Convergence in child schooling across Districts of Pakistan: Evidence from Club Convergence

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Abstract

Early schooling has a critical role in the development of a child's intellect. The literature uses spatial models, such as density, locality, and distance in developing nations, to highlight spatial inequalities in child education. This study examines the club convergence of child schooling across districts in light of the necessity for research on geographic disparities in formal child education in Pakistan. We utilize two measures of education: the number of girls enrolled in secondary schools and the total number of secondary school enrollment. Based on the clustering approach developed by Phillips and Sul (2007), the study is conducted. Data used in this study were sourced from the Pakistan Social and Standards Measurement Survey (PSLM), which runs from 2004 to 2020. Overall, the study's conclusions reject the convergence of secondary school enrollment data to a single equilibrium state. Four convergence clubs for the entire secondary school are highlighted by the results. In contrast, four convergence clubs and one diverging group are shown in the secondary school enrollment data for girls. The results demonstrate that secondary school attendance varies by district, necessitating the development of programs aimed at reducing these geographical differences in children's education.

Keywords: *Child Schooling, Club convergence, Geographic inequalities, Spatial models.*

Introduction

Early childhood education is essential for a child's intellectual advancement and progress. Significant strides have been made worldwide in offering primary education to children. While enrollment and retention rates are on the rise in developing countries, the important challenge remains in guaranteeing that all children attend, remain in school, and acquire knowledge. Numerous children still do not have access to education in developing nations, with the primary concern being what happens after completing primary schooling. Without access to secondary education, children face limited prospects for improving their futures. Sociocultural barriers and economic challenges prevent specific marginalized groups, especially adolescent girls, from pursuing this opportunity. The absence of secondary education hinders the ambitions of countless girls and their families.

Nearly 90% of secondary age adolescents are not attending school in three global regions: 85 million in Southern Asia; 63 million in sub-Saharan Africa; and 23 million in Eastern and South-

Eastern Asia (UNICEF, 2020). Pakistan, in South Asia, is also grappling with a significant challenge in ensuring universal access to education. The country has the second-highest rate of out-of-school kids (44%), with an estimated 22.8 million youngsters (5–16 years old) not attending school. Enrollment in primary school comprises around 8.6 million females and 10.7 million boys, while lower secondary school enrollment comprises 2.8 million girls and 3.6 million boys (UNICEF, 2020).

According to Pakistan National Human Development Report (NHDR) 2020, the secondary school enrollment has increased slightly. The enrolment pattern for girls at secondary levels illustrates the same gaps that have persisted over the past decades. The reasons behind the educational deprivation of girls reflect cultural constraints and regional patterns. Girls' education is considered as poor investment as daughters tend to get married off and leave their natal homes. Girls are discouraging from education due to supply side factors, like unavailability of girls' schools, lack of public transport, longer distances to schools, shortage of female teachers, and absence of sanitation facilities at schools.

Pakistan has faced a variety of domestic and international economic, social, and political challenges throughout the last 20 years, but free trade and reforms have been key factors in the remarkable economic progress of the nation. Pakistan's GDP increased by more than four times, from $82.69 billion in 2000 to $280 billion in 2021, in just 20 years. The country has managed to maintain a rather robust average GDP growth rate of about 4.6 percent during the last 20 years. Pakistan's developmental trajectory has not produced any social or economic advancement, especially when it comes to the provision of public services (Easterly, 2003).

It is important to note that not only does the overall level of education vary between provinces, but recent studies suggest that there is also significant variation in the level of education across districts within province. Literature on development has not given attention to convergence or divergence in education across regions in developing. This is perhaps because we tend to think of a developing state as a homogenous social, economic and political entity. One of the most important issues facing developing nations like Pakistan is the finding of convergence in socioeconomic indicators. Reducing regional disparities throughout Pakistan has been one of the main targets of Pakistan Vision 2025.

In Pakistan, the club convergence at the district level has received virtually little attention, despite the abundance of research on regional convergence throughout the world. From this angle, the study experimentally examines the problem of diverse Pakistani districts convergent to many steady states and the emergence of "convergence clubs," as suggested by several researchers in the growth writings (Baumol, 1986 & Galor, 1996).

The remainder of the study is organized as follows. Following the introduction in Section 1, the literature review is covered in Section 2, and the methods and data are presented in Section 3. The results and debate are explained in part four, and the conclusion and policy recommendations are covered in section five.

Literature Review

The subsequent section covers the theoretical literature and empirical evidence related to the club convergence problem.

2.1 Theoretical Literature

The "Convergence[1]" debate is a hot topic in literature. Most researchers in the modern growth debate after *World War II* have concentrated on the neoclassical model of growth originating from Solow in 1956. Solow also argues that countries with a higher capital stock per capita have a lower rate of return on capital. Therefore, because of arbitrage, capital will flow to the poorer nations from the rich. This accumulation of capital will help the countries to converge. Advocates of the neoclassical school argue that spatial disparities diminish with economic growth (Sala-I-Martin and Barro, 1995).

Many alternative theories follow from the neo-classical model's incapacity to explain steady state growth. Diverging from the neo-classical model, the theories of institutional theory, endogenous growth, and new economic geography all largely uphold Myrdal's (1957) central statement that inequities are raised by the spatial practice of expansion. While there are structural similarities between economies in terms of preferences, government policies, production technology, etc., some growth theories (Azariadis & Drazen, 1990; Barro & Sala-i-Martin, 1992; Quah, 1996; Azariadis, 1996; Galor, 1996) argue that economies may converge to diverse steady state equilibria if their initial conditions differ. Therefore, only if all of the similar economies' initial conditions are the same can a shared, balanced growth path be predicted. A convergence club is the term used to characterize economies moving in the direction of the same steady state equilibrium, according to Galor (1996).

The concept of club convergence was first defined at the end of the eighties by Baumol and Wolff (1988). Chatterji (1992) describe that a convergence club implies the existence of various regions that are forced in the long run to a level of steady state with alike per capita income. At country level, Quah introduced the concept of the club convergence hypothesis in 1996. He developed a technique for simulating the dynamics of cross-sectional economic distributions that is not predicated on any theoretical model. Quah argues that there is no process of economic convergence since the worldwide distribution of the distribution of per capita income now has two peaks.

