioned variables affect labour productivity.

The empirical equation that we estimate in this paper takes the following form:

$$ln\Delta Y_{it} = \alpha_i + \sum_{j=1}^{p} \alpha_1, ijln\Delta Y_i, t-j + \sum_{j=0}^{q_1} \alpha_2, ijln\Delta Wages_i, t-j + \sum_{j=0}^{q_2} \alpha_3, ijln\Delta CI_i, t-j + \sum_{j=0}^{q_3} \alpha_4, ijln\Delta CU_i, t-j + \sum_{j=0}^{q_4} \alpha_5, ijln\Delta SI_i, t-j + \sum_{j=0}^{q_5} \alpha_6, ijln\Delta WE_i, t-j + \beta_1, ijln\Delta Y_{i,t-1} + \beta_2, ijln\Delta Wages_{i,t-1} + \beta_3, ijln\Delta CI_{i,t-1} + \beta_4, ijln\Delta CU_{i,t-1} + \beta_5, ijln\Delta SI_{i,t-1} + \beta_6, ijln\Delta WE_{i,t-1} + \emptyset_i, ECME_{i,t-1} + \varepsilon_{it} \quad \ldots(4)$$

where i = 1,2,3,...N and t = 1,2,3,...T, αi represents the fixed effects, α1−α5 is the lagged coefficients of the independent variables and the regressors in the short run, Δ is the first difference of variables, while β1−β5 are the long-run coefficients of labour productivity (Y), wages, capital intensity (CI), capacity utilization (CU), skill intensity (SI) and welfare expenditure (WE), θi represents the coefficient of the ECM which measures the speed of adjustment that is made every year towards long-run equilibrium and $\varepsilon_{it}$ the error term which is assumed to be white noise and varies across state and time.

The empirical approach represented by the Equation 4 above examines the relationship between labour productivity and the independent variables of wages, capital intensity, capacity utilisation, skill intensity, and welfare expenditure. The variables included in Equation 4 are strongly supported by economic theories and the empirical literature. For example, the efficiency wage theory states that higher real wages lead to higher labour costs, which are associated with job losses. When employers pay higher wages, workers work harder to avoid being laid off (Storm and Naastepad 2007). The second argument uses a macroeconomic framework to explain the favourable correlation between productivity and real wages. According to this framework, an increase in real wages forces firms to use more capital because labour becomes more expensive. An increase in real wages leads to substitution, increasing the marginal productivity of labour (Wakeford 2004). The third point arises from the fact that when labour costs increase as a result of higher real wages, the firm is forced to substitute capital for labour, which increases the marginal productivity of labour (*see*Golder2004, Vulgaris and Popadogonas 2005, Narayan and Smyth 2009, Fiouz 2010). Similarly, according to growth theories, capital intensity has a positive impact on labour productivity. For example, Solow's (1956) classical model explains how a change in capital accumulation can affect labour productivity and economic growth. The positive relationship between capital and labour productivity can also be demonstrated in the studies of Kaldor (1966), Denison (1974), Homer and Sylla (1991), and Barro and Sala-i-Martin (2004). We have also given preference to skill intensity, represented as human capital, since the Solow growth models of Schultz (1961), Romer (1990), and Mankiw, Romar, Weil (1992), include human capital as an important factor along

with labour and physical capital. The inclusion of skill intensity in the model is advocated on the grounds that governments are currently implementing a variety of programmes to improve skills. Human capital also drives invention and imitation and contributes to production along with other factors of production and through technical change (Aggrey, *et. al.* 2010). Furthermore, India has enacted a large number of labour laws for the benefit of workers in the organised sector of India. The productivity of the economy will substantially rise if the industrious working class is satisfied and has the opportunity to live a comfortable life, which will promote the overall advancement of the economy (Singh 2000).

### *Preliminary Tests of the Panel Autoregressive Distributed Lag* Model

The Panel Autoregressive Distributed Lag Model framework helps to mitigate the limitations of the previous literature by distinguishing between short-term and long-term effects. However, before proceeding to specify the short-term and long-term coefficients, three conditions must be met in order to estimate the outcomes of the model. First, the time series data must not exhibit trends, i.e., all included variables must be stationary at the level or first difference. Second, the Autoregressive Distributed Lag Model must have a cointegration equation, and third, an optimal lag length must be estimated. If the tests yield a satisfactory result, we can proceed with the estimation of the model represented by Equation 4. Before we proceed with estimation of results, we have provided basic characteristics of data and descriptive summery statistics in Table 1.

Table 1 provides the descriptive statistics of the variables employed in the study. The descriptive statistics of data shows the basic characteristics of the data is highly favourable to proceed with the estimation of the result. Thus, we can proceed with the estimation of the results to find the significant factors affecting labour productivity in the organised textile industry of India.

Table 1: Descriptive Summary Statistics

| Variables | Observations | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Labour Productivity | 640 | 4.78 | 0.51 | 3.97 | 5.74 |
| Wages | 640 | 7.93 | 1.25 | 6.03 | 9.89 |
| Capital Intensity | 640 | 4.30 | 0.72 | 2.99 | 6.52 |
| Capacity Utilization | 640 | 4.80 | 0.21 | 4.60 | 7.58 |
| Skill Intensity | 640 | 3.39 | 1.58 | 16.40 | 22.34 |
| Welfare Expenditure | 640 | 3.18 | 1.17 | 0.41 | 6.45 |

Note: All continuous variables are measured in log.
Source: Author's calculations using ASI plant-level data.

We begin our empirical investigation with a preliminary test of the panel unit root, which can be used to determine whether the time series has a unit root. The Im-Pesaran-Shin test was used. This test is characterised by its null hypothesis,

which states that there is no unit root in the series. The results of our investigations involving variables with levels are shown in Table 2.

Table 2: Unit Root Test Results of Variables at Level

| At level | | | |
|---|---|---|---|
| Variables | Statistics | Probabilities* | Results |
| Labour productivity | -6.1565 | 0.000 | Stationary |
| Real Wages | 0.3462 | 0.6754 | Non Stationary |
| Skill Intensity | -.6.6522 | 0.000 | Stationary |
| Capital Intensity | -0.4543 | 0.7687 | Non Stationary |
| Capacity Utilization | 0.5643 | 0.6820 | Non Stationary |

Note: ** Probabilities are computed assuming asymptotic normality.

The result presented in Table 2 clearly shows that of the five variables, the null hypothesis can be rejected only for two variables, namely labour productivity and skill intensity, at a significant level of 1 per cent. For three variables, namely real wages, capital intensity, and capacity utilisation, the unit root test confirms that the series are non-stationary. We converted the time series data of the three variables into stationary series by performing the unit root at the first difference. Table 3 shows the results of the Im-Pesaran-Shin unit root test at the first difference.

Table 3: Unit Root Test Results of Variables at First Difference

| At First Difference | | | |
|---|---|---|---|
| Variables | Statistics | Probabilities* | Results |
| Real Wages | -0.7462 | 0.000 | Stationary |
| Capital Intensity | -1 .4543 | 0.000 | Stationary |
| Capacity Utilization | -0.5643 | 0.000 | Stationary |

Note: ** Probabilities are computed assuming asymptotic normality.

The Im-Pesaran-Shin test at first difference, used to test for a unit root, shows that all three variables listed in Table 3 are stationary at a oneper cent significance level.

The next step in our empirical investigation is to determine the ideal lag length for the model. The number of lags for the Panel Autoregressive Distributed Lag Model is selected using either the Akaike Information Criterion (AIC) or the Schwartz-Bayes criterion (SBC). The Akaike Information Criterion is used in our study to determine the ideal length of the lags. Given the small number of annual observations, a maximum lag length of three is chosen, as per the AIC.

Further, an Autoregressive Distributed Lag Model can be estimated, only if cointegration between the dependent and independent variables is detected. Cointegration can be detected using a number of methods, mainly those proposed by Pedroni (1999, 2004), Kao (1999), and Westerlund (2007). Westerlund (2007)

test is inappropriate for this study because, according to Westerlund, bias is exhibited when the sample size T is less than 100. Therefore, the Pedroni cointegration test was used in our study to determine the presence of cointegration. The Pedroni Test differs from the Kao Test as it supports panel-specific cointegrating vectors. Because both panel and group statistics exceeded the 2-point cutoff for the Pedroni cointegration test, which indicates the variables are cointegrated at a 1 per cent significance level.

Table 4: Results of Pedroni Cointegration Test

| Dependent Variable: Labour Productivity | | |
|---|---|---|
| | Outcome | |
| | Within-Dimension (Panel) | Between-Dimension (Group) |
| v-Statistic | 2.36 | |
| rho-Statistic | -8.90 *** | -9.87 *** |
| PP-Statistic | -12.67 ** | -12.87 *** |
| ADF-Statistic | -18.90 *** | -8.98 *** |

Source: Author's own calculations.

Following Pedroni (1999), two different forms of residual scores are reported in Table 4. The first type, which includes panel-v, panel-rho, panel-PP, and panel-ADF statistics, is included in the first panel of the table. These tests are based on combining the regression residuals along the inner dimension of the panel. The second panel of the table contains the second type of test, which consists of the three subtests, Group Rho, Group PP, and Group ADF statistics. On the other hand, the second test is based on the combination of the regression residuals between the dimensions of the panel. The null hypothesis for both types is that there is no cointegration. According to Pedroni (1999), panel ADF and group ADF should be considered because they have better properties for small samples, and therefore their statistics provide accurate estimates. In agreement with these authors, the variables can be said to have a long-run relationship since five of the seven statistics, including panel ADF and group ADF, are significant.

Further, several diagnostic tests was conducted to test the normality of data and to understand whether the model suffers from the problem of heteroscedasticity and autocorrelation. The results are presented in Table 5. Note that the null is the proper functional form for Ramsey Reset. The absence of heteroscedasticity is the null for the Arch Test. The absence of serial correlation serves as the null for the Breusch-Pagan-Godfrey (B-G) Test. The null hypothesis in the J-B Test is normality.

The model is well-fitted because the estimated R-square and adjusted R-square values are 0.833 and 0.784, respectively. The functional form of the estimated model is accurate, according to our diagnostic result of the estimated Ramsey Reset Test. The model does not have a heteroscedasticity problem, as shown by the expected results of the Arch and Breusch-Pagan-Godfrey (B-G)

Tests. The current model is normal and finds no serial correlation, according to the estimated results of the Jarque-Bera test and serial correlation.

Table 5: Diagnostic Test of the Data

| R-square | 0.833 |
|---|---|
| Adjusted R-square | 0.784 |
| Multicollinearity VIF test (mean VIF) | 1.00 |
| Durbin–Watson statistics | 1.975 |
| Ramsey reset | 0.298 (0.767) |
| ARCH | 0.229 (0.635) |
| Breusch-Pagan-Godfrey test | 0.441 (0.647) |
| Jarque–Bera test | 2.217 (0.330) |

Note: P-values are presented in parentheses.

Source: Author own Calculations.

### *Estimation Panel Autoregressive Distributed Lag* Model

There are three methods for estimating the Autoregressive Distributed Lag Model: Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effect (DFE). In our study, we have used the PMG method to estimate Panel Autoregressive Distributed Lag Model. We offer some justifications for choosing PMG estimators over MG or DFF estimators. First, PMG is based on the notion that error terms are distributed independently of the regressor and are serially uncorrelated (Pesaran, *et. al.* 1999). Explanatory variables can therefore be considered exogenous variables. Second, the short-run coefficients and error variances may vary, while the long-run coefficients are identical across the cross-section. Third, the long-run coefficients must be consistent across groups according to the likelihood-based PMG estimator. If the homogeneity restriction indeed holds, this will lead to consistent estimates. Fourth, the PMG estimator is less prone to outliers and, at the same time, can solve the serial autocorrelation problem when the number of cross-sections (N) is very small. Moreover, by choosing an appropriate lag structure for both the dependent and independent variables, the likelihood-based estimator solves the problem of endogenous regressors.

In contrast, specifications with dynamic fixed effects use Least Square Dummy Variables (LSDV) or the generalised method of moments to control for state-specific effects. In most cases, the dynamic fixed effect is used to summarise cross-sectional data. DFE estimators, like PMG estimators, require that the coefficients of the cointegration vectors be the same for all panels. If the parameters are essentially homogeneous, PMG estimators should be more effective than MG estimators. Given the null hypothesis, the PMG would be preferable. On the other hand, the MG is recommended as a more effective estimator if the null hypothesis is rejected. The optimal model is selected for

interpretation based on the Hausman Test. The result of the Hausman Test, which was not significant with p-values of 0.23 and 0.51 for the mean group and dynamic fixed effect, respectively, confirmed the presence of homogeneity in the long-term coefficients. This shows that PMG is a recommendable model in our analysis, so we focus on the PMG estimate for further interpretation of the results.

Table 6: Result of Panel ARDL Model

| Variables | Dependent Variable: Labour Productivity | | |
|---|---|---|---|
| | *Pooled Mean Group* | *Mean Group* | *Dynamic Fixed Effects* |
| Error Correction Coefficient | −0.299*** | −0.326*** | −0.378*** |
| | (0.110) | (0.056) | (0.098) |
| ***Long-run Coefficients*** | | | |
| lnWages | 0.21*** | 0.34** | 0.66** |
| | (0.360) | (0.408) | (0.298) |
| ln Capital Intensity | 0.18*** | 0.21*** | 0.52** |
| | (0.078) | (0.289) | (0.210) |
| ln Capacity Utilization | 0.21*** | 0.008* | 0.39 |
| | (0.471) | (0.470) | (0.463) |
| ln Skill Intensity | 0.33*** | 0.19** | 0.12* |
| | (0.564) | (0.465) | (0.278) |
| Ln Welfare expenditure | -0.09*** | 0.10*** | 0.094 |
| | (0.863) | (0.897) | (0.94) |
| ***Short-run Coefficients*** | | | |
| ΔWages | 0.36*** | 0.34*** | 0.26 |
| | (0.302) | (0.453) | (0.183) |
| Δ Capital Intensity | 0.03*** | 0.01** | -0.01 |
| | (0.012) | (0.543) | (0.008) |
| Δ Capacatity Utlization | 0.16*** | -.0.34*** | 0.17*** |
| | (0.052) | (0.379) | (0.042) |
| Δ Skill Intensity | 0.18** | 0.43** | -0.172*** |
| | (0.564) | (0.432) | (0.045) |
| Δ Welfare expenditure | 0.03*** | 0.12*** | 0.012 |
| | (0.342) | (0.376) | (0.456) |
| Intercept | 0.948 | 3.09 | -0.292 |
| | (0.389) | (1.924) | (0.184) |
| States | 16 | 16 | 16 |
| Observation | 448 | 448 | 448 |
| Hausman test | | 0.382 | 0.608 |
| | | [0.169] | [0.128] |

Notes: * indicates significant at 10 per cent; ** significant at five per cent; *** significant at one per cent, Δ is the first difference operator.
Standard errors in brackets P-values of Hausman test are in square brackets. The estimation of pooled mean group, mean, and dynamic fixed effect are carried out while controlling for time and state specific effect.

Source: Author's own Calculations using ASI Plant Level Data

In Table 6, the ARDL panel model results have three components: the error correction term or convergence coefficient, the long-run coefficient, and the short-run coefficient. The error correction term in Table 6 has the expected negative sign and is statistically significant at the one per cent level, indicating that the dependent variable and the regressors have a stable long-term relationship. The coefficients of -0.23 indicate that the variables will converge to equilibrium positions at a rate of 23 per cent per year. The system takes about five years to return to the equilibrium if it deviates from the equilibrium position.

The coefficients of all explanatory variables in Table 6 have the expected positive sign and are consistent with the expectations of economic theory. At the 1 per cent level, all coefficients are also highly significant. Based on the PMG model, it is clear that real wages are significantly related to labour productivity in both the short and long run. However, labour productivity has only a limited impact on wages over time. For example, *ceteris paribus*, a 1 per cent increase in real wages raises labour productivity by 36 per cent in the short run, but by only 26 per cent in the long run. Although there are no studies to support the findings of such results in India's organised textile sector, the results are consistent with the studies of Hall (1986), Alexender (1993), and Kumar, *et. al.* (2004), who found that labour productivity has a decreasing relationship with real wages over time. Capital intensity and capacity utilisation also show a positive and significant relationship in both the short and long run. The results show that capital intensity has a small effect on labour productivity in the short run, but is significant in the long run. In the short run, *ceteris paribus*, a one per cent increase in capital intensity increases labour productivity by three per cent, but in the long run, it increases labour productivity by 21 per cent. This suggests that firms tend to mechanise more, leading to higher capital inputs per worker over time. The result also shows a positive and significant association between labour productivity and capacity utilisation. A one per cent rise in capacity utilisation increases labour productivity by 16 per cent in the short run, but in the long run, the effect is more noteworthy as labour productivity increases by 21 per cent, *ceteris paribus*. The model showed that skill intensity has the largest long-term impact on labour productivity of all the variables in the model. Both the short-run and long-run coefficients on skill intensity are positive and significant at the one per cent level, indicating a positive relationship between the two variables. In the short run, *ceteris paribus*, a one per cent increase in skill intensity increases labour productivity by 18 per cent, while in the long run; it increases labour productivity by 33 per cent. The reason for this difference could be the time lag between workers' acquiring skills and applying them. Moreover, in the short run, workers are slow to adapt to technological advances in the industry. In the long run, the negative coefficient on welfare expenditure suggests that, *ceteris paribus*, a one per cent rise in welfare expenditure will lead to a nine per cent decline in labour productivity.

This study empirically examines the long-run relationship between productivity and its determinants using balanced panel data from 16 textile-producing states covering the period from 2002 to 2012. The Autoregressive Distributed Lag Model also provides interesting information about the error correction term for each state, which shows the speed of adjustment between labour productivity and independent variables. The results are presented in Table 7.

Table 7: Estimate of PMG Model of Error Correct Term for Individual States

| State | Coefficient of Error Correction term | |
|---|---|---|
| Tamil Nadu | -0.1849 *** | (0.012) |
| Himachal Pradesh | -0.1763 *** | (0.234) |
| Kerala | -0.1698 *** | (0.675) |
| Rajasthan | -0.1689 *** | (0.685) |
| Maharashtra | -0.1647 *** | (0.764) |
| West Bengal | -0.1632 *** | (0.876) |
| Gujarat | -0.1483 *** | (0.675) |
| Madhya Pradesh | -0.1387 *** | (0.768) |
| Punjab | -0.1298 *** | (0.876) |
| Andhra Pradesh | -0.1187 *** | (0.768) |
| Karnataka | -0.1167 *** | (0.362) |
| Bihar | -0.1139 *** | (0.465) |
| Haryana | -0.1083 *** | (0.176) |
| Uttar Pradesh | -0.0763 *** | (0.245) |
| Assam | -0.729 *** | (0.364) |
| Odisha | -0.6598 *** | (0.376) |

Notes: *** Significant at one per cent; ** significant at five per cent and * significant at 10 per cent, Standers errors in bracket

Source: Author's own Calculations using ASI Plant Level Data

Table 7 shows the coefficient on the error correction term for each state. The error correction term, which has a negative sign and is significant at a one per cent level, shows that all states show a tendency to move towards equilibrium if dependent variables and independent variables diverge from the equilibrium. The result reveals that Tamil Nadu adjusts fastest among all states when labour productivity and independent variables diverge from equilibrium. The coefficient of error correction is negative, which shows that the adjustment rate is 18.49 per cent per period when the equilibrium between real wages and productivity deviates in Tamil Nadu. From the table, Himachal Pradesh, Kerala, Rajasthan, Maharashtra, and West Bengal will experience rapid adjustment in real wages and labour productivity. In these states, the adjustment to equilibrium will occur at a relatively rapid rate of about 15 per cent at a significant one per cent level. A slow adjustment in wage productivity is observed in Bihar, Haryana, and Uttar Pradesh. Uttar Pradesh has the slowest adjustment rate, with an average adjustment rate of seven per cent per period.

## IX Inference from Estimates

Based on the above results, we can draw several inferences. First, the positive and significant impact of skill on labour productivity shows that the skill development programmes implemented by the government under initiatives such as Skill India are producing positive results in the organised textile sector of India. Second, the

results show that skill development can produce more capable and innovative workers who can think critically and lead to innovation, which in turn leads to higher efficiency and productivity. Third, the significant impact of capital intensity on labour productivity also suggests that greater capital development is occurring in India's organised textile sector. This indicates that India's organised textile sector has become more mechanised in recent years. Fourth, wages induce workers to form stronger bonds and give them impetus to increase their productivity. Wage increases have a positive impact on workers' well-being, educational attainment, and standard of living, leading to an increase in labour productivity. Therefore, wages should be linked to productivity levels. Fifth, capacity utilisation can minimise the total cost of a textile product and provide a competitive edge in an internationally competitive market.

## X Conclusion

In this paper, an attempt has been made to study the determinants of labour productivity in the organised textile sector of India. By applying Panel Autoregressive Distributed Lag Model method for the period 1980–1981 to 2019–2020, we were able to identify the short run and long run determinants of labour productivity. The obtained results are consistent with economic theories and empirical literature. As can be seen from the result, skill, capital intensity, wages, and capacity utilisation were the most important determinants of labour productivity in the organised textile sector. This further supports the importance of all these variables in increasing productivity. Although the impact of each variable on labour productivity has been identified with great consistency and robust results, two major limitations must be pointed out here. First, an important limitation of the study is that its estimation is only for the formal sector of the textile industry. A better result could have been obtained by using the informal sector, where a large part of the labour force is employed. Second, we note that despite the ASI data's excellent reliability and wide coverage, errors in data reporting and other factors cannot be completely ruled out.

We conclude our paper with a few recommendations. The paper recommends that textile companies should adopt productivity-oriented wage policies. The government should encourage companies to pay higher wages by promoting some preferential policies for textile companies. Massive investment in weaving mills, powerlooms, and handlooms is needed to increase labour productivity. A comprehensive skill development programme should be developed for the entire value chain of the textile industry, supported by technological advances. Modernization programmes must be implemented in this segment to overcome the problem of obsolete machinery.

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# Relationship of Gross Domestic Product, Female Labour Participation and Fertility Rate: Evidence from Panel Data of 157 Countries

**Suraj Sharma**

*This study examines the relationship between gross domestic product, female labour participation, and fertility rate in a model that spans 157 countries from 1991 to 2018. It demonstrates cointegration or the existence of a long-run relationship among variables. Both short-run and long-run trends in gross domestic product and fertility rates have a significant impact on female labour participation, and this relationship is non-linear. The study finds a U-shaped relationship between female labour participation and gross domestic product, with fertility being one of the most important non-economic factors. Increased economic activity and lower fertility rates around the world have a real and positive impact on female labour participation.*

***Keywords***: Female labour participation rate, Economic progress, Fertility rate

## I Introduction

According to the findings of this study, long-run trends in economic growth and fertility rates have a significant impact on female labour participation, and the relationship is non-linear. Economic development and demographic transition, which have a lot to do with gender equality, are accounted for by the changing relationship of these three points (Galor and Weil 2000, Lagerlof 2003). It suggests a unified endogenous growth model where transition of an economy from a Malthusian regime to modern growth regime is developed. As per the study, there is a U-shaped relationship between female labour participation and economic progress, with fertility being one of the most important non-economic variables. Earlier studies using cross-country evidence (Cagatay and Ozler 1995, Goldin 1995, Pampel and Tanaka 1986), time-series framework (Goldin 1995, Tilly and Scott 1987), and even pooled data framework (Goldin 1995, Tilly and Scott 1987) suggest a U-shaped relationship between female labour participation and economic growth (Tam 2011, Tsani, Paroussos, Fragiadakis, Charalambidis and Capros 2013). However, differences in income groups across economies undermine this hypothesis. Like Lechman and Kaur (2015) takes a sample of 162 countries for a period of 1990 to 2012 and finds that U-shaped female labour

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participation-gross domestic product (FLP-GDP) hypothesis does not exist for low-income economies.

The study investigates this in a model that takes into account a long time series from 1991 to 2018 and a large pool of 157 countries using different measures of female labour participation, short and long-run panel analysis, and regression analysis to capture the relationship between female labour participation (FLP), Gross Domestic Product (GDP), and fertility (i.e., total fertility rate, TFR). Panel data estimations are used to capture country-specific and time-specific fixed effects, as well as dynamic long-run panel data analysis with panel unit root, co-integration, and dynamic ordinary least square regression. Econometric estimates are supported by a descriptive analysis of income groups.

The long run economic progress and demographics have so much to do with gender equality and female participation in the labour market (Lagerlof 2003, Dinc and Budic 2016). GDP, GDP per capita may be used to gauge economic progress quantitatively, while TFR can be used to measure demographics. This study uses a broad panel of countries to capture the above-mentioned model, which accounts for disparities in income, societal and cultural norms, and changing structural transformations. The goal of the study is to look at the relationship between female labour participation, gross domestic product, and fertility rate in a country panel from 1991 to 2018. The countries are chosen based on the data availability for the time period in question. Countries with no data for the chosen time period are clearly excluded from the sample. The study's major goal is to capture changes in FLP as a result of GDP and fertility rate changes. To account for the non-linearity in the model, the GDP squared element is included. The research is one-way, and it assumes that changes in a country's output and fertility rates have an impact on female labour participation. The study hypothesises that the relationship between FLP and GDP is non-linear and forms a U-shape. Furthermore, the study hypothesises that a high fertility rate is associated with a lower FLP score in general.

In comparison to past research, this study takes a fresh technique and considers two types of labour participation, as well as GDP and GDP per capita, which have been included in distinct models in the methods section. GDP per capita incorporates the role of population in the model. The study contains a diverse set of nations in order to capture the whole FLP-GDP relationship, which would be impossible to do in a time series framework or with a smaller sample of countries in the same income group. Furthermore, the study employs both short and long term dynamic analysis, making it more comprehensive than earlier literature.

