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Convergence in Human Development across Districts of Pakistan: Evidence from Club Convergence Test

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ABSTRACT

Studies on the convergence club have become a focal point in economic growth and development literature over the last three decades. This paper analyzes the club convergence hypothesis going beyond the traditional use of GDP per capita. It examines the convergence club of 97 Pakistani districts over the period 2004-20015. The analysis is based on an augmented index for measuring development through convergence and the clustering method of Phillips and Sul (2007). The index consists of 3 sub-indices of education, health, and household welfare level, with each index further composed of 5 indicators. The Principal Component Analysis (PCA) is used to aggregate these indicators to get sub-indices and a final development index. Results of the study indicate that the districts do not converge to the same long-run equilibrium. Instead of overall convergence, we find eleven convergence clubs and one non-convergent group for human development. The existence of clubs means that measures aimed at reducing disparities in human development and promoting regional growth should consider the specific characteristics revealed in the convergence analyses. Spatial differences thus need to be addressed mainly through pro-poor regional policies.

Introduction

The "convergence" debate is a hot topic in literature. The basis of the convergence proposition was first presented in the writings of Tucker and Hume in the mid-18th century (Elmslie, 1995). However, the convergence-divergence discussion itself is deemed to have been founded by Veblen's (1915) claim that the benefit in development lies with latecomers because the early developing nations make the initial errors and construct the technology. 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 modifies the Harrod-Domar modelby adding up labor as a factor of production, consequently completing the equation of growth. 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. In accordance with Solow (1956), advocates of the neoclassical pattern conclude that inequalities are bound to lessen with growth (Sala-I-Martin and Barro, 1995).

The fall-down of the neo-classical model in explaining steady-state growth leads to a new type of model known as endogenous models of growth (Romer, 1986; Lucas, 1988). These models are based on processes such as inter-temporal knowledge spillovers and "learning by doing," averting returns to scale from declining. Contrary to the neoclassical model, the theories of endogenous growth (Romer, 1986; Lucas, 1988; Aghionn and Howit, 1998), institutional theory (Lundvall, 1992; Nelson, 1993) and the new economic geography (Krugman, 1991; Venables, 1999) tend to agree with the fundamental statement of Myrdal (1957) that growth is a growing spatial practice that results in higher disparities.

One type of growth theory (Azariadis & Drazen, 1990; Barro & Sala-i-Martin,1992; Chatterji,1992; David,1994; Durlauf& Johnson,1995; Quah,1996; Azariadis,1996; Galor,1996) shows that economies that are rather similar in their structural characteristics (e.g., production technology, preferences, government policies, etc.) may, however, converge to different steady-state equilibria if they differ in terms of initial conditions. Hence, within a group of similar economies, a common balanced growth path can only be expected if their initial conditions are also identical. So, economies that approach the same steady-state equilibrium are said to form a convergence club (Galor, 1996). The notion of convergence clubs was first defined at the end of the eighties by Baumol and Wolff (1988). Chatterji (1992) describes that a convergence club implies various regions forced in the long run to a steady-state level with identical income per capita. At a country level, Quah introduced the notion of the club convergence hypothesis in 1996. He established a method (not based on a theoretical model) designed for modelling the dynamics of cross-sectional distributions of economies. Quah (1996) described that the per capita income developed into a twin peaks distribution at the world level so that there is no convergence process among economies.

Despite the rich literature on regional convergence worldwide, the club convergence at the district level in Pakistan has been almost entirely neglected. In this perspective, this study empirically analyzes the issue of different districts converging to several steady states across Pakistan and the manifestation of "convergence clubs" as was proposed by various scholars in the growth literature (see Baumol, 1986; Durlauf, 1995; and Galor, 1996).

Literature Review

Empirical studies on the convergence club hypothesis have reached various outcomes concerning the quantity and features of groups, particularly influenced deeply by the methods employed. The empirical methods are oriented on the following directions: chronological series tests of unit root and co-integration (Evans & Karras, 1996; Evans, 1998; Kutan & Yigit, 2005; Guetat & Serranito, 2007; Siklos, 2010; Lopez & Papell, 2012) and cross-section augmented Solow regression (Barro & Sala-i-Martin, 1992). While Phillips and Sul (2007) proposed a non-linear factor model based on a panel convergence, the convergence clubs being identified within the panels using a clustering procedure.