2.2 Empirical Literature

Vital Numerous conclusions regarding the number and characteristics of groups have been drawn from empirical research on the convergence club theory, with the methods used having a significant impact. Two clubs were identified by Wolff and Baumol (1988) using a basic nonlinear model: A club with low-income divergence and another with significant income convergence. Linking the economic gap[2] at some time with the particular economic gap at a previous time and incorporating more influences of those former levels, Chatterji (1992) established the existence of two clubs' convergence which are mutually exclusive: one comprising the rich nations and another consisting of the poor ones. By employing regression tree

[1]There are the three convergence notions. **a) The Absolute Convergence Hypothesis** states that, independent of the starting economic conditions, regional per capita income converges over time. **b) Conditional Convergence Hypothesis:** Despite different initial conditions of economies (human capital, capital stock per capita, labor force, and income per capita), over time, per capita of economies that are similar in their structural features (e.g., technologies, government policies, preferences, population growth rates, etc.) converge in the long run income. **C) Club Convergence Hypothesis:** Assuming identical initial conditions, the per capita income of regions with similar structural features converges with time.

[2]The difference between the level of GDP per capita of the wealthiest region and level of GDP per capita of the other regions

analysis and using income per capita income as a measure of development, Quah (1993) studied the club convergence hypothesis for 105 economies for the period 1960–1990. Quah observed a growing twin-peak, involving division of regions into two dissimilar income groups.

Regression tree analysis was employed by Durlauf and Johnson in 1995 to provide evidence of club convergence for 121 economies. Galor (1996) created models for club convergence, which elaborated on the possibility of several steady-state equilibria. He argued that economies with similar characteristics eventually gravitate towards a common steady-state equilibrium, despite the fact that there is no convergence across distinct sets of equilibria.

The research on the club convergence phenomenon discussed above, however, was conducted using methodologies that were unable to address the problems of economic structure, economic change, individual heterogeneity, and convergence path. Conversely, Phillips and Sul (2007) provided a novel approach to classifying panels into club convergence groups and examined the part heterogeneity within and between economies plays in the transitional dynamics of economic growth. As a result, after Phillips and Sul (2007), a large lot of research was done on economic convergence; some of these works are covered below.

In research published in 2018, Li et al. examined the convergence of regional income for 2286 Chinese territories between 1992 and 2010. Their results, which included six clubs, indicated that the establishment of these clubs has been influenced by per capita fixed assets, population density, and industrialization. In China, Tian et al. (2016) studied the convergence of regional income for 31 provinces between 1978 and 2013. The authors distinguished between two groups of convergence and proposed that investment, human capital, and openness raise the likelihood that a region will belong to the high-income club.

Velázquez et al. (2015) examined the convergence patterns in per capita income among the Mexican states from 1940 to 2015 using a time-series approach, accounting for both transitional and temporal variability.

The results imply that there is no shared long-term equilibrium among the Mexican states. Club convergence rather than overall convergence was noted for both regional inequality and per capita income. According to Bartkowska and Riedl's (2009) analysis, 206 European regions' per capita income formation of convergence clubs between 1990 and 2005 showed the presence of these clubs, suggesting that the regions' per capita income forms five distinct sets that each converge to a steady state path.

As the literature showed, the only metric employed in a large number of studies on convergence clubs is per capita GDP. More recently, the concept of club convergence has been extended to quantify economic convergence using development indexes. Some of the studies are shown below.

Based on an improved index, Basel et al. (2020) analyze the convergence club to gauge advancement in 102 economies. The index comprises seven primary development indicators, namely education, health, environment, energy consumption, living standard, and good governance. The study confirmed four final convergence clubs and looked into the club formation of 102 countries between 1996 and 2015.

Montaṇe et al. (2018) used the income and human development index to examine the convergence hypothesis in Spain from 1980 to 2007 and 1980 to 2014. According to the study's conclusion, there are less clubs between 1980 and 2014, which suggests that provincial differences have decreased as a result of the Great Recession. Szendi (2014) looked at the HDI in each nation between 1990 and 2010, analyzing the growth from an economic and social

perspective by using the HDI's beta convergence and its club convergence. The results look at certain small-scale social and economic convergence. In terms of regional distinctions and the global center-periphery concept, convergence clubs support the prevalent global tendencies.

In Pakistan, the club convergence at the district level has gotten very little attention in the literature, despite the abundance of literature available worldwide. From this angle, the subject of distinct districts in Pakistan convergent to several stable states and the emergence of convergence clubs, investigates experimentally the growth theories proposed by many researchers (Baumol, 1986; Durlauf, 1995; and Galor, 1996). The literature study clearly demonstrates that, with regard to Pakistan, no studies addressing the educational dimensions of human development have been carried out to comprehend the convergence club concept at the district level. In order to quantify the comprehensive features of education, we utilize data on secondary school enrollment rates for both girls and boys. From this data, we can then use the club convergence hypothesis.

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3. Data and Methodology

3.1 Variable Description

Most literature has utilized per capita GDP as the dominant proxy variable to measure living standards, both experimentally and operationally. As a result of its inability to take into consideration the larger aspect of human well-being that growth rates in income are unable to capture, economists are now aware that this measure of welfare is flawed (Sen, 1983; Goossens, 2007; Stiglitz at al., 2019). Both economists and non-economists have put out a variety of possibilities in this regard (Becker et al. 2005; Roy & Bhattacharjee, 2009). This study therefore aims to assess the club convergence based on secondary school enrollment generally and among girls for 92 districts in Pakistan between 2004 and 2021.

3.2 Data Source Data Limitation

Seven PSLM Surveys conducted between 2004 and 2021 provided the district-level data for the study. Data from PSLM surveys are available for 131 districts spread over four Pakistani provinces. 39 districts are removed from the data for this analysis because some observations are missing.

