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Measuring Quality-adjusted Labor Inputs in South Asia, 1970–2015

Koji Nomura and Naoyuki Akashi[†]

December 2017

Abstract

This paper attempts to adjust labor input for quality change over time, and quantify its impact on the TFP growth estimates, in six South Asian countries, i.e. Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka, covering the period of 1970–2015. This work requires employment data differentiated into labor categories and their corresponding wage estimates for each of these countries. The database we compile are country's employment and wage matrices cross-classified by four attributes, namely, gender, education, age, and employment status. Our findings suggest that it is significant to account for labor quality change. In the whole period of our observation, labor quality growths are considerable in all six South Asian countries included in this study, ranging from 0.7% per year on average in Bangladesh to 1.9% in Nepal, compared to the annual growths in total hours worked ranging from 1.4% in Sri Lanka to 2.6% in Bhutan. The changes in labor quality explain 27–46% of the quality-adjusted labor input (QALI) growth in the South Asian countries, implying downward revisions to their TFP growths estimated without considering the changes in labor quality of 0.4–1.1 percentage points per year on average.

Keywords: Labor quality; labor inputs; productivity; South Asia

JEL classification: C82; D24; E24; J21; N35

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1 Introduction

Measuring quality-adjusted labor inputs (QALI) growth is one of the important but challenging issues in the development of productivity accounts. QALI aims to reflect the heterogeneity of each hour worked among different types of workers, which the traditional measures of aggregate labor inputs, i.e., number of workers/jobs, full-time equivalents, and hours worked, fail to account for. To construct QALI requires information on worker characteristics to distinguish the workforce into different types, which are then weighted by their marginal productivities, usually approximated by their respective hourly wages. The 2008 System of National Accounts (2008 SNA) of the United Nations (2009) recommends developing QALI as an alternative measure of labor inputs to those assuming homogeneity. However, it also notes that measuring QALI is "very data intensive and only those countries that have highly developed statistical systems are likely to have the detailed data required" (para. 19.55, 2008 SNA). The purpose of this paper is to explore the data availability on labor inputs and to develop the QALI estimates based on harmonized methodologies for the whole economy of six South Asian countries, i.e., Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka.

In Asia, QALI has been measured mainly in some advanced countries, in which richer data on labor inputs and income/wages are available. In Japan the QALI measures have been developed in many studies since the 1960s such as Watanabe and Egaitsu (1968), Tachibanaki (1976), Imamura and Kuroda (1984), and Kuroda et al. (1997). In the latest study by Nomura and Shirane (2014), the industry-level QALI estimates are developed for the period 1955–2012, allocating the Japanese workers to 20,240 groups cross-classified by gender (2 classes), education (4), age (11), employment status (5), and industry (46). In Korea, similar work is found in Pyo, Rhee, and Ha (2006) with labor data cross-classified by gender (2), age (3), education (4), and industry (72) from 1970 to 2003.

As to the measurement at the aggregate level, Young (1995) developed the aggregate-level QALI estimates for the Asian Tigers, i.e., Hong Kong, Korea, Singapore, and the ROC (Taiwan), by distinguishing labor on the basis of gender (2), age (9 to 11 classes, depending on the country and the observation period), and education (2 to 7), covering the period from 1966 to 1990. In Singapore, Nomura and Amano (2012) identifies the resident and non-resident workers in the context of a QALI database, along with the classifications of gender (2), education (5 to 7, depending on the period), age (5 to 12), employment status (4) for the period 1974–2011, and evaluates the impacts of policies to reduce the number of low-skilled foreign workers and to upgrade the skills of resident workers.

In emerging Asian countries, however, studies to measure QALI are limited mainly due to severe constraints of data availability. In particular, for South Asian countries, there may be no preceding studies measuring the aggregate-level QALI based on a harmonized methodology. Recently, a QALI database was developed in a context of constructing the industry-level productivity account, such as the KLEMS database for India and Pakistan. Das et al. (2015) and Burki, Hussain, and Khan (2016) developed a multi-dimensional labor input database by gender

(2 categories), education (3), age (3), and industry (27) in 1980–2012 for India and by gender (2 categories), skill (3),[1] age (4), and industry (7) in 1980–2010 for Pakistan, respectively. For Bhutan, in a project of the United Nations Department of Economic and Social Affairs (UNDESA 2016), QALI are measured by distinguishing labor on the basis of gender (2 categories), education (7), age (11), employment status (3), and industry (12) for the period 1990–2014.[2]

In the context of international productivity comparisons at the aggregate level, productivity database like OECD (2017) and APO (2017) measures labor inputs in terms of total hours worked. The current practice reflects the operating reality of the lack of fully comparable labor data among countries. Alternatively, some productivity analyses have employed a simplified methodology to approximate the QALI and labor quality measures. In a series of studies to analyze the world economy in Jorgenson and Vu (2011) and Vu (2013), they have employed the estimates on labor qualities in the Conference Board Total Economy Database (TED).[3] The labor quality indicators in TED are estimated based not on survey results on labor inputs and wages, but on a model utilizing the available estimates on the average years of schooling (Wittgenstein Centre 2015) and on the population by gender, age, and education (Barro and Lee 2012).[4] For the countries in which labor quality estimates are not provided by TED, the Jorgenson-Vu studies estimate labor quality growths based on a simple formula, using data on the mean year of schooling years for population aged 25 and the assumption that the return on education is 3 percent.

The robustness of these non-survey approaches to measure labor quality should be tested against estimates based on survey data. Although data on labor inputs and income/wages are limited in emerging Asian countries, some occasional, one-off survey data are available. At Keio Economic Observatory, Keio University, Tokyo, the project to develop the QALI data for Asian countries (the Asia-QALI) has been conducted since 2013, under the auspice of APO. By collecting survey data on labor inputs and income/wages in each country and trying to fully utilize the survey results, the Asia-QALI project plans to publish its first set of estimates in 2017–2018. The purpose of this paper, as a first project report is to describe the details of the data, methodologies, and assumptions used to develop the estimates for six South Asian countries, i.e., Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka. Although the availability and reliability of data are limited in these countries, the regional comparisons of the estimates based on a harmonized methodology may contribute to illuminating potential measurement errors and to improving the measures of labor inputs.

[1] The definition of skill as a labor category in Burki, Hussain, and Khan (2016) corresponds to that of education elsewhere. Labor skill is classified into three levels, low, medium, and high, based on the education levels of workers.

[2] The UNDESA project for developing the industry-level growth accounting framework for Bhutan was led by Koji Nomura (Keio University) and Hamid Rashid (UNDESA), supported by Mr. Nyingtob Pema Norbu (Gross National Happiness Commission, Royal Government of Bhutan), Mr. Sonam Tshering (Bhutan Interdisciplinary Research & Development), Mr. Sonam Laendup (National Statistics Bureau), Mr. Tandin Dorji and Ms. Dechen Dema (MoLHR).

[3] See the TED website (https://www.conference-board.org/data/economydatabase/). TED presents estimates of labor quality for 16 Asian countries: Bangladesh, Cambodia, China, ROC, Hong Kong, India, Indonesia, Japan, Malaysia, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Thailand, and Vietnam.

[4] See De Vries and Erumban (2015).

The paper is structured as follows. Section 2 provides the definitions of the cross-classified data on the number of employment, hours worked, and hourly wages. For estimating missing data, similar procedures as presented in Section 2.2 are employed for each country. Section 3 presents the data sources and the country-specific classifications of four labor categories, i.e., gender, educational attainment, age, and employment status,[5] highlighting country-specific data issues in each country. Section 4 presents the estimated indicators of QALI and labor quality improvement. Section 5 concludes.

2 Measurement Framework

2.1 Framework

In this section we describe the framework for measuring QALI and labor quality. Our methodology follows the approach set out by Jorgenson and Griliches (1995), in which an index number of aggregate labor input was constructed, based on labor compensation data for male workers, classified by educational attainment. An extended version of this approach to the industry level for the U.S. economy was presented in Jorgenson, Gollop, and Fraumeni (1987, Ch.3), in which data on number of workers, hours per worker, and hourly wages was finely disaggregated into age, sex, occupation, class of employment, as well as educational attainment.

To account for the heterogeneity in hours worked, we distinguish workers by four categories with the following notation: $geas$ subscripts for gender (g), education (e), age (a), and employment status (s), in each country. Our measurement covers six South Asian countries, Bangladesh (abbreviated as BAN), Bhutan (BTN), India (IND), Nepal (NEP), Pakistan (PAK), and Sri Lanka (SRI). The definitions of the characteristics in each category can differ among countries, as presented in each country subsection of Section 3. The following variables are defined at the elementary level in our measurement:

N_{geas} employment matrix, number of workers in category $geas$,
H_{geas} hours worked by all workers in category $geas$,
H_l abbreviation for H_{geas},
h_l hours worked per worker of category l ($H_l = N_l h_l$),
w_l hourly wage of category l,
L_l labor input of category l,
P_l^L price of labor input of category l, and
V_l^L nominal labor compensation of category l ($\mathrm{V}_l^L = \mathrm{P}_l^L L_l = H_l w_l$).

These variables are defined in each country (k) and year (t), as $N_{geas,tk}$. For simplification, we omit k and t, as long as it may not confuse the framework.

We aggregate the volume of labor input using a translog quantity index of the individual components:

(1) $\Delta \ln L = \sum_l \bar{v}_l^L \Delta \ln L_l$,

[5] The country-common classifications in each category are not defined in our measurement, because of the difficulties to compare the characteristics among countries and of the maximum use of available information in each country.

where the weights $\bar{v}_l^L$ are the two-period average share of each type of labor income in total labor income. To quantify the impact of substitution among different types of labor input, we assume that labor input for each category L_l is proportional to hours worked H_l:

(2) $L_l = \varphi_l H_l$,

where the constants of proportionality φ_l transform hours worked into flows of labor services. By the identity of nominal labor compensation as $P_l^L L_l = H_l w_l$, this infers that the price of labor input for each category is proportional to hourly wage w_l:

(3) $P_l^L = w_l/\varphi_l$.

We assume that labor services are the same at all points in time for each category of hours worked in each country. For example, an hour worked by a regularly employed male worker, aged 40, with four years of college education in Japan represents the same labor input in 1970 as in 2015, regardless of the difference in cohorts.

Under assumption of Equation (2), the labor quantity index in Equation (1) is expressed in terms of hours worked:

(4) $\Delta \ln L = \sum_l \bar{v}_l^L \Delta \ln H_l$.

L measures the quality-adjusted labor input (QALI),[6] since L aggregates hours worked by different types of workers, which are weighted by their marginal productivities, approximated by their respective hourly wages.[7] The corresponding price of labor input P^L is implicitly defined as the ratio of the value of labor compensation V^L $(= \sum_l V_l^L)$ to the volume index as:

(5) $P^L = V^L/L$.

Compared to the quality-adjusted price index of labor input P^L, we define a simple average of hourly wage at the aggregate level as:

(6) $w = V^L/H$.

where

(7) $H = \sum_l H_l$

is the unweighted sum of each type of hours worked. Finally, the labor quality index Q is defined from both of the quantity and price sides as:

(8) $Q = L/H = w/P^L$.

Labor quality Q measures the part of labor input volume which is not explained by the number of hours worked observed. This also indicates the part of hourly wage which is not explained by the quality-adjusted price of labor input. In our measurement, the aggregate measures of price, quantity, and quality defined in the equations (5)–(8) are measured for total employment (all s) and for employees only (s=1).

Following the methodology employed in Jorgenson, Gollop, and Fraumeni (1987) and Ho and Jorgenson (1999), the labor quality index is disaggregated into first- to fourth-order indices to facilitate the investigation of the sources of labor quality change. This disaggregation is

[6] Observations of the constants φ_l are not required to define aggregate labor input.

[7] The System of National Accounts 2008 came to refer to the quality-adjusted labor input as a measure of labor inputs (United Nations 2009, Chapter 19), in addition to the conventional metrics of full-time equivalents and total actual hours worked. It is described that the volume index of QALI is "weighted together using average hourly wages for a worker falling into each category. The premise behind this approach is that workers are hired only until their marginal price (that is, their wages, including on-costs) is less than the marginal revenue expected to result from their production." (para 19.56).

formulated as

$$\begin{aligned}\Delta \ln Q = {} & \Delta \ln Q_G + \Delta \ln Q_E + \Delta \ln Q_A + \Delta \ln Q_S \\ & + \Delta \ln Q_{GE} + \Delta \ln Q_{GA} + \Delta \ln Q_{GS} + \cdots + \Delta \ln Q_{AS} \\ & + \Delta \ln Q_{GEA} + \Delta \ln Q_{GES} + \Delta \ln Q_{GAS} + \Delta \ln Q_{EAS} \\ & + \Delta \ln Q_{GEAS} \ ,\end{aligned} \tag{9}$$

where $\Delta \ln Q_G$ is an example of a first order index (for gender), $\Delta \ln Q_{GE}$ a second order index (for gender and education), and so on. Uppercase subscripts are used to signify that only one index exists for each dimension. For example, only one Q_G exists, whereas H_g, defined in equation (10), exists for each gender, male and female.

We now explicitly define the first order index and second order index. For the dimension of gender, we have

$$H_g = \sum_e \sum_a \sum_s H_l \tag{10}$$

and

$$\Delta \ln L_G = \sum_g \bar{v}_g^L \Delta \ln H_g \ , \tag{11}$$

where the weights $\bar{v}_g^L$ are the two-period average share of each type of labor income in total labor income. Then, the first order index for gender is defined as

$$\Delta \ln Q_G = \Delta \ln L_G - \Delta \ln H. \tag{12}$$

Similarly, the first order indices can be calculated for the other eas dimensions. The second order index is defined as

$$\Delta \ln Q_{GE} = \Delta \ln L_{GE} - \Delta \ln Q_G - \Delta \ln Q_E - \Delta \ln H, \tag{13}$$

where

$$\Delta \ln L_{GE} = \sum_{ge} \bar{v}_{ge}^L \Delta \ln H_{ge} \tag{14}$$

and

$$H_{ge} = \sum_a \sum_s H_l \ . \tag{15}$$

Similar second order indices can be calculated for each pair of the $geas$ dimensions, giving a total of six second order indices. There are four third order indices and one fourth order index. The sum of the growth rates of all orders' labor qualities provides the JGF decomposition formula presented in equation (9).

2.2 Data Development

The data constraints, such as the use of less-disaggregated data and the frequent changes in available data over periods, require a country-common measurement framework to develop a fully cross-classified (four dimensional) labor dataset, which consists of the number of workers (N_{geas}), hours worked (H_{geas}), and labor compensation (V_{geas}^L). In the case of no survey results available, auxiliary data are used for interpolation or extrapolation. A country-common framework for data development is described in this section, and the country-specific issues are discussed in each subsection of Section 3.

2.2.1 Number of Workers

Depending on the availability of the most detailed data, the methods to construct the

four-dimensional (4D) employment matrix N_{geas} vary in response to five scenarios, denoted as cases A to E. In case A, the full set of 4D data is directly observed. In case B, three kinds of 3D data are available. For example, if N_{ges}, N_{gea}, and N_{gas} are available, $\widehat{N}_{geas}$ is estimated based on two kinds of 3D data held as the restrictions (i.e., $\sum_a \widehat{N}_{geas}=N_{ges}$ and $\sum_s \widehat{N}_{geas}=N_{gea}$) and the remaining kind of 3D data (i.e., N_{gas}) as the initial values for the $a \times s$ matrix information in each g category of $\widehat{N}_{geas}$. For matrix balancing, we apply the KEO-RAS approach, which is one of the applications of the Lagrange multiplier method (see Kuroda et al., 1997). This procedure is described as:

$$(16) \quad \min \sum_{as} \left(\widehat{N}_{geas} - N_{gas}\right)^2, \text{ subject to } \quad N_{ges} = \sum_a \widehat{N}_{geas} \text{ and } \quad N_{gea} = \sum_s \widehat{N}_{geas},$$

where N_{gas} is the initial values and N_{ges} and N_{gea} are the restrictions.

In case C, only two kinds of 3D data are available (e.g., N_{ges} and N_{gas}). Contrast to case B, the missing information (i.e., the $e \times a$ matrix information) is compensated by the use of auxiliary data. The first row of Table 1 summarizes case C. The auxiliary data to provide the initial values of $N_{gea,tk}$ is classified into four types: 1. estimates based on 2D data (e.g., the estimates based on available three kinds of 2D data: $N_{ge,tk}$, $N_{ga,tk}$, and $N_{ea,tk}$),[8] 2. estimates based on data in the near periods (e.g., $N_{gea,t'k}$ where $t-2 \le t' \le t+2$), 3. estimates based on the labor force matrix,[9] and 4. data in other countries (k') as the last resort in the case that no relevant auxiliary data or estimates are available.[10] If the data in the near period (the 2nd type of auxiliary data) is used as the initial values, this method is named as case $C_{0,2}$ in Table 1.

Table 1: Auxiliary Data to Estimate 4D Employment Matrix

	Auxiliary data (restriction, initial value)			
	1: Estimates based on 2D data	2: Estimates based on data in near periods	3: Estimates based on labor force	4: Data in other countries
	e.g. $\bar{N}_{gea,tk}$ or $\bar{N}_{geas,t}$	e.g. $N_{gea,t'k}$ or $N_{geas,t'k}$	e.g. $\hat{\beta}_{gea,tk}F_{gea,t}$	e.g. $N_{geas,tk'}$
C: Two 3D data e.g. $N_{ges,tk}$ & $N_{gas,tk}$	$C_{0,1}$	$C_{0,2}$	$C_{0,3}$	$C_{0,4}$
D: One 3D data e.g. $N_{aes,tk}$	$D_{1,1}$	$D_{1,2}$	$D_{1,3}$, $D_{2,3}$	$D_{1,4}$, $D_{3,4}$
E: No 3D data	$E_{11,1}$	$E_{11,2}$, $E_{12,2}$, $E_{13,2}$, $E_{22,2}$	$E_{11,3}$, $E_{12,3}$	$E_{11,4}$, $E_{13,4}$, $E_{23,4}$

Note: The C, D, and E in the rows of this table correspond to the cases that two kinds of, one kind of, and no 3D data are available, respectively. As the use of auxiliary data, for example in case $D_{a,b}$, "a" indicates the type of auxiliary data used to provide the additional restriction(s) for missing information and "b" indicates the type of auxiliary data used as the initial values.

[8] As Equation (16) presents the method to estimate 4D data based on three kinds of 3D data, similar method can be applied to estimate 3D data based on three kinds of 2D data.

[9] In addition to the 4D employment matrix, 3D data on population ($P_{gea,tk}$) and labor force ($F_{gea,tk}$) are developed for the whole period of our observation in all countries. Appendix A.1 presents the details. The labor force matrix times the employment rate ($\beta_{gea,tk}$), which is observed in the near periods, provides the initial values of the information of $N_{gea,tk}$. Thus, in the case that the data or estimates of the $e \times a$ matrix information are not available, the use of the estimates based on labor force matrix provides the last resort in our measurement.

[10] The use of other country's data is very exceptional, as presented in Table 2.

Table 2: Data Development Procedures in Employment and Wage Matrices

	Employment matrix						Wage matrix					
	BAN	BTN	IND	NEP	PAK	SRI	BAN	BTN	IND	NEP	PAK	SRI
1970	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1971	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$C_{0,4}$	$E_{11,3}$	$D_{3,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1972	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1973	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1974	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1975	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1976	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1977	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1978	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1979	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1980	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1981	$E_{22,2}$	$E_{11,2}$	$D_{1,3}$	$C_{0,4}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1982	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1983	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1984	$E_{13,4}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1985	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1986	$E_{13,4}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{11,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1987	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1988	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1989	$E_{13,4}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$
1990	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{22,2}$
1991	$E_{13,4}$	$E_{11,2}$	$D_{1,3}$	$C_{0,4}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{22,2}$
1992	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{22,2}$
1993	$E_{22,2}$	$E_{11,2}$	$D_{1,3}$	$E_{22,2}$	$D_{1,2}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$	A	$D_{22,2}$
1994	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$D_{1,2}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{22,2}$
1995	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{22,2}$
1996	$E_{13,4}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{22,2}$
1997	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{11,2}$
1998	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$D_{1,2}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{11,2}$
1999	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{11,1}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{11,3}$	A	$D_{11,2}$
2000	$E_{13,4}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{11,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{11,2}$
2001	$E_{22,2}$	$D_{1,2}$	$D_{1,3}$	$C_{0,4}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{11,2}$
2002	$E_{22,2}$	$E_{11,2}$	$D_{1,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{11,1}$
2003	$E_{13,4}$	$D_{1,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{11,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{11,1}$
2004	$E_{22,2}$	$D_{1,2}$	$C_{0,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$	A	$D_{11,1}$
2005	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{11,1}$
2006	$E_{13,4}$	$D_{1,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{11,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	A	$D_{11,1}$
2007	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$C_{1,2}$	$D_{22,2}$	A	$D_{11,1}$
2008	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{11,1}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,3}$	A	$D_{11,1}$
2009	$E_{22,2}$	A	$C_{0,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	A	$B_{0,3}$	$D_{22,2}$	A	$D_{11,1}$
2010	$E_{13,4}$	A	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{11,2}$	A	$D_{22,2}$	$D_{22,2}$	A	$D_{11,1}$
2011	$E_{22,2}$	A	$D_{1,3}$	$C_{0,4}$	$E_{11,3}$	$D_{3,4}$	$D_{22,2}$	A	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{11,1}$
2012	$E_{22,2}$	A	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$C_{0,4}$	$D_{22,2}$	A	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{11,1}$
2013	$E_{13,4}$	A	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$C_{1,3}$	A	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{11,1}$
2014	$E_{22,2}$	A	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	A	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{11,1}$
2015	$E_{22,2}$	$E_{11,2}$	$E_{11,3}$	$E_{22,2}$	$E_{11,3}$	$E_{13,4}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{22,2}$	$D_{11,2}$	$D_{22,2}$

Note: See Table 1 and Table 3 for the definitions of procedures to develop an employment matrix and a wage matrix, respectively.

In case D, only one kind of 3D data is available (e.g., N_{ges}). Then two kinds of auxiliary data have to be prepared. One kind is employed to provide the information on age (a) as an additional restriction and the other one is used as the initial values. The second row of Table 1

summarizes case D. If the estimate based on 2D data (the 1st type of auxiliary data) has to be used as the additional restriction and the estimate based on labor force matrix (the 3rd type of auxiliary data) is used as the initial values, this estimation procedure is described as case $D_{1,3}$ in Table 1. Case $D_{1,1}$ is preferred to case $D_{1,3}$ and case $D_{1,3}$ is preferred to case $D_{2,3}$ in our measurement.

When no 3D data is available, which is case E as summarized in the final row in Table 1, two types of 3D auxiliary data have to be used to provide the additional restrictions and one type of 3D data is used as the initial values. There are many combinations of auxiliary data when three kinds are used in the estimation procedure, e.g., $E_{11,3}$ or $E_{13,2}$ as presented in Table 1. In our measurement, the procedures described on the left side are preferred in each case. The left block (2nd–7th columns) in Table 2 provide the procedures to develop the 4D employment matrix in each year of the whole observation period. Data availability among the South Asian countries is hugely diverse, depending on the census and survey years and the frequency. The most frequent procedures applied are $E_{11,3}$, $E_{13,4}$, and $E_{22,2}$ reflecting the difficulty in obtaining the 3D data.

2.2.2 Hours per Worker

The estimated matrices in the number of workers are converted into those based on hours worked. For example, when only one kind of two-dimensional data (by gender and age) on average hours worked per worker (h_{ga}) is available, we assume that they are the same regardless of the differences in education and employment status in each group of $g \times a$. When several kinds of data on hours worked per worker are available (e.g., h_{ge} and h_{ga}), a higher dimensional matrix of total hours worked (i.e., H_{gea}) is estimated (with two constraints of H_{ge} and H_{ga}), and then the balanced hours worked per worker (i.e., h_{gea}) are developed. The KEO-RAS method is used to estimate the employment matrix of hours worked, using the employment matrix of number of workers as the initial matrix as described in the following equation:

(17) $\min \sum_{ea} \left(\widehat{H}_{gea} - N_{gea}\right)^2$, subject to $H_{ge} = \sum_a \widehat{H}_{gea}$ and $H_{ga} = \sum_e \widehat{H}_{gea}$.

2.2.3 Hourly Wage

The procedures to construct the wage matrix are separated into two steps, involving the development of compensation matrices, first, of employees (COE) and, then, of self-employed and unpaid (contributing) family workers. In the first procedure, the COE matrices (Nhw_{geas_1}) are estimated and then the hourly wage matrix (w_{geas_1}) are defined. The wage matrix for employees has three dimensions, (i.e., $g \times e \times a$), giving rise to four possible data scenarios and in turn the corresponding methods to measure the 3D wage matrix. In case A, full 3D wage matrix is directly observable. Cases B and C are defined as the cases that two and one kind of 2D wage matrix are available, respectively. Finally, in case D, there is no wage data available. In Table 3, these estimation cases and the kinds of auxiliary data used are listed in the rows and the

columns, respectively. The auxiliary data in the third column indicates the estimated data on relative wages among different classes in each labor category in other countries are used. In the South Asian countries, wage functions are estimated in Pakistan and Bhutan, as presented in Appendix A.2. Applied methods to estimate 3D wage matrix in each country are presented in the right block (8nd–13th columns) in Table 2.

Table 3: Auxiliary Data to Estimate 3D Wage Matrix of Employees

	Auxiliary data (restriction, initial value)		
	1: Estimates based on 1D data	2: Estimates based on data in near periods	3: Data in other countries
	e.g. $\hat{w}_{ge,tk}$ or $\hat{w}_{ga,t}$	e.g. $w_{gea,t'k}$	e.g. $w_{gea,tk'}$
B: Two 2D data e.g. $w_{ge,tk}$ & $w_{ge,tk}$	$B_{0,1}$	$B_{0,2}$	$B_{0,3}$
C: One 2D data e.g. $w_{ge,tk}$	$C_{1,1}$	$C_{1,2}$	$C_{1,3}$
D: No 2D data	$D_{11,1}$	$D_{11,2}$, $D_{22,2}$	$D_{11,3}$, $D_{22,3}$

Note: The B, C, and D in the rows correspond to the cases that two kinds of, one kind of, and no 2D wage data are available. As to the use of auxiliary data, for example in the case $D_{a,b}$, "a" indicates the data type used as the additional restriction(s) for missing information and "b" indicates the data type used as the initial values.

Having constructed the COE matrix, the second procedure is to estimate the compensation matrix of self-employed (own-account) workers and unpaid (contributing) family workers. In the Asia-QALI database project, a country-common assumption is applied for all countries, with the exceptions for countries where reliable data are available. The assumption used in Asia-QALI is that the wage differential ratio (WDR) in hourly wages of non-employees to employees in each elementary group of labor inputs is set as 0.2 in the standard case. In Japan, Nomura and Shirane (2014) estimates WDR as 0.24 for agriculture industry and 0.60 for other industries, after examining the income data. In Singapore, Nomura and Amano (2012) estimates the average hourly wages relative to those of employees of own-account workers as 0.67 for male and 0.81 for female and of contributing family workers as 0.29 for male and 0.26 for female in 2000. In this paper, considering a much larger share of workers in agriculture in South Asia, an assigned value of 0.2 as WDR is applied to all the countries studied.

3 Data Sources and Issues

3.1 Bangladesh

The primary statistics we use to construct the cross-classified labor data for Bangladesh are presented in Table 4. Main sources are the *Population and Housing Census* (PHC) and the *Labour Force Survey* (LFS), published by the Bangladesh Bureau of Statistics (BBS). While the first PHC in Bangladesh was in 1872, the first PHC after the liberation war in 1971 was

conducted in 1974. Since 1981 PHC has been carried out decennially, with the latest one being in2011. LFS has been conducted since 1980, but not on a regular interval (once in every 2 to 5 year). Some adjustments are required to reconcile the differences in the coverage and definitions between surveys. The coverage of employment in PHC includes younger workers who are 10–14 years old as opposed to the 2010 LFS, which covers only workers who are 15 years old and above. Employment in the informal sector is not included in PHC, while it is in LFS.

Table 4: Data Sources in Bangladesh

	Sources	Categories	Periods
N	Population and Housing Census (PHC)	ges	2011
		ga	1974, 91, 2011
		gs	1974, 2011
	Labour Force Survey (LFS) (usual definition)	ge	2000, 03, 10, 13
		ga	1984, 89, 2003, 06, 10, 13
		gs	1984, 86 , 96, 2000, 03, 06, 10, 13
		g	1984-86, 89, 91, 96, 2000, 03, 06, 10, 13
		e	2000, 03, 06, 10, 13
	Labour Force Survey (LFS) (extended definition)	gs	1989, 91
		g	1989, 91, 96, 2000
h^w	Labour Force Survey (LFS)	gs	1989, 91, 2006, 10, 13
		g	1984, 89, 91, 96, 2000, 06, 10, 13
$h^w w$	Labour Force Survey (LFS)	gs_1	1984, 86, 2003
$h^m w$	Labour Force Survey (LFS)	gas_1	2013
		gs_1	2000, 03, 06, 10, 13
Nhw	BBS estimates	s_1(COE)	1998-2010

Note: h^w, $h^w w$, and $h^m w$ are average hours worked per week, weekly wages and monthly wages, respectively. PHC and LFS are developed by Bangladesh Bureau of Statistics (BBS). Data on Nhw are provided by the BBS expert on the APO Productivity Databook project.

In the labor data we construct for Bangladesh, each of the characteristic dimensions of labor contains a set of disaggregated components, as presented in Table 5. The classifications are defined to take full advantage of the data publicly available, avoiding extreme assumptions in the process of reconciling the data from different sources and compiling the time-series data as much as possible. We have a total of $2 \times 5 \times 12 \times 3 = 360$ groups for the period 1970–2003 and of $2 \times 10 \times 12 \times 3 = 720$ groups for the period 2003–2015.

