

MEASURING RURAL INCOME INEQUALITY AND ANALYZING AGRICULTURAL AND NON-AGRICULTURAL INCOMES IN DISTRICTS AT CPEC IN PAKISTAN USING GEOGRAPHIC INFORMATION SYSTEM

Lubna NAZ* and Syed Ammad ALI**

Abstract

This study has two-fold objectives. First, analyze the rural income inequality and its decomposition by employment status and education of the household. Second, analyze the income inequality of districts of Pakistan located at the China-Pakistan Economic Corridor (CPEC). Theil Index, a member of the generalized entropy inequality and inequality decomposition technique. Furthermore, the Geographic Information System-GIS was used to map the rural income (agricultural and non-agricultural). Pakistan Social and Living Standards Measurement Survey (2012-13), provincial and district representative data set, was used. Results show that the households mainly earned from agriculture and those in which heads had the post-secondary qualification make the largest contributions to rural income inequality. A decomposition of income inequality within and between districts on CPEC routes indicates higher variations. GIS-based mapping of rural income depicts districts on routes of CPEC having a large non-agricultural income.

Keywords: China-Pakistan Economic Corridor, Geographic Information System, Inequality-Decomposition, Rural Income Inequality, Theil Index.

JEL Classification: I24; J10; O12; Q12.

I. Introduction

In developing countries, two important features characterize a rural economy. First, the farm income, which is synonymous with the rural income, and second, the ownership of agrarian assets, has a profound effect on the rural income distribution [Bhandari (2013)]. However, the changing structure of the rural economy calls for re-examining the characteristics of the economically active population and patterns of rural employment to assess the rural income and its distribution [Chambers, et al., (1991)]. The need for analyzing rural income formation becomes more pressing when a country contracts

* Assistant Professor, Department of Economics, ** Research Economist, Applied Economics Research Centre, University of Karachi, Karachi, Pakistan.

bilateral deals with their trading and strategic partners to strengthen coordination in trade, employment, investment, and social networking.

In the two high-profile visits by the Chinese leadership, first in 2013, when the premier Li Keqiang visited Pakistan and proposed the China-Pakistan Economic Corridor (CPEC), China pledged to invest about USD 46 billion in various sectors. The second in 2015 by president Xi Jinping, China signed the investment agreements worth more than USD 28 billion. It was the biggest investment deal Pakistan contracted with China [Xie, et al., (2015)]. The projects included highways, railways, gas and oil pipelines, optic fibre links and energy development. The most significant of the proposed projects was the construction of trade routes connecting the Kashgar (Xinjiang, China) with the Gwadar (Balochistan, Pakistan).

The China-Pakistan Economic Corridor (CPEC) has three specified routes: Eastern, Western, and Central routes. The Eastern route goes through Gwadar-Turbat-Khuzdar-Ratodaro-Kashmore-Rajanpur-D.G.Khan-Rawalpindi-Hasanabdal and onward. The Western route is connected through Gwadar-Turbat-Khuzdar-Kalat-Quetta-Zhob-D. I. Khan-Bannu-Kohat-Peshawar-Hasanabdal and onward. The Central route connects through Gwadar-Turbat-Khuzdar-Ratodaro-Kashmore-Rajanpur-D. G. Khan-D. I. Khan-Banu-Kohat-Peshawar-Hasanabdal and onward. The many districts on these routes are rural and show the moderate to the highest level of multiple deprivations. According to a study by Jamal (2011), D.I. Khan, Kashmore, D.G. Khan, Rajanpur and Turbat were on the highest level of multiple deprivations in 2009. Among provinces, Balochistan had the highest level of multiple deprivations, and Punjab was at the lowest of multiple deprivations.

Moreover, the rural income distribution showed a sizable variability at the regional level. The Gini coefficient of rural income decreased in Punjab from 0.41 in 2005 to 0.36 in 2011. It increased in Sindh from 0.27 in 2005 to 0.32 in 2011. Balochistan showed an increase in the Gini coefficient of rural income from 0.23 in 2005 to 0.29 in 2011. Khyber Pakhtunkhwa has only exhibited an unchanged Gini coefficient (0.34) of rural income inequality in a similar time-span [SPDC (2016)]. In Pakistan, a decline in rural income is mainly attributed to non-farm income. It may be due to the largest share of non-farm income (66 per cent) to the total income of poor rural households [Adams (1994)].

The existing literature analyzes three important dimensions of income inequality in the context of Pakistan; measurement of income inequality, growth sensitivity of income inequality, and decomposition of income inequality. The studies by Ahmad (2002), Anwer (2003), Asad and Ali (2011), De Kruijk and Van Leeuwen (1985), Idreas and Ahmad (2010), Naschold (2009), Nasir and Mahmood (1999) and Zakir and Idrees (2009) used the selected inequality measures to analyze income inequalities across various occupations and the regions. The inequality analyses based on the relationship between economic growth and income distribution shows a negative or very low growth sensitivity to income distribution at national and regional levels [Asad and Ali (2011), Cheema, et al., (2012), Jamal (2014) and Talat (2010)]. The income inequality

decomposition by income sources of households shows that non-farm income is income-inequality-decreasing in Pakistan [Adams, et al., (1995), De Kruijk and Kamal (1987) and Khadija (2012)].