	Provinces			
	Punjab (2)	**Sindh (13)**	**KP (7)**	**Balochistan (17)**
	Nankana Sahib,	Sujawal, Umerkot, Shahdadkot, Tando Allah Yar, Tando	Tor-Ghar, Mohmand, Bajaur, Khyber,	Washuk, Nushki, Sheerani, Ketch, Panjgur, Harnai, Kohlu,

Districts	Chiniot	Muhammad Khan, Kashmore, Jamshoro, Matiari.	Kurram, North Waziristan, Orakzai, South Waziristan,	Dera-Bugti, Zhob, Chaghi, Jhal Magsi, MusaKhel,

3.3 Economic Methodology

Two The present investigation used the log t test by Phillips and Sul (2007), to study convergence within a panel of districts and to detect the existence of any cross-district convergence clubs inside Pakistan. The method is empirically sound since it spontaneously creates exclusive clubs out of areas with comparable qualities. This approach is noteworthy because the logit test utilized in It is independent of any assumptions about the trend or stochastic non-stationarity of the variable of interest, as well as the shared elements in the panel among parties (Aksoy et al. 2019). The following time-varying common-factor representation for district *i* is used in the methodology. The approach depends on a novel decomposition of the dependent variable. In general, panel data are broken down as follows:

$$\boldsymbol{logy_{it} = \emptyset_i u_t + \varepsilon_{it}} \quad \textbf{(1)}$$

In this case, u_t stands for the common factor, φ_i for the unit characteristic component, and ε_{it} for the error term. However, in the model used here, the log of per capita income, log y_{it}, features a temporal fluctuations factor portrayal, which could be the product of how typical panel data is represented.

$$\boldsymbol{logy_{it} = (\emptyset_i + \frac{\varepsilon_{it}}{u_t})u_t = \delta_{it} u_t} \quad \textbf{(2)}$$

In this case, the unit specific component denoting the unique fraction that varies eventually is absorbed by δit along with the error term. The second technique try to clarify income per capita income by evaluating the share (δ_{it}) of the common development route (u_t) that nation *i* commences. The first model attempted to expose the behaviors of the individual log y_{it} by the common factor μ_t and 2-unit characteristic mechanisms, φ_i and ε_{it}. A relative transition coefficient, h_{it}, is constructed to mimic the transition coefficients δ_{it}:

$$\boldsymbol{hit = \frac{logy_{it}}{N^{-1}} \sum_i^N = logy_{it} = \frac{\sigma_{it}}{N^{-1}} \sum_i^N = \sigma_{it}} \quad \textbf{(3)}$$

As a result, hit stands for the economy's transition route relative to the cross section average and has two meanings: first, it describes how a region behaves in regard to other regions, and second, it illustrates how region *i* is relative to other regions' deviation from the common growth path μ_t. When there is convergence, meaning that every region follows the same transition route, $h_{it} \rightarrow 1$ for all *i* as $t \rightarrow \infty$. Following that, $V_{2t} = N^{-1} \sum_i (h_{it} - 1)^2$ converges to zero. In the event that there is no convergence, there are several possible outcomes. For instance, V_t may stay bounded above zero and not converge, or it may converge to a positive value, which is a feature of the convergence club.

To identify the null assumption, Sul and Phillips (2007) model δ_{it} using a semi parametric form:

$$\boldsymbol{\delta i = \delta i + \frac{\sigma i \, \xi it}{L(t) t^{\alpha}}} \quad \textbf{(4)}$$

Where δ_i is fixed, σ_i is an idiosyncratic scale parameter, ξ_{it} is *iid (0,1), L(t)* is a function varying slowly (such that $L(t) \rightarrow \infty$ as $t \rightarrow \infty$) and α is the decay rate.

The null hypothesis of convergence can be described as:

$$\boldsymbol{H0 : \delta i = \delta \; and \; \alpha \geq 0} \quad \textbf{(5)}$$

The alternative hypothesis, $\delta_i \neq \delta$ for all $\boldsymbol{i}$ or $\varrho < 0$, is tested against it. Recall that Different transitional models for regions I and J, including momentary divergence, which indicates times, are apparent in the null hypothesis of convergence. when $\delta_i \neq \delta j$. the method proposed by Sul and Phillips (2007), therefore, enables us to detect convergence even in the situation of transitory divergence, where other methods, including stationarity tests (refer to Franses and Hobijn, 2000), are ineffective. Stationary time series approaches fail to identify the asymptotic co movement of two time series, which is the main reason why the convergence proposition is wrongly rejected.
Under convergence, the cross-sectional variance of h_{it} has the limiting form, as explained by Phillips and Sul (2007), taking into consideration Eq. (4).

$$\boldsymbol{Vt^2 \sim \frac{A}{L(t)^2 t^{2\alpha}} \; as \; t \to \infty \; for \; some \; A > 0} \qquad \textbf{(6)}$$

The following regression based convergence test can be deduced:

$$\boldsymbol{log(\frac{v1^2}{vt^2}) - 2 \, log \, L(t) = \alpha + blogt + u_t}$$

$$\boldsymbol{For \; t = [rT], [rT] + 1, \ldots, T} \qquad \textbf{(7)}$$

In general, r∈(0, 1) and *L(t)* are functions that vary slowly. Based on Monte Carlo simulations, Sul and Phillips (2007) recommend using *L(t)=log t* and *r=0.*, for sample sizes smaller than *T=50*. In order to assess the discrepancy of the null hypothesis $\alpha \geq 0$, a one-sided t test robust to autocorrelation and heteroskedasticity is finally applied using $\hat{b} = 2\boldsymbol{\alpha}$.

If $t\hat{b} < -1.65$ (1% significance level)
The null hypothesis is rejected in that case.
The test consists of 4 stages that can be summarized as follows. In the group's time series dimension, units are first arranged in descending order with regard to the last period. Next, a club convergence is built using the log t test. This is performed by adding each district individually to a set of the two areas with the highest initial revenue, and then executing the log t test until the t for this set is greater than t -1.65. The log t test is then repeated on this set, examining the convergence of each remaining unit in the sample one at a time. In the event that it's not, the remaining units undergo the first three steps. If clubs don't form, it can be determined that those economic units are different.

3.4 Selection of model

This study utilizes the log t test suggested by Sul and Phillips (2007) to study the convergence of development index across districts of Pakistan. The technique is empirically strong as it divides regions endogenously with alike characteristics into unique groups called clubs. According to Aksoy et al. (2019), the log t test is significant because it is not dependent on any assumptions

regarding the common elements in the panel among individuals and the trend or stochastic non-stationarity of the variable of interest.

