Relative Efficiency of Organized and Unorganized Segments of Indian Textile and Garments Industry: A Preliminary Exploration

Sarmishtha Sen[1], University of Calcutta, Kolkata, India
Subrata Majumder, Sundarban Mahavidyalaya, South 24 Parganas, India

Abstract

Abolition of important protective measures in the Textile Policy of 2000 has exposed the decentralized sector of Textile and Garments (T&G) producers in India to increased competition. The post-reforms period also experienced increased linkages between the organized and unorganized units of this industry. Important observations from the analyses based on annual cross-section unit-level data from the Annual Survey of Industries (ASI) and the National Sample Survey (NSS) rounds respectively on the organized and unorganized sections for the period between 2001 and 2011, include: (i) an absolute decline in the average productivities for the unorganized segment and widening gap with the organized sector in this regard; (ii) a fall in relative efficiency of the former with respect to the other; and (iii) increased divergence from the national grand frontier even of the best performing firms in the unorganized T&G industry.

1. Introduction

1.1 During the pre-reforms years the decentralized small units of the Indian Textile and Garments industry (T&G hereafter) have been given policy support to realize its relatively high potential for employment generation (Little, Mazumdar and Page 1987; Roy 1996). However, average performance of such units did not improve much in this period. This raised concerns regarding the segment's continued dependence on protective policies as well as doubts on effectiveness of such policies (Roy, 1998b; Ganesh 2002). Withdrawal of major protective measures for the unorganized segment in the Textile Policy 2000 increased its dependence on the organized section for assured market access mainly via contract-work (Teewari 1999, 2000; Maiti, 2008; Maiti and Marjit 2009; Maiti and Sen 2010). Micro-level studies indicate that organized segment also relied increasingly on sub-contracting to the unorganized segment as part of the former's cost-cutting measures (Teewari 2000; Roy 1996, 2009). Under the presumption of same technological exposure, the unorganized segment is considered to be both less productive and less efficient due to its generally sub-optimal scale of operation than its organized counterpart (Seth 1995; Rani & Unni 2004; Perry et al 2007; Taymaz 2009). So, if the organized-unorganized linkage increases a few changes are expected in the structure, conduct and relative performance of these two segments.

1.2 Any actual improvement in unorganized segment's relative efficiency will point toward the complementary nature of organized-unorganized interaction. If the complementary relation grows in the post-reforms years, it is likely that the organized section will out-source the more labor intensive operations to the unorganized one where

[1]e-mail: sarmishtha.sen@gmail.com

the latter has started enjoying some spillover technical upgradation; these two factors taken together will contribute favorably towards an enhancement of labor productivity as well as efficiency. However, a number of structural factors may come in between to obstruct such efficiency gains. For example, while increased spillover of improved production techniques and practices from the organized segment may create opportunity to raise the unorganized segment's efficiency, small suppliers' asymmetric bargaining power in value chain, traditionally dominated by intermediaries, may erect barrier in realization of such improvements. Available literature on T&G clusters (Teewari 2000; Singh & Sapra, 2007; Heyer, 2013 for example) indicates possibilities of effective intervention on the part of the policy makers to remove these structural weaknesses.

1.3 In this background it would be interesting to ask whether there has actually been any convergence in the performance of the two segments of the T&G industry. This paper seeks to explore the relative factor productivity, production efficiency in the organized vis-à-vis unorganized sector and its change over the reform period for T&G industry of India. Using unit-level annual cross-section data from the Annual Survey of Industries (ASI) for the organized part and National Sample Survey (NSS) data on the unorganized section for the study period 2001-11[2], this study poses the following research questions:

(i) Did the gap in factor productivities between the two sectors decrease during the study period?

(ii) Has the relative efficiency of the unorganized T&G industrial units increased with respect to the organized T&G firms over time?

There are two parts in this question: first, did the firm-level technical efficiency in both the sectors improve and grow as a result of the reforms? Secondly, did the best-performing firms of different groups come closer to each other and to the overall set of best-performers of the country?

1.4 The rest of the paper is organized in the following way: Next section (Section 2) lists the specific research questions while in section 3 the data sources and variables used in the analysis are described. Section 4 has three subsections, each explaining the methodologies applied for individual research exercises. Section 5 discusses the main findings. Section 6 concludes the paper.

2. Research Questions

2.1 This paper attempts to carry out the following exercises for the stated research questions:

(i) It explored the direction of gap between average productivities (labour & capital) of unorganized and organized T&G industry at two selected time points (Exercise I).

[2] We have combined NSS data for 2000-01 and ASI data for 2001-02 for the initial point and joined ASI 2009-10 with NSS 2010-11 data at the last point of our analysis. Following the style of referring to ASI data we have considered 2001 as the beginning and 2011 as the end of our study period – 2001 and 2011 being the two time-points considered.

(ii) In the second part of the analysis, we compared the relative efficiency of unorganized T&G sector (measured with respect to organized T&G sector) at two selected time points (Exercise II).

(iii) As the third exercise our aim was (a) to determine the firm-level and group-specific technical efficiency (TE) scores by constructing *group* frontiers and (b) to assess the closeness of different *group* frontiers to the *grand* frontier (Exercise III).

2.2 First two exercises are relatively straightforward. But the steps involved in the last one need elaboration. The specific group and grand analysis are explained below.

2.3 It is well-known that different groups of units in a particular industry may operate under different technological conditions. Available literature on the Indian T&G sector also indicates such possibilities[3] (Little, Mazumdar & Page op cit.; Roy 1998a; Ganesh op cit.). In such a context a *meta-frontier* approach to efficiency analysis (Rao, O'Donnell, Battese 2003; Bhandari & Ray 2011; Majumder, 2011) will be more appropriate.