The available evidence on rural income inequality, this study contributes to the existing literature in three important ways. First, it provides a measure of inequality of rural income at the provincial level. Second, it analyzes the rural income inequality decomposition the employment status of the head the employer, self-employed, non-farm worker, unpaid family worker and the employed in agriculture, head's education, primary, matric, intermediate, graduation, and above), and over districts on CPEC routes. Third, it uses the Geographic Information System (GIS) for mapping agricultural and non-agricultural incomes of households in the selected districts [Figure A-1, A-2, A-3, A-4, A-5 and A-6 in Appendix]. The study uses the Pakistan Social and Living Standards Measurement Survey, 2012-13, which is a representative data set at provincial and district levels. It uses the generalized entropy inequality and Theil-decomposition technique for analyzing rural income inequality. This study makes the first attempt to analyze the geographic distribution of rural income, taken as a sum of agricultural and non-agricultural incomes, on CPEC routes, by using Geographic Information System-GIS.

This study is organized as follows; Section II presents the discussion on the data and methodology. Section III elaborates on research findings and discussion; lastly, Section IV narrates conclusion and policy recommendations.

II. Data and Methodology

This study uses the eighth round of the Pakistan Social and Living Standards Measurement Survey, 2012-13. The data on rural households, which makes up 65 per cent of the entire sample (75,516), was used. It excludes 26 Primary Sampling Units or PSU consisting of 396 households in the Panjgur district of Balochistan and only 1 PSU comprising 16 households in Karachi due to the law and order situations. The survey provides information on households characteristics, place of residence, level of education, and family size and employment status of farm and non-farm on a regional level. Vast coverage of districts in the survey helps policy-makers to use survey-based findings in formulating the development plans at the district level.

PSLM uses two stages of stratified sampling. The sampling frame for urban areas comprises enumeration blocks within small cities or towns; each enumeration block includes 200-250 households, categorized into low, average, and high-income groups. In rural areas, the sampling frame comprises Moza of villages as given by a listing used in the 1998 Population and Housing census.¹ The enumeration blocks and villages were selected as primary sampling units (PSUs). The sample PSUs were selected using probability proportional to a sample size (PPS) method from each stratum. Finally,

¹ https://www.pbs.gov.pk/sites/default/files/pslm/publications/pslm_prov_dist_2012-13/introduction.pdf

households from each sample PSUs were selected, called secondary sampling units [PBS (2012-13)].

This study uses information on various sources of income of rural households. In rural settings, the incomes of all family members are pooled. Two main income sources are farm and non-farm. The farm income includes income from own crops, share crops, contract crops, and livestock. The non-farm income sources comprise the non-farm paid income, income from business and income earned from extra work by the unpaid family worker. The rural income excludes taxes, social security contributions and benevolent funds. However, it includes bonuses, provident funds and other income and allowances. Other income comprises remittances, pension and rental income received during a survey period; these receipts were not used due to anomalies in their values.

The study aggregated rural income for the six employment titles of the household cultivator, the employer, self-employed, paid employee, family worker, and livestock. The aggregate rural household income was converted into the real nominal income was divided by CPI. There are two problems in using income data from PSLM. First, the data on income from agriculture was available on both monthly and yearly frequency (crop production and livestock). The value of agriculture crops brought for sale in the market fluctuates at least two times under normal circumstances in a year. The value of output is usually lower (such as sugar crop) at the time of harvest as compared to its value in the rest of the year. Hence, agricultural income on yearly frequency may be used as an indicator of farm household well-being in survey-based research. Second, the data on income is collected through a single question, without cross-questioning a household [PSLM (2012-13)]. The study avoided the first problem as the data on monthly frequency was only 2 per cent of the total agricultural income. However, we could not get around to the second problem.

This study analyzes rural household income inequality by using a Theil index, a member of the Generalized Entropy inequality family at provincial and district levels, particularly in districts included in the routes of CPEC. Furthermore, it examined rural income inequality decomposition by the employment status and education of the head at the provincial level.

The Generalized entropy (GE) class of inequality indices is as follows in Equation (1),

$$E(\alpha) = \frac{1}{n(\alpha^2 - \alpha)} \sum_{i=1}^n \left[\left(\frac{y_i}{\bar{y}} \right)^\alpha - 1 \right] \quad (1)$$

$E(\alpha)$ Signifies a class for the given values of α ; a positive and large value of α indicates that $E(\alpha)$ is more sensitive to the upper tail of the income distribution, and a small value α indicates the higher sensitivity of $E(\alpha)$ to a lower end of the income distribution. The empirical analysis of inequality uses two forms of Equation (1) given by Shorrocks (1980). The first form is as follows in Equation (2),

If $\alpha = 0$

$$E(0) = -\frac{1}{n} \sum_{i=1}^n \ln \left(\frac{y_i}{\bar{y}} \right) \quad (2)$$

$E(0)$ is known as the Mean Logarithmic Deviation.

If $\alpha = 1$

$$E(1) = -\frac{1}{n} \sum_{i=1}^n \left(\frac{y_i}{\bar{y}} \right) \ln \left(\frac{y_i}{\bar{y}} \right) \quad (3)$$

In Equation (3) y_i is a household income, n is the sample size, \bar{y} is the mean household income and $E(1)$ is Theil index. It is additively decomposable under relatively weak restrictions. It is superior to the Gini index, which is not decomposable under certain situations, such as if income sources or components are not disjoint or overlapping. Theil index also satisfies certain properties such as income scale invariance, population size independence and the Pigou Dalton axiom of transfer [Shorrocks (1980)].