By using a simple non-linear model, Wolff and Baumol (1988) concluded the existence of two clubs: a high income convergence club and a low income non-convergent one. Linking the economic gap at some time with the particular economic gap at a previous time and incorporating more influences of those former levels, Chatterji (1992) establishes a two clubs convergence that are mutually exclusive: one comprising the rich nations and another consisting of the poor ones. By employing regression tree analysis, Quah (1993) examines the club convergence hypothesis for 105 countries over a period of 1960–1990 using per capita income as a measure of development. Quah observed a growing twin peak involving the division of regions into two dissimilar income groups. Using a regression tree analysis, Durlauf and Johnson (1995) found evidence for club convergence to multiple steady states for 121 countries. Their results suggest that heterogeneity in the available level of human capital and its growth determines the formation of clubs. Adding to this concept that there can be multiple steady-state equilibria, Galor (1996) developed models for club convergence. Where, he argued that, in the long run, countries with similar characteristics do tend towards common steady-state equilibrium, but there is no convergence across different sets of equilibria.

While the studies mentioned above focused on the club convergence phenomena are based on the methods that could not address the issue of individual heterogeneity, economic structure, economic transition and convergence path. However, Phillips and Sul (2007) came up with a new technique to cluster panels into club convergence groups. Phillips and Sul argued about the role of heterogeneity over time and across economies in the transitional dynamic of economic growth. Subsequently, there has been a proliferation of work on economic convergence after Phillips and Sul (2007). Some of these studies are discussed below. Aksoy et al. (2019) investigated club convergence in per capita income across 81 NUTS-III regions in Turkey for the period 1987–2017. Their result showed strong evidence of convergence clubs across Turkish regions. For the period 1987–2001, they found five clubs and six clubs in the second period covering 2004–2017.

Tian et al. (2016) examined regional income convergence in China for 31 provinces over the period 1978–2013. They identified two convergence clubs and suggested that investment, human capital, and openness increase the probability of

regions in the high income club. A similar study was conducted by Li et al. (2018), considering 2286 regions of China for the period 1992–2010. Their result shows six convergence clubs and concludes that per capita fixed assets, population density, and industrialization have promoted convergence club formation.

Velázquez et al. (2015) analyze the convergence patterns in income per capita across the Mexican states over the period 1940–2015 by applying a time-series approach considering temporal and transitional heterogeneity. Results indicate that Mexican states do not converge to the same long-run equilibrium. Instead of overall convergence, club convergence was found for both regional inequality and income per capita. Bartkowska and Riedl (2009) investigate convergence clubs' formation in per capita income among 206 European regions from 1990 to 2005. They find that convergence clubs exist, indicating that European regions form five separate groups converging to their steady-state paths. Hao (2008) evaluated the convergence club using China's provincial data over the period 1985–2000. His study found that the Chinese regions are clustered into two groups where these two convergence clubs exhibit heterogeneity among growth behaviors.

The above literature showed that extensive research on club convergence is confined to the use of GDP per capita. Recently the concept of club convergence has extended to the development index for convergence across countries/regions. Some of the studies are discussed below.

Basel et al. (2020) analyze the convergence club based on the augmented index for measuring development across 102 economies. The index is composed of seven major development indicators: education, health, energy use, access to water and sanitation, environment, living standard, and good governance. The study examines the club formation of 102 economies over a period o 1996–2015 and reveals four final convergence clubs.

Montan˜e's et al. (2018) analyses the convergence hypothesis for Spain based on the income and human development index over the periods 1980–2007 and 1980–2014. They find that the number of clubs decreases for the period 1980–2014, indicating that the Great Recession lowered the provincial disparities. Szendi (2014) analyzes the Human Development Indicator (HDI) in the countries of the world from 1990 to 2010 to analyze the development from an economic and social aspect, using beta convergence of HDI and its club-convergence. The results describe small economic and social convergence. The convergence clubs also support the prevailing tendencies of the world in the aspect of regional differences and the global centre-periphery theory.