2.4 In this study we take organized and unorganized segments at the two selected time-points as the relevant groups and derive *group* frontiers for each of them. The *group* efficiency scores enable us to compare the efficiency performances of firms within a group facing the same sets of financial and institutional constraints, while the average *group* scores evaluate the effect of producing in a particular segment – organized or unorganized.

2.5 A major part of existing literature on the unorganized manufacturing sector while recording its generally inferior performance relative to that of the organized units also predicted that withdrawal of state-support in the form of government policies protecting or directly promoting the small scale units will lead to decline of the sector (Seth op. cit.; Taymaz op.cit.). But other studies on the unorganized sector especially in the context of textile sector have emphasized on the segment's historically displayed ability to withstand competition by successful adjustments and innovations (Liebl and Roy 2001, 2003; Roy, 1998a; 2009). However, such adjustments have been accompanied by increasing differentiation within the sector. Thus most of these studies continue to observe growth and dynamism in certain sections of the unorganized T&G enterprises alongside decline for the others. In fact the intensifying competition in the post-reforms period creating both opportunities for expansion and threats for survival - may have increased such differentiation.

2.6 In this context, we may expect the group of relatively better performers even within the unorganized T&G segment to improve their average group TE over time. This may also reduce the gap between average TE for the growing segment of the unorganized T&G units with that of the relatively dynamic T&G units in the organized sector. So at the next stage we treat the best-performing units in each group as representative firms of the respective *group*-frontiers. Then we tried to evaluate the change in closeness of the relatively well-performing enterprises in all groups during the study period to a common benchmark technology set for all such units.

[3] The difference may arise because of varied technological capacities developed traditionally or due to the distinct nature of demand those units cater to.

2.7 Thus instead of constructing a grand-frontier from applying DEA on all observations, we cull out the units in each group operating on respective group-frontiers. An output-oriented DEA is run on the pooled data to derive a grand frontier[4]. Our approach provides a relative measure of efficiencies of different groups of best-performing firms also through a comparison of their average Technology closeness ratio (TCR hereafter).

3. Database and Variables:

3.1 Unit level data on the registered factories are available from the Annual Survey of Industries (ASI) database and the information on unorganized manufacturing units are provided by the successive rounds of National Sample Survey (NSS). We are proposing a framework to carry out an analysis of difference as well as integration by combining these two databases. As common time points we have matched NSS 56th Round Survey 2000-01 data on Unorganized Manufacturing Sector with the 2001-02 ASI data and 2010-11 NSSO Round (Survey of Unincorporated Non-agricultural Enterprises) with 2009-10 ASI data to assess the change in the comparative performance of the organized and unorganized segments of the T&G industry in the years following Textile Policy 2000. The choice of NSSO time points is obvious and that of ASI was constrained by our access and availability of unit level data.

3.2 Each observation in our data set collates information on a number of variables including those on input and output bundles for different individual industrial enterprises. Necessary adjustments were made to ensure comparability of categories representing the same variables, as is illustrated in Table 1.

3.3 Three types of enterprises were covered by the NSS rounds based on nature of operation in the reference year of the particular survey: perennial, seasonal and casual. As the ASI data have no counterpart for 'seasonal' or 'casual' enterprises in the organized segment, we have considered only the perennial enterprises in the unorganized sector which operate regularly throughout the year.

3.4 Labour-use pattern and choice of optimum techniques are likely to differ between enterprises mainly using own labour and those hiring labour on a regular basis. Thus, to make the comparison more meaningful we have only included unorganized firms hiring worker on a regular basis. Two full-time hired workers[5] were taken as the relevant cut-off to get the final set of observations. So our data set from the unorganized sector covers a part of the NDME (Non-Directory Manufacturing Establishments) and the entire DME (Directory Manufacturing Establishments) section.

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[4] As any particular firm typically faces varying technological and structural conditions at different time-points that influence their optimum decision-making, production-information in two periods, even if it refers to the same firm represent distinct observations.

[5] It has been empirically observed in the Indian context that except for the very small-sized enterprises such as own-account manufacturing enterprises (hiring no labour on a regular basis) or those hiring very few full-time workers, unorganized manufacturing enterprises with small size of employment such as NDMEs are more productive than the OAMEs and can also be more productive than much larger firms (Little, Mazumdar & Page 1987; NCAER 2009; Roy 2009 among others). So we excluded the OAMEs and the size-group immediately above that, while retaining a part of the NDMEs.

3.5 Both the data sets[6] were converted at 2004-05 prices by deflating with the help of wholesale price index (WPI) for 'Manufacturing Products'[7] (Table 2 gives the deflator series used here). The pre-reform analysis has been carried out on the basis of 10,058 unit level observations and the analysis of the later period uses 7265 observations[8].

4. Methodology Applied

4.1 *Productivity Analysis*: Using the firm-level input-output data at the two chosen time-points for unorganized and organized T&G segments we have determined the industry-level average of factor productivities (GVA per unit of labour and capital) and that of capital-labour ratio calculated for individual enterprises at 2004-05 prices (Exercise I). We have also reported the average productivity values along with the coefficient of variation for different size-groups of the unorganized sector constructed on the basis of size of employment - determined by number of total workers employed by an establishment.