Table 5: Classes in Labor Categories in Bangladesh

Period (t)	1970-2003	2003-2015
Gender (g)	1) Male, 2) Female	
Education attainment (e)	1) No education, 2) Class 1 to 4, 3) Class 5 to 10, 4) S.S.C (Scondary School Certificate) and H.S.C (Higher Secondary Certificate), 5) Degree & above	1) No education, 2) Class 1 to 5, 3) Class 6 to 8, 4) Class 9 to 10, 5) S.S.C & equivalent, 6) H.S.C&equivalent, 7) Degree&equivalent, 8) Master degree & equivalent, 9) Doctors/engineers, 10) Technical/vocational
Age (a)	1) 10–14, 2) 15–19, 3) 20–24, 4) 25–29, 5) 30–34, 6) 35–39, 7) 40–44, 8) 45–49, 9) 50–54, 10) 55–59, 11) 60–64, 12) 65 and over	
Employment status (s)	1) Employer, employee, day labour, domestic worker/maid servant, paid/unpaid apprentice, 2) Own account worker, 3) Unpaid family helper	

The Bangladesh LFS series of workers are based on two different definitions, namely usual

and extended definitions. According to BBS's explanation in LFS 1999–2000, one of the most significant differences between the two definitions is whether activities within households, e.g. cleaning, processing food, and so on, are regarded as economic production or not. The workers mainly engaged in these activities are counted as employment in the extended definition, but not in the usual definition.[11] Thus a large gap between the two definitions is found especially in the numbers of unpaid family female workers. Table 6 compares the numbers of workers by employment status and gender between the two definitions in the periods of 1991, 1996, and 2000, in which both estimates are available in LFS. In 1996 the number of the unpaid family female workers based on the extended definition (16.1 million persons) is approximately 6.6 times larger than that based on the usual definition (2.4 million persons).

Table 6: Extended and Usual Definitions of Workers in Bangladesh LFS

		1991			1996			2000		
		Extended definition (a)	Usual definition (b)	a/b	Extended definition (a)	Usual definition (b)	a/b	Extended definition (a)	Usual definition (b)	a/b
Total employment	Total	50,159	34,900	1.44	54,600	40,313	1.35	58,070	38,979	1.49
	Male (g1)	30,442	-	-	33,780	33,164	1.02	36,120	31,087	1.16
	Female (g2)	19,717	-	-	20,820	7,149	2.91	21,950	7,892	2.78
Employees (s1)	Total	13,231	13,200	1.00	16,690	16,692	1.00	18,040	16,120	1.12
	Male (g1)	11,593	-	-	13,570	13,565	1.00	14,320	13,061	1.10
	Female (g2)	1,638	-	-	3,120	3,127	1.00	3,720	3,059	1.22
Own-account worker (s2)	Total	13,052	13,300	0.98	16,010	16,008	1.00	18,750	18,170	1.03
	Male (g1)	11,784	-	-	14,420	14,414	1.00	16,460	16,040	1.03
	Female (g2)	1,268	-	-	1,590	1,594	1.00	2,290	2,130	1.08
Unpaid family helper (s3)	Total	23,653	8,400	2.82	21,900	7,613	2.88	21,280	4,689	4.54
	Male (g1)	6,921	-	-	5,790	5,185	1.12	5,340	1,986	2.69
	Female (g2)	16,731	-	-	16,110	2,428	6.64	15,940	2,703	5.90

Unit: Thousands of Persons.
Sources: Bangladesh Bureau of Statistics (BBS), Labour Force Survey in various years.

Figure 1 compares the ratios of unpaid family workers in female employment between the two definitions in Bangladesh, with those in other South Asian countries (excluding India[12]). The ratios based on the extended definition are available until 2000, which ranges from 72.6% (in 2000) to 85.2% (in 1991). These are obviously larger than those in the other South Asian countries. This may illuminate that the coverage based on the extended definition may be too wide, compared to the standard practices in labor statistics in other South Asian countries. The recent LFS after 2003 publishes the number based only on the usual definition. Figure 2 presents the number of total workers based on the two definitions. Although the estimates in ILO (2015) seem to follow the extended definition estimates, these data are not available after 2003 and the usual-definition estimates are used in our measurement.

[11] According to LFS 1999–2000 (BBS, 2002), explanations of each definition are following: 1) Extended definition of economically active population refers to person of age 10 and above who are either employed or unemployed during the reference period. Also persons who engaged themselves in household activities, such as threshing, cleaning, care of livestock and poultry, food processing, boiling, drying etc. are considered as economically active population. 2) Usual/conventional definition of economically active population or civilian labour force refers to person of 10 years of age and above who are either employed or unemployed during the reference period of the survey. Persons working less than 15 hours without pay or profit in the family farm or enterprise (activities like care of livestock, poultry, processing, husking, prevention of food etc.) are not considered as economically active population.

[12] In India, unpaid family worker is not classified separately in the classification of employment status (see Table 10).

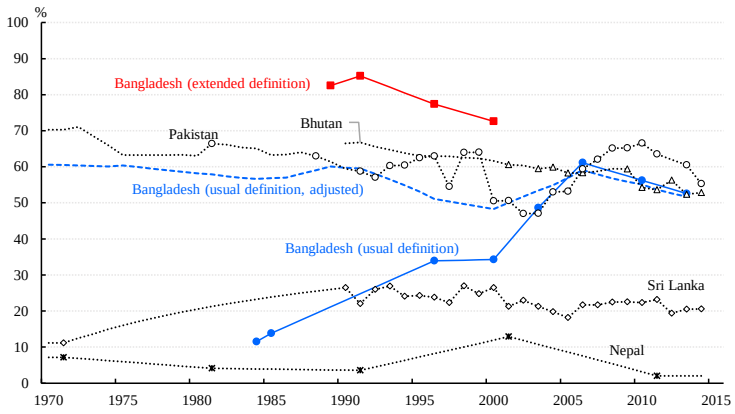

Figure 1: Ratio of Unpaid Family Worker in Female Employment in South Asia

Sources: Population census, labor force survey, and other labor statistics in each country, including author adjustments.
Note: The adjusted usual-definition data in Bangladesh is our estimate.

However, adopting the usual definition in our estimates for Bangladesh confronts us with data consistency issues over time. As shown in Figure 1, the ratio of unpaid family workers in female employment has an upward trend, increasing from 11.0% in 1984 to 35% in 2000, and then to 62.0% in 2006. The increase from 2000 to 2006 in the usual definition is mainly due to the inclusion of female workers who engage in livestock and poultry-raising as unpaid family workers,[13] reflecting the "changes in social attitude during the recent years and growing awareness about the need for recognition women's economic activity" (Rushidan and Islam 2013). Thus we adjust the usual-definition estimates before the 2000 LFS, from which the female workers engaging in livestock and poultry-raising were excluded. In this adjustment, we simply assume that the ratio of female workers on livestock and poultry-raising activities in unpaid family female workers, which is observed in 2006, is constant over periods. Until the mid–2000s, the adjusted ratios of unpaid family worker in female employment in Bangladesh are lower than those in Bhutan and Pakistan and higher than that in Sri Lanka, as shown in Figure 1.

Since 2003, another adjustment is required in the usual-definition estimates in LFS, which excludes employment aged 10–14. Figure 2 shows this exclusion generates a considerable gap between the 2000 LFS and the LFS after 2003. In the 2000 LFS, the ratio of 10–14 year-old-workers occupies almost 10% of total employment. Although the number of workers aged 10–14 is not available in the LFS after 2003, the number of 10–14 aged workers was 2.6% of total employment in the 2011 PHC. Based on the shares observed in 2000 (LFS) and 2011 (PHC), we interpolate the shares for the period 2001–2010 and adjust the original usual-definition estimates.

[13] The number of unpaid family helpers increased about 50% from 2,703 thousand in the 2000 LFS to 3,975 thousand in the 2006 LFS. Of which, 110 percentage points are contributed by the expansion in the numbers of workers engaged in livestock and poultry-raising from 1,000 to 2,805 thousand.

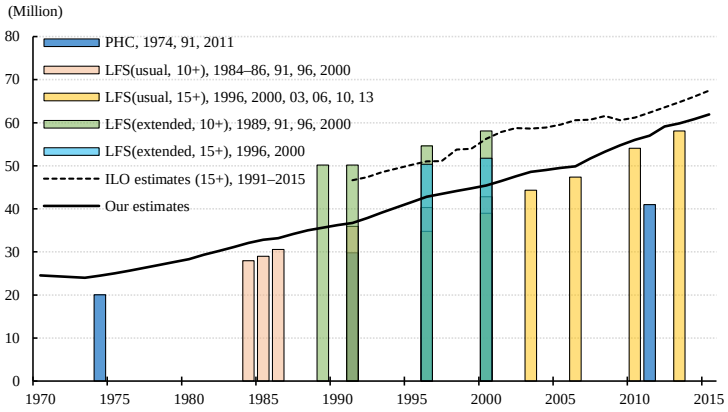

Figure 2: Number of Total Employment in Bangladesh

Before 1983, the data on employment status is not available in LFS; only the 1974 PHC provides the information, as shown in Table 4. However, as mentioned above, there are some differences in the coverage of status between LFS and PHC. We estimate the details of the differences and the data in the PHC are adjusted accordingly. By assuming that the majority of own account workers and unpaid family helpers are engaged in agriculture industry, the data on the number of employment in agriculture industry is used as auxiliary data for interpolation/extrapolation.[14] Compositions of the estimated number of total employment in each category are presented in Figure 3.

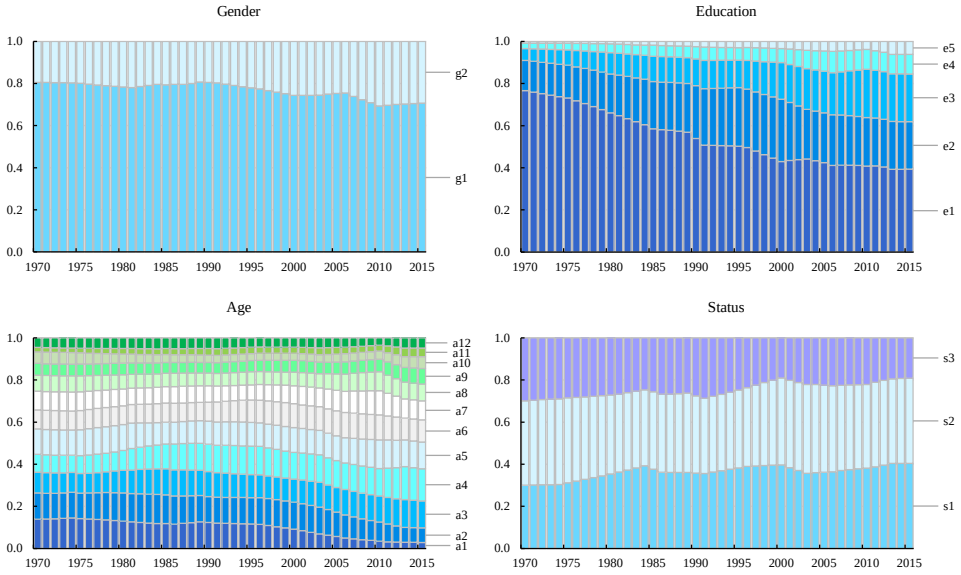

Figure 3: Employment Composition in Each Category in Bangladesh

LFS provides the two-dimensional wage data for employees (w_{gas_1}) in 2013 and the

[14] In 1984 and 1985, ratios of sum of own account worker and unpaid family helper to total employment are 57.8% and 61.2%. On the other hand, ratios of workers in agricultural industries in same years are 60.0% and 58.2%, respectively.

one-dimensional wage data (w_{gs_1}) in other six survey years, as presented in Table 4. In Figure 4, the COE estimates by the project expert at Bangladesh Bank (BB) for the period 1998–2010[15] and our estimates based on our hours worked and the LFS wage (w_{gs_1}) are compared. Both estimates are fairly close except in 2003. Thus we use the COE estimates by the BB expert for 1998–2010 as the constraint in developing the total compensation of our labor data. The next step is to determine the relative wages among different categories, which are not observed. We apply the relative wage information among different age groups in each gender, which are observed in the 2013 LFS, to the one-dimensional wage data in other LFS years. In addition, by applying the relative wage information among different educational groups, which are estimated in the wage function for Pakistan (see Appendix A.2), three-dimensional wage (w_{geas_1}) is constructed for all LFS years.[16] For the non-LFS years, the constant relative wages are assumed.

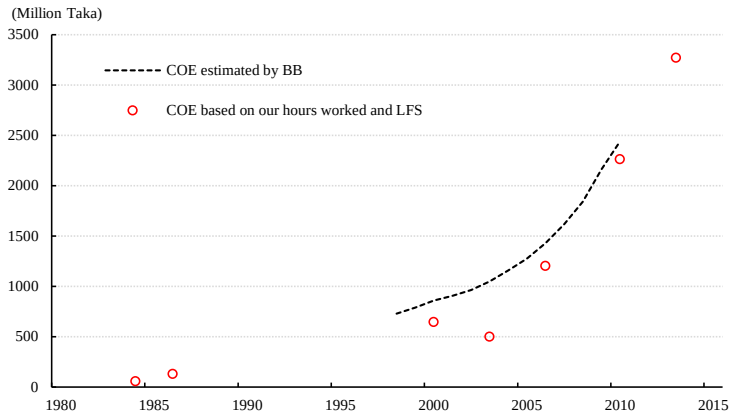

Figure 4: COE Estimates in Bangladesh

In the periods before 1998 and after 2010, we assume that the growth rates of average hourly wages are one percentage point higher than the growths of GDP deflator at an aggregate level. The gap in the price changes (one percentage point) is estimated for the period 1998–2010. Finally the estimates of the labor share and COE share in GDP at basic price is presented in Figure 5. Labor compensations for own-account worker (s=2) and unpaid family helper (s=3) are estimated based on the country-common assumption on the wage differential ratio of 0.2 between employees and non-employees in each group of labor inputs.

[15] The official estimates for COE are not available in the system of national accounts in Bangladesh. The COE estimates referred here are provided by the expert at Bangladesh Bank, Mr. Moanmmad Ballal Hossain, who joined the APO Productivity Databook project in 2012.

[16] As shown in Table 2, the estimating methods are defined as $C_{1,3}$ for 2013 and $D_{11,2}$ for other LFS years.

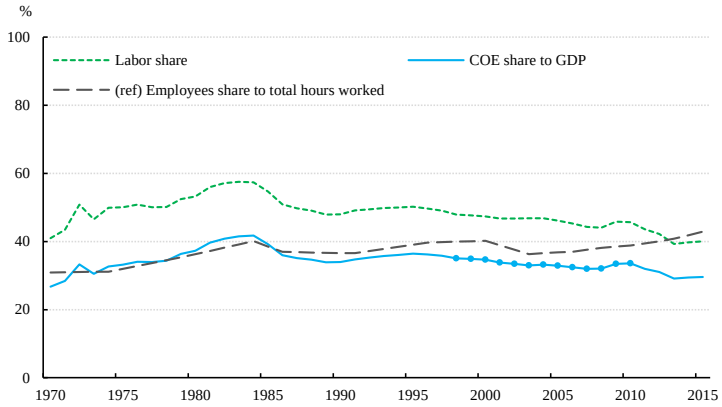

Figure 5: Labor Share in Bangladesh

Note: The dots of the COE share indicate the years, in which the COE estimates are provided by the BB expert.

3.2 Bhutan

The data sources used for constructing the labor matrix in the Kingdom of Bhutan are listed in Table 7. Two kinds of primary statistics are available in Bhutan: the *Population and Housing Census of Bhutan* (PHCB) conducted by the Office of Census Commissioner (OCC) and the *Labour Force Survey* (LFS) conducted by the Ministry of Labour and Human Resources (MoLHR).[17] Although the first national census was conducted in 1969, only the results of the 2005 PHCB is used in our measurement.[18]

Table 7: Data Sources in Bhutan

	Sources	Categories	Periods
N	Population and Housing Census of Bhutan (PHCB)	ga, gs, s	2005
	Labour Force Survey (LFS)	geas(unpublished)	2009-14
		gea, gs	2001, 03-04, 06, 09-15
	Key Indicators of the Labour Market（KILM)	g	1991–2014
h^m	Labour Force Survey (LFS)	geas(unpublished)	2009-14
		gs	2001, 03-04, 06, 09-15
$h^m w$	Labour Force Survey (LFS)	geas(unpublished)	2009–14
Nhw	Supply and Use Tables for Selected Economies in Asia and the Pacific (ADB)	s1(COE)	2007

Note: h^m and $h^m w$ are average hours worked per month and monthly wages, respectively. MLHR: Labour Market Information Bulletin, NSB: National Statistical Bureau. The unpublished LFS data is provided in the UNDESA project (UNDESA 2016).

LFS is available since 1998. In addition, for the period 2009–2014, we can follow the estimates developed in UNDESA (2016), in which unpublished four-dimensional LFS microdata on the number of workers, hours worked, and employees' hourly wage ($N_{geas}, h_{geas}, and\ w_{geas_1}$) were used. For the years other than 2009–2014, data from the published LFS was used. In addition to these primary data, the ILO estimates (ILO 2015) on the number of workers by gender are used as the controlled totals of our time-series estimates. In our data cross-classified by four categories defined in Table 8, each labor input is classified to $2 \times$

[17] The first LFS in 1998 was conducted by Central Statistical Office (current National Statistics Bureau). The sample size was 6,000 in 2013 and 2014 surveys and 12,000 in 2012 survey.
[18] Although the census has been conducted several times, they were criticized from the viewpoint of accuracy (e.g., see p.272 in Savada (1993)). While the most recent PHCB was conducted in 2017, the results are yet to be published.

$7 \times 11 \times 3 = 462$ groups.[19]

Table 8: Classes in Labor Categories in Bhutan

Period (t)	1970-2015
Gender (g)	1) Male, 2) Female
Education attainment (e)	1) No education, 2) Primary, 3) Lower secondary, 4) Middle secondary, 5) Higher secondary, 6) Undergraduate and over, 7) Religious professionals
Age (a)	1) 15-19, 2) 20-24, 3) 25-29, 4) 30-34, 5) 35-39, 6) 40-44, 7) 45-49, 8) 50-54, 9) 55-59, 10) 60-64, 11) 65 and over
Employment status (s)	1) Employees, 2) Own account worker, 3) Contributing family worker

Figure 6 compares the number of workers at the aggregate level in PHCB, LFS, and our estimates. There is a break in the series between the 2006 LFS and the 2009 LFS when the results of the 2005 PHCB were first employed to construct the household list used in the LFS in 2009, and the estimated number of workers has been stable since then. As a measure of total labor inputs, however, the coverage is incomplete as both PHCB and LFS count only domestic workers. The estimates for the number of foreign workers are published in the *Labour Market Information Bulletin* (LMIB) by MoLHR for the period 2009–2015. The sum of the number of workers in LFS and the number of foreign workers in LMIB are almost consistent with the KILM estimates in ILO (2015). Thus our measurement follows the ILO estimates as the controlled totals of the number of workers for the whole economy in the period 1991–2015. And in the years when LFS is available, its data on labor compositions are used as presented in Table 7. For the period 1970–1990, in which such data are not available, the number of workers is estimated by extrapolation using our auxiliary employment data (see Appendix A.1). Compositions of the estimated number of total employment in each category are presented in Figure 7.

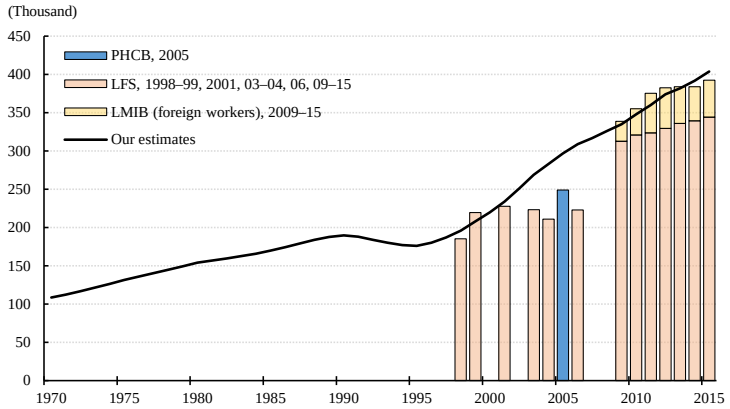

Figure 6: Number of Total Employment in Bhutan

[19] Among seven classes of educational attainment, religious professionals (e=7) is unique in Bhutan. The entrance age and duration years are not defined in religious schools. In our computation of average schooling years, e.g., in Figure 33, this class is excluded.

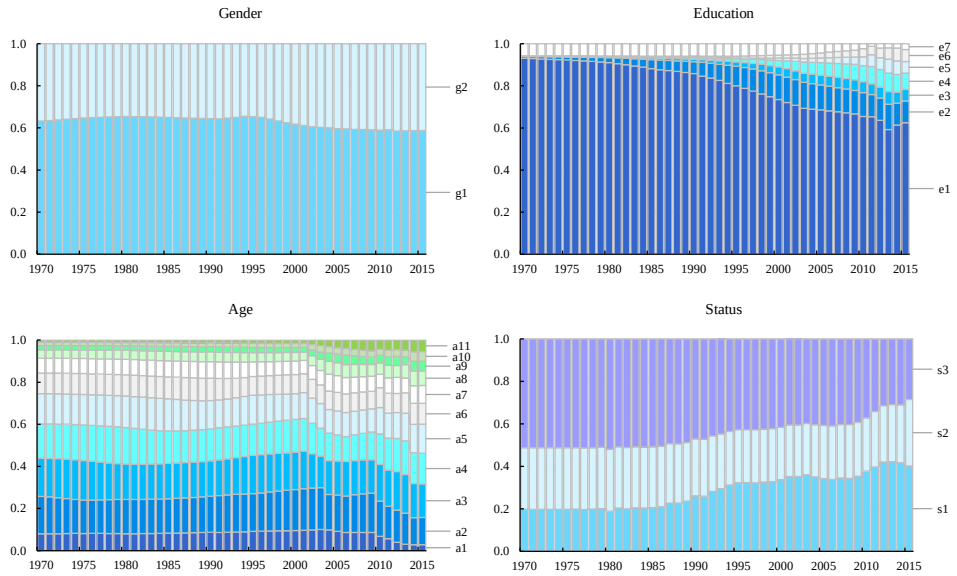

Figure 7: Employment Composition in Each Category in Bhutan

In the system of national accounts of Bhutan (BTN-SNA), data on COE is not available. Our measurement follows the COE estimate in 2007, which is published in the Use Table constructed in ADB (2012), as the benchmark estimate.[20] In the period 2009–2014, unpublished four-dimensional data of hourly wages for employees are available as presented in Table 7. Using these unpublished LFS data, the wage function for Bhutan was estimated in UNDESA (2016). Figure 8 provides the estimated results. Based on the estimated parameters in each labor category, we assume constant rates of relative wages for the whole period of our observation.

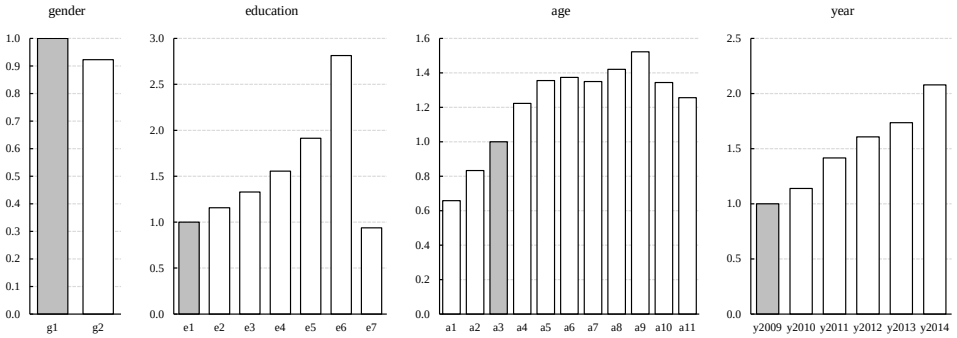

Figure 8: Estimated Wage Differentials in Bhutan
Source: UNDESA (2016).

The changes in nominal wages at the aggregate level in 2009–2014 follow the parameters

[20] The COE estimated in the ADB Use Table (ADB 2012) is divided by industries. Based on the examination in UNDESA (2016), however, the estimate in electricity industry seems too large, compared to the estimate based on the wage data reported by the Druk Green Power Corporation (DGPC) and the Bhutan Power Corporation (BPC), which are a producer of hydropower electricity and a distributor of electricity to households (3,457 million Nu in the ADB Use Table and 720 million Nu in the estimate in UNDESA). Thus in our measurement, some industry-level estimates of COE reported in ADB are replaced by the estimates developed in UNDESA.

for each year dummy variable in the estimated wage function, as shown in the final chart in Figure 8. In other years, nominal wages are extrapolated using the wage estimates in government sector (community, social and personal services) published in UNDESA (2016),[21] except for the period 1990–1999, in which the trend of CPI is applied as the wage trend. Figure 9 compares the growth rates of these data. Estimated labor share and COE share to GDP are presented in Figure 10. The labor compensations for own-account worker (s=2) and contributing family worker (s=3) are estimated based on the country-common assumption on the wage differential ratio of 0.2 between employees and non-employees in each group of labor inputs.

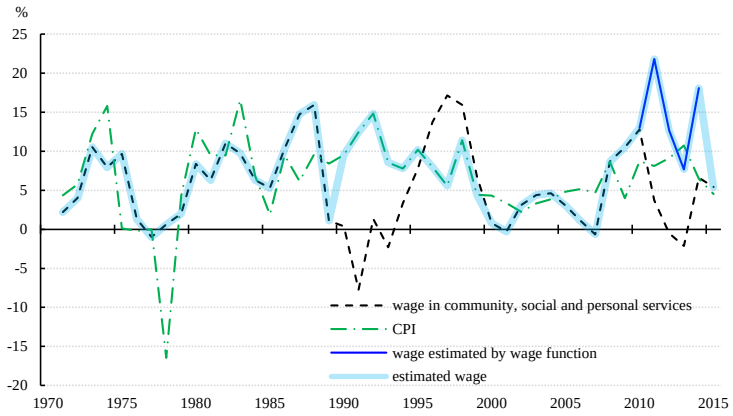

Figure 9: CPI and Hourly Wage in Bhutan

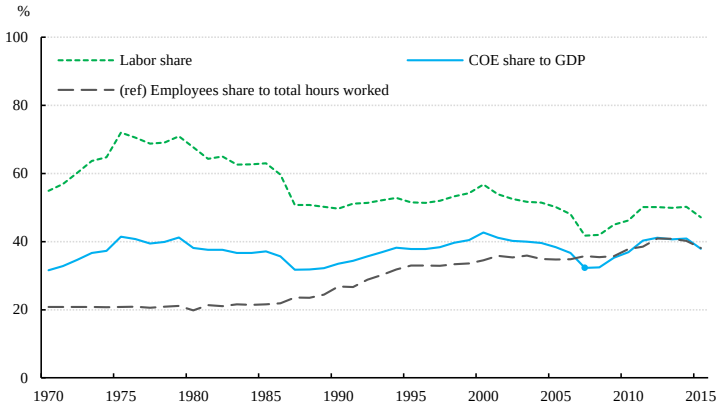

Figure 10: Labor Share in Bhutan

Note: The dot of the COE share indicates the year, in which the COE estimate is available in ADB (2012).

3.3 India

The list of our data sources for India is presented in Table 9. The main data sources are the decennial *Census of India* (COI) published by Office of the Register General & Census Commissioner, India (ORGI), Ministry of Home Affairs (MHA), and the *Employment and*

[21] The estimates for wages in government sector in UNDESA (2016) are based on the COE estimates published in BTN-SNA.

Unemployment Survey (EUS). The first systematic and modern COI was conducted in 1865, and the 2011 COI was the fifteenth round.[22] The *de facto* method employed until the 1931 COI had been one that the census was conducted throughout the country on a single night. However, due to its high cost and requiring an uneconomically large force of census takers, this method was replaced by an extended *de facto* method from the 1941 COI whereby the census data from every individual are collected door to door and using the same questionnaire over a period of three weeks. EUS in India is two surveys conducted at different intervals, which are implemented by different organizations. The quinquennial EUS is also named the *National Sample Survey* (NSS) and had been conducted by the National Sample Survey Office (NSSO), Ministry of Statistics and Programme Implementation (MOSPI), since 1972 until 2011,[23] while the annual survey has been carried out by Labour Bureau (LB), Ministry of Labour & Employment (MOL&E). The first EUS was conducted in 2009 and has been conducted five times so far.[24] In both NSS and EUS, two different concepts of labor force are used, which are the usual principal status (UPS) and the usual principal and subsidiary status (UPSS). The former includes in the labor force those who work or look for work during longer part of the 365 days preceding the survey, whereas the latter includes even those who are outside the labor force in the majority of time and have worked only some part of the year. In our measurement, UPSS is adopted to correspond to the concepts of SNA.[25] Based on these data and the COE estimates in the Indian System of National Accounts (ISNA), which is available for the whole period, the four-dimensional labor matrix is constructed.

Table 9: Data Sources in India

	Sources	Categories	Periods
N	Census of India (COI)	gea	1981, 91, 2001, 11
		ge, ga	1971, 81, 91, 2001, 11
	National Sample Survey (NSS)	ges	2004, 09
		gas, ga	1993, 2002, 04, 09
		ge	1983, 87, 93, 99, 2004, 09
		gs	1972, 77, 83, 87, 89-95, 97-2002, 04, 09, 11
		g	1972, 78, 83, 87, 89-95, 97-2002, 04, 07, 09, 11
	Employment and Unemployment Survey (EUS)	gs	2013, 15
D^w	National Sample Survey (NSS)	gs	2009
h^d_W	National Sample Survey (NSS)	gs_1	1983, 93, 99, 2004, 07, 09
Nhw	National Accounts (ISNA)	s_1(COE)	1970-2015

Note: D^w and h^dw are days worked in a week and daily wages, respectively. The Census of India is published by Office of the Register General & Census Commissioner (ORGC). The Employment and Unemployment Survey is conducted by the Labour Bureau (LB). Other sources are developed by the National Sample Survey Office (NSSO).