Steps of log t test

The test comprises four steps which can be summed up as follows: First, given the last period in the time series dimension of the group, units are arranged in descending order. After that, a club convergence is produced by means of the log t-test. Further, this is done by summing up districts one at a time to a set of the two regions of maximum income at the start and operating the t log test until t is greater than −1.65. The next step is to test if the remaining units in the sample converge by repeating the log t-test on each one of them one at a time. If not, the first three stages are applied to the remaining units. If no clubs are formed, it can be analyzed that those economic units differ.

Empirical results and discussions

In this section, we discuss the findings for club convergence of Secondary School enrollment across districts of Pakistan. There are further two sub-sections, the first sub-section presents the empirical findings for Overall Secondary School enrollment, and the second subsection discusses the discussion on empirical results for girl's secondary school enrollment.

3.5 Club Convergence of Overall Secondary School Enrollment

This section discusses the findings for overall convergence and club convergence of overall secondary school enrollment.

3.5.1 Log t convergence test

We start by examining complete convergence in the total enrollment in secondary schools. First, we perform 92 district log-t regressions for the years 2004–2020. Table 1 provides an overview of the test outcomes. The convergence for the full sample is rejected since the t statistic value is less than -1.65 and statistically significant at 1%. We then proceed to the club identification as a consequence.

Table 1: Results of Phillips Sul log Regression

Variable	Coefficient	SE	T-stat
log(t)	-1.1470	0.0188	-60.9862

Note*:* Convergence test rejects the null hypothesis at the 1% level

Identification of clubs

We next proceed to determine the development of convergence clubs in the absence of overall panel convergence. The Phillips-Sul club clustering techniques are utilized for cub identification based on a certain data set. The findings of the clubs' identification are shown in Table 2. The creation of the five Convergence Clubs is displayed in the table.

Table 2: Club Convergence Results

Clubs	Districts	No of districts	*b* Coefficient	*t* Statistic
Club 1	Lahore, Pakpatten, Multan, Sheikhupura, Islamabad, Faisalabad, Khushab, Rawalpindi, Attock, Chakwal, Mandi Bahuddin, Sargodha, Mianwali, T.T.Singh, Okara, Gujranwala, Jhang, Jehlum, Gujrat, Hafizabad, Sialkot, Kasur, Vehari, Sahiwal, Narowal, Khanewal, Layyah, Bahawalnager, Sukkur, Larkana, Dadu, Hyderabad, Karachi, Upper Dir, Karak, Lower Dir, Chitral, Peshawar, Malakand, Charsada, Nowshera, Kohat, Swat, Mansehra, Abbottabad, Haripur, Bannu, LakkiMarwat, Mardan, Swabi, Quetta, Pashin, Sibbi, Kalat, Mastung, Khuzdar, Kharan, Gwadar, QillaSaifullah,	59	-0.039	-0.370
Club 2	Bhakhar, Lodhran, Bahawalpur, D.G.khan, Rahim Yar Khan, Shaheed Benazirabad, Khairpur, Nowshero Feroze, Jaccobabad, Ghotki, Shikarpur, Sanghar, Mirpur Khas, Tank, Hangu, D.I.Khan, Batagram, Qilla Abdullah, Loralai	19	0.688	2.986
Club 3	Rajanpur, Muzaffargarh, Badin, Shangla, Bonair, Ziarat, Awaran, Lasbilla, Nasirabad, Jafarabad	10	0.358	1.669
Club 4	Tharparkar, Barkhan	2	1.257	2.723
Club 5	Thatta, Kohistan	2	0.841	0.467

Note*:* Results display 5 clubs from row 1 to row 5.

Since t-statistics are much higher than -1.65, Table 2's results clearly reveal that the "overall secondary school enrollment" across 92 districts initially converged to five clubs.

3.5.2 Club merging tests

For There's a chance that the convergence procedure will overvalue the actual number of clubs. To address this possible problem, we assess the integration of neighboring clubs into larger clubs through the use of club merging tests. We continue the investigation by looking for club convergence. A log t test is run on every pair of clubs, and if all of them jointly satisfy the convergence proposition, they can be united to form a new club. Table 3 presents the findings.

Table 3: Results of the Club Merging Test

S.No	Merging Clubs	Coefficient	SE	T-stat
1	Club 1 + Club 2	-0.625	0.0358	-17.478
2	Club 2 + Club 3	0.021	0.1215	0.169
3	Club 3 + Club 4	0.114	0.1464	0.781
4	Club 4 + Club 5	-0.822	0.0475	-17.309

3.5.2 Final clubs classifications

The above club merging results revealed evidence of convergence between two clubs. After convergence between 2nd club and 3rd club, the final club classification shows four convergence clubs. The results are depicted in Table 4.

Table 4: Final Clubs Classification

Clubs	Final Club	No of districts	*b* Coefficient	*t* Statistic
Club 1	Lahore, Pakpatten, Multan, Sheikhupura, Islamabad, Faisalabad, Khushab, Rawalpindi, Attock, Chakwal, Mandi Bahuddin, Sargodha, Mianwali, Jhang, Okara, T.T.Singh, Gujranwala, Jehlum, Sialkot, Gujrat, Hafizabad, Kasur, Vehari, Sahiwal, Narowal, Khanewal, Layyah, Bahawalnager, Sukkur, Larkana, Dadu, Hyderabad, Karachi, Upper Dir, Karak, Lower Dir, Chitral, Peshawar, Malakand, Charsada, Nowshera, Kohat, Swat, Mansehra, Abbottabad, Haripur, Bannu, LakkiMarwat, Mardan, Swabi, Quetta, Pashin, Sibbi, Kalat, Mastung, Khuzdar, Kharan, Gwadar, QillaSaifullah,	59	-0.039	-0.370
Club 2	Bhakhar, Lodhran, Rajanpur, Muzaffargarh, Bahawalpur, Rahim Yar Khan, Khairpur, Shaheed Benazirabad, D.G.khan, NowsheroFeroze, Ghotki, Jaccobabad, Shikarpur, Badin, Sanghar, Hangu, Mirpur Khas, Shangla, Bonair, D.I.Khan, Tank, Batagram, Qilla Abdullah, Ziarat, Awaran, Lasbilla, Loralai, Nasirabad, Jafarabad	29	0.021	0.169
Club 3	Tharparkar, Barkhan	2	1.257	2.723
Club 4	Kohistan, Thatta	2	0.841	0.467

Note*:* Results display 4 clubs from row 1 to row 4.

