Policy Brief

CITY DEVELOPMENT PRODUCT: DATA ARCHITECTURE FOR SUSTAINABLE ECONOMIC DEVELOPMENT IN PAKISTAN

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INTRODUCTION

The government of Pakistan currently does not have a methodology for estimating Regional Domestic Product (RDP) at the provincial, district or city level. The need for disaggregated estimates of economic growth has become salient after the 18th amendment to the constitution (2010), under which key areas of economic development including health, education, infrastructure, and industrial development have been devolved to the provinces. Furthermore, the 18th amendment mandated provinces to further distribute revenues to districts, which form the next administrative tier. These reforms were widely lauded as a strong step towards fiscal federalism and improved allocative efficiency in public finance.

The constitutional steps taken towards decentralized governance and institutionalized distribution of public resources have, however, run into capacity constraints: lower administrative tiers do not have the informational architecture that is requisite for efficient planning and development. As a result, a wedge between de jure and de facto practice of fiscal federalism has emerged. As a step toward decreasing this wedge, this study identifies and addresses a key part of the problem: the lack of reliable and methodologically comparable economic data at the city level.

Availability of city level data that is reliable and comparable can have multiple channels of impact on the state's planning, administrative, and public funds management capacity. Many developing countries, including Brazil, Colombia, and India have developed provincial Systems of Regional Accounts (SRA) based on extensive survey and data collection regimes that are analogous to the national income accounting exercise that takes place each year to compute aggregate GDP measures. However, with the cheap availability of high-resolution satellite imagery, a more cost-effective estimation methodology of subnational GDP estimation can be derived. Moreover, while this proposed top-down approach to RDP estimation may leave certain supranational economic activities unaccounted which is a natural problem in subnational income accounting, it nevertheless has the advantage of being a consistent estimator of growth across all districts, which is an important requirement for distributive purposes under study. Economists and other research fields have incorporated this new source of data as a powerful tool for analysis, and there is little reason why public sector analysis can't benefit from this affordable and near-real time data source.

NIGHTLIGHTS AS A RELIABLE ESTIMATOR OF ECONOMIC ACTIVITY

The availability of fine grain, remotely-sensed data has become a new powerful tool for analysis within the economics discipline. Economists have found many applications for this source of data, and multiple rich streams of economic literature have developed as a result. One of the most commonly-used sources of satellite data is night lights (NTL), or the total visible light emitted from Earth's surface at night for any defined region.

The logic of using NTL as a proxy for economic development follows the same logic that uses data on consumption decisions to proxy for income. The underlying assumption is that lightning, like consumption, is a normal good and therefore varies by income. This assumption has also been verified empirically in a number of studies. A very recent validation of using NTL for measuring regional GDP came from a study focusing on Colombia, where the already government collects national acconts-style GDP data at the municipal level. With a very high correlation (regression coefficient: 0.827), the authors of the study concluded that NTL can serve as a good indicator of GDP estimations for municipal regions (Perez-Sindin et al. (2021).

FINDINGS

Table 1 presents the interprovincial spatial distribution of economic activity in Pakistan as estimated by the NTL-based methodology. As can be seen in the first set of results, Punjab province leads with an estimated 54 percent contribution to Pakistan's GDP. When normalized by population, the per million estimate of GDP is almost identical to the national NTL-based GDP for all of Pakistan. Spatial disaggregation of economic activity by province also allows me to impute the per capita Regional Domestic Product (RDP) at the provincial level, which is PKR 188,000 for Punjab. This number is very close to the national per capita GDP of PKR 182,000.

The second largest contributor to Pakistan's GDP based on NTL-based GDP estimates, Sindh contributes to 27 percent of Pakistan's overall GDP. When normalized by population, Sindh's NTL per million is higher than the national level by thirteen percent. This implies that a segment of Sindh's population is relatively more productive than the national mean. This is not a surprising result, as it is well understood that Karachi is the economic capital of the country. This is reinforced by the province claiming the highest NTL per cell in all of Pakistan. As a result of Karachi's high productivity, the imputed per capita RDP for Sindh is PKR 213, 000.

As per NTL-based RDP estimates, Khyber Pakhtunkhwa province contributes 8 percent to the national GDP of Pakistan. After normalizing for population, the NTL per million estimate is 46 percent of the national NTL per million estimates. Khyber Pakhtunkhwa's imputed RDP using the NTL-based approach shows a per capita income of PKR 102, 000. It is important to note that KP's estimates include the newly merged tribal districts (ex-FATA), which have one of the lowest levels of economic development in the country.

Estimates from this study show that Balochistan contributes approximately eight percent to the national economy of Pakistan. At 0.81 of the national mean, the NTL per million score of Balochistan is higher than that of KP largely due to the smaller population base which goes into the denominator of the NTL per million results. Imputed er capita income for Balochistan is approximately PKR 152, 000 which again is higher than KP owing to a smaller population base.