The labor data cross-classified by four categories are defined in Table 10. India is the only country studied that includes workers aged under 10 years old in the coverage of labor. It should be noted that unpaid family worker is not separately defined. In Indian labor statistics, employer

[22] The first COI was conducted by different parts of country in different years between 1865 and 1872. Since the second round, in 1881, the COI has been undertaken synchronously in the whole country.
[23] The subjects of NSS are not limited to only labor but also health, investment, industries, etc. The subjects are different in every round. The 1972 NSS is 27th round and the 2011 NSS is 68th round. Here, the quinquennial survey is called NSS and the annual survey is called EUS to distinguish between them.
[24] In 2011 both NSS and EUS are conducted. Their sample size are 101,724 and 128,298 and labor force participation rates are 51.6% and 52.9%, respectively.
[25] In measurements of labor inputs in Visaria (1998) and the India KLEMS published by the India Reserved Bank (Das, et al. 2015), UPSS is applied.

and unpaid family worker (also named as a helper in household enterprise) are included in the self-employed. In contrast, casual labour is separately defined as a worker who casually engages in farm or non-farm enterprises run by others and earns wage for daily or periodic work. Our data for India consists of $2 \times 7 \times 11 \times 3 = 462$ groups.

Table 10: Classes in Labor Categories in India

Period (t)	1970-2015
Gender (g)	1) Male, 2) Female
Education attainment (e)	1) Not Literate, 2) Literate & up to primary, 3) Middle, 4) Secondary, 5) Higher secondary, 6) Diploma/ Certificate, 7) Graduate & above
Age (a)	1) 0-14, 2) 15-19, 3) 20-24, 4) 25-29, 5) 30-34, 6) 35-39, 7) 40-44, 8) 45-49, 9) 50-54, 10) 55-59, 11) 60 and over
Employment status (s)	1) Regular/Wage salaried employees 2) Self-employed, 3) Casual labour

Figure 11 compares the estimates of the number of workers at the aggregate level in COI, India KLEMS, and our estimate. In NSS and EUS, the aggregate data is published only in the form of employment-to-population ratio, which is not directly comparable with other statistics. Our estimates are developed based on the data derived from NSS and EUS, using the COI estimates to provide the information on labor compositions. The discrepancies between our estimates and COI stem from the omission of some regions from COI and possibly a difference in the concept of labor force used as the COI estimates seem closer to the number based on UPS rather than UPSS.

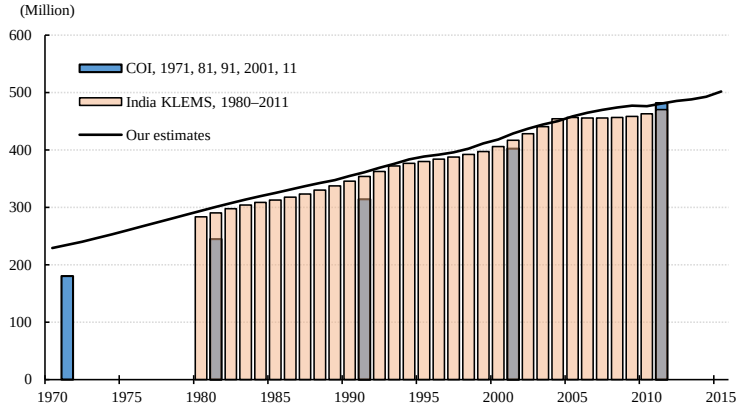

Figure 11: Number of Total Employment in India

Since no surveys provide any data on hours worked, our four-dimensional hours data are estimated based on the assumption that hours worked per day are 8 hours regardless of labor categories of each worker.[26] On top of that is another assumption to take into account of the

[26] For workers aged under 10 years old only, 6 hours is applied as the assumed hours worked. In addition, days worked per week is assumed in our estimates and different number of days is applied to groups in gender and employment status. For example, hours worked for male employees, male self-employed, and male casual labour, are assumed to be 6.5, 6, and 6 days per week, respectively. And for female, days worked for each employment status are assumed to be 5.5, 6, and 5.5 days, respectively.

effect of monsoon on hours worked. In India, their works, especially in agriculture, are restricted in monsoon season (June to August). Thus in these three months, hours worked for the self-employed and casual labour, the majority of whom are engaged in agriculture, are assumed to be two-thirds of other months.

The compositional changes in the number of workers in each category are presented in Figure 12. In contrast to the trends in other South Asian countries, the female share has been gradually decreasing from 32–34% in the 1970s and the 1980s to 27% in the first half of the 2010s. One reason that discourages women to work is pointed out as "India's conservative social values" in the Financial Times (2015). Traditionally, the majority of women have not worked outside of household, except for those who are the poorest or the most privileged. The poorest women have the necessity to work for survival and the privileged women have the opportunities to have high level education and skills. However, for most of the women, there are only few opportunities and motivations, since Indian men consider having wives who do not work outside home as a positive social indication of their sufficient financial resources. Since female social rights are still disregarded in India, many wives are under pressure to stay home and to look after their children or aging in-laws. The Financial Times (2015) concludes that "with the decline of abject poverty, more and more women are opting out of the labour market, especially if they see available jobs as beneath their dignity."

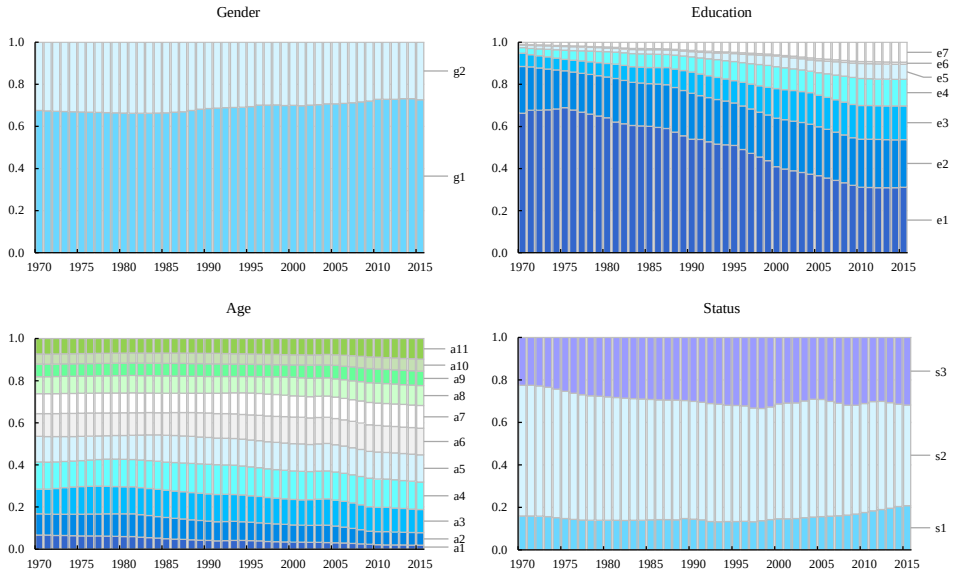

Figure 12: Employment Composition in Each Category in India

In the years 1983, 1993, 1999, 2004, 2007, and 2009, data for daily wages are available in NSS. Using these wage data and our estimates of hours worked, COE is estimated. Figure 13 compares two kinds of our estimates, including or excluding casual labour (s=3) in employees, against the official COE estimates published in ISNA. In the case where casual labour is excluded from employees, our estimates accounts for 43% of the COE estimates in ISNA at the

highest in 1999. The corresponding figure when causal labor is included is 69% in the same year. In the ILO estimates on the number of workers, where employment status is divided into employees, employers, own-account workers, and unpaid family workers, the sum of employees and employers is close to the number of regular/wage salaried workers in our estimates. Following the ILO definition, our measurement assumes the former case that excludes casual labour from employees. One factor that may have contributed to the considerable wedge between our COE estimates and the official figures is the exclusion of over-time payments from NSS. Given that this may explain only a small portion of the discrepancy, the totals of our COE estimates are reconciled to its official counterparts published in ISNA by adjusting the nominal wages in our system.

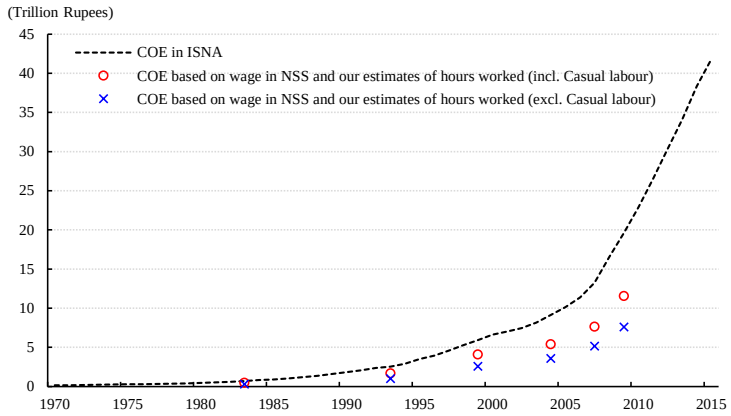

Figure 13: COE Estimates in India

For the years in which data of wages by-gender for employees (w_{gs_1}) is available in NSS, the wage matrix with three dimensions (w_{geas_1}) is constructed by combining those wage data with the relative wage information from the estimated wage function in Bhutan (see Appendix A.2). For the other years, the relative wages are interpolated linearly or are extrapolated assuming relative wages measured in the nearest period as constant. The estimated shares of labor compensation and COE to GDP are presented in Figure 14, based on the country-common assumption on the wage differential ratio of 0.2 between employees and non-employees in each group of labor inputs.[27]

[27] The wage differential ratio is applied for self-employed only. For casual labour, the wage rates for employees are employed in each group of labor.

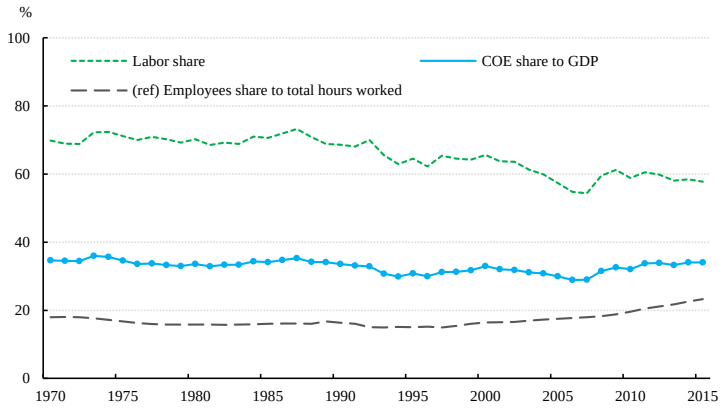

Figure 14: Labor Share in India

Note: The dots on the COE share line indicate the years in which the official COE estimates are available.

3.4 Nepal

The data used for constructing the labor matrix in Nepal are listed in Table 11. Two sources of primary labor statistics are available in Nepal: the *National Population and Housing Census* (NPHC) and the *Labor Force Survey* (LFS), both are conducted by the Central Bureau of Statistics (CBS). The first NPHC was conducted in 1911, and they have been implemented in a decennial basis until 2011, except for the fifth NPHC, which was conducted in 1952 being the first in adopting the internationally comparable concepts, definitions, and classifications. LFS has been conducted only twice so far, in 1999 and 2008. As a part of the Ninth Five-Year Plan of Nepal (1997–2002), the first LFS was launched to ease poverty by facilitating skills enhancement and rural development. The sample size of the 1999 LFS is 14,355 households and 71,560 persons out of 3.74 million households and 19.1 million persons.[28]

Table 11: Data Sources in Nepal

	Sources	Categories	Periods
N	National Population and Housing Census (NPHC)	gas	1971, 81, 91, 2001, 11
		ge	1971, 81, 91, 2011
	Labour Force Survey (LFS)	ga, ge	1999, 2008
h^w	Labour Force Survey (LFS)	ges, gas	2008
		ga, g	1999, 2008
$h^m w$	Labour Force Survey (LFS)	gs_1	1999, 2008
Nhw	National Accounts (NSNA)	s_1(COE)	2000-15

Note: h^w and $h^m w$ are average hours worked per week and monthly wages per person, respectively. All data are developed by the Central Bureau of Statistics (CBS).

The Nepalese System of National Accounts (NSNA), which is still based on the 1993 SNA, provides the official COE estimates only for the period 2000–2015. Based on NPHC, LFS, and the COE estimates in NSNA, labor data cross-classified by four categories defined in Table 12 are constructed. In our data for Nepal, labor input is classified into $2 \times 5 \times 11 \times 3 = 330$

[28] The CBS recognizes the sample size in the 1999 LFS is not big enough for fully reliable results. According to their analysis of the 1999 LFS, three times of the sample (approximately 50,000 households) was required for obtaining reliable results. In the second round of LFS, however, the sample size was limited to 16,000 households.

groups. Note that the classifications in the category of educational attainment are based on the current education system in Nepal, although they have been revised several times during our observation period.[29]

Table 12: Classes in Labor Categories in Nepal

Period (t)	1970-2015
Gender (g)	1) Male, 2) Female
Education attainment (e)	1) Never attended/less than primary, 2) Primary (class1 to 5), 3) Secondary (class 6 to 10) 4) Higher-secondary (class 11 to 12), 5) Degree level
Age (a)	1) 10-14, 2) 15-19, 3) 20-24, 4) 25-29, 5) 30-34, 6) 35-39, 7) 40-44, 8) 45-49, 9) 50-54, 10) 55-59, 11) 60 and over
Employment status (s)	1) Employer, employee, 2) Own account worker, 3) Unpaid family worker

Labor inputs in both NPHC and LFS include workers engaged in extended economic activities, which are activities to produce goods consumed within the household.[30] In Figure 15, female employment-to-population ratios are compared among the South Asian countries. The Nepalese ratio based on the official broad definition seems to be somewhat higher than those in other five countries in the region. This is similar to the case in Bangladesh, in which we have the usual and the extended definitions of workers (see section 3.1). In our measurement, some female workers who belong to extended economic activities in Nepal are redefined to be excluded from the definition of workers. Since the two-dimensional data (N_{ga}) on the number of the workers engaged in extended economic activities is available only in the 2001 NPHC, this share is held constant, for the whole period of our observation, to identify the number of workers in the extended sector in each *ga*-group. Some workers in extended activities should be counted within the boundary of labor inputs. Since the details of engaged activities are not available in NPHC, the ratio estimated in Section 3.1 for Bangladesh is employed for female workers in extended activities. As can be seen in Figure 15, the adjusted female employment-to-population ratio is higher than those in other countries in the region for the whole period.

[29] In Nepal, the compositions of schooling years among primary school, lower secondary school, and secondary school have been revised four times since 1951. In 1951–1970 the 5+2+3 composition system was employed. It was revised to 3+4+3 for the period 1971–1980, reverted back to the 5+2+3 system for 1981–1991, and settled at 5+3+2 from 1992 to date. In our classifications for educational attainment, lower secondary school and secondary school are grouped to one class (e=3). Therefore, none of the revisions makes a material difference to our definitions except the one implemented in 1970–1971 which can result in inconsistency. However, the effect of such misclassification seems to be negligible as shown in Figure 17.

[30] "The 1993 SNA concept has been introduced in the 2001 census and the activities like the production of goods consumed within the household, collecting fuelwood and fetching water, has been dragged in inside the production boundary of economic activities. These additional activities included in the traditional type of economic activities are termed as "extended" economic activity." (NPHC, 2001)

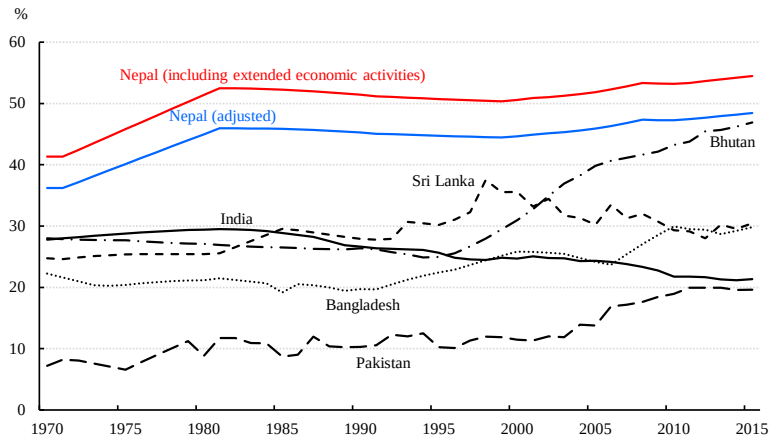

Figure 15: Female Employment-to-Population Ratios in South Asian Countries

Figure 16 shows the survey data on the number of workers at the aggregate level (i.e. NPHC and LFS) against our estimates and the ILO estimates (ILO 2015). Our estimates are benchmarked to NPHC results after our adjustments on the workers engaged in extended economic activities up to and including the 2001 NPHC. We deviate from this practice for the latest NPHC in 2011, in which the reported total number of workers at 9.93 million is almost unchanged from the 9.90 million in the 2001 NPHC whereas the ILO estimates depict a steady upward trend during the decade under concern. Therefore, the results of the 2011 NPHC are used only to provide labor compositions in our measurement. From 2001, the number of workers is extrapolated using the LFS estimates in 1999 and 2008 and the auxiliary employment data (N_{gea}) we developed based on the data on population and labor force (see Appendix A.1). Compositions of the estimated number of total employment in each category are presented in Figure 17.

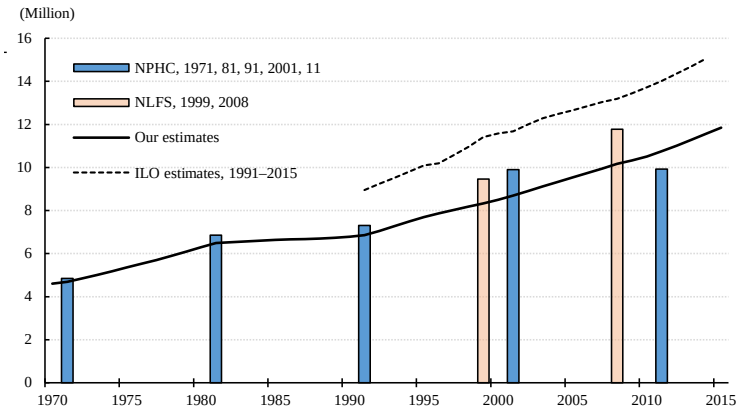

Figure 16: Number of Total Employment in Nepal

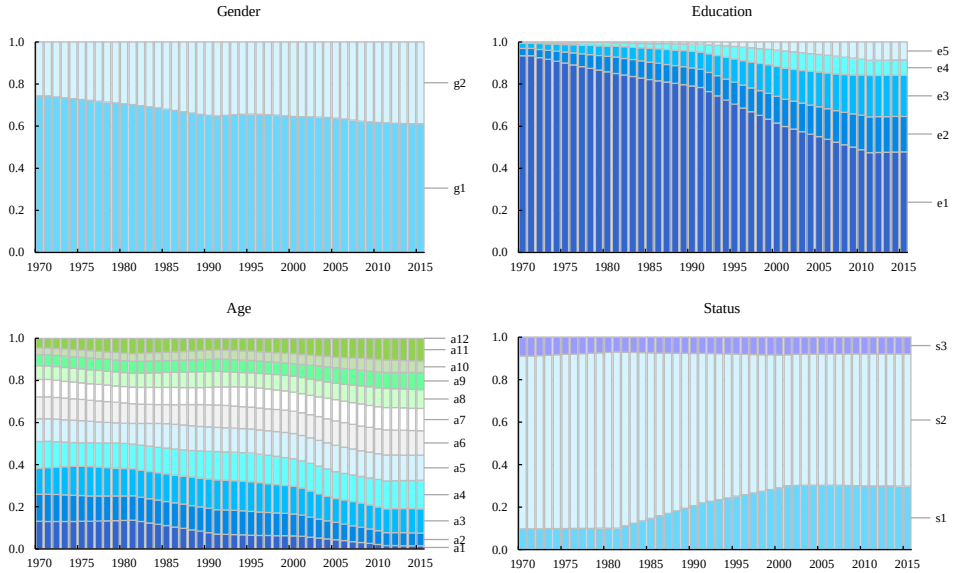

Figure 17: Employment Composition in Each Category in Nepal

The LFS provides the income data by gender for employees (w_{gs_1}) in 1999 and 2008 as presented in Table 11. In Figure 18, our COE estimates based on our hours worked and the LFS wage data for 1999 and 2008 are compared against those in the NSNA covering the period 2000–2015. Our estimate for 2008 is 47% below the COE figure in the NSNA; the sources for the discrepancy are unclear. In our measurement, the nominal wages are adjusted so that the totals of our COE estimates are reconciled with the NSNA.[31] In the periods when one-dimensional wage data for employees (w_{gs_1}) are available in LFS, i.e., 1999 and 2008, the wage matrix with three dimensions (w_{geas_1}) is constructed by using those wage data and the relative wage information from the estimated wage function in Pakistan (see Appendix A.2).[32] For the non-LFS years, constant relative wages are assumed.

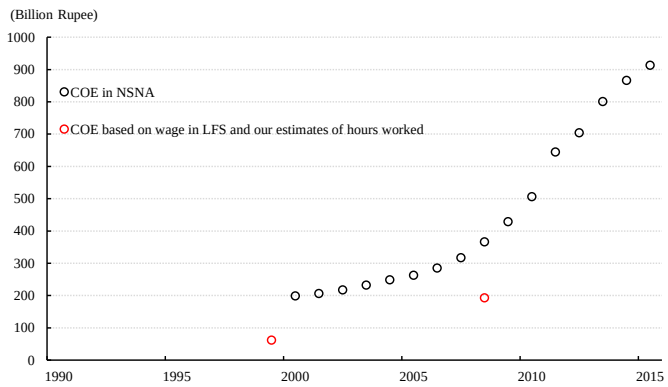

Figure 18: COE Estimates in Nepal

[31] The definition of income in LFS includes both earnings paid in cash and in kind, bonuses, and tips. And those earnings are values before the deduction of tax, social security, or pension payments.
[32] According to the notations in Table 2, the estimation method for 1999 and 2008 is described as $D_{11,3}$.

In the period 1970–1999, we assume that the growth rates of average hourly wages are identical with the growths in GDP deflator at the aggregate level. This approximation is derived from a comparison of both measures in the period 2000–2015.[33] Finally our estimates of the labor share and COE share in GDP at basic price is presented in Figure 19. Labor compensations for own account worker (*s*=2) and for unpaid family worker (*s*=3) are estimated based on the country-common assumption on the wage differential ratio of 0.2 between employees and non-employees in each group of labor inputs.

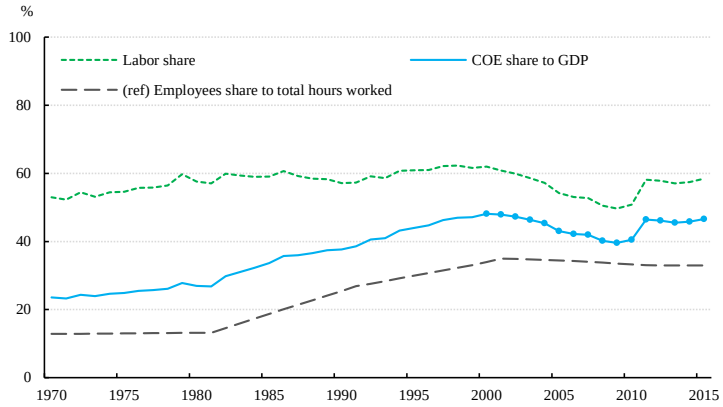

Figure 19: Labor Share in Nepal

Note: The dots on the COE share indicate the years in which the official COE estimates are available.

3.5 Pakistan

The data used for constructing the labor matrix in Pakistan are listed in Table 13. Two major sources of primary statistics are available in Pakistan: the *Population Census* (PC), and the *Labour Force Survey* (LFS). Both of them are conducted by the Pakistan Bureau of Statistics (PBS). After gaining independence from India in 1947, PC has been carried out five times. The frequency was almost once a decade in the 20th century but after the 1998 PC, it was not implemented until 2017.[34] LFS has been implemented on an annual basis since its launch in 1963 by the Federal Bureau of Statistics (FBS), which was the predecessor of PBS. LFS covers all areas of Pakistan except the Federally Administered Tribal Areas (FATA)[35] and the military restricted areas, in which about 2% of total population is estimated to be accounted for, according to the 2014 LFS. The sampling frames are constructed based on PC and in the 2014 LFS, 42,292 households are selected from 2,949 enumeration blocks. In addition to these sources, the *Census of Manufacturing Industries* (CMI), which is also conducted by PBS, is used as auxiliary data to estimate wage data in our measurement.

[33] The growth rates of GDP deflator and hourly wage are 8.1% and 7.2%, respectively, in 2000–2015. As an approximation, an identical trend is assumed in our measurement.
[34] The 2017 PC was implemented in March 2017, but the results have not yet been published.
[35] The FATA consists of seven tribal agencies, which have been in existence since the period of British rule, and six frontier regions. The Constitution of Pakistan provides that legislative powers of the National Assembly of Pakistan and the provincial assemblies do not apply to the FATA.

Table 13: Data Sources in Pakistan

	Sources	Categories	Periods
N	Population Census (PC)	gea	1981
		gas	1998
		gs	1981, 98
	Labour Force Survey (LFS)	ges	1993-94
		ge	1988, 91-94, 2002, 04, 06-11, 13
		ga	1970-72, 75, 79, 85-88, 91-93, 98, 2000, 02, 04, 07-11, 13
		gs	1988, 91-2011, 13-14
		g	1970-72, 75, 79, 85–88, 91-95, 97-98, 2000, 02, 04, 06-11, 13-14
		s	1971-72, 75, 79, 85-88, 91-2011, 13-14
h^w	Labour Force Survey (LFS)	gs, g	1998, 2000, 02, 06-11, 13
		s	1979, 83, 85-88, 91-94, 97,98, 2000, 02, 04, 06-11, 13-14
h^W	Labour Force Survey (LFS)	geas	1991-95, 97-98, 2000, 02, 04, 06-11 (custom-made)
$h^m w$	Labour Force Survey (LFS)	$geas_1$	1991-95, 97-98, 2000, 02, 04, 06-11 (custom-made)
		s_1	1991-95, 97-98, 2000, 02, 04, 06-11, 13-15
	Census of Manufacturing Industries	s_1 (manufacturing)	1970-84, 87-88, 91, 96, 2001, 06
Nhw	Experimental Input-Output Table of Pakistan	s_1(COE)	2000

Note: h^w is average hours worked per week. $h^m w$ indicates monthly wages per person. Experimental Input-Output Table of Pakistan is constructed in Burki, Hussain, and Khan (2016). Other data are developed by the Pakistan Bureau of Statistics (PBS). Monthly wage data provided by CMI in 1972–75, 1977, 1980, and 1982–1984 are limited only in Punjab. Data on the number of workers in armed forces is observed in the *Military Balance* published by the International Institute of Strategic Studies (IISS).

By our request for this project to develop QALI for Pakistan, PBS provided the unpublished LFS data with four-dimensions on weekly average hours worked per worker (h^w_{geas}) and monthly income per worker for employee ($h^m w_{geas_1}$) covering the period 1991–2011.[36] In our data for Pakistan, each labor input measure is classified into $2 \times 4 \times 11 \times 3 = 264$ groups, as presented in Table 14.

Table 14: Classes in Labor Categories in Pakistan

Period (t)	1970-2015
Gender (g)	1) Male, 2) Female
Education attainment (e)	1) Illiterate, 2) Below matric, 3) Matric but below degree, 4) Degree and above
Age (a)	1) 10–14, 2) 15–19, 3) 20–24, 4) 25–29, 5) 30–34, 6) 35–39, 7) 40–44, 8) 45–49, 9) 50–54, 10) 55–59, 11) 60 and over
Employment status (s)	1) Employees, employers, 2) Own account workers, 3) Contributing family workers

In Figure 20, survey data on the numbers of workers from PC and LFS are compared with our estimates and the estimates in ILO (2015). Survey results from the two data sources diverge considerably and the contributing factors to the gap are not apparent. ILO estimates are more in line with the LFS series than with the PC series, which is significantly lower. . In our measurement, the LFS estimates are used as the controlled totals of the labor matrix to be estimated. In addition, the armed forces, which are omitted from LFS, are included for international comparisons. Data on the number of workers in the armed forces are based on the *Military Balance* published by the International Institute of Strategic Studies (IISS). In the years, when no data is available, the number of workers is interpolated by using the auxiliary employment data (N_{gea}) we developed based on data on the population and the labor force (see Appendix A.1).

[36] This custom-made data in the LFS was purchased from Mr. Shaukat Ali at PBS, at KEO, Keio University in January 2012.

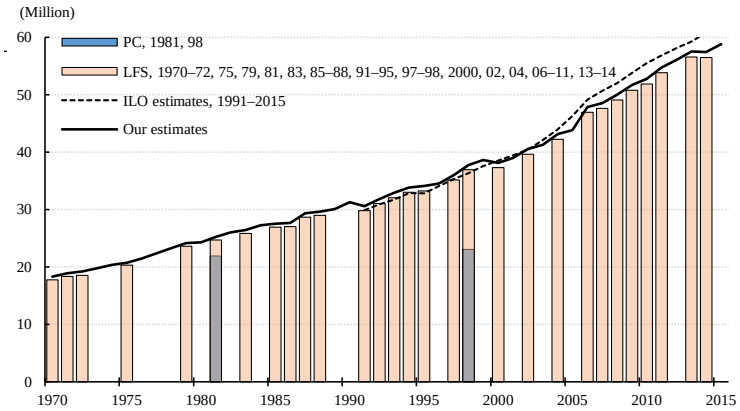

Figure 20: Number of Total Employment in Pakistan

Compositions of the number of workers in each category are presented in Figure 21. In Pakistan, as a common characteristic shared by most Islamic countries, the female share in total employment is extremely low by the international standard. Although it has been rising steadily from 7% in 1970 to 22% in 2015, this is the lowest share among the South Asian countries, compared with, for example, 27% in India and 30% in Bangladesh. According to ILO (2013), the existing social norms are one factor that represses female labor participation in Pakistan, in addition to low level of educational attainment, delay of urbanization, and so on. In Pakistani society, according to ADB (2016), "men are seen as the primary breadwinners" and "women's work is generally actively stigmatized." As women's choice of whether to work outside home is restricted by other family members, such as their husbands or the in-laws, ADB (2016) reports that women "do not even play a role in deciding to seek paid employment." The rise in female labor participation appears to have gathered some momentum in the 2000s, a phenomenon, according to ILO, mainly owing to an improvement in education and a decline in the fertility rate.[37]

The COE data in the experimental input-output table for the year 2000 in Burki, Hussain, and Khan (2016) is used to benchmark our estimates. Prior to 2000, PBS has complied three IOTs in 1985, 1990, and 1991, in which the COE shares in GDP are estimated as 21.5%, 24.0%, and 24.2%, respectively. However, these estimates are considerably lower than the 2000 benchmark estimate of 36.8% and the labor shares, in which the compensations of own-account workers and contributing family workers are added, are smaller than the estimates in other South Asian countries.[38] Alternatively, LFS data on monthly wage of employees ($h^m w_{s_1}$) are available during 1991–2015 and are used to check the COE estimates in 1991. Our extrapolation based on the changes in monthly wages in LFS and the 2000 benchmark estimate of COE suggests a share of 44.8% in 1991, which is 20.6 percentage point higher than the estimate in the 1991 IOT by

[37] The female employment-to-population ratio estimated in our measurement has risen to 20% in 2015, from 7% in 1970. Meanwhile, the fertility rate, according to the World Bank (2016), decreased from 7 children per woman in 1970 to 3 children per woman in 2015.