4.2 For the second part of our analysis an m-input standard Cobb-Douglas production function with CRS was considered:

$$Y_i = A\Pi_j X_{ji}^{\beta_n} e^{\gamma_i}$$

where, $\Sigma_n \beta_n = 1$

A: the industry-specific technology

e^{γ_i} : efficiency-factor for the i^{th} firm;

i.e., Y_i may vary across firms with same technology and using same level of inputs due to variation in γ_i. The γ_i values can be generated for all constituent sectors of the industry (assuming no variation in firm-specific efficiency within each sector). The series can also be generated for the individual firms. In the first case we can estimate sector-specific relative efficiency (as in Exercise II) while firm-specific relative efficiency can be evaluated in the latter (Exercise III). The methods applied are explained in the following two sections.

4.3 Estimation of Relative Efficiency: Sector-specific

4.3.1 The most crucial assumption that allows for this estimation is that the technological opportunity set is the same for producers in all the sectors under consideration. Given the available dataset containing information on one output and three inputs (capital, labour and intermediate inputs), we have considered GVA[9] as the relevant output measure here

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[6] Given that capital stock and intermediate inputs generally used in T&G production are manufactured products, the same deflator series has been used for output as well as capital stock and intermediate inputs.

[7] To simplify we have not resorted to use of multiple indices although use of WPI for textile products and WPI for textiles machinery or that for general machinery to deflate output and fixed capital stock respectively would be more appropriate. However, this is a limitation of the measures used in this work.

[8] The final data set was obtained after excluding firms with non-positive values of output (the relevant measures-gross output or GVA) and/or inputs (capital, labour and material-fuel) to make it more reliable as well as amenable to DEA.

[9] Gross output in excess of energy and materials costs, as explained in Section 2.2

and capital and labour as the inputs. Then the i[th] firm's production function can be written as:

$Y_i = AL_i^{\beta} K_i^{1-\beta} e^{\gamma i}$ …….. (1)

where,

$\frac{Y_i}{L_i} = \mathrm{A}\left(\frac{K_i}{L_i}\right)^{1-\beta} e^{\gamma i}$

or, $lny_i = lnA + (1-\beta)lnk_i + \gamma i$ ……..... (2)

Where, $y_i = \frac{Y_i}{L_i}$ and $k_i = \frac{K_i}{L_i}$;

Substituting $\gamma i = \gamma i = \theta D_j\ D_{ji}$ being the dummy for the j[th] sector; j = organized, unorganized

we can apply an OLS method on the production function as in equation (2):

$lny_i = \alpha + \rho lnk_i + \theta\, D_{ji} + \varepsilon_{ij}$ …….. (3)

$\alpha = lnA$ + intercept-term in γi (if any),

$\rho = (1 - \beta)$;

θ estimates the pure efficiency-differential due to operating in a particular sector and ε_{ij} is the stochastic error term.

If $D_{ji} = 0$ for all enterprises in the organized segment and

= 1 for all firms in the unorganized segment of the concerned industry,

$\hat{\theta} = \gamma_{unorg} - \gamma_{org}$ (estimated)

and relative efficiency: $e^{\hat{\theta}} = e(\gamma_{unorg} - \gamma_{org}) = e^{\gamma unorg}/e^{\gamma org}$……(4)

4.4 Estimation of Firm-specific Relative Efficiency: Data Envelopment Analysis

4.4.1 Here we allow for variation in efficiency of firms even within a particular sector and our objective is to evaluate the relative efficiency of firms in a sector by applying Data Envelopment analysis (DEA). The DEA tries to generate the production frontier from the available observed data without making any specific assumption regarding the functional form of the production function. This method was first introduced into the Operation Research (OR) literature by Charnes, Cooper and Rhodes (CCR) in 1978. The model was developed under the assumption of constant returns to scale (CRS) and was subsequently extended to the case of variable returns to scale (VRS) by Banker, Charnes and Cooper (BCC) in 1984[10]. Non-parametric DEA generates a production frontier on the basis of only observed input-output data by applying linear programming (LP) technique and without considering the input and output prices.[11]

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[10] The two models are respectively known as first generation efficiency measurement model under the assumption of CRS and second generation model under the assumption of VRS.

[11] Being non statistical in nature the LP solution of DEA problem produces no standard error and makes no room for hypothesis testing, which is a limitation.

4.4.2 Under the standard assumptions of feasibility, convexity and free disposability, the DEA algorithm generates the frontier under the defined technology and measures technical efficiency from the calculated distance of an observed point from the generated frontier.

Suppose there are N firms in the system and we consider the t^{th} firm. The input output bundle of that firm is: $x^t = (x_{1t}, x_{2t}, ..., x_{nt})$ and $y^t = (y_{1t}, y_{2t}, ..., y_{mt})$.

The LP problem following BCC model becomes

Max: ϕ

Subject to: $\sum_{t=1}^{N} \mu_t y_{jt} \geq \phi y_{jt}; \forall j = 1,2,.....,m$

$$\sum_{t=1}^{N} \mu_t x_{it} \leq x_{it}; \forall i = 1,2,.....,n$$

$$\sum_{t=1}^{N} \mu_t = 1$$

$$\mu_t \geq 0; \forall t = 1,2,.....,N$$

The score generated from the expression $\frac{1}{\phi}$ is nothing but the output oriented technical efficiency of the t^{th} firm under VRS[12]. Notably, this is only a radial measure of (in) efficiency.

This technique was applied first to obtain group-specific frontiers (for a total of four groups – one for each segment at each time-point) in order to evaluate individual unit's *group* efficiency. It allowed us also to identify how operating in a particular segment influenced individual unit's performance as also how the performance in each segment has changed over time.