The review of the literature clearly shows that for Pakistan, no studies have been conducted to understand the convergence club hypothesis at the district level, taking into consideration the broader aspects of development. Thus, we construct an augmented development index that could capture the comprehensive aspects of development into some measurable units and then understand the club convergence hypothesis on the basis of this index.

Material and Methods

Variables Description and Data Source

Several economists criticize the use of per capita GDP as a measure of development as it fails to account for the wider aspect of human well-being, which is far beyond what growth rates in income can capture (Sen, 1983; Goossens, 2007; Stiglitz et al., 2009; Todaro & Smith, 2011; Schepelmann et al., 2010). In recent growth literature, renowned economist Xavier Sala-I Martin has suggested that convergence can be applied in human development (Roy & Bhattacharjee, 2009). So, in this study, we attempt to analyse the convergence club for 97 districts based on an augmented index for measuring development over a period of 2004–2015.

The development index is composed of three sub-indices of education, health and Household living standard. Each of the sub-indices is based on five indicators. The indicators are aggregated through weights obtained from Principal Component Analysis (PCA) (Basel et al., 2020). Data for these indicators at the district level is collected from six PSLM Surveys. The list of indicators used to compute sub-indices is given in Table 1.

Table 1
List of indicators of education, health and household welfare level

No	Development Index		
	Education Index	**Health Index**	**Household welfare Index**
1	Population that has attended school ever	Children that have been immunized (Treatment of diarrhea in children (Aged under 5)	Households with electricity
2	Population that has completed primary level or higher	Children aged 12-23 months) Children affected by diarrhea in last 30 days (Aged under 5)	Household with Gas.
3	Net enrolment rate at the middle level (age 11-13)	Treatment of diarrhea in children (Aged under	Households by housing ownership.
4	Net enrolment rate at the Matric level (age 14-15)	Pre-natal consultations	Households with RCC Roof.
5	Adult Literacy level (15 years and older population)	Health Consultation (Number of individuals who consulted for treatment expressed as proportion of total individuals fallen sick during last two weeks)	Households with flush toilet.

Data Limitation

Data for the study is taken from six PSLM Surveys over the period 2004-2015. PSLM surveys cover data for 116 districts across four provinces of Pakistan. For this study, 19 districts are dropped from the data due to missing observations. The detail of the districts dropped is given in Table 2.

Table 2
List of districts dropped from data due to missing observation

	Provinces			
	Punjab	**Sindh**	**KP**	**Balochistan**
Districts	Chinio, Nankana Sahib	Kashmore, Shahdadkot, Tando Allah Yar, Tando Muhammad Khan, Sujawal, Umerkot, Matiari, Jamshoro	Tor Ghar	Ketch, Panjgur, Kohlu, Derabugti, Sheerani, Washuk, Nushki, harnai

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 sound as it endogenously classifies regions with similar characteristics into unique groups called clubs. The importance of the logt-test is that the test employed in this technique doesn't depend on any assumption relating to trend or stochastic non-stationarity of the variable of concern and the common factors in the panel across individuals (Aksoy et al. 2019).

The log t-test

The methodology is dependent on a pioneering disintegration of the variable of concern. Panel data are generally decomposed in the following manner:

$$log\ y_{it} = \varphi_i u_t + \varepsilon_{it}, \qquad (1)$$

Where u_t signifies the common factor, φ_i symbolizes the component of unit characteristic, and ε_{it} represents the error term. On the other side, in the pattern applied here, the log of income per capita, log y_{it} has a time-varying factor depiction that might be resulting from the representation of typical panel data:

$$log\ y_{it} = (\varphi_i + \varepsilon_{it} / u_t) u_t = \delta_{it} u_t, \qquad (2)$$