[38] Figure 38 in section 4 compares our final estimates of labor shares among countries.

PBS. Therefore, for the periods when the monthly wages in LFS are available, i.e., 1991–2015, the extrapolated COE estimates are used.[39]

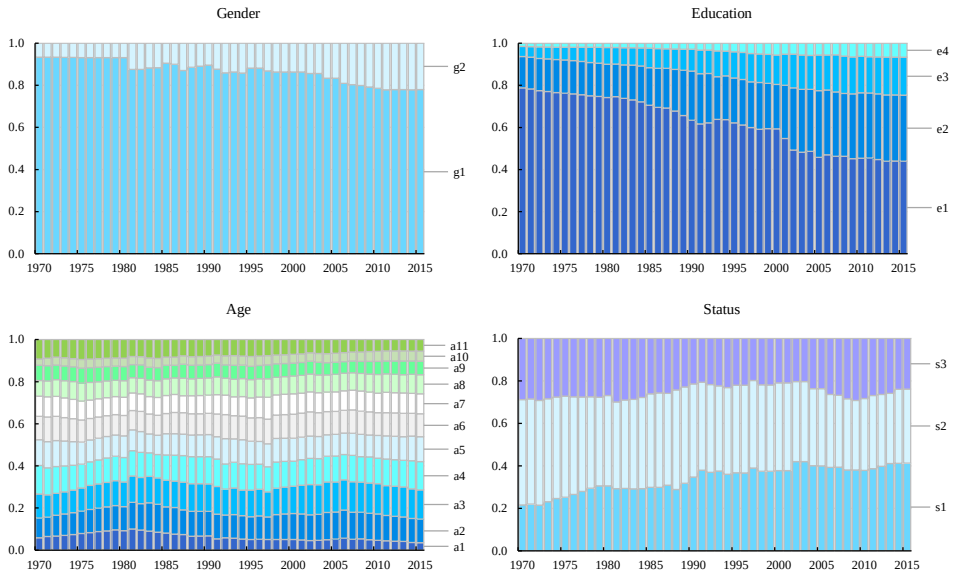

Figure 21: Employment Composition in Each Category in Pakistan

In 1970–1990, although there is no LFS, data on monthly wages are available from CMI for workers engaged in manufacturing industries.[40] In 1970–1991, CMI hourly wages increases faster than GDP deflator by 5.7 percentage points per year on average. Considering that the difference in the growth rates between LFS hourly wages and GDP deflator is only 0.9 percentage points per year in 1991–2015, it suggests that the wage increases in manufacturing sector may exceed those in the whole economy. Taking everything into account, we approximate the hourly wage growth for the whole economy at 2 percentage points lower per year than that in the manufacturing sector in 1970–1991. Figure 22 compares the growth rates of hourly wages from LFS, CMI and our estimates against GDP deflator.

[39] Although LFS is the annual survey, it was not implemented in 1996, 1999, 2001, 2003, 2005, and 2012. For these periods, nominal wages are interpolated using GDP deflator.
[40] CMI data for 1985, 1986, 1989, and 1990 are not available. For these periods, monthly wages are interpolated using GDP deflator.

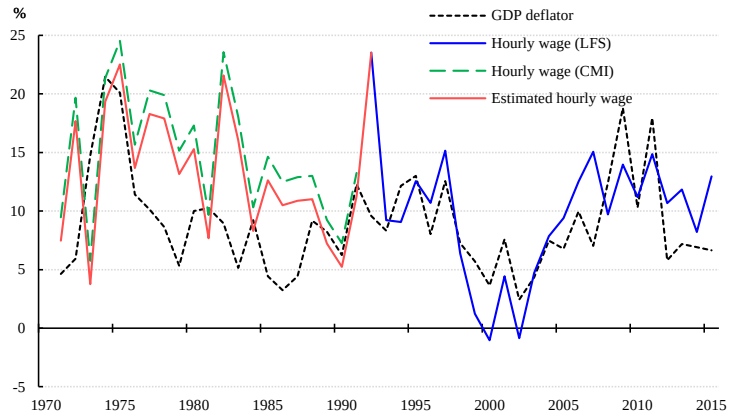

Figure 22: GDP Deflator and Hourly Wage in Nepal

Note: Average growth rates of GDP deflator and hourly wage during 1991–2015 are 8.8% and 9.7%, respectively.

Custom-made data for a wage matrix provided by PBS are available for 1991–2010, except for the years of 1996, 1999, 2001, 2003, and 2005. However, they display a great deal of volatility at the elementary level. To avoid these fluctuations in relative wages over periods, our measurement uses the estimated parameters of the wage function (Table 20 in Appendix A.2). Figure 23 provides the estimated results of the wage function. The estimated parameters are used over the whole period to provide the information on relative wages among different classes in each labor category.

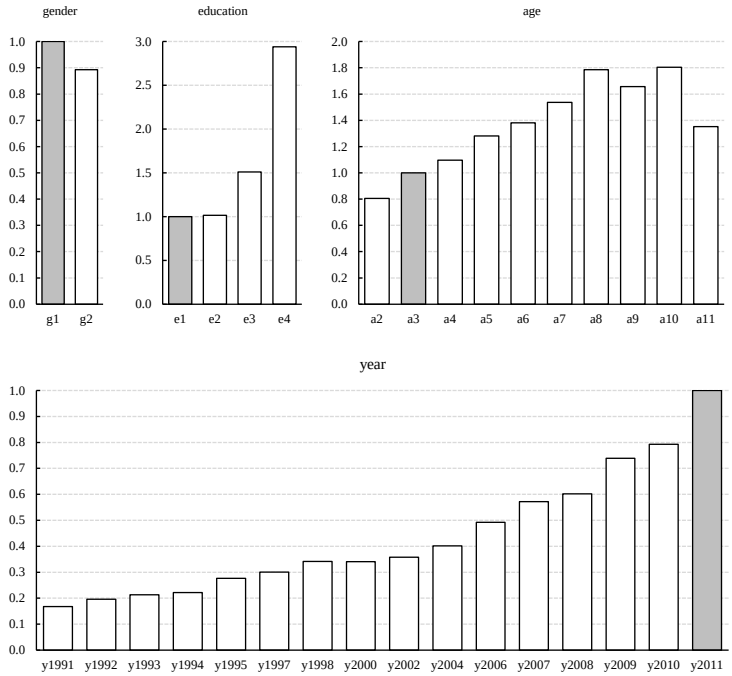

Figure 23: Estimated Wage Differentials in Pakistan

Note: See Table 14 for the classification of labor categories in Pakistan.

The estimated shares of labor compensation and COE to the basic-price GDP at current

prices are presented in Figure 24. The compensation of own-account worker (s=2) and unpaid family helper (s=3) are estimated based on the country-common assumption on the wage differential ratio of 0.2 between employees and non-employees in each group of labor inputs.

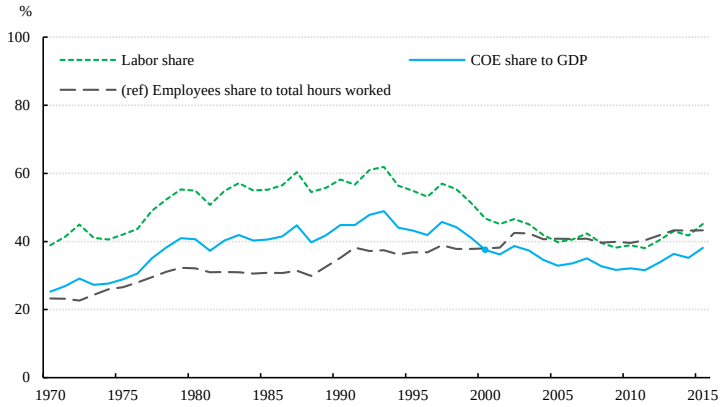

Figure 24: Labor Share in Pakistan

Note: The dot on the COE share indicate the year in which the estimated data is available from the experimental input-output table in Burki, Hussain, and Khan (2016).

3.6 Sri Lanka

The data used for constructing the labor matrix in Sri Lanka are listed in Table 15. Two sources of primary statistics are available in Sri Lanka: the *Census of Population and Housing* (CPH) and the *Labour Force Survey* (LFS), both are conducted by the Department of Census and Statistics (DCS). Sri Lanka's first CPH was conducted in 1871, which was also the first population census in South Asia. The regularity in the timing and coverage of the decennial CPH in Sri Lanka was interrupted by war and conflicts for the periods of World War II and the civil war (1983–2009). Understandably the civil war between the government and the Liberation Tigers of Tamil Eelam (LTTE) raised security concerns in the country. Consequently the 13th census in 2001 covers only 18 districts out of 25 as the Northern and Eastern regions were dominated by LTTE. After the end of the civil war in 2009, the 14th CPH in 2012 reverted to a full coverage for the first time in 31 years.

Table 15: Data Sources in Sri Lanka

	Sources	Categories	Periods
N	Census of Population and Housing (CPH)	gas, ga	1971, 2012
		ge	1971
		gs	1971, 81, 2012
		g	1971, 81, 2012
		s	1971, 81, 2012
	Labour Force Survey (LFS)	gea	2011–12
		ga, ge, gs	1990–2015
		g	1981, 85, 90-2015
h^w	Labour Force Survey (LFS)	g	1999–2014
		e, a	2002–11
w	Labour Force Survey (LFS)	gs_1	1997–2008
$h^m w$	Labour Force Survey (LFS)	gs_1	2002–11, 13–14
		es_1, as_1	2002–11
Nhw	National Accounts (SRI-SNA)	s_1(COE)	1973-76, 81-2002, 10-15

Note: h^w and $h^m w$ are average hours worked per week and monthly wages, respectively. LFS data on hourly wage (w) is derived from the ILOSTAT database developed in ILO, the definition of which excludes those in the industries of electricity, gas and water, financing, insurance, real estate and business services, and community, social and personal services. LFS publications provide data on $h^m w$ only. All other data is published by the Department of Census and Statistics (DCS).

LFS is a sample survey conducted on a quarterly basis since the first quarter of 1990. The civil war has had the same concomitant effect on LFS as on PHC of restricting the geographic coverage of the survey. In the period 1990–2007, the coverage excluded both Northern and Eastern provinces. In 2008, the coverage was extended to include Eastern provinces and since 2011 full geographic coverage has been implemented. LFS started with a sample size of 2,000 households, which has been consistently enlarged in order to obtain more precise estimates at the district level. In the latest LFS, the annual sample size reaches 25,000 households. Based on these data and the COE estimates in the Sri Lanka's system of national accounts (SRI-SNA), labor data cross-classified by four categories defined in Table 16 are constructed. The number of labor groups in Sri Lanka is $2 \times 5 \times 12 \times 3 = 360$ in our measurement. SRI-SNA has been compliant with the 2008 SNA (United Nations 2009) since 2016 and revisions on COE are backdated to 2010. The COE estimates in SRI-SNA based on the 1993 SNA are available in the periods 1973–1976 and 1981–2002, and the impact of shifting to the 2008 SNA is significant as shown by the difference in the shares of COE to GDP at basic price before and after the changeover (i.e., 47% in 2002 versus 29% in 2010).

Table 16: Classes in Labor Categories in Sri Lanka

Period (t)	1970-2015
Gender (g)	1) Male, 2) Female
Education attainment (e)	1) No Schooling, 2) Grades 1-5, 3) Grades 6-10, 4) G.C.E.(O/L), 5) G.C.E.(A/L), Degree & above
Age (a)	1) 10-14, 2) 15-19, 3) 20-24, 4) 25-29, 5) 30-34, 6) 35-39, 7) 40-44, 8) 45-49, 9) 50-54, 10) 55-59, 11) 60-64,
	12) 65 and over
Employment status (s)	1) Employee, employer, 2) Own account workers, 3) Contributing family worker

Note: In category of educational attainment, G.C.E (O/L or A/L) stands for General Certificate of Education (O-Level or A-Level). And G.C.E (O/L) is certification required for entrance to senior secondary school. Also G.C.E (A/L) is necessary for entering college or university.

In Figure 25, the number of workers in our estimates is compared with the estimates from the primary data sources, namely CPH and LFS, which have different geographic coverages. LFS did not achieve a full coverage until 2011, when the Northern and Eastern province were included for the first times. According to the LFS survey results in 2011, employment in those previously excluded provinces was almost 787 thousand (or 10.4% of the total employment). In our measurement, the post-2011 LFS estimates are used as the baseline estimates. For other LFS years of 1990–2010, the number of workers in the excluded provinces is estimated and added by assuming constant shares of employment in these provinces in the total employment.[41] In the period 1970–1989, when LFS is not available, the CPH estimates in 1971 and 1981 and the auxiliary employment data (N_{gea}) developed based on data on the population and the labor force (see Appendix A.1) are used for interpolation/extrapolation.

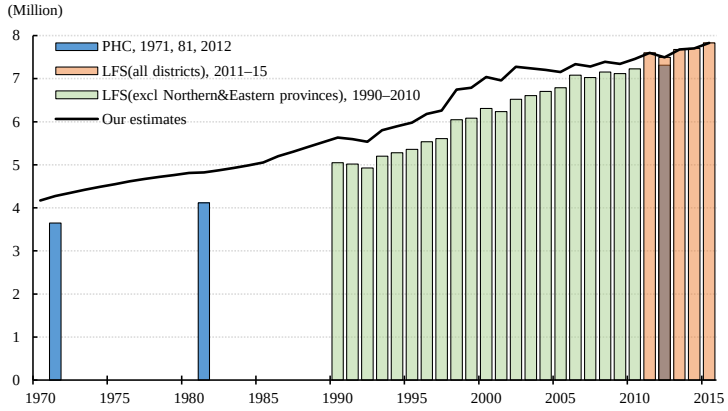

Figure 25: Number of Total Employment in Sri Lanka

Compositions of workers in each category are presented in Figure 26. It is one of the outstanding properties of the labor supply in Sri Lanka among the South Asian countries that workers with an educational level of junior secondary (e=3: grades 6-10) or above account for about 40% of the total labor supply as of the beginning year of our observation period. Free education from kindergarten to university has been provided since the 1940s, and junior secondary level education has been compulsory since the educational reform in 1971. However in higher education, the rate of expansion is slower than that in the lower level education, due to the quota of university entrance and the difficulty to enter graduate university.[42] Another property in the employment matrix in Sri Lanka is that the employees' share in total employment was shrinking in the 1980s. This trend in Sri Lanka is unique in our measurement covering South Asia.

[41] In the period 2008–2010, only Northern province is excluded. In this period, the share of employment in this province is assumed as constant at 4.2% of the total employment, which is the ratio observed in 2011.
[42] According to the Sri Lanka University Statistics conducted by the University Grants Commission, although the total number of undergraduate enrollment in university was 86 thousand in 2015, the number of graduates in the same year was only 28 thousand.

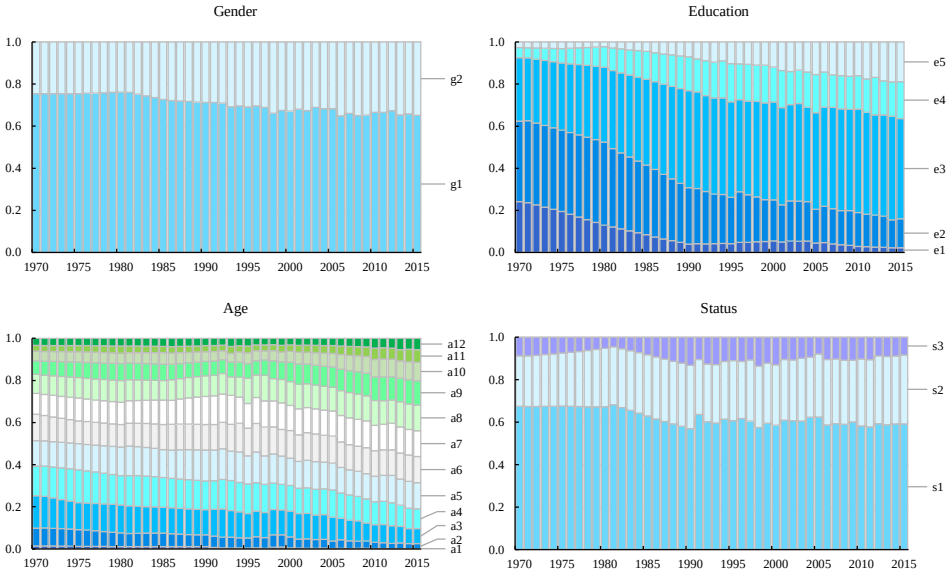

Figure 26: Employment Composition in Each Category in Sri Lanka

In the period 2002–2011, LFS provides three kinds of one-dimensional wage data for employees (w_{gs_1}, w_{es_1}, and w_{as_1}). Setting these data as constraints, three dimensional wages are estimated (described as $D_{11,1}$ in Table 2). In the periods 1997–2001 and 2013–2014, in which only one of one-dimensional wage data (w_{gs_1}) is available, three-dimensional wages are constructed using those data and the estimated relative wages from the period 2002–2011 ($D_{11,2}$ in Table 2). For the other years, constant relative wages are assumed in our measurement. Based on the wage data observed in LFS and our estimates of hours worked, COE is estimated. In Figure 27, our COE estimates and the official COE estimates in SRI-SNA are compared. Our estimates are only 46% of the official estimates based on the 1993 SNA on average in 1997–2002 and 43% of estimates based on the 2008 SNA in 2010–2014. In our measurement, the nominal wages are adjusted so that the totals of our COE estimates are reconciled to the official COE figures in SRI-SNA.

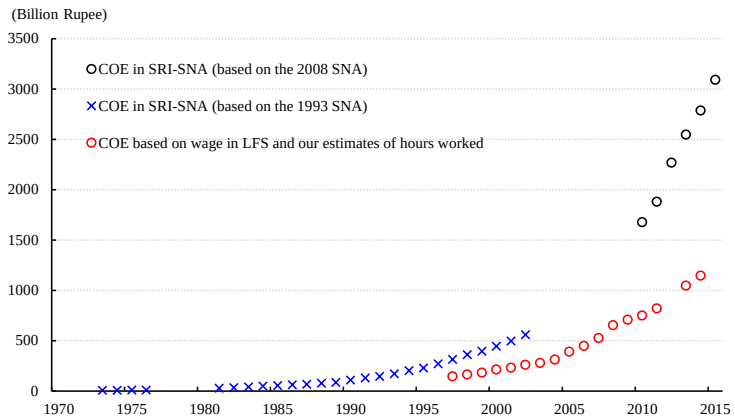

Figure 27: COE Estimates in Sri Lanka

The nominal trend of hourly wage at the aggregate level are estimated using the COE estimates in SRI-SNA when they are available, i.e. for the periods 1973–1976, 1981–2002, and 2010–2015. For 1977–1980 and 2003–2009, when official COE is not available, nominal wages are interpolated using GDP deflator and monthly wage data ($h^m w_{s_1}$), respectively. In the period 1970–1972, hourly wage is extrapolated using the growth rate of GDP deflator plus 3 percentage points, which is the average difference in the growth rates between our estimated hourly wages and GDP deflator in 1973–2015 (Figure 28).

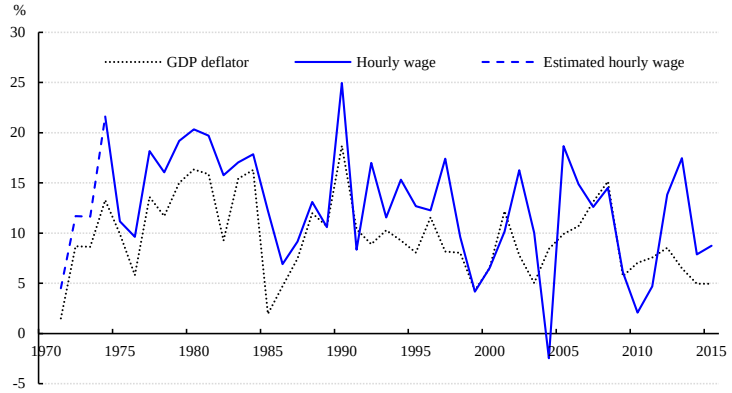

Figure 28: GDP Deflator and Hourly Wage in Sri Lanka

Note: Average growth rates of GDP deflator and our estimated hourly wage during 1973–2015 are 10.0% and 13.0%, respectively.

Figure 29 presents the estimated labor shares. The COE share to GDP at current basic price dipped rapidly between 2002 and 2010. We compare this trend with the labor income per worker employed in industrial activities (i.e., excluding agriculture and service sector) in the *Annual Survey of Industries* (ASI) published by DCS. The correlation coefficient between our and the ASI estimates on nominal wages per worker is 0.92 in the period 2006–2014, when both data are available. Our current decision is that our COE estimates follow the official estimates in the SRI-SNA. The compensations for self-employed and unpaid family workers are estimated, based on the country-common assumption on the wage differential ratio of 0.2 between employees and non-employees in each group of labor inputs.

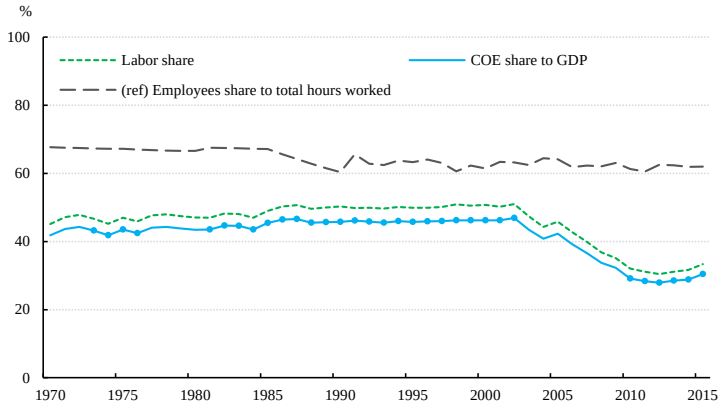

Figure 29: Labor Share in Sri Lanka

Note: The dots of the COE share indicate the years in which the official COE estimates are available.

4 Results

The digest of the estimated results on QALI and labor quality growths in the South Asian countries are presented in Table 17. Supplementary time series on the aggregate measures of labor inputs and wages, and components of the employment matrix by individual country are presented in Appendix A.3 (in Table 21–Table 26, in Table 27–Table 32 respectively). In the whole observation period 1970–2015, the average annual growth rates of labor quality ranges from 0.7% in Bangladesh to 1.9% in Nepal, compared to the annual growths in total hours worked ranges from 1.4% in Sri Lanka to 2.6% in Bhutan. These results indicate that the total hours worked as a measure of labor inputs have considerably underestimated the growths of QALI in the South Asian countries. Although country's performance in labor quality growths is highly diverse, the indices of labor quality increased almost monotonically in the whole period, (Figure 30), and labor quality growths are positive in almost all five-year intervals during the whole period of observation in all countries (Figure 31). In 1970–2015, changes in labor quality explain more than one-third of the QALI growth in all South Asian countries, with an exception of Bangladesh, in which it is slightly lower than other countries (27.2%). At the other end of the spectrum stands Nepal, achieving the fastest growth in labor quality at 1.9% per year on average, contributing 45.8% of the QALI growth.

Table 17: QALI and Labor Quality Growths

	1970 –75	1975 –80	1980 –85	1985 –90	1990 –95	95– 2000	2000 –05	2005 –10	2010 –15	1970 –80	1980 –90	90– 2000	2000 –10	1970 –2015
Bangladesh														
Labor input	1.0	4.0	3.5	1.3	4.2	2.4	2.3	2.6	2.7	2.5	2.4	3.3	2.5	2.7
Hours worked	0.4	2.4	2.7	1.4	3.7	2.0	1.8	2.3	0.7	1.4	2.0	2.9	2.1	1.9
	(38.2)	(61.3)	(75.4)	(107.5)	(89.2)	(83.7)	(78.7)	(89.7)	(26.7)	(56.5)	(83.9)	(87.2)	(84.4)	(72.8)
Labor quality	0.6	1.5	0.9	-0.1	0.4	0.4	0.5	0.3	2.0	1.1	0.4	0.4	0.4	0.7
	(61.8)	(38.7)	(24.6)	(-7.5)	(10.8)	(16.3)	(21.3)	(10.3)	(73.3)	(43.5)	(16.1)	(12.8)	(15.6)	(27.2)
Bhutan														
Labor input	4.1	3.0	2.9	4.7	1.1	5.6	6.1	6.2	2.2	3.5	3.8	3.3	6.1	4.0
Hours worked	3.8	3.2	1.9	2.1	-1.5	4.5	4.4	3.9	0.8	3.5	2.0	1.5	4.2	2.6
	(94.2)	(104.7)	(66.2)	(44.7)	(-135.3)	(81.6)	(72.7)	(62.5)	(36.6)	(98.7)	(53.0)	(45.6)	(67.5)	(64.6)
Labor quality	0.2	-0.1	1.0	2.6	2.6	1.0	1.7	2.3	1.4	0.0	1.8	1.8	2.0	1.4
	(5.8)	(-4.7)	(33.8)	(55.3)	(235.3)	(18.4)	(27.3)	(37.5)	(63.4)	(1.3)	(47.0)	(54.4)	(32.5)	(35.4)
India														
Labor input	2.9	3.2	3.2	3.1	2.4	3.0	2.9	3.0	2.5	3.0	3.1	2.7	3.0	2.9
Hours worked	2.4	2.4	2.1	1.8	1.8	1.5	1.9	0.9	1.1	2.4	2.0	1.7	1.4	1.8
	(83.4)	(76.8)	(65.4)	(59.9)	(73.9)	(51.7)	(67.4)	(29.3)	(45.3)	(80.0)	(62.7)	(61.7)	(47.8)	(61.5)
Labor quality	0.5	0.7	1.1	1.2	0.6	1.4	0.9	2.1	1.3	0.6	1.2	1.0	1.5	1.1
	(16.6)	(23.2)	(34.6)	(40.1)	(26.1)	(48.3)	(32.6)	(70.7)	(54.7)	(20.0)	(37.3)	(38.3)	(52.2)	(38.5)
Nepal														
Labor input	3.4	3.7	4.8	4.2	6.0	5.4	4.7	3.5	2.6	3.5	4.5	5.7	4.1	4.2
Hours worked	3.0	3.2	1.6	1.1	2.7	1.9	2.3	2.2	2.5	3.1	1.4	2.3	2.3	2.3
	(88.5)	(88.0)	(34.4)	(26.1)	(44.8)	(36.3)	(49.6)	(64.3)	(96.5)	(88.3)	(30.5)	(40.8)	(55.8)	(54.2)
Labor quality	0.4	0.4	3.1	3.1	3.3	3.4	2.4	1.2	0.1	0.4	3.1	3.4	1.8	1.9
	(11.5)	(12.0)	(65.6)	(73.9)	(55.2)	(63.7)	(50.4)	(35.7)	(3.5)	(11.7)	(69.5)	(59.2)	(44.2)	(45.8)
Pakistan														
Labor input	4.7	3.6	2.7	4.6	3.8	2.9	3.9	3.8	3.1	4.1	3.7	3.4	3.8	3.7
Hours worked	3.1	1.7	2.7	2.8	2.1	1.9	2.5	3.3	1.9	2.4	2.7	2.0	2.9	2.4
	(67.1)	(46.5)	(97.2)	(60.4)	(56.3)	(64.9)	(64.8)	(88.1)	(60.3)	(58.2)	(74.1)	(60.0)	(76.2)	(66.5)
Labor quality	1.5	1.9	0.1	1.8	1.7	1.0	1.4	0.4	1.2	1.7	0.9	1.3	0.9	1.2
	(32.9)	(53.5)	(2.8)	(39.6)	(43.7)	(35.1)	(35.2)	(11.9)	(39.7)	(41.8)	(25.9)	(40.0)	(23.8)	(33.5)
Sri Lanka														
Labor input	2.4	2.3	2.4	3.6	2.3	4.2	0.9	0.3	2.4	2.3	3.0	3.3	0.6	2.3
Hours worked	1.7	1.8	0.3	3.1	0.8	3.9	-0.8	0.7	1.5	1.8	1.7	2.3	-0.1	1.4
	(70.9)	(79.2)	(13.2)	(86.6)	(34.0)	(91.8)	(-92.1)	(221.7)	(64.4)	(74.9)	(57.4)	(71.2)	(-13.9)	(62.3)
Labor quality	0.7	0.5	2.0	0.5	1.5	0.3	1.8	-0.4	0.8	0.6	1.3	0.9	0.7	0.9
	(29.1)	(20.8)	(86.8)	(13.4)	(66.0)	(8.2)	(192.1)	(-121.7)	(35.6)	(25.1)	(42.6)	(28.8)	(113.9)	(37.7)

Note: All figures are average annual growth rates, except for those in parentheses, which are contribution shares (relative to labor input growth).