The remainder of the paper is divided into the following sections: Section II reviews the study of related literature and gives a theoretical foundation for better understanding the modelling utilising graphical representations. Section III explains the data and time frame; Section IV discusses the study's methodology; Section V explains the results and analysis, including the short-run and long-run panel models; and Section VI presents the study's conclusions, policy implications,

and future research directions.

## II Review of Literature and Theoretical Framework

It has been discovered that increasing labour participation is characterised by growth in the Gross Domestic Product (GDP) or national income, but the relationship between the two is very complex when Female Labour Participation (FLP) is factored in. It has been observed that the relationship between national income and female labour participation rates exhibits a U-shaped curve. This means that in the early stages of growth and development, FLP decreases as GDP increases, and in later stages, FLP increases as GDP increases, forming a U-shaped curve. Previous studies using FLP as a key variable in macroeconomic and microeconomic studies have fairly raised the notion of gender equality in work participation. Studies revealed the importance of the issue, which must be viewed from various angles, as well as how the changing development scenario leads to changes in FLP and vice versa.

The pioneering works of Boserup (1970), Boserup and Schultz (1990), and Goldin (1995) are important to mention when discussing theorising the U-shaped relationship between FLP and GDP, GDP per capita for cross country data. They argued that one of the causes of the downward sloping FLP – GDP curve is the transition of an economy from a low-income agricultural sector-based to an industry or service sector-based economy. This entails abandoning old production techniques in favour of new or advanced ones, particularly in industry, which necessitates mass migration from rural agriculture-based economies to urban centres. The basic static labour supply model does not necessarily lead to the U-shape. Some researchers disagreed with the U-shaped pattern for female labour force participation over the course of economic development and claimed that because there were too many variables involved, the U-shaped hypothesis could not be used to generalise the data (Durand 1975, Standing 1978). The results of panel data analysis, however, have been ambiguous (Gaddis and Klasen 2014, Luci 2009, Tam 2011).

According to Schultz (1991), a U-shaped pattern is formed as a result of changes in the sectoral composition of the labour force. In the early stages of economic development, the use of advanced agricultural techniques reduces job opportunities for females due to the shift from the household, family farms, and small-scale cottage industry to large-scale industries with larger markets, a phenomenon known as the income effect (Goldin 1995). Furthermore, large-scale industry job opportunities necessitate migration, which is characterised by social stigma, which discourages female migration and forces them to care for families. The nature of the work is unpaid, unrecognised, and discourages females from participating in paid work.

Danchev and Sevinc (2012) opined that the poor level of education among females is one of the reasons for the downward sloping FLP – GDP curve. When a good educational level and skills are lacking, the nature of the work one gets is

manual and even the willingness to work gets affected. The initial transition from farm work, household work, and small industries creates a vacuum in which females have few manual job opportunities. Because of existing stigmas or customs, women are generally barred from working in manufacturing. Goldin (1995) observed that the reason for the downward slope of the U-shaped relationship in the early stages of economic development is due in part to the strong income effect (a decrease in the demand for female labour in agriculture) and the weak substitution effect (a reduction in the relative prices of home-produced goods).

However, as economic development progresses, national income rises, female education levels rise, and the value of women's labour in the market rises relative to the price of goods, a phenomenon known as the substitution effect, FLP rises again in relation to GDP. This upward-sloping section of the FLP – GDP curve indicates that females are returning to paid work and the labour force. This phenomenon contributes to greater gender equality in labour participation. The entire process suggests that in the early stages of economic development and growth, the income effect is much stronger than the substitution effect, and that in later stages, due to the strong substitution effect, an upward rising section of the FLP – GDP U-shaped curve is observed.

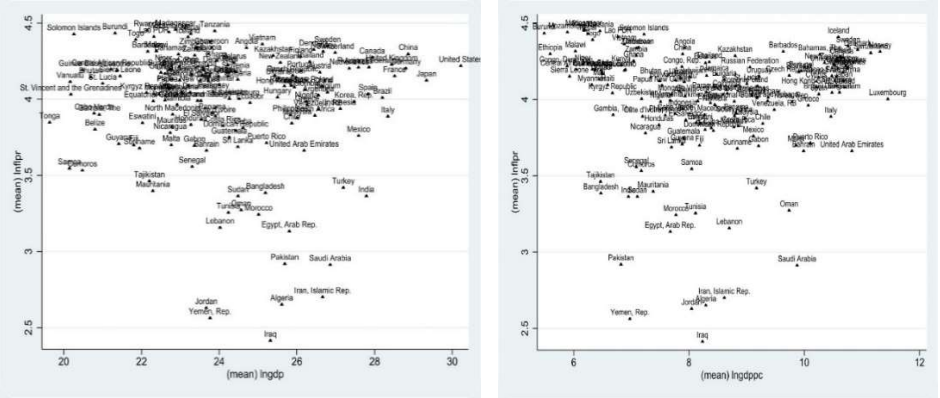
As I discuss the role of gender equality in economic development and demographic transition, I come across works by Galor and Weil (2000) and Lagerlof (2003), who see fertility changes as a key to demographic transition and support the U-shaped FLP-GDP hypothesis. According to Galor and Weil (2000), departure from the Malthusian trap is accounted for by demographic transition, technological change, and long-run output growth. This technological shift encourages spending on high-quality children, resulting in a higher return on investment in education. The rapid increase in human capital accumulation has an impact on output growth and has resulted in a demographic transition that has a negative impact on fertility rates. Lagerlof (2003) took a different approach, allowing for the goods cost of children and re-coordination process in achieving stable economic growth, and believes that a more equal level of gender equality would accelerate the process of stable economic growth by increasing human capital, lowering fertility rates, and valuing women's time.

## *Cross Country Plots*

In Figures 1 and 2, I plot the mean of female labour participation against the mean of gross domestic product using their natural logs. I traced out a U-shaped relationship between mean of female labour participation using two forms of female labour participation, i.e., log of female labour participation rate (age 15-64) ($LNFLPR_{it}$) and log of labour force, female (per cent of total labour force) ($LNLFF_{it}$) and economic progress, measured as mean of log of gross domestic product ($LNGDP_{it}$) and mean of log of gross domestic product per capita ($LNGDPPC_{it}$) in sample countries from 1991 to 2018. Figures 1 and 2 show that

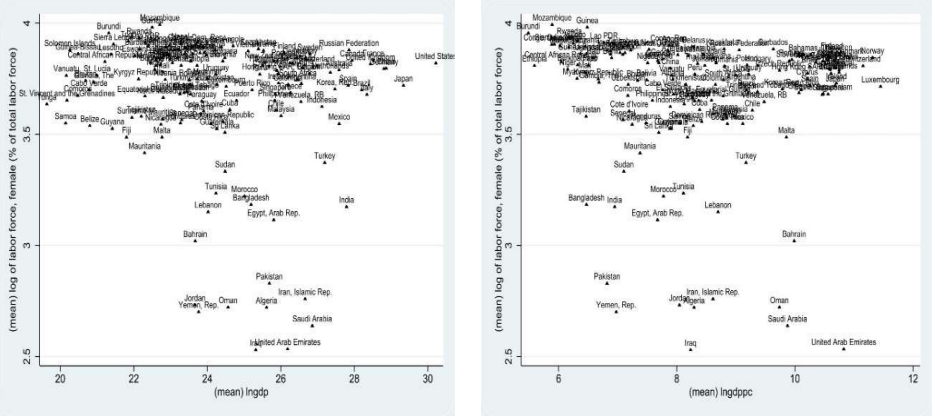
both low and high mean income levels are associated with high levels of mean female labour participation. Some countries fall below the natural U-turn line, and despite positive changes in national income, they are unable to achieve a level of female labour participation that is equitable. These are predominantly Asian African Islamic countries where non-economic factors such as societal and cultural norms prevent females from entering the labour force. This means that economic indicators alone will not suffice to track changes in female labour participation.

Figure 1: LNFLPR vs LNGDP and LNFLPR vs LNGDPPC. 1991-2018




Source: World development indicators, World Bank Group.

Figure 2: LNLFF vs LNGDP and LNLFF vs LNGDPPC 1991-2018

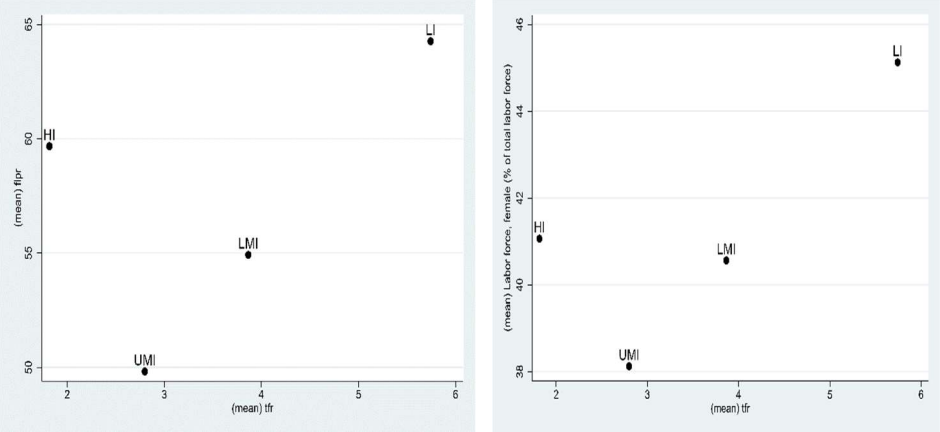



Source: World development indicators, World Bank Group.

Fertility rates in countries are one of the non-economic factors influencing female labour participation, which is largely determined by societal and cultural norms. Figure 3 shows that low-income countries have high mean female labour participation (an FLPR ≅ 64.0 per cent and an LFF ≅ 45.0 per cent) and high mean

fertility rates (≅ 5.7), whereas high-income economies have low mean female labour participation (an FLPR ≅ 50.0 per cent and an LFF ≅ 41.0 per cent) and low mean fertility rates (≅ 1.8). Figure 3 clearly shows the U-shaped relationship between mean female labour participation and GDP.

Figure 3: Income group-wise FLPR vs TFR and LFF vs TFR 1991-2018




Source: World development indicators, World Bank Group.

Earlier studies have found that the relationship between FLP and fertility rates is very complex depending on the measurement criteria of FLP and the panel of the study, despite a global trend of decreasing fertility rates around the world (Shittu and Abdullah 2018). However, a negative relationship is found between the two (De la Rica and Ferrero 2003, De Santis and Pino 2009, Mishra and Smyth 2010, Shittu, Abdullah, and Umar 2019, Tsani, *et. al*. 2013), implying lower FLP with high fertility countries and higher FLP with low fertility countries.

As a result of the literature review thus far, I can conclude that using time-series analysis to examine the link is limited, and seeing the complete transition requires a larger panel data set for a heterogeneous geographical area. This holds true for the FLP-GDP link as well. Many other factors influence FLP, such as female education level, social norms, culture, and institutions (Fernandez 2013), however in order to make the study sample heterogeneous and broad, I had to adhere to GDP and fertility to predict FLP. Female education data was fragmented, and intervals for different nations were unequal, so it was left out of the set of explanatory variables. Social norms and cultural variables are inferred in a similar way. The main purpose of the research is to track changes in FLP as a result of changes in GDP and fertility rates. The study is one-way, with the assumption that changes in a country's output and fertility rates affect female labour participation.

## III Data

The data comes from the World Bank's World Development Indicators database. Female labour participation has been considered in two forms: first, labour force participation rate, female (per cent of female population ages 15-64) and second, labour force, female (per cent of total labour force). Real GDP and real GDP per capita have been used to measure economic development. Fertility has been measured using fertility rates, total (births per woman). The panel is made up of data from 157 countries and spans the years 1991 to 2018 (*see* appendix). The countries are from all over the world, and the sample contains some high-income, low-income, lower-middle-income, and upper-middle-income countries to maintain income heterogeneity.

## IV Research Methodology

For the estimation of the U-shaped relationship between female labour participation and economic progress, we use GDP and its square as regressors and female labour participation rate as regressand. Based on previous empirical research we use TFR as one of the regressors. The basic model is written as follows;

$$FLPR = f\ (GDP, GDPSQ, TFR) \quad \ldots(1)$$

$$FLPR_{it} = c + GDP_{it}^{\beta_1} + GDPSQ_{it}^{\beta_2} + TFR_{it}^{\beta_3} \quad \ldots(2)$$

Where *FLPR* is the female labour participation rate (age 15-64), *GDP* is the gross domestic product (constant 2010 US$), *GDPSQ* is square of *GDP* and *TFR* is the total fertility rate. We take the natural logarithm of our basic model so that coefficients can be interpreted as elasticities (natural log variables are denoted using LN). Here, $\varepsilon_{it}$ is normally distributed error term. We retain the constant term in Eq. 4 as $\beta_0$ and coefficients of *GDP*, *GDPSQ* and *TFR* as $\beta_1$, $\beta_2$ and $\beta_3$ respectively.

$$LNFLPR_{it} = Ln(c) + \beta_1 LNGDP_{it} + \beta_2 LNGDPSQ_{it} + \beta_3 LNTFR_{it} + \varepsilon_{it} \quad \ldots(3)$$

$$LNFLPR_{it} = \beta_0 + \beta_1 LNGDP_{it} + \beta_2 LNGDPSQ_{it} + \beta_3 LNTFR_{it} + \varepsilon_{it} \quad \ldots(4)$$

The study uses four different models where *Model 1* belongs to eq. (4). *Model 2* considers the log of GDP per capita in place of the log of GDP as a variable of economic progress. The rest of the model is the same as eq. (4). I use the labour force, female (per cent of the total labour force) (LFF) as an outcome variable in *Model 3* and *Model 4*. Furthermore, *Model 3* uses GDP and *Model 4* uses GDP per capita (GDPPC) as a variable of economic progress. So, we have four different

models to capture the relationship between female labour participation and economic progress in this study.

First, the study carried out a static panel data analysis to estimate short-run coefficients considering individual heterogeneity. The study used fixed and random effect models and include the Hausman (1978) test to select between the two models.

The first-panel model is written as follows:

$$LNFLPR_{i,t} = a_0 + a_{0i} + a_1 LNGDP_{i,t} + a_2 LNGDPSQ_{i,t} + a_3 LNTFR_{i,t} + \varepsilon_{i,t} \quad \ldots(5)$$

$a_0$ is the intercept term and it is being identical for all cross-sections (countries);
$a_{0i}$ is the term of fixed effect for the cross-sections (countries);

In case, the relationship between endogenous and exogenous variables is not fixed, but random, we may reformulate the error term as follows;

$$\varepsilon_{i,t} = a_{0i} + \triangle_t + \nu_{i,t} \quad \ldots(6)$$

$a_{0i}$ in this case, becomes a random effect term for the cross-sections (countries);
$\triangle_t$ is the temporal effect;
$\nu_{i,t}$ is an error term.

The second-panel model uses a panel cointegration model to estimate the long-run coefficients is written as follows;

$$LNFLPR_{i,t} = a_1 LNGDP_{i,t} + a_2 LNGDPSQ_{i,t} + a_3 LNTFR_{i,t} + \varepsilon_{i,t} \quad \ldots(7)$$

To determine the order of integration in this panel model, we begin with panel unit root tests. If we discover that the order of integration is the same for all of the variables mentioned above, we use panel cointegration tests to confirm the long-run relationship between variables. Finally, if we find cointegration among the variables of interest, we employ Dynamic Ordinary Least Squares (DOLS).

### *Panel Unit Root Tests*

The panel unit root tests developed by Harris-Tzavalis (1999), Im-Pesaran-Shin (2003), Augmented Dickey-Fuller-Fisher (ADF-Fisher) and Philips-Perron-Fisher (PP-Fisher) of Maddala and Wu (1999) are employed in this study. For ADF-Fisher and PP-Fisher, we use inverse normal Z statistic which offers the best result suggested by Choi (2001). To mitigate the impact of cross-sectional dependence, the study first subtracts the cross-sectional averages from the series and then computes statistical values to confirm the degree of integration of variables. The study uses both constant only; and constant with trend specifications to test any presence of unit root in the series.

### *Panel Cointegration Test*

The panel cointegration test proposed by Pedroni (1999, 2004) is employed in this study. The use of Pedroni test is justified because we have a cross-section dimension greater than the time dimension (N>T). This test uses seven different statistics and has null hypotheses of no cointegration among the variables. It also considers heterogeneity in using panel specific parameters which makes it better than estimations using Kao (1999). It is better not to use Westerlund (2005) cointegration estimations because it best soothes for a dataset having shorter cross-sections than time dimension (N<T).

## V Result and Analysis

### *Short-Run Pooled Panel Model Estimation*

To begin, the study employs pooled panel data to estimate short-run coefficients for all four models. Table 1 shows the pooled fixed effect panel model for all four models based on the Hausman test results, which show that a fixed effect model outperforms a random effect model ($p<0.00$). Large within standard deviations show that there is variation in FLP over time for countries, and a fixed effect estimator is appropriate in this case (*see* appendix Table A1). Fisher coefficients (F statistics) show that for all four models, overall fit with regressors is better than no regressors.

Panel models, i.e., models 3 and 4, with $LFF_{it}$ as the outcome variable, are found to be optimal based on the Akaike's Information Criteria (AIC), Bayesian Information Criteria (BIC) and log-likelihood. Model 4 is particularly optimal when the outcome variable is $LFF_{it}$ and one of the regressors is $GDPPC_{it}$.

From the negative coefficients of $GDP_{it}$ (-0.298, $p<0.00$) and $GDPPC_{it}$ (-0.347, $p<0.00$) and positive coefficients of the square of $GDPSQ_{it}$ (0.007, $p<0.00$) and $GDPPCSQ_{it}$ (0.023, $p<0.00$), the study traces out the U-shaped relationship between female labour participation ($LFF_{it}$) and gross domestic production ($GDP_{it}\ or\ GDPPC_{it}$) meaning thereby as the GDP/GDP per capita increases, female labour participation tends to decrease having a quadratic vertex function, pass through the lowest point and again start being positively related, which is visible from the positive coefficients of the squared term of GDP and GDP per capita, forming a U-shaped curve.

Table 1: Panel model (Fixed effect)

| Variables | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Dependent VR | $LNFLPR_{it}$ | $LNFLPR_{it}$ | $LFF_{it}$ | $LFF_{it}$ |
| Intercept | 7.414*** (0.4833117) | 6.506*** (0.1275156) | 6.982*** (0.3507291) | 5.041*** (0.0954925) |
| LNGDP | -0.336*** (0.0398007) | | -0.298*** (0.0288825) | |
| LNGDPSQ | 0.008*** (0.0008256) | | 0.007*** (0.0005991) | |
| LNGDPPC | | -0.669*** (0.0305283) | | -0.347*** (0.0228617) |
| LNGDPPCSQ | | 0.045*** (0.001863) | | 0.023*** (0.0013952) |
| LNTFR | -0.093*** (0.0109094) | -0.164*** (0.0092979) | -0.119*** (0.0079167) | -0.154*** (0.0069629) |
| AIC | -9980.651 | -9980.651 | -12799.78 | -12928.78 |
| BIC | -9955.097 | -9955.097 | -12774.23 | -12903.23 |
| DoF | 4 | 4 | 4 | 4 |
| Loglikelihood | 4994.325 | 4994.325 | 6403.892 | 6468.391 |
| R-squared (within) | 0.1279 | 0.2048 | 0.1667 | 0.1908 |
| R-squared (between) | 0.0003 | 0.0454 | 0.0002 | 0.0066 |
| R-squared (overall) | 0.0009 | 0.0490 | 0.0000 | 0.0089 |
| F statistic | 207.07 | 363.54 | 282.42 | 332.88 |
| F probability | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Hausman test | 34.79*** | 45.75*** | 48.83*** | 60.76*** |

Notes: *, **, and *** denote 10 per cent, five per cent and one per cent level of significance, respectively.
Source: Authors' calculations.

Regardless of the model, the sign of the coefficient for TFR was significantly negative, which depicts a one per cent increase/decrease in total fertility rate results in a 0.15 per cent decrease/increase in female labour participation ($LFF_{it}$). The result indicates a high fertility rate negatively relates with female labour participation ($FLPR_{it}$ *and* $LFF_{it}$) in general. However, the relationship between the two is also U-shaped where low-income economies are characterised with high female labour participation and high fertility rates, lower-middle-income economies are characterised with moderate female labour participation and somewhat high fertility rates, upper-middle-income economies are characterised by low female labour participation and moderate fertility rates and for high-income economies, falling trend of female labour participation reverse but not to the extent of low-income economies. High-income economies are characterised by somewhat high female labour participation and the lowest fertility rates.

Individual fixed effects results demonstrate that low-income economies lead in terms of high female labour participation, as seen by positive individual fixed effects (*see* model 4) for all 22 low-income economies (excluding Sudan, Tajikistan, and Yemen) (*see* appendix Table A3). These economies' structural characteristics are such that they are in the early phases of economic development,

unable to fully utilise their resources, particularly natural resources, and are mostly agriculturally based.

29 out of 48 high-income economies including Australia, Austria, Bahrain, Belgium, Brunei Darussalam, Chile, Cyprus, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Macao, Malta, Mauritius, Netherlands, Norway, Oman, Panama, Puerto Rico, Saudi Arabia, Singapore, Spain, Switzerland, Trinidad and Tobago, and the United Arab Emirates, 11 out of 40 lower-middle-income economies including Bangladesh, Egypt, Honduras, India, Mauritania, Morocco, Nicaragua, Pakistan, Senegal, Sri Lanka, and Tunisia and 20 out of 47 upper-middle-income economies including Algeria, Belize, Costa Rica, Cuba, Dominican Republic, Fiji, Guatemala, Guyana, Indonesia, Iran, Iraq, Jordan, Lebanon, Malaysia, Mexico, North Macedonia, Samoa, Suriname, Turkey, and Venezuela have a negative effect, implying that economic expansion and structural changes in these economies have resulted in a decrease in female labour market participation. This also demonstrates and implies that, as a result of economic expansion, the negative fixed effect has become more prevalent, with a growing number of economies showing a negative effect. In comparison to low-income economies, even high-income economies have not reached an average high level of female labour participation.

The results of the temporal fixed effects analysis from 1991 to 2018 reveal that there was a positive relationship, implying that global economic expansion and lower fertility rates have a real and positive impact on female labour participation (*see* appendix Table A4).

However, the study did not include a social or religious variable to account for the impact of societal norms on FLP, but it is obvious from individual fixed effects and preliminary analysis that the nature of the link between FLP, GDP, and TFR differs between countries. For example, the majority of nations with negative individual effects are Muslim countries, where women are unable to participate in the labour market as actively as men due to religious restrictions. These findings are supported by literature such as Doumato and Posusney (2003), Nassar (2003), and Wolch and Dear (2015).

## *Long Run Panel Cointegration Model Estimation*

### *Panel Unit Root Tests*

Table 2 presents the results of the panel unit root test and hypothesises that the series is stationary around a constant or stationary around a constant and a trend. All variables are integrated of order 1 or series are stationary at I (1) at the 1.0 percent level of significance, as shown by panel unit root tests. For both constant as well as constant and trend regressions, the findings of unit root at levels are inconsistent, although all series became stationary at the first difference. As a result, a panel cointegration test can be used to confirm the long-run relationship between variables of interest.

Table 2: Unit Root Tests

| Variables | Harris-Tzavalis (z value) | | Im-Pesaran-Shin ($t\text{-bar}_{NT}$) | | ADF-Fisher (inverse normal Z) | | PP-Fisher (inverse normal Z) | |
|---|---|---|---|---|---|---|---|---|
| | Level | I (1) | Level | I (1) | Level | I (1) | Level | I (1) |
| Pooled data (Countries = 157, T = 28) | | | | | | | | |
| Constant | | | | | | | | |
| LNFLPR | 8.9 | -85.2*** | -1.2 | -3.8*** | 0.9 | -20.4*** | 1.3 | -33.6*** |
| LNLFF | 9.5 | -75.3*** | -1.6 | -3.9*** | -2.5** | -20.9*** | -2.3** | -35.1*** |
| LNGDP | 4.3 | -64.1*** | -1.1 | -4.0*** | 4.9 | -24.9*** | 3.4 | -35.8*** |
| LNGDPSQ | 4.9 | -63.7*** | -1.1 | -4.0*** | 5.0 | -24.8*** | 3.8 | -35.7*** |
| LNTFR | 8.7 | -56.2*** | -1.4 | -2.4*** | -3.8*** | -2.7*** | 0.9 | -11.3*** |
| LNGDPPC | 4.7 | -65.1*** | -1.0 | -3.9*** | 4.1 | -24.6*** | 5.4 | -35.5*** |
| LNGDPPCSQ | 5.1 | -61.9*** | -1.1 | -3.9*** | 3.2 | -24.6*** | 4.4 | -35.5*** |
| Constant and trend | | | | | | | | |
| LNFLPR | 8.2 | -37.4*** | -1.7 | -4.1*** | 1.9 | -16.6*** | 4.4 | -29.7*** |
| LNLFF | 11.4 | -30.6*** | -1.6 | -4.3*** | 0.2 | -17.9*** | 4.3 | -31.9*** |
| LNGDP | 6.9 | -25.6*** | -2.5*** | -4.1*** | -2.5** | -18.1*** | -4.6*** | -29.4*** |
| LNGDPSQ | 6.7 | -25.1*** | -2.4*** | -4.1*** | -2.6** | -18.2*** | -3.9*** | -29.5*** |
| LNTFR | 11.6 | -19.3*** | -1.7 | -2.8*** | -2.0** | 7.7 | 3.9 | -8.3*** |
| LNGDPPC | 7.1 | -26.8*** | -2.3 | -4.1*** | -1.5* | -17.9*** | -2.6** | -29.1*** |
| LNGDPPCSQ | 8.6 | -24.7*** | -2.1 | -4.1*** | -0.4 | -18.7*** | -0.2 | -29.5*** |

Notes: *, **, and *** denote 10 per cent, five per cent and one per cent level of significance, respectively. Optimum lag length has been chosen using AIC as 1 for above unit root tests. LN denotes natural logarithms of variables.

Source: Authors' calculations.