The rural income inequality between (I_b) and within the province (I_w) can be represented as follows,

$$I = -\sum_{k=1}^4 \frac{N_k}{N} \left(\frac{\bar{y}_k}{\bar{y}} \right) \ln \left(\frac{y_k}{\bar{y}} \right) + \sum_{k=1}^4 \left(\frac{N_k}{N} \frac{\bar{y}_k}{\bar{y}} \right) I_k \quad (4)$$

The first term from the left (on the right-hand side) of Equation (4) shows rural income inequality between provinces like Punjab, Sindh, KPK, and Balochistan. The second term on the right-hand side implies income inequality within provinces. Moreover, the rural income inequality was decomposed by the education (primary, matric, intermediate, graduation and post-graduation) of the head of rural household as follows in Equation (5),

$$I = \sum_{q=1}^5 \frac{N_q}{N} \left(\frac{\bar{y}_q}{\bar{y}} \right) \ln \left(\frac{y_q}{\bar{y}} \right) + \sum_{k=1}^5 \left(\frac{N_q}{N} \frac{\bar{y}_q}{\bar{y}} \right) I_q \quad (5)$$

III. Results and Discussion

1. *Income Inequality by Employment Status and Province-Wise*

The employment status of the head of a household affects the distribution of rural income at the regional level. The rural income inequality decomposition by the employment status of the head of a household for Sindh indicates that rural income is highly concentrated in households with agricultural employment (0.51). It also infers

that income derived from crop production and livestock is less egalitarian compared to other sources of rural income in Table 1. A similar study by Arif, et al., (2000) indicates that households with employment in agriculture (agricultural labour) were poorer compared to households with non-farm wage workers. Moreover, agriculture income especially derived from crop production, exacerbated rural income inequality compared to other sources of income [Glewwe (1986)].

A highly skewed land distribution mainly causes poverty and inequality in rural areas. About 1 per cent of households own more than 35 acres of land, and 10 per cent of households own 5 to 12.5 acres of agricultural land in Pakistan [Anwar, et al., (2004)]. According to the Agricultural Census of 1990, 2000 and 2010, the inequality in the ownership of agricultural land remained highest in Punjab during 1990-2010 (Gini coefficient stayed at 0.63), whereas land ownership inequality dwindled from 0.59 (1990) to 0.55 (2010) in Sindh.

In Punjab, a household headed by non-farm-worker contributes about 16 per cent and headed by self-employed about 22 per cent to the rural income inequality. It is evident from the findings that employment in agriculture contributes more than any other employment status in rural income inequality. For instance, it contributes by

TABLE 1

Rural Income Inequality Decomposition by Employment Status of the Households at Provincial Level

Employment Status	Punjab		Sindh		KPK		Balochistan	
	Inequality index	Percentage contribution	Inequality index	Percentage contribution	Inequality index	Percentage contribution	Inequality index	Percentage contribution
Employer	0.32	2%	0.26	0.06%	0.20	0.12%	0.19	0.13%
Non-farm paid worker	0.26	16%	0.22	15%	0.25	19%	0.17	16%
Unpaid family worker	0.31	19%	0.22	23%	0.37	11%	0.14	17%
Self employed	0.22	22%	0.19	14%	0.23	18%	0.14	18%
Agriculture	0.26	38%	0.51	41%	0.24	37%	0.41	39%
All groups	0.27		0.24		0.30		0.20	
Within	0.27	98%	0.22	93%	0.29	88%	0.19	91%
Between	0.003	1.2%	0.016	6.7%	0.030	11%	0.014	8%
	N=17,262		N=11,219		N=7,827		N=9,128	

Source: PSLM, 2012-13.

37 per cent in KPK, 41 per cent in Sindh and almost a similar percentage (39) in the rural income inequality of Balochistan (Table 1). In KPK, the variation in rural income resulted mainly from within employment groups 88 per cent, and 11 per cent only variation in rural income is attributable to between groups. Nonetheless, the variation between groups is the largest in KPK compared to Punjab, Sindh, and Balochistan. A household headed by an unpaid family worker contributes more to rural income inequality in Sindh compared to other provinces (by 23 per cent) in Table 1. This result complements the findings of the Labour Force Survey (2010-11), which showed that the share of unpaid family workers in Sindh has increased to 40 per cent of the total labour force during 2010-11.

The results of rural income inequality decomposition for Balochistan shows that the household headed by a non-farm worker contributes more to rural income inequality is 16 per cent, and self-employed heads contribute by 18 per cent to total rural income inequality. Adams (1994) found that the poorest rural households received 40 per cent of their income from non-farm sources in Pakistan and non-poor rural households received about 35 per cent of their total income from non-farm sources, which indicates the importance of non-farm income to mitigate rural income inequality.

The Theil index value was the highest of all groups in KPK (0.30) and lowest in Balochistan (0.20). The variation in rural income inequality largely resulted from within variation in the provinces is about 90 per cent and was hardly attributable to the variation between provinces (Table 1).