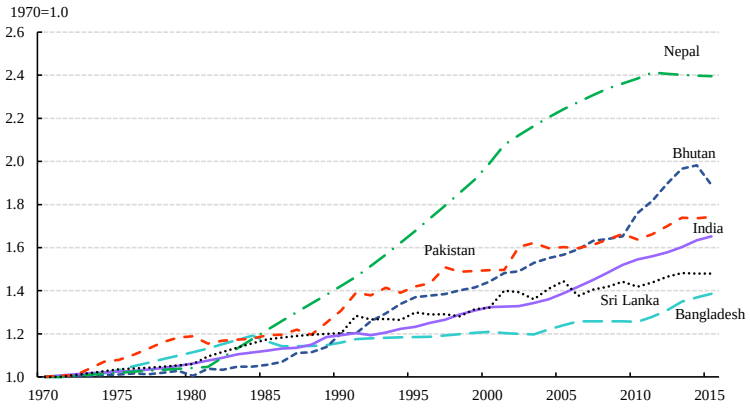

Figure 30: Labor Quality Indices

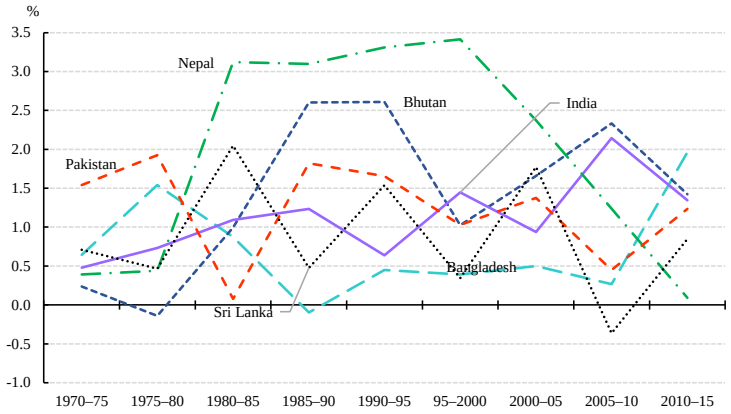

Figure 31: Five-Year Averages of Labor Quality Growth

The corollary of a positive growth in labor quality is an upward bias in the estimates of TFP based on total hours worked as labor inputs (thereafter as TFP*) compared to a more preferable measure of TFP based on QALI. Figure 32 decomposes the growth rates of TFP* estimated in APO (2017) into two effects, i.e., the labor quality changes and the preferable measure of TFP growth.[43] In Nepal, although the estimated growth rates of TFP* were positive in the late 1980s and early 1990s, they are revised to be negative after considering the vigorous labor quality improvements of 3.1% and 3.3% per year on average, respectively. As a result, the revised TFP growths in Nepal are negative in all five-year intervals. In the whole period, the average annual growth rate of the Nepalese TFP* is revised from –0.3% to –1.4% after adjusted for labor quality.

Reflecting the positive growths of labor qualities in all South Asian countries in the past four and a half decades, TFP* are downwardly revised; from 0.2% to –0.2% in Bangladesh, from 2.0% to 1.2% in Bhutan, from 1.9% to 1.1% in India, from 1.9% to 1.3% in Pakistan, and from 1.6% to 1.2% in Sri Lanka in 1970–2015. The revised TFP growths are still high in Pakistan, Sri Lanka, and India, which have larger GDP shares of manufacturing, i.e., 13%, 20%, and 14% in 2015, respectively, compared to 8% in Bhutan and 6% in Nepal.[44] The exceptional country is Bangladesh. Although the manufacturing sector accounts for 18% of GDP in Bangladesh in 2015, TFP growth is negligible in the long run. One of the reasons may be that manufacturing in Bangladesh is highly skewed toward textile and wearing apparel, which accounts for 49% of manufacturing-sector GDP in 2015.

[43] The TFP estimates presented in Figure 32 reflect some revisions in employment and wage matrices, and thus in labor shares, for the South Asian countries after the publication of APO (2017).
[44] It should be noted that, in the current measurement of TFP, growth in the mining industry directly affects the estimates of TFP growth, since natural resources are not counted as capital inputs. However, the mining sectors have relatively minor impacts in the South Asian countries, as its GDP share ranges from 1% (Pakistan) to 4% (Bhutan) in 2015.

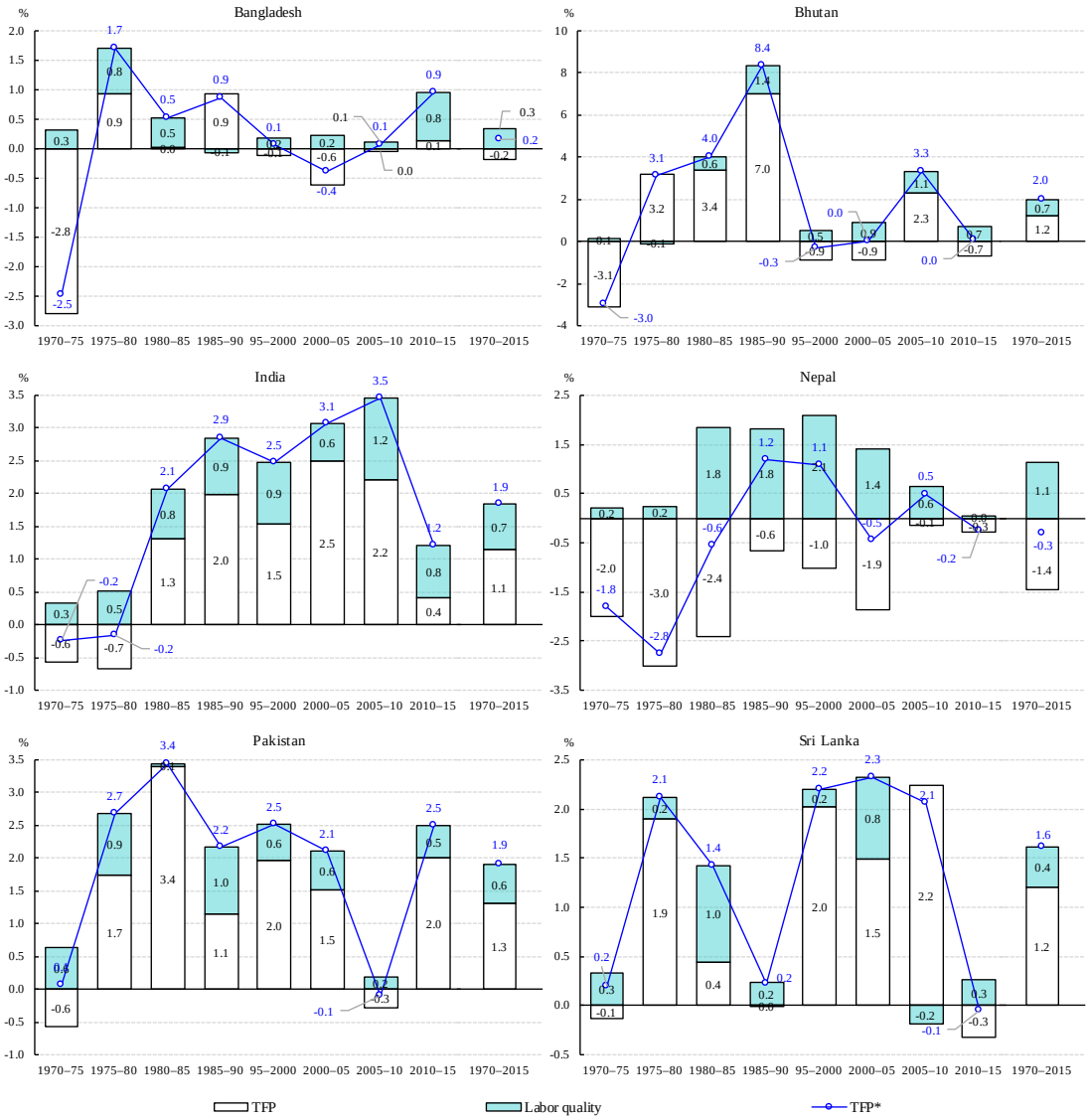

Figure 32: TFP and Labor Quality Growths

The differences in labor quality change among countries seem to depend on the gaps in the initial levels of education. Figure 33 plots countries' initial levels of average schooling years (ASY) of workers in 1970, against their respective average growth rates of labor qualities between 1970 and 2015. As the two variables seems to have a negative correlation, some of the achievements of higher labor quality growths in Nepal and Bhutan are explained by their lower initial levels of education on average in our observation. Workers in Sri Lanka are much more educated on average in 1970 than those in other countries, as shown in Figure 33. This may partly explain a lower growth in labor quality of Sri Lanka among the South Asian countries. However, a lower labor quality growth in Bangladesh is not explained by the initial level of education.

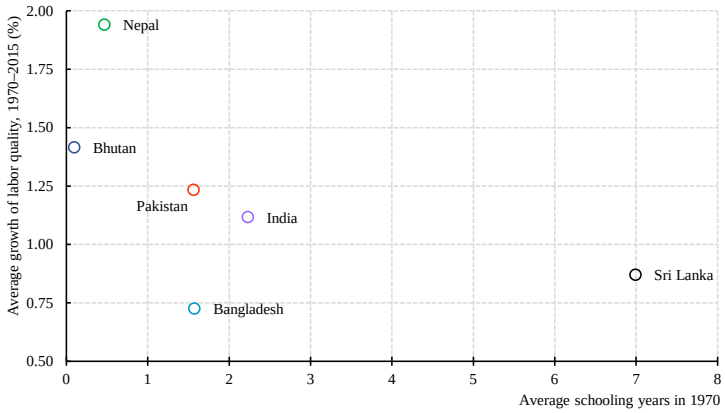

Figure 33: Labor Quality Growth and Average Schooling Years

It should be noted that labor quality growth does not decrease monotonically according to an increase in ASY of workers. Figure 34 plots countries' initial level of ASY in each sub-period of the 1970s, 1980s, 1990s, 2000s, and the period 2010–2015 against their respective average growth rates of labor qualities. In Bhutan and Nepal, labor quality growth is very minimal in the 1970s, in which their initial levels of ASY are much shorter than 1 year, and has a peak in the periods, in which the ASY are 1–2 years. This may reflect an increase of workers who graduated primary school in both countries. This is the first wave of labor quality growth.

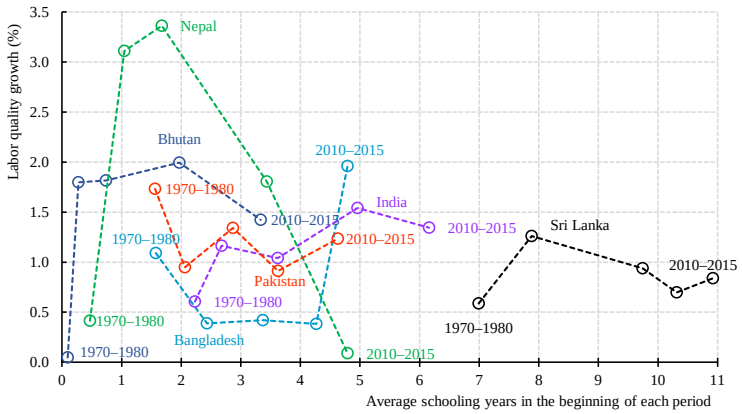

Figure 34: Labor Quality Growth and Average Schooling Years

The second wave in labor quality improvement in terms of education may be found around 5–6 ASY on average, as observed in India and Pakistan in Figure 34, reflecting an increase in workers who graduated secondary school. Recently, Bangladesh also seems to enjoy the second wave with a high growth rate of labor quality as 2.0% per year on average during 2010–2015, as presented in Table 17. One of the reasons that Bangladesh has a lower labor quality growth among the South Asian countries, regardless of the lower initial level of education on average, is that its first wave of labor quality pickup had passed before the beginning of our observation period. In South Asia, Sri Lanka is an exception who experienced the third wave of labor quality

growth, as observed in around the 8–9 ASY mark in Figure 34, reflecting an increase of workers who graduated higher secondary school.

These findings on labor quality change related to the average schooling years of workers are an observation simply focusing on the relationship between these two variables. Figure 37 and Table 18 present a more precise picture as the decomposition of labor quality growths in the JGF formula presented in equation (9) in Section 2.1. Based on the estimated results, the labor quality factor, which has the largest impact on labor quality growth, is the first order index for education (Q_E) in many of the South Asian countries. In all countries except Bangladesh, it has an impact to push the labor quality growth upward by more than 1.0% per year on average in the period 1970–2015, indicating that it is a factor to foster economic growth by 0.4–0.6% per year.

The second largest factor to affect the labor quality growth is the first order index for employment status (Q_S). It tends to have a considerable positive impact in some particular periods in the South Asian countries, except in Sri Lanka, as shown in Figure 37. This estimate depends not only on the shifts from self-employed and contributing family workers to employees in these countries, but also on the wage gaps between them. In our measurement, the wage differential ratio (WDR) in hourly wages between non-employees and employees in each elementary group of labor inputs are assumed to be 0.2 for all countries. Figure 35 evaluates the sensitivity of the estimated growths of Q_S on average in 1970–2015 on the WDR assumption. Sri Lanka is the exception, in which the employees' share in total employment shrank in the whole period of our observation. In all countries except Sri Lanka, the estimated growth rates of Q_S are revised to be small when the WDR increases. The possible revisions seem to be smaller in India, Bangladesh, and Sri Lanka. In Nepal, however, it should be noted that the estimate of Q_S is most sensitive to the WDR assumption among all countries studied. The second order index for education and status (Q_{ES}) tends to be negative. In 1970–2015, they range minus 0.4–0.6% per year on average in all countries except Bangladesh. This implies the relatively younger workers have entered the labor markets as employees in these countries.

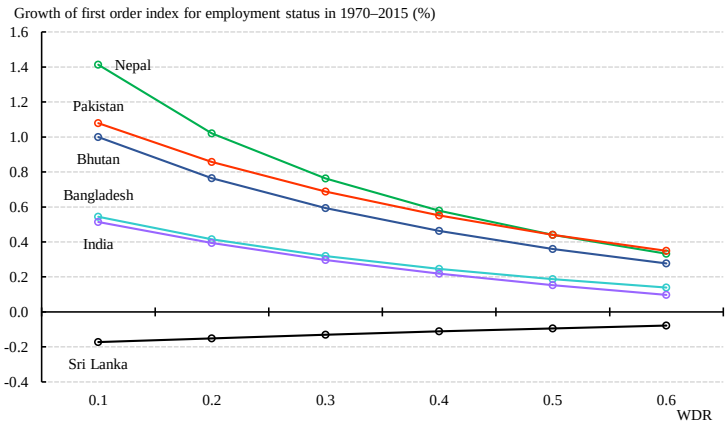

Figure 35: First Order Index for Status based on Different WDR Assumptions

The rise in female participation in the work force tends to have a negative impact on the

labor quality growth, reflecting lower wages for female workers than those for male workers. The increase in the female worker share provides another reason for the lower growth in labor quality in Bangladesh, where we observe a considerable negative impact of the first order index for gender (Q_G) in the late 1990s and late 2000s. These reflect the increase in the female share, i.e., by 3.4 percentage points (from 22.2% to 25.6%) during 1995–2000 and by 5.9 percentage points (from 24.7% to 30.6%) during 2005–2010, as presented in Table 27 in Appendix A.3. The rise in female participation in the work force in Bangladesh, which might be mainly absorbed in textile and wearing apparel manufacturing, contributed to the decline in labor quality growth in these periods.

All South Asian countries have a negative contribution of Q_G for the period 1970–2015, as minus 0.2% per year on average in Nepal and minus 0.1% in Bangladesh, Bhutan, and Pakistan. India is exceptional in enjoying a positive impact at 0.05% per year. The reason for this is twofold (Figure 36): first, at 32.4% in 1970, it had the second largest female-worker share in total employment at the beginning of our observation period; and second, India is the only country where the female-worker share is on a declining trend, from 32.4% in 1970 to 27.0% in 2015, reflecting the conservative social values in India, as described in section 3.3.

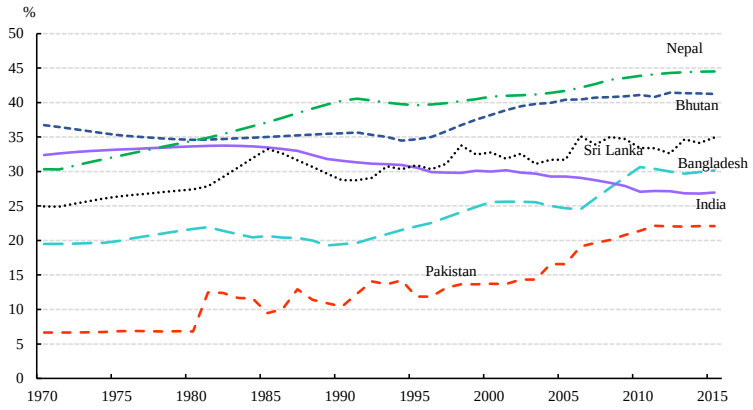

Figure 36: Female Worker Share in Total Employment

The first order index for age (Q_A) plays a role in improving labor quality in most periods in most of the countries in South Asia, reflecting their robust age structures of workers.[45] It contributes to lifting the labor quality growth by 0.2% per year on average in Nepal and 0.1% in India, Bangladesh, and Pakistan, in 1970–2015. Although Bangladesh seems to enjoy the second wave of labor quality growth in terms of education (0.8% per year) in the recent period 2010–2015, the second order index for age and education (Q_{EA}) is minus 0.6%. This suggests that secondary school graduates are entering the labor market at a younger age.

[45] Sri Lanka is exceptional in that her ratio of the working population (aged 15–64) to dependent population (aged under 14 and over 65) has peaked in the mid-2000s, whereas other South Asian countries will reach their peaks only in the late 2030s and 2040s, according to the projections of the United Nations (2017).

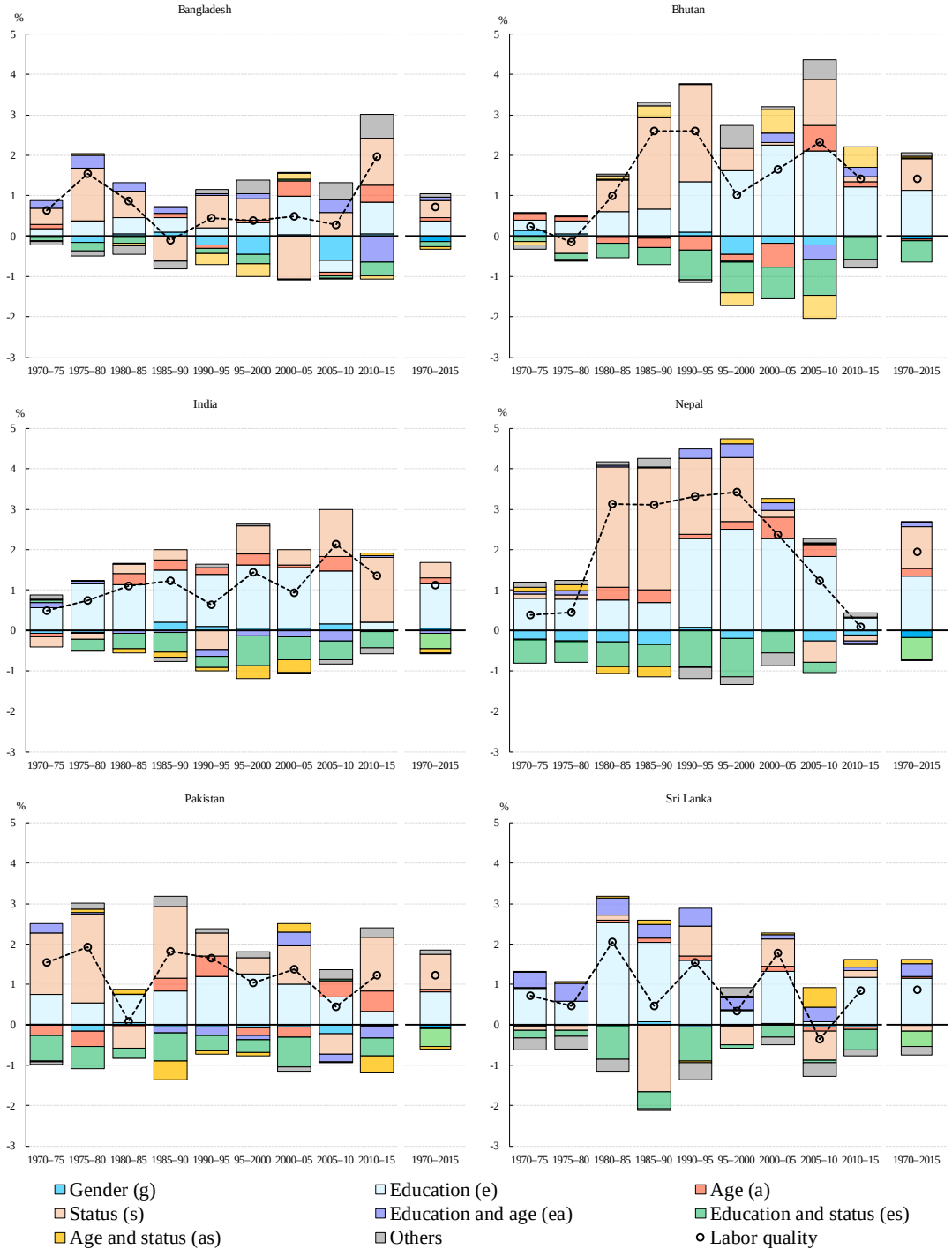

Figure 37: Decompositions of Labor Quality Growth of Employment

Table 18: Decompositions of Labor Quality Growth of Employment

	1970–75	1975–80	1980–85	1985–90	1990–95	95–2000	2000–05	2005–10	2010–15	1970–80	1980–90	90–2000	2000–10	1970–2015
Bangladesh														
Labor quality	0.64	1.54	0.87	-0.10	0.45	0.39	0.50	0.27	1.96	1.09	0.39	0.42	0.38	0.73
Gender (g)	-0.04	-0.15	0.05	0.10	-0.22	-0.44	0.04	-0.60	0.05	-0.09	0.08	-0.33	-0.28	-0.13
Education (e)	0.18	0.37	0.40	0.36	0.20	0.33	0.95	-0.29	0.79	0.27	0.38	0.26	0.33	0.36
Age (a)	0.12	0.01	-0.02	0.11	-0.09	0.07	0.37	-0.08	0.42	0.06	0.04	-0.01	0.14	0.10
Status (s)	0.38	1.30	0.65	-0.60	0.80	0.53	-1.06	0.58	1.16	0.84	0.02	0.66	-0.24	0.42
Gender and education (ge)	-0.05	-0.03	-0.05	-0.04	-0.03	0.01	-0.06	0.13	-0.02	-0.04	-0.05	-0.01	0.03	-0.02
Gender and age (ga)	-0.02	-0.04	-0.01	0.00	-0.03	0.03	-0.03	0.15	-0.15	-0.03	0.00	0.00	0.06	-0.01
Gender and status (gs)	0.02	0.06	-0.07	0.04	-0.13	0.02	0.15	0.49	-0.15	0.04	-0.01	-0.05	0.32	0.05
Education and age (ea)	0.19	0.31	0.23	0.14	0.06	0.11	0.00	0.31	-0.64	0.25	0.19	0.08	0.15	0.08
Education and status (es)	-0.09	-0.22	-0.16	0.01	-0.13	-0.24	0.06	-0.07	-0.34	-0.15	-0.07	-0.18	0.00	-0.13
Age and status (as)	-0.01	0.04	-0.07	-0.03	-0.27	-0.32	0.14	-0.01	-0.08	0.02	-0.05	-0.30	0.07	-0.07
Others	-0.04	-0.11	-0.08	-0.19	0.29	0.29	-0.05	-0.34	0.93	-0.08	-0.13	0.29	-0.20	0.08
Bhutan														
Labor quality	0.24	-0.14	0.99	2.60	2.61	1.03	1.66	2.33	1.42	0.05	1.80	1.82	2.00	1.42
Gender (g)	0.14	0.06	-0.04	-0.05	0.11	-0.45	-0.17	-0.22	-0.04	0.10	-0.05	-0.17	-0.20	-0.07
Education (e)	0.24	0.31	0.61	0.67	1.25	1.62	2.25	2.10	1.22	0.28	0.64	1.43	2.17	1.14
Age (a)	0.17	0.11	-0.14	-0.24	-0.34	-0.17	-0.61	0.64	0.12	0.14	-0.19	-0.25	0.02	-0.05
Status (s)	0.00	-0.43	0.76	2.27	2.40	0.54	0.07	1.14	0.13	-0.21	1.52	1.47	0.61	0.76
Gender and education (ge)	-0.02	-0.02	-0.04	-0.04	-0.13	-0.06	-0.08	0.00	-0.09	-0.02	-0.04	-0.10	-0.04	-0.05
Gender and age (ga)	0.00	0.02	0.04	0.03	-0.02	0.05	-0.23	-0.19	0.15	0.01	0.03	0.02	-0.21	-0.02
Gender and status (gs)	-0.11	-0.05	0.03	0.04	-0.11	0.38	0.14	0.17	0.05	-0.08	0.04	0.13	0.16	0.06
Education and age (ea)	0.01	0.01	0.03	0.01	0.01	-0.02	0.23	-0.35	0.24	0.01	0.02	-0.01	-0.06	0.02
Education and status (es)	-0.12	-0.15	-0.35	-0.41	-0.75	-0.76	-0.77	-0.88	-0.53	-0.14	-0.38	-0.76	-0.83	-0.53
Age and status (as)	-0.09	-0.02	0.07	0.28	0.00	-0.30	0.60	-0.58	0.49	-0.06	0.18	-0.15	0.01	0.05
Others	0.03	0.02	0.02	0.04	0.20	0.20	0.22	0.50	-0.32	0.02	0.03	0.20	0.36	0.10
India														
Labor quality	0.48	0.73	1.09	1.23	0.64	1.44	0.94	2.14	1.35	0.61	1.16	1.04	1.54	1.12
Gender (g)	-0.08	-0.05	0.00	0.19	0.10	0.05	0.05	0.17	-0.02	-0.06	0.10	0.07	0.11	0.05
Education (e)	0.56	1.14	1.14	1.29	1.30	1.57	1.50	1.30	0.20	0.85	1.21	1.43	1.40	1.11
Age (a)	-0.07	-0.02	0.26	0.25	0.17	0.28	0.06	0.35	0.01	-0.05	0.26	0.22	0.20	0.14
Status (s)	-0.26	-0.14	0.25	0.26	-0.47	0.70	0.38	1.16	1.60	-0.20	0.25	0.11	0.77	0.39
Gender and education (ge)	0.06	-0.09	-0.13	-0.17	-0.12	-0.16	-0.12	-0.17	0.00	-0.01	-0.15	-0.14	-0.14	-0.10
Gender and age (ga)	0.01	0.01	0.00	-0.03	-0.02	-0.02	0.01	-0.03	-0.01	0.01	-0.02	-0.02	-0.01	-0.01
Gender and status (gs)	0.06	0.05	-0.01	-0.11	-0.05	-0.01	-0.06	-0.13	-0.11	0.06	-0.06	-0.03	-0.09	-0.04
Education and age (ea)	0.13	0.08	-0.07	-0.06	-0.17	-0.14	-0.15	-0.27	0.03	0.10	-0.06	-0.15	-0.21	-0.07
Education and status (es)	0.07	-0.28	-0.37	-0.49	-0.28	-0.74	-0.58	-0.43	-0.41	-0.10	-0.43	-0.51	-0.50	-0.39
Age and status (as)	0.02	0.00	-0.11	-0.11	-0.07	-0.31	-0.30	-0.02	0.07	0.01	-0.11	-0.19	-0.16	-0.09
Others	-0.02	0.03	0.15	0.21	0.26	0.23	0.14	0.22	-0.02	0.00	0.18	0.25	0.18	0.13
Nepal														
Labor quality	0.39	0.44	3.12	3.10	3.31	3.41	2.37	1.24	0.09	0.41	3.11	3.36	1.80	1.94
Gender (g)	-0.21	-0.25	-0.29	-0.36	0.07	-0.19	-0.01	-0.26	-0.11	-0.23	-0.32	-0.06	-0.14	-0.18
Education (e)	0.80	0.76	0.76	0.68	2.20	2.50	2.27	1.84	0.31	0.78	0.72	2.35	2.05	1.35
Age (a)	-0.01	0.00	0.31	0.31	0.10	0.19	0.54	0.29	0.01	-0.01	0.31	0.15	0.42	0.19
Status (s)	0.11	0.11	2.97	3.03	1.88	1.59	0.17	-0.53	-0.15	0.11	3.00	1.74	-0.18	1.02
Gender and education (ge)	-0.07	-0.05	-0.03	-0.02	-0.29	-0.20	-0.25	-0.11	0.02	-0.06	-0.02	-0.25	-0.18	-0.11
Gender and age (ga)	0.02	0.02	0.03	0.02	-0.05	-0.06	-0.12	-0.11	-0.05	0.02	0.03	-0.06	-0.11	-0.03
Gender and status (gs)	0.10	0.12	0.05	0.11	-0.16	0.05	0.01	0.21	0.09	0.11	0.08	-0.06	0.11	0.06
Education and age (ea)	0.06	0.10	0.05	0.02	0.24	0.33	0.18	0.02	-0.05	0.08	0.03	0.29	0.10	0.11
Education and status (es)	-0.59	-0.54	-0.60	-0.53	-0.91	-0.95	-0.55	-0.25	0.00	-0.56	-0.57	-0.93	-0.40	-0.55
Age and status (as)	0.12	0.15	-0.17	-0.26	-0.01	0.13	0.09	0.02	-0.02	0.13	-0.22	0.06	0.06	0.00
Others	0.07	0.02	0.04	0.10	0.23	0.03	0.03	0.11	0.04	0.05	0.07	0.13	0.07	0.07
Pakistan														
Labor quality	1.54	1.93	0.08	1.82	1.65	1.03	1.38	0.45	1.23	1.73	0.95	1.34	0.91	1.23
Gender (g)	0.02	-0.15	0.05	-0.04	-0.05	-0.08	-0.05	-0.23	-0.03	-0.07	0.00	-0.06	-0.14	-0.06
Education (e)	0.73	0.54	0.71	0.85	1.19	1.26	1.00	0.68	0.33	0.64	0.78	1.23	0.84	0.81
Age (a)	-0.27	-0.40	-0.04	0.32	0.52	-0.17	-0.26	0.41	0.50	-0.33	0.14	0.17	0.07	0.07
Status (s)	1.52	2.20	-0.53	1.77	0.56	0.41	0.96	-0.50	1.34	1.86	0.62	0.48	0.23	0.86
Gender and education (ge)	-0.01	0.03	-0.03	-0.01	0.00	0.03	0.04	0.10	0.01	0.01	-0.02	0.02	0.07	0.02
Gender and age (ga)	-0.02	0.01	-0.01	0.00	0.01	0.01	0.03	0.03	0.00	-0.01	-0.01	0.01	0.03	0.01
Gender and status (gs)	-0.02	0.16	-0.03	0.06	0.05	0.03	0.04	0.21	0.01	0.07	0.01	0.04	0.13	0.06
Education and age (ea)	0.24	0.04	0.00	-0.16	-0.21	-0.11	0.35	-0.18	-0.29	0.14	-0.08	-0.16	0.08	-0.04
Education and status (es)	-0.62	-0.53	-0.23	-0.70	-0.38	-0.33	-0.73	0.05	-0.44	-0.58	-0.47	-0.36	-0.34	-0.44
Age and status (as)	-0.04	0.07	0.13	-0.46	-0.08	-0.08	0.21	-0.01	-0.40	0.02	-0.17	-0.08	0.10	-0.07
Others	0.01	-0.05	0.07	0.21	0.05	0.06	-0.21	-0.11	0.21	-0.02	0.14	0.05	-0.16	0.03
Sri Lanka														
Labor quality	0.71	0.47	2.05	0.47	1.54	0.34	1.77	-0.36	0.85	0.59	1.26	0.94	0.71	0.87
Gender (g)	-0.03	-0.01	-0.01	0.07	-0.06	-0.03	0.03	-0.04	-0.04	-0.02	0.03	-0.05	-0.01	-0.01
Education (e)	0.91	0.57	2.52	1.97	1.59	0.36	1.30	0.08	1.17	0.74	2.24	0.98	0.69	1.16
Age (a)	0.01	0.00	0.08	0.10	0.10	0.01	0.13	-0.12	-0.06	0.01	0.09	0.05	0.01	0.03
Status (s)	-0.11	-0.14	0.12	-1.66	0.74	-0.45	0.67	-0.70	0.17	-0.12	-0.77	0.15	-0.02	-0.15
Gender and education (ge)	-0.05	-0.01	0.02	0.12	-0.02	-0.02	0.02	-0.01	-0.10	-0.03	0.07	-0.02	0.01	-0.01
Gender and age (ga)	0.04	-0.01	0.00	-0.08	-0.03	0.00	-0.03	0.02	-0.01	0.01	-0.04	-0.01	0.00	-0.01
Gender and status (gs)	-0.06	-0.08	-0.12	0.13	0.00	0.01	0.00	0.02	0.03	-0.07	0.00	0.01	0.01	-0.01
Education and age (ea)	0.38	0.46	0.42	0.35	0.46	0.30	0.12	0.35	0.09	0.42	0.39	0.38	0.23	0.33
Education and status (es)	-0.20	-0.13	-0.84	-0.41	-0.84	-0.09	-0.29	-0.07	-0.50	-0.16	-0.62	-0.46	-0.18	-0.38
Age and status (as)	0.02	0.03	0.04	0.11	-0.04	0.04	0.03	0.48	0.19	0.03	0.07	0.00	0.26	0.10
Others	-0.22	-0.21	-0.19	-0.23	-0.37	0.22	-0.20	-0.38	-0.08	-0.21	-0.21	-0.08	-0.29	-0.18