where δ_{it} absorbs the error term and hence the unit-specific factor signifying the distinctive fraction that differs over time. The first model tried to reveal the behavior of the individual $log\ y_{it}$ by the common factor μ_t and two-unit characteristic components φ_i and ε_{it}. The second method looks to explain per capita income by calculating the share (δ_{it}) of the common growth path (u_t) that country i undertakes. To model the transition coefficients δ_{it}, a relative transition coefficient h_{it} is built:

$$h_{it} = log y_{it} / N^{-1} \sum_{i}^{N=1} log\ y_{it} = \sigma_{it} / N^{-1} \sum_{i}^{N=} \sigma_{it} \quad (3)$$

h_{it} stand for the transition path of economy i relative to the cross-section average and has a dual understanding: first, it determines the behavior of individual regions in relation to other regions, and second, it portrays the relative disappearance of region I from the common growth path μ_t. In the case of convergence, when all regions move in the direction of the identical transition path, $h_{it} \rightarrow 1$ for all i as $t \rightarrow \infty$. Afterwards, the cross-sectional variance of h_{it}, indicated by $V^2_t = N^{-1} \sum_i (h_{it}-1)^2$, converges to zero. There are various possible conclusions in the case of no convergence. For example, V_t might converge to a positive number, an attribute of convergence club, or remain restricted above zero and not converge or diverge.

In order to discover the null hypothesis, Sul and Phillips (2007) model δ_{it} in a semi-parametric form:

$$\delta_i = \delta_i + \sigma_i \xi_{it} / L(t) t^{a} \quad (4)$$

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:

$$H_0 : \delta_i = \delta \text{ and } a \geq 0 \quad (5)$$

It is tested against the alternative $H_A : \delta_i \neq \delta$ for all i *or* $a < 0$. Remember that different transitional models of regions i and j are apparent under the null hypothesis of convergence, including momentary divergence, which refers to periods where $\delta_i \neq \delta_j$. Consequently, the technique suggested by Sul and Phillips (2007)allows us to identify convergence even in the case of transitional divergence, where other techniques such as stationarity tests (Franses and Hobijn, 2000) fail. Principally, stationary time series techniques are incapable to discover the asymptotic co-movement of two-time series, and consequently, the convergence proposition is rejected mistakenly.

Considering Eq. (4), Sul and Phillips (2007) explain that the cross-sectional variance of h_{it} has the limiting form under convergence.

$$V_t^2 \sim A / L(t)^2 t^{2a} \text{ as } t \rightarrow \infty \text{ for some } A > 0 \quad (6)$$

The following regression based convergence test can be deduced:

$$log (V_1^2 / V_t^2) - 2 log L(t) = a + b log t + u_t$$

$$For\ t = [rT], [rT] + 1, \ldots, T \quad (7)$$

Where generally r∈(0, 1) and *L(t)* are functions varying slowly. Sul and Phillips (2007), based on Monte Carlo simulations, suggest utilizing *L(t)=log t* and *r=0.* for sample sizes below *T=50*. At last, by means of $\hat{b} = 2\,a$, a one-sided t-test robust to autocorrelation and heteroskedasticity is applied to test the disparity of the null hypothesis α ≥ 0.

If $t\hat{b} < -1.65$ (significance level 5%)

The null hypothesis is negated in that case.

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 $t\hat{b}$ is greater than −1.65. After that, the log t-test is repeated, and one by one, all of the units left behind in the sample to test whether they converge. If not, then to the remaining units, the first three steps are applied. If there are no clubs formed, one may analyse that those units of economy diverge.

Results and Discussion

In this section, we discuss the findings for club convergence of development index across districts of Pakistan. There are further two sub-sections, the first sub-section discusses the empirical results, and the second subsection presents the discussion on empirical results.

Club Convergence of Development Index

This section discusses the findings for overall convergence and club convergence of the development index. For testing the convergence hypothesis and for identifying the convergence club, we use the technique proposed by Phillips and Sul (2007).

