Changes in Educational Assortative Marriage in India: Evidence from National Sample Surveys, 1983-2012

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Abstract: Economic growth in India from the 1990s has been accompanied by an increase in economic inequality and the persistence of low intergenerational occupational and educational mobility. The rise in educational assortative marriage (or "marrying one's like" in respect of education) has important implications for economic inequality and intergenerational mobility. This paper examines whether there was an increase in educational assortative marriage in India from 1983 to 2012, and the magnitude of this increase. Changes in educational assortative marriage have been analysed using correlation measures and a method proposed by Altham (1970) and Altham and Ferrie (2007). Results show that relative educational assortative marriage has increased between 1983 and 2012 even after controlling the influence of changes in the distribution of educational attainments over the reference period.

JEL classification codes: J12, J24, J62, I24
Keywords: education, assortative marriage, Altham statistic , Caste,

1. INTRODUCTION

The rise in educational assortative marriage (or "marrying one's like" in respect of education) has important implications for economic inequality and intergenerational mobility. This paper examines whether there was an increase in educational assortative marriage in India from 1983 to 2012, and the magnitude of this increase.

Assortative marriage can be described as the coming together in marriage of individuals who have "more [socio-economic] traits in common than would likely be the case if pairings were random"[1]. Increase in magnitude of similarity in wives' and husbands' economic and social traits can affect economic inequality across households (Fernandez and Rogerson 2001, Kremer 1997, Mare 2000, Schwartz 2010, Greenwood *et al.* 2014, and Hu and Qian 2015). Studies based on data from different countries have shown that the increases in assortative marriage tend to widen income and earning inequality across households (Esping-Andersen 2007, Schwartz 2010, Greenwood *et al.* 2014 and Hu and Qian 2015). For example, Hu and Qian (2015) have shown that the increase in educational assortative marriage between 1983 and 2007 was associated with a growing inter-household earnings inequality in urban China. Similarly, Greenwood et *al.* (2014) have shown that, between 1960 and 2005, an increase in educational assortative marriage has contributed to increase in income inequality across households in the United States.

The degree of educational assortative marriage can not only affect inequality across households in the current generation, but can also slow down mobility with respect to certain socio-economic achievements between individuals and their offspring (Mare 2000, Durlauf and Shaorshadze 2014, Handy 2014, and Guell, Mora and Telmer 2015). Patterns of assortative

[1] See http://dictionary.reference.com/browse/assortative-mating

marriage can influence levels of intergenerational mobility, as the pattern of marriage between individuals forms the "family background" for their offspring in a society (Mare 2000 and 2011, and Durlau and Shaorshadze 2014). An increase in the degree of assortative marriage implies greater disparities in resources available for children in different households; it thus leads to differential investment in the next generation's education. In the context of developed countries, different studies have empirically shown how a assortative marriage can lead to a decline in intergenerational mobility (Ermisch *et al.* 2006, Handy 2014, and Guell, Mora, and Telmer 2015). For example, Handy (2014) examined the effect of educational assortative marriage on intergenerational mobility with respect to education and earnings in the United States. His study showed that assortative marriage "can explain about one quarter of the observed intergenerational persistence of schooling and earnings" in the United States (Handy 2014. p. 2). Another recent study by Guell, Mora and Telmer (2015) based on 2001 census data from Catalonia showed that an increase in assortative marriage among different generations in the 20th century led to a decrease in intergenerational mobility in the region.

Since early 1990s Indian economy has experienced relatively high economic growth rates. This high economic growth was, however, accompanied by an increase in economic inequality and the persistence of intergenerational occupational and educational mobility[2]. A study of changes in educational assortative marriage can provide further insights into the persistence of economic and social inequalities in a period of high economic growth in India. This paper contributes to literature on educational assortative marriage in Indian context in two ways: First, to the best of our knowledge, this is the first paper that examines changes in levels of educational assortative marriage for a relatively long time period of 29 years (1983-2012) in India. Second, the

[2] See Dev 2013, Sarkar and Mehta 2010; Subramanian and Jayaraj 2013 & 2015; Motiram and Sarma 2014 among others. Also see Emran and Shilpi 2015, Reddy 2015, Azam and Bhatt 2015, Ji 2014, Lambert et al. 2014, Motiram and Singh 2012.

methodology used in this paper provides estimates of changes in educational assortative marriage after controlling for changes in educational expansion among men and women over time.

The rest of the paper is organised in to following sections: Section two provides brief discussion on peculiarities of Indian marriage system and reviews the studies on educational assortative marriage in India. Section three presents data and methodology. Section four presents the results. Section five presents discussion.