In macroeconomic analysis, labor share is one of the most important variables. Although the definition is simple as a ratio of labor income to GDP at current basic prices, its measurement is fraught with difficulties, especially in countries where the informal sector and informal labor account for a significant contribution to the economy at large. This explains the limited availability of the official estimates of COE in the South Asian countries as described in Section 3, and the total labor income must depend more or less on ad hoc assumptions to estimate the labor income of non-employee. Thus the estimates are subject to a degree of data uncertainty and could be sensitive to the underlying assumptions. Bearing in mind these caveats, Figure 38 compares our final estimates on labor shares for the South Asian countries from 1970 to 2015. As a country group, the labor shares hovered within a range of 40–70% in 1970, which declines to the 30–60% range in recent years. The decline has been particularly marked in Pakistan and Sri Lanka. The timing of the start of the declining trend varies from country to country: it was roughly from the 1980s in Bangladesh and Bhutan, from the 1990s in India and Pakistan, and from the 2000s in Nepal and Sri Lanka.

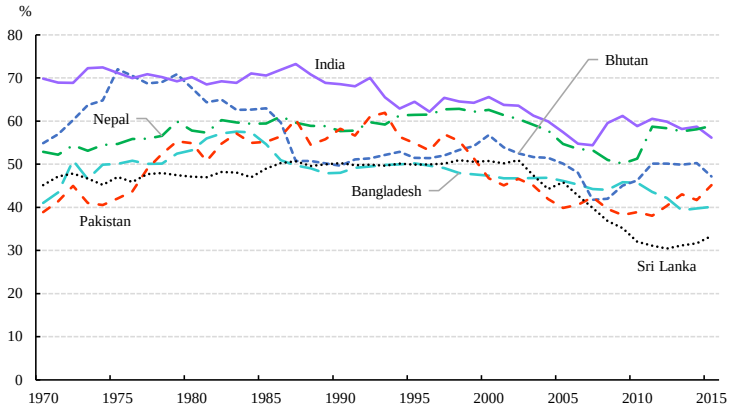

Figure 38: Labor Share in South Asia

5 Conclusion

In this study employment and wage matrices are developed based on the available survey data as much as possible, in order to estimate the quality-adjusted labor input (QALI) index and to evaluate labor quality change in the South Asian countries. This study is a first report of our Asia-QALI database project, which has been under construction since 2013 at KEO. In addition, as far as we are aware, this is a first study based on a harmonized methodology to compare labor quality changes among the South Asian countries, tackling the challenging issues of their data availability and reliability on labor inputs and income/wages.

Our estimated results indicate that total hours worked as a measure of labor inputs considerably underestimates the QALI in South Asia. In 1970–2015, labor quality growths ranges from 0.7% per year on average in Bangladesh to 1.9% in Nepal, compared to the annual growths in total hours worked ranges from 1.4% in Sri Lanka to 2.6% in Bhutan. The changes in

labor quality explain 27–46% of the QALI growth in the South Asian countries, implying TFP growths estimated without considering the changes in labor quality should to be revised downward by 0.4–1.1 percentage points per year on average in 1970–2015. Although the availability and the quality of survey data pose challenging measurement issues, our study confirms a similar importance for all South Asian countries to capture the labor quality changes for evaluating their productivity growths.

Although the changes in labor quality have a considerable impact on the picture of productivity performances of the economies in South Asia, the sources of their labor quality changes are different, depending on the country-specific movements in supply and demand side factors. On the supply side, it highly depends on the initial level of education, the increase in educated workers, the rise of female participation in the work force, and the age structure of workers. On the demand side, labor quality growth also depends on the changes in the industrial structure, in particular the expansion of employees in the manufacturing sector. Although there may be room for revisions and improvements in our estimates as a first measurement of labor inputs in South Asia, our estimates of labor quality seem to reflect most properly the changes in the supply and demand sides in each country of South Asia.

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Appendix

A.1 Auxiliary Data

In the case that data on the number of workers are not available, the number of labor forces is used as an auxiliary data to interpolate or extrapolate the available data on the number of workers. We define the numbers of population and labor force, cross-classified by three categories (gea), as P_{gea} and F_{gea}, respectively. The ratio of the number of labor forces to the corresponding population is defined in each category as

(18) $F_{gea} = \alpha_{gea} P_{gea}$,

where α_{gea} is the labor force participation rate ($0 \leq \alpha_{gea} \leq 1$). Similarly, the ratio of the number of employment to the corresponding labor force is also defined,

(19) $N_{gea} = \beta_{gea} F_{gea}$,

where β_{gea} is the employment rate ($0 \leq \beta_{gea} \leq 1$).

United Nations (2017) provides the population matrix by gender and age P_{ga} annually and Barro and Lee (2010) provides the population matrix by gender, age, and education P_{gea} on a quinquennial basis.[46] Using these international data and country-specific data, P_{gea} is prepared for each period of our observation. For the case that population data by education is not available in national data, the Barro-Lee Database (BLD) is used to provide the information on educational compositions. For the interval periods when the BLD is not available, the information on educational compositions are linearly interpolated. In the case that the two kinds of population-by-education data are available in national data, three-dimensional population data (P_{gea}) is estimated every year using the KEO-RAS method as follows:

(20) $\min \sum_{ea} \left(\hat{P}_{gea} - P_{gea}\right)^2$, subject to $\mathrm{P}_{ge} = \sum_a \widehat{\mathrm{P}}_{gea}$ and $\mathrm{P}_{ga} = \sum_e \widehat{\mathrm{P}}_{gea}$,

where P_{gea} is the initial values and P_{ge} and P_{ga} are the restrictions.

In the years when the labor force data is available in national data, F_{gea} is constructed based on a similar method. In the case that two types of two-dimensional labor force data (i.e., F_{ge} and F_{ga}) are available, the three-dimensional matrix is estimated using P_{gea} as the initial values in the KEO-RAS framework. Using the estimated P_{gea} and F_{gea}, the labor force participation rate α_{gea} is measured. For the years when the labor force data is not available, α_{gea} are estimated by a linear interpolation.

[46] While the population database of United Nations (2017) includes all South Asian countries, the Barro-Lee database does not include estimates for Bhutan. In our measurement, the two-dimensional population data (P_{ga}) is used as the auxiliary population data for Bhutan.

A.2 Wage Function

For Pakistan, the wage function is estimated using the custom-made data, as described in Section 3.5. The function is formulated as,

(21) $\ln w_{geast} = \beta_g D_g + \beta_e D_e + \beta_a D_a + \beta_t D_t + \varepsilon.$

where w_{geast} is average hourly wage (relative to the reference wage in g=1, e=1, a=3, and t=2011), D_l are binary variables as the dummies of g, e, a, t. A similar function was estimated for Bhutan in UNDESA (2016), as described in Section 3.2. The estimated results of the OLS are presented in Table 19 for Bhutan and Table 20 for Pakistan, respectively.

Table 19: Estimated Results in Bhutan

Variables	Parameters	
Female	-0.0800 (0.015)	***
Primary	0.1463 (0.023)	***
Lower secondary	0.2843 (0.023)	***
Middle secondary	0.4417 (0.022)	***
Higher secondary	0.6493 (0.024)	***
Undergraduate and over	1.0343 (0.025)	***
Religious professionals	-0.0639 (0.039)	
15–19	-0.4190 (0.037)	***
20–24	-0.1826 (0.026)	***
30–34	0.2011 (0.025)	***
35–39	0.3041 (0.026)	***
40–44	0.3171 (0.027)	***
45–49	0.2996 (0.028)	***
50–54	0.3515 (0.030)	***
55–59	0.4203 (0.034)	***
60–64	0.2958 (0.041)	***
65+	0.2282 (0.047)	***
2010	0.1299 (0.029)	***
2011	0.3478 (0.026)	***
2012	0.4741 (0.026)	***
2013	0.5509 (0.027)	***
2014	0.7316 (0.028)	***

R-Square	Adj R-Sq	F-value	N
0.7519	0.7506	577.336	7087

*** $p < 0.01$,** $p < 0.05$,* $p < 0.1$
Standard errors are in parentheses.
Note: results are relative to reference earning in g=1, e=1, a=3, and t=2009.

Table 20: Estimated Results in Pakistan

Variables	Parameters	
Female	-0.1131 (0.019)	***
Below matric	0.0151 (0.026)	
Matric but below degree	0.4130 (0.026)	***
Degree and above	1.0784 (0.027)	***
15–19	-0.2166 (0.041)	***
25–29	0.0925 (0.038)	**
30–34	0.2478 (0.038)	***
35–39	0.3231 (0.038)	***
40–44	0.4300 (0.038)	***
45–49	0.5799 (0.039)	***
50–54	0.5050 (0.039)	***
55–59	0.5900 (0.039)	***
60+	0.3023 (0.041)	***
1991	-1.7837 (0.046)	***
1992	-1.6281 (0.046)	***
1993	-1.5439 (0.046)	***
1994	-1.5074 (0.046)	***
1995	-1.2856 (0.046)	***
1996	-1.2023 (0.046)	***
1998	-1.0740 (0.047)	***
1999	-1.0760 (0.046)	***
2001	-1.0279 (0.046)	***
2003	-0.9130 (0.046)	***
2005	-0.7085 (0.046)	***
2007	-0.5595 (0.046)	***
2008	-0.5083 (0.046)	***
2009	-0.3025 (0.046)	***
2010	-0.2323 (0.046)	***

R-Squared	Adj R-Sq	F-value	N
0.869	0.865	264.784	1189

*** $p < 0.01$,** $p < 0.05$,* $p < 0.1$
Standard errors are in parentheses.
Note: results are relative to reference earning in g=1, e=1, a=3, and t=2011.

A.3 Annex Tables

Table 21: Aggregate Labor Input in Bangladesh

Year	Price[1)] (index) P^L	Price/CPI (index) P^L/CPI	Quantity[2)] (mil. Taka) L	Outlay (mil. Taka) V^L	Quality (index) Q	Employment (1000s) N	Hours per month (hours) h	Hourly wage (Taka/hour) w	Hours worked (mils.) H
1970	0.053	1.065	525,651	27,796	0.838	24,562	210.1	0.449	5,160
1971	0.055	1.001	522,405	28,721	0.841	24,348	210.2	0.468	5,117
1972	0.058	0.992	519,472	30,090	0.844	24,147	210.2	0.494	5,077
1973	0.081	0.906	517,190	41,911	0.846	23,991	210.3	0.692	5,045
1974	0.140	0.912	528,059	73,957	0.847	24,478	210.3	1.197	5,148
1975	0.115	0.892	565,614	65,077	0.886	25,026	210.3	1.030	5,263
1976	0.121	0.891	576,432	70,025	0.880	25,658	210.2	1.082	5,394
1977	0.141	0.881	609,301	85,945	0.906	26,300	210.1	1.296	5,526
1978	0.165	0.889	625,451	103,185	0.907	26,956	210.0	1.519	5,662
1979	0.194	0.970	624,919	121,035	0.884	27,629	210.0	1.739	5,802
1980	0.224	0.977	647,225	145,165	0.893	28,323	209.9	2.034	5,946
1981	0.249	0.981	684,834	170,567	0.913	29,354	209.9	2.307	6,162
1982	0.274	0.931	722,401	197,789	0.936	30,203	210.2	2.596	6,350
1983	0.298	0.891	762,148	227,213	0.959	31,125	210.5	2.889	6,553
1984	0.341	0.911	804,125	274,525	0.981	32,113	210.8	3.379	6,770
1985	0.385	0.927	782,792	301,185	0.970	32,804	207.1	3.694	6,795
1986	0.415	0.921	767,986	318,541	0.939	33,211	203.5	3.927	6,759
1987	0.465	0.940	773,559	359,849	0.938	34,175	200.1	4.386	6,837
1988	0.504	0.949	778,854	392,779	0.938	34,993	196.7	4.756	6,882
1989	0.549	0.973	783,765	430,045	0.940	35,643	193.3	5.201	6,890
1990	0.580	0.970	838,511	486,409	0.947	36,204	201.2	5.566	7,283
1991	0.619	0.973	891,665	551,903	0.957	36,690	209.0	5.998	7,667
1992	0.647	0.981	926,668	599,462	0.959	37,905	209.4	6.295	7,936
1993	0.659	0.970	962,995	634,273	0.964	39,134	209.8	6.439	8,209
1994	0.695	0.971	998,886	693,938	0.968	40,372	210.2	6.814	8,487
1995	0.758	0.961	1,034,852	784,793	0.972	41,615	210.7	7.459	8,768
1996	0.806	0.998	1,068,966	862,085	0.976	42,815	211.3	7.942	9,045
1997	0.843	0.991	1,095,081	922,883	0.982	43,508	211.8	8.347	9,214
1998	0.889	0.964	1,120,308	995,631	0.988	44,156	212.3	8.850	9,375
1999	0.943	0.964	1,144,490	1,079,020	0.994	44,765	212.9	9.436	9,529
2000	1.000	1.000	1,173,720	1,173,720	1.000	45,428	213.4	10.089	9,694
2001	1.049	1.028	1,192,417	1,250,635	0.993	46,462	213.5	10.507	9,919
2002	1.109	1.052	1,215,877	1,348,137	0.988	47,586	213.6	11.051	10,166
2003	1.205	1.082	1,237,211	1,490,814	0.982	48,610	213.8	11.954	10,393
2004	1.309	1.092	1,248,020	1,633,227	0.980	49,052	214.3	12.950	10,510
2005	1.426	1.112	1,253,711	1,788,371	0.974	49,514	214.6	14.024	10,627
2006	1.589	1.160	1,255,077	1,994,241	0.966	49,869	215.0	15.503	10,720
2007	1.744	1.167	1,284,017	2,239,660	0.956	51,684	214.4	16.843	11,081
2008	1.936	1.190	1,308,049	2,532,631	0.947	53,310	213.9	18.508	11,403
2009	2.228	1.299	1,327,376	2,957,288	0.937	54,758	213.4	21.086	11,687
2010	2.477	1.335	1,341,688	3,323,007	0.928	56,039	213.0	23.199	11,937
2011	2.709	1.319	1,335,867	3,618,872	0.939	57,006	206.0	25.679	11,744
2012	2.936	1.346	1,369,115	4,019,185	0.960	59,148	199.0	28.459	11,769
2013	3.126	1.333	1,375,148	4,298,419	0.988	59,846	191.9	31.197	11,482
2014	3.375	1.345	1,445,726	4,878,618	1.001	60,267	197.7	34.116	11,917
2015	3.665	1.375	1,516,020	5,556,676	1.011	60,751	203.6	37.430	12,371

Note: [1)] Corresponding price index of labor input defined by implicit index computed by V^L/L. [2)] Labor input volume calculated by using the Törnqvist-Theil quantity index evaluated in 2000 price.

Table 22: Aggregate Labor Input in Bhutan

Year	Price[1)] (index) P^L	Price/CPI (index) P^L/CPI	Quantity[2)] (mil. Nu) L	Outlay (mil. Nu) V^L	Quality (index) Q	Employment (1000s) N	Hours per month (hours) h	Hourly wage (Nu/hour) w	Hours worked (mils.) H
1970	0.071	0.624	3,761	269	0.693	109	237.7	0.868	26
1971	0.077	0.641	3,898	299	0.694	112	237.6	0.933	27
1972	0.084	0.659	4,057	339	0.696	117	237.6	1.018	28
1973	0.097	0.678	4,233	411	0.698	121	237.6	1.188	29
1974	0.117	0.695	4,414	515	0.699	126	237.6	1.430	30
1975	0.120	0.715	4,610	553	0.702	132	237.6	1.475	31
1976	0.124	0.738	4,776	590	0.704	136	237.6	1.524	32
1977	0.127	0.751	4,918	622	0.702	140	237.6	1.556	33
1978	0.110	0.778	5,117	562	0.707	145	237.6	1.361	34
1979	0.120	0.813	5,319	640	0.713	149	237.6	1.501	36
1980	0.136	0.787	5,358	729	0.697	154	237.6	1.660	37
1981	0.147	0.773	5,641	829	0.720	157	237.6	1.854	37
1982	0.163	0.779	5,713	930	0.716	160	237.7	2.042	38
1983	0.179	0.726	5,901	1,056	0.726	163	237.8	2.277	39
1984	0.202	0.765	6,022	1,215	0.727	166	237.6	2.568	39
1985	0.219	0.814	6,206	1,358	0.732	170	237.6	2.805	40
1986	0.238	0.805	6,442	1,532	0.741	174	237.3	3.088	41
1987	0.244	0.775	6,875	1,675	0.771	179	237.1	3.288	42
1988	0.285	0.824	7,069	2,017	0.773	184	236.9	3.860	44
1989	0.309	0.820	7,365	2,273	0.790	188	236.7	4.267	44
1990	0.333	0.803	7,855	2,613	0.834	190	236.3	4.858	45
1991	0.371	0.798	7,788	2,891	0.834	188	236.4	5.421	44
1992	0.419	0.777	7,971	3,340	0.872	184	236.3	6.401	43
1993	0.466	0.777	8,022	3,740	0.897	180	236.3	7.328	43
1994	0.541	0.843	8,156	4,413	0.928	177	236.3	8.794	42
1995	0.601	0.855	8,303	4,988	0.950	176	236.3	9.996	42
1996	0.663	0.868	8,540	5,666	0.955	180	236.4	11.098	43
1997	0.761	0.935	8,918	6,788	0.960	187	236.5	12.794	44
1998	0.861	0.956	9,475	8,159	0.972	196	236.6	14.662	46
1999	0.947	0.985	10,163	9,627	0.981	208	236.9	16.281	49
2000	1.000	1.000	10,969	10,969	1.000	220	237.2	17.513	52
2001	0.991	0.958	11,967	11,860	1.027	234	236.9	17.827	55
2002	1.031	0.973	12,880	13,282	1.033	251	236.3	18.659	59
2003	1.061	0.977	13,672	14,502	1.060	269	228.1	19.697	61
2004	1.107	0.978	14,230	15,753	1.076	283	222.4	20.860	63
2005	1.168	0.980	14,857	17,359	1.086	297	219.1	22.231	65
2006	1.174	0.935	16,072	18,875	1.105	309	224.1	22.718	69
2007	1.170	0.886	17,133	20,049	1.131	317	227.3	23.187	72
2008	1.250	0.873	17,831	22,289	1.137	326	228.9	24.889	75
2009	1.432	0.958	18,729	26,811	1.146	335	232.2	28.722	78
2010	1.575	0.985	20,284	31,940	1.221	348	227.2	33.666	79
2011	1.882	1.081	21,562	40,584	1.259	360	226.4	41.499	81
2012	2.015	1.043	22,764	45,865	1.315	374	220.3	46.389	82
2013	2.089	0.994	23,806	49,726	1.363	382	217.5	49.863	83
2014	2.396	1.054	23,654	56,685	1.374	392	209.0	57.663	82
2015	2.620	1.102	22,693	59,452	1.311	404	204.0	60.146	82

Note: [1)] Corresponding price index of labor input defined by implicit index computed by V^L/L. [2)] Labor input volume calculated by using the Törnqvist-Theil quantity index evaluated in 2000 price.

Table 23: Aggregate Labor Input in India

Year	Price[1)] (index) P^L	Price/CPI (index) P^L/CPI	Quantity[2)] (bil. Rupees) L	Outlay (bil. Rupees) V^L	Quality (index) Q	Employment (1000s) N	Hours per month (hours) h	Hourly wage (Rupees/hour) w	Hours worked (mils.) H
1970	0.058	0.660	5,408	313	0.755	229,293	173.1	0.658	39,693
1971	0.059	0.654	5,567	329	0.760	234,635	173.1	0.676	40,613
1972	0.063	0.655	5,737	362	0.764	240,339	173.0	0.725	41,590
1973	0.079	0.699	5,905	465	0.768	246,444	172.9	0.909	42,611
1974	0.090	0.624	6,074	549	0.771	252,914	172.7	1.047	43,677
1975	0.092	0.600	6,252	574	0.773	259,733	172.5	1.067	44,803
1976	0.094	0.666	6,436	607	0.776	266,680	172.3	1.100	45,939
1977	0.106	0.689	6,635	701	0.781	273,567	172.1	1.240	47,085
1978	0.109	0.694	6,849	747	0.787	280,407	172.0	1.290	48,240
1979	0.114	0.681	7,082	804	0.794	287,225	172.0	1.356	49,408
1980	0.133	0.716	7,321	974	0.802	294,028	172.0	1.604	50,573
1981	0.147	0.698	7,581	1,113	0.812	300,842	172.0	1.792	51,735
1982	0.160	0.705	7,851	1,256	0.823	307,485	172.0	1.979	52,891
1983	0.180	0.708	8,130	1,460	0.834	313,831	172.1	2.253	54,008
1984	0.203	0.737	8,355	1,693	0.841	319,807	172.2	2.561	55,079
1985	0.219	0.757	8,574	1,882	0.847	325,351	172.4	2.796	56,085
1986	0.243	0.771	8,802	2,139	0.854	330,992	172.5	3.121	57,112
1987	0.274	0.799	9,010	2,470	0.857	337,190	172.7	3.534	58,229
1988	0.307	0.818	9,281	2,849	0.869	342,437	172.9	4.010	59,215
1989	0.328	0.847	9,716	3,191	0.895	347,575	173.2	4.418	60,192
1990	0.370	0.877	9,999	3,702	0.901	355,041	173.2	5.016	61,496
1991	0.413	0.859	10,266	4,239	0.909	361,186	173.3	5.645	62,585
1992	0.481	0.895	10,391	4,999	0.902	368,954	173.1	6.523	63,857
1993	0.508	0.888	10,687	5,428	0.910	376,035	173.0	6.953	65,050
1994	0.551	0.874	11,052	6,090	0.923	383,554	173.0	7.650	66,345
1995	0.647	0.932	11,300	7,314	0.930	388,870	173.1	9.056	67,310
1996	0.708	0.936	11,579	8,203	0.945	391,951	173.3	10.063	67,933
1997	0.811	1.000	11,821	9,585	0.955	395,780	173.3	11.647	68,581
1998	0.889	0.968	12,264	10,902	0.974	402,455	173.4	13.019	69,784
1999	0.942	0.980	12,729	11,991	0.988	411,423	173.6	13.994	71,406
2000	1.000	1.000	13,122	13,122	1.000	418,193	173.9	15.037	72,718
2001	1.034	0.997	13,485	13,945	1.002	428,993	173.9	15.578	74,601
2002	1.085	1.002	13,775	14,944	1.004	436,964	174.1	16.372	76,064
2003	1.132	1.007	14,190	16,062	1.015	444,599	174.3	17.269	77,508
2004	1.217	1.044	14,572	17,742	1.027	450,184	174.6	18.804	78,624
2005	1.281	1.054	15,152	19,411	1.048	458,500	174.7	20.190	80,120
2006	1.373	1.064	15,711	21,565	1.071	465,157	174.8	22.107	81,290
2007	1.530	1.115	16,242	24,855	1.095	470,082	174.8	25.201	82,191
2008	1.864	1.253	16,769	31,250	1.120	474,087	175.0	31.394	82,951
2009	2.131	1.293	17,311	36,891	1.147	477,130	175.3	36.756	83,638
2010	2.382	1.290	17,634	42,010	1.167	476,285	175.9	41.795	83,762
2011	2.641	1.305	18,010	47,570	1.178	481,016	176.1	46.789	84,724
2012	2.906	1.309	18,405	53,491	1.192	485,362	176.3	52.090	85,574
2013	3.167	1.295	18,809	59,566	1.210	488,325	176.4	57.616	86,153
2014	3.416	1.304	19,358	66,129	1.234	492,687	176.5	63.369	86,963
2015	3.450	1.282	19,940	68,794	1.248	501,969	176.4	64.737	88,556

Note: [1)] Corresponding price index of labor input defined by implicit index computed by V^L/L. [2)] Labor input volume calculated by using the Törnqvist-Theil quantity index evaluated in 2000 price.

Table 24: Aggregate Labor Input in Nepal

Year	Price[1)] (index) P^L	Price/CPI (index) P^L/CPI	Quantity[2)] (mil. Rupees) L	Outlay (mil. Rupees) V^L	Quality (index) Q	Employment (1000s) N	Hours per month (hours) h	Hourly wage (Rupees/hour) w	Hours worked (mils.) H
1970	0.087	1.113	65,878	5,713	0.502	4,749	144.7	0.693	687
1971	0.098	1.277	67,055	6,542	0.502	4,835	144.7	0.779	700
1972	0.094	1.138	69,557	6,555	0.505	4,996	144.6	0.756	722
1973	0.114	1.234	72,238	8,224	0.507	5,168	144.4	0.918	746
1974	0.130	1.174	75,072	9,735	0.510	5,350	144.3	1.051	772
1975	0.130	1.097	78,034	10,174	0.512	5,539	144.1	1.062	798
1976	0.126	1.092	80,880	10,169	0.515	5,720	144.0	1.029	824
1977	0.138	1.086	83,875	11,534	0.517	5,910	143.9	1.130	850
1978	0.151	1.113	87,012	13,160	0.519	6,110	143.8	1.248	878
1979	0.163	1.156	90,298	14,695	0.521	6,321	143.6	1.349	908
1980	0.176	1.088	93,736	16,466	0.524	6,540	143.5	1.462	938
1981	0.192	1.071	97,024	18,637	0.526	6,749	143.3	1.605	967
1982	0.208	1.041	102,335	21,336	0.548	6,800	144.0	1.815	980
1983	0.229	1.019	107,789	24,730	0.569	6,856	144.7	2.077	992
1984	0.244	1.052	113,325	27,621	0.591	6,913	145.4	2.289	1,005
1985	0.279	1.114	118,906	33,157	0.612	6,969	146.1	2.713	1,018
1986	0.314	1.055	124,140	39,005	0.633	7,004	146.8	3.162	1,028
1987	0.351	1.065	129,379	45,453	0.653	7,039	147.4	3.650	1,038
1988	0.391	1.088	134,747	52,671	0.674	7,079	148.1	4.187	1,048
1989	0.433	1.106	140,450	60,784	0.694	7,131	148.8	4.775	1,061
1990	0.474	1.118	146,643	69,447	0.714	7,197	149.5	5.380	1,076
1991	0.565	1.155	153,804	86,907	0.736	7,287	150.3	6.614	1,095
1992	0.624	1.089	163,580	102,087	0.761	7,493	150.4	7.551	1,127
1993	0.670	1.087	174,376	116,859	0.787	7,716	150.5	8.388	1,161
1994	0.712	1.067	185,907	132,433	0.815	7,943	150.6	9.227	1,196
1995	0.768	1.069	197,921	152,006	0.843	8,165	150.7	10.295	1,230
1996	0.822	1.048	209,467	172,234	0.872	8,353	150.7	11.401	1,259
1997	0.857	1.049	221,068	189,377	0.901	8,528	150.7	12.279	1,285
1998	0.932	1.026	232,757	216,963	0.931	8,695	150.7	13.803	1,310
1999	0.975	0.999	244,720	238,510	0.962	8,856	150.6	14.903	1,334
2000	1.000	1.000	258,763	258,763	1.000	9,043	150.0	15.901	1,356
2001	0.959	0.934	275,529	264,293	1.043	9,255	149.5	15.915	1,384
2002	0.965	0.912	288,704	278,529	1.066	9,493	149.6	16.346	1,420
2003	0.981	0.877	301,958	296,159	1.087	9,731	149.6	16.951	1,456
2004	1.006	0.875	314,958	316,956	1.107	9,966	149.6	17.716	1,491
2005	1.021	0.831	327,503	334,245	1.126	10,193	149.6	18.272	1,524
2006	1.064	0.810	340,388	362,106	1.143	10,440	149.5	19.333	1,561
2007	1.140	0.820	353,063	402,344	1.159	10,681	149.5	21.003	1,596
2008	1.267	0.830	365,795	463,602	1.175	10,925	149.4	23.672	1,632
2009	1.440	0.849	377,138	543,077	1.186	11,116	149.9	27.159	1,666
2010	1.645	0.887	389,401	640,410	1.198	11,327	150.4	31.322	1,704
2011	2.011	0.993	405,133	814,673	1.212	11,602	151.1	38.738	1,753
2012	2.152	0.971	413,743	890,404	1.209	11,884	150.9	41.363	1,794
2013	2.394	0.990	423,130	1,012,907	1.206	12,185	150.9	45.919	1,838
2014	2.536	0.968	432,992	1,098,228	1.205	12,493	150.8	48.578	1,884
2015	2.667	0.944	443,085	1,181,866	1.203	12,800	150.8	51.031	1,930

Note: [1)] Corresponding price index of labor input defined by implicit index computed by V^L/L. [2)] Labor input volume calculated by using the Törnqvist-Theil quantity index evaluated in 2000 price.