## *Panel Cointegration Results*

Table 3: Pedroni's Panel Cointegration Test

| Dependent VR | Model 1 $LNFLPR_{it}$ | | Model 2 $LNFLPR_{it}$ | | Model 3 $LFF_{it}$ | | Model 4 $LFF_{it}$ | |
|---|---|---|---|---|---|---|---|---|
| | C | C & T | C | C & T | C | C & T | C | C & T |
| Panel statistics | | | | | | | | |
| V | -3.5*** | -6.5*** | -3.9*** | -5.1*** | -3.5*** | -6.3*** | -3.9*** | -4.8*** |
| Rho | 0.2 | 2.4 | 0.7 | 2.5*** | -0.1 | 2.2 | 0.6 | 2.2 |
| PP | -3.4*** | -3.2*** | -2.9*** | -2.3*** | -3.6*** | -3.0*** | -3.5*** | -2.9*** |
| ADF | -4.5*** | -3.9*** | -3.1*** | -2.5*** | -4.3*** | -2.5*** | -1.1 | -2.2*** |
| Group statistics | | | | | | | | |
| Rho | -9.7*** | -7.7*** | -9.4*** | -7.5*** | -10.5*** | -7.8*** | -10.1*** | -7.8*** |
| PP | -33.1*** | -35.3*** | -33.5*** | -34.1*** | -34.1*** | -34.8*** | -34.9*** | -34.7*** |
| ADF | -37.7*** | -41.9*** | -39.4*** | -40.3*** | -40.2*** | -42.7*** | -35.2*** | -41.0*** |

Notes: *, **, and *** denote 10 per cent, five per cent and one per cent level of significance, respectively. Optimum lag length and leads have been chosen using AIC as 2 for above cointegration test. C and C & T denotes constant and constant and trend estimations.

Source: Authors' calculations.

The Pedroni (1999, 2004) test is used in this study to capture a stable long-run association between variables. For the cointegration test, all four models with female labour participation as regressand and GDP/GDP per capita and fertility rate as regressors are utilised. There is no cointegration among variables, according to the study's hypothesis. The Pedroni test produces four panel and three group statistics, with the majority being used to test the null hypothesis. Table 3 shows that at a 1.0 per cent level of significance, we cannot accept the null hypothesis of no cointegration among variables, indicating that there is cointegration among variables of interest or a long-run relationship between variables for the aforementioned models for constant and trend estimations. The existence of a long-run relationship suggests that long-run dynamic ordinary least squares should be used (DOLS).

### *Panel Cointegration Estimations using DOLS*

Pedroni's cointegration tests reveal the presence of panel cointegration, which lead to the estimation of DOLS coefficients in order to determine the direction and size of the long-run association between female labour participation and GDP/GDP per capita. The pooled model coefficients in Table 4 show that there is a long run association between female labour participation ($FLPR_{it}\ and\ LFF_{it}$) and economic progress ($GDP_{it}\ and\ GDPPC_{it}$) for 157 countries from 1991 to 2018 and the U-shaped relationship is demonstrated for our wide panel. The negative and significant coefficients for $GDP_{it}\ and\ GDPPC_{it}$ as well as positive and significant coefficients for the square of $GDP_{it}\ and\ GDPPC_{it}$ suggest that there is long-run linkage and a U-shaped relationship between female labour participation and GDP/GDP per capita. The long-run negative coefficient for $TFR_{it}$ indicates that high fertility rates have a negative impact on female labour participation in the long run.

Table 4: Results of Dynamic OLS Estimations

| Dependent VR | Model 1 $LNFLPR_{it}$ | Model 2 $LNFLPR_{it}$ | Model 3 $LFF_{it}$ | Model 4 $LFF_{it}$ |
|---|---|---|---|---|
| LNGDP | -0.334** | | -0.268** | |
| | (0.1321527) | | (0.0960253) | |
| LNGDPSQ | 0.007** | | 0.005** | |
| | (0.0027765) | | (0.0020175) | |
| LNGDPPC | | -1.238*** | | -0.682*** |
| | | (0.0909204) | | (0.0681648) |
| LNGDPPCSQ | | 0.070*** | | 0.036*** |
| | | (0.0056608) | | (0.004244) |
| LNTFR | -0.105*** | -0.214*** | -0.0808*** | -0.179*** |
| | (0.0285883) | (0.0258844) | (0.0207729) | (0.0194061) |
| Wald chi2 | 19.76*** | 269.25*** | 25.56*** | 224.98*** |
| R-squared | 0.9334 | 0.9001 | - | - |

Note: *, **, and *** denote 10per cent, five per cent and one per cent level of significance, respectively. Figures in parentheses are corresponding standard errors. Automatic leads and lags specification are based on SIC criterion. The dependent variable in model 1 and 2 is FLPR and in model 3 and 4 it is LFF.
Source: Authors' calculations.

The short and long run coefficients for GDP, GDP per capita and fertility point to the same conclusion, implying a U-shaped link between FLP and GDP as well as a negative relationship between FLP and fertility in general. Previous research (Tam 2011, Boserup, Tan, and Toulmin 2013, Lechman and Okonowicz 2013, Olivetti 2013, Tsani, *et. al.* 2013) that advocated for U-shaped feminisation is consistent with the findings. Bayanpourtehrani and Sylwester (2013) and Gaddis and Klasen (2014) both support the conclusion that economic development and declining fertility allow female participation in the labour market. It is crucial to note that after disaggregating the data, Lechman and Kaur (2015) discovered that the U-shaped hypothesis was accurate for all economies except low-income economies, and that the limiting factor was the lack of a large pooled aggregated panel. Low-income economies are still awaiting the transition, and until that time comes, it is impossible to determine the true FLP-GDP link.

## VI Concluding Remarks

For a panel of 157 countries across the world, this study looked at the relationship between female labour participation, gross domestic product, and fertility rate. When fertility rate is considered one of the most important non-economic elements determining demographic transition, the results show a substantial U-shaped association between FLP and GDP/GDP per capita. This FLP-GDP-TFR link holds true in both the short and long term. Panel data estimations, as well as dynamic long-run panel data analysis including panel unit root, co-integration, and dynamic ordinary least square regression, were used to capture country-specific and time-specific fixed effects. It was found that both short- and long-term trends in gross domestic product and fertility rate have a considerable impact on female labour participation, and that the connection is non-linear. The study discovered that increased economic activity and lower fertility rates have a meaningful and favourable impact on female labour participation around the world.

In terms of the unique relationship between FLP and GDP, the analysis' results are robust because the study used long time series and a large panel of countries, i.e., aggregated data, resulting in estimations that are reliable, stable, and take structural changes into account. Nevertheless, one must keep in mind that the results would not be reliable at the country level.

The importance of findings indicates policy implication of directly affecting fertility decisions of populations because the U-shaped FLP-GDP relationship was found very stable and every country will follow the pattern unless they make changes to their population policy and thereby influencing demographic transition. As a result, countries with declining FLP should not panic and should instead advocate policies that remove or reduce barriers to female labour participation. This study is unique in its sample size and the first to have a large panel because only cross country and time-series literature cannot be taken as solid evidence of U-shaped FLP-GDP relationship, considering demographic transition through fertility rates. The findings are significant because they have policy implications,

implying that encouraging economic progress and gender equality (in terms of fertility decisions) could increase female labour participation rates. The modernising of society and cultural norms should be promoted by policy measures.

Despite this, a variety of factors other than economic advancement and fertility, influence female labour participation, including education, social conventions, culture, and other intangible elements. It's also worth noting that because the data was so fragmented and country-specific variables are difficult to incorporate in a varied panel, the education variable could not be included at the aggregate level for a large panel. The intricacies of structural changes in an economy or the global economy have an impact on the FLP-GDP-TFR relationship. This study could not capture the effect of these structural changes in an economy, as suggested, a service-oriented economy generates favourable conditions for growing female labour participation and an industry-oriented economy marginalises women's involvement in the labour market. To capture the true relationship during transition, one should have a large time series for a specific geographical area. Furthermore, this research is based on estimates of female labour participation rates and merely reveals statistical associations. Obviously, future study should capture and control the other aspects described above in order to have precise estimations and effective policy actions. Future research could, for example, look at whether women can access better employment and opportunities in ever-changing labour markets. These are in place to prevent any overestimation of the influence of economic progress and TFR on female labour participation.

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## Appendix

Table A1: Descriptive Statistics

| Variable | Description | Level | Mean | S.D. | Range |
|---|---|---|---|---|---|
| LNFLPR | Log of labour force participation rate, female (per cent of female population ages 15-64) | Overall | 3.96 | 0.40 | 1.83-4.52 |
| | | Between | | 0.03 | 3.90-4.01 |
| | | Within | | 0.40 | 1.78-4.57 |
| LNLFF | Log of labour force, female (per cent of total labour force) | Overall | 3.67 | 0.31 | 2.06-4.03 |
| | | Between | | 0.03 | 3.62- 3.69 |
| | | Within | | 0.30 | 2.03-4.07 |
| LNGDP | Log of gross domestic product (constant 2010 US$) | Overall | 24.31 | 2.22 | 19.19-30.52 |
| | | Between | | 0.31 | 23.85-24.79 |
| | | Within | | 2.20 | 19.37-30.35 |
| LNGDPSQ | Log of square of GDP | Overall | 595.66 | 109.19 | 368.07-931.22 |
| | | Between | | 15.07 | 573.68-619.20 |
| | | Within | | 108.18 | 370.57-919.14 |
| LNGDPPC | Log of gross domestic product per capita (constant 2010 US$) | Overall | 8.39 | 1.51 | 5.10-11.63 |
| | | Between | | 0.19 | 8.13-8.67 |
| | | Within | | 1.50 | 5.07-11.57 |
| LNGDPPCSQ | Log of square of GDPPC | Overall | 72.60 | 25.76 | 26.03-135.16 |
| | | Between | | 3.08 | 68.31-77.24 |
| | | Within | | 25.59 | 23.99-133.51 |
| LNTFR | Log of fertility rate, total (births per woman) | Overall | 1.03 | 0.51 | -0.15-2.14 |
| | | Between | | 0.10 | 0.89-1.24 |
| | | Within | | 0.51 | -0.13-2.08 |

Source: Authors' calculations.

Table A2: List of Countries with Highest and Lowest FLPR, LFF and TFR

| S.N. | Country | FLPR | Country | LFF | Country | TFR |
|---|---|---|---|---|---|---|
| Ranked highest in parameters | | | | | | |
| 1 | Madagascar | 86.3112 | Mozambique | 54.2971 | Niger | 7.52282 |
| 2 | Rwanda | 85.9304 | Guinea | 53.6246 | Chad | 6.88614 |
| 3 | Tanzania | 85.5619 | Burundi | 52.2454 | Mali | 6.68996 |
| 4 | Mozambique | 84.9424 | Rwanda | 51.0654 | Congo, Dem. Rep. | 6.57732 |
| 5 | Burundi | 84.3341 | Togo | 50.3465 | Burundi | 6.5335 |
| 6 | Nepal | 83.9559 | Lao PDR | 50.0296 | Angola | 6.42121 |
| 7 | Solomon Islands | 83.7093 | Nepal | 49.9648 | Uganda | 6.38886 |
| 8 | Lao PDR | 82.3794 | Sierra Leone | 49.6969 | Burkina Faso | 6.21746 |
| 9 | Iceland | 82.2154 | Congo, Dem. Rep. | 49.6494 | Nigeria | 5.96861 |
| 10 | Togo | 80.7779 | Congo, Rep. | 49.4787 | Ethiopia | 5.84843 |

Contd…

Table A2: List of Countries with Highest and Lowest FLPR, LFF and TFR

| S.N. | Country | FLPR | Country | LFF | Country | TFR |
|---|---|---|---|---|---|---|
| Ranked lowest in parameters | | | | | | |
| 1 | Iraq | 11.3635 | Iraq | 12.7339 | Macao SAR, China | 1.11546 |
| 2 | Jordan | 13.9523 | United Arab Emirates | 12.7359 | Hong Kong SAR, China | 1.11879 |
| 3 | Yemen, Rep. | 14.2025 | Saudi Arabia | 14.1042 | Spain | 1.2825 |
| 4 | Algeria | 14.3036 | Oman | 15.3453 | Italy | 1.31893 |
| 5 | Iran, Islamic Rep. | 15.2395 | Algeria | 15.3517 | Korea, Rep. | 1.32211 |
| 6 | Saudi Arabia | 18.6168 | Jordan | 15.502 | Greece | 1.33607 |
| 7 | Pakistan | 18.9333 | Yemen, Rep. | 15.8516 | Ukraine | 1.37146 |
| 8 | Egypt, Arab Rep. | 23.0177 | Iran, Islamic Rep. | 16.1198 | Germany | 1.37964 |
| 9 | Lebanon | 23.5585 | Pakistan | 17.2355 | Singapore | 1.3875 |
| 10 | Morocco | 25.6862 | Bahrain | 20.5422 | Japan | 1.39214 |

Source: Authors' calculations.

Table A3: The Individual Fixed Effect Estimations

| Country | Income group | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|---|
| Australia | HI | 0.201227 | -0.02383 | 0.08374 | -0.01268 |
| Austria | HI | 0.190766 | -0.06445 | 0.096607 | -0.01926 |
| Bahamas, The | HI | 0.339131 | 0.173321 | 0.173872 | 0.110784 |
| Bahrain | HI | -0.27833 | -0.38529 | -0.63556 | -0.68257 |
| Barbados | HI | 0.336912 | 0.277633 | 0.167437 | 0.164551 |
| Belgium | HI | 0.06108 | -0.16408 | 0.080416 | -0.02218 |
| Brunei Darussalam | HI | 0.096202 | -0.10825 | 0.010618 | -0.07415 |
| Canada | HI | 0.248568 | 0.047836 | 0.106103 | 0.025484 |
| Chile | HI | -0.1176 | -0.13563 | -0.06078 | -0.07757 |
| Cyprus | HI | 0.163316 | -0.0151 | 0.061727 | -0.01447 |
| Czech Republic | HI | 0.184119 | 0.081837 | 0.091643 | 0.040849 |
| Denmark | HI | 0.351419 | 0.04894 | 0.158692 | 0.019457 |
| Finland | HI | 0.312142 | 0.070431 | 0.185443 | 0.072259 |
| France | HI | 0.107762 | -0.03561 | 0.102049 | 0.053506 |
| Germany | HI | 0.134914 | -0.02308 | 0.029059 | -0.01916 |
| Greece | HI | -0.01903 | -0.1694 | -0.0165 | -0.08697 |
| Hong Kong SAR, China | HI | 0.098959 | -0.09757 | 0.06022 | -0.03006 |
| Hungary | HI | 0.047535 | -0.01168 | 0.117966 | 0.085233 |
| Iceland | HI | 0.455151 | 0.219913 | 0.165737 | 0.068833 |
| Ireland | HI | 0.116718 | -0.14036 | 0.05757 | -0.06323 |
| Israel | HI | 0.195243 | 0.065148 | 0.164342 | 0.096809 |
| Italy | HI | -0.16084 | -0.31781 | -0.07379 | -0.12841 |
| Japan | HI | 0.028072 | -0.12165 | -0.0671 | -0.1021 |
| Korea, Rep. | HI | -0.03074 | -0.10657 | -0.02514 | -0.0545 |
| Luxembourg | HI | 0.048993 | -0.4204 | 0.032954 | -0.17908 |
| Macao SAR, China | HI | 0.182631 | -0.08035 | 0.107764 | -0.00072 |
| Malta | HI | -0.26933 | -0.38228 | -0.22215 | -0.25749 |

| Country | Income group | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|---|
| Mauritius | HI | -0.14474 | -0.12606 | -0.12915 | -0.10998 |
| Netherlands | HI | 0.199929 | -0.03954 | 0.072022 | -0.03256 |
| New Zealand | HI | 0.285566 | 0.100863 | 0.157122 | 0.067678 |
| Norway | HI | 0.333725 | -0.05911 | 0.159564 | -0.01927 |
| Oman | HI | -0.65386 | -0.69854 | -0.89887 | -0.92812 |
| Panama | HI | -0.03008 | 0.003457 | -0.05785 | -0.04707 |
| Poland | HI | 0.099512 | 0.081384 | 0.107279 | 0.095172 |
| Portugal | HI | 0.211368 | 0.081974 | 0.138888 | 0.076698 |
| Puerto Rico | HI | -0.24301 | -0.39809 | 0.023343 | -0.05172 |
| Romania | HI | 0.11936 | 0.11704 | 0.115315 | 0.10591 |
| Saudi Arabia | HI | -1.04905 | -1.08132 | -1.00046 | -1.02253 |
| Singapore | HI | 0.116993 | -0.13447 | -0.01656 | -0.13246 |
| Slovenia | HI | 0.220505 | 0.078837 | 0.135777 | 0.071183 |
| Spain | HI | 0.005652 | -0.13382 | -0.01871 | -0.072 |
| Sweden | HI | 0.365619 | 0.11122 | 0.171279 | 0.055339 |
| Switzerland | HI | 0.31029 | -0.04626 | 0.1012 | -0.05786 |
| Trinidad and Tobago | HI | 0.03667 | -0.00864 | 0.008257 | -0.00791 |
| United Arab Emirates | HI | -0.29808 | -0.56463 | -1.12806 | -1.2538 |
| United Kingdom | HI | 0.184925 | 0.042833 | 0.082045 | 0.03339 |
| United States | HI | 0.081836 | -0.00068 | 0.016497 | 0.028148 |
| Uruguay | HI | 0.206964 | 0.18839 | 0.108021 | 0.094795 |
| Burkina Faso | LI | 0.272817 | 0.324032 | 0.20634 | 0.21674 |
| Burundi | LI | 0.477405 | 0.440271 | 0.312166 | 0.300552 |
| Central African Republic | LI | 0.229792 | 0.27339 | 0.164549 | 0.198189 |
| Chad | LI | 0.245878 | 0.326945 | 0.208862 | 0.235402 |
| Congo, Dem. Rep. | LI | 0.309831 | 0.29305 | 0.320851 | 0.284097 |
| Ethiopia | LI | 0.383863 | 0.305798 | 0.214787 | 0.149224 |
| Gambia, The | LI | -0.07554 | 0.059209 | 0.064959 | 0.151382 |
| Guinea | LI | 0.245471 | 0.314041 | 0.364279 | 0.387631 |
| Guinea-Bissau | LI | 0.199023 | 0.314236 | 0.171161 | 0.257487 |
| Haiti | LI | 0.155934 | 0.206177 | 0.201383 | 0.218194 |
| Madagascar | LI | 0.530796 | 0.547365 | 0.275458 | 0.267995 |
| Malawi | LI | 0.383563 | 0.39617 | 0.275887 | 0.272335 |
| Mali | LI | 0.213981 | 0.28407 | 0.181397 | 0.199478 |
| Mozambique | LI | 0.51273 | 0.495121 | 0.378842 | 0.35591 |
| Niger | LI | 0.309968 | 0.358088 | 0.197578 | 0.205889 |
| Rwanda | LI | 0.510891 | 0.54066 | 0.297289 | 0.307877 |
| Sierra Leone | LI | 0.194439 | 0.217222 | 0.255867 | 0.273781 |
| Sudan | LI | -0.55093 | -0.45758 | -0.26137 | -0.24308 |
| Tajikistan | LI | -0.48697 | -0.44442 | -0.07286 | -0.05342 |
| Togo | LI | 0.442758 | 0.50166 | 0.275446 | 0.305349 |
| Uganda | LI | 0.280057 | 0.338659 | 0.273342 | 0.277227 |
| Yemen, Rep. | LI | -1.35017 | -1.25717 | -0.89384 | -0.87188 |
| Bangladesh | LMI | -0.5543 | -0.55547 | -0.45592 | -0.48302 |
| Benin | LMI | 0.270165 | 0.371931 | 0.232292 | 0.269677 |

| Country | Income group | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|---|
| Bhutan | LMI | 0.138605 | 0.271709 | 0.012777 | 0.11398 |
| Bolivia | LMI | 0.191166 | 0.281027 | 0.113736 | 0.143612 |
| Cabo Verde | LMI | -0.09383 | 0.051856 | -0.02041 | 0.086301 |
| Cameroon | LMI | 0.42428 | 0.525121 | 0.268515 | 0.29506 |
| Comoros | LMI | -0.46293 | -0.28344 | -0.02177 | 0.100124 |
| Congo, Rep. | LMI | 0.287347 | 0.410145 | 0.28175 | 0.333237 |
| Cote d'Ivoire | LMI | -0.02443 | 0.081393 | 0.009892 | 0.03798 |
| Egypt, Arab Rep. | LMI | -0.80685 | -0.70915 | -0.51267 | -0.48889 |
| El Salvador | LMI | -0.07381 | -0.00057 | 0.028035 | 0.054783 |
| Eswatini | LMI | -0.11013 | 0.007393 | 0.191065 | 0.258896 |
| Ghana | LMI | 0.332337 | 0.414267 | 0.258268 | 0.276064 |
| Honduras | LMI | -0.10018 | -0.00896 | -0.08509 | -0.0518 |
| India | LMI | -0.63574 | -0.53009 | -0.50184 | -0.4658 |
| Kenya | LMI | 0.306727 | 0.375311 | 0.275311 | 0.282756 |
| Kyrgyz Republic | LMI | 0.081843 | 0.126834 | 0.070641 | 0.096175 |
| Lao PDR | LMI | 0.46269 | 0.528778 | 0.259385 | 0.290139 |
| Lesotho | LMI | 0.216176 | 0.316185 | 0.174668 | 0.239648 |
| Mauritania | LMI | -0.53856 | -0.40671 | -0.21322 | -0.15092 |
| Mongolia | LMI | 0.075534 | 0.156838 | 0.144294 | 0.18864 |
| Morocco | LMI | -0.69444 | -0.6205 | -0.41811 | -0.40214 |
| Myanmar | LMI | 0.154732 | 0.114367 | 0.099606 | 0.060964 |
| Nepal | LMI | 0.492674 | 0.478223 | 0.264947 | 0.242567 |
| Nicaragua | LMI | -0.16779 | -0.09197 | -0.1153 | -0.08198 |
| Nigeria | LMI | 0.054909 | 0.197156 | 0.229928 | 0.269665 |
| Pakistan | LMI | -1.00947 | -0.93347 | -0.7761 | -0.77004 |
| Papua New Guinea | LMI | 0.162237 | 0.267623 | 0.257494 | 0.296976 |
| Philippines | LMI | -0.04448 | 0.052203 | 0.024854 | 0.04766 |
| Senegal | LMI | -0.36208 | -0.25999 | -0.04052 | -0.00829 |
| Solomon Islands | LMI | 0.418649 | 0.603652 | 0.165923 | 0.297141 |
| Sri Lanka | LMI | -0.25557 | -0.20287 | -0.14888 | -0.13887 |
| Tanzania | LMI | 0.534436 | 0.579993 | 0.299065 | 0.295034 |
| Tunisia | LMI | -0.68624 | -0.63166 | -0.42277 | -0.40821 |
| Ukraine | LMI | 0.171283 | 0.198139 | 0.181698 | 0.181249 |
| Uzbekistan | LMI | 0.067124 | 0.116578 | 0.079215 | 0.08459 |
| Vanuatu | LMI | 0.099156 | 0.298756 | 0.040618 | 0.186005 |
| Vietnam | LMI | 0.413463 | 0.427592 | 0.214533 | 0.199646 |
| Zambia | LMI | 0.370569 | 0.475305 | 0.258984 | 0.291382 |
| Zimbabwe | LMI | 0.408189 | 0.48604 | 0.263074 | 0.285201 |
| Albania | UMI | 0.062492 | 0.115651 | 0.057314 | 0.086035 |
| Algeria | UMI | -1.29021 | -1.21158 | -0.91633 | -0.89687 |
| Angola | UMI | 0.429061 | 0.562051 | 0.319549 | 0.358332 |
| Argentina | UMI | 0.059116 | 0.092107 | 0.06808 | 0.073924 |
| Armenia | UMI | 0.025608 | 0.07208 | 0.129705 | 0.158471 |
| Azerbaijan | UMI | 0.198545 | 0.237077 | 0.187397 | 0.197808 |
| Belarus | UMI | 0.282156 | 0.295148 | 0.202297 | 0.201448 |

| Country | Income group | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|---|
| Belize | UMI | -0.19687 | -0.05317 | -0.1798 | -0.07211 |
| Botswana | UMI | 0.099664 | 0.167258 | 0.174829 | 0.207281 |
| Brazil | UMI | -0.01656 | 0.049763 | -0.0135 | 0.023932 |
| Bulgaria | UMI | 0.170813 | 0.169533 | 0.151727 | 0.1455 |
| China | UMI | 0.229208 | 0.361785 | 0.040261 | 0.114259 |
| Colombia | UMI | 0.101411 | 0.154808 | 0.062563 | 0.07509 |
| Costa Rica | UMI | -0.11836 | -0.10193 | -0.11406 | -0.11187 |
| Cuba | UMI | -0.14132 | -0.12116 | -0.07047 | -0.06977 |
| Dominican Republic | UMI | -0.14157 | -0.08491 | -0.08671 | -0.07212 |
| Ecuador | UMI | 0.04187 | 0.1086 | 0.015033 | 0.031374 |
| Equatorial Guinea | UMI | 0.040539 | 0.106418 | 0.035612 | 0.079585 |
| Fiji | UMI | -0.26928 | -0.16125 | -0.19893 | -0.12959 |
| Gabon | UMI | -0.22845 | -0.18726 | 0.068904 | 0.085182 |
| Georgia | UMI | 0.16566 | 0.210363 | 0.147231 | 0.169961 |
| Guatemala | UMI | -0.17393 | -0.07515 | -0.09046 | -0.06146 |
| Guyana | UMI | -0.27408 | -0.15582 | -0.17712 | -0.09641 |
| Indonesia | UMI | -0.04377 | 0.063295 | -0.04553 | -0.00833 |
| Iran, Islamic Rep. | UMI | -1.27144 | -1.20754 | -0.91134 | -0.89207 |
| Iraq | UMI | -1.50995 | -1.4032 | -1.07291 | -1.0437 |
| Jamaica | UMI | 0.217459 | 0.27051 | 0.144205 | 0.168368 |
| Jordan | UMI | -1.29752 | -1.19926 | -0.89184 | -0.85692 |
| Kazakhstan | UMI | 0.337916 | 0.365182 | 0.229657 | 0.230371 |
| Lebanon | UMI | -0.78495 | -0.75219 | -0.50771 | -0.49853 |
| Malaysia | UMI | -0.07824 | -0.04653 | -0.0699 | -0.06679 |
| Mexico | UMI | -0.23599 | -0.17195 | -0.13192 | -0.10452 |
| Namibia | UMI | 0.029347 | 0.123159 | 0.221502 | 0.265254 |
| North Macedonia | UMI | -0.06519 | -0.02471 | -0.03718 | -0.01044 |
| Paraguay | UMI | 0.116453 | 0.192629 | 0.013258 | 0.039047 |
| Peru | UMI | 0.212726 | 0.281731 | 0.128559 | 0.144455 |
| Russian Federation | UMI | 0.185193 | 0.220401 | 0.148504 | 0.169973 |
| Samoa | UMI | -0.46917 | -0.26912 | -0.17224 | -0.02569 |
| South Africa | UMI | -0.06761 | -0.00424 | 0.093247 | 0.110452 |
| St. Lucia | UMI | 0.09495 | 0.151763 | 0.018299 | 0.088723 |
| St. Vincent and the Grenadines | UMI | -0.00431 | 0.125849 | -0.11814 | 0.003632 |
| Suriname | UMI | -0.28774 | -0.22191 | -0.11069 | -0.05958 |
| Thailand | UMI | 0.271129 | 0.317172 | 0.130478 | 0.141242 |
| Tonga | UMI | -0.19475 | 0.023623 | -0.11854 | 0.052256 |
| Turkey | UMI | -0.56633 | -0.52831 | -0.30407 | -0.29098 |
| Turkmenistan | UMI | 0.052661 | 0.125465 | 0.078975 | 0.106564 |
| Venezuela, RB | UMI | -0.03051 | -0.03528 | -0.00805 | -0.01852 |

Note: HI, LI, LMI, and UMI denotes high income, low income, lower middle income and upper middle income respectively.