The mean income of the household and the education status of the head correlate positively.² A higher education status corresponds to a higher placement of households in income distribution. The head with graduation or above qualification contributed more to rural income inequality in Punjab, Sindh, and KPK. The households headed by those having post-secondary education contributed to more rural income inequality in Balochistan (Table 2).

On average, a household headed by a graduate or post-graduate has twice as much income as households whose heads have only primary education. In Punjab, almost half of households' heads (42 per cent) of the first two quintiles of the rural income distribution have only elementary education (primary). In contrast, only 10 per cent of the richest households have heads with only primary education.³

In the rural inequality analysis, the study found a higher Theil index value for households where heads have a primary or up to matric level schooling (0.30) compared to families where heads have a higher qualification (0.25) in KPK [Table 2 column (3)]. In Punjab and KPK, within a group, variation in rural income is lower; it is only 0.09 in Punjab and 0.05 in KPK (Table 2). On the other side, Sindh and Balochis-

² The correlation coefficients of education (for each level) and household mean income was computed. The results are not reported in the study.

³ Head's education (each category) was analyzed for each income quintile of rural income. Results are not displayed in the study.

TABLE 2
Rural Income Inequality Decomposition by Family Head's Education

Education	Punjab		Sindh		KPK		Balochistan	
	Inequality index	Percentage contribution	Inequality index	Percentage contribution	Inequality index	Percentage contribution	Inequality index	Percentage contribution
Primary	0.21	23%	0.2	20%	0.31	14%	0.17	15%
Matric	0.24	17%	0.23	9%	0.30	15%	0.17	19%
Intermediate	0.22	15%	0.24	4.60%	0.23	26%	0.15	32%
Graduate	0.19	34%	0.18	31%	0.24	25%	0.11	24%
Postgraduate	0.23	21%	0.23	40%	0.25	20%	0.16	6.20%
All groups	0.24		0.24		0.32		0.36	
Within	0.09	40%	0.22	36%	0.05	29%	0.21	42%
Between	0.23	60%	0.043	54%	0.29	61%	0.08	48%
	N=4,807		N=2,649		N=2,649		N=2,686	

Source: PSLM, 2012-13.

tan depict a higher concentration of rural income within a group of 0.22 and 0.21, respectively. Among the groups, theil index coefficients of rural income were higher in KPK (0.29) and Punjab (0.23), Table 2. About 1/3 variation in total rural income inequality is attributable to within a group, while 2/3 of rural income inequality stems from the variability between groups in all provinces, except Balochistan.

Nevertheless, the inequality decomposition analysis shows that the contribution of head's education to rural income inequality depends on the proportion of heads with a certain level of education in the entire sample. It is evident by the results, as heads with a post-graduate qualification contribute by only 6.2 per cent of total rural income inequality in Balochistan, whereas in Sindh, such contribution is the highest (40 per cent) among all groups. It may be because of a positive association of agrarian assets and human capital in Sindh.

2. Income Inequality Decomposition by Districts

Results of income inequality decomposition by districts⁴ indicates that Faisalabad, Rawalpindi, Peshawar and Quetta contribute more to income inequality compared to

⁴ Caveat: the problem with the decomposition of income inequality by a group of districts (included in all routes of CPEC) is the likelihood of getting biased mean values of household income for all groups (districts), it is due to striking differences in the economic and social conditions in between districts.

other districts in CPEC routes (Table 3). Some districts such as Kalat, Turbat, Gwadar, and Khuzdar contribute insignificantly to income inequality in CPEC routes. It is because only a greater proportion of the household makes their living from non-farm and self-employment. The GIS mapping of districts indicates that most of the districts connected through CPEC have households whose livelihood largely depend on non-farm activities. Therefore, the projects offered by CPEC, especially in the non-farm sector, will help in the reduction of rural income inequality.

Some districts, mostly in Balochistan, Kalat, Khuzdar, and Gwadar, did not contribute significantly to income inequality during 2012-13 (Table 3). Moreover, the

TABLE 3
Income Inequality Decomposition by Districts (all three Routes of CPEC)

Districts	Household Income (mean values)	Inequality Index	Percentage Contribution
Attock	25,939 (586.51)	0.29	3%
Rajanpur	20,787 (694.73)	0.23	3%
Faisalabad	34,983 (546.02)	0.22	17%
Multan	25,125 (586.5)	0.26	9%
Attock	25,939 (1047.2)	0.29	3%
Rawalpindi	35,683 (817.6)	0.25	11%
Bannu	18,942 (845.43)	0.30	2%
D. I. Khan	20,808 (881.09)	0.31	4%
Kohat	23,871 (1204.2)	0.32	3%
Peshawar	32,180 (814.2)	0.24	9%
Larkana	24,810 (825.5)	0.25	4%
Kalat	26,186 (763.08)	0.12	1%
Khuzdar	22,326 (624.24)	0.15	2%
Gwadar	29,129 (938.5)	0.16	1.90%
Kech/Turbat	27,210 (801.2)	0.12	1%
Quetta	36,087 (857.13)	0.18	6%
Zhob	22,578 (948.9)	0.23	2%
All		0.25	
Within		0.23	91%
Between		0.02	9%

Source: PSLM, 2012-13.

breakup of employment ranks across districts shows that about 75 per cent heads in Kalat, 78 per cent in Khuzdar, 92 per cent in Gwadar, and 81 per cent of heads of households in Kech are either self-employed or non-farm workers.