2. MARRIAGE IN THE INDIAN CONTEXT

In contemporary Indian society, marriage is nearly universal. Calculations from 68th round of Employment and Unemployment Survey data of the National Sample Office show that, in 2012, only around two per cent of women aged between 30 and 35 were never married. Unlike other societies in the world, South Asian Society is peculiarly stratified on the basis of the institution called caste. Caste-based endogamy is one of the defining features of the Hindu caste system (Ambedkar 1916). Almost all marriages in India are still arranged within "marriageable" castes. Caste and religion are the most important criteria in the selection of prospective spouses in India. According to the Indian Human Development Survey 2011-12, only five per cent of Indian marriages were inter-caste in year 2011-12[3]. A study based on caste-specific matrimonial advertisements in newspapers by Banerjee et *al.* (2013) showed the persistence of a strong expressed desire among individuals to marry within their own caste. In other words, inter-caste and inter-religious marriages in Indian society still continue to be shunned, despite the expansion of education and increasing urbanisation. Nevertheless, with the continuous increase in the importance of education in modern India, education can play an important role in an individual's selection of a prospective spouse even within arranged marriages (see Banerjee, et *al.* 2013). In

[3] See http://www.thehindu.com/data/just-5-per-cent-of-indian-marriages-are-intercaste/article6591502.ece

other words, both families and individuals consider the educational attainment of a prospective spouse as an indicator of their families' future economic achievement.

Studies on Educational Assortative Marriage in India

Educational assortative marriage is well studied in developed countries and in some of less-developed countries (for reviews see Kalmijn 1998, Blossfeld 2009 and Schwartz 2013). In India, however, to the best of our knowledge, no systematic study variations in patterns and trends in assortative marriages over a relatively longer time period has been undertaken. A few studies have analysed assortative marriages in a limited context; among them are Driver (1984) and Dalmia and Lawrence (2001). All such studies have shown a high occurrence of assortative marriages (with respect to on different traits or variables) in India (see Driver 1984, Dalmia and Lawrence 2001, Esteve and McCaa, 2008).

3. DATA AND METHODOLOGY

3.1. Data

We used data from the Employment and Unemployment Surveys (EUS) of the National Sample Survey Office (NSSO) from Rounds 38 (1983), 47 (1987-88), 50 (1993-94), 55 (1999-00), 61 (2004-05) and 68 (2011-12). To analyse educational assortative marriage we considered data on all married couples (wives and husbands) in every household covered by the survey. We then classified the educational attainments all husbands and wives into four ordered categories: (1) below primary; (2) primary completed or middle school completed (henceforth middle school); (3) secondary or higher secondary completed (henceforth secondary); and (4) completed an undergraduate degree or more (henceforth graduate). We restricted our analysis to women aged 21-50 years and their husbands.

3.2. Methodology

Since educational categories used here can be strictly ranked, Kendall rank correlation (Kendall's tau) and Spearman's rank correlation coefficient (rho) are used to compute the association in educational attainments between husbands and wives in each year.

To measure changes in educational assortative marriage over time, following Greenwood *et al.* (2014) we used another measure, δ_t, based on a contingency table. A contingency table is a matrix in which the educational attainment of wives is arrayed across rows i (i = 1, 2, 3, ... N) and the educational attainment of husbands across columns j (j = 1, 2, 3,... N). The f_{ij} entry of the contingency table represents the percentage of wife-husband couples where the wife's educational attainment level is at the i^{th} level and the husband's educational attainment level is at the j^{th} level. The cells on the main diagonal of the matrix represent women marrying men with same educational attainment as theirs. This simple measure of homogamy is referred to as the "absolute homogamy rate," H_t, and measures the proportion of individuals in the main-diagonal cells. The absolute homogamy rate, H_t, is defined as:

$$H_t = \left(\sum_{i=1}^{N} f_{ii}\right) \Big/ f_{++} \qquad (1)$$

Where $\sum_{i=1}^{N} f_{ii}$ is the sum of main-diagonal cells of the contingency table and $f_{++} = \sum_{i=1}^{N} \sum_{j=1}^{N} f_{ij}$ is the grand total of cells of the contingency table.

We define educational homogamy in a year t as $\delta_t = H_t / H_{tr}$ (2)

Where H_t is the actual absolute homogamy in contingency table (in year t) and H_{tr} is the proportion of individuals in the main-diagonal cells, if men and women were matched randomly and keeping the marginal distributions of a given contingency table unchanged. If this ratio, δ_t, is

greater than one, it implies that marriages are occurring more homogenously than they would in conditions in which men and women were matched randomly.

A measure of correlation between the educational attainments of women and their husbands provides an aggregate picture of the temporal changes in educational assortative marriage. However, when we want to compare changes in educational assortative marriage between two time points, the results from this measure get confounded by changes in the distribution of educational attainments among men and women over time. Similarly, measure of educational homogamy, δ_p, and absolute homogamy, H_p, do not control for changes in educational distribution over time. Further, H_t and δ_t only focus on diagonal cells, and hence fail to capture the association between off diagonal cells. Differences in educational homogamy between two time points (two contingency tables) can be attributed to two processes. The educational distribution of men and women may vary over time because of the secular expansion of education in an economy. In other words, more and more women and men gain access to education over time and this may lead to changes in the distribution of educational attainments among men and women. These differences in the distributions of educational attainments among men and women between two points in time (contingency tables) influence the magnitude of educational assortative marriage. In other words, the observed difference in the magnitude of educational assortative marriage between two points in time may be due to differences in the distribution of educational attainments between two points in time. Even if the distributions of educational attainments among women and men across two points in time are the same, the actual assortative mating may differ. This could be because of changes in men's and women's preferences with respect to the educational attainments of their partners at two different points in time. For example, levels of assortative marriage may change over time because, since returns to education increase over time, highly educated individuals prefer spouses with similar educational attainments.