Source: Authors' calculations.

Table A4: The Temporal Fixed Effect Estimations

| Time | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| 1992 | 0.0051757 | 0.0024454 | 0.0031259 | 0.0018993 |
| 1993 | 0.0080882 | 0.0027299 | 0.004501 | 0.0021358 |
| 1994 | 0.0145686 | 0.0054572 | 0.0083996 | 0.0044133 |
| 1995 | 0.0165444 | 0.0048576 | 0.0096735 | 0.0044463 |
| 1996 | 0.0206316 | 0.0068386 | 0.0134627 | 0.0071626 |
| 1997 | 0.0256878 | 0.008948 | 0.0179121 | 0.0101595 |
| 1998 | 0.0316245 | 0.0123828 | 0.0225791 | 0.013623 |
| 1999 | 0.0370076 | 0.0155043 | 0.027221 | 0.0171552 |
| 2000 | 0.0385641 | 0.0142512 | 0.0295904 | 0.0181859 |
| 2001 | 0.0411222 | 0.0149611 | 0.0314516 | 0.019172 |
| 2002 | 0.0443496 | 0.0169485 | 0.0346621 | 0.021725 |
| 2003 | 0.0479886 | 0.0191894 | 0.0378398 | 0.0241298 |
| 2004 | 0.0527785 | 0.0218267 | 0.0406661 | 0.0258361 |
| 2005 | 0.0580042 | 0.025328 | 0.0441444 | 0.0284517 |
| 2006 | 0.0624739 | 0.0280179 | 0.0466058 | 0.0299544 |
| 2007 | 0.0674857 | 0.0312954 | 0.0499605 | 0.0323827 |
| 2008 | 0.0695394 | 0.0334002 | 0.051352 | 0.0336149 |
| 2009 | 0.0723314 | 0.0386008 | 0.0538456 | 0.0370909 |
| 2010 | 0.0727674 | 0.037851 | 0.0550645 | 0.0377169 |
| 2011 | 0.0756387 | 0.039069 | 0.056699 | 0.0385582 |
| 2012 | 0.0809662 | 0.044227 | 0.0597419 | 0.0414258 |
| 2013 | 0.0832165 | 0.0451064 | 0.0601248 | 0.041231 |
| 2014 | 0.0844653 | 0.0456527 | 0.0605931 | 0.0413252 |
| 2015 | 0.0894138 | 0.0492047 | 0.0625586 | 0.0426798 |
| 2016 | 0.0927492 | 0.0513339 | 0.06401 | 0.0435754 |
| 2017 | 0.0939702 | 0.0504392 | 0.0621226 | 0.0407868 |
| 2018 | 0.0980754 | 0.0528652 | 0.0627679 | 0.0407076 |

Source: Authors' calculations.

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# The Spatiality of Rights to the Basic Services and Amenities in Urban Agglomerations of West Bengal

**Monidip Mondal and Subhadeep Mondal**

*This piece aims to explain the spatiality of rights to basic services and amenities in urban agglomerations of West Bengal and the variables impacting them. The study used quantitative methodology to formulate an urban basic services and amenities index using House listing and Housing data and Town Amenities data, Census of India, 2011. It is noticed that there are huge variations in the provisioning of urban basic services and amenities within and among urban agglomerations. Variation in urban basic services caused due to civic status, population class, size, population density, population growth rate, and district GDP at constant prices. Drawing from the core-periphery model, we observed that the proximity to larger regional urban agglomerations like - Kolkata, Asansol-Durgapur and Siliguri defines the quality of basic services and amenities in an individual urban agglomeration. At the outset, the study proposes a rereading of 'right to the city' and the 'right to the urban basic services' as a spatial framework rather than essentializing it as a mere constitutional provision.*

**Keywords:** Amenities, Basic services, Civic status, Governance, Right to the city, Urban agglomerations

## I Introduction

Urban Agglomerations (UAs) are nuclei for regional development. People expect a better living and quality of life in the urban centres. But urban centres often fail to provide even essential civic services to the residents due to various factors. In its classification of the place of residences, the Census of India classified the urban centers based on a deterministic approach to population characteristics into statutory towns and census towns and thus UAs. But the governance of these urban centers is poorly defined, so financial allocations are often questionable. These civic institutions cannot cater to the need for basic services of their people. The fundamental right of citizens and the right to the city for basic services are also

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being questioned. This deprivation of basic human needs is spatially defined across the urban centres of urban agglomerations. This study tries to bring the spatial aspect of the deprivations and dispossession by juxtaposing human rights to basic services and the right to the city. The present study intends to study the differentials of urban basic services and the factors affecting it concerning the human right to basic services and the right to the city.

Following the introductory section, the causes of UA development have been investigated in developmental economic literature. The following section addressed conceptualising the spatial approach to the right to basic services. The fourth section explains why West Bengal was chosen as the region for the study. The fifth section stated the study's main research question. The detailed methodology was described in the section that followed. The seventh section explained our findings, followed by a discussion, and the study was concluded in the final section.

## II Nucleating Urban Agglomerations

As defined by the Census of India, 2011, UA is a continuous urban spread constituting a town and its adjoining urban outgrowths or two or more physically contiguous towns together with or without urban outgrowths of such towns. Each town and its outgrowth are treated as an integrated urban area designated as an Urban Agglomeration. For delineation of UAs during the Census of India, 2011 adopted the definition:

(a) The core town or at least one of the constituent towns of an urban agglomeration should necessarily be a statutory town
(b) The total population of a UA (i.e., all the constituents put together) should not be less than 20,000 as per the 2001 Census.

These agglomerations on the local scale can be conceptualized as developmental nuclei for the surrounding regions. The preference of the local people to migrate to these nuclei is to search for jobs, economic opportunities, a promise of an urban way of life and better urban infrastructures. Infrastructure, income and regional developments are woven intricately, which are the foundations of any economy. Public capital investments accompany the making of infrastructural development, and it simultaneously creates employment, thus making a significant contribution towards national income, productivity, growth and enhancing international competitiveness. Infrastructure development reduces the natural inequality among regions, contributing to economic advancement by raising productivity and enhancing the quality of life. In a cumulative causation effect, physical infrastructure leads to economic growth by multipliers of investment, employment, output, income and ancillary development, whereas the absence of social infrastructure facilities results in lower productivity and efficiency of the population. But in the post-liberalised era, the rising inequality in

infrastructural facilities is the primary cause of rising income disparity in these urban centres (Ghosh and De 2005).

Urban public infrastructure is an example of a shareable input that directly impacts city efficiency and promotes the realisation of agglomeration economies. Because of the size and quality of the public infrastructure, different levels of productivity from a single agglomeration economy can rise. According to Eberts and McMillen (1999), public infrastructure is an important input to the production process that concentrates on the metropolitan area, facilitates the interaction between infrastructure and economic agents, and, most importantly, agglomeration economies exist when firms in an urban area share a public good as an input to production, increase the productivity of other inputs, attract inputs from elsewhere, and stimulate demand for construction of infrastructure and other services.

The theory of the emergence of large agglomerations based on increasing returns to scale and factor mobility is known as New Economic Geography (Krugman 1998). Increasing returns to scale tend to encourage geographical concentration of goods production, attracting mobile production factors. As a result, cities are the epicentre of many growth processes, such as technology adoption and capital accumulation (Das, Ghate and Robertson 2015). The development of agglomerations as a whole has a long history. Even when no region has natural advantages, cumulative processes driven by positive externalities can form core-periphery structures. As a result, transportation costs, scale economies, and the importance of footloose industries all play a role in determining whether or not such industrial concentration will occur (Schmutzler 1999). At the same time, due to a lack of infrastructure and poor policy, medium-sized towns are experiencing a lack of agglomeration economies, which limits the growth of medium-density locations (Das, *et. al.* 2015)

Economic agglomerations are classified by Parr (2002) as economies of scale, scope, and complexity, further subdivided into spatially constrained internal and external economies of a firm. Internal economies of horizontal, lateral, and vertical integration involve the concentration of economic activity, but the existence of these internal economies does not automatically lead to an agglomeration economy within a given firm. These external economies can be found in a variety of geographical locations. Localization economies result from the concentration of similar firms in the same industry, resulting in a pool of skilled labour, lower freight rates, specialized services, and information spill-overs. Urbanisation economies are external to the firm and industry, but arise due to city-industry concentration. These businesses share common public infrastructure and specialized services, lowering the city's business costs for everyone. Activity-complex economies are based on the concentration of dissimilar firms linked via backward or forward links. The advantages of proximity include lower transportation costs, more efficient material flows, and lower inventory costs.

The growth of multi-nucleate growth nodes occurs in the process of agglomeration due to a trade-off between agglomeration economies and

transportation diseconomies, where urbanisation economies as early stages of industry development cause the industry to locate in the largest cities (Eberts et al. 1999). Localization economies may become dominant as industries grow and move to smaller cities. According to Mori's model, agglomeration economies are created by consumer demand for variety and scale economies in manufacturing goods production. As urban areas grow, some businesses may decide it is more cost-effective to locate in the agricultural hinterland and produce in a different city. As a result of the increased agglomeration economies, smaller cities may continue to grow as more firms enter and cities merge to form a megalopolis.

In his cumulative causation model of development, Gunnar Myrdal explained the backwash effects and role of dynamic clusters connected with population movement and population growth due to economies of agglomeration (Fujita 2004). The spatially polarising process ends with rapid industrialization, urbanisation, congestion transport and communication bottlenecks and insanitary conditions starting with the external diseconomies (Bagchi 2005). Regional economists like Eberts, *et. al.* (1999) opine for the diseconomies of city size, high wages, high land and housing prices, pollution and crimes but cities with more investment in social overhead capital will have fewer diseconomies and greater net productivity.

Solow growth model argued that diminishing returns in leading regions would give rise to convergence among the regions (Feldstein and Horioka 1992). Still, urban and regional economists opined that diminishing returns are not the only possible outcome as in metropolitan areas, the contradiction between economies of scale, location and agglomeration contrasts with the size-related congestion dis-economies. Krugman (1999) opines the contrasts of centripetal forces of economies of higher productivity, larger plant size, access to markets and products, thick labour markets and knowledge spill-overs, with centrifugal forces of higher land rents, commuting costs, congestion and pollution leading to higher wages and taxation, thus causing divergence. The increasing returns to scale become possible in other small urban centres. Therefore, divergence is followed by convergence among the regions. In this view, regional imbalances are bound to increase without state intervention. Here comes the role of public investment in infrastructure development, which creates a greater advantage, and the process of circular causation initiates the process of circular causation. (Chakravorty 2005). The divergence pattern reflects policy failures and poor governance, the difference in levels of public infrastructure and corruption (Das, *et. al.* 2015).

The World Development Report by World Bank, 2008 on Reshaping Economic Geography, highlighted the importance of density, distance and division for regional development. The discussion on distance encourages productivity from agglomeration economies. Urban centres appear to be a focus for economic growth where industrial production, skilled labour and higher wages tend to agglomerate and where geographical proximity facilitates information and communication flow. The spatial factors of infrastructure development show a strong relationship between being close to a major city. The migration of rural folk

to the urban centres can be regarded as a major convergence engine between the regions.

## III 'Right to the Basic Services': A Spatial Approach

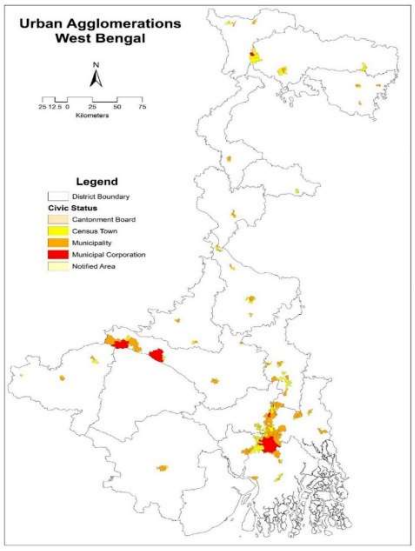
Providing basic services is a constitutional provision. The discourse on the right of the citizen to get basic services started in pre-independent India. Lord Ripon's resolution of 1882 started the conversation regarding the rights of the citizens to get basic services from the local government. But long after the independence, in 1992, through the 74th constitutional amendment act, the rights of basic services got ensured (Ahluwalia 2011, Bagchi and Kundu 2003, Sivaramakrishnan 2013). The urban local body can provide basic services like safe drinking water, sanitation, proper housing, etc. All these aspects are related to a dignified and protected life, a fundamental right of the people. Article 21 of the Indian Constitution discusses the 'Right to Life and Personal Liberty'. The honourable Supreme Court of India acknowledges this as one of the core fundamental rights. On the one hand, this article describes the rights from an individualistic approach. But Article 21 of the Indian Constitution and the 74th Constitutional Amendment Act provisions represent a picture beyond the individualistic approach. Thus, the element of spatiality comes into the picture- the right to life and basic services for those who reside in that particular urban area.

The existing literature (Sivaramakrishnan and Buch 1993, Bagchi and Chattopadhyay 2004, Kumar 2004) either took the right-based approach or discussed the status of basic services (un)availability. This paper is trying to bridge the gap in this paper. Drawing from both vantage points, the paper attempts to analyse the 'right to the city' (Turok and Scheba 2019) concept on the UA scale. The prime rationale behind UA as a scale or site of analysis is the critique of the 'right to the city' framework (Marcuse 2009) and the spatial complex of urban agglomeration. The agenda of the right to the city has sub-questions- whose right, what rights, and what city is it to which we want the right? Henry Lefevre's iconic definition says 'Right to the city' is both a cry and a demand; a cry as it is a necessity and a demand for a dream/more (Marcuse 2009). The framework advocates for the urban poor and displaced people. The second question is the recent trend to adopt this framework is mainly about the moral claims embedded in the ethos of justice and morality, in this case, the constitutional mandate of the Urban Local Bodies to provide services to their citizens (Harvey 2008). The last part is about what city? According to Lefevre, this is about the existing and future cities- a place in an emerging urban society (Merrifield 2011, Marcuse 2012). The existing literature on this framework barely discusses urban agglomeration. In this paper, our locus of enquiry falls beyond the ambit of intra-city spatial entity as it asks questions like -whose city, whose rights? Rather, we are conceptualizing this particular urban spatial category as a place in the urban society which is in a process of emerging (the last component of the 'right to the city' framework). There is where the novelty of our argument lies.

## IV Why West Bengal?

In the larger urbanization context, at the national level, West Bengal is one of the out-migrating states in India. The outflow of migration can be recorded in the last census and earlier censuses (Bhagat 2011). The population growth rate of West Bengal has seen a decline from 17.84 per cent to 13.84 per cent during 2001-2011. As per the rank-size distribution, West Bengal lies in the primate city structure where historically, Kolkata is the Primate City (Das and Dutt 1993). But at the same time, the state has grown more than 500 new census towns (Chatterjee 2013)[1]. Such a huge increase in census towns is driven by migration towards the urban centre in the state for a better life and economic opportunity. The latest census of 2011 found that the growth rate of small and medium towns, specifically class IV, V and VI, constituted 4.80 per cent, 4.02 per cent and 0.56 per cent in 2001 to 10.96 per cent, 12.47 per cent and 1.53 per cent in 2011 Census respectively. It indicates the emergence of new small towns as a recent phenomenon in the state. About 53 per cent of Class IV towns and 73 per cent of Class V towns are new (Guin 2017). These new urban centres have experienced lack of public infrastructure due to poor governance, fund crunch and irregular growth. In such overcrowding conditions in urban areas, the public infrastructure plays an important role in the sustainability and convergence of the areas. Availability and deprivation of basic services in the new growth foci of urban centre are determining factors of basic human rights and the right to the city. Thus, it becomes necessary to study the UAs as spaces of possession and deprivation in basic services and the determining factors behind their differentials.

Figure 1: Location and Civic Status of Constituent Urban Units of UAs of West Bengal



## V Research Questions

This study aims to shed light on the spatial pattern of rights to basic services and amenities in the UAs of West Bengal and the factors that contribute to its differentials.

## VI Dataset and Methods

The study has been designed with a quantitative framework of measurement of the quality of basic services and availability of basic amenities in the UAs of West Bengal. The list of urban agglomeration and its constituent towns of West Bengal have been collected from the Primary Census Abstract of Urban Agglomeration Table for West Bengal, Census of India, 2011. The working definition used in conceptualizing 'services' as intangible basic services which are provided in an in-situ spatial framework at the household level, like in-house safe drinking water, sanitation, electricity, housing, etc., whereas 'amenities' are those services which are provided ex-situ by different institutions like schools, colleges, hospital and banks. These services and amenities are part of the basic needs for maintaining a basic standard of living. The data regarding the basic services of the urban units have been collected from HL-14: Percentage of households to total households by amenities and assets from Census of India, 2011. The per-capita availability of basic amenities has been computed from the Town Amenities Table of West Bengal, 2011.

| Basic Services (Percentage of Total Households having Access) |
|---|
| Safe drinking water |
| Location of source of drinking water within premises |
| Electricity as main source of lighting |
| Latrine facility within premises |
| Total flush latrines |
| Bathing facility within premises |
| Waste water outlet connected to drainage |
| LPG/PNG for cooking, |
| Availing banking services |
| Permanent structure as place of residence |

| Basic Amenities (Per Capita Availability) |
|---|
| Govt. Primary Schools |
| Govt. Middle Schools |
| Govt. Secondary Schools |
| Govt. Senior Secondary Schools |
| Govt. Degree Colleges |
| Govt. Medical Colleges |
| Govt. Engineering Colleges |
| Govt. Management Colleges |
| Govt. Polytechnique Colleges |
| Allopathic Hospital Beds |
| Alternative Medicine Hospital Beds |
| Dispensary/Health Center Beds |
| Family Welfare Center Beds |
| Maternity and Child Welfare Center Beds |
| Maternity Home Beds |
| TB Hospital/ Clinic Beds |
| Nursing Home Beds |
| Nationalised/ Private Commercial/ Cooperative Banks |

The construction of the Urban Basic Services Index (UBS) and Urban Basic Amenities (UBA) for urban units of UAs and their constituent towns have been initiated with normalization of variables using the range equalization method. This method is a popular method of data normalization used previously in the Human Development Index (UNDP, 1990) and Quality of Living Index (Mondal 2020) using the following formula.

$$X_{id} = \frac{OB_{val} - MIN_{val}}{MAX_{val} - MIN_{val}}$$

Where $X_{id}$ refers to the normalized value, $OB_{val}$ is the Actual Value, $MIN_{val}$ stands for Minimum value and $MAX_{val}$ represents the maximum value of the variable. The normalized value varies between 0 (very poor) and 1 (very good).

The Weights of individual variables in the UBS Index have been computed with Principal Component Analysis (PCA). The main use of PCA is to reduce the dimensionality of the data set while retaining as much information as possible (Kundu and Basanta K. Pradhan 2002). For the construction of the index, weights of each variable have been assigned by multiplying the component scores of each variable with the Eigenvalues above 1. Weights obtained from Varimax rotation as the maximum variance are explained by the dataset's first three components (Chakravorty 2005). The individual variable index has been prepared by multiplying the weights by the normalized data for individual variables. The aggregated UBS Index has been made out with the summation of all individual indices and divided by the total weights.

The UBA Index have been computed by the average of all the normalized score of the variables selected for the index.

For visualization and understanding the spatial setting of differentials in and among UA, the UBS index and UBA index have been classified into five classes, i.e., very low, low, moderate, high and very high based on Natural Break (Jenks classification), and mapped.

Further, to understand the causes of differentials in the UBS Index, the population density, growth rate and class of town for 2011 have been extracted from the Town Amenities data for West Bengal, Census of India, 2011. The district Gross Domestic Product (GDP) of 2010-2011 at constant prices (2004-2005) have been collected from the State Domestic Product and District Domestic Product of West Bengal 2013-2014 report published by the Bureau of Applied Economics and Statistics, Department of Statistics and Programme Implementation, Government of West Bengal. Correlation and regression analysis was done among Urban Basic Services Index, population density, population growth rate, civic Status of the urban centers and district GDP at Constant prices (2004-2005) for 2010-2011 have been computed.

## VII Results and Discussion

### *Spatial Patterns of Basic Services in UAs*

UAs in West Bengal are found in three geographical areas: Kolkata-centric, Asansol-Durgapur-centric and Siliguri-Jalpaiguri-centric. The Kolkata-centric development of UAs started in the colonial capital of India before 1911. This region was also the central hub of industrial development due to favourable factors. The people from surrounding areas started to agglomerate around the city, searching for employment in services and the secondary sector. The development of Asansol-Durgapur-centric agglomeration began with the setting up of a steel factory at Durgapur with many other ancillary industries. The mineral-rich belt, which required cheap labour in the surrounding area, also attracted people to settle there. The Siliguri- Jalpaiguri centric development of UAs was due to the trade and tourism industry and as a gateway to North-eastern India. Thus, the economic gains impeded the growth of UAs in the state. Apart from this, the district headquarters and some other important mofussil towns started showing signs of agglomeration around them.

The differential in the distribution of Urban Basic Services over the UAs has been measured using Urban Basic Services (UBS) Index using the percentage of households having tap water from a treated source for drinking water, access to safe drinking water, drinking water within premises, electricity as the primary source of lighting, having latrine facility, flush latrine facility, bathrooms within premises, wastewater outlet connected to drainage, LPG/PNG use, banking facility and permanent structure of the house. Class-size distribution of basic services in the urban centers was heavily top-sided. The fourth quartile distribution of the UBS Index, i.e., the top 25 per cent of the UBS Index, is found over 77 urban centers amongst which 42 are Class I towns, whereas in the first quartile, i.e., the bottom 25 per cent of the UBS Index is found over also 77 urban centers of which 18 are class IV, 46 towns are Class V and 3 Class VI towns. The smaller urban units of classes IV, V and VI are poorly supplied with basic services. This highlights the size-class differences in the distribution of urban basic Services in UAs of West Bengal.

The UBS also varies due to the civic status of the urban centers. It can be understood from the fact that the first quartile, i.e., the bottom 25 per cent of the UBS Index, is found in over 75 Census towns and 2 Municipalities out of 77 bottom-ranked urban centres. In contrast, the fourth quartile, i.e., the top 25 per cent of the UBS Index, is found over 6 Municipal Corporations, 50 municipalities and 19 Census Towns, and two others, including the Cantonment board and Industrial Township. It indicates that the civic status of the urban centers, governing structure, mechanism and allocation of the financial resource by the states is an important determinant for providing basic services. The Municipal Corporations and Municipalities have the civic status, financial resources and own machinery to supply basic services to their population. In contrast, census towns

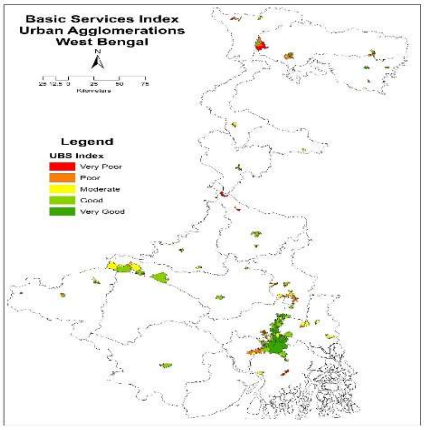
which are still under the jurisdictions of *Panchayati Raj Institutions* (PRI) suffer from poor governance and poor financial resources due to a lack of government allocation of funds and mechanisms of internal financial resource generation, thus end up with poor basic services to its population (Roy and Pradhan 2018).

Figure 2 of the spatial distribution of the UBS Index in UAs indicates that the 'core' urban units or the 'statutory towns' as defined by the Census of India, 2011 around which the agglomeration process developed in the region shows better urban basic services availability compared to their periphery in all the UAs. The peripheral urban centers significantly lack basic service provisioning.