4.4.3 At the next stage, we applied a *meta-frontier* analysis proposed by Battese and Rao (2002) as illustrated in Rao, O'Donnell & Battese 2003 and also applied in Bhandari & Ray (2011). The objective was to evaluate the relative technological proximity of best-performing establishments of different groups to national frontier taking both the time-points into account. In this approach, a global or *grand frontier* is calculated by considering all firms in the sample and the efficiency of a firm belonging to a group is calculated also with reference to the *grand frontier*. For our purpose it was necessary to pool together the group-frontier units separated out from each group to derive the relevant *grand frontier*. This helped us to examine the technological proximity of any *group frontier* to the *grand frontier* with the help of group-average[13] of TCR (a ratio of global to local technical efficiency scores for every unit).

[12] The (in)efficiency measurement with additional constraint $\sum_{t=1}^{N} \mu_t = 1$ in the above model makes BCC model an extended version of the CCR model.

[13] Geometric mean of TCRs was used to get the average.

5. Findings

5.1 *Average Productivities*: At constant prices none of the changes in organized segment is statistically significant. However, unorganized part of the industry experienced sharp fall in average productivities and a considerable rise in capital-labour ratio (see Table 3). The productivity values for both the years also indicate that not only have the unorganized sector productivity indicators declined, the productivity-gaps between the organized and unorganized establishments of the T & G industry have actually widened (Table 4).

5.1.1 The deterioration in unorganized segment's performance may be due to unpreparedness or failure to adjust in the new situation. Reforms appear to have affected this section more adversely than its organized counterpart. Or it might be that capital accumulation and restructuring in the large organized units which were initiated after announcement of 1985 Textile Policy and accelerated after 1991-92 reforms have started paying off, so that there is not much market-space left for viable operation by the unorganized establishments anymore.

5.1.2 We tried to evaluate the above changes in various size-groups[14] defined on the basis of number of total workers employed by an unorganized firm (detail of this classification is given in Table 5) in the T & G industry.

5.1.3 First we compared the changes in average productivity values and capital-intensity (presented in Table 6) for all size-groups. We consider both mean and median AP_L and find out same direction of change in the sub-groups as those observed for the unorganized segment as a whole (detailed results of tests for statistical significance is given in Table 7). At both the time-points mean AP_L was higher in the larger size-groups. However this gap narrowed during the study period. For instance, the ratio of the mean AP_L in the largest size-group to that of the smallest one decreased at the second time-point. Coefficient of variation (CV) in AP_L also recorded a fall in the last year. Thus we notice some kind of uniformity and increasing homogeneity within each size-group and also between the size-groups. However, it is slightly higher among firms for the smallest group in both the years and the largest size-group in the last year.

5.1.4 AP_K was also relatively high in the higher size-groups. Although AP_K at the endpoint declined for all the size-groups the gap between the two extreme groups increased slightly. Except for the largest size-group, capital-labour ratio increased across the size-classes. Intra-group variation became higher in the last period as reflected by increased CV for every size-group.

5.1.5 We can sum up the discussion above by arguing that during the study period average productivity of labour in the unorganized T&G sector has fallen farther behind that of its organized counterpart while capital productivity somewhat improved vis-à-vis the values recorded by the organized firms.

5.2 Estimation of Relative Efficiency: Results of the estimation of relative efficiency of the unorganized sector of the T&G industry with respect to the organized sector there for

[14] Variation of productivity-change is examined by size-based classification here as size is considered as a crucial limiting factor in enhancing unorganized firms' productivity and efficiency.

both the selected years are presented in Table 8. Here, we have divided the states with a minimum presence[15] of organized and unorganized T&G production units into two groups. The first consists of states with relatively large number of such units ('high concentration states') and the second group contains the rest among those selected in the first stage i.e., states with relatively low presence of T&G units ('medium-concentration' states[16]).

5.2.1 It was observed that unorganized segment was relatively less efficient than the organized section of the T & G industry in both the years under consideration[17]. Notably, relative efficiency of the unorganized enterprises was little better in the medium-concentration states in both the years. Thus, higher agglomeration in the high-concentration states does not seem to have led to greater relative efficiency of the unorganized segment than in the medium-concentration states. Secondly, we also noticed an over-time decline in relative efficiency of the unorganized T&G segment with respect to the organized counterpart[18].

5.2.2 The same pattern was generally observed when the estimation was repeated individually for all the states in the two groups - the only exception being the state of Karnataka (Table10).

5.3 Analysis of Technical Efficiency: Before we sum up the results of the data envelopment analysis we present the summary statistics for output and inputs (Table 11). These serve to show the extent of difference in the average scale of operation between the organized and unorganized sector units considered in this study.

5.3.1 Next, selected descriptive statistics of the TE scores for firms in the two study-segments are presented in Table 12**.** Technical efficiency scores measured against the *group-frontiers* for the two segments at the selected time-points show that average *group* efficiency was the lowest in the organized segment in 2009-10 and highest for the organized units in 2001-02. Average group-efficiency has fallen in both the segments in the last year and the fall was much sharper in the organized part.

5.3.2 Notably, coefficient of variation in individual *group* efficiency within the organized sector has increased during the study period, while the same remained almost the same for its unorganized counterpart. Relatively high decline in average *group*-TE of the organized

[15] States with very low presence of T&G units (less than 100 - in either of the year) were not considered here. this list was cross-checked with available literature on Indian textiles sector and Annual Reports of Ministry of Textiles – different years;

[16] States with more than 5% of sample units in each in either of the two years fell in the 'high concentration' category while 'medium concentration states' included those with less than 5% of total but more than 100 T&G units – organized and unorganized taken together. Additional care was taken to ensure that each group has a balance in terms of number of observation belonging to organized and unorganized segments to enable the relative efficiency analysis. Details of this classification with number of observations in each group are given in Table 9.