However, as discussed above, the simple measures of assortative mating (τ, σ, H_i, δ_i) do not distinguish between differences in assortative mating between two points in time caused by the two reasons mentioned above. Therefore, to measure changes in the association between the educational attainments of women and their husbands while also accounting for changes in educational structure, we use the method proposed by Altham (1970), and Altham and Ferrie (2007).[4]

Contingency table **P** can be adjusted to have the same marginal distributions in rows (educational attainments of wives) and columns (educational attainments of husbands) in the contingency table **Q** following Mosteller (1968) and such an adjustment does not alter association between rows (educational levels of wives) and columns (educational levels of husbands) in table **P** (Altham and Ferrie, 2007). Once table **P** and table **Q** are adjusted to have the same marginal frequencies (distributions of educational attainments among women and their husbands), we compute the difference between the absolute homogamy rates of table **P** and table **Q.** This difference in homogmay shows what would have changed in absolute educational homogamy in the absence of changes in educational distribution between wives and husbands between two points (table **P** and table **Q**) (Altham and Ferrie (2007). In other words, this procedure of adjusting the marginal frequencies of one table to match those of the other is useful to find out whether the observed difference in absolute educational homogamy, H_t, between contingency table **P** and table **Q** is a result of difference in their marginal frequencies (i.e. changes educational distributions of educational attainments among women and their husbands between two points in time) (Altham and Ferrie 2007).

[4]This method is analogous to the frequently used log-linear models in the literature that are used to measure the detailed patterns and trends in educational assortative marriage over time net of changes in the distribution of educational attainment among husbands and wives.

To compute difference in the magnitude between the underlying association between rows and columns (between educational attainments of women and their husbands) in contingency tables **P** and **Q**, we use measure of odds ratios. In a 2x2 contingency table, an odds ratio measures the association between rows and columns. An odds ratio for a 2x2 contingency table $\begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix}$ can be written as $(p_{11}/p_{12})/(p_{21}/p_{22})$. Here, the odds ratio represents the chances of someone with education level 1 marrying someone with education level 1 rather than marrying someone with education level 2, relative to the chances of an individual with education level 2 marrying someone with education level 1 rather than marrying someone with education level 2.

In case of a contingency table with multiple rows and columns the number of odds ratios that we can generate is large. We can compute $[r(r-1)/2][s(s-1)/2]$ number of odds ratios for a contingency table with with r rows and s columns. Altham and Ferrie(2007) propose an Altham metric (1970) to compute the difference in the magnitude of association between rows and columns in two contingency tables **P** and **Q**. Altham's metric is invariant to differences in marginal frequencies (that is, differences in the distributions of educational attainments of among women and their husbands) (Altham and Ferrie, 2007). Long and Ferrie (2013, p.12) define Altham's metric as "the sum of the squares of the differences between the logs of the cross-product ratios in tables **P** and **Q**." Altham's metric, $d(\mathbf{P}, \mathbf{Q})$, measures the difference in the degree of association between rows (r) and columns (s) in table **P** and table **Q**.

$$d(\mathbf{P},\mathbf{Q}) = \left[\sum_{i=1}^{r}\sum_{j=1}^{s}\sum_{l=1}^{r}\sum_{m=1}^{s}\left|log\left(\frac{p_{ij}p_{lm}q_{I}q_{lj}}{p_{I}p_{lj}q_{ij}q_{lm}}\right)\right|^{2}\right]^{\frac{1}{2}} \quad (3)$$

If in table **P** and table **Q** the association between educational attainment of wives (rows) and educational attainment of husbands (columns) is identical, the Altham metric value equal to zero. On the other hand, if table **P** and table **Q** exhibit very dissimilar patterns of association, the value of $d(\mathbf{P}, \mathbf{Q})$ will be large.

Altham metric $d(\mathbf{P}, \mathbf{Q})$ only useful to know whether association between rows and columns in **P** and **Q** differ from each other or not. However, to ascertain which one of the mobility tables has a higher association between their rows (educational attainment of wives) and columns (educational attainment of husbands), we compute $d(\mathbf{P}, \mathbf{J})$ and $d(\boldsymbol{Q}, \mathbf{J})$. Altham metrics $d(\mathbf{P}, \mathbf{J})$ and $d(\mathbf{Q}, \mathbf{J})$respectively compare table **P** and table **Q** to table **J** in which row and columns are independent. In table J, there is no association between educational attainment of wives (rows) and educational attainments of husbands (columns). In other words, $d(\mathbf{P}, \mathbf{J})$ and $d(\mathbf{Q}, \mathbf{J})$ respectively quantify difference in degree of association between their respective rows and columns from independence. Thus, if $d(\mathbf{P}, \mathbf{Q}) > 0$ and $d(\mathbf{P}, \mathbf{J}) < d(\mathbf{Q}, \mathbf{J})$, it implies that association between educational attainment of wives (rows) and educational attainment husbands (columns) in table **P** is closer to the independence than table **Q**. In other words, association between educational attainment of wives (rows) and educational attainment husbands (columns) in table **Q** is higher than in table **P**[5].