Province	NTL (Aggregate)		NTL Per Million		Max		Imputed RDP	
	Abs. (000s)	Share	Abs.	Rel.	Abs.	Rel.	RDP (PKR, Bil.)	P.C. RDP (PKR)
Pakistan	**1,233.9**	**1**	**6126.1**	**1**	**532.5**	**1.00**	**38,000**	**182,000**
Punjab	670.7	0.54	6098.1	0.99	319.2	0.60	20,656	188,000
Sindh	331.5	0.27	6927.2	1.13	532.5	1.00	10,209	213,000
Kh. Pakhtunkhwa	101.1	0.08	2847.6	0.46	196.5	0.37	3,113	102,000
Balochistan	61.0	0.05	4944.7	0.81	237.0	0.45	1,878	152,000
Islamabad CT	40.6	0.03	20249.7	3.31	75.1	0.14	1,249	624,000
AJK + GB	29.0	0.02	6236.6	1.02	10.6	0.02	893	190,000

Table 1: Cross-province comparisons of VIIRS VNL V2 nightlights, 2019 (Elvidge et al., 2021). Population data is from PBS Census, 2017. GDP data taken from World Bank's World Development Indicators (WDI).

CITY DOMESTIC PRODUCT (CDP)

The NTL-based RDP estimation methodology can be used to estimate City Domestic Product (CDP) at the city level. Figure 1 presents the urban share of economic activity among the twenty largest cities in Pakistan. Among these, the city of Karachi alone contributes 18 percent of the urban economic output. By magnitude, Karachi is by far the largest urban center of economic activity, followed by Lahore, Faisalabad and Islamabad at approximately 7 percent each. After accounting for the mega cities which are well understood as regions with high economic activity relative to the rest of the country, what shows up is the significant contribution of Pakistan's medium-sized cities. Cities like Hyderabad, Gujranwala and Rawalpindi combined provide roughly the same economic output as the city of Karachi. This may be due to the presence of of small and medium sized manufacturing clusters concentrated in each of these cities.

Figure 1 Economic activity in Pakistan's Largest Cities
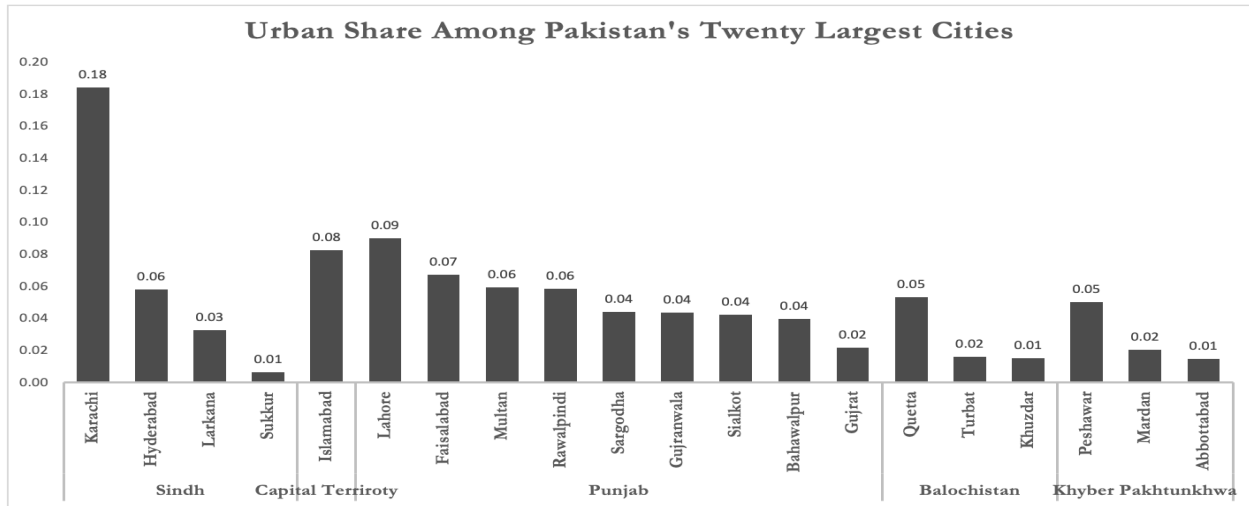
It is important to point out that the CDP estimates presented in Figure 3 are based on de jure city limits, and actual figures may be larger due to urban sprawl beyond the jurisdictional limit of the city. As an example, Figure 2 (below) shows how Gujranwala city has outgrown its defined city limits). Since these de facto city limits are not factored into the above CDP estimates, the above results may be biased downwards. A natural next step would be to account for this bias by expanding the city limits in my analysis.

CONCLUSION

The project to develop city-level RDP estimates is a promising avenue for building data architecture for economic and urban development in Pakistan. The CDP data allows researchers and policymakers alike to analyze the economic geography of Pakistan using a sound and consistent methodology. Preliminary findings highlight meaningful differences in economic activity across provinces, districts, and cities. These findings also show the promise of Pakistan's smaller cities, many of which are growing faster than their neighboring cities. An exploration of the determinants of these growth differentials is a fruitful avenue for future research. The CDP dataset has the potential to be a significant value-add to Pakistan's research and policy space alike.