Considering the UAs as a whole, the fourth quartile of the UBS index is found over Kalimpong, Bolpur, Barddhaman, Kolkata, Koch Bihar, Durgapur, Raghunathpur, Chakdah, Baruipur and Jalpaiguri. In contrast, the first quartile is found over UAs of Dhulian, Jaynagar-Mazilpur, Jhalda, Nabadwip, Basirhat, Jangipur, Diamond Harbour, Puruliya, English Bazar and Habra. The UAs in the first quartile are located distant from three major regions of UAs, i.e., Kolkata, Asansol-Durgapur, and Siliguri. It highlights the lopsided dominance of major UA-centric development of urban basic services in West Bengal.

To get a broad picture of the spatial differences, let's take urban basic service provisioning around Kolkata, Asansol-Durgapur and Siliguri regions individually. Considering the Kolkata region of UAs, the peripheral urban centers towards Uluberia, Budge Budge, Baruipur, Jaynagar-Mazilpur, Diamond Harbour, Basirhat, Gobardanga, Habra and Dankuni show poor urban basic services. Raghunathpur, Puruliya, Jhalda, Bolpur, and Suri show poor service provisioning in the Asansol-Durgapur region. Similarly, in the Siliguri region, distant urban centers of Dinhata, Koch Bihar, and Alipurduar show poor urban service provisioning. The other distant UAs like Raiganj, Balurghat, English Bazar, Dhulian, Jangipur, Baharampur, Katwa, Krishnanagar and Santipur also show poor urban basic services. Thus, we can conclude that better urban basic services are likely linked with proximity to large UAs.

Figure 2: Urban Basic Services of UAs of West Bengal, 2011



### *Determinants of Spatiality of Basic Services*

Correlation and regression analysis have been done to understand the determinants of urban basic services. The correlation of the UBS Index with population density gives a value of 0.4334, a positive, moderately related to the UBS index. Thus, increasing the UBS Index, the Density increases simultaneously, dummy variable of civic status with census towns as 3, Municipalities as 2 and Municipal Corporations as 1, that shows a correlation of -0.5044. It implies that the UBS Index increases with increasing the hierarchy of civic status (Census towns to Municipal corporations).

Table 1: Regression analysis of UBS index with other determinants

| Source | SS | df | MS | Number of obs. | 200 |
|---|---|---|---|---|---|
| Model | 1.541707 | 4 | 0.385426 | F (4, 195) | 18.09 |
| Residual | 4.154049 | 195 | 0.021303 | Prob>F | 0.000 |
| Total | 5.6957 | 199 | 0.286218 | R-squared | 0.271 |
| | | | | Adj R-squared | 0.256 |
| | | | | Root MSE | 0.146 |

| UBS_Index | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| Density_2011 | 5.17E-06 | 1.97E-06 | 2.63 | 0.009 | 1.29E-06 | 9.06E-06 |
| Civic_Status | -0.08838 | 0.018 | -4.91 | 0.000 | -1.24E-01 | -5.29E-02 |
| Growth_Rate_2011 | -0.00083 | 0.00039 | -2.13 | 0.034 | -1.60E-03 | -6.26E-05 |
| District GDP at Constant Prices | 2.82E-06 | 1.04E-06 | 2.72 | 0.007 | 7.78E-07 | 4.86E-06 |
| _cons | 0.731797 | 0.057575 | 12.71 | 0.000 | 6.18E-01 | 4.53E-02 |

The causality factor for the UBS index can be understood with the regression analysis in Table 1. The study considered the UBS Index as the dependent variable, population density, growth rate, and civic status of the urban centres as dummy variables and District GDP at constant prices (20014-2005) for 2010-2011 as independent variables. The regression analysis shows an adjusted R-Square value of 0.2557, explaining the 25.57 per cent of the total variation in the independent variable by the dependent variable. The t-value explains the effect of the individual independent variable on the UBS index. The highest t-value of civic status implies its role in explaining the variation of the UBS index. The negative t-value also represents the negative relation of the dummy variable of civic status, as the census towns have a lower UBS index than the others. The same is the case with the growth rate. The higher the growth rate, the lower the UBS index. The P-value of less than 0.05 for all the independent variables shows a significance level of 95 per cent confidence level. This proves the accountability of the dependent variables explaining independent variables.

### *Spatial Patterns of Basic Amenities in UAs*

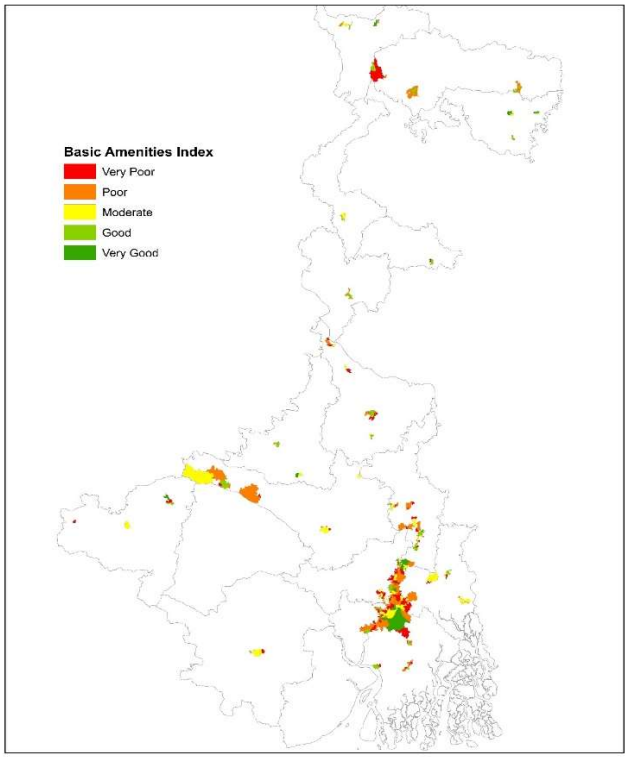
The spatial pattern of basic amenities in the urban agglomerations of West Bengal has been evaluated using the Basic Amenities Index computed by the availability of government schools, colleges and medical beds per ten lakh population. The UBS and UBA indices have a Pearson correlation of 0.308, which signifies a moderate positive correlation between them. Higher levels of services are directly related to the higher levels of amenities in the urban agglomeration. UAs of West Bengal have an average of 5.6 government schools per ten thousand population and 6.9 government higher educational institutes per million. There are only 11.8 beds in the government medical facilities per ten thousand population in UAs which is higher than the national average of 5.3 per ten thousand population but far less than recommended levels of 25 hospital beds per ten thousand population in lower economic countries. There are 77 banks per million population, including nationalized banks, private commercial banks and cooperative banks in the UAs of the state.

The trends of the UBA index examined by the civic status reveal huge differences between census towns and statutory towns regarding all the basic amenities. Municipal corporations are provided with higher amenities than municipal towns. These 90 municipal towns account for 54.67 per cent of the total UA population, and seven municipal corporation accounts for 33.74 per cent of the total population of the UAs. The maximum number of availabilities of government schools is found to be in municipal corporations (6.82 schools per thousand population), followed by municipal towns (5.60 schools per ten thousand population) and census towns (5.55 schools per ten thousand population). Similar patterns can be found in the availability of government higher educational institutes. Municipal corporation areas have 1.61 institutes per lakh population, followed by municipalities with 1.34 institutes per lakh. But census towns are highly deprived of higher educational institutes, with 0.35 institutes per lakh population. A typical pattern in the availability of medical beds in the towns can be noticed. The municipal towns have 25.65 beds per ten thousand population, but municipal corporations have only 12 beds per ten thousand population. This is due to the role of municipalities as micro-regional centres of growth. These municipalities mostly act as district or sub-divisional headquarter, which have district hospitals, sub-divisional hospitals, and other lower-order hospitals. The census towns have 5.51 beds per ten thousand population, mainly in rural hospitals and primary health centres. The availability of banks is higher in municipal corporations, with 14.3 banks per lakh population, followed by 9.6 banks per lakh in municipalities. The census towns have an abysmally lower rate of 6.8 banks per lakh population.

The population size-class distribution of UBA in the UAs indicates better amenities in class III cities followed by classes I and II. Class VI towns are better equipped with basic amenities than class IV and V class cities.

The core-periphery model of differences can also be observed in the UAs. The Kolkata, Durgapur-Asansol and Siliguri-centric urban agglomerations have higher UBA than others. Besides, the foci of UAs, generally municipal corporations or municipalities, have better basic amenities than their peripheral units.

Figure 3: Urban Basic Amenities of UAs of West Bengal, 2011




Compared to the UAs, basic amenities in the northern districts are better. The fourth quartile (Top 25 per cent) in the UBA index is Darjeeling, Alipurduar, Dinhata, Jalpaiguri, Koch Bihar, Beldanga, Kalimpong, Raghunathpur, Bolpur, and Tufanganj. In contrast, first quartile (Bottom 25 per cent) UAs are Durgapur, Krishnanagar, Dhulian, Santipur, Kharagpur, Jangipur, Dankuni, Siliguri, Jaynagar-Mazilpur and Basirhat. Thereby the UAs away from Kolkata, in northern districts, perform well due to the micro-regional growth center of the districts. The poor-performing UAs mostly lay near Kolkata, Durgapur-Asansol and Siliguri. The last picture shows the skewed Kolkata-centric growth story of West Bengal. We can infer how resources are concentrated within and around Kolkata only. This is an interesting observation that we are witnessing. The literature suggests that the proximity to a large metropolitan city offers better services due to its spill-over effect. But in this case, Kolkata-centric development is so overpowering that the

proximate regions fail to gain the benefits. Focusing on these large metropolitan areas of Kolkata, Asansol-Durgapur, and Siliguri reveals that these UAs perform better in UBA provisioning than their neighbouring UAs.

## VIII Conclusion

In this paper we are knitting the story- dynamics of Urban Agglomeration. There are three major players in the picture; Urban Basic Services, Urban Basic Amenities and the protagonist called Urban Agglomeration. The larger context of this story is Core-Periphery framework where Lager Urban Agglomerations are considered to be the core and the distanced regions as periphery. Here, we would like to mention that the main crux of the story is to distinguish between UBS and UBA, one is in-situ and the other one is ex-situ respectively. From the above analysis of urban basic services for UAs of West Bengal, it can be concluded that the urban centers around the major agglomerating nucleus of Kolkata, Durgapur and Jalpaiguri Agglomeration have higher levels of basic services than the distant urban centers. But the distant UAs like Dhulian, Jaynagar-Mazilpur, Jhalda, Nabadwip, Basirhat, Jangipur, Diamond Harbour, Puruliya, English Bazar and Habra greatly lacks in provisioning of basic services. But the basic amenities produced distinctive patterns in the north-south divisions of the state. The basic amenities are relatively better in medium-sized towns and their UAs of North Bengal. But the distant towns from Kolkata UA are poorly provided with basic amenities in South Bengal. Thus, the concentration of urban amenities and services in the Kolkata UA has led to the lopsided provisioning of basic services and amenities of surrounding UAs.

The differentials of UBS and UBA also vary according to the class and civic status of the individual urban centres. The levels of basic services also depend on the density of the urban centre, growth rate and district GDP at 95 per cent levels of confidence. Besides, the proximity factor to large UAs, i.e., Kolkata, Asansol-Durgapur and Siliguri, exacerbates their role in regional development.

The spatial entity called urban itself is very complex. More on that, UAs add another layer of complexity to it. Considering the nucleus of the UAs as the core and the outgrowths as the periphery, this study found that the core has better urban basic services than the periphery. If the distance increases from the core, the availability of basic services gets reduced. It can be argued that it is very obvious that the core has more endowment in terms of its period of inception than the periphery, which is still evolving; that is why the basic services should be better quite naturally. Our findings also confirm this argument. But here, the study advocates perceiving these as merely constitutional provisions; rather, the ‘right to the city’ framework and the ‘right to the basic services’ should be perceived as a spatial framework. The gap is spatially observed. So, it is not only a matter of individual right to basic services in the city core, but it is spatial right of both the core and the periphery. In this globalised economy, investment is coming from the periphery of the UAs (Mitra and Kumar 2015). So, it is time to think beyond the

decaying core. Thus, it is a time to re-think the 'right to basic services' as a spatial approach.

Thus, more emphasis should be given to achieving regionally balanced development, which will help in the convergence among the regions as the public infrastructure and basic services play an important role in enhancing productivity; thus, increasing returns to scale can be achieved in the UAs. The spillover and backwash effects in the surrounding regions will also develop the proximity factor to urban areas.

## Endnote

1. State-wise distribution of Census Towns: West Bengal-780, Kerala-461, Tamil Nadu-376, Maharashtra-279, Uttar Pradesh-267, Andhra Pradesh and Telangana-228, Jharkhand-188, Gujarat-153, Karnataka-127, Assam-126, Odisha-116, Madhya Pradesh-112, Rajasthan-112, Punjab-74, Haryana-14, Bihar-60, Goa-56, Uttarakhand-42, Jammu & Kashmir-36, Tripura-26, Manipur-23, Chattisgarh-14, Meghlaya-12, Nagaland-7, Himachal Pradesh-3, Arunachal Pradesh-1 and Mizoram-0. (Source: PIB Press Release, MoHUA Dated: 17 May, 2016, https://pib.gov.in/newsite/PrintRelease.aspx?relid=145405 accessed on 16 May, 2023).

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# Determinants of Health Insurance in India: Evidence from 75th National Sample Survey

**Jivan Biradar and Dipti Joshi**

*The cost of medical treatment is a sudden burden on the person's budget. To avoid the risk, the health insurance becomes a safeguard. The scenario of non-life insurance (specifically health insurance) penetration is not encouraging in India. The penetration of non-life insurance (ratio of premium to GDP) has increased from 0.80 per cent in 2013 to 0.94 per cent in 2019. Also, health insurance density is lower in India. The objective of this paper is to analyze the various factors affecting the decision of health insurance take up by household in India.*

*The NSSO 75th round unit level data on health has been taken into consideration. Out of the 113,823 sample households, 113,821 were taken for this study. Multivariate logistic regression analysis is used to analyze the determinants of decision of taking up of health insurance. The results show that, there is a lower share of health insurance take up in rural area than urban. The social group wise difference is found in purchase of health insurance. The richest wealth quintile has greater probability of taking up health insurance than lower wealth quintile; female household head has greater probability of taking up of health insurance than male counterpart. Moreover, level of education affects positively, the health expenditure support from employer, support from government is negatively associated with the taking up of health insurance. Chronic ailments and hospitalization are positively and negatively related with health insurance being taken up respectively. This study suggests that, there is a need of health insurance related awareness and initial support from government to increase penetration of health insurance in India.*

**Keywords:** Health insurance, NSSO, Non-life insurance, Health expenditure support, Insurance penetration, Insurance density

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## I Background

The cost of medical treatment is an unexpected burden on a common person's budget. To share the risk of this burden, insurance becomes a safeguard. However, the penetration of insurance in India is negligible (Kumar, *et. al.* 2020, Chakrabarti and Shankar 2015). The insurance penetration is calculated as percentage of insurance premium to GDP. It improved to 3.76 per cent in 2019 from 2.71 per cent in 2001 (Government of India, 2021) but it is still lower than the international level. Furthermore, the insurance penetration is lower than many major countries in Asia and also lower in comparison with developed countries like United Kingdom, United States (US) and others (IRDAI, 2020).

The scenario of non-life insurance penetration is not encouraging in India. It increased from 0.80 per cent in 2013 to 0.94 per cent in 2019. It was 2.80 per cent and 3.88 per cent at the World level during the same period (IRDAI, 2020). The non-life insurance penetration has not increased in the recent period significantly in many countries except US and this is abundantly negligible in case of India.

Another measure of insurance level is insurance density. The insurance density is measured as ratio of premium (in US Dollar) to total population. The insurance density is the highest in Switzerland except in 2019 (United States is highest in 2019 with $ 7495). But, in India, it is just between $ 52 to $ 78 from 2013 to 2019, which is less as compared to major Asian countries and even far less than China (IRDAI, 2020). The Non-Life insurance density is higher in many developed countries as compared to Asian countries. At the world level, it increased from $285 in 2013 to $439 in 2019 with 7.47 per cent of compound annual growth rate (CAGR), but in India, it increased from $ 11 to $ 19 during the same period with 9.54 per cent of CAGR, whereas in China non-life insurance density increased by 14.12 per cent of CAGR (IRDAI, 2020). In the non-life insurance, health insurance awareness is insignificant and its coverage is also minimum. It has been shown by various studies, that health insurance in India is restricted to less than 10 per cent of the people and it is focused on the formal sector (Bhandari and Sinha 2010, Meitei and Singh 2021).

The health insurance is important in any society. There is wide inequality in access of health care facility and health insurance in India (Johar, *et. al.* 2018) and considerable regional disparity in health insurance enrollment pattern is also there. (Chakrabarti and Shankar 2015). The government support to healthcare facilities is crucial to increase health insurance participation (Duku 2015, Gupta 2007), particularly middle and low socio economic groups who favoured it compared to private health insurance (Reshmi, *et. al.* 2007). Moreover, it is argued that the implementation effectiveness plays critical role in public health insurance programs (Maurya 2019).

However, private health insurance is preferred by older and sicker individuals (Kapur 2020). In a country like Chile, purchase of insurance is mandatory by law; Sapelli and Torche (2001) have illuminated the choice between public and private insurance. It is argued that, earning is the important factor in influencing choice of

health insurance. Hidalgo, *et. al.* (2013) have studied how risk and social variables are likely to impact private sector health insurance provision participation and they found that the number of dependents, gender and wages have considerable impact. Hofter (2006) pointed out the determinants of private health insurance purchase decision in Chile and he has found that, socio-economic factors like income, education level, employment status etc. influence the probability of purchasing private insurance.

Furthermore, the health insurance penetration is lower in India than other types of insurance (Chakrabarti and Shankar 2015, Gupta 2007, Yadav and Mohanty 2021). There are many factors affecting the buying decision of health insurance. It is argued that richer households have a higher probability of enrolling into health insurance (Yadav and Mohanty 2021). They have also discussed that, age, occupation and education level are positively associated with health insurance enrollment. Tanja, *et. al.* (2016) studied health insurance in India and argued that, ethnographic case studies could add more in understanding the impact and use of various health insurance on both healthcare providers and insurance holders.

There are few studies on determinates of health insurance in India using national representative data, i.e., National Family Health Survey (NFSH). Yadav and Mohanty (2021) had done a study to understand the determinants of choice of health insurance. They found health insurance in India is more skewed towards the richer households. Khan, *et. al.* (2021) tried to find out the population level in various types of health insurance coverage in India. They found, contextual factors at state, district and community level contribute to variation in household coverage in health insurance. Meitei and Singh (2021) analyzed the coverage and correlates of health insurance in north-eastern region of India. It argued that demographic and socioeconomic factors, households with Below Poverty Line (BPL) cardholder and bank account, all played an important role in the coverage of health insurance in these states of India. Ali, *et. al.* (2020) analyzed the health insurance support to maternal health care in India using latest NSSO health round data.

On this background, we tried to find out why there is lower penetration and density of health insurance in India. Besides this, what are the socio economic characteristics of households which influence the decision to purchase health insurance? The objective of this paper is to analyze the different factors affecting purchase of health insurance. It will provide further insights to understand the problem of lower penetration and density of health insurance in India. So, this study will be a contribution in two ways: first, it is used as national representative data collected by NSSO to study the starting of health insurance and second, it is a contribution to understand factors affecting decision of households to purchase health insurance.

The outline of the paper is as follows: Section II discusses research methodology and data sources. Section III focuses on the results and discussion of the study. Section IV focuses on factors affecting the decision to take up health insurance in India with the help of multivariate logistic regression techniques. The

paper concludes with a brief discussion about results and their implication to researchers, policy makers and insurance companies.

## II Research Methodology

The Data for this study has been extricated from the 75th round of National Sample Survey Office (NSSO). It is a national level sample survey conducted by the GOI from July 2017 to June 2018 (GOI, 2019). Like any other NSSO rounds, the focus of this round was to collect information on two important aspects. Like the the earlier one, the 75th round survey was pointed toward producing essential quantitative data on the health sector. Secondly, deciding the pervasiveness rate at state and national level of general morbidity by age-group and gender, as well as by explicit classifications of disease, were the
significant goals of the survey.

The NSSO survey covered 113,823 households samples and 555,115 individuals (Rural: 325,883; Urban: 229,232; Male: 283,200; Female: 271,877) from randomly selected 8077 villages and 6181 urban wards by two-stage random sampling method. In the first stage, rural villages and urban wards were chosen, and in the subsequent stage, families were chosen. Out of the 113,823 sample households, 113,821 were taken for this study. Out of these, only 10338 (9.98 per cent) have paid health insurance premium during the survey period.

The health insurance premium paid or not paid is taken as dependent variable and the place of residence (rural/urban), household size, social group, religion, monthly consumer expenditure are taken as household level and age, gender, education, marital status, whether hospitalized during previous year, whether suffering from any chronic ailment and whether covered by any scheme for health expenditure support were taken as individual level independent variables. These factors have been incorporated in the view of ideas from the existing review of literature (Acharya 2018, Yellaiah and Ramakrishna 2012, Bhat and Jain 2006, Dale and Lila 1990, Vince and Joyce 1994). The independent variables description is given in Table 1.

Table 1: Description of Independent Variables used in the Study

| Name of the variable | Description |
|---|---|
| *Household level* | |
| Place of residence | Place of residence is divided into rural and urban. Rural is =1 and urban is = 2. We have taken rural as a reference category. |
| Household size | Household size is divided into two categories, less than and equal to 5 members and more than 5 members.<br>Less than and equal to 5 members is considered as reference category. |
| Social group | Social group variable is divided into four categories, Scheduled Tribes (ST), Scheduled Caste (SC), Other Backward Castes (OBC) and Others.<br>We have taken SC as the reference category. |
| Religion | Religion is divided into four categories, Hindu, Muslim, Christian and Others. Hindu is considered as reference category. |

| Name of the variable | Description |
|---|---|
| Wealth Quintile | We have categorized five wealth quintiles based on the monthly per capita consumption expenditure (MPCE) into Poorest, Poor, Medium, Rich, and Richest. The poorest is considered as reference category. |
| *Individual level* | |
| Age | Age variable is divided into four groups; less than 20, 21 to 45, 46 to 60 and above 60. The reference age group is considered less than 20. |
| Gender | The data provides information on the sex of the individuals: male or female. For our study, we have taken male as a reference category. |
| Education level | The education variable is divided into four groups: not literate, primary, secondary and higher. For our study, we have taken 'not literate' as a reference category. |
| Marital status | The data provides information on the marital status of the individuals: never married, currently married, widowed and divorced / separated. The never married group is considered as a reference category for marital status group. |
| Whether hospitalized during last 1 year | Whether hospitalized during last 1 year, if Yes=1, otherwise=2. The 'yes' response is taken as the reference category . |
| Whether suffering from any chronic ailment during last 1 year | Whether suffering from any chronic ailment during last 1 year, if Yes=1, otherwise=2. The reference category taken is 'yes' response. |
| Whether covered by any scheme for health expenditure support | Whether covered by any scheme for health expenditure support is divided into three groups: government support, employer support and household support. For our study, we have taken household support as a reference category. |

Considering the categorical nature of dependent variable, we have used logistic regression model. Multivariate logistic regression analysis is one of the most well-known statistical techniques. Logistic regression predicts the output of a categorical dependent variable (Peng, *et. al.* 2002). Therefore, the outcome should be a categorical or discrete value. It can be either Yes or No, 0 or 1, true or false, etc. The dependent (outcome) variable is binary that had a question of amount of medical insurance premium paid for household members during last 365 days (Not paid for 0 and Paid for 1). The households that paid health insurance premium are treated as 'insured' and those 'not paid' are considered as 'not insured'. Logistic regression equation can be expressed as:

$$\text{logit}(y) = In\left(\frac{p}{1-p}\right) = \alpha + \beta x \quad \ldots(1)$$

Where,
$y$ = dependent variable (medical insurance premium paid or not)
β = regression coefficient
$x$ = independent variable
p = probability of insured household
1 - p = probability of not insured household

$$P = \frac{1}{1+e^{-(\alpha+\beta x)}} \quad \ldots(2)$$

Where P is the probability of the outcome of interest or 'event', such as a household is insured, α is the y intercept, β is the regression coefficient.

$$Logit\ (Health\ Insurance) = \alpha + \beta_1\ (place\ of\ residence) + \beta_2\ (household\ size) + \beta_3\ (social\ group) + \beta_4\ (religion) + \beta_5\ (wealth\ quintile) + \beta_6\ (age) + \beta_7\ (gender) + \beta_8\ (education\ level) + \beta_9\ (marital\ status) + \beta_{10}\ (hospitalized) + \beta_{11}\ (chronic\ ailment) + \beta_{12}\ (health\ expenditure\ support) + \varepsilon_i$$

Where α is constant, β's are coefficients of explanatory variables and ε is the error term. The dependent variable (i.e., health insurance) shows the insurance premium paid or not paid. The odds ratio has been used for interpreting the results of the logistic regression in the data analysis (Abedin, T., *et. al.* 2016). The study has used STATA 16.0 package for the complete analysis.

## III Results and Discussion

The sample distribution of surveyed households shows that, 90.92 per cent (103474 households) have not paid any premium for health insurance during the survey period and only 9.08 per cent (10338 families) have paid the health insurance premium (Table 2). More households have not taken health insurance in rural India as compared to urban households; among the various social groups, SC (4.08 per cent) and ST (4.54 per cent) groups are less insured (Table 3). There is evidence that the health insurance among the socially backward is less in comparison with the non-backward groups (Acharya 2018).