We also compute another form of Altham metric $d^{\cdot}(\mathbf{P}, \mathbf{Q})$ which only takes account of off-diagonal cells of table **P** and **Q** to compare degree of association between table **P** and table **Q**. In other words, this measure allows us to measure the association between educational attainment of wives and educational attainment of husbands excluding those who married within their own educational group. However, for any given two contingency tables with r rows and r columns $d^{\cdot}(\mathbf{P}, \mathbf{Q})$ has same properties as $d(\mathbf{P}, \mathbf{Q})$, except that we compute the likelihood ratio χ^2 statistic G^2 with $[(r-1)2-r]$ degrees of freedom (Altham and Ferrie 2007).

[5] Altham and Ferrie (2007) point out that in some cases we can encounter a situation where $d(\mathbf{P},\mathbf{Q}) > 0$ but $d(\mathbf{P}, \mathbf{J}) \approx d(\mathbf{Q}, \mathbf{J})$. This implies that in both tables **P** and **Q**, the same degree of association between rows and columns exists, but tables **P** and **Q** differ in how they vary from independence.

4. RESULTS

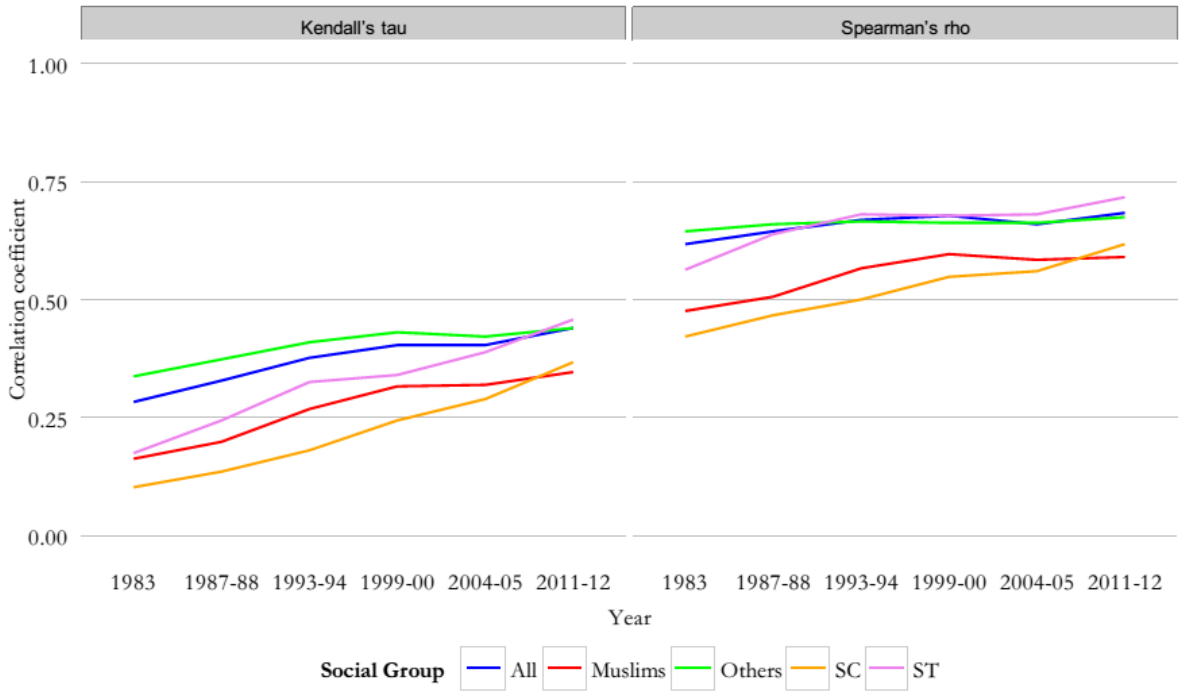
Table 1 Educational distribution of wives and husbands by social group in 1983 and 2012 (in per cent)

	Wives									
Social Group	Scheduled tribe		Scheduled caste		Muslims		Others		All	
Year	1983	2012	1983	2012	1983	2012	1983	2012	1983	2012
Below primary	94.4	67.4	92.8	63.5	86.3	63.7	73.8	41.5	80.2	50.1
Middle	4.8	23.9	6.4	23.8	11.4	24.5	18.7	27.6	14.6	26.3
Secondary	0.6	7.1	0.8	10.3	1.8	9.8	5.5	21.3	3.9	16.8
Graduate	0.2	1.7	0.1	2.4	0.6	2.0	2.1	9.6	1.4	6.8
Total	9761	10813	13741	12542	11345	8355	57209	50948	92059	82660
	Husbands									
Below primary	81.3	49.4	76.7	45.1	66.7	48.7	50.4	26.6	59.4	34.3
Middle	14.9	32.3	18.8	33.4	23.9	32.7	31.0	30.5	26.7	31.4
Secondary	3.0	13.0	3.8	16.1	7.1	13.8	12.8	28.4	9.8	23.3
Graduate	0.7	5.3	0.8	5.4	2.2	4.8	5.8	14.4	4.1	11.0
Total	9761	10813	13741	12542	11345	8355	57209	50948	92059	82660