Log t Convergence test

We begin by testing full convergence in the development index. At first, we run the log t regression across 97 districts for the period 2004–2015. The results obtained through this test are summarized in Table 3. The value of t-statistic is less than - 1.65 and is statistically significant at 1%, and hence we reject the null hypothesis of overall convergence among districts. Furthermore, it implies that the convergence hypothesis in the whole sample is rejected. Thus, we need to proceed further for the identification of the clubs.

Table 3
Phillips Sul log Regression Results

Variable	Coeff	SE	T-stat
log(t)	-1.3071	0.0510	-25.6440

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

Identification of Clubs

Given the absence of overall panel convergence, we proceed to determine the formation of convergence clubs. For cub Identification, we apply the *Phillips-Sul algorithms of club clustering* for a given set of data. Table 4 shows the output obtained for the identification of the clubs. The table shows the formation of 11 Convergence Clubs and one non-converging group.

Table 4
Club Convergence Results

Clubs	Districts	No of districts	*b* Coefficient	*t* Statistic
1st Club	Lahore, Hyderabad, Karachi	3	0.109	0.550
2nd Club	Jehlum, Chakwal, Gujranwala, Gujrat, Sialkot, Sheikhupura, Malakand, Peshawar, Nowshera, Haripur	10	0.316	1.433
3rd Club	Faisalabad, Dadu, Abbottabad, Swabi	4	0.152	0.783
4th Club	Attock, Sargodha, Khushab, T.T.Singh, Hafizabad, Mandi Bahuddin, Narowal, Kasur, Okara, Multan, Larkana, Lower Dir, Chitral, Charsada, Kohat, Karak, Mansehra, Mardan, Quetta.	19	0.458	2.224
5th Club	Sahiwal, Khanewal, Lodhran, Layyah, Sukkur, NowsheroFeroze, Swat, Bonair, Hangu, LakkiMarwat, Pashin, Sibbi, Gwadar.	13	0.390	1.869
6th Club	Mianwali, Jhang, Vehari, Pakpatten, Muzaffar Garh, Bahawalnager, Khairpur, Shaheed Benazirabad, Sanghar, Upper Dir, Batagram, Bannu, Kalat, Mastung, Kharan, Zhob, QillaSaifulla.	17	0.215	1.052
7th Club	Bhakhar, Bahawalpur, Rahim Yar Khan, Ghotki, Shikarpur, Mir Pur Khas, Shangla, D.I.Khan, Tank, Ziarat.	10	0.560	2.621
8th Club	D.G.khan, Jaccobabad, Khuzdar, Awaran, Lasbilla, Loralai.	6	0.305	1.382
9th Club	Thatta, Qilla Abdullah, Musa Khel, Nasirabad, Jafarabad, JhalMagsi, Bolan	7	0.505	1.984

10th Club	Tharparkar, Barkhan.	2	1.493	2.565
11th Club	Kohistan, Chaghi.	2	-0.946	-0.389
12thGroup	Islamabad, Rawalpindi, Rajanpur, Badin	4	-1.418	-24.736

Note: Results display 11 clubs from row 1 to row 11 and one no-convergent club in row 12

Results from Table 2 clearly show that the development index across 97 districts converged initially to eleven clubs as t-statistics are significantly larger than - 1.65. Four districts, including Islamabad, Rawalpindi, Rajanpur and Badin belong to the non-converging group.

Club Merging Tests (Convergence between the Clubs)

The convergence algorithm may lead to overestimation of the true number of clubs, as noted by Phillips and Sul (2009). We evaluate merging adjacent clubs into larger clubs by applying club merging tests to tackle this potential issue. We proceed with the analysis by testing for convergence between clubs. Phillips and Sul (2009) proposed log t-test for adjacent clubs after club clustering to merge two or more clubs into new clubs. The logt-test is performed on all the pairs of clubs, and if the convergence hypothesis is satisfied jointly, they can be merged to form a new club. The results are presented in Table 5.