The final club classification revealed four convergence clubs. The first club is Lahore, Pakpattan, Multan, Sheikhupura, Islamabad, Faisalabad, Khushab, Rawalpindi, Attock, Chakwal, Mandi Bahuddin, Sargodha, Mianwali, Jhang, T.T.Singh, Okara, Gujranwala, Jhelum, Gujrat, Sialkot, Hafizabad, Kasur, Vehari, Sahiwal, Narowal, Khanewal, Layyah, Bahawalnagar, Sukkur, Larkana, Dadu, Hyderabad, Karachi, Upper Dir, Karak, Lower Dir, Chitral, Peshawar, Malakand, Charsada, Nowshera, Kohat, Swat, Mansehra, Abbottabad, Haripur, Bannu, LakkiMarwat, Mardan, Swabi, Quetta, Pashin, Sibbi, Kalat, Mastung, Khuzdar, Kharan, Gwadar, QillaSaifullah. The second club is integrating Bhakhar, Lodhran, Rahim Yar Khan, D.G.khan, Bahawalpur, Rajanpur, Muzaffargarh, Khairpur, Shaheed Benazirabad, NowsheroFeroze, Ghotki, Shikarpur, Jaccobabad, Badin, Sanghar, Mirpur Khas, Shangla, Bonair, Hangu, D.I.Khan, Tank, Batagram, Qilla Abdullah, Ziarat, Awaran, Lasbilla, Loralai, Nasirabad and Jafarabad. The third club comprises Tharparkar and Barkhan. The fourth club encompasses Thatta and Kohistan.

Relative Transition Paths

The relative transition trajectories for each of the four convergence clubs are depicted in the images below. Club 1 consists of all districts with enrollment rates higher than those of other clubs combined. Nonetheless, the convergence rates among the members of Club 3 are occurring faster than the rates in the Aforementioned clubs, as evidenced by the high coefficient computation and illustrated by figure 3 in comparison to the other figures.

Figure 1: Relative Transition Paths for Club 1

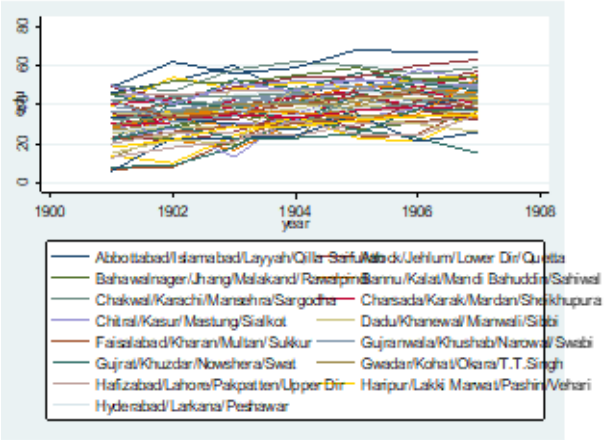


Figure 2: Relative Transition Paths for Club 2

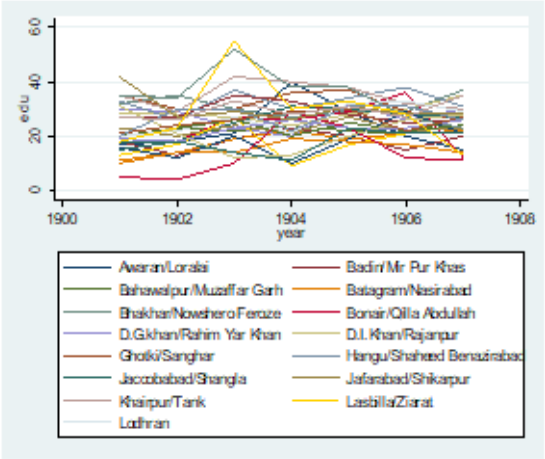


Figure 3: Relative Transition Paths for Club 3

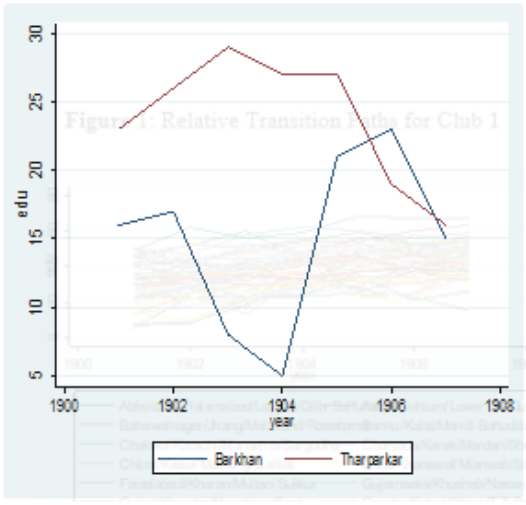
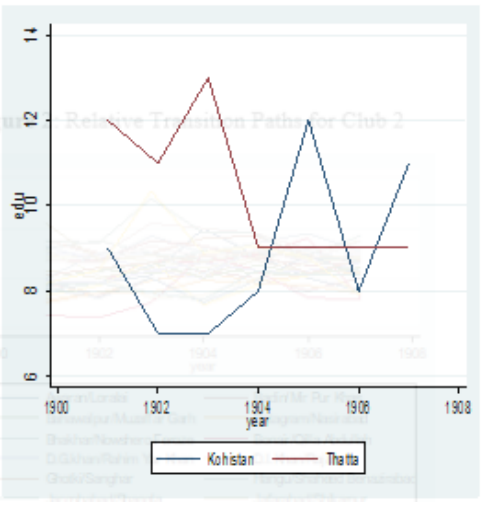


Figure 4: Relative Transition Paths for Club 4



Given that Pakistani districts are divided into four distinct convergence clubs, the aforementioned club findings and statistics unequivocally show that there is no convergence in secondary school enrolment overall throughout districts. Districts grouped under the same club have similar enrolment rates.