The study of educational assortative marriage over a long period of time has to take into account changes in the distribution of educational attainments over time as this distribution has an impact on the individual's choice of a spouse. Table 1 presents changes in the cross-sectional distribution of educational attainments of women and their husbands by social groups between 1983 and 2012. Between 1983 and 2012, the distribution of educational attainments among wives and husbands changed significantly (see columns 1 and 2 of Table 1). While 80.2 per cent of all wives and 50.1 per cent of all husbands were in the category "below primary education" in 1983,

the corresponding in 2012 was 59.4 per cent for wives and 34.3 per cent for husbands. Even as the proportion of husbands and wives with educational attainment below the primary school level declined between 1983 and 2012, the proportion of husbands and wives with middle and secondary educational attainment increased. The gap between the proportion of husbands and wives in the educational category "graduate and above" increased from 5.4 percentage points in 1983 to 6.9 percentage points in 2012. In 1983 and 2012, the distribution of educational attainments among women and their husbands showed stark differences with respect to educational attainments across social groups. In 1983 and 2012, groups such as Scheduled Castes and Tribes and Muslims were mostly concentrated at the lowest educational level. For example, in 2012, around half of all husbands and around two thirds of all wives belonging to the Scheduled Caste, Scheduled Tribe and Muslim social groups were concentrated in the "below primary education" category. The corresponding figures for the "Others" social group were 41.5 per cent for wives and 26.6 per cent for husbands.

Figure 1: Changes in educational homogamy by social group, 1983-2012



Figures 1 shows changes in the overall association between wives' and husbands' educational attainments between 1983 and 2012 based on simple measures of Kendall's τ and Spearman's ϱ. Kendall's τ increased from 0.339 in 1983 to 0.442 in 2012, and, similarly, the Spearman correlation coefficient increased from 0.644 in 1983 to 0.677 in 2012. In other words, the correlation between husbands' and wives' educational attainments increased between 1983 and 2012.

Kendall's τ and Spearman's ϱ showed differences in the association between wives' and husbands' educational attainment among different social groups over the reference period. Throughout 1983-2012, the association between the educational attainments of wives and husbands belonging to the Scheduled Castes and Tribes and Muslims was higher than the corresponding association among "Other" social groups. Figure 1 showed that the increase in educational assortative marriage was lowest for the social group titled "Others": the Spearman's ϱ in this case increased from 0.644 in 1983 to 0.677 in 2012. At the same time, Kendall's τ value for Scheduled Castes increased from 0.422 in 1983 to 0.619 in 2012.

Table2: Percentage distribution of educational attainments for wives and husbands, all, 1983 and 2012

Wife's educational attainment	Husband's educational attainment				
1983	Below primary	Middle	Secondary	Graduate	Total
Below primary	71.8	23.0	4.4	0.8	73,805
Middle	11.6	52.6	28.0	7.9	13,410
Secondary	1.9	14.2	51.4	32.5	3,555
Graduate	0.6	4.4	17.4	77.5	1,290
Total	54,637	24,615	9,043	3,764	92,059