3. *Income Inequality Route-Wise*

The income inequality decomposition in the Eastern route showed that Attock (0.29), D. G. Khan (0.28), and Multan (0.26) have higher income inequality compared to other districts in the Eastern route (Table 4). The results suggest that income inequality within districts is larger in all routes, eastern, western and central, whereas it is lower between districts during 2012-13 (Tables 4, 5 and 6).

However, the eastern route indicates the sizeable income inequality within districts (9 per cent) compared to the western route (6.8 per cent) and the central route (5 per cent). The results show that urban districts on CPEC routes indicate higher income inequality and their contribution to total income inequality compared to rural districts. Faisalabad and Multan contribute by 26 and 13 per cent, respectively, to income inequality in the eastern route. Similarly, Peshawar makes up the highest contribution (by 24 per cent) to income inequality in the central route and by 22 per cent in the western route.

TABLE 4
Income Inequality Decomposition by Districts on CPEC-Eastern Route

Districts	Inequality Index	Percentage Contribution
Faisalabad	0.22	26%
D. G. Khan	0.28	8%
Rawalpindi	0.25	16%
Attock	0.29	5%
Rajanpur	0.23	5%
Kech	0.12	2%
Gwadar	0.15	3%
Multan	0.26	13%
Larkana	0.25	6%
Khuzdar	0.15	3%
All	0.25	
Within	0.23	91%
Between	0.01	9%

Source: PSLM, 2012-13.

TABLE 5
Income Inequality Decomposition by Districts on CPEC-Central Route

Districts	Inequality Index	Percentage Contribution
Attock	0.29	9%
Rajanpur	0.23	9%
Kech	0.12	4%
D. I .Khan	0.31	11%
Kohat	0.32	8%
Bannu	0.30	7%
Larkana	0.25	12%
Peshawar	0.24	24%
Khuzdar	0.15	5%
All	0.25	
Within	0.24	94%
Between	0.013	5%

Source: PSLM, 2012-13.

TABLE 6
Income Inequality Decomposition on CPEC-Western Route

Districts	Inequality Index	Percentage Contribution
Bannu	0.30	7%
D. I. Khan	0.32	10%
Kohat	0.33	8%
Peshawar	0.24	22%
Attock	0.29	8%
Kalat	0.12	3%
Khuzdar	0.15	5%
Kech	0.12	4%
Quetta	0.18	16%
Zhob	0.23	6%
All	0.24	
Within	0.22	93%
Between	0.016	6.80%

Source: PSLM, 2012-13.

IV. Conclusion and Policy Recommendations

This study examines rural income inequality and its decomposition by employment status and education of the household's head at the provincial level. Moreover, it analyzes regional income inequality decomposition, particularly of districts connected through China-Pakistan Economic Corridor or (CPEC) in Pakistan. It uses the Theil index, which is a member of the generalized entropy inequality, to measure the rural income inequality. The Theil index is additively decomposable; it also satisfies certain other properties such as income scale invariance, population size independence and the Pigou Dalton axiom of transfer [Shorrocks (1980)]. The study uses Theil-decomposition inequality-decomposition (Distributive Analysis Stata Package, Stata 14). The GIS was used for mapping geographical differences in the aggregated agricultural and non-agricultural incomes in the selected districts.

Results indicate that agriculture and self-employment contribute the largest to the rural income inequality; it may be because of the sheer dependence of poor households, which makes a large proportion of the rural population in all provinces, on non-farm sources (self-employment and unpaid work) to earn their livelihood. The rural income inequality is higher within groups than between the groups in all provinces. However, rural income inequality within employment groups is the highest among all provinces in Khyber Pakhtunkhwa. In contrast, the rural income inequality decomposition by education shows a higher income inequality between the groups representing different education levels of the head of households than within the groups. Punjab has the highest level of rural income inequality between the groups, followed by Khyber Pakhtunkhwa. A recent study by SPDC (2012) shows that KPK is the most rural province, whereas Sindh is the most urban. Moreover, the existing literature suggests that rural regions have higher inequality in education across gender and income groups than urban [Jisnu, et al., (2006)]. In Sindh, rural income is highly concentrated in households having agricultural employment (0.51).

Furthermore, the inequality decomposition analysis indicates that households headed by a non-farm-worker and self-employed contribute 15 per cent and 23 per cent, respectively, to rural income inequality. In Khyber Pakhtunkhwa, rural income inequality mainly stems from a group (employment status) variation (0.89), and only 11 per cent attributed to between groups. Nonetheless, the variation in rural income between groups is the largest in KPK compared to other provinces (Punjab, Sindh, and Balochistan). In Balochistan, the household headed by agricultural employment contribute more to rural income inequality (39 per cent), and self-employed heads contribute by 18 per cent to total rural income inequality. The Theil index value is the highest of all employee groups in KPK (0.30) and lowest in Balochistan (0.20). The household's head with graduation or above contribute more to the rural income inequality in Punjab, Sindh, and KPK, and heads with post-secondary education contribute more to economic inequality in Balochistan. The income inequality within

districts is higher than between the districts (connected through CPEC), implying greater differences between rural and urban areas of the same district.