3.6 Club Convergence of Girl's Secondary School enrollment

The results for both club and overall convergence of secondary school enrollment among girls are covered in this section.

3.6.1 Log t Convergence test

First, we examine complete convergence in the club convergence of secondary school enrollment for girls. Initially, we perform 92 district log-t regressions covering the years 2004–2020. Table 5 summarizes the test results that were obtained. The idea that districts have typically converged must be rejected because the t statistic is less than -1.65, which makes it statistically significant at 1%. We have to proceed with the club identification as a result.

Table 5: Results of Phillips Sul log Regression

Variable	Coefficient	SE	T-stat
log(t)	-1.1593	0.0236	-49.1533

Note: convergence test rejects the null hypothesis at the 1% level

Identification of Clubs

Since there is no general panel convergence, we move on to investigate how convergence clubs develop. We use the club clustering algorithms of Phillips-Sul for cub identification given a collection of data. The results obtained for club identification are displayed in Table 6. Six clubs of convergence and one non-converging group are formed, as the table illustrates.

Table 6: Club Convergence Results

Clubs	Districts	No of districts	*b* Coefficient	*t* Statistic
Club 1	Islamabad, Attock, Rawalpindi, Jehlum, Chakwal, Khushab, Gujrat, Sialkot, Mandi Bahuddin, Narowal, Kasur, Dadu, Hyderabad, Upper Dir, Malakand, Peshawar, Chitral, Nowshera, Haripur, Swabi, Lower Dir, Sibbi, Mastung, Kharan	24	0.750	2.767
Club 2	Sargodha, T.T.Singh, Hafizabad, Lahore, Mianwali, Okara, Faisalabad, Sheikhupura, Vehari, Sahiwal, Gujranwala, Multan, Khanewal, Layyah, Larkana,	22	0.450	1.900

	Karachi, Charsada, Karak, Mansehra, Abbottabad, LakkiMarwat, Mardan			
Club 3	Bhakhar, Jhang, Pakpatten, Lodhran, Bahawalpur, Bahawalnager, Khairpur, Sukkur, Kohat, Batagram, Bannu, Quetta, Pashin, Qilla Abdullah, Gwadar, Loralai	16	0.196	1.033
Club 4	D.G.khan, Rajanpur, NowsheroFeroze, Shaheed Benazirabad, Muzaffargarh, Rahim Yar Khan, Jaccobabad, Shikarpur, Thatta, Sanghar, Mirpur Khas, Swat, Shangla, Bonair, Hangu, D.I.Khan, Tank, Ziarat, Lasbilla, Nasirabad	20	0.360	1.648
Club 5	Badin, Tharparkar, Kalat, Barkhan	4	0.156	0.960
Club 6	Kohistan, Awaran, QillaSaifullah	3	0.957	3.495
G~7	Ghotki, Khuzdar, Jafarabad	3	-2.429	-300.30

Note: Results display 6 clubs from row 1 to row 6 and one non convergent group in row 7.
Note: The *G~ symbol represents the non-converging group.*

As t-statistics are much bigger than -1.65, Table 6's results unequivocally demonstrate that girls' secondary school enrollment throughout 92 districts first converged to six clubs. The non-converging group includes Ghotki, Khuzdar, and Jaffarabad districts.

3.6.2 Club Merging Tests (Convergence between the Clubs)

The convergence algorithm can cause the actual number of clubs to be overestimated. The logit test is run on each pair of clubs to see if the convergence hypothesis is satisfied mutually. Table 7 presents the findings.

Table 7: Results of the Club Merging Test

S.No	Merging Clubs	Coefficient	SE	T-stat
1	Club 1 + Club 2	0.4799	0.2065	2.3244
2	Club 2 + Club 3	-0.1680	0.1424	-1.1798
3	Club 3 + Club 4	0.0464	0.1571	0.2953
4	Club 4 + Club 5	-0.4406	0.0588	-7.4954
5	Club 5+ Club 6	-1.2747	0.0604	-21.0967
6	Club 6 + G~7	-1.7727	0.0688	-25.7588

Note: The *G~* symbol represents the non-converging group.

3.6.3 Final Clubs Classification

According to the club merging results above, three clubs appear to be convergent. To create a club of sixty-two, the first, second, and third clubs combine. The final club classification display consists of four convergence clubs and one divergent group following convergence between two groupings. Table 8 presents the findings.

Table 8: Final Clubs Classification

Clubs	Final Club	No of districts	*b* Coefficient	*t* Statistic
Club 1	Islamabad, Vehari, Okara, Jehlum, Bhakhar, Narowal, Khushab, Multan, Lodhran, Lahore, Mianwali, Gujrat, Faisalabad, Jhang, Gujranwala, Chakwal, T.T.Singh, Layyah, Sialkot, Attock, Hafizabad, Sargodha, Mandi Bahuddin, Rawalpindi, Kasur, Sheikhupura, Sahiwal, Khanewal, Pakpatten, Bahawalpur, Bahawalnager, Khairpur, Sukkur, Larkana, Dadu, Hyderabad, Karachi, Lower Dir, Chitral, Malakand, Charsada, Abbottabad, Upper Dir, Nowshera, Kohat, Haripur, Karak, Peshawar, Mansehra, Batagram, Bannu, LakkiMarwat , Mardan, Swabi, Quetta, Pashin, Qilla Abdullah, Sibbi, Mastung , Kharan , Gwadar, Loralai	62	-0.178	-1.465
Club 2	D.G.khan, Shaheed Benazirabad, Muzaffargarh, Rahim Yar Khan, Rajanpur, NowsheroFeroze, Jaccobabad , Shikarpur, Thatta, Sanghar, Mirpur Khas, Swat, Shangla, Bonair, Hangu, D.I.Khan, Tank, Ziarat, Lasbilla, Nasirabad	20	0.360	1.648
Club 3	Badin, Tharparkar, Kalat, Barkhan	4	0.156	0.960
Club 4	Kohistan, Awaran, QillaSaifullah	3	0.957	3.495
G~5	Ghotki, Khuzdar, Jafarabad	3	-2.429	-300.305

Note: Results display 5 clubs from row 1 to row 4 and one non-convergent group in row 5.
Notes: The *G~7 symbol represents the non-converging group.*