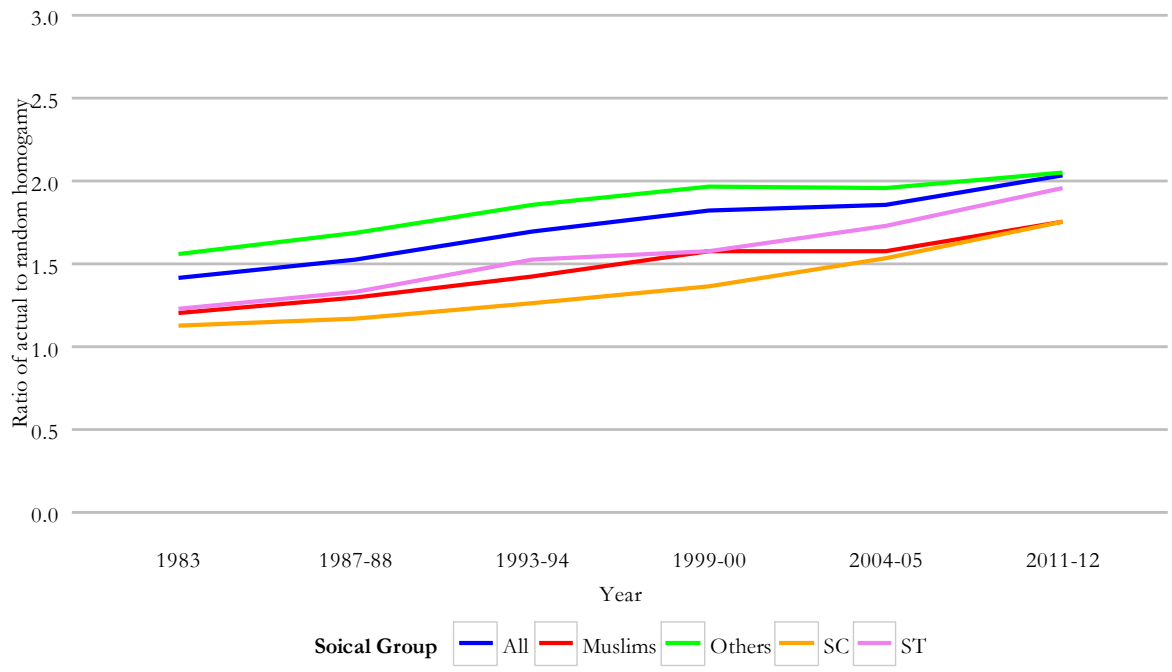
2012	Below primary	Middle	Secondary	Graduate	Total
Below primary	60.8	28.4	9.6	1.2	41,381
Middle	12.3	52.6	30.3	4.8	21,713
Secondary	3.4	18.6	54.2	23.9	13,924
Graduate	0.2	3.7	21.4	74.7	5,642
Total	28,320	25,980	19,270	9,089	82,660

Note: Cell values as percentage of row sum.

Table 2 corss-classfies women and their husbands educational attainments in contingency tables in 1983 and 2012. In a given year, each cell in the contingency table represents the observed fraction of married couples with a combination of educational pairing. In other words, the contingency table for a particular year provides a preliminary idea of the extent of educational assortative marriage. For example, in 1983, 71.8 per cent of women with an educational below the primary level married men with in the same educational category, 23.0 per cent of women with an education below the primary level married men with middle school qualifications, about 4.4 per cent of women with an education below the primary school level married men with secondary school qualifications and only 0.8 per cent women with an education below the

primary school level married men with graduate degrees. Each cell on the main diagonal in a contingency table represents the educationally homogamous, individuals who married persons with the same education attainment as their own. The off-diagonal cell represents the educationally heterogamous, individuals who married persons with an educational qualification other than their own. Proportion of main-diagonal cells in the total contingency table gives the absolute level of homogamy in a given year.

Figure 2: Changes in educational homogamy by social group, 1983-2012



To measure the extent of homogamous marriage in each year, we compute the ratio (δ_i) of the proportion of actual homogamous marriages in a year to the proportion of homogamous marriages if women and men were matched randomly in that year. Figure 2 shows the ratios of actual to random homogamous marriages in each survey year between 1983 and 2012. Figure 2 shows that the ratio δ_i has increased from 1.4 in 1983 to 2.1 in 2012, which indicates an increase in educational homogamy between 1983 and 2012 at the all India level. Figure 2 shows that though the tendency for educational homogamy increased between 1983 and 2012 for all social groups, there were differences between these social groups in terms of the magnitude of

educational homogamy. "Others" and Scheduled Tribes showed higher educational homogamy than other social groups throughout the reference period.

Table 3: Summary measures of association between wives' and husbands' educational attainment in India, by social group, in 1983 and 2012

1	2	3	4	5	6	7	8	8
	Social Group	Year	H_t	H_t'	$d(\mathbf{P}, \mathbf{J})$	$d(\mathbf{Q}, \mathbf{J})$	$\mathbf{d}(\mathbf{P}, \mathbf{Q})$	$d^i(\mathbf{P}, \mathbf{Q})$
1	ST	1983	83.40	66.20	52.73***	58.37***	27.72***	23.31***
		2012	65.10	83.00				
2	SC	1983	79.50	63.70	42.98***	46.49***	21.84***	14.87***
		2012	61.70	78.50				
3	Muslims	1983	71.50	64.30	38.74***	42.19***	9.19***	8.57***
		2012	63.60	78.10				
4	Others	1983	62.70	58.00	42.60***	43.60***	11.20***	8.81***
		2012	55.80	61.40				
5	All	1983	68.30	60.60	43.69***	44.70***	11.64***	9.38***
		2012	58.50	67.10				

Note: H_t is absolute educational homogamy rate (per cent main-diagonal cell values), H_t' is absolute educational homogamy after imposing the educational distribution of wives and husbands from the other contingency table. Significance levels for the likelihood ratio $\chi 2$ statistic G^2 (degrees of freedom: 9 for $d(\mathbf{P}, \mathbf{J})$, $d(\mathbf{Q}, \mathbf{J})$, and $d(\mathbf{P}, \mathbf{Q})$; 5 for $d^i(\mathbf{P}, \mathbf{Q})$): *** < 0.01 ** < 0.05 * < 0.10.