[17] A part of this gap in relative efficiency may however be attributed to the different measures used to estimate fixed capital stock for the two segments under consideration. Since the value of the capital used by the organized segment is assessed on the basis of book-value alone and that for the unorganized segment is obtained on the basis of market value, hence there is a possibility of under statement for the former that may culminate into an overestimation of its performance-lead. However, no such applicable adjustment practice is available to make the two series compatible and the paper presents analysis with this limitation unattended.

[18] The conclusion remains the same when we perform the analysis for each state considered here (Table 10).

firms may be a reflection of increased heterogeneity in efficiency-performance of the constituent firms while a section of the segment may have actually improved their efficiency. Similarly, the observed small decline in average TE for the unorganized units may be a result of almost unchanged CV (and homogeneity) in average group-TE even in presence of somewhat uniform fall in firm-specific efficiency. Thus from this table we cannot directly infer that the decreased gap in technical efficiency between the two segments indicates an actual improvement in unorganized segment's relative performance. In fact, findings from the earlier analyses on firm-level productivity and segment-specific relative efficiency points to the contrary.

5.3.3 Thus we make use of the *meta-frontier* and compare TCR of the concerned groups to assess the extent of relative improvement in average performance of the two segments over time.

5.3.4 As explained in the subsection 4.4.3 on methodology, we have concentrated only on the best-performing units in each group. Measures of relative performance of these groups –consisting of the frontier units alone - are summed up in the Table 13. This table shows that the best-performing organized units have the greatest proximity to the national technology frontier in the last year. On the other hand, even the *group* frontier firms in the unorganized segment at the end of the study period exhibited the lowest average TCR among frontier firms of all groups taken together and the highest decline in the same during the study period. We arrive at a similar conclusion when we look at the percentage of the *group frontier* firms operating on the *grand frontier* (Table 14).

5.3.5 It is important to note that average TCR for best-performing units within unorganized segment was higher than that for the organized frontier firms at the initial time point. In fact TCR was the highest for the 2000-01 unorganized frontier units also having the highest proportional presence on the *grand frontier*. It seems plausible that burden of adverse effects of reforms especially in the post-2000 years has fallen disproportionately heavily on this sector and the decline was somewhat uniformly experienced by firms within the group. Thus even the relatively well-performing establishments appeared incapable of restructuring in an efficiency-enhancing way and could not benefit from the dynamism of the organized segment.

5.3.6 As a confirmatory exercise, we carried out the estimation of relative efficiency for the group of unorganized frontier firms with respect to the group of organized frontier units at both the time-points. The results summarized in Table 15 are self-explanatory and support our earlier observation of declining relative performance even among the best performing firms in the unorganized T &G sector.

6. Conclusion

6.1 Various empirical studies have reported much lower average labour productivity for units in the unorganized manufacturing sector as a whole or for some selected sectors in it than for those in their organized counterpart in India and other developing countries. De-reservation of the fast-growing garments subsector is likely to encourage entry of large-firms and greater outsourcing of labour-intensive activities to the smaller units. With

increased linkages of unorganized T&G units with the organized firms along the textile value-chain we may expect a convergence in the performance of the two segments.

6.2 In the light of above findings our study explored (i) the productivity-gaps between the sectors studied (ii) change in relative efficiency of relatively big unorganized T&G establishments with respect to organized part of the industry and (iii) change in relative position of different sections of the concerned industry in terms of firm-level and sector-specific efficiency in the post-reforms years. Findings of this paper suggest (a) a considerable and statistically significant decline even in the absolute levels of factor productivities in the unorganized segment; (b) their falling relative efficiency with respect to the organized section over time; and (c) increase in divergence of even the best-performing T&G units in the former sector from the national *grand* frontier for the T&G sector.

6.3 A few points emerge from the observation of all-round decline in relative performance of the bigger unorganized T&G establishments vis-à-vis the organized T&G units during the first decade of the present century. First, these results contrast sharply the findings of available studies that the unorganized powerlooms and the garments manufacturing units accounted for much of the textile sector growth in the 1990s (Liebl & Roy op cit.; Roy 2009; for example). In fact economies of scale are not expected to favour large organized units significantly in the dynamic garments sector which has exhibited a small-scale bias worldwide. Small unorganized powerlooms units also evidently performed well even without reservation. Secondly, the recorded performance of the segment was one of substantial improvement in certain aspects like productivity growth during the immediately preceding decade (Roy 1998b; Raj 2007). Thus, withdrawal of protective measures and other aspects of reforms seem to have reduced this section of producers into an extremely vulnerable state. Sub-contracting and increase in other linkages with the organized part of the industry also could not enhance the former's performance at least during the study period. Finally, this tendency is alarming when we note from the successive NSS reports that during the same time estimated number of T&G enterprises and the estimated number of workers engaged in those units increased respectively by 33.3% and 15.29% as barriers to entry in the unorganized T&G sector is almost non-existent. Thus we need to study the sector at a more disaggregated level while explicitly linking the changing structure with the changing performances by controlling selected firm-level characteristics in our subsequent works.