There were four clubs that showed convergence and one non-converging group in the final club classification. The first club contains Islamabad, Vehari, Okara, Jehlum, Bhakhar, Narowal, Khushab, Multan, Lodhran, Lahore, Faisalabad, Mianwali, Jhang, T.T.Singh, Chakwal, Layyah, Gujranwala, Gujrat, Sialkot, Attock, Hafizabad, Sargodha, Rawalpindi, Kasur, Sheikhupura, Sahiwal, Khanewal, Pakpatten, Mandi Bahuddin, Bahawalpur, Bahawalnager, Khairpur, Sukkur, Larkana, Dadu, Hyderabad, Karachi, Lower Dir, Chitral, Malakand, Charsada, Abbottabad, Upper Dir, Nowshera, Kohat, Haripur, Karak, Peshawar, Mansehra, Batagram, Bannu, LakkiMarwat , Mardan, Swabi, Quetta, Pashin, Qilla Abdullah, Sibbi, Mastung , Kharan , Gwadar, Loralai. The second is integrating Rajanpur, Rahim Yar Khan, D.G.khan, Muzaffargarh, Shaheed Benazirabad, NowsheroFeroze, Jaccobabad, Shikarpur, Thatta, Sanghar, Mirpur Khas, Swat, Shangla, Bonair, Hangu, D.I.Khan, Tank, Ziarat, Lasbilla and Nasirabad. The third club comprises Badin, Tharparkar, Kalat and Barkhan. The fourth club encompasses Kohistan, Awaran and QillaSaifullah. Ghotki, Khuzdar, and Jafarabad make up the final club of non-converging districts.

Relative Transition Paths

The relative transition paths for the four convergence clubs and one diverging club are displayed in the figures below. Overall, Club 1 districts have higher enrollment rates than other clubs' districts. However, the convergence rates among the members of Club 4 are accelerating more quickly than those in the other clubs, as illustrated by figure 8 when compared to other figures and indicated by the high value of the coefficient.