Table 25: Aggregate Labor Input in Pakistan

Year	Price[1)] (index) P^L	Price/CPI (index) P^L/CPI	Quantity[2)] (mil. Rupees) L	Outlay (mil. Rupees) V^L	Quality (index) Q	Employment (1000s) N	Hours per month (hours) h	Hourly wage (Rupees/hour) w	Hours worked (mils.) H
1970	0.031	0.469	560,798	17,662	0.669	18,300	190.2	0.423	3,480
1971	0.034	0.477	594,357	19,946	0.674	18,920	193.5	0.454	3,661
1972	0.039	0.532	592,604	23,318	0.673	19,222	190.1	0.532	3,654
1973	0.041	0.455	637,189	26,385	0.695	19,760	192.7	0.578	3,807
1974	0.051	0.440	684,151	34,733	0.716	20,349	194.8	0.730	3,965
1975	0.064	0.460	708,864	45,436	0.722	20,732	196.5	0.930	4,073
1976	0.074	0.496	735,753	54,511	0.738	21,472	192.7	1.098	4,137
1977	0.090	0.544	770,503	68,994	0.757	22,355	188.9	1.361	4,224
1978	0.108	0.616	808,422	87,004	0.777	23,300	185.2	1.680	4,316
1979	0.123	0.652	835,523	103,030	0.791	24,158	181.5	1.959	4,384
1980	0.143	0.673	848,727	121,001	0.795	24,277	182.4	2.277	4,429
1981	0.154	0.651	854,765	131,762	0.772	25,248	181.9	2.391	4,592
1982	0.189	0.755	890,754	168,735	0.781	26,051	181.7	2.971	4,733
1983	0.221	0.828	907,948	200,601	0.784	26,438	181.7	3.480	4,804
1984	0.237	0.837	944,023	223,495	0.788	27,278	182.2	3.747	4,971
1985	0.265	0.886	973,253	257,647	0.798	27,548	183.6	4.244	5,059
1986	0.293	0.946	984,856	288,181	0.800	27,667	184.6	4.702	5,107
1987	0.326	1.008	1,047,936	342,072	0.815	29,345	181.8	5.344	5,334
1988	0.359	1.018	1,026,471	368,289	0.800	29,635	179.6	5.766	5,322
1989	0.390	1.027	1,109,124	432,949	0.837	30,082	182.8	6.562	5,498
1990	0.415	1.002	1,224,707	508,508	0.874	31,275	185.8	7.291	5,812
1991	0.461	0.995	1,293,202	596,035	0.930	30,621	188.5	8.606	5,771
1992	0.577	1.137	1,330,732	768,097	0.922	31,843	188.2	10.683	5,992
1993	0.617	1.106	1,432,064	883,632	0.946	32,928	190.9	11.716	6,285
1994	0.672	1.071	1,422,751	955,423	0.930	33,860	187.6	12.537	6,350
1995	0.753	1.069	1,479,668	1,114,799	0.950	34,122	189.5	14.370	6,465
1996	0.827	1.063	1,508,404	1,247,437	0.960	34,548	188.8	15.938	6,522
1997	0.949	1.096	1,641,536	1,557,736	1.009	35,994	187.6	19.228	6,751
1998	1.003	1.090	1,678,849	1,684,155	0.995	37,774	185.4	20.042	7,003
1999	1.012	1.056	1,724,659	1,744,547	0.998	38,636	185.6	20.269	7,172
2000	1.000	1.000	1,713,072	1,713,072	1.000	38,154	186.3	20.081	7,109
2001	1.048	1.016	1,746,232	1,830,522	1.001	38,987	185.7	21.075	7,238
2002	1.048	0.983	1,937,710	2,030,103	1.072	40,548	184.9	22.561	7,499
2003	1.080	0.985	2,006,372	2,166,656	1.085	41,264	186.0	23.526	7,675
2004	1.147	0.974	2,057,487	2,360,770	1.068	43,154	185.2	24.612	7,993
2005	1.261	0.981	2,082,548	2,625,969	1.071	43,841	184.0	27.125	8,068
2006	1.427	1.029	2,231,145	3,183,822	1.069	47,861	181.0	30.620	8,665
2007	1.644	1.102	2,290,348	3,764,507	1.079	48,571	181.3	35.617	8,808
2008	1.736	0.967	2,385,312	4,141,194	1.095	50,011	180.7	38.192	9,036
2009	1.972	0.967	2,479,240	4,889,093	1.112	51,713	178.9	44.044	9,250
2010	2.229	0.960	2,514,008	5,604,676	1.095	52,791	180.4	49.042	9,524
2011	2.586	0.995	2,628,115	6,797,321	1.111	54,761	179.2	57.716	9,814
2012	2.889	1.013	2,735,665	7,902,131	1.136	56,108	178.1	65.913	9,991
2013	3.263	1.063	2,851,682	9,303,906	1.163	57,526	176.9	76.170	10,179
2014	3.545	1.077	2,856,819	10,126,515	1.161	57,446	177.7	82.655	10,210
2015	4.027	1.193	2,937,133	11,826,755	1.165	58,835	177.8	94.216	10,461

Note: [1)] Corresponding price index of labor input defined by implicit index computed by V^L/L. [2)] Labor input volume calculated by using the Törnqvist-Theil quantity index evaluated in 2000 price.

Table 26: Aggregate Labor Input in Sri Lanka

Year	Price[1)] (index) P^L	Price/CPI (index) P^L/CPI	Quantity[2)] (mil. Rupees) L	Outlay (mil. Rupees) V^L	Quality (index) Q	Employment (1000s) N	Hours per month (hours) h	Hourly wage (Rupees/hour) w	Hours worked (mils.) H
1970	0.025	0.454	282,869	6,982	0.757	4,172	158.0	0.88	659
1971	0.026	0.461	289,735	7,467	0.757	4,273	157.9	0.92	675
1972	0.029	0.482	297,349	8,523	0.764	4,346	157.9	1.03	686
1973	0.032	0.490	304,910	9,723	0.770	4,419	157.9	1.16	698
1974	0.039	0.536	312,377	12,247	0.777	4,488	157.9	1.44	709
1975	0.043	0.556	319,556	13,874	0.784	4,550	157.9	1.61	718
1976	0.048	0.602	325,126	15,460	0.787	4,616	157.9	1.77	729
1977	0.057	0.709	339,917	19,270	0.790	4,671	162.4	2.12	759
1978	0.066	0.738	345,662	22,868	0.793	4,719	162.7	2.48	768
1979	0.080	0.802	351,538	27,994	0.798	4,765	163.1	3.00	777
1980	0.097	0.774	357,627	34,668	0.803	4,808	163.4	3.68	785
1981	0.116	0.782	371,883	42,958	0.829	4,823	164.0	4.53	791
1982	0.133	0.809	383,615	50,833	0.844	4,871	164.4	5.29	801
1983	0.154	0.825	397,686	61,263	0.860	4,926	165.5	6.26	815
1984	0.181	0.830	405,496	73,252	0.875	4,988	163.9	7.47	817
1985	0.200	0.907	402,340	80,627	0.889	5,056	157.8	8.42	798
1986	0.209	0.877	430,662	90,089	0.895	5,201	163.0	8.85	848
1987	0.224	0.871	443,218	99,221	0.901	5,303	163.6	9.53	867
1988	0.250	0.852	455,855	113,805	0.905	5,411	164.1	10.68	888
1989	0.272	0.832	468,447	127,380	0.908	5,522	164.7	11.67	909
1990	0.343	0.863	480,580	164,623	0.910	5,632	165.2	14.74	931
1991	0.372	0.835	513,150	190,995	0.971	5,596	166.4	17.09	931
1992	0.432	0.871	502,164	217,063	0.958	5,537	166.8	19.59	924
1993	0.482	0.869	531,839	256,280	0.961	5,804	168.1	21.89	976
1994	0.576	0.958	522,804	301,167	0.957	5,893	163.5	26.05	963
1995	0.632	0.976	539,844	341,058	0.983	5,977	162.0	29.36	968
1996	0.725	0.965	552,456	400,316	0.976	6,178	161.4	33.45	997
1997	0.852	1.036	547,694	466,800	0.977	6,257	157.9	39.37	988
1998	0.917	1.019	591,351	542,000	0.970	6,750	159.2	42.03	1,075
1999	0.952	1.010	616,869	587,035	0.995	6,787	161.1	44.75	1,093
2000	1.000	1.000	665,960	665,960	1.000	7,041	166.7	47.28	1,174
2001	1.067	0.935	688,422	734,735	1.059	6,958	164.6	53.45	1,145
2002	1.258	1.006	657,027	826,260	1.054	7,274	151.0	62.68	1,099
2003	1.412	1.067	610,826	862,185	1.030	7,238	144.5	68.70	1,046
2004	1.365	0.946	673,922	919,579	1.066	7,203	154.7	68.78	1,114
2005	1.596	0.997	697,318	1,112,971	1.092	7,153	157.3	82.43	1,125
2006	1.884	1.070	662,921	1,249,225	1.041	7,340	153.0	92.73	1,123
2007	2.109	1.034	680,900	1,436,053	1.063	7,280	155.1	105.98	1,129
2008	2.410	0.964	684,212	1,649,165	1.073	7,394	152.0	122.28	1,124
2009	2.556	0.989	685,718	1,752,506	1.090	7,347	150.9	131.74	1,109
2010	2.605	0.949	708,046	1,844,172	1.072	7,460	156.0	132.04	1,164
2011	2.653	0.905	779,125	2,067,392	1.088	7,601	166.1	136.43	1,263
2012	3.076	0.976	805,794	2,478,842	1.107	7,498	171.1	161.04	1,283
2013	3.610	1.071	771,354	2,784,566	1.120	7,681	158.0	191.15	1,214
2014	3.899	1.120	783,996	3,056,722	1.118	7,700	160.5	206.08	1,236
2015	4.258	1.212	796,468	3,391,242	1.118	7,831	160.3	225.09	1,256

Note: [1)] Corresponding price index of labor input defined by implicit index computed by V^L/L. [2)] Labor input volume calculated by using the Törnqvist-Theil quantity index evaluated in 2000 price.

Table 27: Compositions of Number of Workers in Bangladesh

Bangladesh

	$N_{g(2)}/N$	N_e/N (1970–2003)					N_e/N (2003–2015)									
	Female	No education	Class 1 to 4	Class 5 to 10	S.S.C and H.S.C	Degree & above	No education	Class 1 to 5	Class 6 to 8	Class 9 to 10	S.S.C	H.S.C	Degree & equivalent	Master degree & equiva	Doctors /engineers	Technical /vocational
	g=2	e=1	e=2	e=3	e=4	e=5	e=1	e=2	e=3	e=4	e=5	e=6	e=7	e=8	e=9	e=10
1970	.195	.767	.143	.057	.025	.008										
1971	.195	.759	.146	.060	.027	.008										
1972	.195	.752	.149	.063	.028	.008										
1973	.196	.745	.151	.066	.029	.008										
1974	.196	.738	.154	.069	.031	.008										
1975	.199	.731	.156	.073	.032	.008										
1976	.203	.719	.161	.078	.034	.009										
1977	.207	.705	.166	.083	.036	.009										
1978	.210	.691	.172	.089	.038	.010										
1979	.213	.676	.178	.095	.040	.011										
1980	.217	.661	.185	.101	.043	.011										
1981	.219	.648	.192	.104	.043	.013										
1982	.214	.633	.200	.107	.045	.014										
1983	.209	.619	.209	.110	.046	.016										
1984	.204	.605	.216	.114	.048	.018										
1985	.206	.586	.224	.120	.053	.018										
1986	.204	.581	.226	.121	.053	.019										
1987	.204	.578	.227	.122	.053	.020										
1988	.200	.574	.229	.122	.053	.022										
1989	.193	.569	.231	.123	.053	.023										
1990	.195	.539	.251	.128	.058	.025										
1991	.197	.507	.268	.134	.063	.027										
1992	.203	.506	.270	.133	.062	.028										
1993	.209	.505	.273	.132	.061	.028										
1994	.215	.504	.275	.131	.060	.029										
1995	.220	.503	.278	.130	.059	.030										
1996	.225	.497	.277	.136	.061	.029										
1997	.233	.479	.281	.146	.063	.030										
1998	.241	.462	.286	.156	.065	.031										
1999	.249	.446	.291	.165	.066	.032										
2000	.256	.430	.296	.174	.067	.034										
2001	.256	.435	.275	.180	.074	.036										
2002	.256	.439	.255	.187	.080	.039										
2003	.256	.442	.235	.194	.087	.042	.442	.235	.109	.085	.048	.039	.026	.013	.002	.001
2004	.250						.434	.236	.114	.081	.054	.038	.027	.014	.002	.001
2005	.247						.425	.236	.120	.077	.060	.037	.028	.015	.002	.001
2006	.245						.411	.241	.126	.073	.066	.035	.029	.015	.002	.001
2007	.261						.413	.238	.129	.077	.064	.035	.027	.015	.002	.001
2008	.276						.412	.236	.132	.080	.063	.034	.025	.014	.002	.001
2009	.292						.411	.233	.137	.084	.062	.034	.023	.014	.002	.001
2010	.306						.408	.230	.142	.087	.060	.033	.022	.014	.002	.002
2011	.304						.409	.227	.141	.086	.060	.033	.025	.016	.002	.002
2012	.300						.404	.226	.140	.086	.059	.033	.029	.018	.002	.002
2013	.297						.393	.227	.140	.086	.060	.033	.034	.022	.003	.002
2014	.299						.371	.237	.146	.090	.062	.035	.033	.021	.003	.002
2015	.302						.348	.248	.153	.094	.065	.036	.031	.020	.002	.002

Table 27: Compositions of Number of Workers in Bangladesh (cont'd)

Bangladesh	N_a/N												N_s/N		
	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65+	Employee	Own account worker	Unpaid family helper
	a=1	a=2	a=3	a=4	a=5	a=6	a=7	a=8	a=9	a=10	a=11	a=12	s=1	s=2	s=3
1970	.139	.124	.099	.085	.121	.090	.089	.076	.055	.055	.021	.045	.300	.401	.299
1971	.140	.122	.097	.085	.121	.091	.089	.076	.056	.055	.021	.046	.302	.403	.296
1972	.141	.121	.096	.084	.120	.091	.090	.076	.056	.055	.021	.047	.303	.405	.293
1973	.143	.121	.096	.084	.120	.091	.090	.076	.056	.055	.021	.048	.303	.406	.291
1974	.145	.122	.095	.082	.119	.091	.090	.076	.056	.055	.021	.048	.303	.407	.290
1975	.142	.121	.093	.085	.123	.091	.089	.075	.056	.053	.022	.049	.311	.403	.285
1976	.140	.124	.093	.087	.125	.091	.087	.074	.056	.051	.023	.050	.320	.398	.283
1977	.138	.127	.095	.087	.126	.091	.085	.072	.055	.049	.024	.050	.328	.392	.280
1978	.136	.130	.099	.088	.126	.091	.083	.070	.055	.047	.025	.050	.336	.386	.278
1979	.133	.132	.103	.090	.125	.091	.082	.069	.055	.045	.025	.050	.345	.380	.275
1980	.130	.133	.108	.094	.122	.089	.080	.068	.055	.043	.026	.050	.354	.375	.271
1981	.126	.134	.112	.102	.121	.088	.078	.066	.054	.041	.027	.051	.363	.369	.268
1982	.123	.136	.116	.105	.115	.089	.078	.065	.054	.040	.027	.051	.373	.367	.260
1983	.121	.137	.119	.109	.110	.089	.078	.065	.053	.040	.027	.052	.383	.364	.253
1984	.119	.138	.122	.113	.107	.090	.078	.064	.052	.039	.028	.052	.393	.361	.246
1985	.118	.136	.123	.118	.104	.090	.079	.063	.052	.038	.028	.051	.377	.367	.257
1986	.116	.134	.124	.122	.103	.090	.079	.063	.051	.037	.029	.051	.362	.371	.267
1987	.119	.130	.123	.125	.104	.088	.079	.062	.051	.036	.029	.051	.361	.372	.267
1988	.123	.127	.122	.128	.106	.087	.079	.062	.051	.036	.030	.051	.361	.374	.265
1989	.126	.125	.120	.129	.107	.087	.078	.061	.050	.035	.030	.051	.361	.377	.262
1990	.124	.123	.119	.130	.109	.090	.077	.060	.050	.035	.031	.051	.358	.367	.276
1991	.120	.123	.117	.130	.111	.095	.076	.059	.051	.035	.032	.051	.356	.357	.287
1992	.119	.123	.115	.132	.112	.097	.074	.060	.051	.034	.031	.050	.363	.360	.277
1993	.118	.124	.113	.134	.113	.100	.072	.061	.052	.034	.031	.048	.369	.363	.268
1994	.117	.125	.111	.135	.113	.103	.071	.062	.053	.034	.030	.046	.376	.365	.258
1995	.116	.126	.109	.135	.113	.106	.072	.062	.053	.034	.030	.044	.383	.369	.248
1996	.114	.127	.109	.135	.111	.108	.075	.061	.053	.033	.030	.044	.390	.374	.236
1997	.109	.129	.108	.133	.113	.110	.077	.061	.054	.034	.029	.044	.392	.384	.224
1998	.103	.129	.108	.130	.115	.112	.080	.061	.055	.034	.029	.044	.394	.394	.212
1999	.098	.128	.108	.129	.116	.114	.083	.062	.056	.034	.029	.044	.396	.404	.201
2000	.092	.128	.109	.127	.117	.114	.086	.064	.056	.034	.029	.044	.397	.413	.190
2001	.084	.128	.112	.129	.117	.112	.088	.066	.057	.033	.029	.045	.384	.415	.201
2002	.077	.128	.115	.130	.116	.113	.088	.067	.056	.035	.031	.046	.370	.418	.212
2003	.069	.127	.117	.131	.115	.113	.089	.068	.054	.036	.032	.048	.357	.422	.221
2004	.063	.122	.116	.130	.116	.116	.094	.072	.055	.037	.032	.047	.360	.418	.222
2005	.057	.116	.117	.128	.118	.118	.098	.077	.056	.038	.032	.045	.362	.414	.224
2006	.050	.109	.120	.127	.119	.120	.101	.082	.059	.038	.031	.044	.364	.408	.227
2007	.046	.104	.121	.128	.124	.120	.105	.084	.058	.038	.030	.042	.370	.405	.225
2008	.042	.099	.122	.129	.128	.119	.109	.087	.059	.037	.029	.040	.375	.402	.223
2009	.038	.094	.123	.130	.132	.119	.112	.088	.059	.038	.028	.037	.378	.400	.222
2010	.035	.091	.124	.130	.136	.119	.115	.089	.060	.040	.027	.035	.381	.398	.221
2011	.032	.084	.127	.139	.134	.114	.107	.086	.063	.043	.032	.038	.388	.401	.211
2012	.030	.077	.129	.147	.130	.110	.099	.083	.067	.047	.037	.043	.396	.402	.202
2013	.030	.071	.132	.156	.127	.104	.091	.079	.070	.051	.042	.048	.404	.401	.194
2014	.029	.071	.126	.149	.127	.112	.094	.084	.070	.053	.040	.046	.410	.410	.180
2015	.029	.070	.119	.143	.127	.121	.097	.089	.069	.054	.038	.043	.416	.418	.166

Table 28: Compositions of Number of Workers in Bhutan

Bhutan

	$N_{g(2)}/N$	N_e/N							N_a/N											N_s/N		
	Female	No education	Primary	Lower secondary	Middle secondary	Higher secondary	Undergraduate and over	Religious Professional	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65+	Employee	Own account worker	Unpaid family worker
	g=2	e=1	e=2	e=3	e=4	e=5	e=6	e=7	a=1	a=2	a=3	a=4	a=5	a=6	a=7	a=8	a=9	a=10	a=11	s=1	s=2	s=3
1970	.367	.932	.008	.001	.001	.001	.000	.057	.080	.177	.181	.163	.143	.098	.070	.040	.021	.015	.011	.198	.289	.512
1971	.365	.930	.010	.002	.001	.001	.000	.057	.080	.175	.183	.164	.143	.098	.070	.040	.021	.015	.011	.198	.289	.512
1972	.362	.928	.011	.002	.001	.001	.000	.057	.081	.171	.186	.165	.143	.098	.071	.040	.021	.015	.011	.198	.289	.512
1973	.359	.926	.012	.002	.001	.001	.000	.057	.081	.165	.188	.166	.143	.099	.071	.040	.021	.015	.011	.199	.289	.512
1974	.355	.924	.014	.002	.001	.001	.001	.057	.082	.161	.189	.167	.144	.099	.071	.040	.021	.015	.011	.198	.289	.513
1975	.353	.923	.015	.003	.002	.001	.001	.057	.081	.159	.187	.169	.145	.099	.072	.041	.021	.015	.011	.198	.289	.512
1976	.351	.921	.016	.003	.002	.001	.001	.057	.082	.158	.184	.171	.146	.099	.072	.041	.021	.015	.011	.199	.289	.512
1977	.349	.919	.017	.003	.002	.001	.001	.057	.082	.159	.179	.173	.146	.099	.072	.041	.021	.015	.011	.197	.290	.514
1978	.348	.916	.019	.003	.002	.001	.001	.057	.081	.161	.174	.174	.147	.100	.073	.042	.021	.015	.011	.199	.289	.512
1979	.347	.914	.021	.004	.002	.001	.001	.057	.081	.162	.170	.175	.148	.100	.073	.042	.022	.015	.011	.202	.288	.510
1980	.346	.910	.023	.004	.002	.001	.001	.058	.080	.163	.168	.173	.150	.101	.073	.042	.022	.016	.011	.189	.292	.519
1981	.346	.905	.027	.005	.003	.001	.002	.058	.081	.163	.167	.170	.151	.101	.074	.043	.022	.016	.012	.204	.288	.508
1982	.347	.900	.030	.005	.003	.001	.002	.058	.081	.163	.167	.166	.153	.102	.075	.043	.023	.016	.012	.200	.289	.511
1983	.348	.895	.034	.006	.003	.001	.002	.058	.082	.162	.167	.161	.154	.103	.075	.044	.023	.016	.012	.205	.287	.508
1984	.349	.889	.038	.007	.004	.002	.002	.059	.082	.163	.168	.156	.154	.104	.076	.044	.023	.017	.013	.204	.287	.509
1985	.350	.882	.043	.008	.004	.002	.002	.059	.083	.163	.168	.153	.153	.105	.076	.045	.024	.017	.013	.206	.286	.508
1986	.351	.877	.046	.009	.005	.002	.003	.059	.084	.164	.168	.152	.150	.106	.077	.045	.024	.017	.013	.210	.285	.505
1987	.352	.873	.048	.010	.006	.002	.003	.059	.085	.166	.168	.151	.146	.107	.077	.045	.024	.017	.013	.227	.280	.493
1988	.354	.869	.050	.010	.006	.002	.003	.059	.086	.167	.168	.152	.141	.108	.078	.046	.024	.018	.014	.227	.279	.494
1989	.355	.863	.054	.011	.007	.003	.004	.059	.086	.169	.167	.152	.137	.107	.078	.046	.025	.018	.014	.236	.276	.488
1990	.356	.858	.057	.012	.008	.003	.004	.058	.087	.171	.168	.152	.134	.106	.079	.046	.025	.018	.013	.262	.267	.471
1991	.356	.847	.064	.013	.009	.004	.005	.059	.087	.175	.169	.153	.132	.102	.078	.046	.025	.019	.013	.260	.268	.472
1992	.353	.837	.070	.015	.010	.004	.006	.059	.088	.177	.171	.152	.132	.097	.078	.046	.025	.019	.014	.282	.261	.457
1993	.350	.826	.077	.016	.011	.005	.006	.059	.089	.179	.174	.151	.134	.093	.076	.046	.025	.019	.014	.295	.257	.447
1994	.345	.812	.086	.018	.012	.005	.008	.059	.090	.179	.179	.149	.136	.090	.073	.045	.025	.020	.015	.312	.252	.436
1995	.347	.800	.093	.021	.013	.006	.009	.059	.091	.180	.182	.148	.137	.089	.070	.044	.025	.020	.015	.324	.249	.427
1996	.350	.788	.099	.023	.016	.006	.010	.058	.092	.182	.182	.149	.135	.089	.068	.043	.025	.020	.015	.323	.250	.427
1997	.358	.775	.105	.027	.019	.006	.011	.057	.093	.185	.181	.151	.131	.090	.067	.043	.024	.019	.016	.322	.250	.427
1998	.367	.762	.110	.030	.023	.008	.012	.056	.094	.189	.178	.153	.127	.091	.065	.042	.024	.019	.016	.327	.249	.424
1999	.375	.748	.114	.034	.027	.009	.012	.055	.095	.192	.177	.155	.124	.092	.064	.041	.024	.019	.016	.329	.249	.423
2000	.382	.735	.117	.038	.031	.012	.013	.054	.096	.194	.177	.156	.123	.091	.064	.041	.024	.019	.016	.337	.247	.416
2001	.389	.721	.120	.041	.036	.014	.015	.053	.096	.197	.178	.156	.123	.089	.063	.039	.023	.018	.016	.352	.242	.405
2002	.394	.708	.122	.042	.045	.015	.017	.052	.099	.198	.164	.145	.119	.090	.065	.047	.028	.025	.021	.352	.243	.405
2003	.398	.693	.123	.044	.053	.017	.020	.050	.100	.199	.150	.132	.117	.089	.068	.054	.033	.031	.026	.361	.241	.398
2004	.399	.690	.121	.045	.056	.020	.022	.047	.099	.168	.161	.131	.111	.088	.081	.061	.039	.030	.032	.351	.245	.404
2005	.404	.686	.118	.046	.059	.023	.024	.043	.092	.172	.162	.124	.114	.088	.080	.061	.042	.031	.036	.342	.250	.407
2006	.405	.681	.117	.047	.063	.026	.026	.040	.087	.173	.163	.118	.114	.090	.077	.062	.045	.031	.040	.338	.253	.409
2007	.407	.677	.115	.049	.066	.029	.028	.037	.087	.179	.162	.122	.112	.087	.074	.060	.042	.030	.044	.346	.252	.403
2008	.408	.672	.113	.050	.069	.032	.030	.034	.087	.183	.161	.126	.111	.086	.072	.058	.038	.030	.048	.344	.253	.403
2009	.409	.667	.111	.051	.073	.035	.032	.031	.086	.186	.159	.131	.111	.083	.071	.056	.035	.029	.052	.353	.254	.393
2010	.411	.655	.112	.052	.076	.043	.038	.023	.068	.167	.174	.146	.125	.094	.064	.054	.036	.028	.044	.378	.250	.372
2011	.408	.654	.105	.051	.082	.056	.040	.012	.057	.154	.172	.152	.119	.094	.074	.059	.040	.032	.048	.397	.261	.342
2012	.414	.637	.106	.052	.083	.056	.045	.021	.040	.153	.184	.156	.123	.091	.077	.056	.044	.032	.046	.420	.266	.314
2013	.414	.592	.121	.060	.087	.067	.054	.019	.030	.148	.183	.160	.132	.097	.070	.063	.037	.033	.047	.422	.269	.309
2014	.413	.613	.104	.053	.084	.064	.061	.020	.028	.128	.162	.146	.135	.099	.084	.070	.047	.045	.055	.417	.273	.310
2015	.412	.625	.103	.055	.078	.055	.056	.028	.028	.129	.160	.146	.138	.099	.085	.069	.046	.045	.055	.402	.313	.285