Neither, measures of correlation between husbands' and wives' educational attainments nor the method based on a ratio of random to actual homogamy accounts for changes in the distribution of educational attainments among wives and husbands. To better understand how educational assortative marriage has changed over time, it is necessary to account such changes. Hence, we use the Altham and Ferrie (2007) method to measure the changes in the strength of association between wives' and husbands' educational attainments net of changes in the distribution of

educational attainments between 1983 and 2012. Table 3 provides summary measures of educational assortative marriage for each panel in Table 2 and for differences in educational assortative marriage between the panels. According to the simple measure of absolute educational homogamy H_t (Table 3, panel 5, column 8), women were less likely in 2012 than in 1983 to marry someone with the same education level as their own. But this difference in educational homogamy was largely a result of differences in the educational distribution between 1983 and 2012. If 2012 had the 1983 educational distribution but the underlying association between rows and columns actually seen in 2012 (panel 5, column 3, row 1), then 2012 (67.1 percent) would have actually had almost the same absolute homogamy as 1983 (68.3 percent). Similarly, if 1983 had the 2012 educational distribution but the underlying association between rows and columns actually seen in 1983 (panel 5, column 4, row 2), then 1983 (60.60 percent) would have actually had almost the same absolute homogamy as 2012 (58.50 percent). In other words, the decline in absolute educational homogamy is largely a product of changes in the distribution of educational attainments of wives and husbands between 1983 and 2012.

In both the years, absolute educational homogamy, H_t, was higher among Scheduled Tribes and Castes and Muslims than among "Other" social groups. This could be because of higher concentration of wives and husbands belonging to Scheduled Tribes and Castes and Muslims in the lowest educational level (below primary) than among the "Others" category. While absolute educational homogamy was lower in 2012 than 1983 for all social groups, the adjusted homogamy rates showed no substantial changes in educational homogamy between 1983 and 2012.

In 1983 and 2012, educational homogamy was very high at both ends of the educational spectrum. In 2012, 60.8 per cent of women whose educational level was "below primary level" married men from same educational category and 74.7 per cent women who were graduates

married men with graduate degrees. Not only were Scheduled Tribes and Castes and Muslims over represented in the lowest educational category, but they also had a higher proportion of people than "Others" in the lowest educational category marrying within the same educational category. For example, in 2012, educational homogamy among "Other" social group in the lowest educational category was 55.4 per cent. The corresponding proportion was 68.3 per cent among Muslims was, 69.3 per cent among Scheduled Tribes, and 64.4 per cent among Scheduled castes it was. This difference in educational assortative marriage across social groups was mainly driven by disparities in educational attainments between "Other" social group on the one hand and Muslims, Scheduled Castes and Scheduled Tribes on the other.

Panel 5 in Table 3 provide summary measures of association between the educational attainments of wives and husbands, based on the Altham metric, for all social groups together. In 1983 and 2012, there was an underlying association between wives' and husbands' educational attainment, independent of the distribution of educational attainments in these years. In other words, as $d(\mathbf{P}, \mathbf{J}) > 0$ and $d(\mathbf{Q}, \mathbf{J}) > 0$, we can reject the null hypothesis that the association between wives' and husbands' educational attainment (in **P** (1983) and **Q** (2012)) was the same as we would have observed under conditions of independence of rows and columns. The difference between **P** (1983) and **Q** (2012) with respect to the magnitude of association (Table 3, panel 5, column 5) $d(\mathbf{P}, \mathbf{Q})$ is 11.64. This implies that we can reject the null hypothesis that the association between wives' and husbands' educational attainments in 1983 (**P**) and 2012 (**Q**) was identical. The association between wives' and husbands' educational attainments in 1983 ($d(\mathbf{P}, \mathbf{J}) = 43.69$) is more close to the independent contingency table **J** than it was the same in 2012 ($d(\mathbf{Q}, \mathbf{J}) = 44.70$). In other words, we can conclude that the association or relative educational assortative marriage was higher in 2012 (**Q**) than in 1983 (**P**). Further, given $d(\mathbf{P}, \mathbf{Q})$ is 9.38, we can reject the null hypothesis that association between wives' and husbands' educational attainment was identical, even if we focus only on the off-diagonal elements in each table (see

panel 1, column 8). In other words, the difference in association between wives' and husbands' educational attainment between 1983 and 2012 was not solely the result of strong similarities in the tendency of individuals to marry someone with the same educational attainment as their own.

Table 3 shows that the association between wives' and husbands' educational attainment varies by social group. Altham statistic $d(\mathbf{P}, \mathbf{Q}) = 27.72$ (Panel 1 and column 7 in Table 3) implies that we can reject the null hypothesis that the association between wives' and husbands' educational attainments for Scheduled Tribes in 1983 (**P**) and 2012 (**Q**) was identical. That is, the association between educational attainments of wives and husbands for Scheduled Tribes in 1983 (**P**) was different from 2012 (**Q**) and this difference was statistically significant. Another set of Altham statistics $d(\mathbf{P}, \mathbf{J}) = 52.73$ and $d(\mathbf{Q}, \mathbf{J}) = 58.37$ suggests that for both the years, 1983(**P**) and 2012(**Q**), for Scheduled Tribes, we can reject the null hypothesis that the association between educational attainments of wives and husbands was the same as what we would have observed under perfect independence between educational attainments of women (rows) and their husbands (columns) in the contingency table J. Further, $d(\mathbf{P}, \mathbf{J}) = 52.73 > d(\mathbf{Q}, \mathbf{J}) = 58.37$ implies that the net association between the educational attainments of wives and husbands was higher in 2012 than in 1983. Similarly, Altham statistics in Table 3 show that other social groups such as Muslims, Scheduled Tribes and Others also had higher relative educational homogamy in 2012 than in 1983.