Table 2: Sample Distribution and Percentages of Selected Variables from Social Consumption in India- Health, 2017-2018

| Particular | Sample Distribution | |
|---|---|---|
| | % | n |
| *Health insurance* | | |
| Premium paid (Insured) | 9.08 | 10338 |
| Premium not paid (not insured) | 90.92 | 103485 |
| *Place of habitation* | | |
| Rural | 56.71 | 64552 |
| Urban | 43.29 | 49271 |
| *Household size* | | |
| ≤ 5 members | 68.28 | 77722 |
| >5 members | 31.72 | 36101 |
| *Social group* | | |
| ST | 13.01 | 14810 |
| SC | 17.13 | 19496 |
| OBC | 40.06 | 45603 |
| Others | 29.80 | 33914 |

| Particular | Sample Distribution | |
|---|---|---|
| | % | n |
| *Religion* | | |
| Hindu | 75.57 | 86012 |
| Muslim | 13.66 | 15549 |
| Christian | 6.62 | 7534 |
| Others | 4.15 | 4728 |
| *Wealth quintile* | | |
| Poorest | 24.44 | 27,820 |
| Poor | 16.62 | 18913 |
| Medium | 20.32 | 23127 |
| Rich | 18.76 | 21348 |
| Richest | 19.87 | 22615 |
| *Marital status of the household head* | | |
| Never married | 2.33 | 2647 |
| Currently married | 85.54 | 97362 |
| Widowed | 11.75 | 13371 |
| Divorced / separated | 0.39 | 443 |
| *Gender of the household head* | | |
| Male | 88.87 | 101152 |
| Female | 11.13 | 12671 |
| *Education of the household head* | | |
| Not literate | 24.05 | 27371 |
| Primary | 22.12 | 25183 |
| Secondary | 40.69 | 46314 |
| Higher | 13.14 | 14955 |
| *Age of the household head (in Years)* | | |
| Less than 20 | 0.90 | 1026 |
| 21 to 45 | 45.26 | 51514 |
| 46 to 60 | 36.20 | 41209 |
| Above 60 | 17.64 | 20074 |
| *Health expenditure support* | | |
| Household support | 1.91 | 2176 |
| Government support | 16.27 | 18518 |
| Employer support | 1.44 | 1641 |
| Not covered | 80.38 | 91486 |
| *Suffering from any chronic ailment during last 1 year* | | |
| No | 90.85 | 103404 |
| Yes | 9.15 | 10419 |
| *Whether hospitalized during last 1 year* | | |
| No | 82.36 | 93747 |
| Yes | 17.64 | 20076 |

Source: Authors' calculation based on unit level data of NSSO 75$^{th}$ round on 'Household Social Consumption: Health' July 2017- June 2018.

In most of the Indian families, males are the head of the family and they take major decisions about health care in the family. But, interestingly, the share of the female headed of family is greater among insured (10.37 per cent) in comparison with not insured households (6.31 per cent). In marital status, divorced/separated category takes greater share and the same with the never married category too. Currently married category is least insured among all categories (6.35 per cent).

The insured (health insurance premium paid) households share is 9.08 per cent and average premium paid by these households is ₹5440. Above 60 years of age of the household head category has greater share for insured category (11.22 per cent) than other categories. This shows that, health related risk or concerns increase as age increases and many people are inclined to purchase health insurance as age increases (Yellaiah and Ramakrishna 2012, Bhat and Jain 2006, Dale and Lila 1990, Vince and Joyce 1994). The poorest category of wealth quintile is less insured while richest are 23.47 per cent insured in total. There is a positive relationship between wealth quintile of the family and purchasing of health insurance (Yellaiah and Ramakrishna 2012, Bhat and Jain 2006, Vince and Joyce 1994).

Table 3: Distribution of Prevalence of Insurance in India, 2017-18

| Particular | Prevalence of Insurance (%) | |
|---|---|---|
| | Not Insured | Insured |
| *Place of habitation* | | |
| Rural | 96.91 | 3.09 |
| Urban | 85.68 | 14.32 |
| *Household size* | | |
| ≤ 5 members | 92.38 | 7.62 |
| >5 members | 95.99 | 4.01 |
| *Social group* | | |
| ST | 95.46 | 4.54 |
| SC | 95.92 | 4.08 |
| OBC | 96.61 | 5.39 |
| Others | 88.39 | 11.61 |
| *Religion* | | |
| Hindu | 93.05 | 6.95 |
| Muslim | 96.50 | 3.50 |
| Christian | 84.49 | 15.51 |
| Others | 91.11 | 8.89 |
| *Wealth quintile* | | |
| Poorest | 97.32 | 2.68 |
| Poor | 94.71 | 5.29 |
| *Medium* | 95.97 | 4.03 |
| Rich | 92.20 | 7.80 |
| Richest | 76.53 | 23.47 |

| Particular | Prevalence of Insurance (%) | |
|---|---|---|
| | Not Insured | Insured |
| *Marital status of the household head* | | |
| Never married | 84.75 | 15.25 |
| Currently married | 93.65 | 6.35 |
| Widowed | 92.22 | 7.78 |
| Divorced / separated | 84.02 | 15.98 |
| *Gender of the household head* | | |
| Male | 93.69 | 6.31 |
| Female | 89.63 | 10.37 |
| *Education of the household head* | | |
| Not literate | 96.85 | 3.15 |
| Primary | 93.57 | 6.43 |
| Secondary | 92.51 | 7.49 |
| Higher | 85.71 | 14.29 |
| *Age of the household head (in Years)* | | |
| Less than 20 | 90.16 | 9.84 |
| 21 to 45 | 91.63 | 8.37 |
| 46 to 60 | 91.09 | 8.91 |
| Above 60 | 88.78 | 11.22 |
| *Health expenditure support* | | |
| Household support | 69.58 | 30.42 |
| Government support | 90.31 | 9.69 |
| Employer support | 58.81 | 41.19 |
| Not covered | 95.07 | 4.93 |
| *Suffering from any chronic ailment during last 1 year* | | |
| No | 93.63 | 6.37 |
| Yes | 89.57 | 10.43 |
| *Whether hospitalized during last 1 year* | | |
| No | 93.47 | 6.53 |
| Yes | 92.12 | 7.88 |

Source: Authors' calculation based on unit level data of NSSO 75$^{th}$ round on 'Household Social Consumption: Health' July 2017- June 2018.

Health insurance related awareness in India is negligible (GOI, 2021). Many families are not aware about the various health insurance schemes and policies. The education status of the family head plays important role while deciding to purchase health insurance. Not literate household's share (96.85 per cent) is major among not insured households. The heads of primary, secondary and higher educated households are purchasing 6.43 per cent, 7.49 per cent and 14.29 per cent respectively which shows level of education is positively related with opting for health insurance (Table 3). Among religions, more Christians are insured (15.51) followed by others category, whereas less Muslims are insured (3.50 per cent) while comparing categories of religions in India.

In cases where any member of the household was hospitalized in last 365 days, there are more probabilities of opting for health insurance. The share of insured households is 7.88 per cent as compared to not hospitalized (6.88 per cent). This shows that, the purchase of health insurance increases with expenditure on hospitalization and there is probability that, households might hospitalize members to get benefits of health insurance. So, there is a direct relationship between hospitalization and purchase of health insurance.

Chronic ailment is another factor which could induce people to take health insurance. Generally, people opt for health insurance to minimize the risk of chronic ailment. The households that suffered from any chronic ailment have higher percentage of the insured (10.43 per cent) than those not suffered from any chronic ailment (6.37 per cent). This shows that, there is a positive relationship between the chronic ailments and purchase of health insurance (Table 3).

The health expenditure support is important for any family. The support provides relaxation and peace of mind to a family. It increases efficiency of individuals. The GOI has been providing support to households with the help of various health insurance expenditure support schemes (Gerard and Somil 2012, Hong, *et. al.* 2012, Choudhury and Srinivasan 2011). Under the government sponsored health expenditure support (e.g., Rashtriya Swasthya Bima Yojana (RSBY) and Arogyasri) only 9.69 per cent households are insured, which shows that the implementation and impact of government support scheme is not as per expectation (Sinha, 2018). Whereas, as an employer of government/for PSU (e.g., the Central Government Health Scheme (CGHS) and reimbursement from government), 41.19 per cent households are covered. There are around, 30.42 per cent households in the insured category that have arranged health expenditure support by themselves with the help of insurance companies. The highest among insured category is employer supported (other than government/PSU) health protection (e.g., ESIS) carrying 41.19 per cent.

However, nearly 95.07 per cent households are neither insured nor covered in any health expenditure support scheme. This shows that, insured households are receiving major support from either government through various health related schemes or from employer under social security scheme (Table 3). Acharya (2018) argued that the share of 'not covered' in any health expenditure support schemes is greater in the not insured category.

## IV Factors Affecting the Decision to Purchase the Health Insurance in India

Table 4 shows the multivariate logistic regression result. The model has been checked for multicollinearity and the Variance Inflation Factors (VIF) has been found to be less than 10. The urban place of residence is higher in health insurance take up as compared to rural area in India. There is a direct relation between education level of household head and decision for purchase up of health

insurance. The household size is negatively related with take up of health insurance.

All social groups are significant; one can observe that, higher strata groups' probability is more probable as compared to vulnerable social groups (i.e., SC and ST) in take up of health insurance. The richest wealth quintile has greater probability of choosing health insurance than lower wealth quintile, also in marital status of the household head category divorced / separated has greater probability followed by widowed. In terms of gender, female household head has greater probability of take up of health insurance than male counterpart.

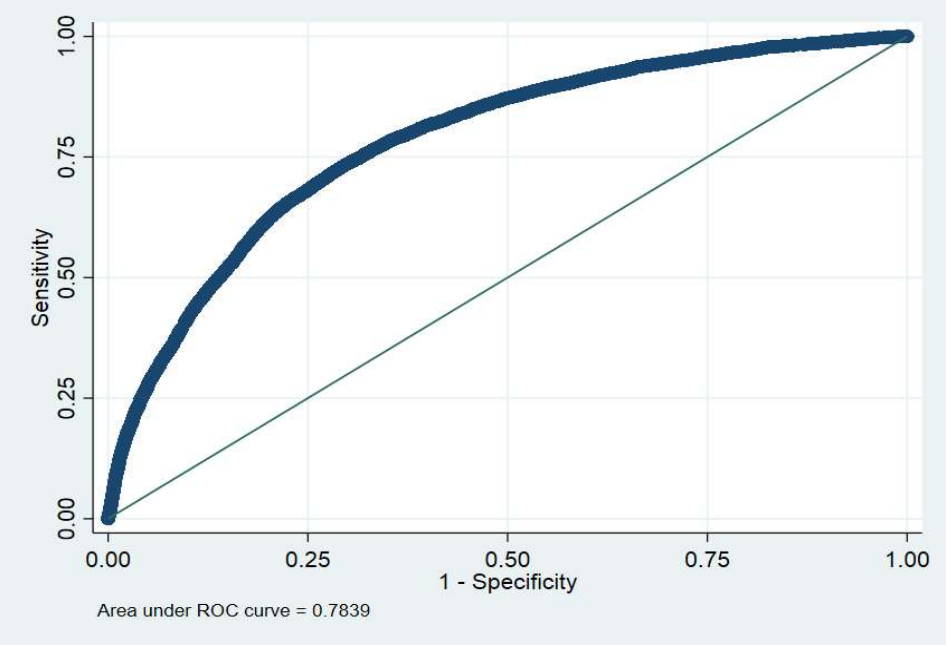
Table 4: Result of the Logistic Regression Showing the Odds of the Determinants of Health Insurance in India 2017-18

| Insured/ Not Insured (Dependent variable) | Odds Ratio | | Robust Standard Error |
|---|---|---|---|
| Constant | 0.16 * | (0.12-0.20) | 0.02 |
| *Independent variables* | | | |
| *Household Characteristics* | | | |
| *Place of habitation* | | | |
| Rural[a] | 1.00 | | |
| Urban | 1.35 * | (1.29-1.42) | 0.04 |
| *Household size* | | | |
| ≤ 5 members[a] | 1.00 | | |
| >5 members | 0.67 * | (0.64 - 0.70) | 0.02 |
| *Social group* | | | |
| SC[a] | 1.00 | | |
| ST | 1.81 * | (1.65 - 1.98) | 0.08 |
| OBC | 1.16 * | (1.07 - 1.25) | 0.05 |
| Others | 1.72 * | (1.60 - 1.86) | 0.07 |
| *Religion* | | | |
| Hindu[a] | 1.00 | | |
| Muslim | 0.85 * | (0.80 - 0.92) | 0.03 |
| Christian | 2.23 * | (2.07 - 2.41) | 0.09 |
| Others | 1.16 * | (1.05 – 1.28) | 0.06 |
| *Wealth quintile* | | | |
| Poorest | 1.00 | | |
| Poor | 1.42 * | (1.29 - 1.56) | 0.07 |
| Medium | 2.00 * | (1.84 - 2.19) | 0.09 |
| Rich | 3.42 * | (3.14 - 3.71) | 0.15 |
| Richest | 5.54 * | (5.09 - 6.03) | 0.24 |
| *Individuals Characteristics* | | | |
| *Marital status of the household head* | | | |
| Never married[a] | 1.00 | | |
| Currently married | 0.87 *** | (0.74 - 1.02) | 0.07 |
| Widowed | 0.89 *** | (0.75 - 1.07) | 0.08 |

| Insured/ Not Insured (Dependent variable) | Odds Ratio | | Robust Standard Error |
|---|---|---|---|
| Divorced / separated | 1.16 *** | (0.83 - 1.62) | 0.20 |
| *Gender of the household head* | | | |
| Male[a] | 1.00 | | |
| Female | 1.28 * | (1.16 - 1.41) | 0.06 |
| *Education of the household head* | | | |
| Not literate[a] | 1.00 | | |
| Primary | 1.75 * | (1.62 - 1.89) | 0.07 |
| Secondary | 1.72 * | (1.60 - 1.85) | 0.07 |
| Higher | 1.65 * | (1.51 - 1.80) | 0.07 |
| *Age of the household head (in Years)* | | | |
| Less than 20[a] | 1.00 | | |
| 21 to 45 | 1.17 *** | (0.90 - 1.53) | 0.16 |
| 46 to 60 | 1.24 *** | (0.95 - 1.62) | 0.17 |
| Above 60 | 1.43 * | (1.09 - 1.88) | 0.20 |
| *Health expenditure support* | | | |
| Household support[a] | 1.00 | | |
| Government support | 0.64 * | (0.57 - 0.70) | 0.03 |
| Employer support | 0.96 *** | (0.82 - 1.11) | 0.07 |
| *Suffering from any chronic ailment during last 1 year* | | | |
| No[a] | 1.00 | | |
| Yes | 0.97 ** | (0.91 - 1.02) | 0.03 |
| Whether hospitalized during last 1 year | | | |
| No[a] | 1.00 | | |
| Yes | 1.44 * | (1.34 - 1.54) | 0.05 |
| *Other Statistics* | | | |
| Total number of observations | 113821 | | |
| Wald $chi^2$ (23) | 9492.28 | | |
| Prob > $chi^2$ | 0.00 | | |
| Pseudo $R^2$ | 0.15 | | |
| Correctly classified | 90.85 % | | |
| Area under ROC curve | 0.78 | | |

Note: a: reference category, Significance level: $*P<0.01$, $**P<0.05$, and $***P<0.1$.
Sources: 75th Round National Sample Survey 2017–18, unit-level data.

With increase in the age of household head, probability of accepting health insurance also increases. Health expenditure support is important for health insurance in a country like India. The all health expenditure supports are negatively related with the take up of health insurance. This shows the need for innovations in government health insurance scheme and also there is a need to create awareness of government health insurance scheme in India.




Additionally, the probability of the hospitalization increases as people take up health insurance; so that, they can utilize health insurance benefits. This decreases the burden of health expenditure on households, so they will not go for distress resources of finance such as debt from banks, depletion of household assets, borrowing from moneylenders, and contributions from family and friends (Sangar, Dutt and Thakur 2018). The chronic ailment is negatively related to the purchase of health insurance.

The multivariate logistic regression model is significant at *p value* 0.01 level. The correctly classified percentage is 90.87 per cent and area under ROC curve is 0.78.

## V Conclusion

The penetration and density of health insurance is lower in India. In this study, we used NSSO 75$^{th}$ round report on health unit level data to understand various factors affecting the take up of health insurance in India.

There is a lower share of health insurance in rural than urban area. The social group-wise difference is found in purchase of health insurance. Moreover, level of education affects positively in take up of health insurance. Education is important in health insurance decision.

It is also found that, the probability of hospitalization increases as people utilize health insurance and its benefits. The chronic illness of any member in the

family increases health related expenditure. These families have greater probability to take health insurance to cover the health expenditure burden.

The health expenditure support is negatively associated with health insurance among Indian families. This suggests that, health insurance is more supported by household expenditure itself. Finally, this study suggests that, there is a need of health insurance related awareness and initial support from government, and government should increase penetration of health insurance in India with various schemes.

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# Contract Marriages for International Migration in Punjab: A Study of Socio-Economic Status of Households

**Anupam Sabharwal and Puran Singh**

*Marriage frauds have reached a critical juncture as contract marriage becomes a modus operandi to reach the destination country. Contract marriage is an unwritten agreement or contract between two young potential migrant marriageable couples, i.e., bride and groom for achieving a common goal of international mobility. It is like a situation of the Stackelberg model, where one acts as a leader and the second follows him. In this situation, the bride acts as a leader due to her better quality of education and groom becomes the follower. The study concluded that the degree of the bride's control over her marital decisions and choice of mate is more based on socio-economic status of the groom's families than individual traits of the grooms. In contrast, the groom's marital decisions and his choice of mate are determined only by the spouse's quality of human capital formation. The study also shows that the role of social and economic networks is of paramount importance in facilitating and speeding up the flow of the contract marriages for migration.*

**Keywords:** Contract marriages, Household capabilities, Human capital formation, International migration, Socio-economic status, Intermediaries.

## I Introduction

Contract Marriage is an un-written agreement or contract between two young potential migrant spouses in a marriageable couple, i.e., bride and groom for achieving the common goal of international mobility. It is a combination of both an economic entity and sanctity of marriage. It involves complex decision-making processes but simple consideration of the probability of joint cross-border migration of the couple involved. After the completion of the initial flow of information, the two parties; brides and grooms with their parents enter into a common agreement of contract marriages and thereby pool their endowment of scarce resources to expand their joint households' capabilities for meeting high

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transaction costs of international student migration to gain and share expected economic benefits from their joint international mobility. It is believed by the investment strategists that when investors lack resources, they enter the co-operative game to invest. Their rational approach in this situation is to pool their scarce resources for joint profit maximization. The two parties who are involved in a game of contract marriage pool their individual scarce resources to maximize their joint expected utility from joint migrations of young couples. It becomes more significant when both parties face scarcity of different kinds of resources. One party, say the bride's side, lacks physical and financial resources (Household deprivations) but have comparative advantages in human capital (Individual abilities), on the other side, the second party, namely the groom's party lacks human capital (Individual deprivations) but have comparative advantages in physical and financial capital (Household Capabilities). In this situation, both parties want to maximize their economic gains through international migration and thus consider contract marriage as a rational and pragmatic investment strategy of collective household welfare in the society where intra household inequality is a common phenomenon.

## II Review of Literature

In common parlance and in ordinary circumstances, marriage is a contract between two individuals based on love and commitment to each other, enter conjugal relationship, reproduction and to share households' responsibilities. The literature on marriage has identified three main functions of the marriage contract: one, couples derive utility from the social customs they enjoy (Cohen 1987, 2002), two, marriage serves as a commitment device that fosters cooperation and investments (Brinig and Crafton 1994, Scott 1990, 2002), three, it serves as a signaling device (Bishop 1984, Rowthorn 2002). Across the world, couples' intimate relationship can be characterized by a combination of passion, closeness, and commitment, although the relative significance of these factors varies across cultures, nations and ethnicities (Keller 2012).

The vast literature on the economics of marriage has been inspired by the seminal work of Becker (1973, 1974). This literature threw light on why a couple prefers to be together than to remain single. But this literature did not reveal why a couple enters marital relationship. The 21$^{st}$ century literature, however, addresses the issues related to why a couple enters the marriage contract. The structural model of the marriage market, estimates that couples learn their match quality over time (Brien, *et. al.* 2004). This model shows that there is a difference between the utility flows during the marriage and the costs of dissolving the marriage. The commitment model (Wydick 2004) reveals that higher quality match couples prefer marriage and low match quality couples prefer cohabitation. This model further argues that higher quality match couples find it more costly to break up the marriage which shows that in repeated game setting, marriage can foster cooperation. Wickelgren (2005) in his study finds that there is bargaining over the

marital surplus, and we largely abstract from bargaining during the process of match making. He also studies the effect of change from mutual consent divorce to unilateral divorce on spouses' investment incentives.

## III Data Base

There is a paucity of secondary data on the contract marriages. Whatever data is available in the newspapers is based on individual cases of failures of marriages. So, there was a need for generating data set on contract marriages for migration based on primary sources. We took the help of various channels, like Newspapers, Social Medias, and IELTS coaching centers, intermediaries/match makers, NGOs working on contract marriages, police stations, and village panchayats. On the bases of F.I.R.'s and above-mentioned sources, we succeeded in locating 123 couple residences and their phone numbers. In fact, we used the snowball sampling method. While conducting our survey, our intention was to interview the same couples' households, so that a rational analysis could be made by juxtaposing these couples together. But, with our best efforts we could succeed to conduct the survey from 100 couple households only.

## IV Methodology

We have followed the simple percentage method in our paper, except in some variables, where we have calculated the Average Weighted Value of the variable by assigning proper weightage.

## V The Rationality of Contract Marriages for International Migration

A significant reason for the growth of transnational and inter-ethnic marriages for cross-border migration across the world is the globalization, liberalization and modernization that have mobilized the populations at the larger scale. These transnational and multi-ethnic populations' mobilizations have facilitated the extension of intimate ties across borders, of course, through faster and cheaper travel and new means for long-distance communication (Elliott and Urry 2010). Some studies (for example, Lu 2007 and Charsley 2012) found that transnational marriages for migration are the result of socio-economic disparities and the precariousness of employment in different parts of the world. These economic hardships have impelled the individuals to cross borders for economic reasons and better life.

The first and foremost purpose of contract marriage is the international migration of the couple. When the youth embrace modern lifestyles and their material needs rise, they often migrate if these needs aren't met locally and they believe better opportunities exist abroad. The 'Exit or Voice' hypothesis (Hirschman 1978) opines that if people feel discontented, they try to change their

circumstances by raising their voices, consent (acquiesce) or leave. A mismatch between personal life aspirations and conditions at home does not necessarily convert into migration if these aspirations are fulfilled by getting jobs, or starting some gainful economic activities at home, but, once the youth lack confidence, or lose hope for any positive changes in the near future in the local conditions, their migration aspirations get light.

## VI The Role of Joint Households' Capabilities of the Couple

The household capability (Sen 1999) is the base of individual choices and freedoms are of paramount importance for the growth and development of individuals, society, and nation. The lack of capability suppresses the human aspirations, limits their choices, and keeps them into inferior socio-economic status. The households' capabilities envelop the individual members' capabilities in the form of human capital formation; households' social, economic, religious, and political standing; access to the flow of information though social, print Medias; and artificial networks.

In our sample survey on contract marriages, we found that brides have human capital and grooms lack human capital but have financial capital.

### *Human Capital*

There are three important components of human capital formation: namely, education, age, and work experience. The group of three plays important role not only in students' migration, but also in the labour market. Vast literature is available on the significance of human capital in one's individual life, and in economy. For example, the endogenous theory of economic growth posits that human capital plays very important role in the economic growth and development of a country. In international labour mobility, the quality human capital has edge over low quality human capital. The migration literature argues that education is often considered an important factor in the long-term integration processes in the destination country, because it enables the immigrants to acquire skills that will lead them to enter the labour market of the destination country. Moreover, education helps the immigrants to understand the culture and the traditions of the country of destination and get assimilated properly. What's more, migration requires migrants to undergo a process of acculturation (Berry 1997). The importance of education lies in shaping individuals' perceptions of economic threat, cultural threat and prejudice (Schneider 2008) and through such impacts could shape potential migrants' attitudes towards migration.

Today's globalized education system is totally based on the quality education. Those who want to migrate as students, need essential educational qualification to fulfill the university requirements. It may be noted that immigration policies of the most advanced countries allow their spouse as dependent movers along with them. Thus, when a couple selects a migration strategy, their best approach is to prioritize

the education of the prime mover. primary decision-maker. It is in the context of marriage for migration that education emerges as first order condition of negotiations. Thus, during the finalization of negotiations of marriage for migration in Punjab, the education of bride is taken special care of, when the grooms lack the quality education.

In addition to the quality and level of education, age and work experience does matter a lot. It is so because age and experience also determine the human capital formation. Here in our study, we have taken three indicators of human capital formation; namely, level of education, age, and the occupation- a proxy of work experience.

### *The Level of Education*

For student migration across the advanced countries, the quality of education along with English skill is a necessary condition. In the present study, we find that groom's party chooses the quality education of bride as the first condition in entering contract marriage for migration. It may be noted that the human capital development of potential brides has enhanced their bargaining power and increased the opportunity costs of quality education, whereas lack of quality education among potential grooms has undermined their bargaining power. It is like a situation of Stackelberg model, where one acts as a leader and the other follows . In this situation, brides clearly act as a leader due to their quality education and grooms become followers. Or it is a cooperative game to gain expected joint utility from expected joint migration by pooling of their resources.

Table 1 clearly indicates that the bride's quality of education is much better compared to the corresponding education of their spouses. The bride's education level clearly shows the fulfilment of necessary conditions of getting admission in foreign universities or colleges. Interestingly, three-fifth of the grooms are only matric, whereas no bride has education level less than secondary level. When, we juxtapose the lower level of education of grooms with corresponding higher level of their age, we find that these situations push the potential male migrants out of the student's migration. These situations of hopelessness of grooms compel them to enter the contract marriage if they want to fulfill their dreams of cross-border migration.