Figure 5: Relative Transition Paths for Club 1

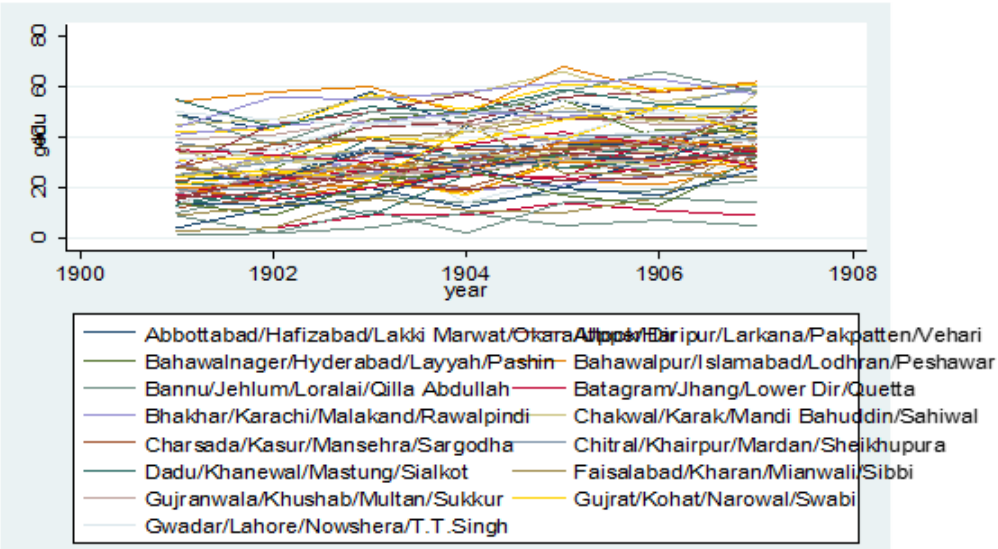


Figure 6: Relative Transition Paths for Club 2

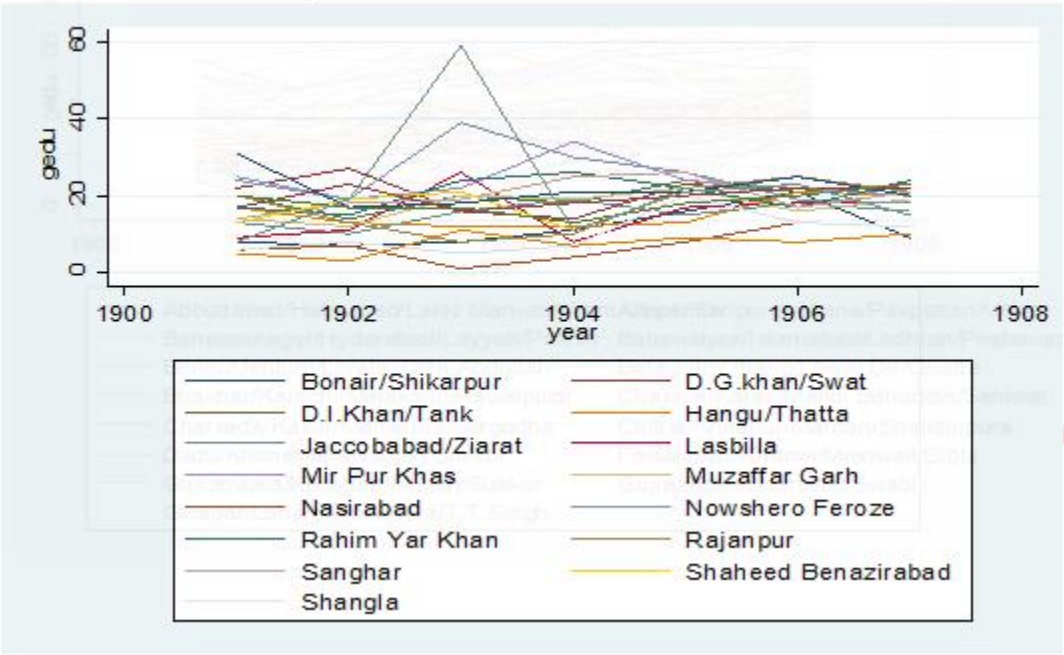


Figure 7: Relative Transition Paths for Club 3

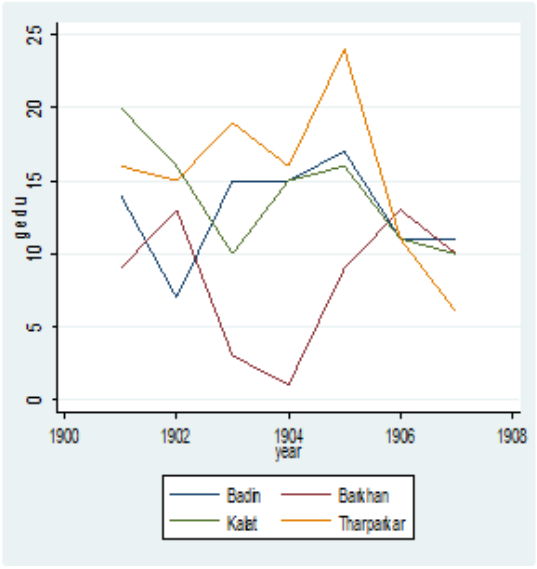


Figure 8: Relative Transition Paths for Club 4

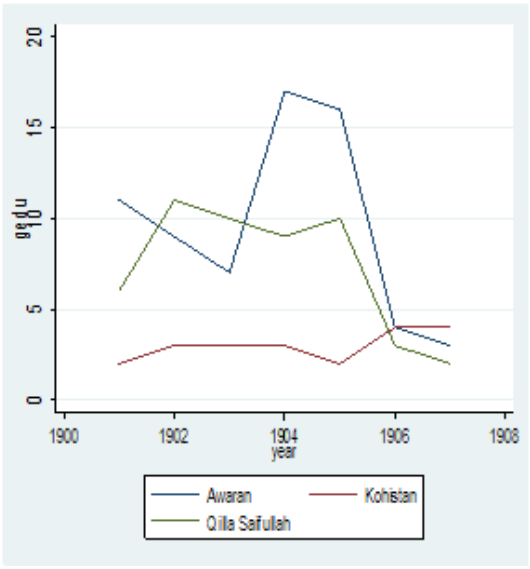
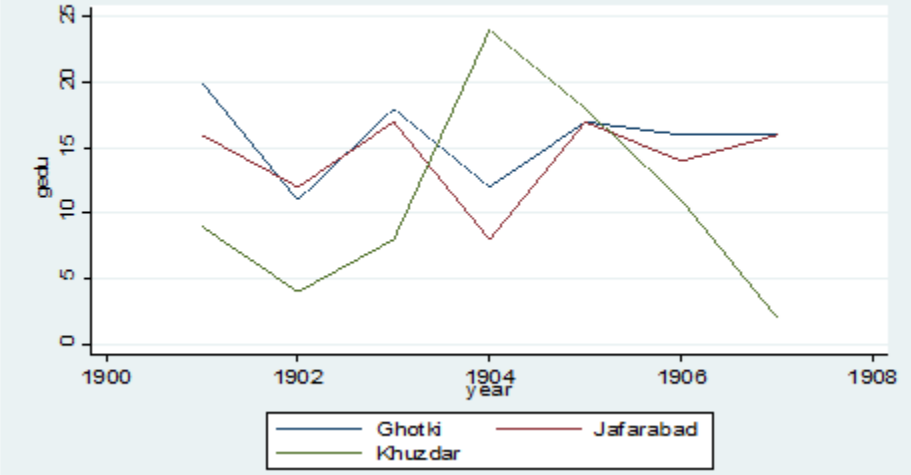


Figure 9: Relative Transition Paths for Non-Convergent Group



Pakistan's districts are split up into four different convergence clubs and one diverging group, which makes it evident from the club results above that there is no convergence between the districts. Districts with comparable levels of development are grouped together, while the most and least developed districts are classified as non-converging groupings since they do not merge with any club.

4. Conclusion and Recommendations

4.1 Conclusion

The study examines whether club convergence exists in Pakistan's 92 districts between 2014 and 2020. As an alternative to testing the club convergence hypothesis using a conventional metric such as the per capita GDP, our work is unique in that it examines educational components of development. We utilize two indicators of schooling—the total number of secondary school enrolled students and the enrollment rate of girls in secondary schools—to represent the nation's child education for this purpose. The results show that, in terms of total secondary school enrollment, there are four convergence clubs. There were four convergence clubs and one divergent group, according to the findings of the secondary school enrollment of girls in Pakistani districts. Additionally, the results demonstrated that there is more variance in girls' secondary school enrollment than there is in secondary school attendance as a whole.

The notion that the educational aspect of human development is not distributed equitably throughout Pakistani districts is given credibility by convergence clubs. Even after fiscal resources were moved to federating units, there are still notable variations and diverging patterns between provinces as well as within districts within provinces. Adopting strategies that could reduce geographic disparities in district-level overall school enrollment and boost the participation of females in schools in Pakistan's poor communities is therefore crucial.

4.2 Recommendations

There are still significant differences and divergent patterns between provinces and between districts within provinces even with the transfer of fiscal resources to federating units. Therefore, initiatives that could improve the participation of girls in schools in Pakistan's disadvantaged areas and lessen spatial disparities in district-level overall school enrollment are needed to be designed. Independent academic research with a regional policy focus is necessary. Furthermore, considering regional social issues is crucial while conducting this kind of research because of the variability. The wild guesses are based on irrational assumptions and questionable approximations due to the absence of credible government data. As a result, it is critical that the government generate accurate district-level statistics on socioeconomic variables.

5. Limitations and Future Directions of the Study

5.1. Limitations of the study

The PSLM Surveys for the years 2004–05 and 2014–15 provided the study's data. Data from four Pakistani provinces and 116 districts are included in PSLM surveys. Twenty-five districts are removed from the study's data because of missing observations. Studies on club convergence mostly concentrate on club identification and formation factors. This study only focused on club identification.

5.2. Future directions of the study

In light of the spatial nature of the above study, additional research can be done on the factors responsible for non-convergence of child schooling across the districts of Pakistan. These spatial econometrics techniques could be extended to other economic, social and environmental issues for Pakistan and developing world as portrayed by the literature on developed countries.

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