The regional income distribution shows districts (in CPEC routes) having a larger share in total non-agricultural income include Attock, Peshawar, and Quetta (on western route), Dera Ghazi Khan, Kech, Gwadar, Attock, Rajanpur, Larkana, and Multan (on eastern route), and Attock, Peshawar, D.I. Khan, Larkana, Kohat, and Bannu (on central route). A study by Jamal (2011) manifests a higher level of multiple deprivations in the selected districts: Rajanpur, Gwadar, Kech, Attock, D. I. Khan, and Attock. Hence, the results of the present study complemented with earlier research, may help to assess the implications of proposed projects under CPEC, especially in the highlighted regions, on poverty and inequality. Based on the findings, the challenges and prospects of the China-Pakistan Economic Corridor (CPEC) are as follows:

- A significant contribution of non-farm workers to the rural income variability highlights the importance of non-farm activities in the rural economy of Pakistan. The accomplishment of CPEC projects will open up opportunities for infrastructure, energy and industrial development, specifically in districts connected through this corridor. These investments are likely to bring down the size of the rural income inequality in Pakistan. However, the investment in agricultural projects may provide needed help to even out rural income variability in the future.
- In Balochistan, the higher contribution of farmworkers and self-employed to rural income inequality sets the alarm for the realization of the possible benefits of CPEC projects. Therefore, the challenge is to create job opportunities for unskilled and semi-skilled in the districts of Balochistan connected through CPEC. On the other hand, Balochistan has a geographically dispersed population and poor infrastructure due to its mountainous terrain, which posits a challenge to CPEC projects.
- In KPK, the variation in rural income between-groups (employment status) is relatively higher, which calls for projects to address spatial disparities in rural income.
- Agricultural employment signifies a higher level of concentration in rural income, as suggested by a higher Theil Index. The existing literature shows that agricultural income inequality is closely connected to inequalities in agrarian assets, especially in landholdings in Pakistan. Therefore, unless provincial governments make serious efforts in land redistribution,⁵ the projects offered at the CPEC in agriculture are likely to deepen agricultural income inequality in Pakistan.

⁵ Land reforms is a provincial subject after the 18th ammendment in constitution.

Bibliography

- Adams, R. H., 1994, Non-farm income and inequality in rural Pakistan: A decomposition analysis, *The Journal of Development Studies*, 31(1): 110–113.
- Ahmad, M., 2002, Income inequality among various occupations/professions in Pakistan - Estimates based on household income per capita, *Lahore Journal of Economics*, 7(1): 90–104.
- Anwar, T., S.K. Qureshi and H. Ali, 2004, Landlessness and rural poverty in Pakistan, *Pakistan Development Review*, 43(4): 855–874.
- Anwer, T., 2003, Trends in inequality in Pakistan between 1998-99 and 2001-02, *Pakistan Development Review*, 42(4): 809–821.
- Arif, M.G., H. Nazli, and R. Haque, 2000, Rural non-agriculture employment and poverty in Pakistan, *Pakistan Development Review*, 39(4): 1089–1110.
- Asad, Ali, M., 2011, Growth and consumption inequality in Pakistan, *Pakistan Economic and Social Review*, 49(1): 69–89.
- Bhandari, P. B., 2013, Rural livelihood change? Household capital, community resources and livelihood transition, *Journal of Rural Studies*, 32: 126–136.
- Chambers, Robert, and G. Conway, 1991, Sustainable rural livelihoods: Practical concepts for the 21st century. Discussion Paper, 296, IDS, [https://doi.org/ISBN 0 903715 58 9](https://doi.org/ISBN0903715589).
- Cheema, A. Raza., and M. Sial Hussain, 2012, Poverty, income inequality, and growth in Pakistan: A pooled regression analysis, *Lahore Journal of Economics*, 17(2): 137–157.
- De Kruijk, H., and R. Kamal, 1987, Sources of economic inequality, *Pakistan Development Review*, 26(4): 659–672.
- De Kruijk, H., and M. V. Leeuwen, 1985, Changes in poverty and income inequality in Pakistan during the 1970s, *Pakistan Development Review*, 24(3-4): 407–422.
- Glewwe, P., 1986, The distribution of income in Sri Lanka in 1969-1970 and 1980-1981: A decomposition analysis, *Journal of Development Economics*, 24(2): 255–274.
- Idreas, M., and E. Ahmad, 2010, Measurement and decomposition of consumption inequality in Pakistan, *Lahore Journal of Economics*, 15(2): 97–112.
- Jamal, H., 2014, Growth and income inequality effects on poverty: The case of Pakistan (1988-2011), Karachi: Social Policy and Development Centre.
- Jamal, H., 2011, Districts' indices of multiple deprivations for Pakistan, Karachi.
- Jisnu, D., P. Pandey, and T. Zajonc, 2006, Learning levels and gaps in Pakistan, Policy Research Working Paper, 4067, World Bank.
- Khadija, S., 2012, Income inequalities and well-being in rural Pakistan, University of Glasgow, Retrieved from <http://theses.gla.ac.uk/3261/1/2012ShamsPhD.pdf>.
- Lerong, Y., L. Renfu, and Z. Linxiu, 2007, Decomposing income inequality and policy implications in rural China, *China and World Economy*, Institute of