Table 1: Different Levels of Education of Brides and Grooms that Determine the Quality of Human Capital

| Sr. No. | Levels of Education | Brides (%) | Grooms (%) | Total (%) |
|---|---|---|---|---|
| 1 | Matriculation | 00.0 | 60.0 | 30.0 |
| 2 | Secondary | 71.0 | 16.0 | 43.5 |
| 3 | Graduation | 26.0 | 13.0 | 19.5 |
| 4 | Post-Graduation | 03.0 | 06.0 | 04.5 |
| 5 | IELTS | 100.0 | 00.0 | 50.0 |
| 6 | Average Years of Education | 13.93 | 12.61 | 13.27 |

Source: Primary data collected through sample survey during the summer of 2022.

### *Occupation of Brides and Grooms at the Time of Marriage*

Generally, in Punjabi society, a boy is married once he is economically independent, i.e., he is gainfully employed either in service or in independent work. Table 2 reveals that only one percent grooms have government service and other 99 per cent are either partially employed as gig workers or are engaged in their family activities that may be farming or small business as unpaid workers. They are mostly disguisedly unemployed or underemployed. No one was found pursuing higher education at the time of marriage. In contrast, 84 per cent brides were pursing their education either in the home country or in destination countries (Table 2). The continuity of education is also necessary for getting admission in some universities or colleges. From this perspective also, grooms lack the fulfillment of admission requirements at foreign universities or colleges. It also clearly signals that potential grooms have weaker bargaining power in contract marriages for migration.

Table 2: Occupation of Brides and Grooms at the Time of Contract Marriage

| Sr. no | Types of Occupation | Brides (%) | Grooms (%) | Total (%) |
|---|---|---|---|---|
| 1 | Student at home Country | 71.0 | 00.0 | 35.5 |
| 2 | Student Abroad | 13.0 | 00.0 | 06.5 |
| 3 | Private Service | 16.0 | 20.0 | 08.0 |
| 4 | Government Service | 00.0 | 01.0 | 00.5 |
| 5 | Unemployed and looking for job | 00.0 | 29.0 | 14.5 |
| 6 | Unpaid Family Work | 00.0 | 50.0 | 25.0 |

Source: Primary data collected through sample survey conducted during summer 2022.

Thus, by examining the human capital of both brides and grooms, brides have better education level and fulfilled the admission requirements in the foreign universities, but grooms lacked it. It is visible that due to their weakness in human capital, these potential grooms have weaker bargaining power in the contract marriages. But it was their economic rationality to enter contract marriages if they had wanted international mobility though spousal visa.

### *Ownership of Land Holdings and Agricultural Machinery*

Land is an important asset, especially in rural society. It is intriguing to note that in the rural areas of Punjab, the ownership of landholdings plays a very crucial role in the marriage market and in the recent years it has got more significance in the contract marriages for migration. It is so because; the ownership of landholdings is an important component of household's capability. The ownership of landholdings is not only the important source of revenue in the rural society, but it is a major factor in the collateral power. Moreover, higher size of landholding is a symbol of higher social and economic status of a household in the rural society. Girls' parents while entering contract marriage for migration give more

importance to the ownership of landholding of boys than their other physical endowments in rural society, and especially in Malwa cultural zone.

### *Different Sizes of Ownership of Land holdings of Brides and Grooms Households*

The literature on the ownership of land in Punjab shows that there is much skewed distribution of land ownership patterns, especially in the Malwa region of Punjab. Why there is such sharp inequality of ownership of land in Malwa? The answer may be found in the history of Malwa region of Punjab. The Malwa has been under princely states even under the British rule. The kings of these princely states gave most of the share of land to a very few chosen ones best known to them. It resulted in high inequality of land ownership. Most of the families of a village own a very small share of the land and a few families share major chunk of the village land. It is true that land is a big source of not only income of those who owned land but a big source of collateral power. Those who are landless or marginal or small farmers have not only less income but also lack collateral power to raise debt both from the organized and unorganized channels. Thus, they face liquidity constraints for raising funds for the education of their children. This puts the relatively poor families in weaker economic position. It is due to this fact that the potential brides' parents enter contract marriages for migration. Even, in rural folklore, the ownership of land is considered as a more important asset than other assets. In rural areas, owning land is not only essential but a must to get a good bride, especially, in Malwa region of Punjab. The higher size of land ownership increases the prospects of getting better chances of marriages in the highly skewed marriage market.

Table 3 shows that the average size of land holdings of grooms' parents is significantly higher than the average size of land holdings of brides' households. If we see the landownership patterns of brides and grooms' households, we find that almost all brides' households (except one per cent) are either landless or marginal farmers. It is negatively skewed. In contrast, most of the grooms' households (87 per cent) are small farmers, semi-medium, medium and large farming households. It is positively skewed distribution. It confirms the land endowment with grooms' households as an important component of household capabilities.

Table 3: Different Sizes of Land Holdings of Brides and Grooms Households

| Sr. No. | Different Types of Size of Landholdings | Brides' Households (%) | Grooms' Households (%) | Total (%) |
|---|---|---|---|---|
| 1 | Land Less | 35.0 | 03.0 | 19.0 |
| 2 | Marginal (0.2.5 Acres) | 64.0 | 10.0 | 37.0 |
| 3 | Small (2.5-5.0 Acres) | 01.0 | 16.0 | 08.5 |
| 4 | Semi-Medium (5.0-10.0 acres) | 00.0 | 61.0 | 30.5 |
| 5 | Medium (10.0-25.0 Acres) | 00.0 | 09.0 | 04.5 |
| 6 | Large (Above 25.0 Acres) | 00.0 | 01.0 | 00.5 |

Source: Primary data collected though the sample survey conducted during the summer of 2022.

Thus, from the ownership of land, brides' households are in weaker position, and they cannot independently send their daughters for higher studies, even, though, their daughters are better human capital. Again, from brides' perspectives, it is their rational strategy to enter for contract marriage.

## *Value of Agricultural Machinery Owned by Brides and Grooms' Households*

There is a significant correlation between ownership size of agricultural land holdings and agricultural machinery. The mechanization of agriculture started with green revolution in the mid-sixties. Onward 1970s, the utilization of agriculture machinery and its ownership has increased at a very fast pace. The research on agriculture machinery shows that there is such fast growth of agriculture machinery in Punjab, that its utilization is inefficient. With policy backing, subsidies and availability of easy credit, farmers are being pushed to buy more machines. Punjab has five times more tractors than required. The agriculture machinery has been owned through bank loans. As more technological gadgets and machinery are encouraged, it throws farmers into debt trap (Sharma, Devinder 2022). But it is accepted that only those who have either a higher size of landholdings or who rent out their agriculture machinery to other farmers not ing it, actually purchase agriculture machinery. In other words, agriculture machinery is the corollary of ownership of land holdings. Even, agriculture machinery like tractors and trolleys are used for transportation and construction activities. Thus, it may be panned out that ownership of agriculture machinery is the indicator and an important component of rural sector households' capabilities. Table 4 demonstrates 67 per cent of brides' households lack agriculture machinery, whereas only 13 per cent of grooms' households do not own any agriculture machinery. It is intriguing to note that 85 per cent of grooms' households have agriculture machinery that have a value of more than Rupees 2.5 lakhs. In case of brides' households, it is just 14 per cent. Thus, it is clear from the value of machinery ownership, that it is mainly concentrated in grooms' households and brides' households lack it.

Table 4: Value of Agriculture Machinery Owned by Brides and Grooms Households

| Sr. No. | Value of Agricultural Machinery (In ₹ Lacs) | Percentage of Brides Households | Percentage of Grooms Households | Total Households |
|---|---|---|---|---|
| 1 | Zero | 67.0 | 13.0 | 40.0 |
| 2 | 0.2.5 | 19.0 | 02.0 | 10.5 |
| 3 | 2.5-5.0 | 14.0 | 30.0 | 22.0 |
| 4 | 5.0-7.5 | 00.0 | 31.0 | 15.5 |
| 5 | 7.5-10.0 | 00.0 | 12.0 | 06.0 |
| 6 | 7.5-10.0 | 00.0 | 12.0 | 06.0 |
| 7 | Above 10 | 100.0 | 100.0 | 100.0 |

Source: Primary data collected through sample survey conducted during the winter of 2022.

There is a direct correlation between ownership of agricultural machinery and ownership of land.

### *Ownership of Houses*

The ownership of the house is one of the three necessities of life. And the construction of a big house is a luxury item. Moreover, the construction of luxurious house is a signal of higher social economic status of the household. It involves a large part of one's lifetime savings and income of the household in the construction of a house. The ownership of a house not only gives comforts to the owners who live therein, but also is an asset of earning rent if it is given on rent partially or fully. In addition, it is an important source of collateral power for mortgage to raise loans for unseen or seen contingencies. During our survey, we came to know that some families raised loans for education abroad against the house as collateral security. Table 5 clearly shows the great inequality in the patterns of ownership of houses between the brides' and grooms' households. It is also clear from the table 5 that more than fourth-fifth (83 per cent) of the brides' households have small houses. In contrast, almost all except three per cent of grooms' households have semi-large, large or palatial houses. Thus, brides' households are less quality houses. And grooms' households are better quality houses. Table 5 shows that the average weighted index value of brides' households is nearly one third (0.22) of the grooms' households (0.56). This inequality of houses also give impetus to the brides' households to enter contract marriages.

Table 5: Ownership and Quality of Houses of Brides Households and Grooms Households

| Sr. No | Types of Houses | Brides (%) | Grooms (%) | Total (%) |
|---|---|---|---|---|
| 1 | Palatial | 00.0 | 13.0 | 06.5 |
| 2 | Large | 00.0 | 56.0 | 28.0 |
| 3 | Semi-Large | 02.0 | 28.0 | 15.0 |
| 4 | Medium | 15.0 | 03.0 | 09.0 |
| 5 | Small | 82.0 | 00.0 | 41.0 |
| 6 | Poor | 01.0 | 00.0 | 05.0 |
| 7 | Total | 100.0 | 100.0 | 100.0 |
| 8 | Average Weighted Index Values of Households | 0.22 | 0.56 | 0.35 |

Source: Primary data collected through sample survey conducted during the summer of 2022.

### *Possession of Financial Capital*

The financial strength of a household is measured with the savings held by a household in different forms (the creditability of a household) and debts of a household (Liabilities of a household). The higher savings than debts of a house show the financial prudence and financial strength of a house. It was intriguing to

observe during the interviews that rural people had both savings and loans in the banks, especially, in cooperative banks. Interestingly, it was found that rich agriculture households have both higher savings and loans, especially, in co-operative banks. When we asked them, why there are both savings and loans in their accounts, they argued that they maintain credit limits in the banks to meet their unforeseen contingencies. They mentioned that they can conveniently access loans at lower interest rates during times of need, and some added that occasionally it results in loan waivers.

### *Savings Patterns of Brides and Grooms' Households*

The possession of financial capital in the form of savings in current accounts, fixed deposits and other financial tools is the strength of a household and important source for the cross-border migration. Generally, people keep their portfolios of savings into mainly two parts -- risky and non-risky investment. The risky investment includes investing in stock markets. The non-risky investment is in the form of fixed deposits or in current savings accounts of Banks. But mostly people in the rural areas, park their savings in the non-risky investment, i.e., in the form of deposits in the Banks or lend to the needy persons. Table 6 clearly demonstrates that nearly 90 per cent of grooms' households have some savings in the banks and in contrast two-third of brides' households did not have any savings. The grooms' households are better off in savings.

Table 6: Different Amount of Savings held by both Brides Households and Grooms households before the contract marriage (₹lacs)

| Sr. No | Amount of Savings (Rupees Lacs) | Brides Households (%) | Grooms Households %) | Total (%) |
|---|---|---|---|---|
| 1 | Nil | 42.0 | 12.0 | 27.0 |
| 2 | 0-2.5 | 57.0 | 50.0 | 53.5 |
| 3 | 2.5-5.0 | 01.0 | 18.0 | 09.5 |
| 4 | 5.0-7.5 | 00.0 | 05.0 | 02.5 |
| 5 | 7.5-10.0 | 00.0 | 07.0 | 03.5 |
| 6 | Above 10 | 00.0 | 08.0 | 04.0 |
| 7 | Total | 100.0 | 100.0 | 100.0 |

Source: Primary data collected though sample survey conducted during the summer of 2022.

### *Debts Owned by Brides and Grooms' Households*

The financial management experts argue that debt of a household creates financial risk and instability. M.L. Darling (1925) in his study of "Punjab Peasant in Prosperity and Debt" argued that Punjab farmers are born in debt, live in debt and die in debt. He further contended that the volume and burden of debt in the Punjab province of British India was higher for the more prosperous farmers or areas. Dr Gian Singh in his survey of 2017 in Punjab found that 85.9 per cent of the farming

households and 80 per cent of the agricultural households are under debt in Punjab. These facts are still true. No Doubt Debts are bad, but these debts also signal the capacity to bear risks and ability to raise loans for emergency. The amount of loans is based on the collateral power of the households. In other words, mostly, the larger the amount of loan held by a household, larger the collateral power with the household. Table 7 shows that more than half (51 per cent) of grooms' households were indebted with more than 2.5 lakhs of debts. While 40 per cent bride's household had no debts at the time of the marriage of their daughters, and 55 per cent brides' household were indebted between zeros to 2.5 lakhs of loans. Table 7 indicates the ability to take loans by grooms' households and inability of brides' households. In other words, it is implicit in the Table 7 that grooms' households had the high propensity to take loans in case need arises in the family and in contrast the brides' households had lower propensity to take loans.

Table 7: Different Amounts of Debts owned by both Brides and Grooms Households before the Contract Marriage

| Sr. No | Amounts of Debts | Percentage of Bride Households | Percentage of Groom Households | Total |
|---|---|---|---|---|
| 1 | Nil | 40.0 | 18.0 | 29.0 |
| 2 | 0-2.5 | 55.0 | 31.0 | 43.0 |
| 3 | 2.5-5.0 | 03.0 | 39.0 | 21.0 |
| 4 | 5.0-7.5 | 01.0 | 09.0 | 05.0 |
| 5 | 7.5-10.0 | 00.0 | 02.0 | 01.0 |
| 6 | Above 10 | 01.0 | 01.0 | 01.0 |
| 7 | Total | 100.0 | 100.0 | 100.0 |

Source: Primary data collected through sample survey during the summer of 2022.

## *Social and Economic Status of Households*

The relative social and economic status of a household is manifested in its social, economic, and political strength in its village. In other words, variables like the level of income, education, employment, and assets of a family have been jointly treated as proxy for socio-economic status of a household, a wider perspective referring to an individual's overall social and economic standing and access to resources (Baker 2014). The psychological approach suggests that early experience with different social ranking and unequal distribution of resources and income, produce different characteristic patterns of thought among people originating from different socio-economic backgrounds (Kohn 1969). It is due to this different pattern of thought of peoples of different social economic groups, their ways of approaching and interacting with other people is different (Kraus, *et. al.* 2012). The people of high social economic status with access to resources are self-focused. They have individualistic orientation. In contrast, the individuals of lower social economic status households have limited access to resources and opportunities and face many constraints. This group of individuals is more

interdependent with each other. Thus, people from lower social economic status households' backgrounds are indeed more "collectivist" than people from higher social economic status backgrounds. These individuals have collective orientation. Besides, the individuals raised in lower social economic status communities have been proved to be more accurate at judging the emotions of strangers (Kraus, Cote, and Keltner 2010). Still more, lower social economic status individuals do spend more time socializing and less time alone than higher-income individuals (Bianchi and Vohs 2016). It has been further demonstrated that collectivist orientation ascribed to lower social economic status individuals, overlaps with communal orientation towards relationship and self-reliance ascribed to higher social economic status individuals which overlaps with exchange orientations towards relationship. It tracks benefits and costs within relationship (Clark, Mills, and Powel 1986). The processes of economic-romantic partnership or contract marriages for migration can be seen by juxtaposing the perspectives of collectivist orientation of lower social economic status brides and exchange orientations of higher-SES grooms. The table 8 clearly demonstrates that more than four-fifth (83 per cent) of the grooms, households are upper-middle or rich households. In contrast, more than three-fifth (63 per cent) of bride's households belong to lower middle or lower/poor households. It is also clear from the table 8 that there is high inequality in the social economic status of brides and grooms' households. The average weighted value of social economic status of brides' households is almost half (0.36) of the grooms' households (0.60). Contract marriages for migration could become possible due to exchange orientation of grooms' households and communal orientations of brides' households. The grooms' parents' commercial orientation gives them impetus to deal for contract marriages, as by doing this they buy international migration for their sons by spending a huge amount of money, on the foreign education of their daughters-in-law. The communal or collectivist orientation of brides' households, encourages them to find such opportunities of financial supports from relatively rich households, for their daughters. Thus, they go for contract marriages.

Table 8: Different Types of Socio-economic Status of Brides and Grooms Households and Weighted Average Value of the Socio-economic Status of Both Types of Households

| Sr. No. | Types of Socio-economic Status of Households | Brides Households (%) | Grooms Households (%) | Total (%) |
|---|---|---|---|---|
| 1 | High | 00.0 | 22.0 | 11.0 |
| 2 | Upper-Middle | 06.0 | 61.0 | 33.5 |
| 3 | Middle | 31.0 | 13.0 | 22.0 |
| 4 | Lower middle | 44.0 | 04.0 | 24.0 |
| 5 | Lower or Poor | 19.0 | 00.0 | 09.5 |
| 6 | Total | 100.0 | 100.0 | 100.0 |
| 7 | Average Weighted Value of Socio-economic Status of Households | 0.36 | 0.60 | 0.49 |

Source: Primary data collected through sample survey during the summer of 2022.

## VII Role of Social and Economic Networks in Information Gathering about Brides and Grooms

The role of social and economic networks in matrimonial alliances begins with information gathering. During our survey time, we came to know that individual network of Vicholas is high knitted. They operate at various stages. There are main Vicholas and sub-Vicholas, the sub-Vicholas gather information about potential brides and grooms and pass over to the main vichola, who further share information with parents or relatives/friends of potential brides and grooms. Table 9 shows that friends, relatives, Individual intermediators (Vicholas) and social/community media, played significant role in gathering information for the potential brides and grooms. Table 9 also shows that parents of brides and grooms were not only dependent on one source, but many of them used more than one information channel in gathering information. These social and economic networks provide every type of information related to individual attributes of brides and grooms and their households, especially, those essential for student's migration.

Table 9: The Role of Different Agents in Gathering and Processing Information for Brides and Grooms and Their Households

| Sr. No | Different Channels | Brides (%) | Grooms (%) | Total (%) |
|---|---|---|---|---|
| 1 | Friends and Relatives | 70.0 | 74.0 | 72.0 |
| 2 | Institutional Intermediator | 02.0 | 08.0 | 05.0 |
| 3 | Individual Intermediator | 40.0 | 50.0 | 45.0 |
| 4 | Print Media-News papers | 05.0 | 10.0 | 07.5 |
| 5 | Organized Media | 04.0 | 08.0 | 06.0 |
| 6 | Social Media | 30.0 | 42.0 | 36.0 |

Source: Primary data collected through sample survey during the summer of 2022.

## VIII Role of Social and Economic Networks in Intermediation and Final Settlements

After gathering information about the potential brides and grooms, there starts the process of mediation and final settlements of the contract marriage for migration. In our study, we found that almost those who provide information about the potential brides and grooms also played role in finally fixing the contract marriages. However, the role of individual intermediators increased in the process of mediation (Table 10). Interestingly, as in information gathering, more than one channel played a role in intermediating between bride and grooms' families. During the process of intermediation, everything is discussed in detail. However, the major discussion revolves around the sharing of expenditure on the education of brides in the destination countries between brides' families and grooms' families or it is to be totally made by grooms' families.

Table 10: Role of Different Agents in Mediation between Brides and Grooms in Match Making

| Sr. No | Channels Of different Networks | Brides (%) | Grooms (%) | Total (%) |
|---|---|---|---|---|
| 1 | Friends and Relatives | 65.0 | 70.0 | 67.5 |
| 2 | Institutional Intermediator | 1.0 | 1.0 | 1.0 |
| 3 | Individual intermediator | 47.0 | 62.0 | 54.5 |
| 4 | Print Media | 0.0 | 0.0 | 0.0 |
| 5 | Organized Media | 04.0 | 04.0 | 04.0 |
| 6 | Social Media | 5.0 | 05.0 | 05.0 |

Source: Primary data collected through Sample Survey, summer 2022.

Thus, it may be panned out that both social and economic networks play very significant role in facilitating the contract marriages for migration.

## Conclusions

Our study shows that the economic-romantic partnership for migration or contract marriage for migration is a rational, pragmatic, and long-term strategy followed by both brides and grooms to escape the potential economic hardships-unemployment, poverty, inequality, falling and contaminated water level, environmental damages, law and order problems, political vendetta, and social hardships. The economic-romantic partnership for cross-border migration is based on the economic rationality of both brides and grooms. The brides and grooms' decisions of contract marriages for migration are determined by their financial/liquidity constraints and lack of human capital formations respectively. In other words, both brides and grooms enter the contract marriages to enhance their joint households' capabilities to migrate jointly.

It may be noted that the contract marriage for migration is fast becoming the pathways of cross-border migration in both rural and urban areas. There is a gain from "migrating together" than finding difficulty in individual migrating due to the constraints attached with student's migration; the necessary and sufficient conditions in the forms of human capital formation and financial capital formation required for students' migration. Both Brides and Grooms knew that they would have been failures in migrating had they tried their independent move. But, once, the couple enters a contract marriage, they pool their human and financial resources and thereby increases their joint household capability that enable the couple to move together, of course, first bride and then groom or jointly depending upon the immigration policies of the destination countries. The study also shows that the role of social and economic networks is of paramount importance in facilitating and speeding up the flow of the contract marriages for migration.

In brief, we may sum up that contract marriage for migration or economic-romantic partnership is being pushed by socio-economic deprivation like high

unemployment, poverty, inequality of income, aspired and enabled by jointly raised households' capabilities.

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# On Colonial Poverty and the Land Reforms in India: A Discourse Analysis

**Samyo Basu**

*This essay discusses the constitutive relations between the discourse of colonial poverty and the land reforms policies that had characterised Indian economic policy-making in the eve of its independence, in their continuities and discontinuities of interaction. By the discourse method, it identifies the particular way of knowing the reality, producing and disseminating effects of truth and bringing the players (e.g. the State) to act and intervene, thus securing the legitimacy and power of the representation, or the regime of truth - the discourse. Section I decodes the ideological dimensions, assumptions and values underlying the colonial and post-colonial discourse on poverty in India. Section II reveals its constitutive relations with the land reforms of the fifties. Section III identifies the consequent rise of the private capitalist class in agriculture, marking one of the earliest indications of the emergence of the notion of 'hegemony' in the Indian context - in the sense of class alliance.*

**Keywords:** Colonial poverty, Land reforms, Private property rights, Class alliance, Hegemony

This essay attempts a discourse analysis of the land reforms of the 1950s in the Indian context. In simpler words, it traces through the shifts in the policy regimes and public action at the eve of independence that provided conditions of emergence to the land reforms policies of the 1950s. These shifts are shown here to be linked to the different *perceptions* of poverty and underdevelopment at different periods of time (Dreze and Sen 1989). The perception of what constitutes poverty - its nature and its causes –determined the changing attitudes of the Indian government over time in defining the appropriate domain of public action, both in terms of state action and also the realm of civil society (Chaudhuri 1993, p. 310). The very experience of poverty reduction in India had been marked by continuities and discontinuities in perceptions of poverty over the colonial and the post-colonial periods. The colonial perceptions on Indian poverty were both carried forward as well as altered by the Indian government in certain ways after independence, their attitude in public policy and planning fed by an image of transition from a backward rural economy to a modern capitalist one, an image that the third world subscribed to at that point of time, as elaborated below. This is to decode and unmask the ideological dimensions, assumptions and values

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underlying the colonial and post-colonial discourse on poverty in India and reveal its constitutive relations with the land reforms of the fifties as well as the consequent rise of the private capitalist class in agriculture, thereby marking one of the earliest indications of the emergence of the notion of 'hegemony' in the Indian context - in the sense of class alliance.

This is done here by means of the discourse method. The set of policies under the land reforms programme undertaken in the Indian economy in the fifties is argued here to be derived from the discourse on colonial and post-colonial poverty, by establishing the constitutive relations between the various forces in the structural and super structural levels active in a particular period of time (Gramsci 1971). Following the methodology of discourse analysis, this thesis goes beyond empirical/realist analyses of Indian public policymaking that tries to capture and understand real changes in the world, and rather concentrates on the conceptualization of discourse *constructing* the social world. The discourse method encompasses a much wider sphere that includes all of the social practices of individuals, and institutions, that make it possible and legitimate to understand phenomena in a particular way, and to make certain statements about what is 'true' (McIlvenny, *et. al*. 2016). As Foucault (1972, 2001) has shown, discourse analysis illustrates how particular discourses systematically construct versions of the social world, that is, how certain bodies of ideas, concepts and beliefs become established as 'knowledge', or as an accepted way of looking at the social world (Doherty 2007), what he calls a particular 'regime of truth'. The focus is on the ways in which the very existence of specific institutions and of roles for individuals to play are made possible by means of thinking and speaking, and how these various definitions are linked to the power and objectives of the particular institutions. Discourse analysis is thus primarily concerned with the analysis of power.

## I Colonial Discourse on Poverty

In the colonial period, the Government of British India saw itself as beneficial, especially to the poor[1] (Chaudhuri 1993, p. 311). Such imperial justifications were based on the protection of private property and development of the country by growth of mercantile towns, new industries, railways and spread of irrigation (Hunter 1889). The problem of poverty was attributed to the rural society owing to its limited development of productive forces and lack of market-oriented production system. These structural constraints were considered responsible for a low level of 'natural' rate of development of India and hence any public action on the part of the government was discouraged as wasteful and unproductive expenditure. Frequent famines and severe food shortages (Orissa famine 1866) did force the entry of remedial action like famine policies (for example, through the Famine Codes of 1901), but they were exceptions in the colonial rule evoked out of acute hunger and innumerable deaths (Bhatia 1967; Ambirajan 1978).