Table 29: Compositions of Number of Workers in India

India

	$N_{g(2)}/N$	N_e/N							N_a/N											N_s/N		
	Female	Not litrate	Literate & up to primary	Middle	Secondary	Higher secondary	Diploma/ Certificate	Graduate & above	0–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60+	Regular /wage salaried employees	Self-employed	Casual labour
	g=2	e=1	e=2	e=3	e=4	e=5	e=6	e=7	a=1	a=2	a=3	a=4	a=5	a=6	a=7	a=8	a=9	a=10	a=11	s=1	s=2	s=3
1970	.324	.663	.222	.063	.026	.012	.003	.010	.067	.101	.117	.129	.122	.108	.094	.080	.060	.048	.073	.159	.615	.225
1971	.326	.677	.205	.059	.030	.014	.003	.011	.066	.099	.119	.129	.122	.109	.095	.080	.060	.048	.074	.160	.615	.225
1972	.328	.677	.200	.058	.033	.015	.003	.012	.065	.100	.123	.126	.120	.109	.095	.081	.059	.048	.073	.159	.613	.228
1973	.329	.679	.194	.058	.036	.016	.004	.014	.064	.101	.126	.125	.118	.110	.095	.081	.059	.048	.072	.156	.609	.234
1974	.331	.683	.186	.056	.040	.017	.004	.015	.064	.102	.129	.124	.116	.110	.095	.081	.059	.048	.072	.152	.604	.244
1975	.332	.689	.176	.054	.043	.018	.004	.016	.063	.103	.131	.124	.114	.110	.095	.082	.059	.048	.071	.148	.599	.253
1976	.333	.678	.181	.056	.046	.018	.004	.017	.063	.104	.132	.125	.113	.109	.095	.081	.059	.048	.071	.143	.594	.262
1977	.334	.668	.185	.058	.048	.018	.004	.019	.062	.105	.132	.127	.112	.109	.095	.082	.059	.048	.070	.140	.590	.270
1978	.335	.658	.188	.060	.051	.018	.004	.020	.062	.106	.131	.129	.111	.108	.095	.082	.059	.048	.070	.139	.586	.275
1979	.336	.650	.191	.062	.054	.018	.005	.021	.061	.107	.130	.131	.112	.108	.095	.082	.059	.048	.069	.139	.584	.277
1980	.336	.641	.194	.064	.056	.017	.005	.023	.060	.107	.129	.131	.113	.107	.095	.082	.059	.048	.069	.139	.581	.280
1981	.337	.621	.206	.069	.057	.017	.005	.025	.059	.108	.128	.130	.115	.107	.094	.082	.059	.048	.068	.139	.578	.283
1982	.337	.613	.206	.071	.059	.018	.005	.027	.057	.106	.129	.132	.118	.106	.093	.082	.059	.048	.068	.139	.576	.286
1983	.337	.605	.205	.074	.062	.020	.005	.029	.055	.104	.129	.132	.122	.105	.093	.083	.059	.048	.069	.139	.573	.288
1984	.336	.603	.204	.075	.063	.020	.005	.030	.052	.102	.129	.133	.126	.106	.092	.083	.060	.049	.068	.140	.570	.290
1985	.335	.601	.203	.076	.063	.021	.005	.030	.050	.100	.129	.134	.128	.107	.092	.083	.060	.049	.068	.141	.566	.292
1986	.333	.595	.206	.079	.063	.021	.005	.031	.048	.098	.129	.135	.129	.108	.092	.082	.060	.049	.069	.143	.563	.294
1987	.330	.591	.208	.081	.063	.021	.005	.031	.046	.097	.129	.137	.129	.111	.091	.081	.060	.049	.069	.143	.562	.295
1988	.324	.574	.212	.088	.066	.023	.005	.034	.044	.095	.129	.138	.128	.113	.092	.081	.060	.049	.069	.142	.563	.295
1989	.318	.556	.215	.094	.069	.024	.006	.036	.043	.094	.129	.139	.127	.115	.092	.080	.060	.050	.070	.148	.555	.297
1990	.315	.540	.218	.101	.072	.025	.006	.039	.041	.092	.130	.141	.127	.116	.094	.080	.060	.050	.070	.145	.554	.301
1991	.313	.538	.208	.103	.077	.027	.006	.041	.039	.091	.130	.141	.126	.116	.097	.079	.060	.050	.070	.142	.553	.305
1992	.311	.527	.210	.104	.080	.029	.006	.043	.041	.091	.129	.140	.126	.117	.098	.078	.059	.050	.071	.133	.556	.311
1993	.310	.516	.212	.105	.084	.032	.006	.044	.042	.091	.128	.139	.126	.117	.100	.078	.059	.049	.072	.132	.554	.314
1994	.309	.513	.207	.105	.087	.035	.006	.046	.041	.089	.127	.138	.127	.118	.102	.078	.058	.049	.072	.134	.547	.319
1995	.306	.510	.202	.106	.091	.037	.006	.048	.040	.088	.126	.137	.127	.119	.104	.079	.058	.049	.073	.133	.546	.321
1996	.299	.491	.206	.112	.094	.040	.006	.050	.039	.086	.125	.137	.128	.120	.104	.080	.058	.049	.074	.135	.543	.322
1997	.298	.473	.210	.118	.097	.043	.007	.052	.037	.085	.123	.137	.129	.122	.104	.082	.057	.049	.075	.133	.534	.333
1998	.298	.455	.214	.125	.101	.045	.007	.054	.035	.084	.122	.136	.129	.124	.103	.085	.057	.048	.075	.137	.529	.334
1999	.301	.438	.217	.131	.104	.048	.007	.056	.034	.083	.121	.136	.130	.125	.102	.087	.058	.048	.076	.142	.531	.327
2000	.300	.409	.231	.141	.104	.050	.007	.060	.033	.082	.121	.135	.130	.126	.101	.088	.059	.048	.077	.146	.541	.313
2001	.302	.398	.234	.143	.104	.052	.006	.063	.033	.081	.120	.135	.130	.127	.100	.088	.061	.048	.077	.147	.544	.309
2002	.298	.390	.235	.145	.103	.053	.007	.067	.032	.080	.122	.134	.128	.126	.101	.088	.062	.047	.079	.148	.544	.308
2003	.297	.382	.237	.148	.102	.053	.008	.070	.032	.082	.124	.133	.129	.125	.101	.087	.062	.048	.077	.151	.549	.299
2004	.293	.373	.238	.150	.101	.054	.009	.075	.032	.082	.125	.133	.130	.125	.101	.086	.061	.050	.075	.154	.554	.291
2005	.293	.367	.232	.149	.108	.057	.009	.078	.030	.079	.124	.133	.130	.124	.101	.087	.063	.050	.077	.157	.551	.292
2006	.291	.355	.231	.151	.112	.060	.009	.081	.029	.076	.123	.133	.129	.124	.102	.089	.065	.051	.079	.159	.540	.301
2007	.287	.344	.230	.154	.117	.063	.009	.083	.027	.072	.121	.134	.128	.125	.103	.090	.066	.053	.082	.161	.529	.310
2008	.283	.332	.228	.156	.122	.066	.009	.087	.025	.068	.118	.135	.128	.126	.104	.092	.067	.054	.084	.163	.517	.319
2009	.279	.320	.226	.158	.128	.069	.009	.090	.023	.063	.116	.135	.128	.127	.106	.093	.068	.055	.087	.168	.512	.320
2010	.271	.311	.228	.160	.128	.071	.009	.092	.021	.062	.115	.135	.127	.127	.106	.094	.067	.056	.088	.176	.512	.311
2011	.272	.310	.229	.161	.126	.072	.010	.092	.021	.062	.115	.134	.127	.126	.107	.094	.067	.056	.090	.184	.514	.302
2012	.271	.310	.229	.161	.126	.072	.010	.093	.020	.062	.114	.134	.127	.126	.107	.094	.067	.057	.092	.190	.509	.301
2013	.268	.309	.228	.161	.126	.072	.010	.094	.020	.061	.113	.133	.128	.126	.107	.094	.067	.057	.094	.196	.497	.307
2014	.268	.309	.228	.160	.126	.072	.010	.094	.019	.060	.111	.132	.129	.126	.108	.094	.068	.057	.096	.204	.482	.314
2015	.270	.310	.227	.160	.126	.072	.010	.095	.019	.059	.110	.131	.129	.126	.108	.095	.068	.057	.098	.210	.471	.320

Table 30: Compositions of Number of Workers in Nepal

Nepal	$N_{g(2)}/N$	N_e/N					N_a/N											N_s/N		
	Female	Never attended /less than primary	Primary class 1–5	Secondary class 6–10	Higher secondary class 11–12	Degree level	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60+	Employee	Own account worker	Unpaid family worker
	g=2	e=1	e=2	e=3	e=4	e=5	a=1	a=2	a=3	a=4	a=5	a=6	a=7	a=8	a=9	a=10	a=11	s=1	s=2	s=3
1970	.303	.940	.032	.023	.003	.003	.119	.129	.126	.130	.110	.106	.085	.065	.054	.033	.044	.094	.809	.097
1971	.303	.940	.032	.023	.003	.003	.118	.130	.129	.128	.110	.105	.084	.065	.054	.033	.045	.094	.809	.097
1972	.308	.931	.036	.026	.004	.003	.118	.129	.133	.123	.109	.105	.083	.066	.054	.033	.048	.095	.811	.094
1973	.313	.923	.040	.029	.005	.003	.118	.127	.137	.119	.109	.104	.082	.066	.055	.033	.050	.095	.813	.092
1974	.318	.914	.044	.031	.006	.004	.119	.124	.141	.115	.108	.103	.081	.067	.056	.034	.053	.096	.814	.090
1975	.322	.906	.048	.034	.008	.004	.119	.123	.142	.114	.106	.103	.080	.067	.056	.034	.056	.096	.816	.088
1976	.327	.898	.052	.037	.009	.004	.120	.121	.142	.115	.104	.102	.080	.067	.057	.034	.059	.096	.818	.086
1977	.331	.890	.056	.039	.010	.004	.121	.120	.140	.117	.102	.101	.080	.067	.057	.035	.061	.097	.819	.084
1978	.336	.882	.060	.042	.011	.005	.122	.118	.138	.120	.099	.100	.080	.067	.058	.035	.064	.097	.821	.082
1979	.340	.874	.064	.044	.012	.005	.123	.117	.135	.121	.098	.099	.080	.067	.058	.035	.066	.097	.823	.080
1980	.345	.867	.068	.046	.013	.005	.124	.117	.133	.121	.098	.097	.080	.067	.058	.036	.069	.097	.824	.078
1981	.349	.859	.072	.049	.014	.005	.125	.116	.131	.120	.100	.095	.080	.067	.058	.036	.072	.098	.826	.076
1982	.354	.853	.073	.052	.016	.006	.119	.116	.131	.122	.105	.093	.081	.068	.058	.037	.070	.109	.814	.077
1983	.360	.846	.074	.056	.018	.006	.113	.116	.132	.123	.110	.092	.082	.069	.057	.038	.069	.120	.802	.078
1984	.366	.839	.075	.059	.020	.007	.107	.116	.133	.123	.115	.091	.083	.070	.057	.039	.067	.131	.790	.079
1985	.371	.833	.076	.062	.022	.007	.101	.116	.134	.125	.118	.092	.083	.071	.057	.039	.065	.142	.778	.080
1986	.378	.827	.077	.065	.024	.008	.095	.116	.135	.126	.119	.094	.083	.072	.057	.040	.063	.154	.766	.080
1987	.385	.822	.077	.067	.026	.008	.090	.116	.136	.127	.120	.098	.082	.073	.057	.040	.061	.165	.754	.081
1988	.391	.816	.078	.070	.028	.009	.084	.116	.137	.129	.119	.102	.081	.074	.058	.041	.059	.176	.742	.082
1989	.397	.810	.079	.072	.030	.009	.078	.116	.139	.131	.118	.105	.082	.075	.058	.041	.057	.187	.731	.082
1990	.403	.805	.079	.074	.032	.010	.072	.117	.141	.133	.117	.106	.083	.075	.058	.042	.055	.199	.719	.082
1991	.405	.799	.079	.076	.035	.010	.066	.117	.143	.136	.117	.107	.086	.075	.058	.043	.052	.211	.707	.082
1992	.403	.780	.084	.083	.041	.012	.064	.117	.143	.136	.116	.107	.089	.072	.059	.043	.054	.219	.699	.082
1993	.400	.760	.088	.090	.046	.015	.063	.116	.143	.136	.116	.106	.093	.070	.059	.043	.056	.226	.691	.083
1994	.398	.740	.093	.097	.052	.018	.062	.115	.143	.136	.115	.105	.095	.068	.059	.043	.057	.234	.682	.083
1995	.396	.721	.097	.104	.057	.021	.061	.113	.142	.137	.116	.104	.096	.068	.059	.044	.059	.242	.674	.084
1996	.397	.703	.102	.111	.061	.023	.060	.111	.141	.137	.117	.104	.097	.069	.059	.044	.062	.250	.666	.084
1997	.399	.686	.106	.117	.064	.027	.059	.110	.138	.136	.118	.105	.096	.072	.058	.044	.064	.257	.658	.085
1998	.402	.669	.110	.123	.068	.030	.058	.108	.136	.136	.119	.105	.094	.074	.058	.045	.067	.265	.650	.085
1999	.405	.652	.115	.129	.071	.033	.057	.107	.134	.134	.120	.107	.093	.076	.058	.045	.069	.273	.642	.085
2000	.408	.634	.119	.136	.074	.037	.056	.105	.133	.133	.121	.108	.092	.077	.059	.046	.071	.281	.634	.085
2001	.410	.617	.123	.141	.078	.041	.055	.101	.130	.131	.121	.109	.091	.077	.062	.047	.075	.290	.626	.084
2002	.411	.604	.125	.146	.080	.045	.051	.095	.127	.132	.123	.112	.093	.078	.065	.047	.078	.291	.626	.083
2003	.412	.591	.129	.150	.081	.049	.047	.089	.123	.132	.124	.114	.095	.078	.069	.047	.081	.292	.626	.082
2004	.414	.579	.132	.154	.081	.053	.044	.085	.119	.132	.125	.116	.098	.078	.072	.048	.084	.292	.626	.082
2005	.417	.566	.136	.159	.081	.057	.040	.082	.116	.130	.126	.118	.101	.079	.074	.049	.087	.292	.626	.082
2006	.422	.553	.140	.164	.082	.061	.036	.078	.116	.129	.125	.118	.103	.080	.075	.051	.088	.292	.626	.082
2007	.427	.540	.144	.169	.082	.065	.032	.075	.117	.129	.124	.118	.104	.083	.075	.054	.089	.291	.626	.083
2008	.433	.527	.149	.174	.081	.069	.027	.072	.117	.129	.124	.118	.105	.086	.074	.056	.091	.290	.626	.083
2009	.436	.515	.154	.179	.078	.074	.023	.068	.116	.130	.124	.119	.105	.088	.074	.058	.094	.289	.627	.084
2010	.439	.503	.159	.185	.074	.078	.019	.064	.115	.132	.124	.120	.106	.090	.075	.059	.097	.288	.627	.084
2011	.441	.490	.166	.191	.070	.084	.015	.060	.115	.135	.124	.121	.107	.091	.076	.058	.098	.288	.627	.085
2012	.443	.490	.165	.191	.070	.083	.014	.060	.116	.135	.123	.120	.107	.090	.077	.057	.100	.288	.628	.085
2013	.444	.491	.165	.190	.070	.083	.014	.060	.116	.135	.122	.119	.107	.090	.078	.056	.101	.287	.628	.085
2014	.445	.492	.164	.190	.070	.083	.014	.060	.116	.136	.122	.118	.107	.090	.080	.054	.103	.287	.628	.085
2015	.445	.493	.164	.190	.070	.083	.013	.060	.116	.137	.122	.117	.107	.090	.080	.054	.104	.287	.629	.084

Table 31: Compositions of Number of Workers in Pakistan

Pakistan																			
	$N_{g(2)}/N$	N_e/N				N_a/N											N_s/N		
	Female	Illiterate	Below matric	Matric but below degree	Degree and above	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60+	Employees	Own account workers	Contributing family workers
	g=2	e=1	e=2	e=3	e=4	a=1	a=2	a=3	a=4	a=5	a=6	a=7	a=8	a=9	a=10	a=11	s=1	s=2	s=3
1970	.066	.788	.149	.047	.016	.059	.093	.115	.135	.122	.111	.095	.075	.071	.030	.093	.216	.496	.288
1971	.067	.783	.150	.050	.016	.064	.092	.106	.128	.124	.117	.096	.075	.073	.036	.088	.220	.495	.285
1972	.067	.775	.153	.054	.018	.067	.099	.104	.127	.124	.114	.096	.079	.069	.038	.083	.215	.493	.292
1973	.067	.770	.155	.056	.018	.070	.102	.105	.123	.118	.111	.094	.082	.070	.039	.087	.231	.485	.283
1974	.067	.765	.157	.059	.019	.074	.104	.107	.118	.112	.109	.092	.084	.070	.039	.090	.247	.478	.276
1975	.068	.763	.158	.060	.019	.079	.106	.111	.113	.105	.105	.089	.085	.072	.041	.094	.253	.475	.272
1976	.069	.760	.158	.064	.019	.084	.110	.114	.112	.104	.102	.088	.083	.070	.041	.093	.265	.459	.275
1977	.069	.755	.158	.068	.019	.088	.112	.115	.114	.103	.100	.087	.081	.069	.040	.091	.280	.444	.276
1978	.068	.751	.158	.072	.019	.092	.113	.116	.116	.103	.099	.086	.079	.068	.040	.089	.295	.430	.275
1979	.068	.747	.158	.075	.020	.096	.115	.118	.116	.102	.096	.086	.077	.067	.040	.087	.306	.417	.276
1980	.068	.743	.158	.080	.020	.093	.114	.117	.116	.103	.097	.087	.079	.067	.040	.088	.306	.425	.269
1981	.125	.746	.155	.078	.020	.100	.127	.125	.120	.099	.092	.084	.072	.063	.039	.080	.293	.408	.299
1982	.124	.738	.160	.081	.021	.096	.125	.124	.119	.099	.095	.084	.073	.064	.039	.081	.294	.416	.290
1983	.117	.731	.165	.083	.021	.090	.135	.126	.111	.091	.094	.083	.078	.061	.044	.088	.292	.421	.287
1984	.116	.722	.170	.086	.022	.086	.132	.125	.111	.092	.095	.084	.079	.062	.044	.089	.293	.429	.278
1985	.095	.705	.179	.092	.024	.081	.125	.126	.121	.100	.096	.086	.079	.064	.039	.083	.299	.441	.260
1986	.100	.695	.186	.094	.025	.077	.126	.125	.124	.102	.101	.085	.078	.061	.038	.084	.299	.444	.256
1987	.129	.692	.188	.093	.026	.074	.117	.132	.126	.102	.101	.081	.083	.066	.039	.077	.309	.432	.259
1988	.114	.678	.198	.096	.028	.066	.119	.131	.129	.103	.100	.086	.081	.064	.041	.081	.289	.469	.242
1989	.109	.657	.215	.100	.028	.067	.117	.131	.129	.104	.100	.087	.081	.064	.041	.080	.318	.454	.228
1990	.104	.634	.233	.103	.029	.067	.116	.131	.129	.105	.101	.087	.081	.064	.040	.078	.347	.438	.214
1991	.123	.617	.238	.112	.032	.054	.117	.132	.131	.107	.108	.092	.084	.065	.039	.073	.379	.414	.206
1992	.141	.622	.235	.111	.032	.059	.108	.123	.120	.120	.114	.093	.081	.063	.043	.077	.370	.413	.217
1993	.137	.639	.202	.122	.036	.057	.113	.126	.123	.110	.111	.090	.084	.065	.046	.076	.376	.401	.224
1994	.142	.637	.208	.117	.038	.053	.111	.121	.126	.114	.111	.093	.085	.065	.043	.078	.361	.408	.231
1995	.119	.622	.213	.125	.040	.050	.108	.127	.123	.109	.112	.094	.087	.063	.046	.081	.367	.412	.221
1996	.119	.612	.216	.129	.043	.051	.111	.127	.120	.108	.113	.097	.086	.064	.045	.078	.367	.413	.221
1997	.132	.599	.217	.134	.049	.051	.107	.119	.119	.109	.117	.104	.088	.066	.045	.076	.389	.412	.199
1998	.136	.592	.222	.136	.050	.050	.118	.125	.125	.112	.111	.096	.084	.064	.042	.073	.375	.406	.219
1999	.136	.594	.216	.137	.053	.051	.121	.127	.122	.111	.112	.096	.084	.062	.042	.072	.375	.406	.219
2000	.137	.594	.211	.139	.056	.050	.124	.129	.120	.109	.113	.097	.085	.061	.042	.070	.378	.413	.209
2001	.137	.548	.253	.147	.052	.048	.124	.137	.121	.107	.114	.095	.084	.061	.041	.068	.378	.413	.209
2002	.143	.492	.295	.160	.052	.046	.122	.144	.124	.106	.115	.094	.084	.061	.040	.063	.420	.376	.204
2003	.143	.482	.299	.163	.056	.047	.123	.140	.125	.105	.114	.095	.084	.060	.042	.066	.420	.376	.204
2004	.166	.486	.294	.161	.058	.050	.130	.144	.123	.102	.110	.093	.082	.058	.043	.067	.401	.363	.236
2005	.166	.458	.317	.168	.056	.052	.129	.143	.123	.103	.109	.093	.084	.057	.043	.065	.400	.363	.237
2006	.191	.470	.308	.166	.056	.057	.134	.144	.120	.103	.107	.093	.084	.055	.043	.061	.393	.343	.264
2007	.196	.463	.306	.177	.055	.052	.128	.145	.125	.105	.111	.094	.082	.056	.042	.059	.394	.339	.267
2008	.201	.463	.298	.177	.061	.054	.126	.143	.121	.106	.110	.096	.083	.057	.044	.059	.381	.335	.284
2009	.208	.452	.308	.175	.065	.050	.125	.144	.124	.104	.110	.094	.085	.060	.047	.056	.381	.327	.292
2010	.214	.454	.311	.173	.062	.047	.124	.144	.121	.108	.107	.094	.088	.062	.047	.056	.379	.338	.283
2011	.221	.455	.309	.172	.064	.045	.120	.142	.126	.111	.110	.097	.088	.061	.047	.054	.386	.344	.269
2012	.221	.447	.312	.176	.065	.043	.118	.142	.126	.112	.110	.097	.087	.063	.047	.054	.398	.337	.264
2013	.220	.440	.315	.179	.066	.041	.117	.143	.126	.113	.111	.097	.087	.065	.047	.054	.411	.330	.259
2014	.221	.441	.314	.179	.066	.036	.114	.141	.134	.117	.108	.095	.091	.063	.047	.055	.412	.348	.240
2015	.221	.440	.314	.180	.067	.036	.112	.139	.134	.118	.109	.095	.090	.064	.048	.055	.413	.349	.238

Table 32: Compositions of Number of Workers in Sri Lanka

Sri Lanka

	$N_{g(2)}/N$	N_e/N					N_a/N												N_s/N		
	Female	No schooling	Grades 1–5	Grades 6–10	G.C.E. (O/L)	G.C.E. (A/L)degree & above	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65+	Employee	Own account worker	Contributing family worker
	g=2	e=1	e=2	e=3	e=4	e=5	a=1	a=2	a=3	a=4	a=5	a=6	a=7	a=8	a=9	a=10	a=11	a=12	s=1	s=2	s=3
1970	.249	.243	.382	.301	.048	.027	.014	.085	.153	.141	.121	.125	.099	.090	.065	.046	.028	.033	.652	.274	.074
1971	.249	.238	.389	.298	.048	.027	.014	.085	.150	.144	.120	.121	.100	.091	.066	.047	.028	.034	.651	.275	.074
1972	.253	.228	.388	.303	.053	.028	.014	.084	.145	.147	.120	.117	.102	.093	.068	.047	.029	.034	.649	.278	.073
1973	.257	.217	.387	.307	.059	.029	.013	.083	.139	.151	.121	.114	.104	.094	.070	.047	.029	.034	.648	.280	.071
1974	.261	.207	.386	.312	.064	.030	.013	.082	.133	.154	.122	.111	.107	.096	.072	.048	.029	.034	.647	.283	.069
1975	.264	.197	.385	.317	.070	.031	.013	.081	.128	.156	.123	.108	.109	.097	.074	.048	.029	.034	.647	.287	.067
1976	.266	.184	.388	.324	.075	.030	.012	.079	.129	.153	.125	.108	.108	.099	.075	.049	.030	.035	.645	.291	.064
1977	.268	.171	.390	.331	.080	.028	.012	.076	.130	.149	.127	.107	.107	.100	.077	.049	.031	.035	.643	.296	.061
1978	.270	.158	.392	.338	.086	.026	.012	.073	.132	.144	.129	.107	.107	.101	.078	.049	.032	.035	.641	.301	.058
1979	.272	.145	.394	.345	.092	.024	.011	.070	.134	.140	.132	.106	.107	.103	.079	.049	.032	.036	.640	.307	.053
1980	.274	.132	.395	.352	.098	.023	.011	.067	.134	.137	.134	.106	.107	.104	.080	.049	.033	.036	.639	.312	.049
1981	.278	.123	.374	.367	.108	.028	.011	.065	.132	.143	.138	.107	.109	.101	.079	.049	.032	.035	.649	.309	.042
1982	.292	.114	.360	.377	.116	.033	.011	.066	.130	.144	.136	.110	.110	.098	.078	.050	.031	.036	.648	.304	.048
1983	.306	.104	.346	.388	.123	.038	.011	.066	.128	.145	.134	.113	.111	.097	.078	.051	.030	.036	.647	.298	.055
1984	.319	.095	.333	.399	.131	.042	.011	.067	.126	.145	.133	.116	.113	.095	.077	.052	.029	.036	.645	.293	.061
1985	.333	.085	.320	.409	.139	.046	.011	.066	.125	.144	.132	.118	.116	.094	.076	.053	.028	.036	.644	.288	.068
1986	.326	.074	.312	.418	.143	.053	.011	.063	.125	.141	.134	.122	.115	.098	.072	.052	.029	.038	.628	.292	.079
1987	.316	.064	.301	.429	.148	.058	.011	.060	.124	.141	.138	.122	.120	.097	.071	.051	.029	.037	.613	.296	.090
1988	.307	.056	.290	.440	.153	.062	.011	.058	.123	.140	.142	.121	.125	.097	.070	.049	.029	.036	.599	.299	.101
1989	.297	.048	.279	.450	.157	.066	.011	.057	.121	.138	.145	.121	.130	.097	.069	.048	.029	.036	.586	.302	.112
1990	.287	.041	.267	.461	.161	.070	.011	.057	.119	.136	.147	.121	.133	.098	.068	.046	.029	.035	.574	.304	.123
1991	.287	.042	.262	.458	.158	.080	.007	.054	.127	.136	.145	.121	.136	.099	.067	.045	.028	.034	.627	.272	.101
1992	.291	.041	.249	.455	.167	.088	.005	.050	.134	.140	.146	.125	.135	.098	.064	.042	.027	.033	.600	.282	.118
1993	.308	.042	.236	.456	.170	.096	.004	.051	.127	.142	.139	.127	.138	.087	.070	.042	.033	.039	.595	.285	.120
1994	.303	.043	.232	.459	.177	.089	.004	.049	.123	.139	.146	.136	.125	.094	.072	.048	.030	.035	.609	.283	.108
1995	.309	.042	.220	.453	.182	.103	.003	.049	.116	.141	.133	.132	.118	.120	.070	.050	.033	.037	.603	.292	.105
1996	.303	.048	.241	.437	.170	.104	.004	.053	.121	.136	.145	.136	.123	.107	.067	.048	.028	.031	.612	.280	.108
1997	.311	.048	.226	.444	.176	.106	.003	.051	.119	.133	.136	.137	.123	.123	.072	.043	.029	.031	.602	.296	.103
1998	.338	.051	.214	.453	.173	.110	.008	.059	.121	.125	.138	.128	.124	.106	.085	.048	.028	.030	.578	.296	.126
1999	.325	.052	.199	.459	.180	.110	.009	.058	.118	.122	.135	.126	.126	.112	.083	.047	.032	.033	.594	.292	.114
2000	.328	.056	.194	.464	.167	.119	.005	.052	.122	.123	.129	.131	.119	.113	.091	.052	.031	.031	.587	.293	.121
2001	.319	.051	.176	.462	.176	.135	.004	.043	.121	.120	.127	.127	.123	.116	.096	.056	.033	.033	.605	.294	.101
2002	.326	.055	.191	.457	.157	.140	.003	.044	.122	.121	.131	.131	.119	.113	.094	.056	.033	.033	.604	.294	.102
2003	.311	.054	.190	.463	.159	.134	.003	.042	.116	.122	.131	.132	.119	.113	.094	.059	.035	.034	.602	.302	.096
2004	.317	.054	.187	.448	.168	.142	.004	.041	.118	.122	.127	.128	.119	.113	.095	.061	.036	.034	.617	.292	.091
2005	.317	.045	.160	.459	.182	.155	.001	.036	.113	.129	.128	.128	.119	.113	.096	.064	.038	.035	.617	.303	.080
2006	.351	.047	.173	.471	.167	.142	.003	.040	.102	.120	.121	.121	.126	.118	.102	.069	.041	.037	.588	.312	.100
2007	.339	.041	.167	.481	.156	.155	.002	.036	.098	.120	.119	.120	.127	.120	.104	.073	.043	.038	.592	.309	.099
2008	.350	.037	.162	.483	.158	.160	.002	.033	.098	.116	.119	.119	.128	.120	.106	.076	.045	.039	.591	.306	.103
2009	.347	.034	.165	.481	.156	.163	.003	.034	.085	.115	.120	.123	.127	.120	.107	.079	.046	.040	.601	.295	.104
2010	.334	.029	.160	.491	.159	.160	.001	.030	.084	.109	.121	.121	.120	.119	.112	.082	.054	.046	.584	.317	.099
2011	.334	.028	.154	.485	.157	.175	.001	.028	.086	.110	.124	.121	.122	.111	.114	.085	.054	.045	.578	.316	.106
2012	.326	.026	.152	.476	.178	.168	.001	.025	.083	.110	.130	.122	.126	.110	.111	.083	.053	.046	.593	.319	.088
2013	.347	.025	.147	.481	.162	.184	.001	.027	.079	.101	.124	.124	.124	.119	.112	.082	.054	.053	.588	.322	.091
2014	.341	.022	.133	.492	.163	.190	.001	.024	.072	.097	.127	.125	.121	.122	.115	.085	.060	.051	.592	.319	.089
2015	.349	.023	.137	.476	.175	.188	.001	.024	.072	.094	.123	.125	.122	.122	.116	.087	.061	.054	.592	.324	.084