- World Economics and Politics, Chinese Academy of Social Sciences, 15(2): 44-58.
- Naschold, F., 2009, Microeconomic determinants of income inequality in rural Pakistan, *Journal of Development Studies*, 45(5): 746–768.
- Nasir, Z. M., and R. Mahmood, 1999, Personal earnings inequality in Pakistan: Findings from the HIES 1993-94. *Pakistan Development Review*, 37(4): 781–792.
- Pakistan Bureau of Statistics, 1990, Agricultural census, Islamabad: Pakistan Bureau of Statistics.
- Pakistan Bureau of Statistics, 2000, Agricultural census, Islamabad: Pakistan Bureau of Statistics.
- Pakistan Bureau of Statistics, n.d., Pakistan Social and Living Standards Measurement Survey (2012-2013), Islamabad: Pakistan Bureau of Statistics.
- Pakistan Bureau of Statistics, 2000, Agricultural census, Retrieved from <http://www.pbs.gov.pk/agriculture-census-publications#1990>.
- Pakistan Bureau of Statistics, 2010, Agricultural census, Retrieved from <http://www.pbs.gov.pk/agriculture-census-publications#2000>.
- Pakistan Bureau of Statistics 2010, Agricultural census, Retrieved from <http://www.pbs.gov.pk/content/agricultural-census-2010-pakistan-report>.
- Shorrocks, A. F., 1980, The class of additively decomposable inequality measures, *Econometrica*, 48(3): 613–625.
- Social development in Pakistan, 2016, Annual Review, Karachi: Social Policy and Development Centre.
- The state of social development in rural Pakistan, 2012, Karachi: Social Policy and Development Centre.
- Talat, A., 2010, Role of growth and inequality in explaining changes in poverty in Pakistan, *Pakistan Development Review*, 49(1): 1–17.
- Wan, G. H., 2001, Changes in regional inequality in rural China: Decomposing the Gini index by income sources, *Australian Journal of Agricultural and Resource Economics*, 45(3): 361-382.
- Xie, X., C. Ma, and J. Li, 2015, Research on employment opportunity under the framework of China Pakistan Economic Corridor, *Proceedings of International Conference on CPEC*, Lahore: Government College University, 108–113.
- Zakir, N., and M. Idrees, 2009, Trends in inequality, welfare, and growth in Pakistan, 1963-64 to 2004-05, Working Papers, 59, Islamabad: PIDE.