Table 5
Club Merging Test Results

S. No	Merging Clubs	Coefficient	SE	T-stat
1	Club 1 + Club 2	-0.3178	0.1318	-2.4105
2	Club 2 + Club 3	-0.0488	0.1643	-0.2974
3	Club 3 + Club 4	0.0705	0.1455	0.4843
4	Club 4 + Club 5	-0.5858	0.0642	-9.1196
5	Club 5+ Club 6	-0.1081	0.1431	-0.7555
6	Club 6 + Club 7	0.1840	0.1708	1.0770
7	Club 7 + Club 8	-0.2338	0.1467	-1.5939
8	Club 8+ Club 9	-0.3479	0.1023	-3.4000
9	Club 9 + Club 10	0.4909	0.2490	1.9715
10	Club 10 + Club 11	-1.9346	0.0770	-25.1191
11	Club 11 + G~12	-1.4634	0.0531	-27.5587

Notes: The G~ symbol represents the non-converging group

Final Clubs Classification

The above club merging results revealed that there is evidence of convergence between four groups. The 2ndand 3rd clubs merge to form a club of 19 districts, while the5th and 6th clubs merge to form a club of 30 districts. The 7th and 8th merge to form a club of 16 districts, while the 9th and 10th clubs combine to form a

club of 9 districts. After convergence between four groups, the final club classification display shows seven convergence clubs and one divergent group. The results are depicted in Table 6.

The final club classification revealed seven convergence clubs and one non-converging group. Lahore, Hyderabad and Karachi represent the first club. The second is integrating fourteen districts from Punjab and KPK, including Jhelum, Chakwal, Faisalabad, Gujranwala, Gujrat, Sialkot, and Sheikhupura, Dadu, Malakand, Peshawar, Nowshera, Abbottabad, Haripur and Swabi. The third club comprises Attock, Sargodha, Khushab, T.T.Singh, Hafizabad, Mandi Bahuddin, Narowal, Kasur, Okara, Multan, Larkana, Lower Dir, Chitral, Charsada, Kohat, Karak, Mansehra, Mardan and Quetta. The fourth club encompasses Mianwali, Jhang, Vehari, Sahiwal, Khanewal, Pakpatten, Lodhran, Layyah, Muzaffar Garh, Bahawalnager, Khairpur, Sukkur, Shaheed Benazirabad, NowsheroFeroze, Sanghar, Swat, Upper Dir, Bonair, Hangu, Batagram, Bannu, LakkiMarwat, Pashin, Sibbi, Kalat, Mastung, Kharan, Gwadar, Zhob and Qilla Saifullah. The fifth club consists of Bhakhar, D.G.khan, Bahawalpur, Rahim Yar Khan, Ghotki, Jaccobabad, Shikarpur, Mir Pur Khas, Shangla, D.I.Khan, Tank, Ziarat, Khuzdar, Awaran, Lasbilla and Loralai. The sixth club consists of Thatta, Tharparkar, Qilla Abdullah, Barkhan, Musa Khel, Nasirabad, Jafarabad, JhalMagsi and Bolan. The seventh group contains Kohistan, Chaghi. The last group comprising non-converging districts contains Islamabad, Rawalpindi, Rajanpur, and Badin

Table 6
Final Clubs Classification

S. No	Final Club	No of districts	*b* Coefficient	*t* Statistic
Club 1	Lahore, Hyderabad, Karachi	3	0.109	0.550
Club 2	Jehlum, Chakwal, Faisalabad, Gujranwala, Gujrat, Sialkot, Sheikhupura, Dadu, Malakand, Peshawar, Nowshera, Abbottabad, Haripur, Swabi.	14	-0.049	-0.297
Club 3	Attock, Sargodha, Khushab, T.T.Singh, Hafizabad , Mandi Bahuddin, Narowal, Kasur, Okara, Multan, Larkana, Lower Dir, Chitral, Charsada, Kohat, Karak, Mansehra, Mardan, Quetta	19	0.458	2.224
Club 4	Mianwali, Jhang, Vehari, Sahiwal, Khanewal, Pakpatten, Lodhran, Layyah, Muzaffar Garh, Bahawalnager, Khairpur, Sukkur, Shaheed Benazirabad,	30	-0.108	-0.756