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Table 1
Variables used in the combined dataset and their definitional compatibility

Variable	ASI data	NSS data
Output (Rs.)	(i) **GVA**: Ex -factory value of output – Costs of materials and fuels consumed [19] (Exercise I & II) (ii) **Y**: Annual ex -factory value of output (Exercise III)	(i) **GVA**: Annual [20] value of total receipt [21] – Expenses on materials and fuels (Exercise I & II) (ii) **Y**: Annual value of total receipt (Exercise III)
Intermediate input (Rs.)	**INTER**: Expenses on materials and fuels consumed	**INTER**: Expenses on materials and fuels consumed = Annual value of (total expenses – other operating expenses + costs of electricity & fuel consumed)[22]
Capital (Rs.)	**K**: Book value of fixed asset on the opening date of the reference year	**K**: Market value of fixed assets (owned & hired) as on the closing date of the reference year – net addition to fixed assets during the reference year
Labour (number)	**L** = Total man-days worked (both manufacturing and non-manufacturing)	**L** = (Total number of FTE workers[23] * 30 * number of months operated * average hours worked[24])/8

Source: Authors' classification from the data used

[19] Information on Gross Value Added (GVA) is not directly available in the ASI database but it can be calculated by deducting expenditure on materials and fuels and other operating expenses from total output (ex-factory value of output and other receipts e.g. value of electricity produced and sold). However, to be consistent with the production framework used in this study GVA values were calculated by subcontracting only costs of materials and energy from ex-factory value of output. Similarly, a new series of value-added was computed from the given GVA data provided by the NSSO to arrive at a similar measure. Observations with negative GVAs were dropped to make the exercise meaningful.

[20] Annual values are obtained directly from NSSO 2000-01 data. But annual values of receipts (and other categories e.g. expenses) for the year 2010-11are computed by multiplying the given series with number of months operated.

[21] It is necessary to note: (a) this category includes receipts from other activities e.g. 'receipt from trade' as well as 'other receipts' – in addition to 'receipts from manufacturing activities'. More accurate values of production could be obtained by deducting the non-manufacturing component from total receipts. Due to the presence of considerable number of missing values (especially for NSS 67th round) this operation would have made the data series unreliable or a substantial number of data points would have been lost.

[22] As in the data for 'value of products & by-products' there are a very large number of missing entries in the series on 'expenses on raw materials' thus making its direct use unreliable.

[23] To make the labour-data comparable to the ASI data, we convert all workers (both full-time and part-time) into full-time equivalents (FTEs), by treating 1 full-time worker = 2 part-time workers.

[24] In the 56th round data, average number of hours worked daily is not given. We assume here that each day consists of an 8-hour block.

Table 2
Deflator series using WPI for 'Manufacturing Products'
(base year: 2004-05)

Year										
MP-dff	**1993-94**	**1994-95**	**1995-96**	**1996-97**	**1997-98**	**1998-99**	**1999-00**	**2000-01**	**2001-02**	**2002-03**
	0.60	0.68	0.73	0.75	0.77	0.80	0.83	0.85	0.87	0.89
Year										
MP-dff	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**
	0.94	1.00	1.02	1.08	1.13	1.20	1.23	1.30	1.40	1.47

Note: 'MP-dff' – Manufacturing-Products Price Deflator

Source: Authors' calculation

Table 3
Change in Average Productivity (L & K) & Capital-labour ratio at 2004-05 prices:
Organized & Unorganized T & G Industry

Value/Segment	Organized	Unorganized
ΔAP_L	-83.33	-26.19***
ΔAP_K	-233.21	-0.32***
Δ(K/L)	83.18	5.09***
Number of Observations	6766	10557

'Δ'–change in value in 2011 over 2001-level; '***' significant at less than 1% level

Source: Authors' calculation

Table 4
Average Productivity (L & K) & **Capital-labour ratio at 2004-05 prices:**
Organized & Unorganized T & G Industry

Measure	Sector	2001				2011			
		Obs.	**Mean**	**Median**	**CV**	**Obs.**	**Mean**	**Median**	**CV**
AP_L	**Organized**	3068	1059.77	478.17	7.16	3698	976.44	591.91	2.01
	Unorganized	6990	163.35	104.39	2.22	3567	137.17	107.41	1.41
AP_K	**Organized**	3068	284.07	1.07	34.73	3698	50.86	1.07	53.04
	Unorganized	6990	1.68	0.99	2.15	3567	1.35	0.78	2.25
K/L	**Organized**	3068	1277.20	457.07	5.09	3698	1360.38	566.10	2.45
	Unorganized	6990	203.91	104.36	1.96	3567	351.78	135.30	4.50

Source: Authors' calculation

Table 5
Number of firms in size-groups defined on the basis of total number of FTE[a] workers

Size-group	Year	I	II	III	IV	V	VI
Workers (#)		3 - 5	5.5 – 7.5	8 - 10	10.5 - 15	15.5 - 20	> 20
Units (#)	2001	2223	2135	1419	755	272	186
Units (#)	2011	1726	793	490	238	96	224

Note: [a] : full-time-equivalent of all full-time and part-time workers

Source: Authors' calculation

Table 6
Change in average productivities and factor-intensities in different size-groups of the unorganized T&G Industry between 2000-01 & 2010-11

Values/Size-Groups		Size Group 1		Size Group 2		Size Group 3		Size Group 4		Size Group 5	
		2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
AP_L	Mean	150.98	133.22	157.50	139.91	168.20	141.62	168.21	144.50	234.32	137.12
	Median	101.25	108.25	104.76	110.02	111.46	107.27	101.64	108.29	102.93	114.17
	CV	2.41	1.44	1.59	1.46	1.38	1.17	1.65	1.27	4.30	0.74
AP_K	Mean	1.56	1.19	1.71	1.27	1.71	1.50	1.74	1.49	1.70	1.47
	Median	0.97	0.74	0.99	0.74	0.96	0.77	1.05	0.91	1.13	0.93
	CV	1.93	1.50	2.10	1.49	2.96	1.80	1.43	1.25	1.00	1.19
K/L	Mean	193.46	293.26	196.58	439.16	216.14	378.77	226.47	514.69	209.25	458.76
	Median	101.44	139.20	104.81	142.05	112.30	139.91	102.26	125.47	99.30	119.81
	CV	1.89	3.07	1.64	3.68	1.49	2.68	2.58	8.72	2.13	2.65
Observations (#)		2223	1726	2135	793	1419	490	755	238	272	96