The Indian nationalists like Naoroji (1901), Dutt (1976) and Joshi (1912) agreed to the structuralist view of poverty that India was poor due to its

underdeveloped productive system, rather than seeing it as a problem of distribution and inequality. But they were against the naturalist and fatalist conceptions of Indian underdevelopment and assigned its root cause in the British colonial rule, especially in their land revenue policy. The excessive revenue demands came from the need to finance their costly foreign administration in India, and it was ensured by appropriating the surplus from the peasants of the Ryotwari system (the Ryots) reducing their lives to bare subsistence. This surplus was not further reinvested for the development of the rural economic base, but the wealth was drained away to their own countries. Moreover, as the colonial tariff policies tuned to the Manchester interests acted as a barrier to Indian industrialisation, it prevented any escape of the exploited ryots from agriculture to industry (Chaudhuri 1993, p. 313).

Against these dual charges of land revenue policy and costly foreign administration against the British, industrialisation was posited as the key to India's economic development by the nationalist critics in the colonial period and later by the Indian Government after independence. As costs of administration would be substantially reduced after independence, the government would be able to recirculate a greater share of the surplus income that was being drained away to Britain leading to industrial growth and increase in income of the poor. Moreover, with the land revenue policy abolished, the Ryots as a class would be allowed to improve their economic conditions by the Government leading to greater retention of the fruits of their own labour for subsistence and investment (Chaudhuri 1993, p. 314). These two primary functions (i) to dismantle the land tenure system and its exploitative class structure in agriculture and (ii) to initiate the socialist pattern of industrialisation put the Indian Government in the driving seat of development, whose sole objective was, in Nehru's words (1936), "fighting poverty under the present system – political and economic". This implied that the growth of private capitalism in place of the existing feudal structure was to be countered through the instrument of socialist planning, i.e., towards a state-regulated path of institutional development. Let us understand here the patterns of arguments from where the institutional land reforms and irrigational development were launched in the First Five Year plan 1951 in order to clearly demonstrate the conditions of formation of the discourse on post-colonial poverty, before the decisive emphasis on rural agrarian development started to decline in the succeeding plans to give way to the heavy-scale industrialisation of the Nehru-Mahalanobis Plan.

## II The Land Reforms

In the eve of Independence, the Indian planners considered themselves to have inherited a semi-feudal[2] social structure from the British, primarily in the vast agricultural sector, where the term 'semi-feudal' was defined by the absence of the mass of free potential wage labourers and failure to be integrated into the capitalist relations of production (Rudra 1978, 1990; Patnaik 1990). Inhibiting the development of the forces of production, the entire agrarian social structure was

related to the prevalent land structure which was argued to be exhibiting a colonial[3] mode of production marked by the Ryotwari system and the Zamindari system along with institutions of social arrangements accompanied by usury, sharecropping, etc. (Bardhan and Rudra 1978, Bardhan 1980, 1984, 1989, Ghose and Saith 1976).

To note, before the British came, it was a feudal kind of society with no well-defined property rights, that is, exhibiting a wide variety of often contradictory property relations that were quite frequent in those days[4] (Laxminarayan et. al.1982). It was the king who would give grants of land to men of learning, courtiers, officials and men who had done some signal service to the crown. But what the king gifted away was his share of the produce and not the propriety rights of the soil. For, the king was not the proprietor of all land in his kingdom and therefore he could not gift away the land owned by individuals (Appu 1997). Often it would be seen that the Brahmins have strengthened their position over the agrarian economy and were donated villages, known as Brahmadeya (Thirumalai 1987). Similar to these, there were different other types of ownerships, but generally a communal ownership in the sense a community rather than a village claimed the right. Private land ownership was obscure and limited. The dominant form of tenurial system was communal ownership of land by villages at that time (Sastri 1975). There would be peasant proprietorship (cultivator paid revenue to the king on the area actually occupied by him), service tenure (land donated to artisans in return for their services) and eleemosynary institutions (charitable religious intermediaries). But as the king could not make use of the land, he needed the other's services. Even a Mughal emperor or governor had never thought of creating an official collector of rents, or invented a title *zamindar* by making a decree or regulation defining their rights and duties (Shartna 1989).

When the British East India Company decided to make direct collections for extracting as much as possible, Lord Cornwallis introduced the Permanent Settlement Act (Bengal and Bihar) in 1773, by which the owners were deprived of hereditary lands and the ownership of the soil passed into the hands of the zamindars who had been merely agents of the Government for the collection of revenues (Dutt 1976, Deshpande 2007). They had no knowledge of the various rights of land or of long standing local customs and practices. If their performance was not satisfactory, they were replaced. This continued upto 1789, after which the British tried the second type of land settlement - the Ryotwari System, introduced by Thomas Munro in 1792. Under this system, the Ryot was directly under the State and the land revenue was assessed on each separate holding. The Ryotwari system was different from the Zamindari system in two respects (Powell 1982): (i) under the Zamindari system, the ryot did not enjoy the right to sell or transfer the land. On the other hand, under Ryotwari system, the bigger peasant proprietors were free from the above limitations. In addition, they possessed an advantage over the occupancy Ryots in the Zamindari areas, who were less favourably placed than the Ryotwari peasants because better irrigation facilities existed in the Ryotwari areas than in the Zamindari areas. As a result, the Ryotwari

peasants were able to retain some surplus after discharging their liabilities. But in the Zamindari System, the landlords were given absolute freedom to deal with their tenants as they pleased. In course of time, it was found millions of tenants lost their rights in the lands to them that they had been cultivating for generations (Thimmaiah 2001). With a view to providing a measure of protection to tenants, Bengal Tenancy Act of 1885 and similar laws were enacted to confer security of tenure on certain categories of superior tenants. The Zamindars usually cultivated their lands through tenants-at-will. The landowners used to lease out their land to tenants for payment of a fixed rent or sharing the produce. Tenants of the Zamindars and all categories of tenants in the Ryotwari areas enjoyed no security of tenure. It is estimated that on the eve of independence, more than one half of the cultivated land was under tenancy and that the bulk of the tenants enjoyed no security of tenure or fixity of rent (Ministry of Rural Development 2001)

It was to give land to these landless tenants based on the principle of private property rights that the famous 'Land to the Tiller' policy of the INC was formulated and land redistribution was implemented in the 1950s in the three major efforts - abolition of the intermediaries, tenancy reforms (regulation of rent, security of tenure, conferment of ownership rights on tenants), and the redistribution of land using land ceilings (and consolidation of holdings) (Herring 1983; National Commission on Agriculture 1976). Throughout the entire planning period, the land policy was an important component in the major issues and policy thrusts[5], but whatever the direction has been, however discontinuous and random, the backbone of the argument had always been this: private property rights are to be given to the cultivators for their own land. The statement deserves more elaboration. For a vast amount of literature has evolved on the issue of land reforms often concluding with the failure of the practical implementation of the reforms, and a rather sympathetic safeguarding to its theoretical underpinnings (Nadkarni 1976, 2002; Rao 1990, 1992). The fact that the land reform programme met with varying levels of success across different States[6] has further reinforced the strength of the theoretical validation of individual property rights. Let us argue over its consequences.

Empirically, the results have been established much clearly. There have been marginal changes in the distribution of agricultural holdings and the area operated between 1953-1954 and 1960-1961 (Chattopadhay 1973). The 1.07 per cent of the total area cultivated by very small farmers (consisting 19.72 per cent of the total number of holdings) hardly increased to 1.27 per cent of the total area (now comprising 17.13 per cent of the total holdings). The share of the big land holders (consisting of 12 per cent of the total number of holdings) indeed fell considerably from 53 per cent to 45 per cent but it was an effect of the fact that the land held by the big landowners in excess of the land ceilings was transferred in the names of the other members and relatives of their families. The concentration of land holdings remained more or less intact as is well known from the data that less than 4 per cent of the tenants received land and less than 2 per cent of the total cultivated land in India was redistributed, at least till the end of the 1970s (Bandyopadhyay

1986), after which land reform issues shifted so conveniently towards land development and administration (land records, etc.).

## III Hegemony as Class Alliance

These figures while bringing out the aspects of implementation failures and corruption miss out on a much deeper issue concerned with the theoretical assumptions behind the reforms. What it fails to see is how the private property regime laid the foundation for capitalist market production to incorporate the interests of the big landowner class without inflicting any damage to its own conditions of existence. The land reforms of the 1950s represented a class alliance by the capitalist with the landowner (Chattopadhay 1973) that avoided smashing the feudal and semi-feudal land relations, and rather resulted in the emergence of the capitalist enterprises in agriculture thereby providing cheap wage goods for industrial labour and keeping wages low and profits high. Further, the capitalist enterprises in agriculture would satisfy the demand for agro-based raw materials for industries and expand the rural market for products of consumer goods industries by raising the purchasing power of the agricultural capitalists and their cohorts. Thus we can say that the capitalist was never led to the point of eliminating feudal interests but it was made sure that the design of the land reforms based on private property ensured a coexistence of capitalist and semi-feudal class relations in agriculture. This way the landowners would shed some of their feudal characteristics, yet allowing them to continue other forms of semi-feudal exploitation through their land-holdings untouched, while simultaneously inducing them to transform their estates as per the logic of capitalist production. This is one of the reasons why the government in the early fifties would provide direct, financial and technical aids to the erstwhile landlords and upper crust of the rich peasantry via community development programmes and national development schemes.

Such a concept of ‘class alliance’ as in the landlord-capitalist rule has been deciphered here by subjecting the colonial (and post-colonial) perceptions on poverty and underdevelopment to the discourse method. This has served two purposes here, namely (i) to reveal the mechanisms of power in the institutions and their statements originating from the discourse of colonial poverty, and (ii) to signify the emergence of one of the earliest notions of hegemony in India, defined by Lenin (1978) as ‘political leadership within a class alliance’ in the Russian context of underdevelopment (Laclau and Mouffe 1985, p. 55). A similar application of the notion can be found in the Indian context in the 1950s, where it was expected to traverse the same trajectory of development following the West with the capitalist guiding the process of transition through its typical motive of profit-driven investment. As seen above, the hegemony of class alliance provided a break from such unilinear, stagist notions of capitalist development as enunciated in our analysis on the colonial (and post-colonial) discourse on poverty. For, hegemony implies that the identity of class would remain intact, but would be

supplanted by a representation of interests, which in the Indian case were depicted as the modernization and progress of the economy, rationalization and commercialization of agriculture and the like. This class alliance matured in the form of the supremacy of the private capitalist class in agriculture throughout the seventies and eighties providing necessary conditions to the crisis of the early 1990s.

With the advent of the Green Revolution in the late sixties, the new class of substantial private land owners successfully deflected the focus of land redistribution to technological reforms and irrigational development (Ghosh 2002, p. 13). Market-oriented arguments further cropped up in the pretext of the Food Crisis, on the grounds of higher productivity and technological indivisibility and larger returns to scale in case of large landholdings and rich capitalist farms in rural agriculture. That was when the land ceiling laws in the second phases were revised to incorporate various exemptions and loopholes by the individual states thus allowing landlords to retain control over their land-holdings. Consequently, a vast ocean of poor-peasants, tenants, share-croppers and innumerable agricultural labourers emerged in the rural property structure as the Indian economy shifted its gears from a semi-feudal economy to a largely peasant economy. There have been instances of the land-owning peasants cultivating their newly acquired land in a subsistent scale of farming (in West Bengal, where lands reforms have been comparably successful) (Chattopadhay 1973). Even then, the increase in the number of uneconomic non-viable holdings and failure of the farmers to produce a marketable surplus and profit were posited to be the crucial causes behind the Food Grain Crisis of the early sixties. It was against this, that the Green Revolution was welcomed by the Indian planners wholeheartedly in 1969. While it did manage to fill some gaps in food production, it was accompanied by a worsening level of inequality, as the small farmers were left out of the intensive cultivation patterns and input-based techniques. All this contributed to the Food Crisis and the corresponding establishment of the rule of the capitalist farmer in public debates and policy making of the seventies and eighties.

## *Conclusion*

The discursive method employed here, was to bring out the constitutive relations between colonial (and post-colonial) discourse on poverty and the land reforms of the 1950s founded on the private property rights regime and reveal how it provided conditions to the emergence of the agricultural capitalist class via this hegemonic alliance. The land reforms were posited in reflection to the question of transition with respect to the economic formation of a post-colonial third world nation – the transition from tradition to modernity, from unreason to reason, from pre-capitalism to capitalism (Sanyal 2007, p. 111). It has been the cornerstone of major differences in opinions on public policy between the liberal and the Marxist traditions as per their presumably unbiased criteria of efficiency and incentivisation between private players and state, or market mechanism and public

pricing policies. But in both these schools of modernisation theories, is inscribed a story of failure, of incompleteness in the trajectory of transition of the underdeveloped economy. While the liberals focus their concerns on fundamental structural changes whereby the traditional economic, social and cultural institutions are to be replaced by a set of modern institutions, thereby creating conditions of sustained economic growth, the Marxists have always meant development in the sense of transition from stagnant pre-capitalist mode of production to a dynamic capitalist mode of production (Desai 1998). The arguments behind the concerns for raising productivity and efficiency have widely ranged from transforming the relations of production through state intervention (often called the radical socialist path) or importing technology and capital (i.e. external agents of surplus extraction). However, what is often missed, is that the mode of appropriation and distribution of surplus, involves the question of power and agency, and the institutions are themselves sites from where statements are made, statements regarding the object of knowledge (here, the third world economy), that involves a particular way of knowing the reality (underdevelopment), that produces and disseminates effects of truth (i.e., of development) and bringing into play agents (e.g., the state) who intervene and act, thereby acting as the source of legitimacy and power of the discourse, the discourse of development (Escobar 1995).

The discourse analysis enabled us to go beyond the vast literature on land reforms revived in the post-Reforms period (and the corresponding debates on state vs. market, efficiency vs. welfare, growth vs. equity), and grasp how it emerged at that time to cater to the idea of development, of transition, that the international developmental organisations, universities and research institutions produced from the actions, their modalities, and the strategies that their practice involved, including the instrument of a strongly committed post-colonial nation-state. Only then we can understand the theoretical contours of the land reforms as part of the discourse of development, as a regime of representation and power.

## Endnotes

1. For detailed readings on continuities in important areas of policy after independence, like land reforms, food policy or planning, *see* B. Chandra 1969, Chattopadhyay 1985, Duncan 1979, Merrilat 1970.
2. In the 1960s and 1970s, there was a debate in India on the nature of the mode of production in agriculture where the scholars attempted to characterize Indian agriculture by differentiating between different terminologies like semi-feudal, colonial etc. (Bhaduri 1973, Bardhan 1980, Banaji 1990, Srinivasan 1979). The scholars were divided into three broad camps - the semi-feudalism school, the capitalist school and the colonial mode of production school. According to Bhaduri (1973), semi-feudalism signified a system where the market for labor-power had not been fully developed, i.e., wage-labor, if it exists, was not free to be bought and sold like other commodities.
3. One of the positions taken in the Indian modes of production debate was the characterization of Indian society as colonial (Alavi 1975, Banaji 1990) where it was argued that the Indian mode of production was an articulatory existence of the colonial mode of production with

either or both the domestic capitalist mode of production and the capitalist mode of production of the concerned center countries. Since this position faced various internal theoretical problems, the colonial mode of production school failed to take off.

4. For detailed analysis of the agrarian structure and the diverse notions of property rights in pre-colonial India, see Zacharias 1950, Karthikeyan 1961, Sastri 1975.

5. The problem of land and land reforms in India had gained in importance since the Second World War leading to a vast literature on the issue (*see* Raj K. 1961, Dutt 1976, Appu 1997). In the sixties, much of the work in India was empirical in nature done by scholars trained in economics of neo-classical type devoted to evaluation studies (*see* Bardhan 1976, 1984, Bardhan and Rudra 1978, Rudra and Sen 1980), the issues of relevance being (i) size of holding and efficiency, (ii) tenancy arrangements and efficiency (iii) tenancy and employment (iv) size of holding, tenancy and employment, technological change, mechanization or modernization. In contrast, Joshi (1975, 1987), Thorner and Thorner (1961), Ladejinsky (1977) have followed a more 'integrated' approach considering the socio-economic-political structure of the society. However, with the Green Revolution, the focus shifted towards technological change rather than institutional reforms.

6. Various cross-state data analyses have shown that the two states in which land reform is widely considered to have been successful are West Bengal and Kerala, and in both cases it was pushed forward by left-wing administration (For readings, *see* Basu and Bhattacharya 1962, Dandekar 1964, Bandopadhyay 1969, Besley and Burgess 2000, Das 2000; Banerjee, Gertler and Ghatak 2002, Ghatak and Roy 2007).

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## Book Review

Daren Acemoglu MIT and Simon Johnson, "*Power and Progress: Our Thousand Year Struggle Over Technology and Prosperity*", Basic Books UK, 2023, pp. 546, Price ₹899/-.

The debate surrounding the true impact of technology on our society has engendered considerable confusion, prompting a critical examination of the subject matter. This discourse ventures into the realm of new knowledge, with proponents of technology extolling its role as a harbinger of transformative change, while others question whether it indeed yields the expected productivity gains. The book deals with how power and progress are interrelated.

Daren Acemoglu and James Robinson, both professors at MIT, have embarked on a journey to examine these complex questions. Their extensive body of work, individually and in collaboration with co-authors, delves into the profound implications of artificial intelligence and technology on the contemporary generation. The authors present a unique approach to examining modern technology narratives, emphasizing its importance in development. They provide a clear vision for embracing technology and offer solutions to inherent problems.

The book commences with a prologue where the authors expound upon the title, "Power and Progress," and elucidate the nuanced meaning of progress. They astutely observe that in the modern world, power is intricately tied to control over technology, and similarly, progress hinges on technological advancements. The authors provide a vivid historical panorama of technological progress and its pivotal role in shaping the trajectory of societal advancement.

Here we should mention about Michael Foucalt and his work on power and specifically his work on power and knowledge and how the former is used to control the later.

The book's chapters trace the historical significance of technology, progressing from agriculture to the industrial revolution and the modern digital age. It highlights how technologies enhancing development by increasing work capacity have generally been positive, but those displacing humans have led to negative consequences. The authors diverge from the common view linking technology to productivity and wages, emphasizing the influence of social and political factors on technological development throughout the book.

The first chapter unfolds with the captivating narrative of the French visionary Ferdinand de Lesseps, the mastermind behind the Suez Canal. The authors meticulously recount how Lesseps conjured a grand vision for the canal and successfully garnered support and investment, firmly believing that technology would invariably come to the rescue when challenges arose. However, his unbridled enthusiasm and optimism drove him to embark on another ambitious

project, the Panama Canal. Tragically, this unflagging zeal led to his downfall and a colossal failure, not only for him but for all those directly or indirectly involved. The authors caution against the perils of being so consumed by a vision that one overlooks potential pitfalls.

The authors then probe the genesis of power and the ability to persuade. The authors posit that persuasion thrives on the potency of narrative, and individuals and entities craft their own compelling stories to sway society. They assert that political and economic power hinges on the ability to influence through narrative. The historical example of Napoleon Bonaparte, who adeptly persuaded his allies to accept his supremacy, is invoked. The authors also scrutinize Wall Street, underscoring the pivotal role of the growth narrative. They highlight how ideas can be remarkably potent in shaping modern narratives, citing the example of the narrative surrounding Black Americans' history of racial discrimination, which was propagated, and how certain elites successfully convinced the nation (USA) to oppress and discriminate against Black individuals. Throughout societies, it is typically the affluent and influential who possess the power to sway and shape narratives for the masses. The authors buttress their argument with a multitude of historical examples. At this juncture, a natural query arises: Is there a potential remedy for this disparity in power? The authors assert that democracy presents a possible solution. It fosters diversity and serves as the foundation for inclusivity, thereby enabling a more equitable distribution of power.

Democracy has shown to be better at removing the many aspects that a country should not have and in general it is thought to be better at producing outcomes that can be beneficial for the common man.

Therefore, it is crucial to consider the intricate interplay between technology's utilization and its contribution to societal betterment. The authors assert that history reveals a recurring pattern where powerful individuals employ narrative manipulation for personal gain. They elucidate this point through various historical examples, including the Malthusian trap, which cast the blame for societal ills on the poor. The authors posit that throughout the evolution of agriculture, inequality was often perpetuated by the wealthy, who skillfully tailored narratives to their advantage. Technological advances in agriculture, for instance, exacerbated the wealth gap between rich and poor.

The industrial revolution, a pivotal turning point in modern history, found its origins in the United Kingdom, ultimately shaping the contemporary global order. The authors emphasize that the industrial revolution was initiated by individuals from humble backgrounds, such as George Stephenson, who led innovations in railways and steam engines despite his modest origins. The authors also delve into the significance of Great Britain in this revolution, attributing its prominence to socioeconomic and institutional factors that paved the way for technological advancement. The authors underscore the symbiotic relationship between institutional factors and societal progress.

Nevertheless, the authors do not shy away from acknowledging the darker side of progress during the industrial revolution, such as the deplorable working

conditions endured by child laborers. These societal casualties catalyzed future revolutions and protests, exemplified by the Luddites' actions.

The advancement of education has witnessed a multitude of approaches, with the authors highlighting the role of progress's casualties during the industrial revolution. This period illuminated that technological progress, in and of itself, may not guarantee societal betterment. Biases inherent in technology are demonstrated through the authors' examination of British colonial practices in India, where Indian goods were restricted from export, while British finished goods flowed freely into India. The second phase of industrialization ushered in superior technologies, leading to increased labor productivity and improved bargaining power for workers. This era also saw the rise of labor unions and collective bargaining, epitomizing the ascendancy of labor-augmenting technological innovations. Consequently, labor-enhancing technology assumed paramount importance during this period.

The authors expound upon the concept of technological dilemma in societies. They cite instances of shared prosperity in both Europe and the United States, largely attributed to user-friendly technology. This era witnessed the establishment of social safety nets, redistributive taxes, unemployment insurance, and educational advancements. However, the authors emphasize that technology should be directed toward augmenting human productivity rather than being wielded solely for profit.

The early 1960s marked a resurgence of technological activism, with ethical hacking and the democratization of technology. The authors underscore the drive among technocrats to make technology accessible to all. However, a shift occurred as business technocrats organized against labor movements, prioritizing shareholder returns and profit maximization.

This shift precipitated increased inequality within the working class, further exacerbated by automation and the loss of job opportunities, particularly due to cheaper imports from China. Economists, once skeptical of large corporations, began to reassess their impact on performance, heralding a change in perceptions. The authors highlight that the contemporary productivity focus increasingly tilts toward wage reduction and employment reduction.

The authors pose a pertinent question regarding the importance of artificial intelligence (AI) and its potential implications. Contrary to some perspectives, the authors contend that AI can enhance productivity and facilitate future progress. Nevertheless, they express concerns about the growing prevalence of surveillance systems. Drawing parallels with Jeremy Bentham's concept of the panopticon, the authors assert that many companies are harnessing AI for surveillance, causing discomfort among workers. The authors posit an alternative vision of machine learning, one that prioritizes the betterment of human productivity—a road less traveled.

The pervasive surveillance systems have cast shadows over the concept of machine usefulness. On one hand, there is a relentless focus on machine learning's capacity to replace humans, while on the other, the authors advocate using

machines to augment human productivity. These conflicting paradigms are currently in contention, with the authors advocating for the latter approach, which has demonstrated enhanced productivity. They cite examples, such as mobile technology's impact in Kerala, India, and the success of M-Pesa in Kenya for money transfers. The authors also grapple with the question of whether technologies from developed countries should be transferred to the developing world, emphasizing that not all technologies are universally applicable. The authors contend that the world has cleaved into two tiers—the super-rich, who assert their genius and extract from others, and tech leaders who perceive most ordinary individuals as error-prone and replaceable. Democracy emerges as a vital force in the modern world, affording citizens space and a voice of dissent. The authors cite the Chinese government's utilization of surveillance to quell dissent as a stark contrast to democratic ideals. They also explore how social media, coupled with AI, can manipulate political narratives and create societal divisions. The authors caution against the potential for AI to undermine labor productivity, suppress dissenting voices, and depress wages.

They underscore the significance of countervailing powers within democracies as vital for fostering dissent and nurturing alternate narratives, which have historically led to sweeping changes in American politics and business practices. The authors emphasize the importance of redirecting technology, an endeavor only achievable through the cultivation of alternative narratives.

In the final chapter, the authors offer a template for moderating technological change through narrative transformation.

The book concludes by emphasizing the authors' call for extensive reforms. Today, the tech industry and large corporations wield more influence than in the past century. The authors draw parallels with the HIV/AIDS crisis of the late 1980s, a time when progress appeared nearly impossible. However, as narratives shifted due to activism and various campaigns, the situation evolved. The authors hold hope that similar change can shape the future direction of technology.

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Siliguri

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## Books Received

K.A. Gunasekaran (Translated from Tamil by V. Kadambari), *The Scar*, Orients Blackswan Private Limited, Noida, Uttar Pradesh 560082, 2024, pp. 120, Price ₹375/-.

## R.B.R.R. Kale Memorial Lectures at Gokhale Institute of Politics and Economics

+ 1937 Modern Tendencies in Economic Thought and Policy by V.G. Kale
1938 The Social Process by G.S. Ghurye
* 1939 Federation Versus Freedom by B.R. Ambedkar
+ 1940 The Constituent Assembly by K.T. Shah
* 1941 The Problem of the Aborigines in India by A.V. Thakkar
* 1942 A Plea for Planning in Cooperation by V.L. Mehta
1943 The Formation of Federations by S.G. Vaze
+ 1944 Economic Policy by John Mathai
+ 1945 A Statistical Approach to Vital Economic Problems by S.R. Deshpande
+ 1946 India's Sterling Balances by J.V. Joshi
* 1948 Central Banking in India: A Retrospect by C.D. Deshmukh
* 1949 Public Administration in Democracy by D.G. Karve
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