	NowsheroFeroze, Sanghar, Swat, Upper Dir, Bonair, Hangu, Batagram, Bannu, LakkiMarwat, Pashin, Sibbi, Kalat, Mastung, Kharan, Gwadar, Zhob, Qilla Saifullah			
Club 5	Bhakhar, D.G.khan, Bahawalpur, Rahim Yar Khan, Ghotki, Jaccobabad, Shikarpur, Mir Pur Khas, Shangla, D.I.Kha, Tank, Ziarat, Khuzdar, Awaran, Lasbilla, Loralai	16	-0.234	-1.594
Club 6	Thatta, Tharparkar, Qilla Abdullah, Barkhan, Musa Khel, Nasirabad, Jafarabad, JhalMagsi, Bolan	9	0.491	1.971
Club 7	Kohistan, Chaghi	2	-0.946	-0.389
Group 8	Islamabad, Rawalpindi, Rajanpur, Badin	4	-1.418	-24.736

Note: Results display 7 clubs from row 1 to row 7 and one no-convergent club in row8.

The club mentioned above results clearly indicates that there is no convergence among districts of Pakistan, as the districts are classified into 7 different convergence clubs and one diverging group. The districts with the same development levels are classified within the same group, while the districts with the highest and lowest development don't merge with any club and are classified as non-converging groups. The final club classification clearly displays that the first three clubs contain 18 districts of Punjab, 13 districts of KP and 4 districts of Sindh. In contrast, Quetta is the only district from Balochistan grouped in the first three convergence clubs. The 4th and 5th clubs encompass 14 districts of Punjab, 10 districts of KP, 9 districts of Sindh and 13 districts of Balochistan. The last two clubs contain 8 districts from Balochistan, 2 districts of Sindh, and one district from KP. The 8th non-converging group includes the two most developed districts of Punjab, namely, Islamabad and Rawalpindi. It also has the two least developed districts of Punjab and Sindh, respectively, i.e., Rajanpur and Badin.

Conclusion

This study is inspired by the failure of the neo-classical model in presenting a viable explanation of steady-state growth. It is for that reason that various new types of models were devised, such as the theories of endogenous growth (Romer, 1986; Lucas, 1988; Aghionn and Howit, 1998), the institutional theory (Lundvall, 1992; Nelson, 1993) and the new economic geography (Krugman, 1991; Venables, 1999). These models tend to agree with the fundamental statement of Myrdal (1957) that growth is a growing spatial practice resulting in greater disparities. Another growth

theory, however, shows that economies that are rather similar in their structural characteristics (e.g., production technology, preferences, government policies, etc.) may converge to different steady-state equilibria if they differ in terms of initial conditions (Azariadis & Drazen, 1990; Barro & Sala-i-Martin, 1992; Chatterji, 1992; David, 1994; Durlauf & Johnson, 1995; Quah, 1996; Azariadis, 1996; Galor, 1996). Hence, within a group of similar economies, a common balanced growth path can only be expected if their initial conditions are also the same. So, economies that approach the same steady-state equilibrium form a convergence club (Galor, 1996). Chatterji (1992) describes that a convergence club implies various regions that are forced in the long run to a level of steady state with the same income per capita.

The paper analyses the presence of club convergence across districts of Pakistan over the period 2014–2015. Instead of using a traditional measure like the per capita GDP as a basis for studying the club convergence hypothesis, the paper explores broader aspects of development. For this purpose, we use the augmented development index. The index is composed of three sub-indices of education, health and Household living standard. Each of them is based on five indicators. The indicators are aggregated through weights obtained from the Principal Component Analysis (PCA), and the Phillips and Sul (2007) technique is employed to determine the number of convergence clubs. The results indicate that instead of overall convergence, we find club convergence for human development across districts of Pakistan. The findings display that there are seven convergence clubs and one non-convergent group. The existence of seven convergence clubs supports the view that human development is not uniformly distributed across districts of Pakistan. Thus, there is a need to design policies that could reduce spatial disparities in human development across them.

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