Source: Authors' calculation

Table 7
Change in average productivity and capital-labour ratio across size-groups of Unorganized T&G Industry between 2001 & 2011

Values/Size-Groups	I	II	III	IV	V
ΔAP_L	-17.76	-17.59	-26.58	-23.71	-97.20
[t-value (significance)]	-1.84 (**)	-1.77 (**)	-2.33 (***)	-1.24	-0.94
ΔAP_K	-0.36	-0.44	-0.21	-0.25	-0.22
[t-value (significance)]	-4.41 (***)	-3.29 (***)	-0.87	-1.46	-1.11
Δ (K/L)	99.81	242.57	162.64	288.22	249.52
[t-value (significance)]	4.75 (***)	6.59 (***)	5.31 (***)	1.72 (**)	2.88 (***)
Observations (#)	3949	2928	1909	993	368

Note: 'Δ'–change in value in 2011 over 2001-level; '***' significant at less than 1% level '**' significant at less than 5% level; not marked: not significant

Source: Authors' calculation

Table 8
Estimation of Relative Efficiency for Groups of Indian states with different concentration of T&G Industry Establishments

States	Year	No. of Observations	Coefficient (Significance at less than 5%)			Relative Efficiency
			ρ	θ	α	e^{θ}
High Concentration States[1]	**2001**	6804	0.39 (**)	-0.98 (**)	3.86 (**)	0.37 (**)
	2011	4885	0.25 (**)	-1.33 (**)	4.78 (**)	0.26 (**)
Medium Concentration States[2]	**2001**	2287	0.37 (**)	-0.88 (**)	3.87 (**)	0.41 (**)
	2011	1693	0.25 (**)	-1.29 (**)	4.74 **)	0.28 (**)
All India[3]	**2001**	9091	0.38 (**)	-0.95 (**)	3.86 (**)	0.39 (**)
	2011	6578	0.25 (**)	-1.32 (**)	4.77 (**)	0.27 (**)

Note: '1' – includes Andhra Pradesh, Delhi, Gujarat, Maharashtra, Tamil Nadu, Uttar Pradesh and West Bengal.
'2' – includes Haryana, Karnataka, Kerala, Madhya Pradesh, Punjab, Rajasthan.
'3' – Aggregate of the high-concentration and medium-concentration states (these 13 states cover around 90% of total T&G units); the result remains similar when we consider all states;

Source: Authors' calculation

Table 9:
Classification of States for Sector-specific Relative Efficiency Analysis
2001 & 2011

States	2001			2011		
	Organized	Unorganized	Total	Organized	Unorganized	Total
High Concentration States						
Andhra Pradesh	124	341	465	156	270	426
Delhi	173	235	408	120	290	410
Gujarat	225	452	677	262	237	499
Maharashtra	245	1040	1285	332	222	554
Tamil Nadu	878	1181	2059	1114	560	1674
Uttar Pradesh	162	990	1152	255	368	623
West Bengal	113	645	758	139	564	703
All High concentration states	1920	4884	6804	2378	2511	4889
Medium Concentration States						
Haryana	169	98	267	255	48	303
Karnataka	230	284	514	168	163	331
Kerala	130	354	484	84	173	257
Madhya Pradesh	65	144	209	42	80	122
Punjab	172	299	471	304	64	368
Rajasthan	161	181	342	202	110	312
All Medium concentration states	927	1360	2287	1055	638	1693