In summary, Altham statistics (see Table 3) confirms that there was an overall increase in the association between wives' and husbands' educational attainment independent of changes in the of distributional of educational attainments between 1983 and 2012. Altham statistics suggest that the net increase in the association between the educational attainment of wives and husbands over the reference period was sharper for Scheduled Tribes and Muslims than for

"Other" social groups. Overall, at an all India level, individuals' preferences for marriage within their own educational group have strengthened over the reference period.

5. DISCUSSION

Economic growth in India from the 1990s has been accompanied by an increase in economic inequality and the persistence of low intergenerational occupational and educational mobility. Studies from different countries have shown that a rise in educational assortative marriage in a society has implications for economic inequality and intergenerational mobility in that society[6]. This paper examined changes in educational assortative marriage between 1983 and 2012 using data from different rounds of the Employment and Unemployment Surveys of the National Sample Surveys Office. To measure the extent of association between educational attainments of husbands and wives, we computed rank correlation coefficients. Further, a method based on contingency tables proposed by Altham and Ferrie (2007) was used to measure changes in educational assortative marriage net of effects because of the spread of formal education over time.

Our results based on Kendall (τ) and Spearman (ϱ) correlation coefficients showed an increase in the association between the educational attainments of women and their husbands between 1983 and 2012. Another method, based on ratio (δ_i) of observed absolute educational homogamy to educational homogamy when men and women in the contingency table are matched randomly, showed an increase in educational assortative marriage in India. Though absolute educational homogamy (H_i) showed a decline between 1983 and 2012, absolute educational homogmay remained almost unchanged once adjusted for changes in the distributions of educational attainments among sample population over time. Altham statistics showed an increase in relative

[6] Among others see Kremer 1997; Mare 2000; Fernandez and Rogerson 2001; Kenworthy, 2004; Mare 2008; Schwartz 2010; Greenwood et al 2014, Durlau and Shaorshadze 2014; Hu and Qian 2015

educational homogamy between 1983 and 2012. In summary, the overall relative homogamy rate or the chances of individuals within a given level of education choosing a spouse with the same level of education increased over the reference period. This increase in educational homogamy characterised all social groups.

In 1983 as well as 2012, educational homogamy was very high at both the ends of the educational spectrum. In 2012, 62 per cent of women with less than primary education married men in the same category. Similarly, in 2012, 76 per cent of women who were graduates married men who were graduates. This closure at both the ends of the educational hierarchy can reinforce existing socio-economic inequalities (Torche 2010 and Schwartz, 2010).

We also documented changes in educational homogamy separately for different social groups. Scheduled Tribes had the highest absolute educational homogamy followed by Muslims and Scheduled Castes. Further, not only were Scheduled Tribes, Scheduled Castes and Muslims over-represented in the lowest educational category but they also had much a higher proportion of people in the lowest educational category marrying within the same educational category. For example, in 2012, educational homogamy in the lowest educational category was 55 per cent among "Other" social group, 69 per cent among Muslims, 67 per cent among Scheduled Tribes and 63 per cent among Scheduled Castes. People of the Scheduled Castes and Tribes and Muslims were the most underprivileged on the basis of their educational and economic achievements. Given that caste based endogamy is the norm in Indian society, and that there is an over representation of Scheduled Tribes and Scheduled Castes at the bottom of the educational hierarchy, higher educational homogamy among Scheduled Tribes and Castes and Muslims can lead to an increase in cross-sectional inequality across the groups.

The increase in the propensity of individuals to select spouses from within their own educational groups coincides with the increase in economic inequality and the persistence of intergenerational immobility during the three decades under study. Research from other countries has shown that an increase in assortative marriage over time can contribute to income inequality across households in an economy (see Greenwood et al. 2014, Schwartz 2010) . Studies by economists and sociologists on marriage and dowry in India indicate the primacy of wealth and income, which can be considered as proxy for the economic status (class) of the households, in arranged marriages (Rao 1993; Agarwal 1994; Anderson 2003). Rao and Finnoff (2015) argue that marriage in India is an important factor in reinforcing economic inequality. Establishing causal relationship between the increase in educational assortative marriage and increases in the economic inequality and persistence of low social mobility is beyond the scope of this paper. Our findings suggest a segmentation of the marriage market based on educational attainment. This increased tendency of marrying within one's own educational group and caste (or religion) may contribute to widen economic inequality across households and to lower intergenerational economic mobility.

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