APPENDIX

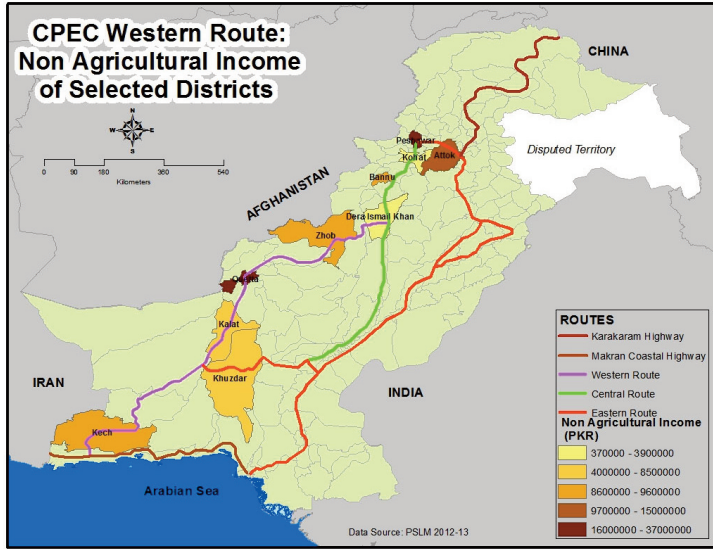


FIGURE A-1

CPEC Western Route: Non Agricultural Income of Selected Districts

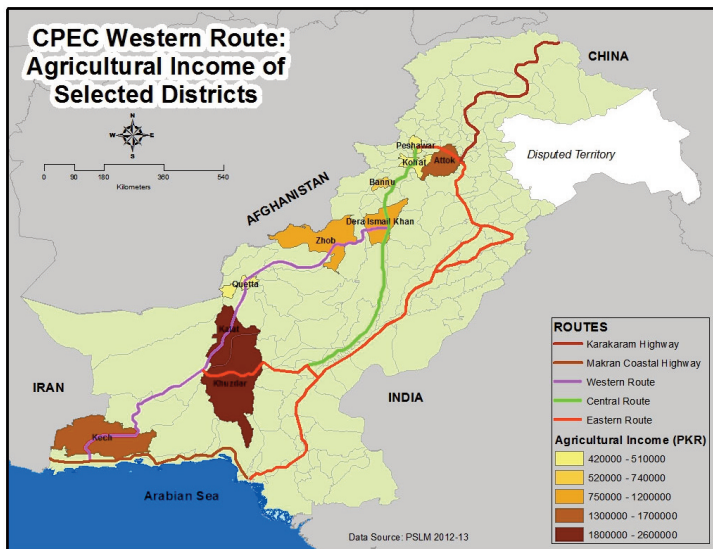


FIGURE A-2

CPEC Western Route: Agricultural Income of Selected Districts

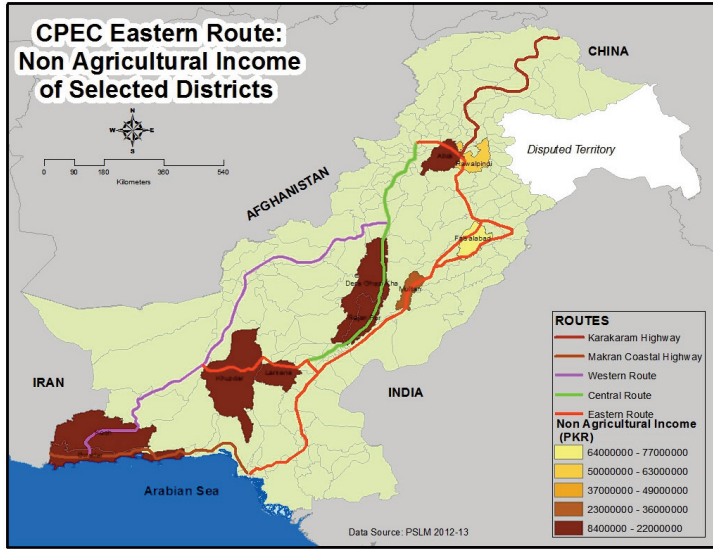


FIGURE A-3

CPEC Eastern Route: Non Agricultural Income of Selected Districts

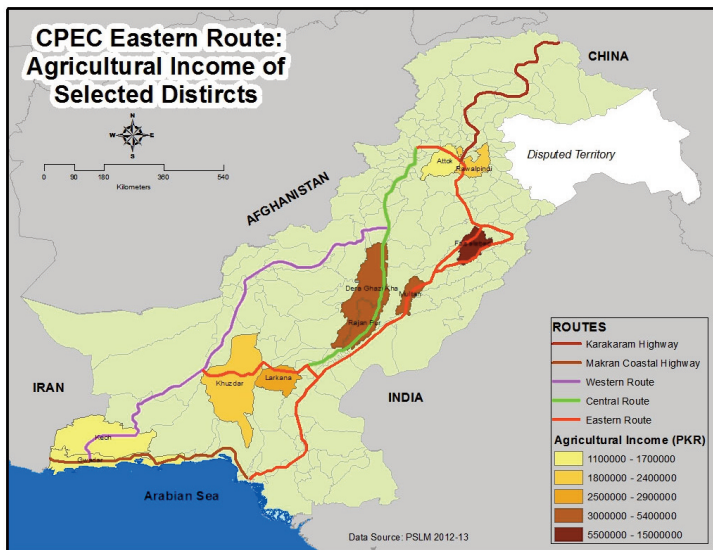


FIGURE A-4

CPEC Eastern Route: Agricultural Income of Selected Districts

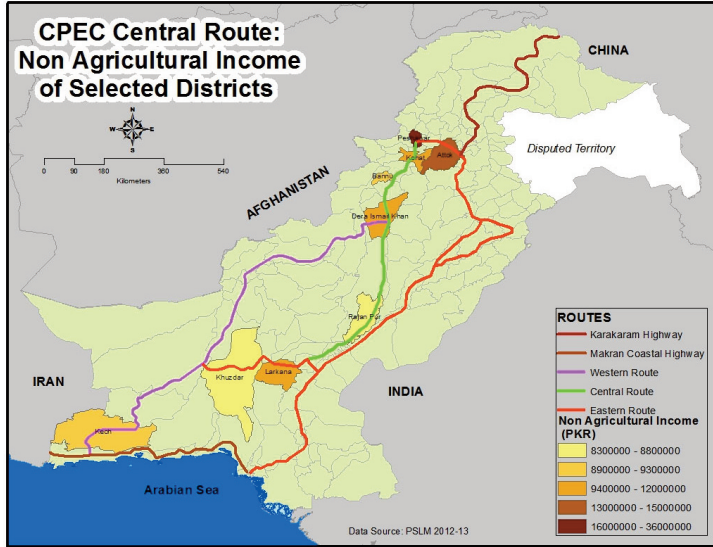


FIGURE A-5

CPEC Central Route: Non-Agricultural Income of Selected Districts

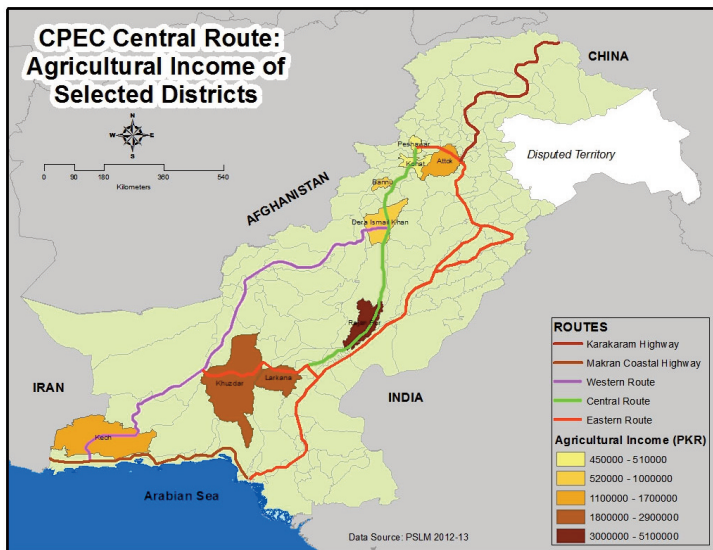


FIGURE A-6

CPEC Central Route: Agricultural Income of Selected Districts