Source: Authors' classification

Table 10: Estimation of Relative Efficiency

States	Year	No. of Observations	Coefficient (Significance at less than 5%)			Relative Efficiency
			ρ	θ	α	e^{θ}
All India[3]	**2001**	10058	0.38 (**)	-0.94 (**)	3.88 (**)	**0.39** (**)
	2011	7264	0.26 (**)	-1.33 (**)	4.72 (**)	**0.27** (**)
Andhra Pradesh	**2001**	465	0.29 (**)	-0.77 (**)	4.03 (**)	**0.47** (**)
	2011	425	0.23 (**)	-1.00 (**)	4.57 (**)	**0.37** (**)
Delhi	**2001**	408	0.28 (**)	-1.92 (**)	5.55 (**)	**0.15** (**)
	2011	410	0.29 (**)	-2.04 (**)	5.38 (**)	**0.13** (**)
Gujarat	**2001**	677	0.30 (**)	-0.77 (**)	4.39 (**)	**0.46** (**)
	2011	499	0.32 (**)	-1.13 (**)	4.38 (**)	**0.32** (**)
Haryana	**2001**	267	0.25 (**)	-1.26 (**)	4.82 (**)	**0.28** (**)
	2011	303	0.16 (**)	-1.55 (**)	5.60 (**)	**0.21** (**)
Karnataka	**2001**	514	0.26 (**)	-1.02 (**)	4.42 (**)	**0.36** (**)
	2011	331	0.38 (**)	-0.85 (**)	3.78 (**)	**0.43** (**)
Kerala	**2001**	484	0.32 (**)	-0.56 (**)	3.60 (**)	**0.57** (**)
	2011	257	0.28 (**)	-0.62 (**)	4.08 (**)	**0.54** (**)
Madhya Pradesh	**2001**	209	0.27 (**)	-0.84 (**)	4.28 (**)	**0.43** (**)
	2011	122	0.07 (**)	-1.68 (**)	5.66 (**)	**0.19** (**)
Maharashtra	**2001**	1285	0.39 (**)	-0.70 (**)	3.80 (**)	**0.49** (**)
	2011	554	0.21 (**)	-1.43 (**)	5.18 (**)	**0.24** (**)
Punjab	**2001**	471	0.42 (**)	-0.79 (**)	3.58 (**)	**0.45** (**)
	2011	368	0.23 (**)	-1.50 (**)	4.88 (**)	**0.22** (**)
Rajasthan	**2001**	342	0.38 (**)	-0.89 (**)	4.05 (**)	**0.41** (**)
	2011	312	0.15 (**)	-1.56 (**)	5.56 (**)	**0.21** (**)
Tamil Nadu	**2001**	2059	0.40 (**)	-1.07 (**)	3.71 (**)	**0.34** (**)
	2011	1671	0.21 (**)	-1.22 (**)	4.97 (**)	**0.29** (**)
Uttar Pradesh	**2001**	1152	0.43 (**)	-1.14 (**)	3.71 (**)	**0.32** (**)
	2011	623	0.19 (**)	-1.89 (**)	5.39 (**)	**0.15** (**)
West Bengal	**2001**	758	0.31 (**)	-0.96 (**)	4.20 (**)	**0.38** (**)
	2011	703	0.28 (**)	-1.11 (**)	4.38 (**)	**0.33** (**)

Source: Authors' calculation

Table 11 Descriptive statistics for Output produced and Inputs used in Organized and Unorganized Segments of the T & G Sector

Measures	2001				2011			
	Real Y	Real Inter	Real K	L	Real Y	Real Inter	Real K	L
Organized T&G Segment								
Count	3068	3068	3068	3068	3697	3697	3697	3697
Mean	213008270.31	151646440.44	113785118.76	90314	331488118.23	243836983.71	161534701.07	114082
Median	67903464.00	45432890.00	12255130.00	28844	94607408.00	60621788.00	20477282.00	42479
Min.	33425.29	21998.85	3.45	56	66088.62	23633.33	0.81	155
Max.	17656537088	12912504832	18042640384	2723663	36462350336	32884074496	30694553600	10293525
SD	552206127.43	396777693.33	528665705.75	194289.97	1056506206.15	884552561.00	755965614.95	289872.91
CV	2.59	2.62	4.65	2.15	3.19	3.63	4.68	2.54
Skewness	14.00	14.42	18.36	5.97	16.05	19.32	23.22	16.13
Kurtosis	358.00	379.53	502.57	53.90	429.18	580.32	795.90	466.63
Unorganized T&G Segment								
Count	6990	6990	6990	6990	3567	3567	3567	3567
Mean	1068765.34	634111.02	505774.70	2755	979348.68	497122.30	938190.70	3526
Median	328341.17	49164.71	243764.70	2160	330461.53	27120.00	343076.90	2250
Min.	11011.76	56.47	776.47	105	6153.85	46.15	923.08	135
Max.	293764704	229411760	88117648	137520	109230768	70384616	62000000	54360
SD	5990352.16	4428718.82	1516642	2854.69	3734927.45	2511548.00	2707346.00	3925.77
CV	5.60	6.98	3.00	1.04	3.81	5.05	2.89	1.11
Skewness	37.27	39.30	33.46	22.56	18.42	14.64	11.54	4.75
Kurtosis	1698.31	1920.14	1710.76	878.85	462.65	298.91	183.57	35.87

Note: the concerned years are 2001-02 and 2009-10 for the organized firms and 2000-01 and 2010-11 for the unorganized section.
Source : Authors' calculation

Table 12
Descriptive Statistics for Group-Efficiency (TE) Scores in T & G Sector

Different Groups	Technical Efficiency Scores						
	Count	Mean	Median	SD	CV	Skewness	Kurtosis
Organized T&G							
2002	3068	0.42	0.38	0.19	0.46	0.93	3.65
2010	3698	0.19	0.16	0.12	0.64	3.28	17.61
Unorganized T&G							
2001	3567	0.29	0.24	0.18	0.64	1.72	6.48
2011	6990	0.25	0.20	0.16	0.65	1.93	7.65

Source: Authors' calculation

Table 13
Technology Closeness Ratio of different groups with Grand Frontier

Groups	Technology Closeness Ratio
Organized Frontier 2002	0.57
Organized Frontier 2010	0.68
Unorganized Frontier 2001	0.81
Unorganized Frontier 2011	0.48

Source: Authors' calculation

Table 14
Number & Percentage of different groups in Grand-Frontier units

Groups	No. of units with GTE=1	% share of the group among all units with GTE=1
Organized Frontier 2002	22	28.95
Organized Frontier 2010	14	18.42
Unorganized Frontier 2001	30	39.47
Unorganized Frontier 2011	10	13.16

Source: Authors' calculation

Table 15
Relative Efficiency of Unorganized Frontier units with respect to Organized Frontier Units in respective years

Year	No. of Observations	Coefficient (Significance at less than 5%)			Relative Efficiency
		ρ	θ	α	e^{θ}
2001	106	0.31 (**)	-0.98 (**)	5.75 (**)	**0.37 (**)**
2011	68	0.38 (**)	-1.85 (**)	5.58 (**)	**0.16 (**)**

Source: Authors' calculation